

2019 ABAER 008

CEAA Reference No. 65505

Report of the Joint Review Panel

Teck Resources Limited

Frontier Oil Sands Mine Project

Fort McMurray Area

July 25, 2019

**Joint Review Panel Established by the Federal Minister of
Environment and Climate Change and the Alberta Energy
Regulator**

Report of the Joint Review Panel Established by the Federal Minister of Environment and Climate Change and the Alberta Energy Regulator

Decision 2019 ABAER 008: Teck Resources Limited, Frontier Oil Sands Mine Project, Fort McMurray Area

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Alberta Energy Regulator

Suite 1000, 250 – 5 Street SW

Calgary, Alberta

T2P 0R4

Telephone: 403-297-8311

Inquiries (toll free): 1-855-297-8311

Email: inquiries@aer.ca

Website: www.aer.ca

and

Canadian Environmental Assessment Agency

160 Elgin Street, 22nd Floor

Place Bell Canada, Ottawa, Ontario K1A 0H3

Telephone: 613-957-0700

Fax: 613-957-0941

Website: <https://www.canada.ca/en/environmental-assessment-agency.html>

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Abbreviations

AAAQG	Alberta ambient air quality guideline
AAAQO	Alberta ambient air quality objectives
ACO	Aboriginal Consultation Office
AEP	Alberta Environment and Parks
AER	Alberta Energy Regulator
<i>ALSA</i>	<i>Alberta Land Stewardship Act</i>
<i>AQMF</i>	<i>Air Quality Management Framework</i>
BATEA	best available technology economically achievable
CAAQS	Canadian ambient air quality standards
<i>CCIR</i>	<i>Carbon Competitiveness Incentive Regulation</i>
CCME	Canadian Council of Ministers of Environment
CCR	<i>Conservation and Reclamation Regulation</i>
<i>CEAA</i>	<i>Canadian Environmental Assessment Act</i>
CEMA	Cumulative Environmental Management Association
CNRL	Canadian Natural Resources Ltd.
COPC	chemicals of potential concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSIA	Canada's Oil Sands Innovation Alliance
CPAWS	Canadian Parks and Wilderness Society
DFO	Department of Fisheries and Oceans (also, Fisheries and Oceans Canada)
ECCC	Environment and Climate Change Canada
<i>EPEA</i>	<i>Environmental Protection & Enhancement Act</i>
ESRD	Environment and Sustainable Resource Development
ETA	external tailings areas

GDP	gross domestic product
HEG	Human Environment Group
<i>IRP</i>	<i>Fort McMurray-Athabasca Oil Sands Subregional Integrated Resource Plan</i>
<i>LARP</i>	<i>Lower Athabasca Regional Plan</i>
LCCS	land capability classification system
MFSP	Mine Financial Security Program
<i>MSAPR</i>	<i>Multi-Sector Air Pollutants Regulations</i>
NEB	National Energy Board
<i>OSCA</i>	<i>Oil Sands Conservation Act</i>
<i>OSCR</i>	<i>Oil Sands Conservation Rules</i>
OSEC	Oil Sands Environmental Coalition
PAH	polycyclic aromatic hydrocarbons
PDA	project development area
RAMP	Regional Aquatics Monitoring Program
<i>REDA</i>	<i>Responsible Energy Development Act</i>
RFMA	registered fur management area
ROPC	receptors of potential concern
<i>SARA</i>	<i>Species at Risk Act</i>
<i>SWQuanMF</i>	<i>Lower Athabasca Region: Surface Water Quantity Management Framework for the Lower Athabasca River</i>
<i>TMF</i>	<i>Lower Athabasca Region: Tailings Management Framework for Mineable Athabasca Oil Sands</i>
UNESCO	United Nations Education, Scientific and Cultural Organization
VOC	volatile organic compounds
WCS	Western Canada Select

WMU wildlife management unit

WTI West Texas Intermediate

Executive Summary

Teck Resources Limited applied to the Alberta Energy Regulator (AER) for the Frontier project in November 2011 and submitted an updated application in June 2015. The environmental assessment under the *Canadian Environmental Assessment Act, 2012 (CEAA 2012)* started in January 2012 and forms part of the application.

The applications are for approval to construct, operate, and reclaim an oil sands mine and processing plant 110 kilometres north of Fort McMurray, Alberta. The project disturbance area is 29 217 hectares, and the project would operate for 41 years.

The Frontier project would produce about 41 300 cubic metres per day (260 000 barrels per day) of bitumen. It would use trucks and shovels to mine two open pits and would include an ore preparation plant, a bitumen processing plant, tailings preparation and management facilities, cogeneration facilities, support utilities, disposal and storage areas, a river water intake, a fish habitat compensation lake, a bridge over the Athabasca River, administration and maintenance facilities, roads, an airfield, and a camp.

The Frontier project required multiple regulatory filings:

- An environmental impact assessment was submitted to Alberta Environment and Parks (AEP; formerly Alberta Environment and Sustainable Resource Development), the Canadian Environmental Assessment Agency (the Agency), and the AER.
- Applications were submitted to the AER under the *Oil Sands Conservation Act (OSCA)*, and AEP under the *Environmental Protection and Enhancement Act (EPEA)*, and the *Water Act* for provincial approvals.
- Approvals will be required under the federal *Fisheries Act* and the *Navigation Protection Act* for activities that may affect fish and fish habitat and navigable waters.
- Approval from the Alberta Utilities Commission will be required for the cogeneration facilities and from the Regional Municipality of Wood Buffalo for parts of the camp.
- Ancillary approvals under the *Public Lands Act*, the *Municipal Government Act*, and the *Historical Resources Act* are also required, but they are not a part of this review.

The federal Minister of Environment and Climate Change and the CEO of the AER announced the establishment of a joint review panel for the Frontier project on May 24, 2016. Mr. A. Bolton was appointed as panel chair, and Mr. R. McManus and Mr. W. Klassen were appointed as panel members. Under the agreement, the panel must conduct its review in a manner that discharges the responsibilities of the AER under the *Responsible Energy Development Act (REDA)*, *OSCA*, *EPEA*, and the *Water Act*; the requirements of *CEAA 2012*; and the panel's terms of reference.

The Minister and CEO of the AER amended the agreement on August 16, 2017, requiring the panel to consider the effects of the Frontier project on the outstanding universal value of Wood Buffalo National Park World Heritage Site, including the Peace-Athabasca Delta.

The panel conducted a public hearing that started on September 25, 2018, in Fort McMurray, Alberta, and continued until October 4. It adjourned and resumed in Fort Chipewyan, Alberta, from October 15 to October 18. On October 20, the hearing resumed in Fort McMurray and was adjourned on October 24. The Aboriginal Consultation Office (ACO) provided its hearing reports on November 26, and final arguments were held in Calgary, Alberta, on December 11 and 12, 2018, at which time the hearing record was closed.

Provincial and federal governments will need to make separate decisions about the Frontier project, taking into account the panel's report.

Decision of the AER

OSCA requires us to consider whether the proposed project is in the public interest. The panel is also aware of our responsibilities under section 15 of *REDA* and section 3 of *REDA General Regulation* and is satisfied that, throughout this proceeding and in this decision report, we have considered the factors that are identified in those provisions. This includes a consideration of the social and economic effects of the Frontier project and of the effects of the Frontier project on the environment. The panel must also consider the requirements of the *Lower Athabasca Regional Plan* and its management frameworks.

The Frontier project is located in an area Alberta has identified as being important for bitumen extraction. The project would provide significant economic benefits. It is expected to create 7000 jobs during construction and up to 2500 operation jobs during the 41-year life of the mine and is anticipated to contribute more than \$70 billion directly to federal, provincial, and municipal governments. Although we find that there will be significant adverse project and cumulative effects on certain environmental components and indigenous communities, under our authority as the AER, we consider these effects to be justified and that the Frontier project is in the public interest. The panel has decided to approve the following AER applications, subject to the limitations and conditions in this report:

- application 1709793 under sections 10 and 11 of *OSCA* to construct, operate, and reclaim a new oil sands mine and processing plant
- application 001-00247548 under section 66 of the *Environmental Protection and Enhancement Act* to construct, operate, and reclaim the Frontier project
- application 001-00303079 under the *Water Act* to carry out activities for site water management associated with the Frontier project
- application 001-00303091 under the *Water Act* for a licence for the annual diversion and use of water

We do not approve construction of the proposed flow splitter on Big Creek, because Teck has not sufficiently demonstrated the need for this structure.

The *Water Act* licence will include the diversion of water from sources in the Athabasca River Basin, including the Athabasca River, groundwater, and surface runoff contributing to Redclay Creek, Big Creek, First Creek, and Athabasca River. The licence will not allow the diversion of water from any water sources within the Peace/Slave River Basin. The northern 27 square kilometres of the project is part of the Peace/Slave River Basin. We did not identify any technical, economic, environmental, or social issues that would cause us to deny a licence for that part of the project, but diversion of water from the Peace/Slave River Basin will be a transfer of water from that major basin to another, the Athabasca River Basin. The *Water Act* prohibits issuance of water licences which allow an interbasin transfer unless the licence is authorized by a special Act of the Legislature. Therefore, a licence relating to the Peace/Slave River Basin cannot be issued. Before Teck can proceed with the part of the project located in the Peace/Slave River Basin, it will need to apply to the Government of Alberta for a special Act of the Legislature that would authorize the issuance of a licence that authorizes the transfer of water between the Athabasca River Basin and the Peace/Slave River Basin.

The panel expects Teck to adhere to all of the commitments it made to the extent that those commitments do not conflict with the terms of its AER approvals, any other approval or licence affecting the project, or any law, regulation, or similar requirement that Teck is bound to observe.

While the panel has concluded that the project is in the public interest, project and cumulative effects to key environmental parameters and on the asserted rights, use of lands and resources for traditional purposes, and culture of indigenous communities have weighed heavily in the panel's assessment.

In approving this project, the panel has set numerous approval conditions. For the conditions, refer to [Appendix 5](#). The panel also made recommendations to the federal Minister of Environment and Climate Change, the Government of Canada and the Government of Alberta, summarized in [Appendix 6](#).

Summary of Key Findings

We find that the project is likely to result in significant adverse environmental effects to wetlands, old-growth forests, wetland- and old-growth-reliant species at risk, the Ronald Lake bison herd, and biodiversity. The project is also likely to result in significant adverse effects to the asserted rights, use of lands and resources, and culture of indigenous groups who use the project area. The proposed mitigation measures have not been proven to be effective or to fully mitigate project effects on the environment or on indigenous rights, use of lands and resources, and culture.

The project, in combination with other existing, approved, and planned projects, is likely to result in significant adverse cumulative environmental effects to wetlands, old-growth forests, wetland- and old-growth-reliant species at risk, fisher, Canada lynx, woodland caribou, the Ronald Lake bison herd, and

biodiversity. The project, in combination with other existing, approved, and planned projects will also contribute to existing significant adverse cumulative effects to the asserted rights, use of lands and resources, and culture of indigenous groups in the mineable oil sands region.

We heard concerns from indigenous communities and others about a lack of progress with respect to the assessment and management of cumulative effects within the Lower Athabasca region, particularly within the mineable oil sands area, the Athabasca River, and the Peace-Athabasca Delta. Parties urged the panel to make recommendations to the governments of Alberta and Canada for immediate action on management frameworks and plans. The panel has included such recommendations to Alberta and Canada related to a number of these issues, where we believed it was within the panel's mandate and appropriate to do so. For a list of the recommendations to the governments of Alberta and Canada, refer to [Appendix 6](#).

The panel believes that the *Lower Athabasca Regional Plan*, although still a work in progress, is an appropriate mechanism for identifying and managing regional cumulative effects. The *Lower Athabasca Regional Plan* is an important framework to introduce a more integrated regional approach, and the panel strongly encourages the Government of Alberta to continue to implement this regional plan. It is critical that the frameworks, plans, and thresholds identified in the *Lower Athabasca Regional Plan* be put in place as quickly as possible.

We recognize that at this stage of the project planning and review process, the level of detail available for some aspects of the project design is limited and there will be some uncertainty about future conditions and the effectiveness of proposed mitigation measures. This is particularly true for some aspects of the project's tailings management and reclamation and closure plans. Overall, however, we found that the level of project design and environmental assessment information provided by Teck was sufficient for the panel to assess the effects of the project. Teck committed to using an adaptive management approach and working with regulators, indigenous communities, and other stakeholders to address uncertainties and issues that arise during construction and operation of the project. In response to requests from the panel, Teck provided several draft mitigation, monitoring, and adaptive management plans for key environmental receptors. While additional work is required to finalize the plans, the panel was satisfied with the level of detail in the plans and Teck's approach to adaptive management.

Economic Effects

A stated outcome of the *Lower Athabasca Regional Plan* is the maximization of the economic potential of the oil sands. The Frontier project will provide significant economic benefits for the region, Alberta, and Canada. Teck stated that the project will result in the recovery of about 3.2 billion barrels of bitumen over its approximately 41-year life. The municipal, provincial, and federal governments will all receive significant direct financial benefits as a result. These include approximately \$12 billion in taxes to Canada, \$55 billion to Alberta in taxes and royalties, and \$3.5 billion in property taxes to the municipal

government. It will provide major and long-term economic opportunities creating a total of 278 190 person-years of direct, indirect, and induced employment across Canada.

Environmental Effects

Reclamation

Teck is planning to reclaim the project footprint to equivalent land capability and relies on reclamation as the key mitigation measure for various environmental effects. While reclamation to an equivalent land capability is legally required, reclamation will not fully mitigate all project effects because some habitat types cannot be reclaimed (e.g., peatlands), reclamation will not occur or be complete for many years, and there are uncertainties associated with final reclamation outcomes. Further, it is uncertain whether indigenous groups will reestablish traditional use activities on reclaimed lands following a multigenerational absence and the resulting loss of cultural connection to those lands.

The panel is encouraged by Teck's plan for progressive reclamation, and we support Teck's plan to establish a reclamation working group to ensure that indigenous viewpoints are respected and integrated into reclamation activities. This should help to address some uncertainties related to reclamation outcomes such as the ability to return the land to equivalent capability, to integrate it to the boreal forest ecosystem, and have it returned to users. While there are uncertainties associated with certain aspects of Teck's reclamation and closure plans and Teck's ability to meet desired outcomes, this is expected at this stage of the process and given the long life of the project. The panel has put in place a number of conditions related to reclamation, monitoring, reporting, adaptive management, and mine closure. Mine reclamation plans will provide the AER with detailed development and reclamation plans throughout the life of the project and allow Teck to enhance and refine its reclamation plan to consider new technology, advances in reclamation techniques, regulation changes, and continuous input from stakeholders.

Wetlands

Wetlands cover 43.6% of the local study area, with the most common wetland class being forested and hardwood swamps. The Frontier project will remove all wetlands from the project development area. Although Teck has included wetlands as part of its reclamation and closure plan, there will be a net loss of over 14 000 hectares of wetlands in the local study area, including an irreversible loss of over 3000 hectares of peatlands. Given the importance of wetlands as habitat for some at-risk species, for biodiversity and for indigenous land use, there is a need for ongoing research into wetland reclamation. The panel has required Teck to conduct wetland reclamation research as part of its reclamation plan. The loss of more than 14 000 hectares of wetlands is a high-magnitude and irreversible project effect. The project in combination with other existing, approved, and planned projects will result in significant adverse cumulative effects to wetlands in the region.

Old-Growth Forests

Old-growth forests serve as habitat for some species, including at-risk species, of birds and wildlife, while also contributing to biodiversity in the region. The project will remove all old-growth forests within the project disturbance area. There may be a loss of habitat for many species reliant on such forests, including species at risk, for at least 100 years following closure in 2081. There will be high-magnitude, long-term, but possibly reversible cumulative effects on old-growth forests. The project in combination combined with other operating, approved, and planned developments will result in significant adverse cumulative effects to old-growth forests in the area.

Woodland Caribou

Woodland caribou are a species at risk and are traditionally and culturally important to indigenous people. The project is not located within an area currently defined as core caribou range; however, there is evidence of some use of the northern portion of the project area by caribou from the Red Earth herd. Given the limited amount of high- and moderate-suitability caribou habitat in the project area and its location outside of current core caribou range, the project is not likely to result in a significant adverse effect to the two caribou herds that are located near the project area. However, the panel recognizes that woodland caribou are declining throughout their range, and provincial caribou range plans have not yet been finalized. The project, therefore, has the potential to make an incremental contribution to already existing significant adverse cumulative effects to woodland caribou.

The panel has imposed several conditions and made recommendations to Teck concerning caribou. Before constructing the Frontier project, Teck must finalize its wildlife mitigation, monitoring, and adaptive management plan; describe how it will monitor effects of the project on caribou, such as incidental predation; and explain how it will determine whether additional mitigation measures related to caribou are required and submit the plan to the AER for approval.

The panel recommends that that the Government of Alberta complete and implement critical range management plans for woodland caribou in northeastern Alberta and that the Government of Canada complete the federal recovery strategy and action plan for woodland caribou, as it pertains to the Red Earth and Richardson range herds. Other recommendations are found in the report.

Ronald Lake Bison Herd

The Ronald Lake bison herd is a small population of disease-free wood bison that are genetically distinct from those found in Wood Buffalo National Park. The Frontier project is located within a portion of the seasonal range of the Ronald Lake herd. There is a concern that development of the project could cause the Ronald Lake bison herd to move northward into Wood Buffalo National Park, which may result in the herd coming into contact with the herds within the park, which are known to carry bovine tuberculosis or brucellosis. The use of the Ronald Lake bison by indigenous peoples is dependent on the bison remaining disease-free. Ronald Lake bison are protected from non-indigenous hunting under Alberta's *Wildlife Act*

and are a listed species under Canada's *Species at Risk Act*. They are subject to the 2018 *Recovery Strategy for the Wood Bison in Canada* under the *Species at Risk Act*.

The magnitude of project's effects on bison habitat is considered high given that the project will affect over 20 per cent of bison habitat within the regional study area, and habitat loss is a primary threat to bison sustainability. The potential for the Ronald Lake bison to become diseased through contact with diseased bison in Wood Buffalo National Park is also considered a high-magnitude effect. While the threat of disease transmission exists today without the project, and there is uncertainty about the degree to which the project will increase this risk, if it were to occur it would represent a high-magnitude effect that would be irreversible. It would have significant consequences for the herd and the asserted rights, use of lands and resources, and cultural practices of indigenous communities who are connected to the herd.

The panel received conflicting evidence and views about the location of critical habitat for the Ronald Lake herd, the habitat's carrying capacity, the potential for the project to increase the potential for the herd to come into contact with diseased bison within Wood Buffalo National Park, and the effectiveness of potential mitigation measures. Given the conflicting evidence, the lack of mitigation measures proven to be effective, and the small population size and at-risk status of the herd, the panel has relied on a precautionary approach to determine that the project is likely to result in significant adverse effects to bison related to habitat availability and disease transmission. For similar reasons, and relying on a precautionary approach, the panel has also determined that the project combined with other existing, approved, and planned projects is likely to result in significant adverse effects to the Ronald Lake bison.

The panel has imposed several conditions and made recommendations to Teck concerning the Ronald Lake bison. Before constructing the Frontier project, Teck must finalize its Ronald Lake bison mitigation, monitoring, and adaptive management plan with input from indigenous communities and relevant provincial and federal authorities and submit it to the AER for approval.

The panel also made recommendations to the governments of Alberta and Canada concerning management of the Ronald Lake bison. The panel recommends that the Government of Alberta continue to monitor the status of the herd and complete its provincial management plan for wood bison under the federal recovery strategy, including a management plan for the Ronald Lake herd. The panel recommends that the Government of Canada complete the imminent threat analysis for wood bison currently underway and its work to define critical habitat for the Ronald Lake bison population as required by the federal recovery strategy for wood bison as soon as possible so that this work can further inform federal decisions related to the Frontier project. The panel also recommends that the governments of Alberta and Canada consider implementing a co-management approach for the Ronald Lake bison that involves indigenous groups and industry. For all of the panel's recommendations related to the Ronald Lake bison, refer to [Appendix 6](#).

Effects to Wetland and Old-Growth-Reliant Species at Risk and Other Wildlife

A substantial amount of wetland and old-growth forest habitat will be lost entirely or lost for an extended period as a result of the Frontier project and this will contribute to losses that have already occurred in the region. The panel found that the project is likely to result in high-magnitude (greater than 10 per cent) effects to habitat availability in the regional study area for some species of migratory birds and bats which are species at risk. The panel concludes that these effects would be significant. The panel also concludes that the project combined with other existing, approved, and planned projects is likely to result in significant adverse cumulative effects for some species of migratory birds, bats and amphibians which are species at risk as well as fisher and Canada lynx. For some species, significant habitat loss has already occurred and the project only makes an incremental contribution to the loss. Despite the findings of significant adverse effects, project and cumulative effects are not expected to threaten the sustainability of regional species populations.

Biodiversity

The project will contribute to a regional loss of upland ecosystems, wetlands, old-growth forests, and areas of high species diversity potential, rare plant potential, and traditional use potential. While reclamation will mitigate these effects, some residual effects will remain. Some high biodiversity potential areas cannot be reclaimed (peatlands) while others will not become reestablished for many years after reclamation and closure (old-growth forests). There is also uncertainty about whether equivalent levels of species and community diversity can be restored given the limited number of species included in reclamation planting prescriptions.

While Teck has an aspirational goal of achieving a net positive impact on biodiversity as a result of the Frontier project and has developed a draft biodiversity management plan for the project, Teck did not provide sufficient evidence to demonstrate how it will achieve levels of biodiversity equivalent to predevelopment conditions, much less a net positive improvement on biodiversity. While Teck stated that it will consider the use of conservation offsets to mitigate residual project effects, it did not identify or commit to any specific offset proposals. Teck noted that the Government of Alberta does not currently have a regulatory requirement or policy framework in place for the use of conservation offsets. The panel also heard concerns from indigenous groups and other participants that the biodiversity management framework to be developed under the *Lower Athabasca Regional Plan* had still not been finalized more than five years after it was to be complete.

The Mikisew Cree First Nation, Athabasca Chipewyan First Nation, and Teck jointly recommended the establishment of a biodiversity stewardship area as a permanently protected area of sufficient size to support the exercise of aboriginal and treaty rights and the culturally important relationships between First Nations and local wildlife, including the Ronald Lake bison. We are aware from public announcements by the Government of Alberta that, since the close of the hearing, it has established the Kitaskino Nuwenëné Wildland Provincial Park, which incorporates much of the land area proposed by the First

Nations to be included in the biodiversity stewardship area. The management intent of the park is to support the exercise of treaty and harvesting rights for First Nations and Métis harvesters, as well as other traditional uses, including cultural activities.

In the absence of sufficient evidence to demonstrate how Teck will achieve its biodiversity objectives, and having regard for the size of the project disturbance area (292 square kilometres), the panel concludes that the project is likely to result in a significant adverse effect to biodiversity, primarily as a result of the loss of wetlands and old-growth forests. The loss of areas of high species diversity potential, rare plants, and traditional use potential contribute to this effect. Given that similar losses of high biodiversity potential areas are occurring at other mining operations in the region, the panel concludes that the project in combination with other existing, approved, and planned developments will also result in significant adverse cumulative effects to biodiversity.

The panel believes that conservation offsets are one of the few available mitigation measures that could be used to mitigate some project and cumulative effects. The panel recommends that Teck discuss the use of conservation offsets with Alberta and Canada, with input from potentially affected indigenous communities, to further mitigate the effects of the project on biodiversity.

The panel recommends that the Government of Alberta consider providing further policy direction and guidance on the use of conservation offsets as part of any future updates to the *Lower Athabasca Regional Plan*. The panel also recommends that it finalize and implement the biodiversity management framework under the *Lower Athabasca Regional Plan* as soon as possible, or, if it no longer plans to implement the biodiversity management plan, that it amend the *Lower Athabasca Regional Plan* as necessary.

Air Quality

The Frontier project is not expected to result in significant adverse effects to air quality. Emissions from the mine fleet make up a substantial portion of NO_x emissions from the project. Teck proposes to mitigate mine fleet NO_x emissions by using Tier IV compliant equipment and ensuring the mine fleet is maintained to prevent an increase in mine fleet emissions; the panel has imposed this as a condition of approval. The Frontier project makes a relatively low contribution to regional emissions and is not expected to cause an increase in NO₂ exceedances in the mineable oil sands area. The panel recognizes there is some uncertainty regarding expected levels of regional NO_x emissions because Teck has assumed that all other operators will transition to Tier IV mine fleet equipment in the future. If Tier IV or equivalent emission control technology is not widely adopted by other operators in the region, then regional NO_x emissions may be higher than those modelled by Teck in its assessment. This may also contribute to exceedances of critical thresholds for NO₂. However the current ambient air quality monitoring in the region should provide sufficient warning of potential NO_x air quality issues in the region such that mitigation measures and adaptive management plans can be implemented regionally, as contemplated in the *Air Quality Management Framework* under the *Lower Athabasca Regional Plan*.

Effects of SO₂ emissions from the Frontier project will be minimal due to the use of low-sulphur natural gas and diesel fuels, which we require as a condition of the approval.

Greenhouse Gas Emissions

The project will be large emitter of greenhouse gases. Total greenhouse gas emissions from the project are estimated to be about 4.1 million tonnes of CO₂ equivalent per year. Teck submitted that the Frontier project will be “best in class” with respect to greenhouse gas emissions intensity, having among the lowest greenhouse gas emission intensities compared to all other oil sands production and having a lower emissions intensity than about half of all oil refined in the United States.

Some participants disputed Teck’s claims about its greenhouse gas emissions intensity and urged the panel to deny the project based on the magnitude of its greenhouse gas emissions. We agree that the evidence provided by Teck does not demonstrate how the Frontier project will achieve best-in-class greenhouse gas emissions intensity. However there is no specific regulatory requirement to achieve this standard. The project is required to meet existing provincial and federal requirements for greenhouse gas emissions, including Alberta’s *Carbon Competitiveness Incentive Regulation* and *Oil Sands Emissions Limit Act*. The project satisfies these requirements.

The panel acknowledges there is some uncertainty about whether or when the 100 megatonne greenhouse gas emissions limit in Alberta’s *Oil Sands Emissions Limit Act* will be implemented; however, the current oil sands greenhouse gas emissions are well below the limit and will remain below the limit with the approval of the Frontier project. Although changes may occur to the *Carbon Competitiveness Incentive Regulation* as a result of the recent change in government in Alberta, the project must comply with any change to regulatory requirements in place over the life of the project. The panel also recognizes that if the project is approved and constructed, it may make it more difficult to achieve Canada’s targets and commitments under the Paris Accord, including a 30% reduction of 2005 greenhouse gas emission levels by 2030 and the 2050 mid-century target for total Canada greenhouse gas emissions of 150 Mt/year. However, the development of policies and programs to meet Canada’s international commitments and implementation of Alberta’s Climate Leadership Plan are beyond the scope of this project review and the authority of the panel.

Groundwater and Surface Water

The project is not expected to result in significant adverse effects to groundwater or surface water quantity or quality.

The proposed project design and mitigation measures will ensure that process-affected water is not discharged to the surrounding environment. While some seepage from tailings areas into groundwater is expected to occur, Teck has proposed appropriate mitigation measures, and the panel has required groundwater monitoring and reporting. These measures should be sufficient to ensure that contaminants

do not reach surface water bodies at concentrations that would cause harm to aquatic resources, wildlife, or humans.

Flooding of organic soils and mercury in inflowing waters has the potential to result in the formation of methylmercury in the fish habitat compensation lake and off-stream storage reservoirs, and there was a concern that this could bioaccumulate in fish tissue, increasing potential health risks for wildlife and humans. Teck has proposed stripping organic soils from the fish habitat compensation lake and off-stream storage reservoirs before construction, and we have included this as a condition of approval. The panel has also included conditions requiring Teck to conduct additional baseline sampling for mercury, to monitor mercury and methylmercury concentrations in the fish habitat compensation lake and off-stream storage ponds, and develop an adaptive management plan that identifies what actions will be taken should elevated levels of mercury or methylmercury be observed. As a result, the project is not expected to make a significant contribution to mercury or methylmercury concentrations in downstream receiving environments.

End-pit lakes are part of Teck's closure plan, but Teck has committed to not placing treated or untreated tailings in them. This is expected to result in higher initial water quality in the end-pit lakes than water in lakes containing fluid tailings, which should result in improved outcomes and shorter timelines for site closure. Some uncertainty remains about when final closure of the reclaimed project area will occur, and currently there is no policy for the release of water from end-pit lakes. However, the panel found the level of information provided by Teck about end-pit lakes to be sufficient at this stage of the regulatory process, given end-pit lakes are many years away for the Frontier project and the understanding of end-pit lakes is improving with ongoing research.

While water levels and flows in the Athabasca River and Peace-Athabasca Delta remain a concern for Mikisew, Athabasca Chipewyan, and other indigenous communities, the project is not expected to have a significant effect on water levels or flows in these areas. Teck has committed to constructing off-stream water storage and to minimizing water withdrawals during periods of low flow on the Athabasca River. In addition, the panel has included conditions requiring that Teck develop an off-stream fresh water storage plan and a water withdrawal minimization strategy and prohibiting the diversion of water from the Athabasca River during periods of low flow to fill end-pit lakes.

Fish and Fish Habitat

The project will result in the destruction or permanent alteration of fish habitat that is part of or supports a recreational or aboriginal fishery, but it is not expected to result in a significant adverse effect to fish or fish habitat following mitigation. Teck proposes to construct a fish habitat compensation lake to mitigate project effects to fish and fish habitat. We accept the view of the Department of Fisheries and Oceans that when finalized and implemented, the detailed fisheries offsetting plan will fully mitigate the effects of the project.

Human Health

The Frontier project is not likely to result in a measureable increase in risk to human health. Exposures to chemicals of potential concern from the project will be small, and emissions from the project combined with other sources in the region are not expected to exceed risk-based regulatory thresholds or other values justified within the human health risk assessment. On the few occasions where regulatory guidelines are predicted to be exceeded, no significant increase over current concentrations is expected as a result of the project. The panel found that the methodology and analysis in Teck's human health risk assessment was appropriate, conservative, and thorough and could be relied on.

The panel has recommended that the governments of Alberta and Canada consider implementing a community health baseline study, including representation from local communities and oil sands operators. The panel recognizes that this recommendation has been made by previous joint review panels; however, the recommendation has yet to be implemented and community members continue to be concerned about the potential for health effects as a result of the amount of industrial development in the region. A community health study may help address some of those concerns.

Effects on Traditional Land Use, Rights, and Culture

During the review of the Frontier project, a number of indigenous groups actively participated in the process with written submissions, documented oral testimony, traditional land-use assessments, cultural impact assessments, and numerous other studies and reports:

Treaty 8 First Nations:

- Athabasca Chipewyan First Nation
- Mikisew Cree First Nation
- Fort McMurray First Nation #468
- Fort McKay First Nation
- Deninu K'ue First Nation
- Smith's Landing First Nation
- Kátł'odeeche First Nation
- Fond du Lac First Nation

Non-status indigenous groups:

- Original (First) Fort McMurray First Nation
- Clearwater River Band

Métis indigenous groups:

- Fort Chipewyan Métis Local 125
- Fort McMurray Métis Local 1935
- Fort McKay Métis Local 63
- Lakeland Métis Local 1909
- Owl River Métis Local # 1949
- Métis Nation of Alberta Region 1
- The Northwest Territory Métis Nation

All of the indigenous groups that would be significantly affected by the Frontier project signed agreements with Teck. Although the panel was not privy to all the details of these private agreements, parties identified a number of economic benefits, opportunities for meaningful engagement and communication, and measures to mitigate the effects of the project. Some groups have expressed outright support for the project and indicated that the implementation of the agreements will lead to measurable positive effects in their communities. Others have indicated that through the agreements they have resolved their project-specific concerns but that their support for the project is conditional on a number of actions by governments through which the effects of the project and other development can be further mitigated. The agreements included recommendations to Alberta and Canada to address issues such as regional planning, water allocation, and wildlife management that are beyond the ability of Teck, the indigenous groups, or this panel, to address. The panel must assume that the measures agreed upon would meet their respective needs and interests with respect to the Frontier project.

Regardless of whether an indigenous community has signed an agreement or has stated its support for the project, the panel is mandated to accept and review information on the potential adverse environmental effects that the project may have on asserted or established aboriginal or treaty rights, and information regarding any measures proposed to avoid or mitigate the potential adverse effects of the project on asserted or established aboriginal or treaty rights.

The panel determined the significance of the Frontier project effects for each indigenous community to their current use of lands and resources and physical and cultural heritage based on the approach in the Agency's guide *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

The panel also assessed the potential for the Frontier project to impact the asserted rights assisted by the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Overall, the project will result in the loss of lands and some resources used for traditional activities, and this will affect indigenous groups and their members who use the project area. The mitigation measures proposed are not sufficient to fully mitigate these effects. The project effects alone are unlikely to extinguish the ability of indigenous groups to practice traditional activities. Although the assessments varied for each group, in general the panel found that the project effects on use of lands and resources for traditional purposes, their cultural and physical heritage, and asserted rights will be adverse and significant for those groups close to the project. For groups far from the project area, the project effects would be negligible.

The panel found that project effects, in combination with the effects of other existing, approved, and planned developments and other disturbances in the region surrounding the project are adverse and significant for most indigenous groups for some or all of the factors assessed. The exceptions are those groups who entered late in the review process and did not provide sufficient information for us to make a determination or who are far from the area—in some cases several hundred kilometres away.

Assessments for each of the indigenous groups are included in this report.

Mitigations by individual project proponents are not effective at avoiding significant adverse cumulative effects in the project region. The intent of the *Lower Athabasca Regional Plan* is to take more of a cumulative-effects-based approach to managing environmental effects in the Lower Athabasca region, but it does not specifically address use of lands and resources for traditional purposes, cultural and physical heritage, and effects on asserted rights. Several indigenous groups expressed concern that it does not address their concerns and does not protect their aboriginal or treaty rights.

Indigenous groups that participated in the hearing raised concerns about the adequacy of consultation by the governments of Canada and Alberta, particularly with respect to the management of cumulative effects in the oil sands region and the impact of these effects on their aboriginal and treaty rights.

Effects to the Outstanding Universal Value of Wood Buffalo National Park World Heritage Site

Water Quantity and Quality in the Peace-Athabasca Delta

The Frontier project is not expected to result in measureable effects to water flows or levels in the Peace-Athabasca Delta. The amount of water to be diverted for the project is very small compared to flows in the Athabasca River, and the change in water level in Lake Athabasca is estimated to be less than one centimetre at the maximum diversion rate. While the cumulative effect for all oil sands water withdrawals may contribute to measureable changes in water levels in the Athabasca River and Lake Athabasca, the magnitude of the change is about 6 centimetres and is small compared to changes resulting from climate change and flow regulation on the Peace River. While cumulative effects to water levels are occurring in the Peace-Athabasca Delta, the project will make a negligible contribution to this effect, and the

combined contribution of all oil sands withdrawals is small. Climate change and flow regulation on the Peace River have much larger adverse effects.

The Frontier project is also not expected to result in measureable effects to water quality in the Peace-Athabasca Delta, Lake Claire, or Ronald Lake. However, the Frontier project has the potential to adversely affect water quality in the Peace-Athabasca Delta and Wood Buffalo National Park through three contaminant pathways: releases from the project area to the Athabasca River, which would flow into the Peace-Athabasca Delta; releases from the project area to the Ronald Lake watershed, which would flow via Buckton Creek into Lake Claire; and aerial deposition of metals, polycyclic aromatic hydrocarbons, or acidifying compounds from the project, which could affect water quality. The panel expects that these effects will be minimal given the low magnitude of changes predicted at the local study area level and the distance between the Frontier project and the Peace-Athabasca Delta and Wood Buffalo National Park, which will further reduce contaminant concentrations in air and water before they reach these areas.

Even though measurable changes to water quality are not expected to occur in the Peace-Athabasca Delta as a result of the project, the panel understands that contaminant loading in the Peace-Athabasca Delta remains a concern, and the project could contribute to this loading. Monitoring and studies conducted to date have not identified any consistent trends in water or sediment quality within the Peace-Athabasca Delta that are attributable to loadings from the oil sands mining industry. However, the panel understands that the Peace-Athabasca Delta is a dynamic system with a high degree of inherent variability in water quality, making it difficult to detect low-level effects. Mitigation measures implemented for the project, along with required monitoring of project effects by Teck, should serve as an early warning indicator of potential adverse downstream effects.

Additional regional monitoring and research is required because the Peace-Athabasca Delta and Wood Buffalo National Park have been less studied relative to the Athabasca River but are of high importance to the region. To better understand the regional contributions the proposed project may be having on water quality in the Peace-Athabasca Delta and Wood Buffalo National Park, Teck must fund regional water quality monitoring programs.

Wildlife and Human Health in the Peace-Athabasca Delta

We are satisfied that Teck's wildlife health risk assessment was conducted in a reasoned and responsible manner and is consistent with existing regulatory guidelines. We agree with Teck's conclusion that the project will only contribute to minor increases in potential exposure to chemicals of potential concern to wildlife in the region and that these exposures are not expected to have an adverse effect on wildlife.

We also find that the project is not likely to result in significant adverse human health effects. Teck's methodology and analysis in its human health risk assessment was appropriate and conservative. Given

that increased risk to human health is not predicted to occur in the vicinity of the project, increased human health risks are not expected to occur in the Peace-Athabasca Delta.

Given the proximity of the Frontier project to Wood Buffalo National Park and the Peace-Athabasca Delta, we find that there is a potential for the project to increase some air quality parameters in those areas. However, the panel expects that any changes that occur will be of low magnitude, and air quality will remain close to background in the Peace-Athabasca Delta and Wood Buffalo National Park.

Migratory Waterfowl and Water Birds

The project will result in the loss of high- and moderate-suitability habitat for migratory birds within the project disturbance area. While this will have a negative effect on waterfowl nesting and rearing habitat and reduce the available waterfowl stopover habitat, considerable habitat remains available in the region. As migratory pathways are not fully understood, it is difficult to assess the magnitude of this effect on birds migrating to and from Wood Buffalo National Park, but the panel expects the magnitude to be low.

In addition, there is the potential for migratory waterfowl and water birds to land on tailings ponds and come into contact with process-affected water or bitumen. Given the number of birds observed to land on tailings ponds and Teck's commitment to use state of the art bird deterrent systems, the panel finds that the likelihood of this occurring is low.

The panel concludes that effects to migratory waterfowl and water birds, while adverse, are not likely to be significant.

Whooping Crane and Whooping Crane Habitat

The project will not directly or adversely affect breeding habitat for Whooping Crane given the location of its breeding habitat and its distance from the project.

The project will result in the loss of temporary stopover habitat for Whooping Crane as discussed above for migratory waterfowl and water birds, but significant habitat remains available in the region. In addition, there is the potential for Whooping Crane to land on tailings ponds and come into contact with process-affected water or bitumen.

The project is not expected to adversely affect recovery of the species. The population has been growing even with oil sands growth. While we cannot rule out the possibility of mortality of Whooping Crane due to contact with tailings ponds, given Teck's mitigation measures, the potential is low and would not have a population-level effect on the species.

Great Plains-Boreal Grassland Ecosystem

The project is not likely to result in adverse effects to the Great Plains-Boreal grassland ecosystem. The project is not expected to result in measureable changes to air quality or surface water quantity and quality in the Peace-Athabasca Delta or Wood Buffalo National Park.

Predator-prey Relationship Between Wolves and Bison

The project is not likely to affect the predator-prey relationship between wolves and bison in the park given the distance between the project and the bison herds that reside within the park. There may be some potential for increased indirect mortality risk as a result of predation for the Ronald Lake bison herd because predation is expected to increase slightly in the southern portion of the Ronald Lake bison range near the project. However predation is expected to remain unchanged in the northern portion of the herd's range in Wood Buffalo National Park.

Ronald Lake Bison Herd

The panel considered the effects of the project on the Ronald Lake bison herd and determined that the Frontier project was likely to result in significant adverse effects to bison related to habitat availability and disease transmission. However, the panel does not consider the Ronald Lake bison herd to be an outstanding universal value of Wood Buffalo National Park because the majority of the herd's range is outside of the park and individuals only infrequently enter its boundaries.

Salt Plains and Gypsum Karst Features

There are no pathways by which the project would affect the salt plains or gypsum karst features within the park.

Integrity, Protection, and Management of Wood Buffalo National Park

The project will not result in any physical disturbance of Wood Buffalo National Park or create any new access routes to its borders. The project does not involve extraction of resources within its boundaries or cause adverse effects to ecosystems within the park. Based on the panel's review, effects of the Frontier project on Wood Buffalo National Park are expected to be of negligible or low magnitude. Since the park's location or remoteness will not be altered, the Frontier project is not expected affect its integrity, which is the overarching outstanding universal value of Wood Buffalo National Park.

Section 5 of *CEAA 2012*

Conclusions, mitigation measures, and recommendations related to section 5(1) of *CEAA 2012* in this report can be found in the following sections: [Bitumen Recovery](#), [Tailings Management Plan](#), [Air Quality](#), [Groundwater](#), [Surface Water Quality](#), [Surface Water Quantity](#), [Fish and Fish Habitat](#), [Wildlife](#),

and Effects on Indigenous Traditional Use of Lands and Resources, Culture, and Asserted Rights. These sections provide the panel's findings on

- the effects on fish, fish habitat and migratory birds and,
- with respect to indigenous peoples, the effects in Canada of any change to the environment in health and socioeconomic conditions, physical and cultural heritage, or the current use of lands and resources for traditional purposes, and to any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

Conclusions, mitigation measures, and recommendations related to section 5(2) of *CEAA 2012* in this report can be found in the following sections: Fish and Fish Habitat and Surface Water Quantity. These sections provide the panel's findings on potential effects on the environment and are directly linked or are necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out of the project.

2019 ABAER 008**Teck Resources Limited
Frontier Oil Sands Mine Project
Fort McMurray Area****Applications 1709793, 001-00247548, 001-00303079, and 001-00303091
CEAA Reference No. 65505****1 Introduction**

Project Description

[1] Teck applied to construct, operate, and reclaim a new oil sands mine and processing plant that would be located in northeastern Alberta about 110 kilometres (km) north of Fort McMurray, Alberta. The development area would be located in Townships 99, 100, 101, and 102, Ranges 9, 10, and 11, West of the 4th Meridian.

[2] The Frontier project would have a disturbance area of 29 217 hectares (292 km²), resulting from two development phases. Phase one would start in 2026, and both phases would be operational by 2037. Phase one will include two processing trains that would begin operating one year apart starting in 2026, and phase two will add a third train, which would begin operating in 2037. Each of the processing trains will have an ore processing capacity of 8000 tonnes per hour and a bitumen production capacity of 13 500 cubic metres (m³) per day (roughly 85 000 barrels [bbl] per day), all together producing about 41 300 m³/day or 260 000 barrels per day of partially deasphalted bitumen ([Table 1](#)).

Table 1. Frontier project schedule

Phase	Start-up year	Mined ore (t/h)	Cumulative bitumen production *	
			(m ³ /cd)	(bbl/cd)
1	2026	8 000	13 500	85 000
	2027	16 000	27 000	170 000
2	2037	24 000	41 300	260 000

* Nominal production rate of partially deasphalted bitumen

[3] The Frontier project will consist of two mine pits and use large shovels and haul trucks to excavate and transport overburden and ore. Each of the three process trains will include ore preparation, bitumen extraction, froth treatment, and tailings preparation.

[4] The tailings management strategy for the Frontier project will be based on enhanced beach capture and the use of centrifuges to treat fluid fine tailings recovered from the external tailings area.

[5] The Frontier project will also include supporting infrastructure and utilities including cogeneration facilities, support utilities, disposal and storage areas, a river water intake, a fish habitat compensation lake, a bridge over the Athabasca River, administration and maintenance facilities, roads, an aerodrome, and a camp.

[6] If approved, the Frontier project would operate for 41 years. [Table 2](#) shows Teck's proposed schedule.

Table 2. Teck's proposed project milestone schedule

Associated project approvals, licences and permits received for Phase 1	2017 to 2018
Teck Board of Directors project sanction decision	2019
Detailed engineering for Phase 1	2019 to 2023
Phase 1, production train 1 – site preparation and construction	2019 to 2025
Phase 1 – first oil ^a	2026
Phase 1, production train 2 – construction	2019 to 2026
Phase 1, production train 2 – first oil	2027
Phase 2 – construction ^b	2030 to 2036
Phase 2 – first oil	2037
Phases 1 and 2 – end of mine life	2066
Closure complete ^c	2081

a First oil production is assumed to occur on January 1, so 2026 comprises Year 1 of production.

b Phase 2 site preparation starts in 2030 and construction of production train 3 starts in 2033.

c Closure is considered complete when major closure works and reclamation have been completed; this includes pit lakes being fully integrated with the surrounding receiving waters.

The Applications

[7] Provincial approvals are required for the following applications:

- Application 1709793 pursuant to sections 10 and 11 of the *Oil Sands Conservation Act (OSCA)* to construct, operate, and reclaim a new oil sands mine and processing plant
- Application 001-00247548 pursuant to section 66 of the *Environmental Protection and Enhancement Act (EPEA)* to construct, operate, and reclaim the Frontier project
- Application 001-00303079 under the *Water Act* for approval to carry out activities for site water management associated with the Frontier project
- Application 001-00303091 under the *Water Act* for a licence for the annual diversion and use of water

[8] The panel's terms of reference define the scope of the environmental assessment of the Frontier project. The panel's mandate was to consider the environmental effects of the project, access road, bridge,

and aerodrome. If the Frontier project is approved, ancillary approvals will be required from other government agencies for other components.

- The Frontier project is also subject to review by the Fisheries and Oceans Canada under sections 32 and 35 of the *Fisheries Act* and the *Canadian Environmental Assessment Act, 2012*.

[9] Teck has not submitted any applications under the *Public Lands Act*. However, in order to proceed with the Frontier project, some activities will need *Public Lands Act* dispositions by the Alberta Energy Regulatory (AER) or Alberta Environment and Parks (AEP).

Legislative and Regulatory Framework

[10] In July 2012, the *Canadian Environmental Assessment Act, 2012 (CEAA 2012)* came into force and repealed the *Canadian Environmental Assessment Act*. Pursuant to section 126 of *CEAA 2012*, the review of the Frontier project commenced under the *Canadian Environmental Assessment Act* and continued under *CEAA 2012*.

[11] In June 2013, the *Responsible Energy Development Act (REDA)* came into force in Alberta. *REDA* created the AER and repealed the *Energy Resources Conservation Act*, which had established the Energy Resources and Conservation Board. In accordance with *REDA*, the AER assumed all of the Energy Resources and Conservation Board's powers, duties and functions under Alberta's energy resource enactments (which includes *OSCA*), as well as Alberta Environment and Sustainable Resource Development's (now Alberta Environment and Parks) powers, duties and functions in respect of energy resource activities related to public lands, water, and the environment. The AER is responsible for *OSCA*, *EPEA*, and *Water Act* applications related to the Frontier project. The panel has factors it must consider under section 15 of *REDA*, section 3 of the *Responsible Energy Development Act General Regulation*, and section 3 of *OSCA*.

[12] The panel is satisfied that throughout this proceeding and in this report that it has considered all the factors identified in those provisions. This includes a consideration of the social and economic effects of the Frontier project, the effects of the Frontier project on the environment, and providing for orderly and efficient development in the public interest of oil sands resources in Alberta.

[13] Section 21 of *REDA* excludes the AER from determining the adequacy of Crown consultation associated with the rights of aboriginal peoples as recognized and affirmed under Part II of the *Constitution Act, 1982*. The Aboriginal Consultation Office (ACO) directs, monitors, and supports the consultation activities of Government of Alberta departments. Under provincial ministerial orders, the AER is required to request advice from the ACO prior to making a decision on an energy application for which First Nations or Métis Settlement consultation is required. The joint operating procedures for the AER and ACO requires that the AER request advice from the ACO as to whether the ACO has found consultation to have been adequate and request advice on mitigation measures that may be required to

address potential impacts on aboriginal rights. The panel made the request and received reports from the ACO with its advice before closing the evidentiary portion of the hearing.

[14] Alberta's *Land-Use Framework*, released in 2008 supported by the *Alberta Land Stewardship Act (ALSA)* sets out how land will be managed in Alberta to effectively balance competing economic, environmental and social demands. The regional plan under *ALSA* relevant to the Frontier project is the *Lower Athabasca Regional Plan (LARP)*. Although further public land applications will be required, the panel is satisfied that for the current applications the Frontier project aligns with *LARP*.

Joint Review Process

[15] The joint review process was established to create a cooperative proceeding pursuant to section 18 of *REDA* and a joint review panel pursuant to sections 38, 39, 40, and 42 of *CEAA 2012*. Under the agreement, the panel must conduct its review in a manner that discharges the responsibilities of the AER under *REDA*, *OSCA*, *EPEA*, and the *Water Act* and discharges the requirements of *CEAA 2012* and the terms of reference attached as an appendix to the agreement.

[16] Then-Alberta Environment (now Alberta Environment and Parks) issued the *Final Terms of Reference for the Environmental Impact Statement for the Frontier project* in February 2009.

[17] Teck submitted an integrated application November 24, 2011, that combined information required under *OSCA*, *EPEA*, the *Water Act*, and *CEAA 2012*.

[18] Between August 2012 and June 2015, Teck responded to four rounds of prepanel information requests with the AER, Alberta Environment and Sustainable Resource Development, and federal authorities, as defined in *CEAA 2012*. A public comment period was announced after each round of information requests to allow the public to review and provide additional comments on Teck's responses.

[19] On June 15, 2015, Teck submitted a project update which included significant changes to the design of the Frontier project, including the elimination of one development area, an expansion of one of the mine pits, a new tailings management plan, and a new bridge over the Athabasca River. Teck stated that the Frontier project was updated in order to realize opportunities associated with the asset exchange between Teck and Shell completed in 2013 and to highlight many improvements to the Frontier project's economic and social benefits and its overall environmental performance. The project update contained over 13 000 pages of additional material compared to the original integrated application and environmental impact assessment submitted in 2011, which contained approximately 8000 pages of material.

[20] Following the project update, there was another round of prepanel information requests with provincial regulators and federal authorities followed by a public comment period.

[21] On May 16, 2016, the AER advised Teck that it had deemed the environmental impact assessment for the Frontier project complete pursuant to section 53 of *EPEA*.

[22] On May 24, 2016, the federal minister of Environment and Climate Change (the Minister) and the CEO of the AER announced the *Agreement to Establish a Joint Review Panel for the Frontier Oil Sands Mine Project*. Pursuant to the agreement, they established the panel and appointed Mr. A. Bolton, as the panel chair, and Mr. R. C. McManus and Mr. W. Klassen as panel members.

[23] Immediately following the announcement of the Joint Panel Agreement on May 24, 2016, in response to the devastating wildfires in the Fort McMurray area, the Minister extended the time limit for issuance of the decision statement for the Frontier project by three months.

[24] The panel announced a public comment period on August 17, 2016, to allow the public to comment on the sufficiency of information submitted to date.

[25] The panel and three secretariat members visited the Frontier project area by helicopter on September 27, 2016.

[26] Between November 2, 2016, and March 20, 2017, the panel sent Teck nine information requests on various topics. Teck responded to the first request on March 29, 2017, and the panel announced a public comment period starting April 7, 2017. Over the next three months, Teck provided responses to the eight remaining information requests. On June 20, 2017, the panel announced that because Teck had provided responses to all information requests, the public comment period would close on July 20. In response to requests received by the public, the panel extended that comment period until July 24, 2017.

[27] On August 24, 2017, the agreement was amended by the Minister and the CEO of the AER to direct the panel to consider the potential effects of the Frontier project on the United Nations Education, Scientific and Cultural Organization (UNESCO) defined outstanding universal value of the Wood Buffalo National Park World Heritage Site, including the Peace-Athabasca Delta. It also reflected updates to the Frontier project provided by Teck.

[28] The panel determined that additional information was required from Teck to meet the new requirements outlined in the Amended Agreement before it could proceed to a hearing. A request for additional information was sent to Teck on August 24, 2017.

[29] On September 13, 2017, the panel requested an eight-month extension to the deadline to produce the joint review panel report. The panel cited several reasons for the request including the significant project update and changes to the terms of reference under the Amended Agreement. The panel was notified by the Minister on November 7, 2017, that the deadline had been extended as requested.

[30] Between October 13 and November 8, 2017, the panel sent two more information requests to Teck. Teck responded on February 28 and March 1, 2018. Another public comment period was

announced on March 12, 2018. Comments were received from indigenous groups, federal departments, and members of the public.

[31] On May 25, 2018, the panel advised Teck that additional information was required. The panel determined the information deficiency was minor in nature and that it would schedule a hearing subject to receiving a commitment from Teck to provide the additional information by June 29, 2018.

[32] On May 29, 2018, Teck confirmed its commitment to provide the required additional information by the requested date. Given Teck's commitment to provide the required information by the deadline, the panel determined that the information on the record was sufficient to proceed to the public hearing portion of the review.

[33] The panel issued a notice of hearing on June 6, 2018. In the notice, the groups listed below were invited to participate in the hearing. Groups or individuals not listed were asked to request to participate in the hearing by June 22, 2018. Teck Resources Limited, Environment and Climate Change Canada, Parks Canada Agency, Health Canada, Transport Canada, Department of Fisheries and Oceans, Natural Resources Canada, and the Canadian Environmental Assessment Agency (the Agency) were required to participate in the hearing.

- Athabasca Chipewyan First Nation
- Fort Chipewyan Métis Local 125
- Fort McKay First Nation
- Fort McKay Métis Community Association
- Métis Nation of Alberta Association Fort McMurray Local Council 1935
- Métis Nation of Alberta Association Lakeland Local Council 1909
- Mikisew Cree First Nation
- Oil Sands Environmental Coalition (OSEC)
- Canadian Parks and Wilderness Society Northern Alberta Chapter (CPAWS)
- Keepers of the Athabasca
- Aboriginal Consultation Office of Alberta Indigenous Relations, whose participation is provided for by Ministerial Order

[34] The panel issued participation decisions on July 6, 2018, and on July 12, 2018, issued a revised notice of hearing setting a schedule for submissions and motions and advising that the hearing would begin on September 25, 2018. The hearing began on that date and closed on December 12, 2018.

[35] On February 5, 2019 the panel requested an extension to July 25, 2019, to produce the joint review panel report. The panel cited several reasons for the request including the length of the hearing, the volume of the hearing record, concurrent reviews, and the need for a quality report. The panel was notified by the Minister on March 28, 2019, that the deadline had been extended as requested.

Table 3. Review process timeline

Date	Process step
February 11, 2009	Final terms of reference for environmental impact assessment
May 21, 2009	Additional terms of reference requirements and clarifications for the proposed project
November 24, 2011	Application submitted to AER by Teck Resources Ltd. and SilverBirch Energy for approval of the Frontier oil sands mine project Traditional land-use study submitted by Fort McKay First Nation
January 12, 2012	Commencement of federal environmental assessment
March 9, 2012	Funding Review Committee's report on the allocation of federal funds for the environmental assessment of the Frontier oil sands mine project
August 15, 2012	Round 1 information request by AER/ESRD/CEAA
August 30, 2012	Public Notice: Frontier Oil Sands Mine Project – Establishment of Timelines under CEAA 2012
January 15, 2013	Teck response to AER/ESRD/CEAA information request round 1
January 18, 2013	Public Notice: Frontier Oil Sands Mine Project – Environmental Assessment Public Comment Period on Additional Information
January 19, 2013	Public Notice: Frontier Oil Sands Mine Project – Environmental Assessment Referral to Review Panel and Availability of Funding
April 11, 2013	Round 2 information request by CEAA
June 6, 2013	Round 2 information request by AER/ESRD
October 28, 2013	Teck response to information request round 2
November 4, 2013	Public comments invited on additional information
December 23, 2013	Federal authorities' information requests provided to ESRD
March 17, 2014	Public Notice: Frontier Oil Sands Mine Project – Public Comment Invited on Draft Joint Review Panel Agreement
May 14, 2014	Round 3 information request by AER/ESRD
October 10, 2014	Teck responses to information request round 3
October 23, 2014	Public comment period on sufficiency of information submitted to date
January 29, 2015	Round 4 information request by CEAA
February 20, 2015	Round 4 information request by the AER/CEAA
June 15, 2015	Project update provided by Teck

Date	Process step
June 30, 2015	Teck responses to AER/CEAA information request round 4
July 2, 2015	Public comment period on sufficiency of information submitted to date
July 9, 2015	Notice of revised applications
November 19, 2015	Public Notice: Availability of Additional Participant Funding
November 27, 2015	AER/CEAA information request round 5
April 15, 2016	Teck responses to round 5 information request
April 28, 2016	Teck revised response to round 5 information request, appendix 31b.1 <i>Water Act Application Form (Corrected)</i>
May 13, 2016	Teck revised response to round 5 information request, question 33
May 16, 2016	Environmental impact assessment for Teck Resources Limited's proposed Frontier oil sands mine project deemed complete by the AER
May 19, 2016	Agreement To Establish a Joint Review Panel for the Frontier Oil Sands Mine Project Between the Minister of the Environment and Climate Change, Canada and the Alberta Energy Regulator
May 24, 2016	Establishment of joint review panel
May 25, 2016	Extension of time limit for issuance of decision statement
June 6, 2016	Corrections to the scope of the project in the panel's terms of reference
August 17, 2016	Panel announces public comment period on sufficiency of information submitted to date
September 27, 2016	Panel aerial tour of the Frontier oil sands mine project area
November 2, 2016	Panel sends package 1 information request
December 8, 2016	Panel sends package 2 information request
December 16, 2016	Panel sends package 3 information request
February 3, 2017	Panel sends package 4 information request
February 16, 2017	Panel sends package 5 information request
February 24, 2017	Panel sends package 6 information request
February 27, 2017	Panel sends package 7 information request
March 1, 2018	Panel sends package 8 information request
March 20, 2017	Panel sends package 9 information request
March 29, 2017	Teck responds to information request package 1
April 7, 2017	Panel announces public comment period on sufficiency of information submitted to date
April 29, 2017	Teck responds to information request packages 2 and 3
May 15, 2017	Teck responds to information request package 6
May 29, 2017	Teck responds to information request package 4

Date	Process step
May 31, 2017	Teck responds to information request packages 7 and 8
June 5, 2017	Teck responds to information request package 5
June 20, 2017	Panel announces public comment period on sufficiency of information submitted to date
August 24, 2017	Amendment of Joint Review Panel Agreement to consider project effects on the outstanding universal value of Wood Buffalo National Park World Heritage Site
August 24, 2017	Panel sends information request regarding the potential effects of the Frontier project on the outstanding universal value of Wood Buffalo National Park World Heritage Site
September 13, 2017	Panel requests an extension of the regulatory timeline under <i>CEAA 2012</i> to submit its report
October 13, 2017	Panel sends package 10 supplemental information request
November 7, 2017	Time limit extension granted
November 8, 2017	Panel sends package 11 information request
January 29, 2017	Teck responds to information request package 11
February 28, 2018	Teck responds to information request package 10
March 1, 2018	Teck responds to information request on the potential effects of the Frontier project on the outstanding universal value of Wood Buffalo National Park World Heritage Site
March 12, 2018	Public comment period on sufficiency of information submitted to date
May 25, 2018	Panel sends package 12 information request
June 6, 2018	Notice of hearing issued
June 6, 2018	Panel asks the Aboriginal Consultation Office for advice on consultation
June 29, 2018	Teck responds to information request package 12
July 12, 2018	Revised notice of hearing issued
September 22, 2018	Panel ruling on questions of constitutional Law
September 25 to	Hearing
October 24, 2018	
November 26, 2018	Alberta Aboriginal Consultation Office hearing reports provided
December 11 and 12, 2018	Final arguments
December 12, 2018	Hearing record closed
February 5, 2019	Panel requests an extension of the regulatory timeline under <i>CEAA 2012</i> to submit its report
March 28, 2019	Time limit extension granted to July 25, 2019

Participant Funding Program

[36] The Agency administers a participant funding program, which supports individuals, non-profit organizations, and indigenous groups interested in participating in federal environmental assessments to ensure that concerns from the public and aboriginal groups are taken into consideration during an environmental assessment process. Neither the panel nor the panel secretariat is involved in the administration of the participant funding program or decisions on funding allocations. Over the course of the review, the Agency allotted \$1 124 274.35 among 21 applicants, including the following:

- Athabasca Chipewyan First Nation
- Canadian Parks and Wilderness Society, Northern Alberta
- Deninu K'ue First Nation
- Fond du Lac Denesuline First Nation
- Fort McKay First Nation
- Fort McKay First Nation and Fort McKay Métis Community Association (Métis Local 63)
- Fort McKay Métis Community Association
- Fort McMurray #468 First Nation
- John Malcolm on behalf of the Clearwater River Band #175
- John Malcolm on behalf of the Original Fort McMurray First Nation
- Kátl'odeeche First Nation
- Keepers of the Athabasca Watershed Society
- Métis Nation of Alberta Association Fort McMurray Local Council 1935
- Métis Nation of Alberta Association Lakeland Local Council 1909
- Métis Nation of Alberta Association Local #125 Fort Chipewyan
- Métis Nation of Alberta Association Owl River Métis Local 1949
- Métis Nation of Alberta, Region 1
- Mikisew Cree First Nation Government and Industry Relations
- North West Territories Métis Nations
- Pembina Institute for Appropriate Development
- Smith's Landing First Nation

Question of Constitutional Law

[37] The panel's ability to consider questions of constitutional law is derived from the *Administrative Procedures and Jurisdiction Act RSA 2000 A-3 (APJA)* and the *Designation of Constitutional Decision Makers Regulation*, A.R. 69/2009. *APJA* defines questions of constitutional law and also provides notice requirements for posing those questions.

[38] On August 30, 2018, the Original Fort McMurray First Nation and the Clearwater River Band No. 175 (collectively the Filers) filed a joint Notice of Question of Constitutional Law. The notice was served on Teck, the Minister of Justice and Solicitor General of Alberta and the Attorney General of Canada

[39] The notice first asserted that the Filers are Indians under section 91(24) of the *Constitution Act, 1867* and are adherents to Treaty No. 8 and hold rights to hunt, fish, trap and gather on traditional lands that would be adversely affected by the proposed project. The notice also stated that the Crown must consult and accommodate First Nations peoples even if existing aboriginal title to the lands has not yet been proven.

[40] The Filers posed the following questions:

- Has the Crown in right of Alberta discharged the duty to consult and accommodate the Clearwater River Band with respect to the potential adverse effects of the project on the Clearwater River Band's treaty rights, as mandated by the treaty and section 35 of the *Constitution Act, 1982*?
- Has the Crown in right of Alberta discharged the duty to consult and accommodate the Original Fort McMurray First Nation with respect to Original Fort McMurray First Nation's aboriginal rights as mandated by section 35 of the *Constitution Act, 1982*?
- Has the Crown in right of Canada discharged the duty to consult and accommodate the Clearwater River Band with respect to the potential adverse effects of the project on the Clearwater River Band's treaty rights, as mandated by the treaty and section 35 of the *Constitution Act, 1982*?
- Has the Crown in right of Canada discharged the duty to consult and accommodate the Original Fort McMurray First Nation with respect to Original Fort McMurray First Nation's aboriginal rights as mandated by section 35 of the *Constitution Act, 1982*?

[41] The Filers sought the following relief:

- The panel deny the project because the Crown in right of Alberta or Canada has failed to adequately discharge the duty to consult and accommodate the Clearwater River Band and Original Fort McMurray First Nation.

- A finding that the project is not in the public interest and cannot be authorized unless and until the Crown has fully discharged its duties to consult and accommodate Clearwater River Band with respect to potential adverse effects on its treaty rights.
- A finding that the project is not in the public interest and cannot be authorized unless and until the Crown has fully discharged its duties to consult and accommodate Original Fort McMurray First Nation with respect to potential adverse effects on its aboriginal rights.
- In the alternative, Teck be directed to resolve the unresolved and serious issues regarding the development of its project on the lands of the Clearwater River Band and Original Fort McMurray First Nation.

[42] On September 12, 2018, the panel outlined a process for receiving written submissions from hearing participants concerning any matters that could bear on the panel's consideration of the Notice of Question of Constitutional Law. The Minister of Justice and Solicitor General of Alberta, the Attorney General of Canada and Teck filed written submissions for the panel's consideration. The Filers provided written submissions replying to Canada's, Alberta's, and Teck's submissions.

[43] On September 22, 2018, the panel released its written decision ([Appendix 3](#)) stating that the questions posed in the notice all ask that the panel assess the adequacy of the Crown's consultation with the Filers, as holders of aboriginal and treaty rights. The panel found that it did not have the need, jurisdiction, or ability to answer those questions.

[44] The panel stated that its terms of reference expressly state that the panel is not required to address that issue. Additionally, as an AER panel, they are bound by section 21 of *REDA*, which states the following:

The Regulator [AER] has no jurisdiction with respect to assessing the adequacy of Crown consultation associated with the rights of aboriginal peoples as recognized and affirmed under Part II of the *Constitution Act, 1982*.

[45] Further, the panel noted that its activities with respect to these proceedings form part of Canada's consultation with indigenous peoples. Consultation by Canada could occur after the panel issues its report and before federal decision-making occurs under *CEAA 2012* or other federal statutes respecting the issuance of approvals. The panel found that the time for assessing the adequacy of consultation should occur after the panel's report has been issued and considered.

[46] The panel, in its capacity as an AER panel, also determined that it lacked the jurisdiction to assess consultation adequacy. And, as a federal review panel, the panel would be acting prematurely if it were to assess the sufficiency of consultation. For these reasons, the panel dismissed the Notice of Question of Constitutional Law.

Motions

Athabasca Chipewyan First Nation Motion

[47] On July 31, 2018, the Athabasca Chipewyan First Nation sought an order from the panel that s. 20(1) of the *Responsible Energy Development Act* does not apply to the hearing of the Frontier oil sands mine project.

[48] Section 20(1) states:

ALSA regional plans

20(1) In carrying out its powers, duties and functions under this Act or any other enactment, the Regulator shall act in accordance with any applicable ALSA [Alberta Land Stewardship Act] regional plan.

[49] The panel decided it could not make such an order and dismissed the motion (see [Appendix 4](#)). In its decision, the panel stated that it must follow all provisions of *REDA*, including section 20, in fulfilling its AER functions. Further, any discussion regarding section 20(1) of *REDA* on the panel's mandate would need to occur with the benefit of all the information the panel expected to receive in the hearing.

[50] On the same day the panel released its decision on the motion, it received OSEC's submission regarding the matter. The panel did not reconsider its decision as OSEC's submission stated the order sought by Athabasca Chipewyan First Nation was not necessary.

Mikisew Cree First Nation Motion

[51] On September 17, 2018 Mikisew Cree First Nation filed a motion pursuant to section 20(1) of *AER Rules of Practice* and section 45 of *CEAA 2012* for an order to have certain representatives of the Government of Alberta attend the hearing to speak to issues related to *LARP* and its frameworks, Alberta's bison management proposals, and the report of the ACO.

[52] Section 6 of the Joint Panel Agreement, section 45 of *CEAA 2012*, and section 20 of the *AER Rules of Practice* allow the panel to require a person to attend an oral hearing and produce documents. Mikisew noted the panel's authority and submitted that the attendance of the requested individuals was necessary for an adequate understanding of measures that have been proposed for mitigating and managing potential impacts of the Frontier project on Mikisew's aboriginal and treaty rights beyond the Frontier project footprint and for the development of recommendations for government action to mitigate those impacts pursuant to the panel's mandate.

[53] Alberta opposed Mikisew's motion and submitted that Mikisew's claim regarding the adequacy of Alberta's regulatory schemes was outside the panel's mandate. Alberta further argued the panel has no

jurisdiction with regard to assessing the ACO's consultation requirements for the Frontier project and no jurisdiction to compel the ACO to present witnesses

[54] The panel concluded it did not have the jurisdiction to compel the individuals who were requested by Mikisew Cree First Nation to speak to the ACO report or any other matters Mikisew Cree First Nation said is evidence filed by Alberta in this proceeding.

[55] The panel agreed with Alberta that the adequacy of Alberta's policy and regulatory regime is not something within the panel's purview and this was not the forum for raising these issues with Alberta (see [Appendix 4](#)).

Keepers Motion

[56] On September 17, 2018, the Keepers of the Athabasca filed a request to the panel pursuant to section 45 of *CEAA 2012* and section 20(1) of the *AER Rules of Practice* to issue a summons to two AER employees to require them to attend the hearing to be cross-examined by the parties. On September 21, 2018, the AER filed a response to that request and on September 25, 2018, the Keepers filed an affidavit in support of its request.

[57] Section 6 of the Joint Panel Agreement, section 45 of *CEAA 2012* and section 20 of the *AER Rules of Practice* allow the panel to require a person to attend an oral hearing and produce documents. For the panel to compel the attendance of a witness, it must be satisfied the evidence sought from the witness is necessary, even crucial, for the panel to carry out its functions and cannot be reasonably obtained from other sources. Such evidence must be relevant, but relevance alone is not sufficient.

[58] The panel was not persuaded that the information sought regarding the scale of Alberta's unfunded environmental liabilities is necessary or critical in order for the panel to carry out its mandate.

[59] The panel also determined that the Keepers had access to relevant information on the scale of Alberta's unfunded environmental liabilities and the adequacy of Alberta's existing regulatory programs associated with such liabilities. Additionally, the panel received evidence from OSEC regarding Alberta's currently unfunded environmental liabilities and the adequacy of its existing regulatory programs. This information also includes public ally available estimates of the Mine Financial Security Program liability and security held by the AER.

[60] The panel denied the Keepers' request (see [Appendix 4](#)).

Participant Involvement in the Review Process

Industrial Organizations

[61] SilverWillow Energy Corporation filed a statement of concern on May 30, 2012. Because the statement of concern was a letter of support for the Frontier project, it was closed by the AER on April 16, 2014.

[62] Shell Canada filed a statement of concern on June 4, 2012. It was withdrawn on June 10, 2015.

[63] Scott Crichton made a presentation to the panel at the hearing on behalf of the International Brotherhood of Electrical Workers, Local 424. Mr. Crichton read a prepared statement of support for the Frontier project and was available for cross-examination.

[64] Luc Berube made a presentation to the panel at the hearing on behalf of Local Lodge 146 of the International Brotherhood of Boilermakers. Mr. Berube read a prepared statement expressing support for the Frontier project and was available for cross-examination.

Other Groups and Organizations

[65] Calgary Economic Development, Edmonton Economic Development Corporation, Ironworkers Local 720, and the Edmonton Chamber of Commerce wrote letters in support of the Frontier project.

Regional Municipality of Wood Buffalo

[66] The Regional Municipality of Wood Buffalo provided a written submission on October 19, 2018. Mayor Don Scott participated in the hearing on behalf of the Regional Municipality of Wood Buffalo. Mayor Scott gave a presentation to the panel endorsing the Frontier project. He also answered questions posed by members of the panel secretariat.

Aboriginal Groups

[67] Athabasca Chipewyan First Nation participated in the hearing through written submissions and by presenting oral traditional knowledge and expert testimony in Fort Chipewyan and final argument in Calgary.

[68] At the hearing, Athabasca Chipewyan First Nation confirmed they had entered into a participation agreement with Teck for the Frontier project and that they had no project-specific concerns. Athabasca Chipewyan First Nation and Teck jointly submitted a document outlining objectives related to environmental management and comprehensive environmental impact mitigation and management commitments from Teck in support of these objectives as well as areas for Crown action and support related to the objectives. Athabasca Chipewyan First Nation and Teck requested that the panel consider the objectives, commitments, and requested recommendations in preparing its report. The jointly

submitted objectives, commitments, and recommendations made by Athabasca Chipewyan First Nation and Teck are included in [Appendix 9](#).

[69] Deninu K'ue First Nation's participation occurred late in the review process. The Deninu K'ue First Nation participated in the hearing by providing a written hearing submission and presenting oral traditional knowledge to the panel in Fort McMurray as well as submitting written final argument.

[70] Deninu K'ue First Nation asserted that they are the holders of aboriginal and treaty rights that may be impacted by the Frontier project and that they had not been consulted regarding the Frontier project. Deninu K'ue First Nation stated that if the panel were to approve the Frontier project, the livelihood of their members would be affected for years to come. Deninu K'ue First Nation stated that an impact benefit agreement should be negotiated between themselves and Teck before the Frontier project is allowed to proceed.

[71] Fond du Lac First Nation's participation occurred late in the review process, appearing before the panel in Fort Chipewyan to present evidence and information regarding their relationship with Treaty 8 nations. Fond du Lac First Nation did not provide a written hearing submission or participate in final argument.

[72] Fond du Lac First Nation stated that the Frontier project has the potential to create an impact on their community hunters and trappers, the animals they hunt, the fish they catch and eat, the plants they gather for ceremonial and consumption purposes, and avian life within their traditional territory.

[73] The Fort Chipewyan Métis Local 125 participated throughout the review process by providing written submissions and comments. They said that cabins, campsites, trails, hunting areas, trapping areas, berry picking areas, medicinal plant gathering areas, animal habitat areas, and areas connected to traditional stories, oral history, and transmission of cultural knowledge, are located in the Frontier project footprint and would be destroyed.

[74] Before the hearing, Fort Chipewyan Métis Local 125 confirmed that they had signed a participation agreement with Teck and that they did not object to the approval of the Frontier project. Fort Chipewyan Métis Local 125 did not participate in the hearing.

[75] Fort McKay First Nation and the Fort McKay Métis participated throughout the review process by providing written submissions and comments, often jointly.

[76] Before the hearing, Fort McKay First Nation entered into a long-term sustainability agreement with Teck for the Frontier project and confirmed that their project-specific concerns had been addressed. Notwithstanding their agreement with Teck, Fort McKay First Nation indicated that they remained concerned about regional cumulative effects issues and their impact on Fort McKay's treaty and aboriginal rights and that they intended to participate in the hearing with respect to these matters.

[77] Fort McKay First Nation participated in the hearing through written submissions, by presenting evidence, and through written final argument.

[78] Fort McKay First Nation provided recommendations for Crown action and asked the panel to make those recommendations to Alberta and Canada. The recommendations proposed by Fort McKay First Nation are included in [Appendix 9](#).

[79] Before the hearing, the Fort McKay Métis confirmed they had entered into a long-term sustainability agreement with Teck regarding the Frontier project and that they did not object to the approval of the Frontier project.

[80] Fort McKay Métis did not participate in the hearing.

[81] Fort McMurray 468 First Nation submitted comments regarding Teck's responses to the panel's supplementary information requests during the sufficiency review phase.

[82] Before the hearing, Fort McMurray 468 First Nation withdrew their statement of concern related to the Frontier project. Fort McMurray 468 First Nation did not participate in the hearing.

[83] Fort McMurray Métis Local 1935 participated in the review process and submitted comments regarding Teck's responses to the panel's supplementary information requests during the sufficiency review phase.

[84] Before the hearing, Fort McMurray Métis Local 1935 confirmed that they had entered into a long-term sustainability agreement with Teck regarding the Frontier project, supported the Frontier project, and did not object to the granting of approvals for the Frontier project. Fort McMurray Métis Local 1935 did not participate in the hearing.

[85] Kátl'odeeche First Nation's participation occurred late in the review process. Kátl'odeeche First Nation provided a written hearing submission, cross-examined Teck in Fort McMurray, and provided written final argument. They did not provide evidence to the panel during the hearing.

[86] Kátl'odeeche First Nation raised concerns about the potential impacts of the Frontier project on Wood Buffalo National Park World Heritage Site, on migratory birds, water quality and quantity in the Peace-Athabasca Delta and downstream, airborne contamination, and consistency with the *United Nations Declaration on the Rights of Indigenous Peoples*.

[87] Kátl'odeeche First Nation stated that the Frontier project should not be approved given the risks to species at risk and to Wood Buffalo National Park's environmental integrity and outstanding universal value. Kátl'odeeche First Nation stated that if the panel approves the Frontier project, it should impose all the conditions that have been proposed by Canada.

[88] Métis Nation of Alberta Association Lakeland Local Council 1909 (Métis Local 1909) submitted comments regarding Teck's responses to the panel's supplementary information requests during the sufficiency review phase.

[89] Before the hearing, Métis Local 1909 confirmed they had entered into a long-term participation agreement with Teck regarding the Frontier project and that they did object to the granting of approvals for the Frontier project. Métis Local 1909 did not participate in the hearing.

[90] The Mikisew Cree First Nation participated throughout the review process by providing written submissions and comments. Mikisew participated in the hearing through written submissions and by presenting oral traditional knowledge and expert testimony in Fort Chipewyan and final argument in Calgary.

[91] Before the hearing, Mikisew and Teck entered into a participation agreement and jointly developed conditions to better mitigate and monitor certain project effects. Mikisew and Teck also jointly developed recommendations for Crown action. Mikisew stated that they did not object to the panel's decision on the Frontier project applications, provided that the panel's decision reflected the Frontier project conditions jointly developed by Teck and Mikisew. However, Mikisew indicated their position on further decisions by the governments of Alberta and Canada regarding the Frontier project would be dependent on those governments committing, prior to issuing final authorizations for the Frontier project, to resolve the outstanding issues set out in Mikisew's submission and discharging their respective duties to consult Mikisew about the Frontier project. Mikisew requested that the panel incorporate the jointly developed conditions with Teck into its decision and recommend that the governments of Alberta and Canada commit, prior to issuing final authorizations for the Frontier project, to implement the measures proposed by Mikisew in their submission to justify the adverse effects of the Frontier project on Mikisew's aboriginal and treaty rights.

[92] The Mikisew-Teck jointly submitted conditions and recommendations are included in [Appendix 9](#).

[93] The North West Territories Métis Nation's participation occurred late in the process. North West Territories Métis Nation participated in the hearing by providing a written hearing submission and presenting traditional knowledge at the hearing.

[94] North West Territories Métis Nation raised concerns regarding the potential downstream effects and potential cumulative downstream effects of the Frontier project on their community. They also stated that the Frontier project would adversely affect their aboriginal rights and that Teck had not made sufficient efforts to gather traditional knowledge from them and address their concerns.

[95] North West Territories Métis Nation submitted recommendations to the panel. Their recommendations are included in [Appendix 9](#).

[96] Original Fort McMurray First Nation and Clearwater River Band 175 participated in the hearing through written submissions and by presenting oral traditional knowledge and community evidence in Fort McMurray and final argument in Calgary.

[97] The Original Fort McMurray First Nation and Clearwater River Band stated their objection to the approval of the Frontier project and indicated that the effects of the project on traditional lands and on their rights would be significant and that the project would result in serious and permanent damage to wildlife, which they rely on.

[98] Métis Nation of Alberta Region 1 submitted comments on the Frontier project to the panel during the sufficiency review phase on behalf of its member locals Fort Chipewyan (#125), Fort McKay (#63), Fort McMurray (#1935), Fort McMurray (#2020), Willow Lake/Anzac (#780), Conklin (#193), Owl River (#1949), Lac La Biche (#2097), Lakeland/Lac La Biche area (#1909), Athabasca Landing (#2010) and Buffalo Lake (#2002).

[99] Before the hearing, Métis Nation of Alberta Region 1 confirmed that they and Owl River Métis Local 1949, Métis Local # 193 Conklin, Métis Local # 780 Willow Lake (Anzac), Métis Local # 2002 Buffalo Lake, and Métis Local # 2010 Athabasca Landing had entered into a long-term participation agreement with Teck regarding the Frontier project and did not object to the approval of the Frontier project.

[100] Métis Nation of Alberta Region 1 did not participate in the hearing.

[101] Owl River Métis Local 1949 submitted comments on the Frontier project to the panel during the sufficiency review phase. Owl River Métis Local 1949 did not participate in the hearing.

[102] Smith's Landing First Nation's participation occurred late in the review process. Smith's Landing First Nation participated in the hearing by providing a written hearing submission and presenting traditional knowledge at the hearing and written final argument.

[103] Smith's Landing First Nation stated that they have been impacted by past and present upstream oil sands development and are concerned that the Frontier project has the potential to further impact their treaty rights and interests and that Teck has failed to assess impacts of the Frontier project on them. Smith's Landing First Nation stated that the Frontier project should not proceed unless Teck takes into account their traditional knowledge, asserted aboriginal and treaty rights, and the potential effects of the project on those rights.

Members of the Public Attending the Hearing

[104] George Clark, holder of 2939, presented to the panel at the hearing. He expressed his concerns about the loss of his trapline, public safety, and the Ronald Lake bison herd.

[105] Darryl Shevolup (senior holder of trapline 2346), Charles Shevolup, and Peter Hoffman (collectively the trappers) appeared at the hearing and asked for the opportunity to present comments to the panel. The trappers spoke about the adverse effects the Frontier project will have on flora and fauna, and water and water-dependent ecosystems. They assert proposed water usage will make river navigation much more difficult and make it more difficult to sustainably trap, hunt and fish.

Nongovernmental Organizations Attending the Hearing

[106] Stand Earth participated in the hearing by providing a written submission and a presentation to the panel. Stand Earth's submission and presentation focused on the economic benefits of the Frontier project. Stand Earth submitted that the Frontier project should not be approved as it is not financially viable.

[107] The Wilderness Committee participated in the hearing through the filing of a brief submission and presentation. The Wilderness Committee's submissions and presentation focused on the carbon emissions associated with the Frontier project and their potential impact on provincial, federal, and global climate objectives.

[108] CPAWS participated throughout the review process by providing written submissions and comments. CPAWS participated in the hearing through written submissions, presentation of expert evidence, cross-examination of Teck, and final argument. CPAWS submitted that the Frontier project, if approved, would significantly hinder Canada's ability to meet its greenhouse gas reduction targets and thereby significantly hinder Canada's transition to a sustainable economy. CPAWS also argued that the Frontier project would have significant adverse environmental impacts on Wood Buffalo National Park that cannot be mitigated. CPAWS provided evidence on the risk the Frontier project's tailings ponds would create for migratory waterfowl that pass over the project area. CPAWS primarily focused on the risks to the Whooping Crane who are reliant on Wood Buffalo National Park for their long-term survival.

[109] Sierra Club BC participated in the hearing by providing a written submission and making a presentation to the panel. Sierra Club BC's submission and presentation focused on climate change, potential effects to Wood Buffalo National Park and the Peace-Athabasca Delta, the risks of transporting diluted bitumen, and the barriers that exist in taking part in the review process.

[110] The Council of Canadians participated in the hearing by filing a written submission and making a presentation to the panel. The Council of Canadians questioned the economic benefits of the Frontier project and stated that, in their opinion, the Frontier project is economically risky with little guaranteed benefit for the public. The Council of Canadians also identified concerns about the cumulative effects of the Frontier project and asked the panel to consider effects to indigenous rights under the *United Nations Declaration on the Rights of Indigenous Peoples*, Canada's climate commitments under the Paris

Agreement, the federal targets for 2030, the *Alberta Oil Sands Emissions Limit Act*, and the health of the Athabasca River watershed and Wood Buffalo National Park.

[111] Keepers of the Athabasca participated throughout the review process through written submissions, presentation of expert evidence, cross-examination of Teck, and final argument. Keepers raised concerns about the financial viability of the Frontier project, climate change, tailings management, aerial emissions, health effects, and the lack of indigenous knowledge used by Teck when developing the Frontier project. Keepers argued that the Frontier project should not be approved.

[112] OSEC participated throughout the review process through written submissions, presentation of expert evidence, cross-examination of the proponent, and final argument. During the hearing, OSEC provided evidence and cross-examined Teck on issues related to the economic viability of the Frontier project, reclamation and closure liabilities, greenhouse gas emissions and climate change, and biodiversity management and caribou. OSEC submitted that the Frontier project is not in the public interest and should not be approved.

Nongovernmental Organizations Not Attending the Hearing

[113] Several nongovernmental organizations provided letters or written submissions to the panel but did not participate in the hearing, including the International Crane Foundation, the Glasswaters Foundation, Honor the Earth, and Kairos.

[114] The International Crane Foundation expressed concerns related to the endangered Whooping Crane and the potential for the Frontier project to pose a threat to the species. They noted that Wood Buffalo National Park is home to the only self-sustaining population of Whooping Crane in North America, and the Frontier project is expected to add approximately 6000 hectares of tailings to the region, posing potential risks to the Whooping Crane because they use the Frontier project area as a stopover site during their migration.

[115] The Glasswaters Foundation filed a request to participate in the hearing, and the panel concluded that it could have relevant information. The Glasswaters Foundation did not attend the hearing but provided a written submission detailing its concerns related to the degradation of the landscape and watershed by fossil fuel extraction and transport, the effects of increased greenhouse gas emissions, the effects of water use by the Frontier project, the expansion of tailings ponds, and the potential for spills during bitumen transport.

[116] Honor the Earth opposed the Frontier project in a letter to the panel. The letter discussed impacts to indigenous communities and culture, human health impacts, social and ecological costs, and environmental impacts including climate change.

[117] Kairos wrote to the panel with concerns that the Frontier project would violate the *United Nations Declaration on the Rights of Indigenous Peoples* and the treaty rights of local First Nations, undermine Canada's progress on greenhouse gas reductions, and threaten endangered species.

Comments from the Public

[118] Martin Olszynski provided a submission to the panel on adaptive management plans.

[119] The panel received three separate form letters. The first was submitted by 8069 individuals expressing concerns about loss of caribou and bison habitat and greenhouse gas emissions. The second form letter was sent to the panel by 3603 individuals stating that the Frontier project contradicts Canada's obligations under the Paris Agreement and threatens the habitat of many animals. The third form letter was submitted by 83 individuals requesting the opportunity to participate in the review process and public hearing. The letter expressed concerns related to climate change, species at risk, biodiversity, water quality, and human health and safety. It also contained objections to CEAA public review process, challenged the public access to information and inadequate timelines, and asked that the hearing be delayed until 2025.

Government of Canada

[120] The Government of Canada participated throughout the review process, providing comments on the draft Joint Panel Agreement and sufficiency of information and reviewing and providing comments in relation to the information responses and the terms of reference for the development of the environmental impact statement.

[121] Federal departments involved included Environment and Climate Change Canada (ECCC), Health Canada, Transport Canada, Natural Resources Canada (NRCan), Parks Canada Agency (Parks Canada), Department of Fisheries and Oceans (DFO), and the Agency. ECCC, Health Canada, Transport Canada, NRCan, Parks Canada and DFO participated in the hearing by providing written submissions and oral testimony. The Agency also provided oral testimony at the hearing but did not provide a written submission.

[122] ECCC participated in the hearing as a federal authority in accordance with section 20 of *CEAA 2012* by providing scientific expert information and knowledge to the panel on areas within its mandate. ECCC's submission focused on concerns related to the terrestrial environment, air emissions and greenhouse gases, polycyclic aromatic compounds and metals, the freshwater environment, and accidents and malfunctions. ECCC recommended that if approved, the Frontier project should be planned, built, operated, and decommissioned in a manner that ensures the highest level of environmental stewardship through conservation, mitigation and reclamation.

[123] ECCC stated that the project would directly affect the Ronald Lake bison herd, the Red Earth and possibly Richardson caribou herds, and Whooping Crane. ECCC's recommendations are set out in [Appendix 7](#).

[124] Parks Canada participated in the hearing as a federal authority to provide specialist or expert advice related to its mandate in the management of protected areas, in particular national parks. Parks Canada's main interest in the Frontier project is because of its close proximity to Wood Buffalo National Park. Wood Buffalo National Park would be less than 30 kilometres north of the Frontier project. Parks Canada's submission focused on Whooping Crane, the wolf-bison predator-prey relationship, migratory waterfowl, water quantity and quality of the Peace-Athabasca Delta and the Great Plains-Boreal Grasslands. Parks Canada's recommendations are set out in [Appendix 7](#).

[125] Parks Canada concluded that that project will likely result in large-scale ecosystem change, and that the Frontier project will likely adversely affect the outstanding universal value of Wood Buffalo National Park.

[126] Canada also provided a document titled "Submission to the Joint Review Panel Frontier Oil Sands Mine Project – Government of Canada Preliminary Assessment of Potential Impacts on Asserted or Established Aboriginal or Treaty Rights" with respect to the methodology for assessing potential impacts on the exercise of aboriginal or treaty rights. The Agency's role was to speak to this submission. The submission sets out Canada's preliminary assessment of the potential impacts of the Frontier project on the asserted or established aboriginal or treaty rights with respect to the Frontier project. Canada's submission concluded that the Frontier project may result in potentially serious impacts on the aboriginal or treaty rights of Athabasca Chipewyan First Nation and Mikisew Cree First Nation.

[127] Canada cross-examined other participants and made final arguments.

[128] Witnesses appearing for the Agency advised they did not assist or advise the panel in assessing the Frontier project under the provisions of *CEAA 2012* and were not providing evidence in that capacity. Instead the Agency coordinated the review of materials provided by indigenous groups and assisted in the comprehensive review of the potential impacts of major projects on the constitutionally protected rights of indigenous people.

[129] Health Canada stated its role at the hearing was to offer information about the potential effects of the Frontier project on human health—specifically, to provide information on the potential effects on human health from changes to air quality, drinking water quality, the acoustic environment or noise, and the potential chemical contamination of country foods. Health Canada informed the panel that the mandate and expertise that Health Canada had formerly held concerning the delivery of health services in relation to First Nations and Inuit had been transferred to Indigenous Services Canada. Health Canada filed a submission and participated in the hearing. Health Canada made several recommendations to the

panel regarding air quality, drinking water, spill response, and country foods. Health Canada's recommendations are set out in [Appendix 7](#).

[130] NRCan's stated mandate is to seek to enhance the responsible development and use of Canada's natural resources and the competitiveness of Canada's natural resource products. NRCan reviewed relevant documents provided by Teck and other parties to inform its written evidence. NRCan's evidence focused on tailings management, hydrogeology (specifically groundwater quantity and flow), and forestry with respect to wildfire management and reclamation planning.

[131] NRCan made several recommendations to the panel regarding tailings treatment, hydrogeology, reclamation, and wildfire management. NRCan's recommendations are set out in [Appendix 7](#).

[132] DFO administers and enforces the *Fisheries Act* and regulations, and its mandate is to ensure the protection of fish and fish habitat. DFO stated that the Frontier project has the potential to affect approximately 1.58 million square metres of fish habitat in the Red Clay Creek and Big Creek watersheds as well as the Athabasca River. It also expressed concerns related to cumulative effects to fish and fish habitat. It stated that impacts to fish and fish habitat could be mitigated and residual impacts offset with the proposed detailed fisheries offsetting plan.

[133] DFO concluded that with proper mitigation, follow-up, monitoring, and adequate offsetting for project-specific habitat loss, the productivity of recreational and aboriginal fisheries in the Athabasca River and tributaries can be maintained. DFO also stated that it had concerns regarding the uncertainty of cumulative effects of oil sands development on fish and fish habitat. DFO made several recommendations to the panel regarding mitigation and monitoring. DFO's recommendations are set out in [Appendix 7](#).

[134] Transport Canada is responsible for transportation policies and programs and seeks to promote an integrated transportation system that is safe, secure, efficient, sustainable, and environmentally responsible. Transport Canada provided information on its regulatory regime as it relates to the proposed bridge to Dalkin Island, the bridge and water intake within the Athabasca River, the infilling of Unnamed Lakes 1 and 2, and the construction of the aerodrome. The focus of Transport Canada's regulatory involvement is with respect to the Navigation Protection Program. Transport Canada's review of the application materials led it to conclude that the construction phase of the physical works may pose interference to navigation. Its recommendations are set out in [Appendix 7](#).

Government of Alberta

[135] The Government of Alberta participated in the review of the environmental impact assessment but did not participate in or provide a written submission to the hearing, other than through the involvement of the ACO.

Hearing

[136] The public hearing began on September 25, 2018, in Fort McMurray, Alberta. The hearing continued until October 4 and was then adjourned. The panel resumed the hearing in Fort Chipewyan, Alberta, from October 15 to October 18. On October 20 the hearing resumed in Fort McMurray, and was adjourned on October 24, 2018.

[137] The ACO provided its hearing reports on November 26, 2018, and final arguments were held in Calgary, Alberta, on December 11 and 12, 2018. The panel closed the hearing record on December 12, 2018.

[138] Those who appeared at the hearing are listed in [Appendix 1](#).

[139] In reaching the determinations contained in this report, the panel has considered all relevant materials constituting the record of the joint review and report found on the public registry maintained by the Agency. This includes all records relating to the review, including submissions, correspondence, hearing transcripts, exhibits and other information received by the panel, and all public information produced by the panel relating to the review of the project. Accordingly, references in this report to specific parts of the record are intended to help the reader understand the panel's reasons relating to a particular matter and should not be taken as an indication that the panel did not consider all relevant portions of the record with respect to that matter. The panel further notes that as a general principle, if written material was filed in the proceeding and the submitter did not participate in the oral hearing so as to allow that material to be tested, the panel has given that written material less evidentiary weight than other written material that was able to be tested during the oral hearing.

2 Purpose or Need of the Project

Evidence

[140] Teck originally submitted the integrated application for the Frontier project to regulators in 2011. It stated it has conducted development activities including acquiring the oil sands leases, planning, exploratory drilling, assessment of project effects and public and aboriginal consultation since 2008.

[141] Teck stated it has an obligation to the people of Alberta to advance the development of the Frontier project to recover the bitumen resources within its leases in a timely and responsible manner. It noted that the global demand for oil continues and that it is in Canada's public interest, and better for the global environment, to supply its oil requirements from Canada rather than from foreign sources.

[142] In describing the need for the Frontier project, Teck identified three main objectives;

- To maximize the value of a product which is essential to everyday life,
- To generate significant economic benefits and opportunities for indigenous communities, local communities, the province of Alberta, and Canada, and;
- To responsibly create value for Teck investors.

[143] OSEC stated that Teck's justification of the need for the Frontier project is based on International Energy Agency forecasts of global oil demand increasing from current levels of 95 million barrels a day to 110 million barrels a day by 2040. They argued that this forecast is inconsistent with the Paris Agreement and the goal of limiting warming to within 2 degrees of preindustrial levels and therefore should not be relied on to justify need. They argued that the panel cannot accept Teck's market assessment that the Frontier project is needed based on this forecast as this would be accepting a future oil demand scenario which is inconsistent with Canada's commitment to the Paris Agreement to limit global warming.

[144] Teck stated that reliance on the International Energy Agency future demand forecast of 110 million barrels per day in 2040 is reasonable given the factors that are driving the international demand for oil. It noted that it is not the panel's responsibility to determine how Canada or the rest of world will reduce its consumption of oil as part of meeting greenhouse gas emission targets. Teck stated that neither this panel nor Alberta or Canada are able to control the future global demand for oil.

[145] Teck also noted that the efficiency of production for the project would be in the top quartile of oil sands production in Alberta, including in situ, and would have lower greenhouse gas intensity than half of all the oil currently refined in the United States, suggesting that the development of the project could displace less greenhouse gas efficient production under future global oil production scenarios.

Analysis and Findings

[146] The panel understands that there is considerable uncertainty regarding forecasts for future oil prices and that there is considerable uncertainty about how Canada and other countries will address greenhouse gas emissions targets in the future.

[147] The panel does not agree with OSEC's argument that in accepting Teck's use of the International Energy Agency forecast that the panel is accepting a future oil demand scenario which is inconsistent with Canada's commitment to the Paris Agreement to limit global warming. In the panel's view, meeting Canada's international commitments is independent of whether global demand for oil increases or decreases.

[148] For the purposes of its assessment, the panel accepts Teck's use of the International Energy Agency forecast for future global oil consumption as support for its need to proceed with the project.

[149] The panel considers greenhouse gas emissions in section 15 of this report. However, determining Canada's ability to meet its international commitments to reduce greenhouse gas emissions is not part of the panel's mandate.

[150] According to the Agency's operational policy statement, *Addressing "Purpose of" and "Alternative Means"* under *CEAA 2012* updated March 2015: "The purpose of the designated project is defined as the rationale or reasons for which the designated project would be carried out from the proponent's perspective. It conveys what the proponent intends to achieve by carrying out the designated project." The purpose of the project can be described as the rationale or reasons for which the project would be carried out from the proponent's perspective. It conveys what the proponent intends to achieve by carrying out the project, what problems it intends to solve, or what opportunities it intends to seize.

[151] The panel finds that the three main objectives for the Frontier project described by Teck satisfy the Agency's operational policy statement by conveying what the proponent intends to achieve by carrying out the project and opportunities it intends to seize (it intends to recover bitumen resources to advance the interests of indigenous and non-indigenous local communities, Albertans, Canadians, and its shareholders), and a problem it intends to solve (it intends to maximize the value of a product which is essential to everyday life).

[152] To satisfy the AER's mandate to provide for the efficient, safe, orderly and environmentally responsible development of energy resources in Alberta, the panel must determine if a project is needed.

[153] The panel finds that from an AER perspective, Teck has demonstrated that there is a need for the Frontier project to recover bitumen resources owned by Albertans and that the benefits of the Frontier project can be realized by local and indigenous communities, the province of Alberta and Canada.

[154] Teck has acquired the rights to develop these bitumen resources from Alberta for this purpose and that it has been evaluating and planning how to best develop them for a number of years.

3 Alternative Means of Carrying Out the Frontier Project

Evidence

[155] According to the Agency’s operational policy statement, *Addressing “Purpose of” and “Alternative Means” under the Canadian Environmental Assessment Act, 2012*, updated March 2015, “‘Alternative means’ are the various technically and economically feasible ways under consideration by the proponent that would allow a designated project to be carried out. Identified by the proponent, the alternative means include options for locations, development and/or implementation methods, routes, designs, technologies, mitigation measures, etc.”

[156] Teck submitted its integrated application to provincial and federal authorities in November 2011. It contained a detailed description of the Frontier project including the selection criteria and preferred alternatives for several project components. In June 2015, Teck provided a project update, which described changes to the design of the Frontier project based on increased knowledge and improvements in available technology since the integrated application was filed. In the project update Teck identified some project components for which the preferred alternatives had changed or been modified. Teck stated that the primary criteria used in the selection of the preferred alternatives were as follows:

- The alternative technology or process must be technically proven and commercially viable.
- The alternative must comply with regulatory legislation, regulations, and directives.
- The alternative should be directionally better environmentally or, in consideration of unavoidable trade-offs, be more operationally robust.
- The alternative must produce a marketable product in accordance with the project schedule and economic model.

Tailings Management

[157] Teck’s original tailings management strategy involved using a thickener to produce thickened tailings and thin-lift drying to consolidate mature fine tailings, which would then be placed in the external disposal areas. In the project update Teck described a revised strategy involving depositing coarse combined tailings through beaching and the construction of dikes. Teck explained that coarse combined tailings would be used to construct dikes, forming a tailings area that will collect fluids and contain other tailings streams including secondary flotation tailings and froth treatment tailings. Fluid fine tailings would be recovered from the external tailings areas by dredging and then processed by centrifuge. Teck stated that the centrifuged fine tailings would be disposed of in dedicated disposal areas. The tailings management strategy selected by Teck is described in section [7](#).

[158] Teck stated that the revised tailing management strategy for the Frontier project is superior to that in the integrated application for several economic and environmental reasons:

- The revised strategy is consistent with the *Lower Athabasca Region: Tailings Management Framework for Mineable Athabasca Oil Sands (TMF)*.
- Fines treatment is decoupled from the extraction and bitumen recovery process, which helps to reduce the risk of producing off-spec tailings and improves operational robustness and reliability.
- The revised strategy is based on technologies that are currently used successfully in oil sands operations.
- The revised strategy uses less water overall.
- Rehandling of tailings (i.e., both to and from the thin-lift drying area) is avoided.
- Challenges associated with operating a large thin-lift drying area are removed.
- The strategy enables progressive reclamation of the surface of an external tailings area during operations.
- In-pit placement of centrifuged fine tailings is preferable to ex-pit options because it eliminates long-term storage of treated fine tailings behind dams and provides a more robust reclamation landscape.

[159] Keepers of the Athabasca, the Original Fort McMurray First Nation, and Clearwater River Band 175 suggested that Teck should use emerging technologies for extraction without creating tailings waste. Teck indicated that this was not currently technically or commercially feasible but that it would monitor the technology.

External Storage for Waste, Tailings, and Reclamation Material

[160] In selecting the locations of the external disposal areas, external tailings areas, and reclamation material stockpiles, Teck stated that it considered several economic and environmental factors:

- limiting potential resource sterilization,
- conserving energy and associated costs by reducing haul and tailings transport distances,
- limiting the energy consumption and cost required to construct dikes, and
- optimizing the use of the limited supply of mine waste material suitable for construction purposes.

[161] Teck described a revised layout in the project update in which the locations of an external disposal area and two external tailings areas were moved. One external disposal area will be placed over Unnamed Lakes 1 and 2 and the surrounding area, and the external tailings areas 1 and 2 were extended to the north. Teck stated that it made the decision to place the external disposal area over the lakes because the Teck-Shell asset exchange required that Big Creek be diverted to avoid resource sterilization, which

made maintaining flows to Unnamed Lake 1 during and after operations not possible, diminishing the value of historic resources around the lakes. Teck stated that relocating the external disposal area also allowed for more efficient mine haulage, potentially reducing air emissions.

[162] Teck stated that it chose to extend external tailings areas 1 and 2 to the north despite the fact that the range of the Ronald Lake bison herd is to the north of the Frontier project (See section 23, “[Wildlife](#),” for more information regarding the Ronald Lake bison herd). Teck stated that this was the preferred option because:

- it was necessary to support the updated tailings plan;
- the additional disturbed area represents 0.1% of the herd’s range, and
- the additional disturbance is offset by the elimination of the thin-lift drying area, relocation of the reclamation material stockpiles, and progressive reclamation, which is facilitated by the updated tailings plan.

[163] Teck also noted that the potential alternative locations would require longer hauls and pumping of tailings, which would require greater energy use.

Aerodrome

[164] Teck stated that it chose to build an aerodrome and operate the Frontier project as a fly-in/fly-out operation for construction and operation. Teck stated that this was preferable to using road transportation from Fort McMurray because the road transport option would lead to increased travel times, decreased worker productivity, and would be less safe due to increased traffic. In response to information requests from the panel, Teck stated that using existing aerodromes constructed for other oil sands operations was not a suitable option because indirect road routes and restricted speeds on those roads result in travel times in excess of one hour, which it considered more than would be acceptable versus retaining a fly-in/fly-out workforce and its own aerodrome.

[165] In the integrated application, Teck proposed locating the aerodrome near the main development area, immediately southeast of the plant site and lodge. In the project update, Teck stated that its new preferred option was to construct the aerodrome east of external tailings area 1. Teck stated that the alternative was preferable because it avoids habitat to the north that is favoured by the Ronald Lake bison herd. The location also reduces habitat fragmentation as it accommodates the placement of a reclamation material stockpile between the aerodrome and external tailings area 1.

[166] The mayor of the Regional Municipality of Wood Buffalo stated at the hearing that future employees of the Frontier project should reside in Fort McMurray to achieve optimal socioeconomic benefits for the region, rather than implementing a fly-in/fly-out solution. He also stated that the Frontier project should make use of the Fort McMurray International Airport rather than its own proposed

aerodrome. He stated that the Fort McMurray International Airport is currently operating at approximately half of its capacity and could therefore accommodate additional industry-related flights.

River Water Intake

[167] In the integrated application, Teck stated that it considered five potential locations to construct the river water intake for the Frontier project and determined that the preferred option was to locate the structure immediately downstream of Dalkin Island. Teck stated that it selected this location, in part, because of input from indigenous communities and the determination that it had the best environmental and hydrological characteristics.

[168] In the project update, Teck explained that the 2012 spring freshet caused the main channel to shift away from the preferred intake location identified in the integrated application, and the main channel did not reestablish at the intake location during the 2013 or 2014 spring freshets. Teck stated that it would therefore need to relocate the river water intake location to Dalkin Island. This location also requires the construction of a bridge to carry the pipeline to the off-stream storage pond. Teck stated that relocating the intake was preferable because maintaining the original preferred location would require dredging and in-stream river training features to maintain operations. According to Teck, dredging and river training are undesirable from an environmental and operational perspective.

[169] The Government of Canada submission stated that the bridge required for the water intake on Dalkin Island may result in the introduction of permanent physical impediments within the river channel. It also stated that it might result in changes to the riverbed and channels, resulting in an increased risk of hazards to navigation on the Athabasca River including sandbars and bridge structures, fencing, and access control.

[170] Teck stated that it selected the option of burying the pipeline between the river water intake and the off-stream storage pond, rather than constructing it aboveground, to avoid impeding the movement of wildlife.

Conceptual Fisheries Offsetting Plan

[171] In the integrated application, Teck identified eight potential locations to construct approximately 60 hectares of compensation fish habitat. Teck stated that its preferred option was to incorporate the compensation habitat into Redclay Creek using the natural topography associated with the creek's entry into the Athabasca River valley. It selected this option due to the environmental, cost, commercial, or technical challenges associated with the other seven options.

[172] Teck stated that changes to the Frontier project in the project update would result in additional fisheries productivity gains. In addition to enlarging the compensation habitat identified as the preferred

alternative in the integrated application, Teck chose to identify additional offsetting options to create the required additional compensation habitat for the following reasons:

- The planned fish habitat compensation lake is located in the range of the Ronald Lake bison herd, and enlarging the lake would reduce bison habitat.
- Enlarging the lake would further reduce terrestrial habitat connectivity along the Athabasca River valley.
- Indigenous communities expressed concerns regarding the creation of lakes they are unlikely to fish and the associated removal of terrestrial habitat suitable for hunting and trapping.
- Teck stated that it believed that more sustainable fish offset alternatives exist in the Athabasca River Basin.

[173] For details regarding the fisheries offsetting plan, see section [20](#), "[Fish and Fish Habitat](#)."

Seepage Control

[174] In the integrated application, Teck stated that it considered four alternatives to control the seepage of process-affected water from external tailings areas:

- Construct a barrier wall with interception wells
- Install liners in external tailings areas to act as a hydraulic barrier
- Passive dewatering via interception wells and trench
- Install active pumping wells

[175] Based on evaluation criteria, including performance certainty, cost, risk of failure, environmental effects, land disturbance, and closure considerations, Teck selected the construction of a barrier wall with interception wells as the preferred alternative.

[176] In the project update, Teck stated that it had reevaluated the seepage alternatives and stated that, instead of the barrier wall with interception wells, it will now install pumping wells and perimeter ditches during operations and install a passive, post-closure seepage control system at the end of mine life. Teck stated that it chose this overall approach as its preferred alternative for the following reasons:

- Pumping wells are a proven, robust, flexible and highly effective seepage control method.
- Redundant seepage control during operations is unnecessary and would adversely affect project economics.

- It would allow Teck to take advantage of advancements in technology and decades of additional hydrogeological data obtained during operations.
- It would ensure that an optimal site-specific seepage control system would be in place in the post-closure period.

[177] See section [17](#), “[Groundwater](#),” for more information on seepage control

Analysis and Findings

[178] The panel finds that Teck identified and assessed various alternative means for carrying out the Frontier project as per the Agency’s operational policy statement. The panel also finds that Teck provided sufficient information on the alternatives selected appropriate options based on the criteria that it identified.

[179] The panel accepts Teck’s explanation for constructing an aerodrome and operating the Frontier project as a fly-in/fly-out facility based on considerations of travel time and road safety. The panel also accepts Teck’s decision to select a tailings management process that is technically proven and commercially viable rather than committing to emerging technologies at this time.

4 Mine Planning and Resource Conservation

Evidence

[180] The Frontier project has two mine pits: the main pit and the north pit. Mining is proposed to begin in the main pit in 2026 and be completed in 2066. Mining in the north pit is proposed to commence in 2059 and be completed in 2062.

[181] Teck developed its mining model in accordance with *Directive 082: Operating Criteria; Resource Recovery Requirements for Oil Sands Mine and Processing Plant Operations*. *Directive 082* specifies a total volume to bitumen in place (TV:BIP) ratio of 12:1 as the minimum value used to define the pit limit for an oil sands mine. Teck stated that an economic pit limit based on a TV:BIP ratio of 16:1 was used for mine design purposes. Teck indicated the 16:1 total volume to bitumen in place used for project design is more sensitive to bitumen price and mining costs. However, Teck stated that although the total volume to bitumen in place ratio of 16:1 was used for mine planning, Teck was not committing to mining beyond a TV:BIP ratio of 12:1.

[182] Teck stated that the project leases have a range of drillhole densities that provided sufficient information required for the estimation of recoverable bitumen and for the project design. The majority of the main pit area has 10 to 16 coreholes per section. Teck acknowledged that the northern portion of the project development area is not drilled to the required *Directive 082* corehole spacing of 700 metres for locations outside the first 10 years pit limit. The areas under the external disposal areas and external tailings areas are also not drilled to *Directive 082* spacing requirements.

[183] Teck believed that the current geological information is sufficient to demonstrate that the hydrocarbon-bearing portions of the McMurray Formation are located immediately west of the main plant facilities and infrastructure and that no mineable bitumen exists beneath these areas.

[184] Teck stated that most project infrastructure is located in areas that do not show an occurrence of potentially mineable resources. Teck noted reclamation material stockpile A is located in a potentially mineable area outside of Teck's lease. However, reclamation material stockpile A will not sterilize resource because it is expected to be depleted by 2073 and because Shell withdrew its applications for the Pierre River mine. Similarly, reclamation material stockpile B is located over Frontier ore but will be removed as part of progressive reclamation efforts before mining in that area.

[185] Teck stated that the crushers are located outside of areas with total volume to bitumen in place of less than 12:1, which minimizes the possibility of ore sterilization. The relocation of crushers will be staged so that ore tied up in the pillar beneath the crusher area and the conveyor corridor will be mined and hauled to the nearest operating crusher. This strategy ensures that ore is not sterilized as a result of changing crusher locations. Teck submitted that no resource sterilization was required at the south lease

boundary, but a boundary pillar may be required if a mine pit was to be developed by the adjacent leaseholder.

[186] In the 2015 project update Teck stated the mineable bitumen estimate was 3.0 billion barrels (2.9 billion barrels from main pit and 0.1 billion barrels from the north pit) using total volume to bitumen in place of 16:1 and 1.8 billion barrels using total volume to bitumen in place of 12:1. In more recent submissions, Teck stated that the total resource estimate for the Frontier project had been updated to 3.22 billion barrels of recovered bitumen as a result of completing additional drilling in 2014 and updating the project geology model in 2015.

[187] When questioned by OSEC regarding inconsistencies in the application materials related to the recoverable reserves and the associated economic impact to the project, Teck indicated it revised the numbers based on the latest drilling information. Furthermore, Teck stated that the independent resource assessor hired by Teck increased the unrisks resource estimate for the project to 3184 million (approximately 3.2 billion) barrels of recovered bitumen, which is within approximately 1% of Teck's most recent estimate.

Analysis and Findings

[188] The panel accepts that Teck's proposed mine plan is based on current drilling and geology information and that refinements to the mine plan may occur over time as additional information is collected during the detailed design and operational phases of the project. The panel finds that the level of resource delineation drilling completed to date is appropriate for mine planning purposes at the application stage but that additional drilling is required in some areas before mining to satisfy the requirements in *Directive 082* for the initial 10 years of mining. The panel requires Teck to provide its additional drilling plans as a part of its annual mine plan submissions to the AER.¹

[189] The panel is satisfied that Teck has made reasonable efforts to minimize resource sterilization during the development of the mine plan and siting of project infrastructure.

[190] The panel accepts that Teck has estimated bitumen recovery using the parameters in *Directive 082* and has defined the economic pit limit based on a total volume to bitumen in place ratio of 16:1 rather than the minimum ratio of 12:1 required in *Directive 082*. The panel also understands that Teck has not committed to mining to all areas where the total volume to bitumen in place ratio is greater than 12:1. While Teck is seeking approval to mine all areas within the proposed pit limit as defined using the 16:1 ratio, Teck is only committing to mining those areas where the total volume to bitumen in place is 12:1 or less.

¹ Draft OSCA Approval – Condition 4

[191] The panel finds this is an acceptable approach as it satisfies the minimum resource recovery requirements required by *Directive 082* while potentially increasing the amount of resource recovered beyond that required. It also establishes the maximum extent of the mine footprint for environmental assessment and approval purposes. The panel recognizes, however, that if mining to something less than 16:1 occurs, this will impact the predicted economic benefits of the project.

[192] The panel understands that the estimated recoverable bitumen may change as more drilling and geology information becomes available. Therefore, the panel requires Teck to provide an update on resource estimation and the impact on the approved mine plan through applications or annual mine plan submissions to the AER.² If major changes to the approved mine plan are required due to changes to resource evaluation, Teck shall submit a mine plan amendment application to the AER including any impacts to the approved mine plan and the project.³

North Pit

Evidence

[193] Teck proposes to develop the project in two pits: a main pit containing the majority of the project's resources and a smaller pit in the northern portion of the project development area. Although the north pit does not contain resources that satisfy the minimum total volume to bitumen in place ratio of 12:1 required to be mined under *Directive 082*, Teck indicated that using the 16:1 design ratio, the north pit contains about 125 million barrels of recoverable reserves and is considered by Teck to be an important part of the project. Teck requested that the north pit be included as part of the Frontier project approvals.

[194] The north pit would be located within the Buckton Creek watershed, an area of particular importance to indigenous communities and some other land users for hunting, trapping, and other traditional use and cultural practices. The watershed is relatively undisturbed by industrial activity, and waters within the watershed flow north to the Ronald Lake area and Lake Claire. The north pit would also be the portion of the project closest to Wood Buffalo National Park.

[195] Teck stated that it had entered into agreements with Athabasca Chipewyan and Mikisew and that the agreements included commitments related to a process that would occur for the two communities before future development of the north pit.

[196] Mikisew and Teck jointly proposed six conditions related to construction and operation within the Buckton watershed and requested that the panel incorporate these as approval conditions, should the project be found to be in the public interest and approved. The proposed conditions require Teck to work

² Draft *OSCA* Approval – Condition 5

³ Draft *OSCA* Approval – Condition 6

collaboratively with Mikisew and provide further baseline data collection, monitoring and analysis of project effects, and detailed design and mitigation measures before development occurs within the Buckton watershed. The proposed conditions are included in [Appendix 9](#).

[197] Athabasca Chipewyan and Teck jointly developed a number of commitments related to the north pit development and requested that the panel include these as approval conditions, should the project be approved. The commitments state that Teck will “carry out a collaborative planning process with respect to the north pit development with Athabasca Chipewyan before submitting applications under the *Public Lands Act* needed to construct and operate the north pit.” The commitments also state that Teck will provide a report to demonstrate that it has met its commitments with respect to the Ronald Lake bison herd, caribou, water quantity and quality, the biodiversity stewardship area, and tailings management commitments and a summary of the collaborative north pit process and areas of consensus and nonconsensus regarding the north pit development. The jointly developed commitments are included in [Appendix 9](#).

Analysis and Findings

[198] The panel notes that the estimated mineable bitumen for the north pit is 0.1 billion barrels, which represents approximately 3% of the recoverable reserves associated with the project. The panel also understands that while the reserves in this area satisfy the total volume to bitumen in place criteria of 16:1, which Teck has used for mine planning purposes, they do not satisfy the total volume to bitumen in place ratio of 12:1, which Teck has committed to mining. Furthermore, mining of this area is not planned until year 34 to year 37. It is therefore possible that mining of the north pit may not occur, even if the project is approved.

[199] The panel recognizes the importance of the Buckton Creek watershed and the Ronald Lake and Lake Claire areas to Mikisew and Athabasca Chipewyan. The panel acknowledges that Athabasca Chipewyan, Mikisew, and Teck have worked together to develop conditions and commitments in an effort to ensure that before development of the north pit occurs, Teck has demonstrated its ability to operate the project in a manner that protects adjacent watersheds. The panel supports the intent of these conditions and commitments and has considered and incorporated them into its conditions to the extent that the proposed conditions were within the AER’s jurisdiction and sufficiently clear to create an enforceable condition.

[200] Mikisew, Athabasca Chipewyan, and Teck have proposed conditions and identified commitments that are intended to ensure engagement between Teck and the two communities takes place before and during the development of the Frontier project, including development of the north pit. The panel supports the intent of the proposed engagement conditions and has included a condition requiring Teck to

provide updates every two years to the AER on its engagement and collaboration efforts with Athabasca Chipewyan First Nation and Mikisew Cree First Nation regarding the north pit development.⁴

[201] The panel will include an approval condition requiring Teck to submit an updated development plan for the north pit for construction, operations, and closure five years before mining in the area.⁵

[202] The panel will also require Teck to submit amendment applications to obtain the approvals required under the *Public Lands Act* to develop the north pit at least two years before any construction in the Buckton Creek watershed.⁶

[203] Additional conditions related to the development of the north pit are discussed in the following sections: [Tailings Management Plan](#), [Groundwater](#), [Surface Water Quality](#), and [Surface Water Quantity](#).

Geotechnical Design

Evidence

[204] Teck provided design parameters and stability analysis for mine and tailings structures including the pit walls, internal and external disposal areas, internal and external tailings areas, internal tailings areas dams (also referred to as dikes within the oil sands area), and reclamations material stockpiles. Teck developed geotechnical design criteria for pit walls and tailings and mine waste disposal structures based on target design factors of safety. Teck stated that the design parameters selection were made based on laboratory testing results, regional experience, and published data.

[205] The two external tailings areas are planned to be built adjacent to each other, sharing a common dike. They are located north of the plant site and east of the main pit. For the proposed dikes, Teck indicated the target minimum factor of safety for failures involving liquefied beach below water is 1.1. For other failure mechanisms, a target minimum factor of safety value of 1.3 is used for post-construction stability, and a factor of safety of 1.5 is used for long-term stability. Teck proposed a maximum height of 60 metres and 90 metres for external and in-pit dikes respectively.

[206] Teck proposed a setback distance of 200 metres from the pit crest to external disposal areas and external tailings areas as defined by geotechnical stability analyses. Teck proposed a setback distance of 250 metres from external tailings area dikes to external disposal areas and to plant or ore processing plant or critical infrastructures to accommodate the external tailings area seepage collection system and to provide flexibility for the external tailings area footprint. Teck proposed a setback distance of 150 metres (200 metres where Clearwater unit is present in the foundation) from reclamation material stockpiles to

⁴ Draft *OSCA* Approval – Condition 7

⁵ Draft *OSCA* Approval – Conditions 8 and 9; Draft *EPEA* Approval – Condition 7.3.6 (b)

⁶ Draft *OSCA* Approval – Condition 10

all areas with infrastructure. Teck also proposed a 200 metre offset for reclamation material stockpiles from rivers, lakes, and the toe of the Birch Mountains.

[207] Teck stated that the established pit limit was suitable for long-range mine planning and conceptual mine design. The actual pit limit location and design would be refined during subsequent engineering phases and during operations with the benefit of close-spaced drilling used for short-range and mid-range mine planning.

[208] Reclamation material stockpile A is located outside of the Teck lease boundary within oil sands lease OSL 7401100017 (see [Figure 1](#)). Teck stated that reclamation material stockpile A would not be permanently depleted until 2073 (year 48 of project operations). Teck also indicated that if Canadian Natural Upgrading Ltd. (Canadian Natural) was to reapply for the Pierre River mine, and if mining was proposed for the area where reclamation material stockpile A is located while the Frontier project mine was active, Teck would work with Canadian Natural to coordinate activities in order to avoid resource sterilization.

Analysis and Findings

[209] The panel understands that Teck has developed its preliminary geotechnical design parameters, design assumptions, and target factors of safety based on information obtained from limited field and laboratory investigation, regional oil sands experience, and available best practice.

[210] While the level of assessment provided by Teck is preliminary in nature, the panel finds that it is acceptable for this stage of application. The applied target factor of safety and design assumptions are consistent with oil sands industry practices and applicable guidelines.

[211] The panel accepts the preliminary geotechnical designs for the proposed structures including pit walls, overburden storage areas, external and in-pit tailings disposal area dikes, and reclamation material stockpiles. The panel understands Teck will carry out detailed engineering design before any earthwork begins. The panel will therefore require Teck to submit the detailed geotechnical designs of overburden storage and tailings disposal structures to the AER for review and approval before construction can begin.⁷

[212] For the construction, operation, and decommissioning of dams, Teck must follow the new *Alberta Water (Ministerial) Regulations*, Part 6, the new *Alberta Dam and Canal Safety Directive* and any other applicable AER dam safety requirements.⁸

⁷ Draft *OSCA Approval* – Condition 11

⁸ Draft *Water Act Approval* – Conditions 5.0 to 5.4

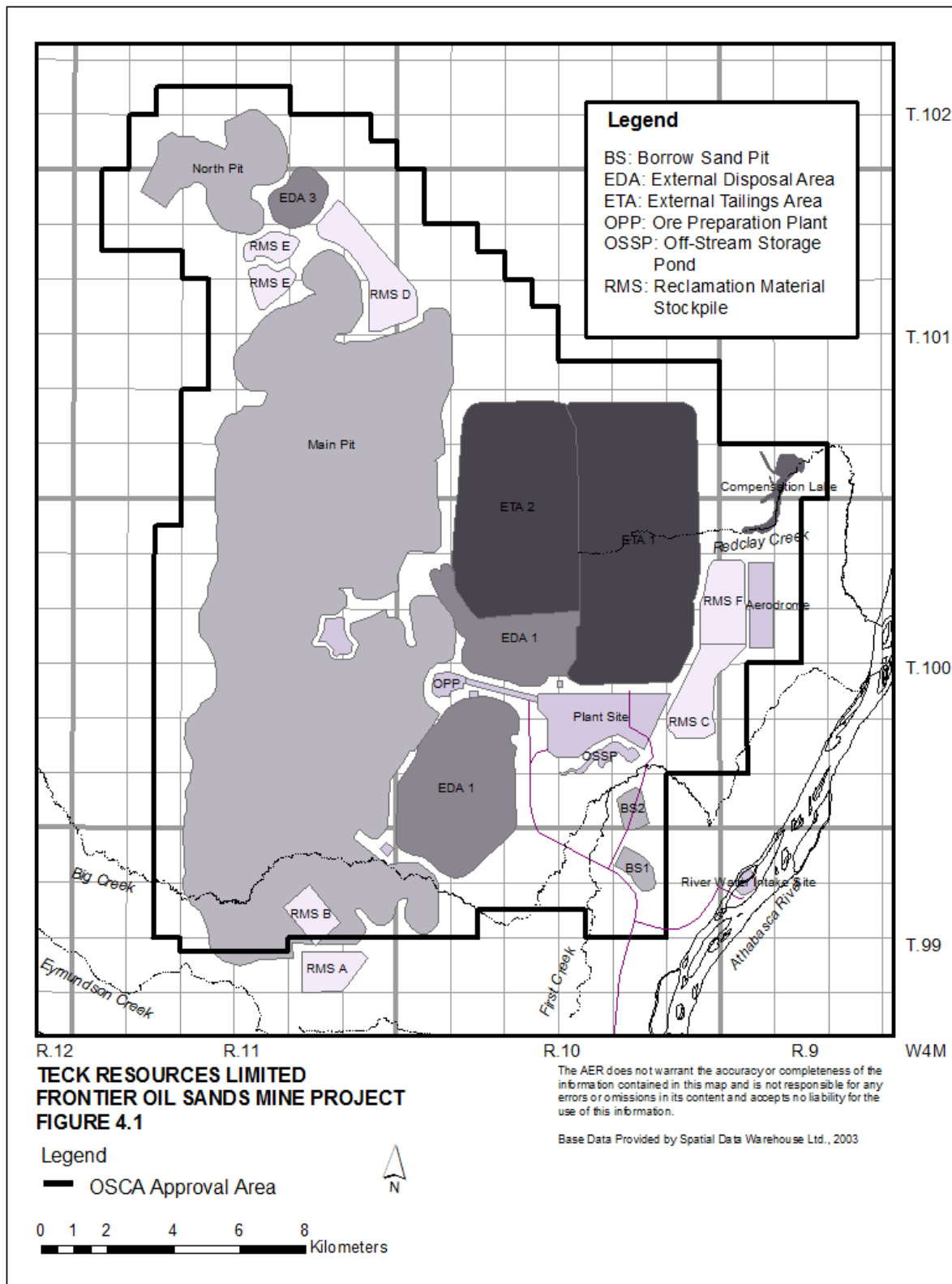


Figure 1. Project elements and boundaries

Main Pit West Boundary Quaternary Channel

Evidence

[213] Teck identified a Quaternary channel on the west boundary of the main pit. Teck indicated that the Quaternary channel was infilled with Pleistocene sediments, including clay and silts. Teck believed very little granular material or water was contained within the Quaternary channel and that no protection of the Quaternary channel would be required.

Analysis and Findings

[214] The panel notes that Teck's initial characterization of the Quaternary channel along the west boundary of the main pit did not identify significant aquifer conditions. The panel believes that additional characterization and assessment of risks to safe mine operations is required during future engineering design stages.

[215] The panel also notes that Teck's preliminary pit wall design requires further analysis supported by detailed assessment that includes site-specific foundation and material characterizations and design parameters. Therefore, the panel will require Teck to submit to the AER the final pit wall designs for the mine pits that include the detailed assessment before construction.⁹

Canadian Natural Proposed Compensation Lake Location

Evidence

[216] The proposed compensation lake associated with Shell's approved Jackpine Mine Expansion (South Redclay Lake) is located within the Teck Frontier proposed project area close to the Athabasca River. The Jackpine Mine Expansion project ownership was transferred from Shell to Canadian Natural in 2017.

[217] Teck indicated that discharge from the central pit lake will be conveyed through the project's fish habitat compensation lake to the Athabasca River through a downstream reach of Redclay Creek. If Canadian Natural constructs a fish habitat compensation lake as originally proposed, the Frontier project's fish habitat compensation lake would discharge to the Canadian Natural compensation lake that discharges to the Athabasca River. Further details on the fish habitat compensation lake for the Frontier project are found in section 20, "[Fish and Fish Habitat](#)."

[218] The proposed Canadian Natural compensation lake includes South Redclay Lake and North Redclay Lake. South Redclay Lake is planned as compensation for the Jackpine Mine Expansion and Pierre River Mines. North Redclay Lake is proposed as part of future fish habitat compensation requirements for Canadian Natural developments.

⁹ Draft OSCA Approval – Condition 12

[219] When asked about the status of the Canadian Natural's plans for the compensation lake proposed within the Teck lease boundary, Teck responded that it had no information about the status.

Analysis and Findings

[220] The panel understands that the applications for the Pierre River mine project were withdrawn. While the Jackpine Mine Expansion project was approved, Canadian Natural's plans for the project are not known.

[221] Before the construction of the Frontier project, the panel expects Teck will have agreements in place with Canadian Natural to ensure the compensation lakes for the Canadian Natural projects and the Frontier project development are able to proceed as planned.

[222] The panel requires Teck to confirm such an agreement is in place before starting construction.¹⁰

South Lease Boundary

Evidence

[223] Teck indicated some project components were located outside of the oil sand leases held by Teck. Reclamation material stockpile A, a diversion ditch, and a small portion of the main pit's southern limit are located outside the south lease boundary within oil sands leases not held by Teck.

[224] Teck stated that reclamation material stockpile A would be temporary and used during reclamation operations. Teck indicated reclamation material stockpile A is expected to be depleted by 2073 (year 48).

[225] Teck also stated it intends to use mid-ore mining at the lease boundary to maximize resource recovery within the leases held by Teck. Along the south lease boundary between the Teck and Canadian Natural leases, the main pit will incorporate a mid-ore pit wall design, resulting in an equal volume of ore for each leaseholder.

[226] In its preliminary closure drainage plan, Teck proposed a pit lake (south pit lake) adjacent to the south lease boundary. Teck stated the proposed preliminary closure drainage plan was based on a mine plan that was withdrawn (Pierre River mine). Teck indicated it had consulted with the former adjacent leaseholder (Shell) during development of the Frontier project closure drainage plan. Teck stated that while there was no plan by the adjacent leaseholder to mine close to the lease boundary, Teck would continue to work with the current leaseholder (Canadian Natural) to discuss the shared boundary and to ensure that resource sterilization would be avoided and that the closure plan and associated closure landscape could be achieved.

¹⁰ Draft OSCA Approval – Condition 13

Analysis and Findings

[227] The panel notes that reclamation material stockpile A is located outside of Teck's lease area for an extended period of time. The panel understands that reclamation material stockpile A will be rehandled when the material is used for reclamation purposes. The panel accepts the placement of reclamation material stockpile A, as shown in [Figure 1](#), outside of the Teck lease as long as there is agreement with the adjacent leaseholder and Teck obtains all regulatory approvals required before construction. The panel therefore requires that Teck submit confirmation to the AER that all required agreements and regulatory approvals are in place prior to establishing reclamation material stockpile A in the approved location, outside of Teck's lease.¹¹

[228] The panel recognizes that the mid-ore mining approach is generally accepted as a way to equally share ore at the lease boundary in order to maximize resource recovery. However, the panel notes that Teck's plan to create a pit lake adjacent to the south lease boundary would effectively eliminate the ability of the adjacent leaseholder to recover their share of the ore if a mine pit was to be proposed for that area.

[229] In the absence of mining on the other side of the south lease boundary, Teck may optimize resource recovery on its lease by mining to the bottom of ore up to the lease boundary subject to agreement with adjacent leaseholder for land disturbance and any other regulatory requirements.

[230] The panel understands that agreements between Teck and Canadian Natural are not currently in place. The panel understands that in the absence of a mine plan by the other party, it is not possible to provide an integrated closure landform design.

[231] The panel believes the south lease boundary development, including the closure landform integration and closure landform design, should be finalized before mining in the south lease area. The panel requires Teck to work with the adjacent leaseholder and submit a lease boundary update five years before any disturbance along the south common lease boundary. The south lease boundary update should include any update on the agreement between the common leaseholders, the mining or disturbance plan along the south lease boundary, a plan for closure landform integration, and conservation and reclamation plan according to the *EPEA* approval.¹²

¹¹ Draft *OSCA* Approval – Condition 17

¹² Draft *OSCA* Approval – Conditions 14, 15, and 16; Draft *EPEA* Approval – Condition 7.3.6 (a)

5 Devonian Geohazard

Evidence

[232] Teck stated that shallow karsting (which can cause sinkholes) was expected to occur adjacent to the Athabasca River where Quaternary strata directly overlie Devonian strata. However, Teck stated that the potential for deep-seated karst and vertical hydraulic connection between the deep Devonian strata and the basal aquifer in the project development area is low. Teck only identified possible lost circulation in one borehole during exploratory drilling, and that borehole is no longer within Teck's project development area because of the Teck-Shell lease exchange.

[233] Teck recognized that encountering localized high-permeability features in the Devonian during operations could result in the inflow of large volumes of saline water into the mine pit or provide preferential pathways for contaminant migration during operations and following closure. As part of its resource evaluation programs, Teck collected cores extending into the upper 10 m of Devonian strata in 680 locations, reviewed the loss circulation event and abnormal total dissolved solids of basal water sands water in well 14-33, and conducted seismic refraction surveys within the project development area.

[234] Teck stated that data gathered to date do not indicate the presence of a continuous karsted layer within the project development area. Teck found the Upper Devonian strata to be massive, with limited fractures. Fractures that were observed were filled with mud or clay matrix material, suggesting they were inactive. Teck said that it would continue to acquire data to better define the Devonian horizon and that the potential risk would be managed through a karst management plan.

[235] Teck provided a conceptual karst management plan which included ongoing characterization, performance criteria and monitoring and development of mitigation strategies. A detailed karst management plan would be developed during future stages of engineering, if the project is approved.

[236] Teck stated that ongoing characterization would include further drilling and coring within the Devonian as mining progressed. Permeable Devonian strata, if encountered, would be flagged for further investigation using techniques such as geophysical assessment, additional targeted drilling and installation of monitoring wells, hydraulic testing, and evaluation of mineralogy or geochemistry of groundwater.

[237] Performance criteria for monitoring during depressurization would include pressure changes and salinity changes within basal water sands and Devonian monitoring wells. A set of performance criteria would be developed for the pit floor that would include indicators of stress and pore pressure and seepage quantity and quality.

[238] Teck committed to developing and continually refining a control surface to limit the depth of excavation if monitoring suggests an increased risk of Devonian inflows to the pit. The control surface

would be determined using information on water pressures in the Devonian and transmissivity of the Devonian zone to calculate how much Cretaceous material should be left in the floor to counter the potential upward force of water pressure in the Devonian. Teck identified depressurization of the Upper Devonian Waterways Formation as another mitigation option to reduce a risk of saline ingress.

[239] Teck stated that if some form of inflow is detected, a timely focused investigation would be conducted to characterize the immediate floor area and identify a remedial action plan. Teck identified two potential mitigation strategies to limit inflow of saline groundwater.

- 1) Balancing in-pit pressures by injection of water (e.g., basal water sands depressurization discharge water) into the basal water sands or shallow Devonian strata to change the hydraulic gradient between any deeper source of saline groundwater and the basal water sands or flooding the pit to counteract the inflow of saline groundwater. This would be a temporary measure to prevent accumulation at surface of very saline water. The flow path for saline groundwater would still need to be restricted before removing the water from the pit.
- 2) Reducing the local permeability of the Devonian strata through one or more of the following:
 - injecting calcium chloride to precipitate gypsum and reduce permeability
 - injecting rapid-setting cement grout with sodium silicate to reduce permeability
 - hot bitumen grouting
 - freezing with injected brine after the open pit is flooded and flood has stopped

[240] Teck indicated that selection of a mitigation strategy would depend on the mechanisms and the rates of inflow should it occur. Teck also stated that other mitigation strategies will be developed during future stages of engineering based on results from ongoing characterization and monitoring.

[241] Keepers of the Athabasca stated concerns about the adequacy of Teck's characterization of the Devonian unit in the project area. They stated that Teck may have underestimated groundwater flow rates through the Devonian if karst is present and that groundwater flow and connectivity between the mine site and the Athabasca River have not been well defined. They stated there was a major gap in the required information because groundwater would very likely flow through the Devonian and Quaternary formations to discharge into the Athabasca River. Keepers of the Athabasca alleged that the baseline information describing groundwater recharge and discharge and groundwater-surface water interaction in Teck's submission were very general and limited and not supported with field measurements. Keepers of the Athabasca recommended more drilling and testing in the project area to feed into the groundwater model and assess risk from the project.

[242] Teck performed sensitivity analysis of groundwater flow and transport model runs with Devonian permeability increased by three orders of magnitude. This resulted in only marginally higher contaminant concentrations at discharge nodes to surface water.

[243] Teck proposed the following measures to address the uncertainty of seepage migration via karst pathways towards the Athabasca River:

- Further characterize the Devonian in the southern portion of the external tailings area, where the Devonian is in direct contact with sand-dominated Quaternary deposits.
- Identify the following options to mitigate potential effects on downgradient receptors should higher-permeability zones be encountered beneath the external tailings areas:
 - Modify the seepage interception well system to capture groundwater seepage within the shallow Devonian by installing additional deeper interception wells into the Devonian or by extending the screens of the proposed Quaternary wells into the Devonian or by increasing pumping rates to effect upward hydraulic gradients from the Devonian.
 - Grout the local zones of karstic permeability.
 - Re-evaluate effects by updating the flow and transport model.

[244] NRCan recognized the potential for karst to exist in the project area. However, NRCan acknowledged that if there is a karst feature rupture, saline flow would be contained within the mine pit and would not be expected to escape the mine pit and impact adjacent surface water. NRCan therefore concluded that adverse environmental effects of saline flow would be negligible.

[245] NRCan noted the concerns of indigenous communities about downward migration of contaminants from the external tailings area through karst features into the Athabasca, but did not offer its opinion on this issue.

[246] NRCan accepted Teck's assessment of no linkage between the project and the karst features in Wood Buffalo National Park.

[247] NRCan stated the proposed karst management plan, including assessment, monitoring, and mitigation strategies, was adequate and commensurate to the risk.

Analysis and Findings

[248] The panel understands that, if karst zones of higher permeability exist in the Devonian bedrock or were activated by mining activity, this could result in the upward flow of saline groundwater from the deeper Devonian aquifer into basal water sands or the mine pit. Shell experienced significant ingress of deep saline aquifer water into cell 2A of its Muskeg River Mine while it was conducting ore cleanup

operations. The incident resulted in some ore sterilization and a loss of storage space for tailings. Consequently, Shell had to revise its mining and tailings plans to accommodate the cell 2A incident.

[249] The panel understands that the potential for karst zones of higher permeability beneath the internal and external tailings areas is one of the uncertainties associated with assessing impacts of process-affected seepage into the Athabasca River. Hydraulic permeability and pressures within the Upper and Middle Devonian have not been well characterized, especially beneath the external tailings areas and between the external tailings areas and the Athabasca River. Should karst zones of higher permeability exist or be activated by mining activity, it could result in the upward flow of saline groundwater from the Devonian into basal water sands or the mine pit or, conversely, a downward flow of process-affected seepage depending on pressure differentials in a particular area. The panel notes that an incident resulting from a Devonian aquifer release into the mine pit would affect the water management plans, mining plans, and tailings management plan.

[250] The panel accepts that full characterization of the Devonian at the application stage or long before the project start-up is not feasible. The panel also understands that when characterization activity is done in conjunction with resource drilling for the mine plan, it would benefit both the mine plan and the karst management plan.

[251] The panel is satisfied with Teck's approach to address the uncertainty of seepage migration via karst pathways towards the Athabasca River in its groundwater modelling work and through the identification of possible mitigation measures should higher-permeability zones be encountered in the vicinity of the external tailings areas.

[252] The panel finds that Teck's proposed karst management plan is acceptable as a conceptual plan. The fully developed karst management plan will provide Teck the necessary measures to identify and avoid or mitigate deep aquifer ingress incidents to the mine pit. The panel therefore requires a detailed karst management plan to be provided to the AER for review and approval before mine start-up and be updated regularly during operations.¹³

[253] The panel will also include conditions that require Teck to monitor relevant hydrostratigraphic units, including Devonian units, and conduct periodic updates to groundwater flow and solute transport models based on new information from supplementary geological investigations and hydraulic testing and monitoring.¹⁴ (See section 17, "[Groundwater](#).")

¹³ Draft *OSCA* Approval – Conditions 18 and 19

¹⁴ Draft *EPEA* Approval – Condition 4.5.10

6 Bitumen Recovery

Project Design and Operations

Evidence

[254] Teck requested approval from the AER to construct, operate, and reclaim an oil sands mine and a processing plant with capacity to produce 41 300 m³/cd (260 000 bbl/cd) of partially deasphalted bitumen. Teck also requested that no production cap be imposed on the project. Teck submitted that a production cap would limit economic optimization of invested capital, reduce energy conservation, and constrain operations.

[255] Teck also requested approval from the AER to receive third-party oil sands material (mined ore or intermediate products such as bitumen froth) and to export similar oil sands material to third parties for processing.

[256] Teck stated it would consult with the AER to establish the required measurement systems and reporting methodology during future planning stages and committed to providing a detailed measurement plan to the AER one year before starting operations.

[257] Teck stated it will develop a comprehensive emergency response plan before construction and committed to providing it to the AER six months before starting operations.

[258] Teck also committed to providing the AER with a commissioning and start-up plan six months before starting operations.

Analysis and Findings

[259] The panel understands that design processing capabilities are expected to be higher than the expected average yearly production rates. The panel expects that higher daily production will be balanced by processing plant availability and that the project will remain within approval emissions limits even during higher daily production rates. The panel therefore finds it is not necessary to impose a production cap as a condition of the *OSCA* approval. Should Teck decide to make modifications to the processing plant resulting in an increase to the average yearly production rate above 41 000 m³/cd (260 000 bbl/cd), an amendment application will be required.

[260] The panel understands that the import and export of oil sands and oil sands products will provide Teck with operational flexibility for the project. The panel therefore approves Teck's import and export of oil sands ore and bitumen froth from third-party sources, with prior notification to the AER.¹⁵

¹⁵ Draft *OSCA* Approval – Condition 1(1)

[261] The panel accepts Teck's commitment to establish measurement systems to meet AER requirements. The panel will condition AER approvals requiring Teck to submit a detailed measurement plan to the AER for approval one year before starting operations.¹⁶

[262] The panel accepts Teck's commitment to submit a comprehensive emergency response plan to the AER and will make this a condition of approval. The site-specific emergency response plan must be prepared in accordance with *Directive 071 Emergency Preparedness and Response Requirements for the Petroleum Industry* and must include how Teck considered input from engagement and collaboration with indigenous groups.¹⁷

[263] The panel also accepts Teck's commitment to provide a commissioning and start-up plan six months before starting operations and will make this a condition of approval. The commissioning and start-up plan must include the mitigations Teck will implement to avoid resource waste during plant commissioning as well as the final engineering design, final plant layout, evaluation of process aids selection and selected rates, diluent selection, and start-up sequence.¹⁸

Bitumen Recovery

Evidence

[264] Teck proposes to use the warm-water bitumen extraction process and high-temperature paraffinic froth treatment process in order to meet the bitumen recovery requirements set out in AER *Directive 082*. The directive requires a processing plant recovery factor of 90 weight per cent (wt%) if the average bitumen content of the as-mined ore is 11 wt% bitumen or greater. If the average bitumen content of the as-mined ore is less than 11 wt% bitumen, the required recovery is determined by an equation that considers the average weight per cent bitumen content of the as-mined ore. Teck indicated that start-up and the first year of operation may bring some challenges that impact its ability to meet the recovery requirements. However, Teck also indicated it would strive to meet the requirements from year one.

[265] The bitumen recovery process starts with ore being crushed at the ore preparation plant and mixed with warm water to create slurry, which is sent to the extraction plant. Conditioning is expected to happen within the 3.5 to 4 km of the three lines going to the extraction plant. Teck indicated that it would further test and research conditioning process aids and that the final process aid selection and dosage rates will be determined during future stages of engineering.

[266] In the 2015 project update, Teck increased the upper-end temperature of the slurry preparation and the extraction process by 5°C in order to increase resource recovery under a wide range of ore grades

¹⁶ Draft OSCA Approval – Condition 22

¹⁷ Draft OSCA Approval – Condition 23

¹⁸ Draft OSCA Approval – Condition 25

and given the high fines content of the ore body. The ore preparation plant hot water temperature is expected to be 77°C to 89°C and the extraction operating temperature in the range of 45°C to 55°C.

[267] High-temperature paraffinic froth treatment process was selected for the project. The process uses paraffinic solvent to precipitate a portion of the asphaltenes contained in the bitumen froth and remove water and solids, resulting in a high-quality, partially deasphalted bitumen that will meet pipeline specification of 0.5 per cent water and solids. The product is then mixed with diluent to be transported to market. Teck conducted pilot testing that demonstrated the bitumen froth responded favourably to the process.

[268] Teck stated that the bitumen in the froth is expected to contain approximately 17 wt% asphaltenes. The amount of precipitated asphaltenes, or asphaltene rejection, will be influenced by the solvent, the solvent-to-bitumen-ratio, operating conditions (temperature and pressure), and the quality of the bitumen froth fed to the froth treatment plant.

[269] Teck indicated that the industry standard for asphaltene rejection is an annual average of about 10 wt%. Teck anticipates its annual asphaltenes rejection will be less than 10 wt%; however, in order to accommodate changes in market conditions, Teck committed to limit asphaltene rejection to 10 wt% of produced bitumen on an annual average. Teck also indicated that it will attempt to optimize asphaltene rejection rates once further information on the site-specific conditions is available.

Analysis and Findings

[270] The panel considers the 5°C temperature change in the extraction process in order to increase resource recovery to be reasonable. The panel notes that *Directive 082* sets out mandatory requirements that apply to Teck. The panel was not presented with a compelling reason why those requirements relating to bitumen recovery should not apply to Teck.

[271] The panel accepts Teck's commitment to limit annual average asphaltene rejection to less than 10 wt% of bitumen production and will include this as a condition of the AER approvals.¹⁹

[272] The panel will also require Teck to provide updates on the optimization of asphaltene rejection rates within its *Oil Sands Conservation Rules (OSCR)* section 58 annual report of operations, starting on the first year of operations.²⁰

¹⁹ Draft *OSCA* Approval – Condition 26

²⁰ Draft *OSCA* Approval – Condition 27

Solvent Losses

Evidence

[273] Most of the paraffinic solvent used is recovered in the solvent recovery unit and reused. Tailings from the froth treatment plant are further processed at the tailings solvent recovery unit to recover additional solvent before disposing of the froth treatment tailings in the external tailings area. Froth treatment tailings contain the rejected asphaltenes, some precipitated maltenes, water, minerals, and some of the unrecovered solvent.

[274] Teck requested an approval condition limiting their solvent losses to less than four volumes per thousand volumes of bitumen production on an annual basis similar to other oil sands mining operations. Teck indicated that the proposed solvent losses would be equivalent to 165 m³/cd (1040 bbl/cd). Teck indicated that it had no intention of discharging untreated froth treatment tailings (tailings that do not pass through a tailings solvent recovery unit) to the tailings disposal area. The preliminary material balance information submitted by Teck indicated that Teck's current design will achieve solvent losses during normal operations lower than four volumes per thousand volumes..

[275] The joint submission from Athabasca Chipewyan and Teck included a recommendation to the panel to include the following condition to any AER approvals: "Teck will: avoid solvent loss of more than four (4) volumes per thousand (1000) volumes of bitumen production average basis and endeavour to reduce solvent loss of three (3) volumes per thousand (1000) volumes of bitumen."

[276] During the hearing, Teck confirmed that it would strive from day one to reduce solvent losses to three volumes per thousand volumes of bitumen, but it committed to less than four. Teck indicated it was premature to comment on how and when they would achieve the three volumes per thousand volumes. Teck indicated that best-in-class performance for solvent loss would be in the range of two and a half to three volumes per thousand volumes of bitumen without including upsets.

Analysis and Findings

[277] Limits on solvent losses are a condition of AER approvals and are based on technology and plant design capabilities and are evaluated on a case-by-case basis. The proposed plant design, Teck's commitment to not discharge untreated froth treatment tailings to tailings disposal areas, Teck's commitment to operate the Frontier project to the highest standard, Teck's commitment to Athabasca Chipewyan to endeavour to reduce solvent losses to less than three volumes per thousand volumes of bitumen production, as well as Teck's recognition of current best-in-class performance, all suggest that a more stringent annual solvent loss limit is appropriate for the Frontier project.

[278] The panel recognizes that solvent losses may be higher during commissioning and initial start-up; therefore, the panel will allow for 12 months of site-wide solvent losses at less than four volumes per thousand volumes of bitumen production at the start of operations for each of the two phases. However

the panel will require solvent losses to be less than three volumes per thousand volumes of bitumen production thereafter.²¹

[279] The panel accepts Teck's commitment to not discharging untreated froth treatment tailings and will include this as a condition of approval. The panel requires Teck to take all reasonable measures to ensure that a tailings solvent recovery unit is operating effectively and efficiently when the froth treatment units are in operation.²²

Storage Tanks

Evidence

[280] Teck provided preliminary storage tank information for the project, which included the expected number of vessels, volume capacities, and air emission abatement controls to be employed. The substances that would require tank storages were listed as bitumen froth, process make-up solvent, diluent, diluted bitumen, diesel fuels, lubricants, and varying process-related waters.

[281] Teck stated that all liquid hydrocarbon storage tanks will be designed to meet the requirements of AER's *Directive 055 – Storage Requirements for the Upstream Petroleum Industry* and the Canadian Council of Ministers of Environment's (CCME's) *Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Aboveground Storage Tanks* (CCME guidelines).

Analysis and Findings

[282] The panel notes that compliance with *Directive 055* is not required for oil sands mining operations. On September 2008, the AER issued *Directive 073: Inspection and Compliance of Oil Sands Mining and Processing Plant Operations*, which provided direction on tank storage requirements for oil sands mining and processing plant operations. *Directive 073* made some portions of *Directive 055* applicable to new mining operations. The panel accepts Teck's commitment to design liquid hydrocarbon storage tanks in accordance with *Directive 055*. However, Teck must also meet other requirements described in *Directive 073*, including secondary containment systems, leak detection systems, and spill prevention systems. Operating procedures, maintenance practices, inspection programs, and record retention requirements outlined in *Directive 073* shall also be followed.²³

[283] Given that the design requirements for the tanks are in a preliminary stage, the panel recommends that Teck re-evaluate the type of emission controls that would meet the objectives of the CCME guidelines as it finalizes the design of all project tanks. The panel notes that the selection of emission

²¹ Draft *OSCA* Approval – Condition 28 and 29; Draft *EPEA* Approval – Condition 4.1.34

²² Draft *OSCA* Approval – Condition 30; Draft *EPEA* Approval – Condition 4.1.7

²³ Draft *OSCA* Approval – Condition 24; Draft *EPEA* Approval – Condition 3.1.3

controls relies not only on volumetric capacities but may also require consideration of tank diameter and the stored volatile organic liquids' vapour pressures. Further discussion on tank emission controls is found in section 14, "[Air Quality](#)."

[284] The panel finds that by meeting the applicable requirements in the CCME guidelines and *Directive 055*, Teck will minimize emissions to air and unauthorized releases (such as spills) and controls will be in place to prevent soil, groundwater, and surface water contamination. The panel will therefore include a condition requiring compliance with these requirements.²⁴

Recommendation to Teck

[285] The panel recommends that Teck re-evaluate the type of emission controls that would meet the objectives of the CCME guidelines as it finalizes the design of all project tanks.

²⁴ Draft EPEA Approval – Condition 3.1.4

7 Tailings Management Plan

[286] The purpose of this section is to describe Teck's proposed tailings management plan for the project and to assess how it is aligned with the *TMF* and *AER Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*. The potential environmental effects resulting from implementation of the tailings management plan are discussed in other sections of the panel's report.

[287] The objective of the *TMF* is to minimize fluid tailings accumulation by ensuring that fluid tailings are treated and reclaimed progressively during the life of a project and that all new fluid tailings associated with a project are ready to reclaim within ten years of the end of mine life. In addition, the *TMF* establishes four outcomes: land use must be returned to Albertans, sustainable ecosystem, liability is minimized to Albertans, and environmental effects are managed.

[288] *Directive 085* uses an outcome-based approach to hold operators accountable for managing fluid tailings. *Directive 085* sets the requirements for operators to demonstrate that their tailings profiles and fluid tailings management plans are aligned with the intent and outcomes of the *TMF*. *Directive 085* requires operators to submit information to support their proposed performance criteria, which establishes when a deposit meets ready-to-reclaim status.

[289] The concept of ready-to-reclaim tailings supports the high-level objective of reclaiming oil sands mine projects to a self-sustaining boreal forest ecosystem. There are two subobjectives that address the different aspects of performance and evaluate if deposits are on a trajectory to meet the high-level objective. Subobjective 1 is to ensure the deposit's physical properties are on a trajectory to support future stages of activity. Subobjective 2 is to minimize the effects of the deposit on the environment and to ensure it will not compromise the ability to reclaim to a diverse, locally common, and self-sustaining ecosystem.

Teck's Proposed Approach to Tailings Management

Evidence

[290] Teck's tailings management strategy was updated in 2015, and further details were provided within Teck responses to information requests and during the hearing. The tailings management plan is based on using centrifuge technology for fluid fine tailings treatment.

[291] The objectives for Teck's proposed tailings management plan include the following:

- meeting the objectives of the *TMF* and *Directive 085*;
- ensuring containment stability for all dams through construction, operations and closure;
- ensuring adequate tailings containment and operational contingency space during operations;

- minimizing and eventually eliminating long-term storage of fluid tailings in the closure landscape;
- effective progressive reclamation and progressively reducing fluid fine tailings inventory;
- maximizing the recycling of process water and effectively managing process-affected wastewater storage; and
- developing landforms, pit lakes and wetlands that are sustainable in the long-term and ensuring discharge waters are acceptable for the release to the environment.

[292] Teck's proposed fines capture technology includes capturing fines in coarse sand beaches and fluid fine tailings de-watering using centrifuge technology, followed by deposition in pit and below ground level. Teck indicated that this approach improves water-use efficiency, allows progressive reclamation, and results in no active tailings dams in the post-closure structure.

[293] Tailings are generated from the bitumen extraction process. The extraction process involves the use hydrocyclones for particle separation and flotation cells to recover residual bitumen and to separate coarse and fine solids.

[294] Teck's extraction process will produce the following five tailings streams:

- Secondary flotation tailings: fine tailings from secondary flotation cells. Used for beaching in the external tailings areas.
- Coarse combined tailings: coarse sand tailings from the primary separation cell combined with some of the secondary flotation tailings. Used for dike construction and beaching in the external and internal tailings areas.
- Froth treatment tailings: tailings from the tailings solvent recovery unit. The froth treatment tailings are processed in the tailings solvent recovery unit to reduce the residual solvent content to an acceptable low level. Deposited in the external tailings area for the life of the project.
- Fluid fine tailings: tailings produced by fines that separate from the coarse combined tailings, secondary flotation tailings, and froth treatment tailings streams at the point of deposition. Deposited in external tailings areas.
- Centrifuged fine tailings cake: produced by centrifuging the fine fluid tailings from the external tailings areas. More than 95% of the centrifuge cake will be deposited in the in-pit disposal areas, and the remaining will be part of the external tailings area.

[295] Teck proposes constructing two external tailings areas (external tailings area 1 and external tailings area 2) and three in-pit tailings areas (internal tailings area 1, internal tailings area 2 and internal tailings area 3) to store fluid tailings, recycle water, centrifuge fine tailings cake (centrifuge cake), and coarse combined tailings. The external tailings areas would be constructed in two stages, with external

tailings area 1 providing initial tailings disposal capacity and external tailings area 2 providing the second stage of containment, until internal tailings area 1 is available.

[296] As part of the 2015 project update, Teck changed their tailings treatment technology from using thickeners to using centrifuges. As Teck will no longer use thickeners, the cyclone underflow containing the majority of the coarse sand particles (greater than 44 microns) will be sent directly to the tailings disposal areas. Approximately 75 per cent of the coarse tailings will be deposited in the external tailings areas, an additional 21 per cent will be deposited in internal tailings area 3, and the remaining coarse tailings will be used to cap centrifuge cake deposits or meet closure landform requirements.

[297] Teck anticipated the coarse combined tailings deposition areas in the external tailings areas will capture more than 50% of the fines in coarse sand beaches, reducing the fines released to form fluid fine tailings. Secondary flotation tailings will be used for beaching in the external tailings areas, providing additional fines capture up to 60%.

[298] The fluid fine tailings, formed by fines that segregate from combined coarse tailings, secondary flotation tailings, and froth treatment tailings, will be centrifuged to form centrifuged cake deposits and disposed mainly in the internal tailings areas.

[299] Teck stated that gypsum and/or polymer will be added to the centrifuge feed to increase the solids content of the centrifuge cake. Teck selected the polymer currently used at other centrifuge operations on a preliminary basis. Teck expects to further review it as part of future stages of the project.

[300] A small amount of centrifuge cake will be placed in external tailings area 2 (dedicated disposal area 1) during the early years of operation. The rest, approximately 96%, will be placed within the in-pit tailings areas (internal tailings area 1 and internal tailings area 2). Centrate water, the water leaving the centrifuges, will be collected and transferred to external tailings area 1 and external tailings area 2.

[301] Teck's tailings facilities are planned to be operated, infilled, capped, and recontoured as per the schedule in [Table 4](#). The closure and reclamation of tailings facilities is discussed in section [10](#), "[Conservation, Reclamation, and Closure](#)."

Table 4. Proposed tailings infilling, sand capping, and reclamation activities schedule

Tailings facilities	Storage type	Operating	Closure infilling	Sand capping	Start of further reclamation activities
ETA 1	Fluid tailings and recycle water	2026–2044	2045–2054		2055
ETA 2	Centrifuge cake (thin lift), fluid tailings and recycle water	2044–2058	2058–2066		2067
DDA 1	Centrifuge cake (thin lift) within ETA 2	2028–2036		2044–2066	2070
ITA 1 CFT	Centrifuge cake (deep deposit)	2037–2050		2053–2058	2060

Tailings facilities	Storage type	Operating	Closure infilling	Sand capping	Start of further reclamation activities
ITA 2 CFT	Centrifuge cake (deep deposit)	2050–2067		2064–2069	2073
ITA 3	Coarse combined tailings	2056–2066	2067–2073		2067

CFT – centrifuged fine tailings

DDA – dedicated disposal area

ETA – external tailings area

ITA – internal tailings area

[302] The environmental effects of tailings deposition areas and tailings processing facilities and Teck’s proposed mitigation are discussed the following sections: [Air Quality](#), [Groundwater](#), [Surface Water Quality](#), and [Conservation, Reclamation, and Closure](#).

[303] Teck stated that it will use an adaptive management approach to improve the reliability and predictability of the tailings management plan and accommodate technological advances. Teck stated it was a founding and active member of Canada’s Oil Sands Innovation Alliance (COSIA), an industry-led research consortium that is actively pursuing fundamental and applied research in fine tailings behaviour, treatment technologies, and deposit performance.

[304] Teck indicated that should the project be approved, there will be opportunities to confirm and optimize design and planning assumptions for cake deposits before large-scale in-pit cake deposition in 2037. Teck also stated that, based on stakeholder input and in order to achieve progressive reclamation, it will not place tailings in the end-pit lakes. Teck also confirmed tailings will not be deposited in the north pit watershed.

[305] Notwithstanding its commitment to not placing tailings in end-pit lakes, Teck indicated that it may wish to re-evaluate its position on the placement of tailings in end-pit lakes, water capping of tailings, in the future should this technology be approved by the Government of Alberta and offer opportunities to improve project performance. However, Teck stated that it would not consider that approach until having discussions with indigenous communities, and it would be subject to receiving the necessary regulatory approvals.

Analysis and Findings

[306] The panel finds that Teck’s proposed tailings management plan is aligned with the objectives of the *TMF*. The panel accepts Teck’s proposed use of centrifuge technology to treat fluid tailings. The panel also accepts Teck’s commitments to not place tailings in the end-pit lakes or the watershed containing the north pit and will include these as conditions in the AER approvals.²⁵ Should Teck want to place tailings in end-pit lakes in the future, it will need to apply for amendment to the project’s approvals. The

²⁵ Draft *OSCA* Approval – Conditions 31 and 32; Draft *EPEA* Approval – Condition 4.3.12

amendment application would need to include the information necessary to assess the environmental effects of the proposed change.

[307] Given the early stage of the project, Teck will require time to verify its proposed tailings treatment technology and deposit performance. The panel considered a number of areas of risk and uncertainty and is imposing conditions to ensure that appropriate information is captured in a timely manner. The conditions found in the draft AER approvals attached as appendices to this decision address froth treatment tailings; the fluid tailings profile; project-specific thresholds; fluid tailings deposition testing; deposit performance and milestones; future plans and other reports submission and requirements, research, monitoring and reporting requirements; and engagement with stakeholders and indigenous communities. Other standard tailings approval conditions are also applied.²⁶

[308] In relation to the chemical additives to be used for tailings treatment, Teck is required to provide additional information to the AER once the final selection is made.²⁷ Depending on the nature of the effects of the additives proposed, an authorization or amendment to the AER *EPEA* approval may be required.

[309] The panel's assessment of the environmental effects and proposed management, mitigation, and monitoring strategies related to tailings management activities are discussed in other sections of this report.

Froth Treatment Tailings

Evidence

[310] Teck proposes to send froth treatment tailings to the external tailings areas where they will be co-deposited (commingled) with other tailings streams. Teck does not propose to segregate or create a separate disposal area for froth treatment tailings.

[311] Teck submitted that this approach is current industry practice. Teck suggested that commingling of tailings streams was an appropriate mitigation strategy and viewed the predicted effects as acceptable. Teck stated it will consider adjusting tailings storage methods for froth treatment tailings should research and monitoring indicate that it is necessary based on site-specific conditions and emerging technology risk.

Analysis and Findings

[312] Although froth treatment tailings constitute a small percentage of the overall tailings volumes for the project, these tailings may pose higher environmental risks because they contain residual paraffinic

²⁶ Draft *OSCA* Approval – Conditions 34, 37, 38, 46, 53, 55, 56, 57, and 63

²⁷ Draft *EPEA* Approval – Condition 4.3.11

solvent, other hydrocarbons, and sulphides. Furthermore, froth treatment tailings may impact the performance of tailings deposits containing centrifuge tailings and the ability to achieve long-term reclamation outcomes.

[313] The panel will therefore include a condition that Teck only deposit froth treatment tailings in the external tailings areas as proposed.²⁸

[314] The panel expects Teck continue to monitor emerging options for the treatment and placement of froth treatment tailings.

Fluid Tailings Profile

Evidence

[315] Teck provided a fluid tailings volume profile as required by *Directive 085*. Teck stated that the project projected fluid tailings inventories are significantly below *Directive 085* requirements at all relevant stages, including early production, operation, and post end of mine life.

[316] The profile indicated that fluid tailings accumulation will increase and reach a peak in 2037, after twelve years of bitumen production operations. The peak fluid tailings inventory is expected to be 231 million cubic metres (Mm³) which represents an equivalent of seven years of full production fluid tailings volume generation.

[317] Teck's tailings profile indicates that within two to three years after the end of mine life, fluid tailings will be reduced to zero.

Analysis and Findings

[318] Under *Directive 085*, the fluid tailings profiles represent the volume of fluid tailings that is *not* ready to reclaim (i.e., does not meet ready-to-reclaim criteria). The fluid tailings profiles are important tools by which the performance of an operator is measured.

[319] *Directive 085* requires that all fluid tailings meet ready-to-reclaim criteria within ten years of the end of mine life. Teck's proposed fluid tailings profile indicates that all fluid tailings are expected to achieve ready-to-reclaim status within two to three years of the end of mine life. Teck's proposed profile also satisfies the *Directive 085* requirement that at the end of mine life there must not be greater than five years of accumulation of fluid tailings production. The panel accepts and approves the fluid tailings profile provided by Teck and shown in [Appendix 5](#) table C-1 for the fluid tailings profile and figure C-1 for the fluid tailings profile graph.²⁹

²⁸ Draft OSCA Approval – Condition 33

²⁹ Draft OSCA Approval – Condition 35

[320] The *TMF* identifies triggers and a limit (known collectively as thresholds) for new fluid tailings. The thresholds will be established on a project-specific basis by the AER and will be used to ensure operators are on track to meet the ready-to-reclaim objective within 10 years. The profile deviation trigger alerts operators and regulators when the volume of fluid tailings is growing faster than originally approved for. It is based on when the fluid tailings volume growth is 20 per cent higher than the approved profile and considers a five-year rolling average to account for year-over-year variability. To allow for this variability, the panel set the profile deviation trigger for Teck as a five-year rolling average of the annual profile deviation. The panel is setting the thresholds based on the approved tailings profile.

[321] In accordance with the *TMF* and *Directive 085*, Teck is also subject to a total volume trigger, which is a volume of fluid tailings that is equivalent to 100 per cent of the greater of the maximum approved fluid tailings profile volume or the end of mine target. This trigger indicates that the volume has exceeded the maximum accumulation of fluid tailings and will require additional management action. Teck is also subject to a total volume limit. Exceedance of this limit is considered an unacceptable risk to the environment and a potential long-term liability. The total volume limit represents 140 per cent of the greater of the maximum approved fluid tailings volume profile or the end of mine target. Teck's total volume trigger is set at 231 Mm³ and the total volume limit at 323 Mm³. See [Appendix 5](#), table C-2 for the tailings profile thresholds.³⁰

Tailings Treatment Technology

Evidence

[322] Teck proposes to treat fluid tailings in phases, beginning with small scale centrifuge operations in 2028. The full-scale centrifuge operations will begin in 2037 after having nine years of site-specific operational experience.

[323] Teck considers centrifuge technology to be sound and proven and referenced the recent implementation of this technology at Syncrude Canada Ltd.'s Mildred Lake Mine and Canadian Natural Jackpine Mine. Teck plans to leverage what it learns of best practices and best technologies from other companies using this technology through its participation in COSIA. Teck indicated those lessons will inform any changes required as a result of future developments from both technology and deposit performance. Teck stated that it would therefore work to refine the implementation of the centrifuge processes and cake deposition strategies over the next several years.

[324] Teck also indicated that decoupling the fluid fine tailings centrifuging from the bitumen recovery process significantly reduces the risk of "off-spec" tailings (tailings which do not meet targeted quality parameters). Teck stated that it will manage poor performance of any off-spec centrifuge cake by widely

³⁰ Draft *OSCA* Approval – Condition 36

distributing it along the perimeter of the in-pit cake deposits. Teck is planning to perform a demonstration-scale implementation of centrifuges in the early stages of the project. Teck believes this will provide them with the operating experience required to optimize design and large-scale implementation.

[325] Teck submitted that all fluid tailings will be processed using centrifuges within one year after the end of mine life. The centrifuge cake will be deposited in external tailings area 2 during the initial years and in in-pit deposit after year 12 of operations. The centrifuge cake deposits are expected to reach a thickness of 30 to 60 m overtime. Teck believes the key uncertainty to this approach is the current limited monitoring data for consolidation in large-scale thick (deep) centrifuge cake deposits. Teck also indicated the uncertainty does not invalidate the tailings management plan or the long-term performance of the facility.

Analysis and Findings

[326] The panel understands that centrifuge technology provides greater process controls to reduce treatment quality variability. The panel accepts Teck's plan to use centrifuge technology on the Frontier project but notes that centrifuge technology is a cost-intensive technology. The fluid tailings treatment capacities rely on building and operating a significant number of centrifuges near the end of mine life, and this may represent a significant economic risk for the project.

[327] The panel expects Teck to continue its research and participation in industry groups to evaluate new alternative tailings treatment technologies to optimize its fluid tailings management strategy.

[328] The risk of "off-spec" tailings and centrifuge cake deep deposits underperformance can result in more fluid tailings than expected, an increase in capping material needs, a decrease in storage capacity, and an increase in the tailings deposit consolidation time. The panel acknowledges that there is some uncertainty about the ability of centrifuge cake deposits to support future reclamation activities, achieve stable targeted ecosites (see section 10, "[Conservation, Reclamation, and Closure](#)"), and meet the *TMF*'s outcomes. Therefore the panel will condition Teck to monitor centrifuge plant operations monthly, monitor centrifuge cake deposits annually, and report on these monitoring results annually.³¹

Deposit Milestones

Evidence

[329] Teck indicated that the deposition of centrifuge fine tailings will occur using thin-lift deposition from the start of operations until 2037, with a thickness of generally less than 1.8 m per year. Deposition of centrifuge fine tailings will occur as deep-centrifuge deposits after 2037.

³¹ Draft *OSCA* Approval – Condition 54

[330] External tailings area 2 will contain a thin-lift centrifuge cake tailings deposit (dedicated disposal area 1). Internal tailings areas 1 and 2 will store centrifuge fluid tailing cake. Internal tailings area 3 will store coarse combined tailings. All fluid tailings will be removed from external tailings area 1 by 2047 and from external tailings area 2 by 2061. At the end of mine life and during the infilling of external tailings area 2, the reclaim water source will be the temporary in-pit fluid storage area, in the location of the proposed central pit lake.

[331] Teck proposes to place centrifuge cake tailings in internal tailings area 1 starting in 2037 and in internal tailings area 2 starting in 2050. The centrifuge cake will be placed year round in deep deposits that range in total thickness from approximately 30 m to 60 m. Teck also proposes to use tailings sand with a thickness of 10 m to cap the external tailings areas and their centrifuge cake deposits (internal tailings areas 1 and 2).

Analysis and Findings

[332] *Directive 085* requires operators to identify critical milestones for each tailings deposit, including deposit preparation, start of fluid placement, capping, and start of further reclamations activities.

[333] The panel accepts Teck's proposed approach for tailings deposition and requires the tailings facilities to be operated, infilled, capped, and recontoured in the timeframe as specified by Teck and outlined in [Appendix 5](#), table E-1.³² The panel also requires that Teck provide to the AER a plan that updates the fluid tailings management for each deposit one year before placement of fluid tailings or treated tailings in each deposit or by any other date as the AER may stipulate in writing.³³

[334] Reclamation and closure of the tailings disposal areas is discussed further in section [10](#), "[Conservation, Reclamation, and Closure](#)."

Ready-to-Reclaim Criteria for ETA 2 (DDA 1) – Thin-Lift Centrifuge Cake Tailings Deposits

Evidence

[335] Teck proposed a centrifuge cake solids concentration of ≥ 50 per cent as the ready-to-reclaim criteria for the project's centrifuge cake deposits, with an expected ≥ 65 per cent solids by weight by the end of deposition with a maximum thickness of approximately 10 metres. Final sand capping is expected to be completed by 2066. The proposed subobjective 2 included closed-circuit water drainage and collection in containment structures for surface flows and waters in contact with tailings, seepage control during operations and post-closure, and groundwater monitoring. Surface water drainage, seepage control,

³² Draft *OSCA* Approval – Condition 40

³³ Draft *OSCA* Approval – Conditions 49 and 50

and groundwater monitoring related to tailings deposits is discussed in the following sections: [Water Management](#), [Surface Water Quantity](#), and [Groundwater](#).

[336] Teck proposed the following specific measures for external tailings area 2 (dedicated disposal area 1)

- Subobjective 1:
 - A minimum of 50 per cent solids by weight at deposition, based upon deposit sampling.
 - A minimum of 65 per cent solids by weight by the end of deposition, based upon deposit sampling.
 - Completion of sand capping by 2066.
- Subobjective 2
 - Surface water: Closed-circuit drainage and collection in containment structures for surface flows and waters in contact with tailings are operating as designed.
 - Seepage: use of pumping wells during operation and a passive seepage control system post-closure for external tailings areas seepage control.
 - Monitor groundwater as required by the *EPEA* approval.

Analysis and Findings

[337] The proposed thin-lift centrifuge cake, with a minimum of 50 per cent solids by weight at deposition, is expected to have reasonable consolidation within a reasonable period of time. Therefore, the panel accepts Teck's proposed ready-to-reclaim criteria for the thin-lift centrifuge cake deposits in external tailings area 2 (dedicated disposal area 1) as outlined in [Appendix 5](#), table D-1.³⁴

[338] Although Teck proposed a passive seepage control system for the external tailings areas post-closure as part of its subobjective 2, no design details were provided. The proposed seepage control systems associated with the external tailings areas are discussed further in section 17, "[Groundwater](#)."

[339] The panel requires Teck to provide by December 31, 2025, updated subobjective 2 ready-to-reclaim criteria for external tailings area 2 (dedicated disposal area 1). The update must include a detailed evaluation and design of the proposed passive seepage control system for the external tailings areas that will be used post-closure.³⁵

³⁴ Draft *OSCA* Approval – Condition 39

³⁵ Draft *OSCA* Approval – Condition 41

Ready-to-Reclaim Criteria for ITA 1 (DDA 2) and ITA 2 (DDA 3) – Deep-Centrifuge Cake Tailings Deposits

Evidence

[340] Teck indicated that by the time in-pit cake deposition occurs, which is planned to begin in 2037, industry as a whole should have more experience with large-scale thick cake deposits, also referred to as deep deposits. Teck noted that industry experience, together with Teck's own test results, will provide the data needed to further understand the deposit behaviour and expected settlement.

[341] Teck proposes to deposit centrifuge cake year round in internal tailings areas 1 and 2; the deposit will reach a total thickness of 30 to 60 m. Teck used a one-dimensional large strain model to calculate centrifuged fine tailings deposit consolidation for internal tailings area 1, which is the deeper deposit. For the analysis, the maximum total centrifuge cake height is about 50 m, and the total capacity of internal tailings area 1 is approximately 218 Mm³.

[342] The annual rate of rise for the 20-year filling period is about 2.5 m. The results of the modelling show total settlement of 15–17 m within 100 years. Teck's one-dimensional consolidation settlement results showed additional total settlement due to the proposed 10 m sand capping.

[343] Teck proposed the following specific measures for the deep-centrifuge cake deposits for internal tailings areas 1 and 2:

- Subobjective 1:
 - A minimum of 50 per cent solids by weight at deposition, based upon deposit sampling.
 - A minimum of 60 per cent solids by weight by the end of deposition, based upon deposit sampling.
 - Crust of cake with a minimum of 70 per cent solids by weight before sand capping, based upon deposit sampling.
 - Completion of sand capping by 2058 for internal tailings area 1 and 2069 for internal tailings area 2
- Subobjective 2:
 - Surface water: Closed-circuit drainage and collection in containment structures for surface flows and waters in contact with tailings.
 - Monitor groundwater as required by the *EPEA* approval.

Analysis and Findings

[344] Teck proposes to rely on Syncrude's and Canadian Natural's experiences in order to achieve the objectives for the deep-centrifuge cake tailings deposits. Therefore, the panel expects Teck to demonstrate no major changes in deep-centrifuge cake tailings deposit performance before capping.

[345] The panel notes there is uncertainty in the consolidation modelling due to the assumptions, estimations, initial and boundary conditions, and scaling effects. The panel does not expect significant hydraulic (seepage-induced) consolidation due to the geology of the area and the possibility that the initial cake deposits may reduce the permeability of the adjacent formation. Therefore, there is uncertainty around Teck's ability to achieve the target physical characteristics of the deep-centrifuge cake tailings deposit. As a result, the panel does not authorize Teck's ready-to-reclaim criteria for deep-centrifuge cake tailings deposits. The panel requires Teck to submit updated, well-justified ready-to-reclaim criteria to address the uncertainties in a future updated tailings management plan by December 31, 2032.³⁶

[346] The panel understands that Teck has enough time to carry out pilot testing to justify the proposed subobjective 1 ready-to-reclaim criteria for deep-centrifuge cake tailings deposits in internal tailings areas 1 and 2. The panel therefore requires Teck to submit to the AER for approval a pilot testing plan for deep-centrifuge cake tailings deposit by December 31, 2025.³⁷

[347] Teck's assumptions regarding treatment technology performance and tailings deposit performance raises concerns about Teck's ability to achieve the approved fluid tailings profile. Therefore the panel requires Teck to submit an updated tailings management plan by December 31, 2032.³⁸

[348] The panel expects that the understanding of tailings treatment technologies and deposit performance will evolve significantly over the next decade. The panel expects that the tailings management plan update due December 31, 2032, be aligned with the objectives of the most recent and relevant government policy (including the *TMF*), meet the regulatory requirements of *Directive 085*, and incorporate the best practice from industry peers and best available tailings treatment technology.

Tailings Research

Evidence

[349] Teck is relying on industry experience and its own test results to provide information needed to further understand the deep deposit behaviour and expected settlement. Teck membership in COSIA is expected to provide further understanding of fine tailings behaviour, dewatering processes, technology development, and deposit characterization.

³⁶ Draft *OSCA* Approval – Condition 42

³⁷ Draft *OSCA* Approval – Conditions 43 and 44

³⁸ Draft *OSCA* Approval – Conditions 47 and 48

[350] Teck is also relying on ongoing monitoring and research to achieve its reclamation outcomes. Teck expects the information generated will be incorporated into the project and inform its adaptive management approach.

Analysis and Findings

[351] The panel notes that research is important to manage risk and resolve site-specific uncertainties in Teck's proposed tailings management approach. In order to ensure appropriate management of these risks and resolve uncertainties, the panel expects Teck to continue its participation in relevant regional initiatives and will require Teck to address uncertainties through research activities and submit plans and report to the AER on the environmental aspects to tailings research and development.³⁹

[352] The panel is concerned about the ability of centrifuge cake deposit to support a 10 m sand cap. This increases the uncertainty of timelines of final reclamation and closure and ultimately meeting the objectives of the *TMF*. Therefore, Teck is required to provide a capping research plan for its centrifuge cake tailings deposits by December 31, 2026.⁴⁰

[353] Teck is also required to provide to the AER a consolidation model or engineering analysis, along with any required supporting information, including milestones, for the deep-centrifuge cake tailings deposits by December 31, 2031.⁴¹

Tailings-related Stakeholder and Indigenous Communities Engagement

Evidence

[354] Teck indicated it had undertaken extensive consultation with indigenous communities most affected by the project. Teck submitted it had agreements with 14 indigenous groups that are intended to last the life of the project. Additionally, Teck, Athabasca Chipewyan First Nation, and Mikisew Cree First Nation jointly developed and submitted recommendations to the panel with respect to shared objectives for environmental management, mitigation commitments from Teck, and areas for requested Crown action and support. Teck indicated it was committed to carrying out its commitments to Athabasca Chipewyan First Nation, Mikisew Cree First Nation, and all its indigenous partner communities. The complete list of jointly developed conditions, commitments, and recommendations submitted to the panel can be found in [Appendix 9](#).

[355] Teck received feedback from indigenous communities affected by the project. Some aspects of the environmental assessment and project application were changed in response to the input received.

³⁹ Draft *EPEA* Approval – Condition 5.1.1

⁴⁰ Draft *OSCA* Approval – Conditions 51 and 52

⁴¹ Draft *OSCA* Approval – Condition 45

With regards to the proposed tailings management plan, Teck indicated that during early engagement with indigenous communities, they expressed concerns about tailings in end-pit lakes. As a result of that feedback, Teck made a commitment to the indigenous communities to not place tailings in the pit lakes.

Analysis and Findings

[356] Both the *TMF* and *Directive 085* highlight the importance of transparency and involvement of stakeholders and indigenous communities in tailings management.

[357] Given this overarching principle, together with the concerns expressed by the participants, the panel requires Teck to engage with stakeholders and indigenous communities on the activities undertaken in respect of fluid tailings management throughout the life of the project. This engagement will include conducting an annual forum once the project is operational (every three years before operations) and reporting to the AER on these engagement activities.⁴²

⁴² Draft *OSCA* Approval – Conditions 58 to 62

8 Water Management

Evidence

[358] Teck requested an approval and licence under the *Water Act* to construct and operate water management facilities and to divert water for the Frontier project. The request included the following activities:

- muskeg drainage and overburden dewatering
- basal water sands depressurization and Quaternary deposit dewatering
- withdrawing, diverting, and impounding surface and groundwater
- constructing, operating, and reclaiming external and internal tailings and overburden disposal areas, including dam structures
- constructing water handling and containment structures, including dam structures
- constructing watercourse crossings such as pipelines, transmission lines, and bridges
- diverting surface waters and streams around the project disturbance area

[359] Teck also provided an overview of the water sources and the water management facilities for the project within their water management plan dated October 2018. The key water management facilities at the Frontier mine consist of a river water intake and recycle water system, external tailings area seepage control system, domestic wastewater and potable water treatment systems, closed-circuit system, release water drainage system, stream diversion system, and off-stream storage pond. All of these facilities provide water handling systems to support mine development, as well as the diversion of water from the Athabasca River, surface water runoff, and groundwater sources. The abovementioned water management facilities are all regulated under the *Water Act* and the *Environmental Protection and Enhancement Act*. This section summarizes Teck's evidence related to the proposed water sources, water management facilities, and aquifer depressurization and dewatering.

Sources of Water

[360] Teck stated that it investigated multiple water sources as potential sources for the project, including local site water (surface and groundwater), local streams (including Redclay Creek, Big Creek, and Eymundson Creek), Ronald Lake, Lake Athabasca, and the Athabasca River. Teck proposed using the Athabasca River as the main water source due to availability and reliability of the water supply. Teck stated that with the use of its proposed off-stream storage pond, the hydrological changes associated with using water from this source are small.

[361] Teck stated that potential water withdrawals from the Athabasca River will vary seasonally and annually depending on the project phase and the amount of precipitation runoff and groundwater seepage water collected within the closed-circuit system.

[362] Teck submitted an application under the *Water Act* to divert water from the Athabasca River, surface runoff water in the closed-circuit areas, seepage to the mine pit, basal water sands depressurization, and seepage from the perimeter of the external tailings area. The requested maximum annual water diversion volume from all water sources during phase 1 (2022 to 2032) was 105.2 million cubic metres (Mm³) per year; during phase 2 (2033 to 2081), the maximum volume was 81.1 Mm³ per year. The requested maximum annual volume of water withdrawal specifically from the Athabasca River during phase 1 was 98.0 Mm³ per year and during phase 2, it was 60.0 Mm³ per year. The maximum rate of withdrawal from the river during both phases is proposed to be 4.2 cubic metres per second.

[363] Teck requested that it be permitted to withdraw additional water from the Athabasca River for the first eight years to accommodate the development of the external tailings area water cap and the start-up of the two process trains that comprise phase 1. After that, the volume could be reduced for the remainder of the project life.

[364] Teck stated that the peak river water withdrawal rate is expected to occur when the external tailings area water cap is being developed and during periodic refilling of the off-stream storage pond. Teck indicated the peak instantaneous river water withdrawal rate for the project is 4.2 cubic metres per second.

[365] Teck stated that the project will involve closed-circuit drainage from 2022 through 2081, including the construction, operation, and reclamation phases of the project and applied under the *Water Act* for a maximum annual surface runoff water allocation of 14.9 Mm³.

[366] Teck has applied for a maximum annual groundwater diversion volume of 14.7 Mm³, which consists of the following components:

- maximum volume of annual seepage inflow to the mine pit: 8.2 Mm³
- maximum volume of basal aquifer depressurization: 3.4 Mm³
- maximum volume of annual seepage from the seepage control system around the external tailings area: 3.1 Mm³

[367] Overall, Teck requested the maximum annual diversion volumes for the project from all sources to be 105.2 Mm³ (2022 through 2032) and 81.1 Mm³ (2033 through 2081).

[368] A summary of Teck's requested annual diversion volumes are provided in [Table 5](#).

Table 5. Summary of requested water diversion volumes

Water source	Maximum annual diversion volume (Mm³)
Surface Water	
Athabasca River	
Phase 1 (2025 to 2032)	98.0
Phase 2 (2033 to 2081)	60.0
Closed-Circuit Areas	
Period 2022 to 2081	14.9
Groundwater	
Seepage to the mine pit (2022 to 2081)	8.2
Basal aquifer depressurization (2022 to 2081)	3.4
External tailings area seepage control system (2026 to 2081)	3.1
Total Groundwater	14.7
Total from all sources	
Phase 1 (2022 to 2032)	105.2
Phase 2 (2033 to 2081)	81.1

River Water Intake and Recycle Water System

[369] The proposed location of the Athabasca River intake was changed to Dalkin Island from its originally proposed location immediately downstream of the island due to morphological changes to the Athabasca River associated with the 2012 spring freshet. The location of the intake is to be outside of Teck's oil sands leases; however, it is located within Teck's proposed *Water Act* fenceline boundary.

[370] The associated proposed river water circuit includes the river water intake and pump house, river water pipeline, off-stream storage pond, river water pond and pumps, firewater system, treated water for boilers and steam generators, and the potable water system. Teck stated that water treatment package units will treat water from the river water pond to make demineralized and soft water. Demineralized water will be used in the steam boilers to generate steam and as make-up to the closed-loop cooling water system. To demineralize the water, filtered water will be pretreated in the water treatment plant and then pass through membranes or ion exchange beds followed by polishers.

[371] Teck stated that the recycle water system supplies the process and flushing water needs for the plant. Recycle water, depending on its quality, might also be used for gland water for the pumps in the extraction, tailings, and ore preparation areas. Athabasca River water and reclaim water from external tailings areas will be the two main sources of make-up water for the recycle water pond. A barge-mounted pump and piping system will pump water from the tailings areas to the recycle water pond at the plant site.

Seepage Control System for the External Tailings Area

[372] Teck stated that during operations, the near-surface seepage from the external tailings areas will be intercepted by perimeter ditches at the toe of the dikes and returned to the external tailings area or transported to the recycle water pond at the plant site. Deeper groundwater seepage will be collected via hydraulic barrier interception wells and pumped to the external tailings areas or the recycle water pond. The post-closure seepage control system will be installed downstream of the perimeter ditch to intercept and direct seepage to constructed reclamation lakes or the central pit lake in the reclaimed footprint. Teck stated that the design intent of the post-closure seepage system is to maintain acceptable downstream water quality conditions in the receiving environment. The post-closure hydraulic barrier would be a physical wall or equivalent control that would be advanced through any surficial sands to the top of low-permeability underlying strata. If the barrier is a physical wall, it would be designed to provide a long-term, low-permeability contiguous barrier to horizontal seepage within the Quaternary sediments.

Domestic Wastewater and Potable Water Treatment Systems

[373] Teck stated that a domestic wastewater treatment system was needed at the lodge. While specific details of the domestic wastewater treatment system were not provided within the application, Teck proposes to pump treated effluent from the domestic wastewater treatment system to the plant's recycle water pond, which is part of the project's closed-circuit system and is the source for water reuse within the bitumen processing plant. The dewatered cake produced from the domestic wastewater treatment system will be disposed of at the project's Class II landfill. Before the recycle water pond and Class II landfill are constructed and commissioned, the treated effluent and dewatered cake will be trucked off site to suitable approved disposal locations. Teck stated that the required additional information for the domestic wastewater treatment system, including the collection system, will be submitted as an *EPEA* application at a later stage of engineering.

[374] Teck is requesting to construct and operate a potable water treatment plant in phase 1 of the project to support the Frontier lodge. Proposed to be located at the lodge, the potable water treatment plant will be designed to support approximately 5000 people and will use ultrafiltration and nanofiltration technology, with ultraviolet and chlorination tertiary treatment. Preliminary engineering designs have the peak potable water demand during the construction phase at approximately 1370 m³/d, but during normal operations, the potable water demand would equal roughly 375 m³/d. Teck expects to truck in potable water to the Frontier site until the potable water treatment plant is approved and operational. Teck stated that a future application to construct and operate the potable water treatment plant will be submitted to the AER once finalized details and engineering is complete.

Closed-Circuit System

[375] Teck proposes to construct and operate a closed-circuit drainage system to collect water from the following sources:

- plant site runoff, including the ore preparation plant and corridor
- runoff and seepage from the external tailings area facilities
- water collected in the mine pits, including precipitation runoff, groundwater seepage, and free-draining overburden water released during excavation
- on-site road drainage, where required

[376] The closed-circuit drainage system will consist of collection ditches, sumps (or groundwater wells), pumps, pipelines, and temporary storage ponds. Teck stated that water within the closed-circuit drainage system will not be released to receiving waters. It will be pumped to the tailings areas where it will enter the recycle water system and be used for process activities.

[377] In addition, during preproduction, when there is limited water storage available, approximately half of the water resulting from depressurization of the basal water sands will be reinjected into an adjacent basal water sands unit in the project disturbance area. The other half of the depressurization water will be placed in an excavated holding pond pending its incorporation into the closed-circuit system.

Release Water Drainage System

[378] Teck stated that the release water drainage system will consist of drainage water collected outside of the closed-circuit system, such as muskeg and overburden drainage water, which will be discharged to receiving waters to reduce hydrological changes that will result from excluding the closed-circuit areas from the watershed. The muskeg drainage and overburden dewatering systems are proposed to consist of ditches, sumps, and polishing ponds. Teck states that the polishing ponds are required to ensure release water is of acceptable quality because water from muskeg drainage and overburden dewatering activities can contain a high concentration of suspended sediment. Teck proposes that natural runoff from undisturbed areas and cleared areas will be routed directly to receiving waters.

[379] In addition, Teck identified that runoff from external disposal areas and reclamation material stockpile areas can contain a high concentration of suspended sediment, and runoff from the external disposal areas can also have an oily sheen. Collection ditches are proposed to be located along the perimeter of the reclamation material stockpiles and the external disposal areas and will convey water to polishing ponds for treatment. Teck proposes that the polishing ponds for the external disposal areas will be equipped with oil exclusion devices. Runoff from external disposal areas that contain dried fine tailings will be conveyed to the closed-circuited system before dried fines deposition begins.

Stream Diversion

[380] Teck stated that stream diversions are required to facilitate muskeg drainage, overburden dewatering, mine pit development, and closed-circuit operations. For the purposes of this section, the term “diversion” refers to the routing of stream flows for discharge to the environment. Streams and runoff from undisturbed areas will be diverted around the project disturbance area in diversion channels. Stream diversions will begin in 2021 and extend through to the end of mining in 2066. Several diversion channels will route natural flows from the Unnamed Creek 18, Unnamed Creek 17, Redclay Creek, and Big Creek watersheds around areas where mining-related activities will occur. Some of these channel diversions will remain operational until the end of closure, which is expected to be in 2081.

[381] In 2037, Teck proposes to construct a flow-splitting structure and an additional 4.85 km diversion channel to divert a portion of flows from Big Creek and Unnamed Creek 2 to the off-stream storage pond. Teck stated that the off-stream storage pond will function as a flow-through structure with diverted flows released through a spillway to a downstream reach of Unnamed Creek 2.

[382] In 2040, the development of the northern reclamation material stockpile D and E will require construction of an 8.4 km long channel to divert headwaters of Unnamed Creek 17. Teck states that, as the mine advances northward, this channel will be extended in 2045 to divert the headwaters of Redclay Creek around the northern boundary of the main pit. Teck also proposes to construct another flow-splitting structure, located at the crossing of Unnamed Creek 17, to direct the flows originating in upstream tributaries of Unnamed Creek 17 northeastward to Unnamed Creek 17, which ultimately flows to Ronald Lake. The flow splitter is proposed to proportionally divide the flow to two separate channels and will be designed to convey sufficient flow to account for the north watershed area that will be closed-circuited. The remaining flow will be conveyed eastward to the existing Redclay Creek diversion and ultimately to the fish habitat compensation lake.

Off-Stream Storage Pond

[383] Teck stated that the off-stream storage ponds have been sized to comply with the *Surface Water Quantity Management Framework for the Lower Athabasca River* (Government of Alberta 2015). Teck indicated that during periods of low flow, river water might not be available for the project or other developments in the Athabasca oil sands region. During these periods, it will rely on off-stream storage as a make-up water supply. In the early life of the mine (2025 to 2036), the off-stream storage pond will be located north of the mine maintenance facility in the main pit area. During the remaining life of the mine (2037 to 2066), most of the required off-stream water will be stored in the external tailings areas for process use, and a smaller off-stream storage pond will be constructed in the Unnamed Creek 2 valley to store fresh water for uses such as boiler feed and potable water.

Aquifer Dewatering and Depressurization

[384] The mine pits intercept groundwater-bearing strata, resulting in the need for overburden dewatering and depressurization of the deeper, pod-like McMurray basal water sands aquifer. The dewatering and the depressurization cannot be avoided during mining operations. Depressurization of the basal water sands will occur through pumping wells, while dewatering of the Quaternary overburden will occur through a combination of wells, sumps, and ditches.

[385] Teck plans to reinject up to 0.94 Mm³ of nonsaline basal water sands groundwater back into the basal water sands aquifer in the western portion of the site for a period of up to three years for temporary storage during preproduction phase. The rest will be placed in an excavated holding pond for this period. Once the external tailings areas are ready to receive basal depressurization water, the depressurization water would become part of the closed-circuit system. The reinjection of the depressurization water into the basal water sands aquifer is subject to obtaining separate AER approvals under *Directive 051* and *Directive 065*.

[386] Teck proposes a basal and process-water storage pond to manage excess basal water sands depressurization water during the preproduction years of 2023 to 2025. The estimated brine volume the storage pond will hold is 0.47 Mm³, and its location is proposed to be within the footprint of external tailings area 2.

[387] Teck provided groundwater quality data for basal aquifer wells within the proposed Teck Frontier footprint. The groundwater samples were analyzed for routine parameters such as chlorides; chloride concentrations were in a range from 36 mg/L to 7400 mg/L.

[388] Teck stated that the storage pond is in the conceptual design stage and will be advanced during future stages of engineering. The design of the storage pond will meet regulatory requirements and consider applicable guidelines, such as the *Guidelines for Alberta Brine Storage Reservoirs* (AENV, 1978) and the *Action Leakage Rate Guidelines* (AEP, 1996).

Analysis and Findings

[389] Further details and assessment of the environmental effects of water management infrastructure and activities are found in the following sections of this report:

- Sources of water – section 19, “[Surface Water Quantity](#),” and section 17, “[Groundwater](#)”
- River water intake – section 20, “[Fish and Fish Habitat](#)”
- Seepage control for the external tailings area – section 17, “[Groundwater](#)”
- Closed-circuit system – section 19, “[Surface Water Quantity](#),” and section 17, “[Groundwater](#)”
- Release water drainage system – section 18, “[Surface Water Quality](#)”

- Stream diversion – section 19, “[Surface Water Quantity](#)”
- Off-stream storage ponds – section 19, “[Surface Water Quantity](#)”
- Aquifer dewatering and depressurization – section 17, “[Groundwater](#)”

Domestic Wastewater and Potable Water Treatment Systems

[390] The panel stresses the importance that Teck reuse water in other areas of the project’s operations to maximize water conservation and minimize environmental effects.

[391] The panel does not have enough information to determine whether the domestic wastewater treatment system would trigger the requirements listed under *EPEA’s Activities Designation Regulation* (Alberta Regulation 276/2003), Schedule 1, Division 2, Part 7(g) or Schedule 2, Division 2(d). The panel therefore requires Teck to further the engineering of the domestic wastewater treatment system and, should the details illustrate that the treatment activity triggers the regulation, to apply for an *EPEA* amendment approval accordingly.⁴³

[392] When designing and operating the system, the panel expects Teck to comply with the *Wastewater System Standards for Performance and Design* (Government of Alberta, 2013) and the *Wastewater System Guidelines for Design, Operating and Monitoring* (Government of Alberta, 2013) of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems*, if the domestic wastewater treatment system triggers an *EPEA* approval.

[393] The panel notes that the construction, operation, or reclamation of a waterworks system (i.e., potable water) that serves an industrial development and that uses, as a source of its water supply, surface water or groundwater other than high-quality groundwater, would trigger an approval under the *EPEA’s Activities Designation Regulation* (Alberta Regulation 276/2003) – Schedule 1, Division 5.

[394] However, Schedule 2(1)(b) of the *Specified Enactments (Jurisdiction) Regulation* (Alberta Regulation 201/2013), states that Part 7 (Potable Water) of *EPEA* is not applicable under *REDA*, and therefore the AER has no authority with respect to it. Once further engineering is complete, the panel recommends Teck apply for an *EPEA* approval to the applicable jurisdictional organization for the construction, operation, and reclamation of the aforementioned potable water treatment plant.

Aquifer Dewatering and Depressurization

[395] Based on the information provided in the application, the panel notes that the chloride concentration range falls within the requirements of *EPEA’s Activities Designation Regulation* (Alberta Regulation 276/2003), Schedule 1, Division 2, Part 8(h)(vii). The panel therefore requires Teck to further

⁴³ Draft *EPEA* Approval – Condition 3.5.1

the engineering of the basal and process-water storage pond and apply for an *EPEA* amendment approval at the appropriate time.

[396] To reinforce the requirement for an *EPEA* amendment application to be submitted at a future date, the panel requires, as a condition of the *EPEA* approval, that Teck obtain an amendment approval before starting construction and operation of the basal and process-water storage pond.⁴⁴

[397] The panel expects that the design and operation of the basal and process-water storage pond will comply with the *Guidelines for Alberta Brine Storage Reservoirs* (AENV, 1978) and the *Action Leakage Rate Guidelines* (AEP, 1996).

Recommendation to Teck

[398] If the domestic wastewater treatment system triggers an *EPEA* approval, the panel expects Teck to comply with the *Wastewater System Standards for Performance and Design* (Government of Alberta, 2013) and the *Wastewater System Guidelines for Design, Operating and Monitoring* (Government of Alberta, 2013) of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems*.

[399] Teck will need to apply to the appropriate authority, AEP, for an *EPEA* approval for the construction, operation and reclamation of the potable water treatment plant.

⁴⁴ Draft *EPEA* Approval – Condition 3.4.11

9 Waste Management

Evidence

[400] Teck developed a preliminary waste management plan to provide guidance for managing generated waste material during the construction and operational phases. Waste as defined in the plan does not include overburden, interburden, and tailings mine waste. Teck also states that detailed waste management procedures and waste management facility designs will be further developed before the start of construction and that this information will be provided to the AER.

[401] Teck's waste management plan considered applicable regulations and guidelines including the *Alberta Waste Control Regulation* (Alberta Regulation 192/1996), federal *Transportation of Dangerous Goods Act and Regulation*, *Alberta User Guide for Waste Managers*, and Alberta's *Hazardous Waste Storage Guidelines*.

[402] Teck provided preliminary waste types and accompanying classifications and storage, transportation, and disposal methods of the expected waste streams to be generated on site.

[403] In terms of on-site storage, Teck will have temporary waste storage areas, waste transfer areas, and two types of permanent landfills. The waste storage and transfer areas will have proper signage and adequate fencing and security to prevent access by wildlife and unauthorized personnel. To reduce environmental impacts from these areas, appropriate weather protection, secondary containment, and leak detection systems will be considered. As stated by Teck, transportation will be essential to move waste from temporary waste storage areas to waste transfer areas and from the waste transfer areas to on-site landfills or off-site, third-party facilities for recycling, treatment, and final disposal.

[404] For final disposal, the majority of waste produced by the project is expected to be recycled or disposed of at approved third-party facilities. On-site disposal of waste in the two landfills will be limited to waste classified as nonhazardous or inert.

Analysis and Findings

[405] The panel is satisfied with the preliminary waste management plan that Teck has provided but expects that a final, detailed plan be submitted before the project begins the construction phase. The final plan should, at a minimum, include Teck's procedures to classify and measure generated waste; defined methods and distinct locations relating to the handling, storing, transporting, and final disposal of generated waste; and details on maintaining sufficient waste tracking and reporting records.

[406] In addition to the regulations and guidelines that Teck has explicitly outlined to be considered within the waste management plan, the panel recommends that Teck also consider the documents *Industrial Waste Identification and Management Options* (Alberta Environmental Protection, 1996) and

AER Directive 073: Requirements for Inspection and Compliance of Oil Sands Mining and Processing Plant Operations in the Oil Sands Mining Area.

[407] The submission of a final detailed waste management plan will be a condition within the *EPEA* approval.⁴⁵ Any future changes related to the management of waste and specifically within the waste management plan will require that the plan be updated and submitted to the AER for reassessment.

Panel Recommendations to Teck

[408] Teck should consider the following documents when finalizing the project's waste management plan:

- *Industrial Waste Identification and Management Options* (Alberta Environmental Protection, 1996)
- *AER Directive 073: Requirements for Inspection and Compliance of Oil Sands Mining and Processing Plant Operations in the Oil Sands Mining Area* (AER, 2008)

Class II and Class III Landfills

Evidence

[409] Teck proposes to construct and operate a Class II and Class III landfill adjacent to each other at the Frontier oil sands mine site. Teck is proposing to dispose of any class I waste to existing off-site approved regional landfills.

[410] The two proposed landfills are situated to the southeast of the ore preparation plant and north of external disposal area 2. Teck's preliminary decision to place the landfills at the proposed location was due to favourable geotechnical conditions, as the soils in the area have generally lower hydraulic conductivities. Teck stated that it is committed to siting, designing and constructing the landfills according to the *Standards for Landfills in Alberta* (Government of Alberta, 2010). However, the required detailed information as specified by the *Standards for Landfills in Alberta* (Government of Alberta, 2010) was not provided within the application, and will be submitted to the AER at the appropriate stage, when the landfills will be required.

[411] Teck provided Class II and Class III waste estimates for the different stages of Frontier's operation. The Class II waste estimates for the construction, operation, and decommissioning phases range from 397 tonnes per annum to 1489 tonnes per annum, while the Class III waste estimates range from 1853 tonnes per annum to 6950 tonnes per annum.

⁴⁵ Draft *EPEA* Approval – Condition 3.4.1

Analysis and Findings

[412] A Class II landfill accepts nonhazardous waste, which may generate leachate within the containment and surrounding area. The *Standards for Landfills in Alberta* requires that all Class II landfills include, at a minimum, a liner and a leachate collection system capable of maintaining the maximum acceptable leachate head.

[413] A Class III landfill accepts inert waste, and the *Standards for Landfills in Alberta* (Government of Alberta, 2010) requires that all Class III landfills be able to contain all of the disposed inert waste.

[414] In addition to minimum design criteria, the *Standards for Landfills in Alberta* (Government of Alberta, 2010) requires information pertaining to siting, operational monitoring, and landfill closure and post-closure.

[415] Based on the domestic waste estimates by Teck, the Class II and Class III waste volumes are below 10 000 tonnes per year. As a result, this waste disposal activity triggers the requirement for a registration under *EPEA's Activities Designation Regulation* (Alberta Regulation 276/2003), Schedule 2, Division 1(c). Given that the oil sands mining activity requires an *EPEA* approval, the AER will incorporate this registration activity under the oil sands mining *EPEA* approval and not require a separate registration.

[416] In conclusion, the panel is of the view that the level of information for the proposed landfill operations is appropriate for planning purposes. Teck should further engineer the two landfill designs and obtain an *EPEA* approval amendment before starting construction of the Class II and Class III landfills. This requirement will be a condition of the *EPEA* approval.⁴⁶ The *Standards for Landfills in Alberta* (Government of Alberta, 2010) and Alberta's *Waste Control Regulation* (Alberta Regulation 192/1996) will be applicable when finalizing the landfill design and operations.

⁴⁶ Draft *EPEA* Approval – Condition 3.4.8

10 Conservation, Reclamation, and Closure

[417] The Frontier project will directly impact landforms, soils, vegetation communities, wildlife, and traditional use and other land-use practices within the project development area and local study area during the construction, operations, and closure phases.

[418] Section 137 of Alberta's *EPEA* outlines an operator's requirement to conserve, to reclaim, and to obtain a reclamation certificate for specified land. The approval holder is to ensure that activities that will be undertaken during the various phases of construction, operation, and reclamation are appropriate for ensuring that the disturbed areas will be reclaimed to an equivalent land capability as defined in the *Conservation & Reclamation Regulation*. The approval holder is also to ensure that conservation and reclamation activities and outcomes align with applicable regional plans. For the Teck Frontier project, reclamation plans and practices must align with *LARP*. Under *LARP*, the project development area must be reclaimed to a diverse self-sustaining locally common boreal forest ecosystem with terrestrial and aquatic ecosystems that are integrated into the surrounding landscape.

[419] Teck relies on reclamation to mitigate the project effects to soils and terrain, vegetation, wildlife, and traditional use. Successful reclamation and closure is required to ensure that the lands are returned to a state that allows equivalent land use, returning the lands to Alberta and minimizing future liability to the public.

[420] Teck submitted a conceptual closure, conservation, and reclamation plan that describes how the project disturbance area of the Frontier oil sands mine project (the project) will be returned to a productive capacity after reclamation.

Evidence

[421] Teck stated that the overarching goal of the closure, conservation and reclamation plan is to support the development of a diverse, self-sustaining, locally common boreal forest landscape with equivalent land capability.

[422] Teck identified the following objectives and goals for the closure, conservation and reclamation plan:

- Provide a predictable closure landscape with integrated, stable, and fully functioning ecosystems that will support a diversity of land uses that are similar to those carried out under baseline conditions.
- Reclaim the disturbed areas in a way that will allow indigenous use of the landscape for cultural and traditional practices.

- Reclaim the disturbed areas such that the closure landscape will have equivalent land capability for primary land uses, similar to what was present before development.
- Obtain reclamation certification and return the lands to the Crown.

[423] Teck's plan is divided into two main segments, a conservation and reclamation plan and a closure plan.

[424] The conservation and reclamation plan describes the measures for salvaging timber and sufficient reclamation material to support reclamation during operations and final reclamation at project closure. Reclamation measures are intended to reclaim the project area to a desired closure landscape that has landforms, drainage patterns, soils, and vegetation patterns that are equivalent to predisturbance conditions and provide for targeted end land uses. Teck's targeted land uses include forestry, wildlife habitat, hunting and trapping, plant harvesting for traditional uses, recreation, fishing, and biodiversity. Teck stated that it will progressively reclaim the Frontier project.

[425] The closure plan describes the conceptual closure landscape for the project development area in terms of the distribution of ecosite and wetland-class distributions and topography, soils, hydrology, terrestrial and aquatic features, and end land use objectives.

Conservation and Reclamation Plan

[426] Teck indicated that the closure, conservation, and reclamation plan was developed using planning concepts and principles related to end land use objectives and achieving reclamation certification that allows the leased lands to be returned to the Crown for subsequent use. Teck indicated that the following planning principles pertain specifically to the conservation aspect of the plan:

- The surface disturbance footprint will be kept to a minimum, to reduce environmental effects within the constraints imposed by the primary objective of recovering the oil sands resource.
- Clearing the site and salvaging reclamation material will be done progressively over an extended period of project development and will be conducted in a way that conserves soil to optimize its quality for reclamation.
- The strategy for salvaging and stockpiling reclamation materials is based on the soil conditions at the site, the land capability of the original landscape, the closure landscape reclamation objectives, and the soil replacement prescriptions required to obtain equivalent land capability.
- Refinements to the mine plan and development schedule will occur on an ongoing basis over the life of the Frontier project and will, by extension, require ongoing detailed planning, modifications, and improvements to the closure, conservation, and reclamation plan.

[427] Teck stated that the following principles were used in the development of the reclamation plan:

- Wherever possible, coversoils will be directly placed to preserve their seed bank and integrity and improve efficiency of operations. This will also reduce associated greenhouse gas emissions by minimizing the need for rehandling.
- To the degree practical and in consideration of competing imperatives, the reconstructed landscape will have a land capability for forestry and forest ecosystems that is equivalent to what is present under existing conditions.
- Coversoil prescriptions have been developed using the latest version of the *Land Capability for Forest Ecosystems in the Oil Sands Region, 3rd Edition* (AENV 2006) calculator to allow for a variety of reconstructed soil types that include all the recognized site types and will support varied revegetated communities that enhance the biodiversity of the reclaimed landscape.
- By placing reclamation materials to the appropriate thickness and quality, and with the inputs of natural processes over time, the reconstructed landscape will support land uses similar to those supported by naturally occurring soils.
- Revegetation objectives and project costs are based on the most current regulatory guidelines.
- The reclamation soil and revegetation objectives were developed using currently accepted best models that can be revised and updated over time.

[428] The proposed operational life of the Frontier project is 41 years, with the following milestones:

- Site preparation activities start in 2019 (seven years before production) with clearing, surface drainage and initial salvage of reclamation material and overburden.
- Bitumen production begins in 2026 and finishes in 2066.
- First reclamation activities occur in 2024 around the shores of the fish habitat compensation lake.
- Continuous reclamation activities begin in 2034.
- Filling of the north pit lake begins in 2063, while filling of the central and south pit lakes starts in 2066; initial discharge of water into the environment from the pit lakes is anticipated to begin in 2081.

[429] Teck stated that reclamation activities will start as soon as practical after final landform construction has been completed on active portions of the project development area. This will minimize the active footprint and provide opportunities for the direct placement of reclamation materials.

Timber Salvage

[430] Teck indicated that non-merchantable timber and slash (i.e., coarse woody debris) would be used primarily as rollback to prevent erosion of exposed soil and as padding for temporary roads; excess would

be burned. Teck indicated timber and slash would not be incorporated into reclamation material stockpiles as it can have adverse effects on soil nutrient ratios.

Soil Management During Construction and Operations

[431] Teck proposes to salvage reclamation materials in two lifts to generate the volumes of suitable resources necessary to create the proposed closure land capability classes: an upper lift consisting of coarse-textured upland surface soil, medium-textured and fine-textured upland surface soil, and fine-textured fluvial fan material, and a lower lift consisting of coarse-textured suitable subsoil material, medium-textured and fine-textured suitable subsoil material, and organic soil. [Table 6](#) details Teck's planned reclamation material salvage layers and depths.

Table 6. Reclamation material salvage depth (from project update, volume 1, table 13.5-2 a)

Salvage layer	Salvage depth
Upper Lift	
Coarse-textured upland surface soil	Overlying LFH, O, and upper 20 cm of mineral material
Medium- and fine-textured upland surface soil	Overlying LFH, O, and upper 35 cm of mineral material
Fine-textured fluvial fan material	Overlying LFH, O, and upper 50 cm of mineral material
Lower Lift	
Coarse-textured suitable subsoil material	20 cm or to depth of suitable-quality subsoil material, as required
Medium- and fine-textured suitable subsoil material	35 cm or to depth of suitable-quality subsoil material, as required
Organic soil	To depth plus over-stripping into underlying mineral

LFH= Surface leaf litter horizon on well drained upland soils

O= Surface organic accumulation, usually peat, on lowland or poorly drained soils

[432] Progressive salvage of the upper lift of reclamation materials will follow site clearing and precede mine development. Teck states that its approach to salvage of lower-lift material recognizes that suitable overburden materials are found throughout the project development area, which allows smaller areas to be excavated to greater depths later in the project development schedule. This allows material salvage to take place as close as possible to the time when it will be required for reclamation placement and, as a result, direct placement can be maximized while minimizing both the areas required for stockpiles and the length of time the materials reside in the piles. Teck stated that other benefits of this approach include a reduction in rehandling of the material and associated adverse effects on its quality as well as reductions in associated greenhouse gas emissions.

[433] Teck indicated that the available volumes of suitable-quality lower subsoil and suitable-quality overburden present at the site will allow the following approach:

- During 2023 to 2025, coarse-textured material from a limited area under external tailings area 1 will be salvaged and stockpiled as it is the only source for this type of lower-lift material.
- Lower-lift material will be removed as part of the general overburden stripping process and placed in the external disposal areas, but it will not be segregated from general overburden or designated for use as reclamation material.
- Review of borehole logs indicates that suitable overburden (i.e., with reclamation suitability ratings of good, fair, or poor) is present in sufficiently large areas and to adequate depths that it is feasible to delay salvaging and stockpiling materials to be used as the lower reclamation lift. Deeper salvage would occur primarily in the 2036 to 2045 interval when mining progresses through the large fluvial fan associated with Redclay Creek where suitable-quality overburden material thicknesses exceed 20 m.

[434] Reclamation material will be stored in discrete stockpiles corresponding to the salvage layers outlined in the application in order to preserve the qualities of each type of material. Reclamation material stockpiles will be revegetated as soon as practical following material placement to stabilize the surface and limit erosional losses.

[435] Issues related to soil conservation including practices for soil salvage and placement is discussed further in section 21, "[Terrain and Soils.](#)"

Progressive Reclamation

[436] Teck stated that areas disturbed by the Frontier project will be progressively reclaimed as soon as it is practical to do so considering the inherent constraints associated with production and operations.

[437] Teck noted that the plant and facilities must be developed before production begins and will be required for the full operating life of the mine. As a result, it will not be possible to reclaim most of the plant components until the post-mining phase. However most of the components of the mine will be developed sequentially over time and will be ready for reclamation as the mine footprint progresses across the landscape. External disposal area 1 will be available for reclamation starting in 2035, while the south portion of external tailings area 1 and the centre portion of the internal disposal area will not be available for reclamation until the 2051 to 2055 timeframe. As the mine develops, the pit will be backfilled with overburden, and tailings and will be reclaimed as soon as conditions allow, thereby reducing the disturbed areas to the degree practical. Annual and cumulative reclamation progress is summarized in [Table 7](#).

Table 7. Annual and cumulative reclamation progression (from project update, volume 1, table 13.5-9)

Year	Status of operations	Reclaimed area (ha)					
		Mine		Plant		Combined	
		Annual	Cumulative	Annual	Cumulative	Annual	Cumulative
2019–2023	Construction	0	0	0	0	0	0
2024	Start of production	0	0	53	53	53	53
2025	Mining operations	0	0	0	53	0	53
2026	Mining operations	0	0	0	53	0	53
2027	Mining operations	0	0	0	53	0	53
2028	Mining operations	0	0	0	53	0	53
2029	Mining operations	0	0	0	53	0	53
2030	Mining operations	0	0	0	53	0	53
2031	Mining operations	0	0	0	53	0	53
2032	Mining operations	0	0	0	53	0	53
2033	Mining operations	0	0	0	53	0	53
2034	Mining operations	127	127	1	54	128	181
2035	Mining operations	120	247	0	54	120	301
2036–2040	Mining operations	591	838	211	265	802	1 103
2041–2045	Mining operations	925	1 763	229	494	1 154	2 257
2046–2050	Mining operations	209	1972	184	678	393	2 650
2051–2055	Mining operations	1 403	3 375	928	1 606	2 331	4 981
2056–2060	Mining operations	1 500	4 875	1920	3 526	3 420	8 401
2061–2065	Mining operations	3 238	8 113	1 039	4 565	4 277	12 678
2066	End of mine life	0	8 113	0	4 565	0	12 678
2067–2081	Closure	4 365	12 478	9 088	13 653	13 453	26 131
Total terrestrial		0	12 478	0	13 653	0	26 131
Pit lakes		3 076	15 563	286	13 654	3 362	29 217
Total		0	15 563	0	13 654	0	29 217

Closure Plan

[438] Teck stated that the closure plan and associated end land uses are based on the following planning principles:

- The land capability and vegetation distributions in the closure landscape are conceptual, and their development over time will be affected by natural variables such as climate change and wildfire that cannot be incorporated in the present models.
- The closure vegetation communities and ecosystems can be developed to allow a variety of uses. For example, the *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region, 2nd Edition* (Alberta Environment, 2010) indicate that by varying the species composition, crown cover, and planting densities, it should be possible to target a given ecosite to commercial forest production, traditional use, or wildlife habitat depending on the desired end land use. Therefore, over time, the vegetation communities and ecosystems can be modified using silviculture practices to address changes in regulatory requirements and input from stakeholders and indigenous communities.
- *EPEA* approvals for oil sands require that an updated mine reclamation plan be submitted three years after the initial approval date and every three years thereafter. The mine reclamation plan must provide a detailed reclamation plan for the next three-year operations period. This allows the mine reclamation plan to reflect recent experience at the site, new technological developments, advances in reclamation techniques, changes in regulatory requirements, and ongoing input and advice from indigenous communities.

Closure Topography and Landforms

[439] Areas that are no longer used for mine operations will be contoured to create drainage systems of ridges and swales to support either upland or wetland vegetation. After contouring, these surfaces will be covered with reclamation soil before revegetation. Teck stated that closure landforms are designed to mimic the natural landscape.

[440] Although there is an increase in topographic diversity at closure due to the inclusion of some steeper slope classes, there is an overall shift in topography towards flatter slopes. Closure drainage features have been designed so that stream channels will have lower velocity and erosion potential.

Soil Reconstruction

[441] Teck developed nineteen potential reclamation coversoil prescriptions for the various landscape features in the project development area having regard for salvage material types, closure topography, closure distribution of surface materials (i.e., tailings sand [coarse] or overburden [medium to fine textured]), and closure drainage.

[442] Tailings deposits will be integrated into the closure landscape. Teck proposes to treat all fine fluid tailings with centrifuge technology to remove excess water. Centrifuge cake will initially be deposited in thin layers in external tailings area 2 for drying and consolidation. Once mined-out space is available, all centrifuge cake will be deposited in mined-out pits before capping and placing reclamation material. In-pit deposits will be up to 30 to 60 metres deep. Surfaces that contain tailings deposits (whole tailings or centrifuge cake) and other material considered to be unsuitable will require a minimum 1 metre deep capping with tailings sand or suitable overburden before placing the reclamation material.

Land Capability

[443] Lands rated as class 1, 2, or 3 have high, moderate, or low capabilities for commercial forest production, respectively; whereas, those in classes 4 and 5 are conditionally productive / severely limited and nonproductive, respectively. In the closure landscape, the areas reclaimed as class 1, 2, and 3 landscapes decrease by 4750 hectares (ha), while those in classes 4 and 5 increase by 950 ha. Open water increases by 3800 ha (mainly pit lakes), while 890 ha of littoral fringes around the lakes, which have no predevelopment counterpart, will be created.

[444] Teck noted that while there are reductions in the area that can support commercial forestry, there are increases in class 5 areas, littoral fringes (i.e., wetlands), and water bodies that have moderate and high potential habitat for certain wildlife species that are important to potentially affected indigenous communities. Teck submitted that increasing the areas with wetland potential in the closure landscape is consistent with recent regulatory direction as set out in the *Guiding Principles of the Wetland Mitigation System of the Alberta Wetland Policy* (ESRD 2013a) and is aligned with Teck's corporate sustainability goals.

[445] Furthermore, Teck noted that upland site types increase by 4400 ha in the closure landscape and that upland site types most associated with commercial forestry activities show an increase of 1500 ha.

Revegetation Plan

[446] Teck's revegetation objectives and strategies are aimed at providing a stable closure landscape that consists of functional ecosystems that will support a range of end land use activities similar to those carried out under existing conditions. A mix of uplands, lowlands, and wetlands will be created and native ecosites established within the constraints imposed by changes in landscape features resulting from the development.

Teck's approach to planting prescriptions is based on the identification of end land-use objectives and associated target site types or ecosites as outlined in the *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region, 2nd Edition* (AENV 2010). Different combinations of reclamation coversoil prescription, substrates (including capping material), landscape features, and drainage class will

be revegetated with combinations of selected overstory and understory species. [Table 8](#) lists the species that Teck will plant in each site type.

Table 8. Conceptual planting prescriptions for different site types (adapted from project update, volume 1, tables 13.6-6 a and 13.6-6b)

Site types	Ecosite	Ecosite phase/wetland class	Tree species	Shrub and forb species	Predisturbance area (ha)	Area in closure landscape (ha)
Dry	a, b	a1, b1, b3	Jackpine, Aspen, White Spruce,	Blueberry, Bearberry, Labrador tea, Green alder,	3 593	3 651
Moist Poor	c	c1	Jackpine, Black Spruce	Bearberry, Labrador tea	67	2 130
Moist Rich	d	d1, d2, d3		Low-bush Cranberry, Buffaloberry, Saskatoon, Prickly Rose, Green Alder, Raspberry	5 984	5 392
Wet Rich	e, f	e1, e2, e3, f1, f2	Aspen, Balsam Poplar, White Spruce	Dogwood, Raspberry, Bracted Honeysuckle, Low-bush Cranberry, Prickly Rose, Green Alder, Raspberry	4 245	3 136
All Other wetlands	i, j, k	i1, i2, j1, j2, k1, k2, k3, treed swamps	NA	NA	11 563	0
Wet Poor	g, h	g1, h1	White Spruce, Black Spruce, Jackpine	Labrador Tea, Bog Cranberry, Common Blueberry	329	4 408
Marshes		MONG		Awned Sedge, Common Spike Rush, American Sloughgrass	475	1 162

Site types	Ecosite	Ecosite phase/wetland class	Tree species	Shrub and forb species	Predisturbance area (ha)	Area in closure landscape (ha)
Shrubby Swamps		SONS		Willow species, Swamp Birch, Alkali Bulrush, Common Cattail, Awned Sedge, Northern Reed Grass	2 058	4 445
Littoral		WONN		Alkali Bulrush, Common Cattail, Rat Root Islands	0	886

[447] Teck will implement a weed control program to control invasive species during reclamation in order to encourage the successful establishment of native species.

[448] [Table 9](#) below compares landscape types in the project development area before and after reclamation and closure.

Table 9. Predisturbance and conceptual closure ecosite phases and wetland-class distributions in the project development area (PDA) (adapted from project update, volume 1, table 13.6-7)

Land type	Predisturbance area (ha)	% of PDA	Closure area (ha)	% of PDA	Change from predevelopment	
					ha	%
Uplands	14 400	49	18 717	65	4 399	+16
Wetlands	14 096	47	5 614	19	-8 489	-28
Peatlands	3 295	10	0	0	-3 295	-100
Littoral fringes of pit lakes	0	0	886	3	886	3
Water	0	0.6	3 995	14.0	3 995	14
Disturbed Area	721	3	0	0	-721	-2
Total	29 217	100	29 217	100		

[449] In general, the closure landscape will contain a higher proportion of uplands than is currently found in the area. There will be a 16% increase in uplands and a 14% increase in open water in the closure landscape. The increase in open water is due to the creation of end-pit lakes, reclamation lakes, and the fish habitat compensation lake.

[450] Shallow wetlands will form part of the closure drainage system. Teck proposes to construct shallow wetlands and lakes where suitable to provide hydrological and environmental benefits. Further,

Teck expects opportunistic (unplanned) wetlands forming on reclamation surfaces to form part of the landscape.

[451] Wetlands present in the closure landscape include marshes (1162 ha) shrubby swamps (4445 ha), and shallow open-water (886 ha) wetlands. According to Teck, the littoral fringes around end-pit lakes are classified as shallow open-water wetlands. This represents an overall decrease in wetland area of 28% (–8489 ha). In addition, 3295 ha of peatlands present in the project area will be permanently lost. Teck stated that given the amount of time required to naturally develop these ecosystems, many consider it unlikely that peatland ecosites can be developed in the time period typically considered for oil sands reclamation. Therefore, reclamation of peatlands is not included in Teck’s reclamation plan.

Closure Drainage

[452] Teck stated that the closure drainage system has been designed to mimic natural drainage features, be sustainable over the long term, and provide a biologically productive landscape that supports native vegetation, fish habitat, and wildlife communities.

[453] Teck stated that the conceptual closure drainage plan has also been designed to reduce the effects of the Frontier project at closure and in the far future and minimize changes in water flow in the watersheds of Ronald Lake (including unnamed creeks 17 and 18), Redclay Creek, and Big Creek (including unnamed creeks 2 and 6). Runoff from the reclaimed landscape will be conveyed to the downstream receiving waters through three end-pit lakes (south, central, and north pit lakes).

[454] Teck stated that the most effective and practical method for treating water from the reclaimed closure mine landscape is bioremediation. This involves directing runoff and seepage flows from reclaimed areas through wetlands and pit lakes before releasing it to receiving waters.

[455] Teck stated that two reclamation lakes will be constructed along the south and east perimeter of the external tailings area to increase the water treatment capacity of the closure drainage system. The reclamation lakes will be operational during production operations and after end of mine life and form part of the closure drainage system. The conceptual closure drainage system is shown in [Figure 2](#).

[456] The end-pit lakes are sized to be hydrologically sustainable over time and provide water storage and sufficient residence time for inflow water to be remediated to acceptable water quality standards for release.

[457] The north pit lake, located within the Ronald Lake watershed, will receive runoff from the Birch Mountains and discharge to Unnamed Creek 18 and flow northward to Ronald Lake. Neither the lake itself nor its drainage area will contain tailings.

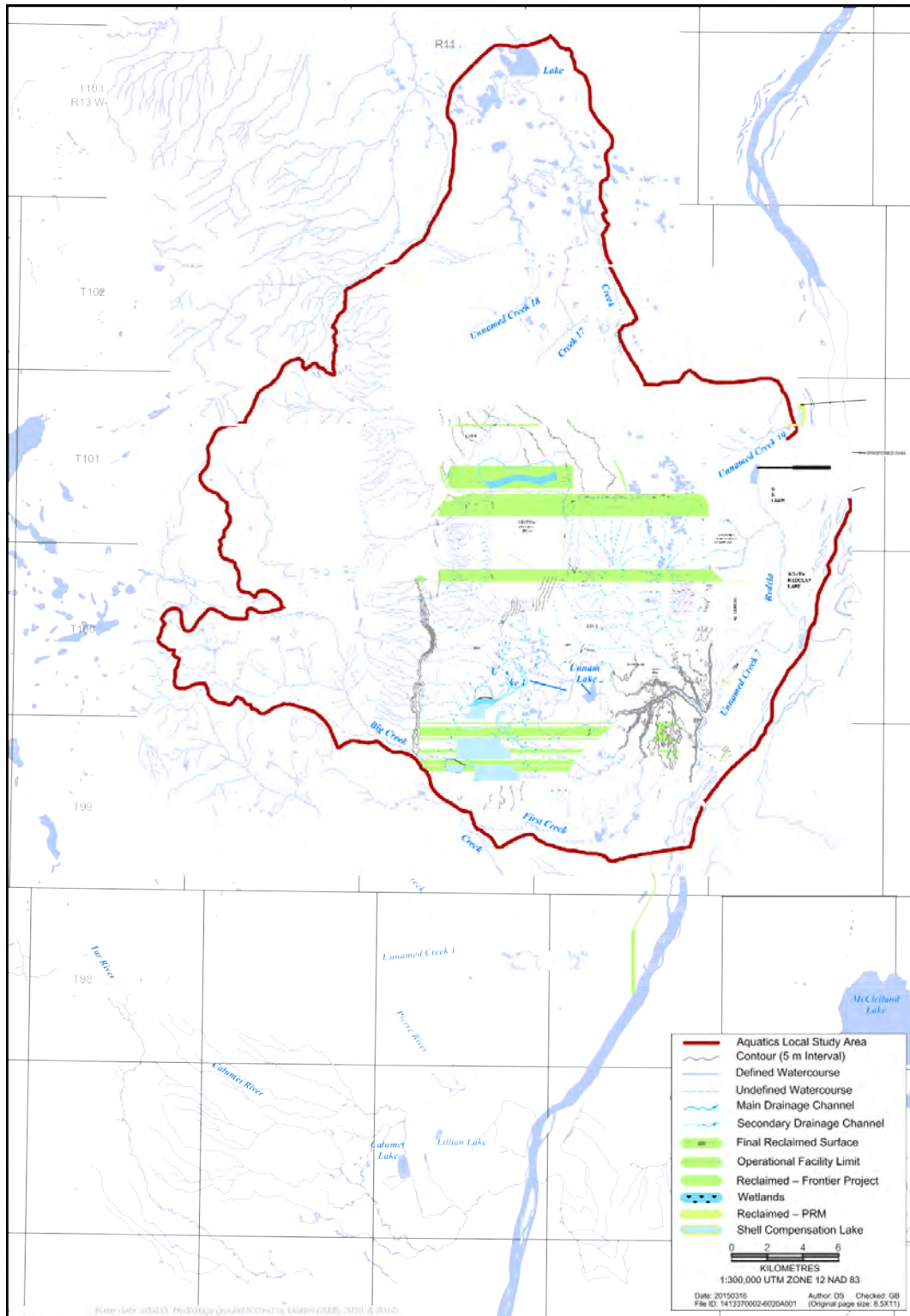


Figure 2. Conceptual closure drainage plan (from project update, volume 1, figure 13.6-4)

[458] The central pit lake, located within the Redclay Creek watershed, will receive runoff from the following areas:

- external tailings areas 1 and 2
- internal tailings area 3
- internal tailings area 2
- internal disposal area (north)
- natural area of 106 km² in the Birch Mountains, including Redclay Creek

[459] Discharge from the central pit lake will be conveyed through the fish habitat compensation lake to the Athabasca River through a downstream reach of Redclay Creek. If Canadian Natural Resources Ltd. (CNRL; acquired from Shell) constructs a fish compensation lake on Redclay Creek as originally proposed, the fish habitat compensation lake would discharge to the CNRL compensation lake that discharges to the Athabasca River.

[460] The south pit lake, located within the Big Creek watershed, will receive runoff from the following areas:

- internal tailings area 1
- internal tailings area 2
- internal disposal area (west)
- natural area of 60.7 km² in the Birch Mountains, including Big Creek

[461] Discharge from the south pit lake will be routed through constructed drainage channels to Big Creek before release to the Athabasca River. If CNRL constructs its proposed fish habitat compensation lake as originally proposed, flow from the south pit lake would be released to the CNRL compensation lake that discharges to the Athabasca River.

[462] The pit lake water will be released through the outlet to the receiving environment only when the water quality meets the regulatory release criteria. Teck stated that the surface water quality modelling in the project update accounted for all expected lake inflows to estimate the water quality at first discharge and that the results of this analysis indicate that the estimated retention times will provide adequate treatment for the pit lake water before first release.

[463] If actual conditions differ from modelled conditions, Teck identified the following options that could be implemented so that pit lake water is suitable for discharge to receiving waters:

- manage the rate of pit lake filling to enable water quality targets to be met,
- add nutrients to the pit lakes to elevate productivity levels and biological treatment capacity,

- increase the efficiency and size of wetlands that route reclamation drainages to the pit lakes, and
- actively or passively treat pit lake outflows by adding wetlands or settling basins to the discharge channels that connect the pit lakes to the receiving waters.

[464] If natural bioremediation proves to be less successful than expected, Teck identified several active treatment options that would be available for treating inflows to pit lakes such as adsorption, microfiltration, ultrafiltration, nanofiltration, reverse osmosis, advanced oxidation, and constructed wetlands. With continued research and development, the treatment technology might be optimized individually or in combination to manage the pit lake waters.

[465] After closure and in the far future, the runoff from the upstream natural and reclaimed areas and seepage interactions with the groundwater flow system will maintain the water balances for the pit lakes and compensate for evaporative losses.

[466] At this time, the Government of Alberta has not provided policy for construction and inclusion of end-pit lakes into the boreal forest landscape.

External Tailings Areas

[467] The reclaimed external tailings areas will be constructed above original ground level to a maximum elevation of 340 m above mean sea level. The average surface elevation will be approximately 330 m above mean sea level, which is approximately 50 m above the predisturbance ground surface. Upon confirmation of all stability considerations being satisfied, sections of the dike walls in the external tailings areas will be breached to allow construction of the proposed closure drainage valleys and channels. Dike breaching will occur before closure.

[468] The top surface and side slopes of the reclaimed external tailings areas will be covered by a layer of reclamation soil. The surface will have a relatively low potential for erosion after mature vegetation has been established.

[469] A drainage system of ridges and swales will be developed on the surface of the tailings sand. With this drainage configuration, the swales will be relatively wet and supportive of wetland vegetation, while the upland ridges created will be relatively dry and supportive of upland vegetation. The seepage collection areas along the perimeter of the reclaimed external tailings areas will support wetland vegetation.

[470] The average overland slope of the reclaimed external tailings areas will be 0.5 per cent, sloping towards the centre of the external tailings areas. Two wetlands are planned to provide residence time for initial bioremediation of runoff from the tailings sand. Runoff from the surface of the external tailings areas and some seepage water will be directed to the central pit lake. The majority of seepage water from the external tailings areas and runoff from the north, east, and south external tailings area slopes will be

directed to two constructed lakes located to the south and east of external tailings area 1 before release to the fish habitat compensation lake.

External Overburden Disposal Areas

[471] The surfaces of the external disposal areas will be contoured to create drainage systems with adequate drainage densities and capped with a layer of reclamation soils. The reclaimed external disposal areas will yield relatively high runoff because the relatively steep topography will be well drained.

Internal Tailings and Overburden Disposal Areas

[472] The mined-out pit cells, except for the cells to be used as pit lakes, will be used for tailings and overburden storage. At closure, internal tailings areas will be capped with tailings sand where required and a layer of reclamation soils (a mixture of organic and mineral soils). A drainage system of the ridges and swales will be developed on the surfaces of the internal tailings areas similar to those prescribed for the external tailings areas. The internal tailings areas surfaces will have slopes of approximately 0.5 per cent and the runoff will be directed to shallow wetlands at the internal tailings areas outlets for initial bioremediation.

[473] Similar to the external disposal areas, the internal disposal areas will be contoured to develop drainage systems with appropriate drainage densities and capped with a layer of reclamation soils.

[474] Attenuation of seepage of process-affected water is discussed further in the sections "[Surface Water Quality](#)" and "[Groundwater](#)."

Reestablishment of Biodiversity and Wildlife Habitat

[475] Teck acknowledged that the Frontier project will directly impact landforms, soils, vegetation communities, wildlife habitat availability, and connectivity and biodiversity in the local study area. The loss of wetlands and old-growth forests will result in the loss of areas of high biodiversity potential and plant and wildlife species adapted to those areas. Inability to reclaim peatlands will result in loss of habitat for peatland-reliant species such as the Rusty Blackbird, Horned Grebe, and Yellow Rail—species that are listed under Canada's *Species at Risk Act (SARA)*.

[476] Teck stated that protecting and enhancing biodiversity is integral to Teck's approach to sustainability; therefore, Teck has developed an approach to managing biodiversity at all their operations. Teck's vision is to achieve a net positive impact on biodiversity as a result of its activities and presence in a region. Teck believes this vision is achievable through a combination of mitigation actions, with on-site rehabilitation playing a primary role and off-site conservation offsets contributing additional benefits, if required. Teck submitted a draft biodiversity management plan outlining its approach to management of biodiversity.

[477] Teck stated that maximizing direct placement of reclamation materials provides the greatest potential for maintaining the existing diversity of the biological components of coversoils (i.e., propagules, organic matter). Direct placement will also introduce species other than those in the revegetation prescriptions. In addition, Teck committed to collecting native seed from the local area for revegetation stock.

[478] Teck acknowledged that newly reclaimed landscapes tend to have high numbers of relatively few species (i.e., those best adapted to pioneering conditions), but it believes that these species will, over time, alter the conditions to be more favourable for other species that will eventually move in. Teck stated that based on its reclamation knowledge from elsewhere in western Canada, diversity will be improved by planting additional species to supplement those recommended in provincial reclamation guidelines. Teck indicated it will target early development of a tree canopy to improve overall stand composition.

[479] Teck's expectation is that biodiversity will be limited during the early stages of revegetation but will increase over time as habitats become established and succession provides greater variation across the landscape.

[480] During the hearing, Teck stated that it fully supports the initiative led by the Mikisew Cree First Nation to create a biodiversity stewardship area to the north of the Frontier project and voluntarily relinquished their Twin Lakes leases to support the establishment of the biodiversity stewardship area.

[481] The effects of the Frontier project on biodiversity and Teck's proposed biodiversity management plan are discussed in section 25, "[Biodiversity](#)."

Post-Mining Traditional Land Uses

[482] Teck stated that the development of the end land-use objectives and target ecosite and wetland-class distributions in the closure landscape has been informed by input from potentially affected indigenous communities. Vegetation communities and wildlife species of traditional value in the predisturbance landscape have been incorporated into the closure plan. Teck submitted that progressive reclamation will allow the development of vegetation communities of varying age structures and compositions that, in turn, will provide a diverse range of habitats necessary for these various species and support post-mining traditional land uses.

[483] Teck committed to continue working with potentially affected indigenous communities to refine the closure, conservation, and reclamation plan through the life of the Frontier project. Teck indicated it plans to co-create reclamation working groups with potentially affected indigenous communities to seek input to the reclamation plan and measures and targets to determine its success.

Potential Effects of Climate Change on Reclamation Outcomes

[484] Teck acknowledged there was uncertainty associated with climate change projections and how future climate change could affect soil moisture regimes, reclamation prescriptions, and how well vegetation would grow on the reclaimed landscape. Teck believed that most of the uncertainty was related to the different climate change scenarios as it could be warmer or colder, wetter or dryer. Teck stated that it had high confidence that through monitoring and adaptive management, reclamation outcomes would be met.

Reclamation Research

[485] According to Teck, research on the establishment of peatland ecosites that naturally develop over thousands of years, is just beginning to be tested in the oil sands region. Early studies focused on the survival of boreal peatland species in wetlands with elevated concentrations of parameters associated with oil sands process material and the survival of species exposed to oil sands process water.

[486] Notable research on the establishment of peatland ecosites is being conducted at two oil sands mines and funded through joint industry partnerships such as COSIA. Both Syncrude and Suncor are testing the viability of fen reclamation. As a founding member of COSIA, Teck has contributed to and will actively participate in regional collaborative research initiatives to complete reclamation and closure studies in order to bring continual improvement to reclamation of oil sands mines.

[487] Other reclamation related research currently supported through COSIA includes the following:

- topsoil reconstruction,
- caribou habitat restoration, and
- reclamation drainage design of Syncrude's waste dumps.

Reclamation Monitoring and Adaptive Management

[488] Teck stated that the closure, conservation and reclamation plan was developed in the context of current regulatory requirements, conservation and reclamation techniques, input from potentially affected indigenous communities and public stakeholders, and end land-use objectives. Teck expected that as reclamation occurs, monitoring results (both those specifically within the Frontier project itself and in the broader oil sands region) and research will identify refinements to the plan that will improve successive reclamation efforts. Teck stated that one of the benefits of progressive reclamation is that it allows a feedback-loop approach to continual application, analysis, and improvement of techniques with time.

[489] Teck developed a draft reclamation monitoring plan in response to an information request from the panel. Teck indicated that the plan will be routinely updated in cooperation and collaboration with regulators and indigenous communities. Vegetation composition and abundance, soils, landform stability, and the quantity and quality of surface and groundwater draining through the system will be monitored.

Collected information will be integrated and analyzed to ensure success of reclamation. Adaptive management will be incorporated into Teck's finalized reclamation monitoring plan.

[490] Teck indicated that elements of the adaptive management aspect of the reclamation program will include the following:

- specific key performance indicators that are consistent with those used in the Cumulative Environmental Management Association's regional initiatives;
- measureable characteristics for each key indicator that are relevant for assessing reclamation performance, informed by input from indigenous communities, and practical to collect during field inspection and monitoring programs;
- evaluation criteria based on the protocols implemented for the Alberta Biodiversity Monitoring Program; and
- clearly defined performance benchmarks against which to evaluate the measured characteristics.

[491] Teck indicated it would follow adaptive management practices for mine operation and closure in general, and for pit lake management in particular. Teck stated that it will follow accepted strategies for adaptive management, which Teck summarized as follows:

- Engage stakeholders and potentially affected indigenous communities.
- Define the challenges and objectives.
- Set out management actions, including mitigation.
- Design a monitoring plan to evaluate the progress towards achieving objectives.
- Develop and refine predictive models.
- Implement the Frontier project, including mitigation.
- Monitor and observe performance of operational and closure mitigation. Compare monitoring data with desired outcomes to evaluate the effectiveness of management and mitigation.
- Revise the design of the Frontier project, including mitigation as necessary (cycle back). The iterative cycle of decision making, monitoring, and assessment, repeated over the life of the project.

[492] Frontier project, leads to a better understanding of project dynamics and an adjusted management strategy based on what is learned.

[493] Mikisew and Teck jointly developed a number of conditions related to construction and operation of the Frontier project and requested that they be incorporated as approval conditions, should the Frontier project be found to be in the public interest and approved. The jointly proposed conditions included two related to reclamation and closure:

- The Proponent shall reclaim land to a self-sustaining ecosystem that supports equivalent land-use capacity, including the use of lands and resources by indigenous groups for traditional purposes.
- The Proponent shall consult with indigenous groups regarding the Mine Reclamation Plan and the Life of Mine Closure Plan, including with reference to any standards developed by indigenous groups.
- The Proponent shall ensure that the Mine Reclamation Plan and the Life of Mine Closure Plan relevant to the North Pit have been the subject of consultation with indigenous groups and will undergo additional consultation as it evolves during mining.

[494] Athabasca Chipewyan and Teck jointly developed commitments related to reclamation and closure and requested that the panel include these as approval conditions, should the Frontier project be approved. The reclamation objectives are:

[495] To return the project area, as quickly as reasonably possible, to a landscape that is as close to its predisturbance condition as possible and that supports the continuation of the exercise of Athabasca Chipewyan's treaty and aboriginal rights.

[496] In furtherance of the jointly developed reclamation objectives stated above, the following mitigation and management commitments were agreed upon:

- engage Athabasca Chipewyan First Nation in the quantification, development, and validation of the mine liabilities reclamation security estimate for the Frontier project;
- work collaboratively with Athabasca Chipewyan First Nation through implementation of the participation agreement on ongoing reclamation plans and conduct of progressive reclamation work;
- review prescriptions to identify ways in which the predisturbance conditions of the project area can be restored with the same number and types of species and ecosites currently present on the landscape through reclamation work;
- design mitigation measures to support proper management and, where prudent and consistent with best reclamation practices, avoid and minimize settlement over time;
- prepare maps that indicate the likely development of landforms, such as lakes, on reclaimed landscapes at different times during reclamation and closure; and
- provide for adaptive management actions and corrective measures to be taken where long-term monitoring results suggest that the reclamation objectives are not being achieved.

[497] NRCan supported Teck's plans to establish a reclamation working group and recommended considering the following:

- Terms of reference should be established that specify the governance, membership, and roles and responsibilities of the reclamation working group.
- Subgroups should be established, as needed, within the reclamation working group structure to ensure all aspects of reclamation are covered.
- As Teck's reclamation plan contains little detail about reclamation practices and timelines, the reclamation working group should provide input on reclamation targets and timelines.
- Indigenous participation in the reclamation working group is critical to ensure that indigenous viewpoints are respected and integrated into reclamation activities.
- The reclamation working group should actively monitor the recovery of ecosystem services during and following reclamation activity, with particular attention paid to rare plants and plants of indigenous importance.
- Incorporate continuous improvement as a guiding principle for the reclamation working group's mandate, review reclamation successes and failures, and consult with relevant authorities if reclamation targets are not achieved.
- Ensure stable funding to support the activities of the reclamation working group over the entire term of the Frontier project.

[498] Teck accepted NRCan's recommendations related to the reclamation working group.

[499] Fort McKay did not identify any project-specific concerns related to the Frontier project but requested the panel make recommendations to the governments of Canada and Alberta with respect to measures it deemed necessary to manage the cumulative effects of development on Fort McKay's treaty and aboriginal rights and interests. Fort McKay submitted that there is a significant gap in cumulative effects management as a result of Alberta Environment and Park's decision to no longer require industry to fund the Cumulative Environment Management Association.

[500] Fort McKay submitted a report by Dr. Gillian Donald that discusses the role, work, and governance structure of the Cumulative Environment Management Association and identifies the gaps it has left in the region. Fort McKay stated that the important work plans defined by the working groups of Cumulative Environment Management Association remain incomplete, and no government-led multistakeholder forums have addressed the knowledge gaps identified by Cumulative Environment Management Association working groups, and this has resulted in stalled cumulative effects management. Fort McKay stated that many of these gaps exist in tailings management, reclamation, and mine closure, which are key mitigations for impacts to treaty and aboriginal rights.

[501] According to Fort McKay, these gaps include the following:

- an adaptive management framework to evaluate if the various management activities are achieving the result of minimizing cumulative effects of development, including evaluating the assumptions and uncertainties in the reclamation guidance documents;
- landscape design guide for closure planning which integrate a variety of design tools, including traditional ecological knowledge, and provide guidance for designing oil sands mining landforms for natural appearance and landform integration;
- management levels or management actions for the regional performance metrics, including limits and triggers;
- risk assessment of pathways for chemicals of potential concern in treated tailings deposit by treatment technology and placement on landscape; and
- a policy for the facilitation and implementation of climate change adaptation actions.

[502] Fort McKay requested that the panel make the following recommendations to the governments of Alberta and Canada related to reclamation and closure criteria and guidelines:

- The Government of Alberta and Canada should establish a multistakeholder initiative similar to the Cumulative Environment Management Association or refund the Cumulative Environment Management Association with stable funding to address current priority management and knowledge gaps with respect to tailings management integration into final reclamation and closure landscape.
- Complete the work of the Closure Coordination Task Group to develop a landscape design guidance document for designing oil sands mining landforms for natural appearance and landform integration.
- Follow up on the gaps identified in the End-Pit Lakes Guidance Document.
- Develop risk pathways for chemicals of potential concern in treated tailings deposit by treatment technology and placement on landscape and to understand risks to reclamation of treated tailings deposits by treatment technology and placement on landscape.
- Develop climate mitigation and adaptation planning for oil sands mine reclamation with inclusion of indigenous communities and conduct a regional analysis of climate change for the mineable oil sands, with consideration of the ecosystem-based approach prompted by the International Union for Conservation of Nature.
- Follow up on the gaps identified in 2015 for reclamation planning, operations, effectiveness monitoring, and certification compiled by Cumulative Environment Management Association's Reclamation Working Group.

Analysis and Findings

[503] Teck proposed reclamation to mitigate the project effects on a range of valued ecosystem components including but not limited to soils and terrain, vegetation, wildlife habitat, biodiversity, and traditional land use.

[504] Section 137 of the *EPEA* outlines an operator's requirement to conserve, to reclaim, and to obtain a reclamation certificate for specified land. This implies that Teck is to ensure that activities that will be undertaken during the various phases of construction, operation and reclamation are appropriate for ensuring that the disturbed areas will be reclaimed to an equivalent land capability as defined in the *Conservation and Reclamation Regulation (CCR)*. In addition to requirements under *EPEA* and the *CCR*, reclamation must be consistent with regional plans including the requirement to reclaim the project area to a diverse self-sustaining locally common boreal forest with terrestrial and aquatic ecosystems that are integrated into the surrounding landscape.

[505] Development and implementation of conservation and reclamation and closure plans are governed by legislation, policy, regional land-use plans, and guidance documents issued by the Government of Alberta and approval conditions and direction issued by the AER.

Specified Enactment Direction 003

[506] *Specified Enactment Direction 003: Mineable Oil Sands Conservation and Reclamation Submissions (SED 003)* was released by the AER on December 18, 2018, shortly after the close of the hearing. *SED 003* clarifies for *EPEA* approval holders how to meet the terms and conditions of their approvals related to reclamation and conservation. The panel will include a condition in the *EPEA* approval requiring Teck to meet the requirements in *SED 003*.⁴⁷

[507] *SED 003* requires three submissions for conservation and reclamation requirements:

- life of mine closure plan
- mine reclamation plan
- annual reclamation progress tracking report

[508] The life of mine closure plan depicts the approval holder's targets and conceptual plan for achieving a final closure of a mine project and outlines what the approval holder is planning to achieve through its conservation, reclamation, and closure activities. The life of mine closure plan must align with regional planning requirements and with the *TMF*. The life of mine closure plan will require Teck to report on signed reclamation agreements and all other commitments that have been made with indigenous communities and stakeholders. The life of mine closure plan is updated periodically through the life of the project.

⁴⁷ Draft *EPEA* Approval – Conditions 7.3.4, 7.3.11, and 7.6.2

[509] The mine reclamation plan uses location-specific information and integrates site-specific constraints and commitments made in applications and the life of mine closure plan. The mine reclamation plan is an operational plan that depicts the approval holder's conservation and reclamation activities for a period of 3 years. It outlines how the approval holder will implement conservation, reclamation and closure activities. The mine reclamation plan incorporates research findings, results, and best practices that reflect an adaptive management approach to conservation and reclamation. Mine reclamation plans are updated through the life of the project and submitted every three years.

[510] The annual reclamation progress tracking report standardizes the annual reporting of conservation and reclamation activities. Information contained in the annual reclamation progress tracking report helps the regulator determine compliance with operating terms and conditions and submitted plans. The annual reclamation progress tracking report is submitted every year.

[511] Each required submission addresses specific milestones throughout the life of a project, including the eight milestones referenced in the *LARP* progressive reclamation strategy. The submissions also require operators to report on how identified reclamation outcomes address traditional end land-use, how stakeholder feedback and traditional land-use information shared by indigenous communities has been integrated into reclamation outcomes, and how biodiversity elements and wildlife and aquatic habitat and species outcomes are being achieved.

[512] Companies are required to implement a reclamation monitoring program to enable performance evaluation of compliance with regulatory requirements and achievement of reclamation outcomes. While they are not required to submit reclamation monitoring data annually, information is to be collected and made available to the regulator upon request, upon application for reclamation certification, or as required by *EPEA* approval conditions. Results of the monitoring program must be used to adapt practices and plans and to show that the approval holder is tracking the progress towards achieving a self-sustaining, locally common boreal forest ecosystem that is integrated into the surrounding area.

[513] The submissions required under *SED 003* will provide the AER with comprehensive and standardized information that will undergo compliance verification in order to reduce risks to the achievement of successful reclamation outcomes. In addition to providing content direction for completing the three submission types, *SED 003* also outlines monitoring and reporting criteria so that conservation and reclamation objectives will be met to achieve equivalent land capability. Compliance with *SED 003* will be required within the *EPEA* approval, and the panel expects Teck to follow this direction for the Frontier project.⁴⁸

⁴⁸ Draft *EPEA* Approval – Conditions 7.3.4, 7.3.11, and 7.6.2

[514] Additionally, the panel requires that Teck provide an updated life of mine closure plan five years before disturbing the north pit area.⁴⁹

[515] In addition to complying with *SED 003*, Teck must consider the following regulations, guidelines, and supporting documents when developing life of mine closure plans and mine reclamation plans:

- *Conservation and Reclamation Regulations* (Alberta Regulation 115/1993),
- *Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region of Alberta* (Alberta Environment and Water, 2012),
- *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects* (Alberta Energy Regulator, 2017),
- *The Canadian System of Soil Classification – third edition* (Agriculture and Agri-Food Canada, 1998),
- *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* (Alberta Environment, 2010),
- *Alberta Forest Genetic Resource Management and Conservation Standards* (Government of Alberta, 2016),
- *The General Status of Alberta Wild Species* (Government of Alberta, 2017),
- *Alberta Wetland Classification System* (ESRD, 2015),
- *Field Guide to Ecosites of Northern Alberta* (Beckingham J.D. and J.H. Archibald, 1996),
- *Guidelines for Wetlands Establishment on Reclaimed Oil Sands Leases* (Cumulative Environmental Management Association, 2014),
- *Weed Control Act* (Statutes of Alberta, 2008), and
- *Weed Control Regulation* (Alberta Regulation 19/2010).

Progressive Reclamation

[516] The panel recognizes that there are limitations to the amount of reclamation that can occur during mine operations, particularly during the early years of mine development. However, the panel is encouraged by Teck's plans for progressive reclamation. Although significant reclamation activities do not start until after 2035, by the end of mine life in 2066, approximately 40 per cent of the project disturbance area will have been reclaimed according to the schedule Teck proposed.

⁴⁹ Draft *EPEA* Approval – Condition 7.3.6(b)

[517] The panel understands, however, that reclaimed lands must meet regulatory requirements for certification before they can be returned to Albertans. The timelines for certification will be dependent on fulfilling regulatory requirements. This is discussed further below.

Tailings Deposits and the Achievement of Targeted End Land Uses

[518] The presence of tailings on the landscape poses a number of potentials risk to achieving reclamation outcomes, including risks to

- the establishment of targeted ecosites, wetland classes, and hydrological drainage patterns;
- the ability to reclaim the project development area to equivalent land capability as required by the *Environmental Protection and Enhancement Act*;
- the ability to return the project area to a locally common boreal forest ecosystem integrated into the surrounding area; and
- meeting the range of targeted end land uses including commercial forest, wildlife habitat, and traditional use.

[519] Teck proposes to deposit tailings in two external tailings areas and three internal tailings areas. In each case, the timeframe from when the deposit is created to when the deposit is ready for reclamation is uncertain. Each type of tailings deposit will need to achieve ready-to-reclaim criteria and have attained sufficient physical strength to be trafficable and capped with tailings sand or other capping material before the area is ready for reclamation. Additionally, the rate and degree of settlement of reclaimed surfaces over deep-centrifuge deposits is unknown. Due to limited experience with the creation and reclamation of deep-centrifuge deposits to date, there is no research currently available that demonstrates successful reclamation and revegetation can occur on reclaimed areas located on in-pit tailings deposits in a timely manner. Long after reclamation material placement and revegetation, reclaimed surfaces on external tailings areas and in-pit tailings areas may continue to settle as water contained within the centrifuge cake deposits continues to express out. In some cases, continued settlement may result in extensive changes in the surface of reclaimed areas.

[520] The presence of tailings on the reclaimed landscape also poses a potential risk to the establishment of functioning reclaimed and opportunistic wetlands. Water expressed from tailings deposits placed in-pit and in the external tailings areas contains chemicals of potential concern that could impact reclamation outcomes in wetland communities. For example gases and other chemicals of potential concern migrating from the tailings to the wetland water and rooting medium could cause a direct impact to water quality that can in turn affect wildlife using reclaimed wetlands. Increased chemicals of potential concern in water can also affect plant growth, ultimately leading to a poor performing wetland that would not meet certification requirements. Chemicals of potential concern include salts, hydrocarbons, and naphthenic acids.

[521] The panel notes that Alberta has not yet provided policy for the construction of end-pit lakes and their inclusion into the boreal forest landscape. Alberta has also not provided criteria for the release of process-affected water from end-pit lakes or the closure landscape to surrounding environment. Future policy direction in these areas has the potential to affect reclamation and closure objectives.

Closure Timeline

[522] Teck's reclamation schedule indicates closure will occur by 2081, however based on the evidence provided, the time to certification and return of the land to the Crown will likely extend well beyond 2081. The timeline for certification is dependent upon the time required for consolidation of tailings deposits and attainment of sufficient strength of the deposits to allow for placement of reclamation material and revegetation, how soon surface- and groundwater on reclaimed sites achieve acceptable water quality standards and can be released to the surrounding environment, and when the reclaimed lands achieve an equivalent land capability.

[523] While Teck has estimated when potential closure may occur, actual timelines to certification and return of the land to the Crown cannot be predicted with certainty because certain components of the project may require prolonged monitoring to ensure that all remedial actions have been taken and to ensure that the site does not pose a risk to the environment. For example, the two reclamation lakes designed to passively treat contaminant seepage from the external tailings areas before it enters the downstream receiving environment will need to be monitored until water quality meets criteria suitable for discharge to the environment.

[524] Uncertainties associated with the consolidation and performance of deep-centrifuge tailings deposits also have the potential to extend timelines to final closure of the project area beyond Teck's predicted closure date of 2081. Teck stated that monitoring of settlement on reclaimed surfaces overlying deep-centrifuge deposits may need to continue for 65 years post-closure.

[525] These and other issues create uncertainty around timelines to reclamation certification and closure of the Frontier project.

Loss of Organic Wetlands (Peatlands)

[526] If approved, the Frontier project will result in the loss of 6690 ha of wetlands, including 3295 of peatlands (bogs and fens) that will be permanently lost. Loss of peatlands is considered irreversible because successful reclamation of large areas of organic wetlands (peatlands) has not yet been proven. For this reason, Teck's reclamation and closure plan does not include the reclamation of bogs and fens.

[527] While there is research at two oil sands mines on reclamation of fen communities, there is need for additional research into peatland reclamation. Peatlands contribute to biodiversity of the boreal

landscape due to their value to plant and wildlife species that depend on them. The panel will require that Teck participate in research related to the reclamation of peatlands.⁵⁰

Extended Timelines to Return Old-growth Forests to the Region

[528] Approximately 2598 ha of old-growth forests will be removed from the project development area. At closure, the oldest stand of reclaimed forest would be 27 years old. If old growth is determined to be 140 years for coniferous species and 100–120 years for deciduous and mixed-wood forests, respectively, a large proportion of old-growth forest will not be present in the project development area for more than 100 years after 2081. Reclamation is only effective as a mitigation measure for old-growth forests in the very long term or far future.

Potential Impact of Climate Change on Reclamation Outcomes

[529] The panel recognizes that future climate change may affect reclamation measures and outcomes for the Frontier project. Potential impacts of climate change include increasing temperatures and more-frequent extreme weather-related events such as drought, floods, and forest fires. Increasing temperatures can also result in higher evapotranspiration rates, which may reduce the amount of soil moisture available for plants, potentially affecting the establishment of vegetation and reclamation to a self-sustaining boreal forest ecosystem. Conversely, flooding of reclaimed lands can result in decreased water quality in water bodies as contaminants from tailings deposits in the landscape could run off, affecting more areas than anticipated and increasing contaminant loading to receiving end-pit lakes, reclamation lakes, wetlands, or receiving water bodies.

[530] The panel understands the challenges associated with predicting and planning for changes which may be uncertain. The panel finds that the adaptive management approach outlined in the draft reclamation monitoring plan is appropriate. The adaptive management program discusses objectives/indicators, metrics, targets/trends, and options for adjustment. While it is somewhat conceptual in areas, Teck states that the final version of the draft reclamation plan will rely on the joint review panel report, the federal decision statement, approval conditions, future stages of project planning, and feedback from indigenous communities and stakeholders to further develop the reclamation monitoring and adaptive management plan.

Biodiversity

[531] The panel acknowledges Teck's aspiration to have a net positive impact on biodiversity. However, given the number of species included in Teck's proposed planting prescriptions compared to the number of species present in predisturbance communities, and Teck's reliance on natural succession to increase species diversity over time, the panel expects that a return to predisturbance levels of

⁵⁰ Draft *EPEA* Approval – Conditions 5.3.1 and 5.3.3(b)

biodiversity will likely only occur in the very long term or far future, if at all. Although Teck discusses the potential use of conservation offsets as a means to mitigate project effects to biodiversity, no specific conservation offset measures have been presented by Teck. Teck stated that the biodiversity stewardship area was not being proposed as mitigation for project effects. It is therefore unclear to the panel how Teck intends to achieve a net positive impact on biodiversity as a result of the Frontier project.

[532] Project effects to biodiversity and Teck's draft biodiversity management plan are discussed further in section 25, "[Biodiversity](#)."

[533] Given the limitations of the proposed reclamation measures in returning reclaimed areas to predisturbance biodiversity levels, in addition to following biodiversity requirements outlined in *SED 003*, the panel requires as a condition within the *EPEA* approval that the following to be submitted as part of Teck's life of mine closure plan:

- Design and submit an improvement program that demonstrates continuous improvement in biodiversity potential both in the number of species planted and on the number of habitats (ecosite phases and wetland classes) on reclaimed sites with a target to increase the number of wildlife habitat types.
- Submit a summary with each updated life of mine closure plan of biodiversity trends during progressive reclamation and closure of the project.
- In light of the importance of peatlands to maintenance of high biodiversity potential of an area, the total area that will be disturbed by the project (3295 ha), the inability to reclaim peatlands once disturbed and Teck's assertion that they can achieve a net positive impact despite the lack of specific conservation offset measures being presented by Teck, the panel expects Teck to construct and conduct research on a wetland targeted to a peatland ecosystem in order to advance the knowledge on peatland reclamation in the mineable oil sands area.⁵¹
- The panel also recommends that the Minister include mitigation measures, monitoring requirements and follow-up programs in the decision statement under *CEAA 2012* (see section 38).

Monitoring and Adaptive Management

[534] The panel accepts that monitoring and adaptive management is an appropriate approach for managing uncertainty during reclamation and closure. The panel finds that the approach to adaptive management outlined in the draft reclamation monitoring plan is reasonable. Teck must finalize and implement its reclamation monitoring and adaptive management program and submit it for review and approval by the AER.⁵²

⁵¹ Draft *EPEA* Approval – Condition 5.3.3(b)

⁵² Draft *EPEA* Approval – Conditions 7.5.1, 7.5.2, and 7.5.4

Reclamation Working Group

[535] The panel supports the establishment of a reclamation working group for the Frontier project and has included recommendations related to such a group following the recommendations suggested by NRCan. In addition to following stakeholder engagement and traditional use requirements outlined in *SED 003*, the panel requires as a condition within the *EPEA* approval that the details of engagement, collaboration, and agreements made related to planning and implementation of reclamation and closure activities be submitted as part of the life of mine closure plan.⁵³

Mikisew Cree First Nation and Teck Resources Ltd. Proposed Conditions

[536] The panel supports the Mikisew and Teck jointly developed proposed conditions related to reclamation and closure. The requirement to reclaim the lands to a self-sustaining ecosystem that supports equivalent land use is a requirement of the *CCR*. Teck has committed to and *SED 003* requires operators to demonstrate how reclamation outcomes address traditional land use and how input and traditional land-use information shared by indigenous communities has been integrated into reclamation outcomes. The panel will include a condition in the *EPEA* approval requiring Teck to satisfy the requirements of *SED 003*.⁵⁴

[537] The panel requires Teck to submit an updated life of mine closure plan within five years of disturbance on the north pit mine area.⁵⁵

Athabasca Chipewyan First Nation and Teck Commitments

[538] The panel supports the Athabasca Chipewyan and Teck jointly developed reclamation objectives and commitments. Teck has committed to working collaboratively with Athabasca Chipewyan and *SED 003* requires that operators demonstrate how reclamation outcomes address traditional end land use and how input and traditional land-use information shared by indigenous communities has been integrated into reclamation outcomes. *SED 003* also requires operators to demonstrate how biodiversity objectives will be met, to monitor reclamation progress and to take corrective action and use adaptive management actions where reclamation objectives are not being achieved. As indicated above, the panel will include a condition in the *EPEA* approval requiring Teck to satisfy the requirement of *SED 003*.⁵⁶

Fort McKay Recommendations

[539] The panel notes that Fort McKay has entered into a long-term sustainability agreement with Teck and did not raise any project-specific concerns at the hearing. The panel also understands that

⁵³ Draft *EPEA* Approval – Conditions 7.3.5(f)

⁵⁴ Draft *EPEA* Approval – Conditions 7.3.4, 7.3.11, and 7.6.2

⁵⁵ Draft *EPEA* Approval – Conditions 7.3.6(b) and 7.3.7

⁵⁶ Draft *EPEA* Approval – Conditions 7.3.4, 7.3.11, and 7.6.2

notwithstanding Fort McKay's position on the Frontier project, it continues to be concerned about the cumulative effects of development on Fort McKay's treaty and aboriginal rights and interests and has therefore requested the panel make recommendations to the governments of Alberta and Canada to take immediate and concrete actions to manage the cumulative effects on treaty and aboriginal rights.

[540] The panel notes that the recommendations Fort McKay is asking the panel to make cover a broad range of issues related to the management of cumulative effects in the oil sands region, including effects resulting from tailings management, reclamation, and mine closure. While the panel accepts that proponents, decision makers, indigenous communities, and other stakeholders would potentially benefit from further guidance in these areas, the panel believes it would be inappropriate for it to make specific and detailed recommendations to the governments on these matters as part of a project-specific regulatory process for an individual proponent. The panel recommends that the governments of Alberta and Canada consider Fort McKay's recommendations as part of their work on cumulative effects assessment and management in the oil sands.

[541] The panel finds that the proposed conservation and reclamation and closure plans for the Frontier project are consistent with government policy, regulatory requirements, and current guidance and industry practices. Mine reclamation plans will provide the AER with detailed development and reclamation plans for ten-year periods, which will allow Teck to enhance and refine its reclamation plan to consider implementation of new technology, advances in reclamation techniques, regulation changes, and continuous input from public stakeholders. While there is some uncertainty associated with certain aspects of the plans and Teck's ability to meet desired outcomes, this is typical at this stage of the process. The panel accepts Teck's proposed approach to monitoring and adaptive management as an appropriate way to manage the uncertainty.

Panel Recommendations to the Government of Alberta

[542] The panel recommends that Alberta consider Fort McKay's recommendations related to mine tailings, reclamation, and closure as part of Alberta's efforts to assess and manage cumulative effects within the Lower Athabasca region.

Panel Recommendations to the Government of Canada

[543] The panel recommends that Canada consider Fort McKay's recommendations related to mine tailings, reclamation, and closure as part of Canada's efforts to assess and manage cumulative effects within the Lower Athabasca region.

11 Accidents and Malfunctions

Evidence

[544] Teck analyzed various accident and malfunction scenarios associated with project activities and facilities for their potential to cause environmental effects, including geotechnical instability of mine pit slopes, tailings and mine waste disposal areas; erosion of closure landforms and pit lake features; release of hydrocarbons and other pollutants into air and water during emergency operations; site safety and traffic accidents; emergency flaring; failure of vapour recovery systems; and waterfowl landings in tailing management areas. From its assessment, Teck stated that only 2 scenarios were ranked with a high level of environmental consequence and were therefore likely to cause adverse effects: geotechnical instability of tailings disposal areas and waterfowl landings in tailings management areas. However, Teck noted that the likelihood of these scenarios occurring was low. For more information on waterfowl landings in tailings management areas, see section 23, “Wildlife.”

[545] In response to joint review panel information request 2.5, Teck undertook an assessment of the adverse environmental effects of a tailings impoundment structure failure, including potential impacts to downstream aquatic habitats. Teck assessed an accident scenario of a breach of an external tailings area structure, with a release of contaminants ranging from 36 Mm³ (million cubic metres) to 294 Mm³ of process-affected water and fine fluid tailings. Teck examined all flow pathways for contaminant transport heading in every direction from the area and identified elements/receptors of the environment that could be affected. These elements/receptors included downstream aquatic habitats, species at risk, communities, cabins and areas of major use. Once Teck established a linkage between the contaminant pathways and elements/receptors, it assigned predicted environmental consequences. Teck provided environmental consequence ratings prior to the application of any emergency response and spill contingency plans.

- Redclay Creek, Unnamed Creek 19, Big Creek, Unnamed Creek 2, Fish Habitat Compensation Lake and Athabasca River: High
- Ronald Lake bison, wolverine, fisher, Canada lynx, Little Brown and Northern Myotis, Northern Goshawk, Yellow Rail, Whooping Crane, Horned Grebe, Short-Eared Owl, Common Nighthawk, Olive-Sided Flycatcher, Rusty Blackbird, Western toad and Canadian toad: High
- Fort Chipewyan: Moderate
- Poplar Point (IR 201 G), Cabins (near the Project Development Area): High

[546] Although the environmental consequences of a tailing impoundment structure would be high, Teck stated that the likelihood of occurrence would be low because of its robust design standards and adaptive management practices. Teck confirmed that its tailing impoundment structure would be designed to meet Canadian Dam safety guidelines. If the worst-case scenario were to occur, Teck would be able to identify the issue during monitoring and immediately take mitigation measures. Teck’s tailings

management plan would allow for the elimination of both the likelihood and consequence of catastrophic failures within five years after the completion of mining. Teck would be able to achieve this because all fluids (both water and fluid fine tailings) would be contained below the original ground surface in a geotechnically secure location. For more information on the tailings management plan, see section 7.

[547] ECCC stated there was a lack of understanding of how Teck will address their responsibilities for preventing and mitigating project-related accidents and malfunctions. It stated that Teck had not provided substantive information on emergency response plans and procedures for the accidents and/or malfunctions that might occur during each phase of the project. ECCC noted that spills of process-affected water, tailings, process chemicals, hydrocarbons and other substances have the potential to affect water quality and harm fish and aquatic organisms, as well as migratory birds. These environmental effects might also directly impact human health via the consumption of contaminated water, fish or wildlife.

[548] ECCC indicated that it understands emergency response and spill contingency plans are conceptual but should include elements and components to outline what type of risks are being posed to the environment and the critical infrastructure. Acknowledging that a catastrophic incident is not only plausible but rather likely to occur during the lifespan of the project, ECCC recommended that Teck commit to a comprehensive emergency response and spill response plan commensurate with its project's environmental risks and taking into account site-specific conditions and sensitivities. This plan should be developed before mine operations begin and be provided to interested parties, indigenous groups and regulators for review and comment.

[549] Parks Canada Agency stated that the project would bring active oil sands development within 30 kilometres of the boundary of Wood Buffalo National Park. The project would be the closest oil sand mine development to the park to date and could have the potential to contribute to adverse cumulative effects on water quality within the Peace-Athabasca Delta via spills, leakage from tailings and/or disposal areas, wastewater management or tailings containment failure. Parks Canada Agency indicated that an accident or malfunction of this type could result in cumulative, irreversible and potentially catastrophic effects on the outstanding universal value of Wood Buffalo National Park either through the Ronald Lake watershed or the Athabasca River watershed. Parks Canada Agency noted that scientists involved with the reactive monitoring mission also expressed concerns regarding potential leaks and failure of tailings containment, increasing the contaminant exposure risk to wildlife and fish, and subsequently the health and integrity of the outstanding universal value of Wood Buffalo National Park (International Union for Conservation of Nature, 2017; UNESCO, 2016).

[550] Parks Canada Agency noted that Teck provided a limited discussion of the potential types of accidents and malfunctions, possible mitigation measures and likelihood and consequence of such an event. It also stated that Teck did not outline any specific details of an emergency response plan. For the accident scenario of an external tailings area breach, Teck did not assess any downstream impacts to the

Peace-Athabasca Delta and Wood Buffalo National Park because it believed that no project contaminants would reach those areas. Parks Canada disagreed with this conclusion. Parks Canada acknowledged that despite improvements made in the mining sector, as well as increased geotechnical engineering knowledge, failures of tailings dams and dikes still occur. It noted tailing pond failures at the Obed Coal Mine in Alberta (2013) where measurable contamination from tailings fluid reached as far as the Peace-Athabasca Delta, over 1000 km downstream from the mine, and the tailings failure at Mount Polley Mine in British Columbia (2014) (Cooke et al., 2016; UNESCO, 2016; IEEIR, 2015; Schindler, 2014) (p.52)

[551] Health Canada agreed with ECCC that Teck should provide a more detailed emergency response plan relating to contaminant releases to water and soil and its potential impacts to drinking water sources.

[552] Athabasca Chipewyan First Nation and Mikisew Cree First Nation identified issues regarding: seepage from tailings and external disposal areas affecting ground and surface water quality; surface water quality beyond 2081 (14 years post-closure, once the end-pit lakes are full) and how drainage from end-pit lakes and other mine features could affect ground and surface water. They expressed concern about the efficacy and lifespan of the External Tailings Area barrier wall and seepage containment and how Teck would address post-closure mitigation in the event of seepage containment failure (Athabasca Chipewyan First Nation & Mikisew Cree First Nation, 2017).

[553] Athabasca Chipewyan First Nation and Mikisew Cree First Nation have expressed concerns regarding Teck's emergency response plan and mitigation measures for accidents and malfunctions. Specifically, they identified the need for further analysis and assessment of the potential environment effects of leaks from tailings management areas; contamination of downstream environments; human health and wildlife health. The First Nations stated their primary concern was the release and exposure of project contaminants through air, water, vegetation, and wildlife consumption.

[554] The Original Fort McMurray First Nation and the Clearwater River Band raised concerns that an oil spill or flaring incident could occur while they are on the land and that they would not be informed of the incident before it reached them. They argued that shipping bitumen as dry bitumen or pellets would reduce effects of a spill.

[555] The Fort McKay Métis raised concerns that the project could cause accidents such as tailing pond breaches and pipeline breaches, resulting in effects local waterways from released oil.

[556] The Deninu K'ue First Nation raised concerns regarding the effects of contaminants from tailing ponds leaks and seepage.

[557] Métis Nation Region 1 stated that they also remain concerned about future potential environment incidents related to oil sands projects.

[558] Some parties expressed concerns regarding the potential success of oil sands reclamation technology which forms the basis for much of the mitigation measures for accidents and malfunctions in the post-closure timeframe. They did not think that Teck would be able to prevent groundwater seepage from tailings management areas and stop water and soil contamination.

[559] In the post-closure landscape, Teck noted there is a potential for the erosion of closure landforms and of the shores of pit lakes. This could lead to exposed deposits of oil sands; the decreased stability of closure landforms and the reduced capability of landforms to contain the waste material. Teck indicated that the shores of the pit lakes will be constructed to prevent overtopping of channels and made of erosion resistance materials in appropriate locations. Teck stated the pit lakes will not be reintegrated into the post-closure drainage network until stability is demonstrated over several seasons. Teck noted that the likelihood of post-closure landforms failing and the release tailings material into the surrounding environment due to erosion is very low. For more information on the closure, conservation and reclamation plan, see section [10](#).

Mitigation Measures

[560] Teck confirmed at the public hearing that an emergency response and spill contingency plan will be developed before construction to deal with potential accidents and malfunctions of the project.

ECCC

[561] As stated previously, ECCC recommended that Teck commit to a comprehensive emergency response and spill response plan commensurate with the project's environmental risks and which takes into account site-specific conditions and sensitivities. The plan would:

- Provide an outline of its spill response measures and systems relating to upset releases to water and soil. The outline should cover environmental risk information for each type of accident or malfunction scenario. It should also cover an assessment of the effectiveness of proposed preparedness and response measures, as well as systems aimed to reduce the environmental consequences.
- Identify and describe and evaluate the potential impacts of all reasonably foreseeable project-related accidents and malfunctions involving the potential release of chemicals or hazardous materials.
- Identify site-specific environmental sensitivities, specific and detailed procedures, and associated timeframes that would ensure a prompt response, regulator notification, as well as cleanup in the event of a chemical or hazardous substance spill or threat of release.
- Provide the plans, measures and systems information identified in (1), (2), and (3) for review prior to construction and upon request of interested stakeholders and indigenous groups. All such plans

should be provided to relevant authorities prior to the commencement of the operations phase and updated regularly throughout the life of the project.

Parks Canada Agency

[562] While Parks Canada acknowledged that Teck had given consideration to the prevention of accidents and malfunctions through its engineering design and tailings management plans, the fact remains that large-scale disasters caused by failure of tailings containment areas can and do occur, regardless of design (Grant et al., 2010). Based on the identified pathways of effects on the outstanding universal value of Wood Buffalo National Park, and the observed and documented state of the Peace-Athabasca Delta, the project could have adverse effects on the outstanding universal value of Wood Buffalo National Park and reduce Canada's ability to restore all four desired outcomes regarding the outstanding universal value in the event that the effects of a catastrophic accident or malfunction reached Wood Buffalo National Park. Parks Canada recommended that Teck be required to:

- Develop spill response measures and systems relating to releases to water and soil for approval prior to the commencement of construction.
- Develop an emergency response plan for approval prior to construction that would include:
 - Project and site-specific mitigation measures and response procedures to minimize the environmental effects of an accident or malfunction reaching Wood Buffalo National Park;
 - How to mitigate effects and prevent contaminants from entering the Peace-Athabasca Delta and Wood Buffalo National Park;
 - effective emergency response capacity and training of staff;
 - commitment to continue diligence to be in state of preparedness/readiness;
 - commitment to sufficient response materials and equipment available in strategic locations; and
 - Community notification and emergency communications procedures to be incorporated into the plan, particularly for drinking water and traditional land users.
- Initiate community awareness and education initiatives about emergency responses.
- Provide Parks Canada Agency with an opportunity to review and comment on the plan.
- Commit to fund the cleanup and restoration of affected areas within Wood Buffalo National Park.

[563] Natural Resources Canada recommended that:

- Teck adhere to all the components of both the *FireSmart Guidebook for the Oil and Gas Industry* as well as the Canadian Association of Petroleum Producers' *Emergency Preparedness Guide for Hazards Associated with Wildfires*.

- Project firefighting staff be trained as provincial Type 2 wildland firefighters, including Incident Command System training for crew members and leaders.
- Implement a grass fuel management plan for Industrial Zone 3.
- Firefighting staff be equipped for suppression of grass and forest fires (e.g., portable gas powered water pumps, hand tools) with equipment compatible with provincial standards.
- Teck collaborate closely with area staff from Alberta Agriculture and Forestry to adequately mitigate wildfire risk and provide for appropriate response.

Analysis and Findings

[564] Teck has assessed project risks and potential accident and malfunction events. It identified that a breach of an external tailings area structure and resultant release of process-affected materials would have a high consequence on residents of Poplar Point and a number of important fish and wildlife species downstream of the project. The panel agrees that a while it is unlikely, failure of an external tailings structure with an associated release of process-affected materials would be a catastrophic disaster from an environmental perspective. The panel also notes that Teck's tailing management plan will eliminate this risk of a dam failure within 5 years of the end of mining activities.

[565] The panel recognizes that there is robust design and regulatory oversight system in place to minimize the risk of a tailings pond dam failure. Teck has committed to conforming to the Canadian Dam Safety Guidelines in the design of its tailing pond dams, and this provides confidence to the panel that the tailing dams will be designed and operated safely.

[566] The panel notes that Teck's Emergency Response and Spill Contingency plans are conceptual at this point, and accepts the concerns expressed by ECCC, Parks Canada and other parties regarding the lack of detail regarding emergency response and spill contingency measures. The types of spills associated with this type of operation are generally limited in size and areal extent and generally contained to the project footprint and so are unlikely to result in significant environmental effects. The panel supports ECCC and Parks Canada recommendations that Teck commit to develop a comprehensive emergency response and spill response plan before mine operations begin and that the plan be provided to interested parties, indigenous groups and regulators for review and comment.

[567] The panel is satisfied that Teck has considered potential accidents and malfunction in the design of the project and that it will prepare appropriate emergency response plans to guide its response to potential accidents and malfunctions should they occur.

[568] In section 6, "[Bitumen Recovery](#)," the panel has imposed a condition on Teck requiring the development of a comprehensive site-specific emergency response plan.⁵⁷ The panel also recommends

⁵⁷ Draft OSCA Approval – Condition 23

that the Minister include mitigation measures in the form of a site-specific response plan in the decision statement under *CEAA 2012* (see section [38](#)).

Recommendation to Teck

[569] The panel recommends that Teck implement Natural Resources Canada's recommendations to:

- adhere to all the components of both the *FireSmart Guidebook for the Oil and Gas Industry* as well as the Canadian Association of Petroleum Producers' *Emergency Preparedness Guide for Hazards Associated with Wildfires*;
- train Frontier project firefighting staff as provincial Type 2 wildland firefighters, including Incident Command System training for crew members and leaders;
- implement a grass fuel management plan for Industrial Zone 3;
- firefighting staff be equipped for suppression of grass and forest fires (e.g., portable gas powered water pumps, hand tools) with equipment compatible with provincial standards; and
- collaborate closely with area staff from Alberta Agriculture and Forestry to adequately mitigate wildfire risk and provide for appropriate response.

12 Panel Approach to Determination of Significance of Project and Cumulative Effects

[570] The panel’s approach for determining the significance of project and cumulative effects is consistent with the Canadian Environmental Agency’s *Operational Policy Statement and Technical Guidance: Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012*.

[571] Teck did not determine the significance of project or cumulative effects in their environmental assessment, stating that it is the responsibility of the Responsible Authority to identify if effects are significant. Instead, it made a determination of “environmental consequence” in its classification of environmental effects. In that determination, Teck did followed the Agency’s guidance. [Table 10](#) summarizes the effects classification criteria and definitions used in Teck’s assessment.

Table 10. Effects classification criteria (from project update, volume 3, section 2.5.8)

Criteria	Definitions	
Geographic Extent	Local	Effects occurring within the local study area
	Regional	Effects occurring within the regional study area beyond the boundary of the local study area
	Provincial	Effects occurring within the provincial boundary, extending beyond the regional study area
	National	Effects occurring within the national boundary, extending beyond the provincial boundary
Duration	Short	Effects lasting less than one year
	Medium	Effects lasting more than one year, but ending by closure
	Long	Effects persisting beyond closure
Frequency	Continuous	Effects occurring continually
	Isolated	Effects occurring once
	Periodic	Effects occurring intermittently but repeatedly over assessment period
Reversibility	Reversible	Measurable parameter returns to levels similar to those present before project disturbance
	Irreversible	Measurable parameter does not return to levels similar to those present before project disturbance
Magnitude	Quantitative or qualitative change in measureable parameter	

[572] The panel has adopted the same criteria and definitions used by Teck in its significance determination as they are consistent with CEEA guidance. While the definition of magnitude depends on the specific valued ecosystem component or parameter under consideration, the panel has generally used the following qualitative descriptors to classify its assessment: negligible, low, moderate, or high.

[573] In addition, the panel has considered ecological context as part of its significance determination. For the Frontier project, ecological context includes recognition that the project is located adjacent to the Athabasca River and downstream of other oil sands mining projects. It would also be the most northerly oil sands mining project and the oil sands mining project closest to Wood Buffalo National Park, a World Heritage Site. It is located within a key wildlife and biodiversity zone and in an area important for the continued practice of indigenous rights. [Figure 4](#) and [Figure 5](#) show areas used by Teck to review the project effects.

[574] The panel used an approach that relied on the sequential interaction between the magnitude, geographic extent, and frequency criteria to inform its determination of significance. The panel’s approach is summarized in [Figure 3](#). Recognizing that the influence of key criteria on the determination of significance may not be the same for all valued ecosystem components, the panel took into account considerations specific to each valued ecosystem component and modified the approach as necessary.

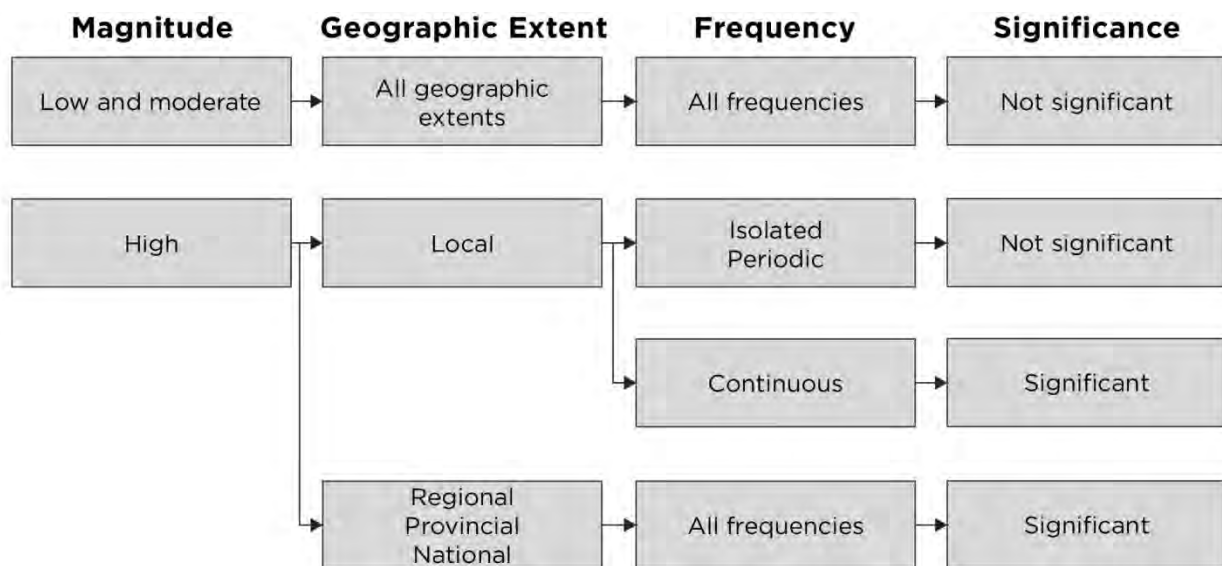


Figure 3. Decision tree for determining significance

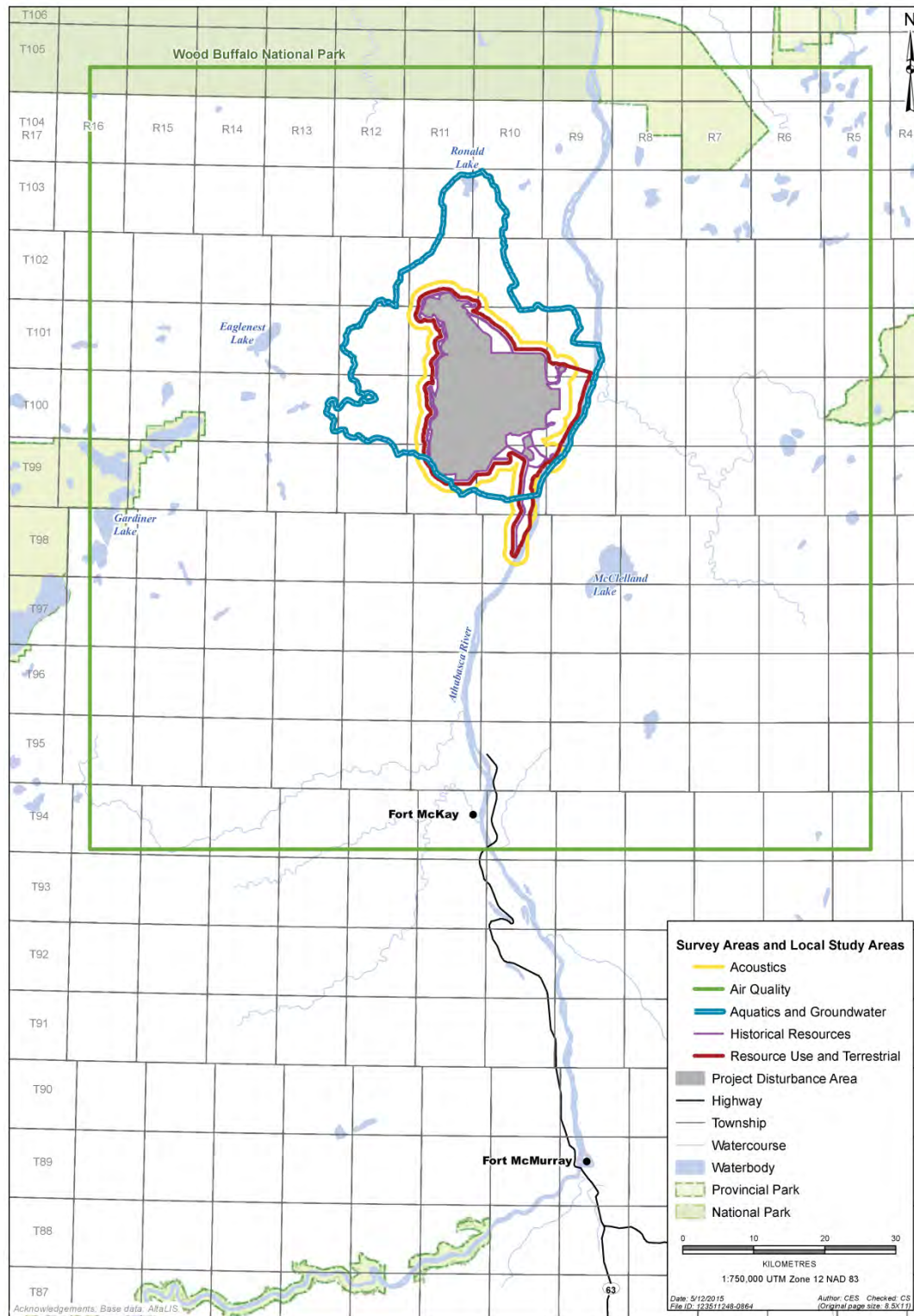


Figure 4. Local study areas

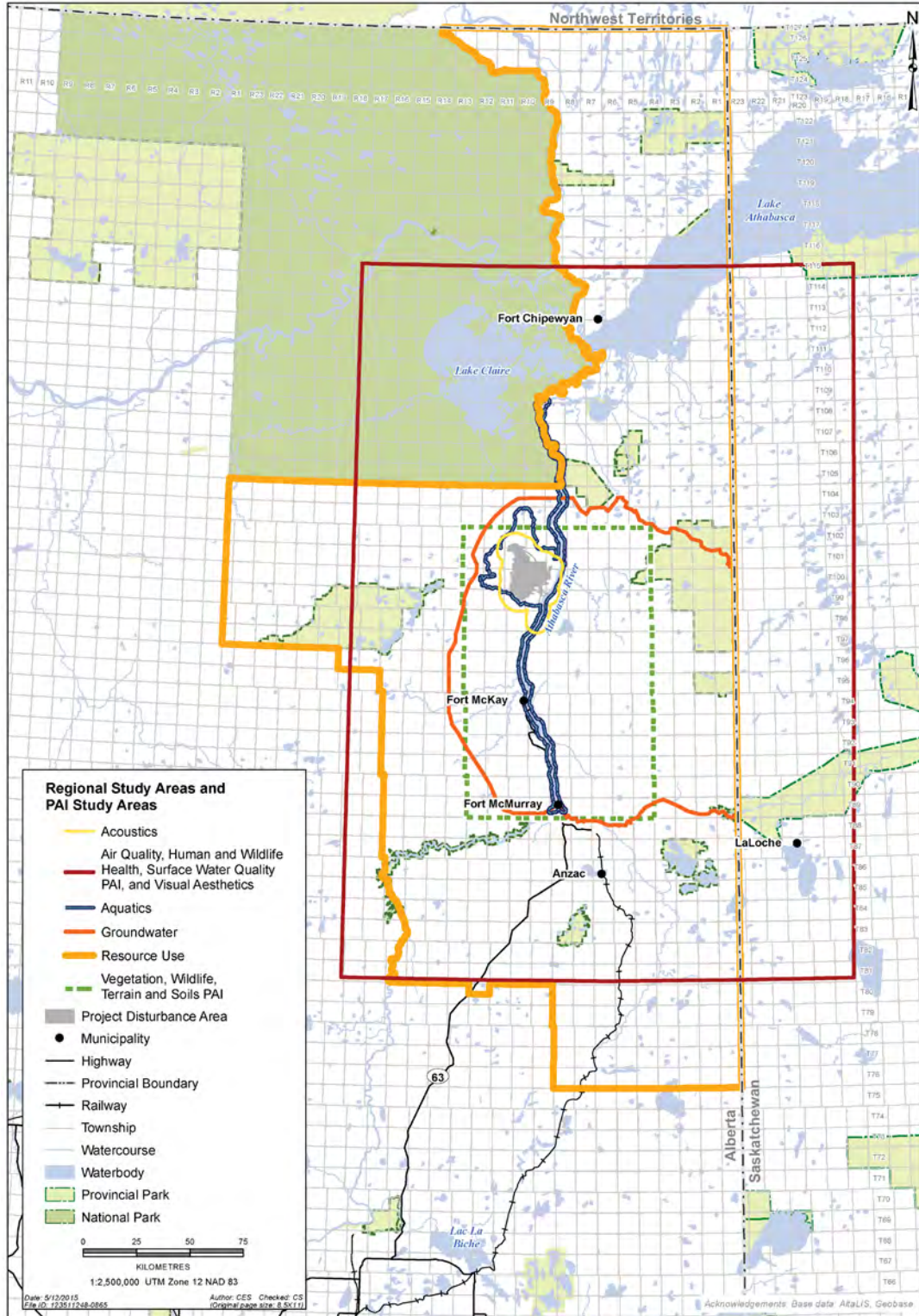


Figure 5. Regional study areas

13 Air Quality

[575] Teck provided a project update in 2015 that updated the air quality assessment to reflect changes in the project and additional information obtained since its initial 2009 integrated application. Teck evaluated the following air quality effects of the Frontier project:

- Nitrogen oxides (NO_x) emissions from boiler, heater, and cogeneration stacks and the mine fleet
- Sulphur dioxide (SO₂) emissions from trace sulphur in the burning of natural gas and diesel fuel in the mine fleet
- Acid deposition resulting from NO_x and SO₂ emissions
- Fine particulate matter (PM_{2.5}) emissions from boiler, heater, cogeneration stacks, mine fleet
- Total suspended particulates, polycyclic aromatic compounds, and metal emissions from mine fugitives
- Hydrocarbon and reduced sulphur compound emissions from fugitive plant, mine face, and tailings areas
- Effects focused on Wood Buffalo National Park and Peace-Athabasca Delta

[576] In conducting its air quality assessment, Teck defined a 290 km × 700 km air dispersion modelling domain within which it quantified all substantive industrial and non-industrial emissions sources. Within the model domain it established a predevelopment scenario, which reflected air quality conditions before oil sands development. It also calculated an existing conditions reference scenario to determine all current emissions. It then assessed three future development scenarios:

- Base case, which included emissions from developments that were operating, under construction, and approved but not yet constructed
- Application case, which included the base case plus emissions from the Frontier project
- Planned development case, which included the application case plus emissions from developments that have been disclosed or applied for but not yet approved

[577] For each of the existing, base, application, and planned development case scenarios, Teck used the CALMET and CALPUFF models (as prescribed by the Alberta *Air Quality Model Guideline*) to define meteorological conditions and predict ambient air quality concentrations and deposition patterns for key project emissions.

[578] Teck stated that its air quality modelling results are conservative. Teck's modelling assumes that all developments in the 290 km × 700 km model domain area will proceed and operate simultaneously at full capacity. They note that emissions from the Frontier project incorporate a number of other conservative assumptions that may overstate these emissions.

Nitrogen Oxides

[579] In the Alberta mineable oil sands area, nitrogen oxides (NO_x) are substances that are primarily produced as a by-product of combustion, which can include industrial boilers and heaters, turbines, mine fleet, urban traffic, and residential and commercial heating. Nitrogen dioxide (NO₂), a specific nitrogen oxide, is both a respiratory irritant and a precursor to ozone formation, photochemical smog, acid deposition, and nitrogen deposition.

Project Effects

Evidence

[580] In the 2015 environmental impact assessment project update, Teck stated that the Frontier project NO_x emissions total would be 20.94 tonnes per day (t/d)—9.00 t/d from stack emissions and 11.94 t/d from mine fleet emissions.

[581] The existing case regional NO_x emissions total is 387.2 t/d, where 248.2 t/d is from stack emissions, 118.0 t/d is from mine fleet emissions, and 21.0 t/d is from non-industrial emissions.

[582] The base case regional NO_x emissions total is 631.9 t/d, where 473.3 t/d is from stack emissions, 137.4 t/d is from mine fleet emissions, and 21.2 t/d is from non-industrial emissions.

[583] The application case regional NO_x emissions total (which includes the Frontier project emissions) is 652.8 t/d, where 482.3 t/d is from stack emissions, 149.3 t/d is from mine fleet emissions, and 21.2 t/d is from non-industrial emissions. The Frontier project emissions represent a relative increase from the base case of 3.3 per cent.

[584] The planned development case regional NO_x emissions total is 789.6 t/d, where 602.1 t/d is from stack emissions, 166.4 t/d is from mine fleet emissions, and 21.2 t/d is from non-industrial emissions.

[585] To provide an indication of existing air quality conditions in the region, Teck presented NO₂ monitoring results from four industrial and five community monitoring stations. This showed that all concentrations at the industry stations are less than the 1-hour Alberta ambient air quality objectives (AAAQO). Maximum concentrations greater than the 1-hour AAAQO only occurred at the Athabasca Valley station in Ft. McMurray in 2013. Teck noted that these higher values at this location were likely due to high traffic volumes associated with highway traffic through Fort McMurray. All other community stations reported maximum 1-hour concentrations of less than 50 per cent of the AAAQO.

[586] Teck stated that the project update modelling overpredicts the top 1-hour NO₂ measurements by 110 per cent at industry stations and 20 per cent at community stations. Teck stated that modelling has a general bias to overpredict NO₂ concentrations, suggesting that results are conservative in nature.

[587] Mikisew Cree First Nation stated that Teck's air quality assessment may have potentially underestimated particulate, NO_x, and hydrocarbon emissions. Mikisew notes that Teck assumes that the Frontier project's mine fleet and all other existing mine fleets will meet Tier IV emission standards, which are the strictest NO_x and particulate matter emission requirements for off-highway diesel engines, by the time the Frontier project is operational. Mikisew notes that hydrocarbon emissions from the Frontier project and other existing operations are underestimated, and a recent publication identified scaling factors to use. Mikisew conducted its own air modelling assessment of NO_x with the AERMOD EPA Regulatory Model, which demonstrated an increase in predicted NO₂ concentrations in the mineable oil sands region.

[588] Teck stated that Mikisew failed to validate the model, where Mikisew relied on it for distances of 50 km to beyond 200 km, which exceed the limitations of the model. Teck also noted that Mikisew agreed that there is no regulatory authority in North America that recommends the use of the AERMOD EPA Regulatory Model at distances beyond 50 km.

Stack Emissions

[589] Stack emissions will come from two cogeneration units with heat recovery steam generators, seven auxiliary steam boilers, and thirteen small natural gas heaters for a total of 22 stacks. These units, being fired with natural gas, would continuously release NO_x emissions from the stacks. In the project update, Teck stated that continuous stack NO_x emissions would be 8.89 t/d plus 0.11 t/d for space heating, totalling to 9.00 t/d.

[590] Teck stated within the 2015 project update that the NO_x emission rates for boilers and heaters that have a capacity equal to or greater than 10.5 Gigajoules per hour (GJ/hr) were required to meet the *Interim Emissions Guidelines for Oxides of Nitrogen (NO_x) for new Boilers, Heaters and Turbines using Gaseous Fuels for the Oil Sands Regions in the Regional Municipality of Wood Buffalo North of Fort McMurray based on a Review of Best Available Technology Economically Achievable (BATEA)* (ESRD, 2007). By using natural gas-fired heaters and boilers, the NO_x compliance limit emission intensity of 26 grams per gigajoule (g/GJ) and the NO_x performance target emission intensity of 7.9 g/GJ were used to calculate the NO_x emission limit for each of the project's boilers and heaters.

[591] Teck stated that when heater and boiler technology will be selected for the Frontier project, the equipment will meet the NO_x emission requirements in the federal *Multi-Sector Air Pollutants Regulations (MSAPR)*. Teck acknowledged that the *MSAPR* emissions limits now stipulate maximum allowable NO_x emissions from the Frontier project's heaters and boilers. The 2015 air quality assessment in the project update used emission rates that are higher than the *MSAPR* requirements; Teck notes that other stack parameters are not expected to change substantially due to meeting *MSAPR*. The *MSAPR* requirements came into effect in June 2016 and required more stringent emission standards for boilers, heaters, and stationary spark-ignition engines. Teck's project update air assessment also assumed that all

boilers, heaters, and the two cogeneration units are simultaneously operating at full capacity and using less-stringent emission standards.

[592] In the project update, the NO_x emission rates of the two cogeneration units were determined using the National Emission Guidelines for Stationary Combustion Turbines (CCME, 1992) and Alberta Air Emission Standards for Electricity Generation and Alberta Air Emission Guidelines for Electricity Generation (CASA, 2003); where the former resulted in the more stringent NO_x emission limit. Teck also stated that the actual NO_x emissions from the cogeneration plant will be less than the calculated emission limits because of the Dry Low NO_x 1+ technology being proposed.

[593] Teck stated that Dry Low NO_x 1+ technology can meet the AEP performance targets. It stated that it has reviewed selective catalytic reduction technology but is committed to using Dry Low NO_x 1+ (DLN1+) gas turbine generators and low NO_x duct burner technology for the Frontier project. It noted that there are increased costs and environmental trade-offs associated with selective catalytic reduction technology. It concluded that there is no net benefit associated with using selective catalytic reduction to further reduce NO_x emissions.

[594] In its April 2017 response to the panel's package 3 information request, Teck provided additional details on project NO_x emissions. It expanded on its discussion of emissions from the two proposed electrical cogeneration turbine units. It proposes to use Dry Low NO_x 1+ technology to reduce emissions to 0.44 t/d of NO_x per unit.

[595] At the panel's request, Teck assessed the costs and benefits of the addition of selective catalytic reduction to its cogeneration units. In terms of NO_x emission from each cogeneration unit, Teck stated that the proposed Dry Low NO_x 1+ technology will emit 0.44 t/d, the Dry Low NO_x (not 1+) combined with selective catalytic reduction will emit 0.44 t/d, and the Dry Low NO_x 1+ combined with selective catalytic reduction will emit 0.11 t/d.

[596] Teck concluded that the addition of selective catalytic reduction to Dry Low NO_x 1+ would result in a decrease in NO_x emissions of 0.67 t/d for the two cogeneration units. It was also stated that the addition of selective catalytic reduction would result in a 1.7 per cent increase in greenhouse gas emission intensity, an increase in PM_{2.5} emissions of 0.16 t/d, emissions of 0.21 t/d ammonia emission vs. no ammonia emissions from Dry Low NO_x 1+, increased risks to safety, and environmental risk associated with on-site storage, use, and transportation of ammonia.

[597] In comparing selective catalytic reduction to Dry Low NO_x 1+ with low NO_x duct burners, Teck estimates that net present cost of implementing selective catalytic reduction, using an 8 per cent discount rate per year over the 41 year operating life of the project, would be an incremental \$75 million in capital and operating costs. The difference in the net present value of Dry Low NO_x 1+ vs. selective catalytic

reduction is primarily a result of increased capital and operating costs and reduced net power generation potential associated with selective catalytic reduction.

Mine Fleet

[598] Teck stated that project mine fleet NO_x emissions total is 11.94 t/d, which is determined based on U.S. EPA Tier IV emission factors. The maximum diesel fuel consumption was determined to be during maximum mine activity (year 31 to year 35); the maximum fuel consumption during this period is predicted to be 1 013 000 litres per day (L/d). Tier IV emission standards represent the maximum allowable NO_x emissions for off-road vehicles under the Canadian *Off-Road Compression-Ignition Engine Emissions Regulations*, which is enabled through the *Canadian Environmental Protection Act*.

[599] Teck stated that mine fleet emission mitigation measures will include

- purchasing haul trucks that are compliant with U.S. EPA Tier IV, when available;
- optimizing mine planning and engineering to reduce haul distances that will result in reduced emissions and increased fuel efficiency (e.g., the average haul distance for the updated assessment is 0.5 km shorter than the integrated application); and
- developing and implementing an anti-idling program for the mine fleet.

[600] ECCC noted that Teck has only committed to Tier IV emission standards for its haul trucks. ECCC stated that it continues to recommend that Teck commit to best-in-class technology, starting with Tier IV engines for all mine fleet equipment, as opposed to just haul trucks. ECCC also stated that further details of the maintenance program should also be provided as it is an important environmental management tool to ensure that after-treatment emission control technologies are functioning properly.

[601] Health Canada recommends that Teck acknowledge that if Tier IV vehicles are not available during the early stages of the Frontier project, the PM_{2.5} model predictions should be considered invalid, thus a plan should be prepared in advance if vehicles other than Tier IV mine fleet vehicles will be deployed at the beginning of project operations. Health Canada also recommends that Teck implement a retrofit and replacement schedule demonstrating off-road equipment conversion to best-in-class technology, starting with Tier IV engines as they become available.

[602] At the public hearing for the Frontier project on September 29, 2018, Teck committed to using mine mobile equipment that meets Tier IV NO_x emission requirements. Teck stated that it has no objections to an approval condition that requires it to meet its commitment to use of Tier IV equipment standards. It assumed that all existing oil sands mining mines would be also be using mine mobile equipment that meet Tier IV emission standards.

Analysis and Findings

[603] Teck presented the results from air quality monitoring stations that are within the air dispersion modelling domain, which indicated that mean annual NO₂ concentrations from 2009 to 2013 are well below AAAQO and the *LARP* level 3 trigger values.

[604] Teck's modelling used a total NO_x emission rate of 20.94 t/d. In a subsequent submission, Teck indicated that the project NO_x emission rate will be reduced to 17.24 t/d as the result of adopting Dry Low NO_x 1+ gas turbine generators and low NO_x duct burner technology to reduce NO_x emissions from its cogeneration units (as discussed below). The panel acknowledges that Teck's assumption that all developments in the 290 km × 700 km model domain area will proceed and operate simultaneously at full capacity is conservative. Teck has committed to meeting *MSAPR* requirements for boiler and heater emissions, where higher estimates were used in the Frontier project air quality assessment. The reductions in project NO_x emissions rate and conservative assumptions result in a conservative, or overstated, estimation of base and application case NO_x emissions.

[605] The panel also notes Mikisew's recommendation that governments reduce the existing provincial NO₂ and SO₂ triggers and limits to be in line with the new Canadian ambient air quality standards (CAAQS). It is uncertain how the CAAQS will impact mitigation measures in the region to reduce ambient NO_x levels, or impact Alberta management actions to address any *LARP* trigger threshold exceedances.

[606] Teck estimated NO_x emission rates for stationary combustion boilers, heaters, and cogeneration units based on provincial and federal policies in 2015. However, the federal regulations for NO_x emission rates from boilers and heaters have become more stringent in 2016 due to the *MSAPR*. The *MSAPR* apply to all boilers and heaters having a rated capacity of 10.5 GJ/hr or higher and that will use or are designed to combust gaseous fossil fuel.

[607] Although the panel is satisfied with Teck's procedure of comparing the varying policies and using the most stringent one to determine NO_x emission limits within their 2015 project update, the project will need to use the updated *MSAPR* as these are the most stringent NO_x emission limits. The most conservative *MSAPR* NO_x emission intensity value of 16 g/GJ was assumed for all of the project's heaters and would form the basis of the heater's NO_x emission limits. For boilers, the thermal efficiency of 86 per cent was used to calculate the NO_x emission intensity value of 17.2 g/GJ, which then enabled the development of the boiler's NO_x emission limits within the *EPEA* approval. The panel will require that project boiler and heater NO_x emission limits be set based on the most stringent applicable requirement.⁵⁸

[608] Teck's procedure for determining the cogeneration unit's NO_x emission limits were provided within the 2015 project update. Since that time, ECCC published the *Guidelines for the Reduction of*

⁵⁸ Draft *EPEA* Approval – Conditions 3.2.1 and 4.1.33

Nitrogen Oxide Emissions from Natural Gas-fuelled Stationary Combustion Turbines (ECCC, 2017).

This document provides new NO_x emission intensities for all power rating combustion turbines using natural gas. For the turbine portion of Teck's two cogeneration units, the panel therefore requires the NO_x emission intensity value of 85 g/GJ to be used.⁵⁹ This subsequently produces the most stringent NO_x emission limit for the cogeneration units when using the CCME methodology.

[609] In evaluating the use of Dry Low NO_x 1+ technology for the Frontier project cogeneration units, the panel notes that Dry Low NO_x 1+ reduces NO_x emissions from the 2.29 t/d (for each cogeneration unit) used in the 2015 project update air quality modelling, to 0.44 t/d (for each cogeneration unit). It reduces overall NO_x project emissions from 20.94 t/d to 17.24 t/d, an approximate 22 per cent reduction from the cogeneration units and an overall reduction of 5.10 per cent from those used in Teck's project update. The panel also notes that 0.44 t/d using only Dry Low NO_x 1+ technology is nearly as low as the 0.39 t/d performance target derived from the Alberta *Interim Emission Guidelines for Oxides of Nitrogen (NO_x) for New Boilers, Heaters and Turbines using Gaseous Fuels for the Oil Sands Region in the Regional Municipality of Wood Buffalo North of Fort McMurray based on a Review of Best Available Technology Economically Available (BATEA)*, or commonly referred to as Alberta Policy 2. The panel believes that Alberta Policy 2 performance targets are what industrial operators should strive to achieve. The panel will require the Frontier project cogeneration NO_x emission limit be set to 0.44 t/d per unit.⁶⁰

[610] Frontier project mine fleet NO_x emissions of 11.94 t/d represents 57 per cent of the Frontier project total NO_x emissions (20.94 t/d). The mine fleet 11.94 t/d NO_x emissions is already assuming the use of the most stringent emissions requirements (i.e., Tier IV). The panel recognizes that the Frontier project mine fleet represents a substantial portion of the Frontier project emissions and the importance of maintaining NO_x emissions at or below 11.94 t/d.

[611] NO₂ emissions, primarily from the mine fleet and gaseous combustion sources, are the most substantial (by mass) criteria air contaminant released by the Frontier project. The panel finds that the Frontier project will increase NO_x emissions 3.3 per cent relative to base case emissions.

[612] The panel accepts Teck's evidence that modelling bias tends to overpredict emissions when compared with actual ambient air quality monitoring results.

[613] Teck has committed to using Dry Low NO_x 1+ gas turbine generators and low NO_x duct burner technology to reduce emissions from its cogeneration facilities. The panel has considered requiring the addition of selective catalytic reduction to further reduce NO_x emissions. The panel acknowledges that Teck's use of Dry Low NO_x 1+, with an emission rate of 0.44 t/d for each unit will be below current Canadian turbine NO_x emission limits of 1.93 t/d for each cogeneration unit. It notes that this emission

⁵⁹ Draft EPEA Approval – Condition 3.2.2

⁶⁰ Draft EPEA Approval – Condition 4.1.33

rate is nearly as low as the Alberta Policy 2 performance target of 0.39 t/d, which is based on “best available technology economically available” performance that companies should strive for.

[614] The panel also acknowledges that the addition of selective catalytic reduction technology for the Frontier project cogeneration units would result in additional PM_{2.5}, greenhouse gas, ammonia emissions, and additional financial costs.

[615] The panel recognizes the need to mitigate NO_x emissions from the Frontier project. However, the panel is of the opinion that the selective catalytic reduction technology does not provide substantial net environmental benefit when compared to the additional emissions and costs.

[616] The panel finds that the Frontier project mine mobile equipment makes up a substantial portion of the Frontier project total NO_x emissions and that mitigation of mine mobile equipment NO_x emissions is important. The panel recognizes that the 57 per cent of overall project NO_x emissions will be due to mine mobile equipment emissions (assuming Tier IV standards are met). It is essential for Teck to use Tier IV compliant mobile equipment fleet and ensure the mine mobile equipment is maintained to prevent an increase in mine mobile equipment emissions. The panel has included a condition that Teck is required to operate and maintain mine mobile equipment haul trucks compliant with Tier IV standards, or equivalent.⁶¹ The panel recommends Teck to develop and implement a plan to provide employee training on minimizing mine mobile equipment idling and the importance of avoiding tampering with emissions control systems. The panel also recommends that the Minister include measures to reduce NO_x emissions in the decision statement under *CEAA 2012* (see section [38](#)).

[617] The panel finds that Teck’s updated predicted NO_x assessment results will be conservative; this is a result of stack emissions using conservative emission rates and the inclusion of all approved projects in the region. Teck’s estimation of future NO_x emission rates also includes an assumption that all existing mine fleets meet Tier IV emission standards.

[618] Teck has committed to operating its entire fleet of mine mobile equipment to Tier IV emission standards or equivalent. The panel recognizes that in order for Teck’s mobile equipment to continually operate within Tier IV emission standards, ongoing and proactive vehicle maintenance is required. The panel will prohibit the removal of emission control technologies from mine mobile equipment.⁶²

[619] In its analysis, the panel finds that elevated levels of NO_x as Teck has modelled, are likely to occur in the Frontier project development area, and any effects are expected to decrease with distance from the boundary. Based on the predicted decreasing levels of NO_x, the magnitude of effects of emissions in the regional study area and local study area are expected to be limited.

⁶¹ Draft *EPEA* Approval – Conditions 4.1.26 and 4.1.28

⁶² Draft *EPEA* Approval – Condition 4.1.27

[620] The panel finds that, if Teck's entire mine fleet meets Tier IV criteria, if *MSAPR* emission standards are achieved by all applicable boilers and heaters, and if Dry Low NO_x 1+ cogeneration technology are all implemented, the NO_x emission effects can be reasonably mitigated. The panel will require Teck to develop and implement an air quality mitigation, monitoring, and adaptive management plan that incorporates the management of all Frontier project NO_x emissions.⁶³

Cumulative Effects

Evidence

[621] The planned development case NO_x emissions total is 789.6 t/d, where 602.1 t/d is from stack emissions, 166.4 t/d is from mine fleet emissions, and 21.2 t/d is from non-industrial emissions.

[622] In the 2015 project update, Teck evaluated the Frontier project NO_x emission effects. The 1-hour NO₂ AAAQO is 300 micrograms per cubic metre (µg/m³).

[623] For the existing conditions scenario, Teck stated that the maximum 1-hour NO₂ is predicted to be 78.7 µg/m³ along the project disturbance area boundary and 504 µg/m³ as a local study area maximum (outside of development areas).

[624] For the base case scenario, Teck stated that the maximum 1-hour NO₂ is predicted to be 87.6 µg/m³ along the project disturbance area boundary and 366 µg/m³ as a local study area maximum (outside of development areas).

[625] For the application case scenario, Teck stated that the maximum 1-hour NO₂ is predicted to be 158 µg/m³ along the project disturbance area boundary and 367 µg/m³ as a local study area maximum (outside of development areas).

[626] For the planned development case scenario, Teck stated that the maximum 1-hour NO₂ is predicted to be 158 µg/m³ along the project disturbance area boundary and 369 µg/m³ as a local study area maximum (outside of development areas).

[627] Teck stated that the maximum 1-hour concentrations near the project are predicted to be less than the 1-hour NO₂ AAAQO and that higher values are associated with existing, approved, and planned developments south of the Frontier project. The predicted project contributions to the local study area maximums are less than 0.1 per cent; in general, NO₂ maximums are predicted to occur within and near all existing, approved, and planned mining developments.

[628] In the 2015 project update, Teck evaluated the Frontier project NO_x emission effects. The annual NO₂ AAAQO is 45 µg/m³.

⁶³ Draft *EPEA* Approval – Condition 4.1.51

[629] For the existing conditions scenario, Teck stated that the maximum annual NO₂ is predicted to be 10.1 µg/m³ along the project disturbance area boundary and 67.5 µg/m³ as a local study area maximum (outside of development areas).

[630] For the base case scenario, Teck stated that the maximum annual NO₂ is predicted to be 13.8 µg/m³ along the project disturbance area boundary and 63.4 µg/m³ as a local study area maximum (outside of development areas).

[631] For the application case scenario, Teck stated that the maximum annual NO₂ is predicted to be 42.4 µg/m³ along the project disturbance area boundary and 63.5 µg/m³ as a local study area maximum (outside of development areas).

[632] For the planned development case scenario, Teck stated that the maximum annual NO₂ is predicted to be 42.7 µg/m³ along the project disturbance area boundary and 66.8 µg/m³ as a local study area maximum (outside of development areas).

[633] Teck stated that the maximum annual concentrations near the Frontier project are predicted to be less than the annual NO₂ AAAQO and that higher values are associated with existing, approved, and planned developments south of the Frontier project. The predicted project contributions to the local study area maximums are less than 0.3 per cent; in general, NO₂ maxima are predicted to occur within and near all existing, approved, and planned mining developments.

[634] Teck stated that no annual NO₂ concentrations from nine air quality monitoring stations in the mineable oil sands area region (four industry stations and five community stations) show concentrations exceeding AAAQOs.

[635] The *LARP Air Quality Management Framework (AQMF)* uses a cumulative effects management approach at a regional level to proactively manage ambient NO₂. The *AQMF* has developed a set of triggers and limits (ranging from levels 1 to 4) to which air quality is compared to, and when the triggers and limits are exceeded, a management response will be implemented.

[636] Teck provided annual measurements from 2009 through 2013 to provide an indication of existing conditions in the region:

- Ambient NO₂ concentrations greater than the *AQMF* trigger 2 and the Fort McKay target have occurred at two of the industry stations. These stations are located near mine developments but not near human habitation.

- Ambient NO₂ concentrations greater than the *AQMF* trigger 2 and the Fort McKay target have occurred at the Athabasca Valley community station. This is due to high traffic volumes associated with the highway that runs through Fort McMurray.
- The concentrations measured in the communities of Fort Chipewyan, Fort McKay, and Anzac are less than applicable AAAQOs.

[637] The CAAQS are national health-based air quality objectives developed by the CCME as part of the national Air Quality Management System. The NO₂ CAAQS is the key driver of the national Air Quality Management System for improvement of air quality in Canada, which becomes effective in 2020 and increases in stringency in 2025. Teck stated that guidance from the CCME and AEP indicates that maximum measured or modelled concentrations within the immediate vicinity and influence of the major industrial facilities such as an oil sands project are not intended to be compared against the CAAQS. Consequently, Teck stated that the CAAQS are not appropriate to evaluate the acceptability of maximum predicted pollutant concentrations along or near the development boundaries of an oil sands project. Teck also stated that the CAAQS are intended for comparison to air concentrations at locations similar to community monitoring stations (not over the entire study areas).

[638] ECCC maintained that the CAAQS may be used in conjunction with results from air quality modelling to predict the effect of a project on downwind locations, including communities and other sensitive receptors. ECCC also stated that modelling data may be used to compare predicted concentrations to ambient standards, including national standards such as the CAAQS, in order to estimate the contribution of the Frontier project to local air quality. ECCC stated that in order to assess the effect of a Frontier project on ambient air quality levels, it is recommended that modelled predictions be compared to the most stringent federal, provincial, or territorial air quality standards applicable to the given area. They note that in many cases, the CAAQS will be the most stringent levels for key air pollutants, especially for longer term projects with emissions after 2025.

[639] Teck maintains that the comparison of predicted concentrations over the entire study area is inconsistent with the intent of the CAAQS but provided the comparison of NO₂ predictions against the CAAQS. The 1-hour NO₂ CAAQS is calculated from the three-year average of the 98th percentile of the daily maximum 1-hour average concentration, where the objective will be 113 µg/m³ in 2020 and 79 µg/m³ in 2025. The annual NO₂ value is calculated from the average over a single calendar year of all 1-hour average concentrations, where the objective will be 32 µg/m³ in 2020 and 23 µg/m³ in 2025.

[640] Along the project disturbance area boundary, the 98th percentile 1-hour NO₂ base case prediction is 84.3 µg/m³, and the application case prediction is 153 µg/m³; the base case is predicted to be in exceedance of the applicable 2025 CAAQS. Outside the project disturbance area, but still within the local study area, the 98th percentile 1-hour NO₂ base case prediction is 352 µg/m³ and the application case prediction is 353 µg/m³. Along the project disturbance area boundary, the annual NO₂ base case

prediction is $13.8 \mu\text{g}/\text{m}^3$ and the application case prediction is $42.4 \mu\text{g}/\text{m}^3$; the application case predicts an exceedance of the applicable 2020 and 2025 CAAQS. Outside the project disturbance area, but still within the local study area, the annual NO_2 base case prediction is $63.4 \mu\text{g}/\text{m}^3$ and the application case prediction is $63.5 \mu\text{g}/\text{m}^3$. Teck notes that the NO_2 increase along the project disturbance area is because of the Frontier project NO_x emission sources, but the Frontier project does not make any substantive contributions to the high application case values in the local study area. Teck indicates that the maximum predicted NO_2 concentrations in the local study area are predicted near the adjacent oil sands mining developments.

[641] Teck provided NO_2 isopleth figures and a summary table of predicted concentrations at discrete sensitive receptor locations for corresponding CAAQS averaging periods. The base case predicts NO_2 CAAQS exceedances, where the application case illustrates the relative contribution of the Frontier project emissions. The project case isopleths illustrate maximum predicted concentrations, where CAAQS exceedances are only in close proximity of the Frontier project boundary. The summary table does identify exceedances of the 1-hour 2025 CAAQS for some cabins and points of interest, where the highest frequency of predicted exceedances at a single receptor is for 91-hours throughout the modelled temporal span.

[642] ECCC stated that the CAAQS are not standards to be achieved at the Frontier project perimeter; they may be used in conjunction with air quality modelling to predict the effects on communities and other sensitive receptors. Modelling data may be used to compare predicted concentrations to ambient standards, including national standards such as CAAQS, in order to estimate the contribution of the Frontier project to local air quality. In order to assess the effect of a Frontier project on ambient air quality levels, ECCC recommends that modelled predictions be compared to the most stringent federal, provincial, or territorial air quality standards applicable to the given area. ECCC also stated that air zone monitoring stations used to report on CAAQS achievement are usually located in population centres; air zones are designed to cover all geographic areas within a jurisdiction and the resulting management levels and actions may be applied across an air zone, even in remote areas. Since the CAAQS are also designed to protect the environment, the lack of a nearby human population is not a reason to discount the use of the CAAQS during an environmental assessment. ECCC noted that since most long-term projects will be operating into the foreseeable future, modelling results can be compared to the most stringent CAAQS limits currently available.

[643] ECCC noted that Teck's modelled results show that the predictions for the Frontier project case (project-only emissions without background concentrations) are above the 2025 1-hour NO_2 CAAQS in the local study area for cabins and places of interest (traditional use areas); there are also predicted exceedances of the annual NO_2 CAAQS at places of interest in the project case. The model predictions show that there are predicted exceedances of the 2025 1-hour NO_2 CAAQS in the base case and the areal extent of the exceedance is increased with the addition of the Frontier project in the application case.

[644] Teck identified the predicted frequencies of concentrations being greater than the 2025 CAAQS for the project case, where the following human health risk assessment receptor locations (as identified in the project update) were identified to have CAAQS exceedances: R79 with 25 exceedances, R81 with 50 exceedances, R148 with 16 exceedances, R149 with 91 exceedances, R151 with 6 exceedances, R152 with 42 exceedances, R153 with 32 exceedances, R181 with 21 exceedances, R182 with 5 exceedances, R184 with 7 exceedances, and R185 with 10 exceedances.

[645] Teck provided a map of the human health risk assessment receptor locations, where R149, R151, R152, R182, R184, and R185 are located within the project disturbance area itself. Whereas R79, R81, R148, R153, and R181 are located adjacent to the project disturbance area boundary.

[646] Mikisew notes that the new CAAQS may require additional measures to reduce NO_x levels in the mineable oil sands area in order to meet these more stringent requirements. Teck stated that they are confident that the strategy of designing the Frontier project to limit NO_x emissions consistent with “best available technology economically available”; implementing the Frontier project-specific air quality mitigation, monitoring, and adaptive management plan; and through collaboration with regional management initiatives including the *AQMF* and the *Lower Athabasca Region air zone Canadian ambient air quality standards response: Government of Alberta action plan*, is an effective strategy to manage air quality relative to the CAAQS.

[647] ECCC stated that it supports Teck’s plans to remain below the CAAQS by implementing best available technology, designing and implementing a local air quality monitoring program, and participating in local and regional air quality management initiatives. ECCC recommends, if the Frontier project is approved, for Teck to take an iterative approach to air quality management and make any necessary adaptations to project equipment or procedures to prevent project emissions from contributing to deteriorating air quality in the local regional area.

[648] ECCC stated that Teck has not provided enough information to demonstrate that all engines at other existing facilities in the region will also be using engines that meet Tier IV standards, as was assumed in the calculation of peak emissions in 2030. In the project update base case scenario, Teck conducted the air quality modelling assessment based on the assumption that all existing mine fleet will meet Tier IV emission standards. The base case also included emissions from all approved industrial developments in the region.

[649] Teck stated that if existing mine fleets do not meet the Tier IV NO_x emission standards in the future, the maximum NO₂ concentrations provided in the integrated application and in the revised air quality assessment, which incorporates the alternate base case, represent an upper bound of expected NO₂ concentrations. Teck compared the total mine fleet NO_x emission rate of 137.35 t/d from the base case to a scenario that better reflects current mine fleet emissions of 210.42 t/d.

Analysis and Findings

[650] Based on Teck's updated NO_x assessment for the Frontier planned development case, the Frontier project has NO₂ ambient air quality effects along the project disturbance area boundary. Project effects to the local study area dissipate along with distance from the project disturbance area boundary. This implies that the Frontier project, as assessed in the project update, has a relatively low contribution to the local study area maximums. Based on the predicted NO₂ concentrations, the Frontier project is not expected to cause an increase in NO₂ AAAQO exceedances in the mineable oil sands area.

[651] In comparing the project update predictions to the applicable CAAQS along the project disturbance area boundary, the Frontier project effects are notable and exceedances of the NO₂ CAAQS are predicted. The panel acknowledges however that CAAQS are not standards to be achieved at the Frontier project perimeter.

[652] When considering NO₂ effects beyond the project disturbance area boundary (but still within the local study area), the Frontier project effects are relatively small. In examining isopleths submitted by Teck, the panel notes that the Frontier project effects are primarily localized near the project disturbance area boundary, but small changes in ambient air quality predictions are effected throughout the domain. The small changes to the air quality predictions due to the Frontier project may be smaller than the margin of error associated with the model prediction confidence. The panel also recognizes that the base case already predicts potential CAAQS exceedances at existing oil sands operations.

[653] The panel also notes Mikisew's recommendation that governments reduce the existing NO₂ and SO₂ triggers and limits to be in line with the new CAAQS. As noted above, it is uncertain how the CAAQS will impact mitigation measures in the region to reduce ambient NO_x levels, or impact management actions to address any *LARP* trigger threshold exceedances.

[654] Teck conducted the air quality modelling assessment based on the assumption that all existing mine fleets in the base case will meet Tier IV emission standards. There is uncertainty if existing mine fleets in the mineable oil sands area will transition to Tier IV emission standards before the Frontier project reaching peak emissions in 2030. This uncertainty also brings into question the conservativeness of the project update conclusions. If Tier IV standards were not adopted by existing mine fleets, future emissions may be higher than those predicted by Teck.

[655] The panel accepts that there is uncertainty regarding whether all operators will use Tier IV mine fleet equipment in the future. The panel relies on the *AQMF* to address regional NO_x emissions in the event that *LARP* NO_x triggers are exceeded in the future.

[656] The panel also notes that future CAAQS and potential management actions under *LARP* may require additional air quality measures by the Government of Alberta in the mineable oil sands area to reduce overall NO_x emissions.

[657] The panel finds that the proposed project has the potential to exceed applicable NO₂ AAAQO and CAAQS at the Frontier project boundary, but the effects are diminishing as distance from the Frontier project increases. The Frontier project has a limited potential to increase NO₂ air quality effects on a cumulative effects basis.

[658] The Frontier project has a relatively low potential to effect NO₂ CAAQS achievement in the mineable oil sands area. Acknowledging that Teck's project NO_x emissions predictions are conservative, the panel finds that the Frontier project effects on CAAQS achievement beyond the project disturbance area is small. The panel believes that NO_x mitigation is the most appropriate approach in managing for CAAQS.

[659] ECCC has indicated that Teck's project-only modelling scenario predicts numerous exceedances of the 2025 1-hour NO₂ CAAQS at cabins and places of interest within the local study area. The panel notes that the locations of these cabins and places of interest are either within the project disturbance area boundary itself or directly adjacent to the boundary. The panel finds that it is reasonable to expect receptor locations within or adjacent to the project disturbance area boundary to experience increased effects to air quality.

[660] The panel accepts that Teck's air quality assessment includes assumptions that result in conservative predictions for cumulative effects of the Frontier project. The panel acknowledges that predicted NO_x exceedances for the planned development case may be the result of conservative modelling assumptions and that such exceedances may not occur in the future as anticipated by modelling efforts. The panel also recognizes that Teck's modelling predictions for NO_x are based on the assumption that all of the mineable oil sands area mine fleets will be Tier IV compliant by 2025. This assumption raises some uncertainties regarding Teck's predictions as the use of Tier IV mine fleets by other operators is outside of Teck's control. The panel will make a recommendation to the Government of Alberta that it develop and implement a plan to facilitate the transition of the mine fleet in the mineable oil sands area to meet Tier IV standards.

[661] In the absence of broad adoption of Tier IV emission controls, the panel recognizes that NO_x emissions in the region have the potential to adversely affect critical AAAQO, CAAQS, and *LARP* thresholds for NO₂. The panel finds that the current monitoring system should provide sufficient warning of potential NO_x air quality issues in the region such that timely mitigation measures and adaptive management plans can be implemented. The panel is of the opinion that regional approaches to NO_x mitigation is the most appropriate approach in managing this potential scenario should it arise. The panel makes a recommendation to Alberta that that it develop and implement a plan to facilitate the transition of the mine fleet in the mineable oil sands area to meet Tier IV standards.

[662] The panel finds that if all of the facilities included in the planned development case proceed, predicted air quality effects associated with NO_x suggest that additional management actions to mitigate

effects may be required under the *AQMF* and *CAAQS* management mechanisms. The panel accepts that the *LARP* framework and *CAAQS* management are the logical approach to address this as a regional air quality issue.

Sulphur Dioxide (SO₂)

[663] Regional sulphur dioxide emissions have been a significant focus of monitoring and management in the mineable oil sands area. These emissions have the potential to affect a number of important environmental factors in the region, including contributions to acidifying emissions. SO₂ emissions are primarily attributed to upgrading facilities in the mineable oil sands area, where standalone oil sands mines are relatively small contributors.

Project Effects

Evidence

[664] Teck stated that SO₂ emissions for natural gas-fired stacks were calculated based on a natural gas sulphur content of 90 ppm, which is based on the maximum sulphur content of natural gas in Alberta's pipeline system. This is considered a conservative assumption as the actual sulphur content of natural gas is expected to be much lower. The mine fleet SO₂ emissions were based on the assumption that diesel sulphur content is 15 milligrams per kilogram (mg/kg).

[665] Teck stated that existing conditions SO₂ emissions are calculated to be 312.9 t/d and base case emissions are calculated to be 307.6 t/d. This represents a 1.7 per cent decrease from existing conditions. The reduction in base case emissions is the result of a SO₂ emission reduction program associated with one of the existing upgraders.

[666] The Frontier project SO₂ emissions total 1.54 t/d consists of 1.51 t/d from stack emissions and 0.03 t/d from mine fleet emissions. The base case SO₂ emissions total 307.6 t/d, which consists of 303.5 t/d from stack emissions, 3.4 t/d from mine fleet emissions, and 0.7 t/d from non-industrial emissions. The Frontier project represents a 0.50 per cent relative increase from the base case emissions.

[667] As a mitigation measure, Teck stated that mine fleet will use ultra-low-sulphur diesel fuel.

[668] ECCC submitted that sulphur emissions associated with upgrading should be included in Teck's analysis. The bitumen product from the Frontier project will need upgrading, where the upgrading process is a notable emitter of SO₂ emissions. If the upgrading is to take place near the Frontier project, ECCC believes that the SO₂ emissions are attributable to the Frontier project. ECCC acknowledges that there is uncertainty in whether or not bitumen from the Frontier project would be replacing depleting feedstock to the upgraders or if this would be additional feedstock.

Analysis and Findings

[669] SO₂ has historically been an important ambient air quality management issue in the mineable oil sands area, where oil sands upgraders are large SO₂ emitters. Teck's project emissions will be less than 0.5 per cent of application case SO₂ emissions. The project SO₂ emissions are minor, assuming low-sulphur fuel is used, when compared to neighbouring oil sands mines with integrated upgraders. The panel will require that Teck use low-sulphur natural gas and diesel fuels for all project operations and recommends that the Minister include the same mitigation measures in the decision statement under *CEAA 2012*.⁶⁴

[670] The panel accepts Teck's evidence that the projects 0.50 per cent relative increase from base case SO₂ emissions are negligible.

[671] SO₂ ambient standards are likely to become more stringent in the near future. The panel finds, even in this context, that the Frontier projects emissions are low and are not expected to result in exceedances of more stringent SO₂ emissions standards.

[672] Teck did not consider potential SO₂ emissions from upgrading or refining bitumen produced by the project as part of its assessment. These emissions would be most appropriately addressed at the location where future bitumen upgrading activities are located. At this point in time, it is unclear where the upgrading would occur.

[673] If upgrading were to occur at existing facilities within the mineable oil sands area or elsewhere, these facilities would have their own mitigation approaches and emission limits that would need to be met. The panel finds that SO₂ emissions associated with upgrading bitumen from the Frontier project are beyond the scope of this review.

Cumulative Effects

Evidence

[674] In the 2015 project update, Teck assessed the potential effects of SO₂ emissions. Teck stated that base case maximum 1-hour SO₂ concentrations within and along the project disturbance area boundary were predicted to be 40.9 µg/m³ and 40.7 µg/m³, respectively. The base case maximum 1-hour SO₂ in the local study area was predicted to be 177 µg/m³; this represents a decrease from the existing conditions case as it reflects the SO₂ emission reduction efforts associated with existing upgraders. The 1-hour SO₂ AAAQO is 450 µg/m³.

[675] The application case maximum 1-hour SO₂ concentrations within and along the project disturbance area boundary remain unchanged from the base case at 40.9 µg/m³ and 40.7 µg/m³, respectively. The application case maximum 1-hour SO₂ in the local study area was unchanged from the

⁶⁴ Draft *EPEA* Approval – Condition 4.1.27

base case at $177 \mu\text{g}/\text{m}^3$. Teck claims that the Frontier project does not make any substantive contributions to the application case local study area or regional study area maximum predictions, where the change from base case to application case is 0.005 per cent or less.

[676] The planned development case maximum 1-hour SO_2 concentrations within and along the project disturbance area boundary were predicted to be $45.8 \mu\text{g}/\text{m}^3$ and $46.6 \mu\text{g}/\text{m}^3$, respectively. Teck attributes this increase to emissions from adjacent mine developments.

[677] In the 2015 project update, Teck assessed the potential effects of SO_2 emissions. Teck stated that base case maximum 24-hour SO_2 concentrations within and along the project disturbance area boundary were both predicted to be $23.2 \mu\text{g}/\text{m}^3$. The base case maximum 24-hour SO_2 in the local study area was predicted to be $69.5 \mu\text{g}/\text{m}^3$; this represents a decrease from the existing case due to SO_2 emission reduction efforts associated with existing upgraders. The 24-hour SO_2 AAAQO is $125 \mu\text{g}/\text{m}^3$.

[678] The application case maximum 24-hour SO_2 concentrations within and along the project disturbance area boundary remain unchanged from the base case at $23.2 \mu\text{g}/\text{m}^3$. The application case maximum 1-hour SO_2 in the local study area was unchanged from the base case at $69.5 \mu\text{g}/\text{m}^3$. Teck claims that the Frontier project does not make any substantive contributions to the application case local study area or regional study area maximum predictions, where the change from base case to application case is 0.0004 per cent or less.

[679] The planned development case maximum 24-hour SO_2 concentrations within and along the project disturbance area boundary were both predicted to be $27.1 \mu\text{g}/\text{m}^3$. Teck attributes this increase to emissions from adjacent mine developments.

[680] In the 2015 project update, Teck assessed the potential effects of SO_2 emissions. Teck stated that base case maximum annual SO_2 concentrations within and along the project disturbance area boundary were predicted to be $2.02 \mu\text{g}/\text{m}^3$ and $2.03 \mu\text{g}/\text{m}^3$, respectively. The base case maximum annual SO_2 in the local study area was predicted to be $10.9 \mu\text{g}/\text{m}^3$. The annual SO_2 AAAQO is $20 \mu\text{g}/\text{m}^3$.

[681] In the application case, annual SO_2 predictions within and along the project disturbance area boundary slightly increase due to Frontier project SO_2 emission sources. The application case maximum annual SO_2 concentrations within and along the project disturbance area boundary remain unchanged from the base case at $3.81 \mu\text{g}/\text{m}^3$ and $2.41 \mu\text{g}/\text{m}^3$, respectively. The application case maximum annual SO_2 in the local study area was slightly increased from the base case at $11.0 \mu\text{g}/\text{m}^3$. To describe the spatial extent of the SO_2 increase, Teck stated that the area in the local study area where concentrations are predicted to be greater than $20 \mu\text{g}/\text{m}^3$ is 15 km^2 , which is a 0.7 per cent increase compared to the base case.

[682] The planned development case maximum 24-hour SO₂ concentrations within and along the project disturbance area boundary were predicted to be 4.06 µg/m³ and 2.71 µg/m³, respectively. Teck attributes this increase to emissions from adjacent mine developments.

[683] The *AQMF* uses a cumulative effects management approach at a regional level to proactively manage ambient SO₂. It contains a set of triggers and limits (ranging from levels 1 to 4) to which air quality is compared to, and when the triggers and limits are exceeded, a management response will be implemented. Teck stated that between 2009 and 2013, 1-hour measurements of existing condition in the region were as follows:

- Ambient SO₂ concentrations greater than the AAAQO only occurred at the Mannix industry station in 2010.
- Ambient SO₂ concentrations greater than the Lower Athabasca Regional Framework trigger 2 occurred at several of the industry stations, and only at the Fort McKay community station in 2013.
- The maximum concentrations are the lowest at the Fort Chipewyan station.

[684] Teck stated that between 2009 and 2013, annual measurements of existing condition in the region were as follows:

- All concentrations were less than the AAAQO, National Ambient Air Quality Objectives, or *AQMF* triggers at the monitoring stations.
- Ambient concentrations greater than the Fort McKay target occurred at the Mannix station in 2010.

[685] Teck provided a comparison of SO₂ predictions against the applicable CAAQS. The 1-hour SO₂ CAAQS is calculated from the three-year average of the 98th percentile of the daily maximum 1-hour average concentration, where the objective will be 183 µg/m³ in 2020 and 170 µg/m³ in 2025. The annual SO₂ value is calculated from the average over a single calendar year of all 1-hour average concentrations, where the objective will be 13 µg/m³ in 2020 and 10 µg/m³ in 2025.

[686] Along the project disturbance area boundary, the 98th percentile 1-hour SO₂ base case prediction is 43.5 µg/m³ and the application case prediction is 43.6 µg/m³. Outside the project disturbance area, but still within the local study area, the 98th percentile 1-hour SO₂ base case prediction is 213 µg/m³ and the application case prediction remains the same at 213 µg/m³.

[687] Along the project disturbance area boundary, the annual SO₂ base case prediction is 2.03 µg/m³ and the application case prediction is 2.41 µg/m³. Outside the project disturbance area, but still within the local study area, the annual SO₂ base case prediction is 10.9 µg/m³ and the application case prediction is 11.0 µg/m³.

[688] Teck notes that the Frontier project does not make any substantive contributions to the application case maximum values in the local study area and regional study area.

[689] Teck stated that the Frontier project does not make any substantive SO₂ contributions to the application case predictions in the local study area or the in the regional study area with respect to the CAAQS.

Analysis and Findings

[690] SO₂ emissions are an important cumulative effects issue in the mineable oil sands area and throughout the Lower Athabasca region. The panel recognizes that current SO₂ emissions are decreasing as the result of continuous improvement of oil sands upgrading in the region.

[691] The panel also notes that project SO₂ emissions are relatively small when compared to the application case and planned development case emission scenarios.

[692] The panel accepts Teck's modelling evidence that exceedances of regional air quality standards, due to project emissions, are not expected in the local study area or regional study area.

[693] Teck's analysis concludes that the model results are conservative as they tend to overpredict SO₂ concentrations.

[694] The panel finds that the Frontier projects contribution to cumulative effects of SO₂ in the local study area and regional study area are low or minimal.

Acid Deposition

[695] NO_x and SO₂ are the main contributors to forming acidifying pollutants in the atmosphere, which are subsequently deposited onto the terrestrial surface. Emitters of acidifying emissions in the mineable oil sands area can include emissions from upgraders, mine fleets, combustion equipment, and on-road transportation. The effects of acidifying emissions are cumulative in nature; the combined emissions from the region contribute to the acid deposition effects. If enough acid deposition occurs, the buffering capacity of soil and surface water ecosystems is overwhelmed and damage to the ecosystem can occur. Naturally occurring or anthropogenically deposited (such as dust from mining activity) base cations can neutralize acid deposition.

[696] The panel finds that given the cumulative nature of acidifying emissions, their effects are most appropriately addressed through a cumulative analysis rather than through a project-specific one.

Cumulative Effects

Evidence

[697] Teck stated in the project update that the CALPUFF model was used to predict potential acid input deposition from precursor emissions for the existing conditions, base case, application case, and planned development case. The acid-forming precursor emissions assessed were NO_x and SO₂, the

Frontier project increases the base case NO_x emission by 3.3 per cent and the base case SO₂ emissions by 0.5 per cent. The project update adopts recent base cation deposition measurements, which replaced the provincial-scale estimates used in the original integrated application. Base cation emissions from the base case, application case, and planned development case will likely be greater than those associated with existing conditions; therefore, adopting the existing conditions base cation values for the assessment cases is a conservative assumption.

[698] Teck stated in the project update that for the base case potential acid input predictions, positive potential acid input (implying acidification) depositions are predicted for the four northern grid cells, and negative potential acid input depositions are predicted for the eight southern grid cells. The average potential acid input deposition for the grid cell where the Frontier project is located is -0.4028 kiloequivalents of hydrogen ion deposition per hectare per year ($\text{keq H}^+ \text{ha}^{-1} \text{a}^{-1}$), where the potential acid input deposition for all regional study area grid cells are less than the most stringent deposition loading criteria ($0.17 \text{ keq H}^+ \text{ha}^{-1} \text{a}^{-1}$ monitoring load). There are areas totalling 150 km^2 within and near existing and approved operations where potential acid input is predicted to be greater than the $0.17 \text{ keq H}^+ \text{ha}^{-1} \text{a}^{-1}$ deposition load.

[699] For the application case, positive potential acid input depositions are predicted for the four northern grid cells, and negative potential acid input depositions are predicted for the eight southern grid cells. The average potential acid input deposition for the grid cell where the Frontier project is located is $-0.3940 \text{ keq H}^+ \text{ha}^{-1} \text{a}^{-1}$, where the average potential acid input for this grid cell has increased by 2.1 per cent due to additional precursor NO_x emissions. Potential acid input deposition for all regional study area grid cells are less than the most stringent deposition loading criteria ($0.17 \text{ keq H}^+ \text{ha}^{-1} \text{a}^{-1}$ monitoring load). There are isolated locations (150 km^2) within and near existing and approved operations predicts potential acid input is greater than the $0.17 \text{ keq H}^+ \text{ha}^{-1} \text{a}^{-1}$ deposition load, which represents a 14 per cent increase in spatial extent relative to the base case.

[700] Teck stated that the project update assessment predictions indicate that the risk of acidification appears to be mitigated by base cation deposition. The risk of acidification would increase if additional dust control at the mines reduces regional-scale base cation emissions without associated decreases in NO_x and SO₂ emissions.

[701] Teck stated that the updated predictions in the project update indicate that risk of acidification appears to be mitigated by base cation deposition. Teck also stated that the risk of acidification would increase if additional dust control at mines reduces regional-scale base cation emissions without associated decreases in SO₂ and NO_x emissions. Teck evaluated acidifying deposition predictions in a scenario with reduced base cation values, which resulted in peak potential acid input deposition values increasing in magnitude.

[702] Teck stated that potential acid input represents the sum of the sulphur substances (e.g., SO₂ and sulphate ion [SO₄²⁻]) and the nitrogen substances (e.g., nitrogen monoxide [NO], NO₂, nitric acid [HNO₃] and nitrite ion [NO₃⁻]) contributions minus the neutralizing effects of the base cation (e.g., calcium base cation [Ca²⁺] and magnesium base cation [Mg²⁺]) contribution. Teck stated that recent measurements indicate much greater base cation deposition in the oil sands region than previously assumed. Based on this recent information, subsequent studies have indicated that the risk of soil acidification is minimal due to these high levels of base cation deposition. Teck used base cation measurements to estimate a regional base cation deposition, where the total base cation deposition (throughfall) values ranged from an average of 0.68 keq H⁺ ha⁻¹ a⁻¹ for the distant sites (70 km to 129 km) to an average of 2.45 keq H⁺ ha⁻¹ a⁻¹ for the near sites (3 km to 29 km). The largest wet deposition of 6.11 keq H⁺ ha⁻¹ a⁻¹ occurred at a distance of 12 km.

[703] ECCC identified limitations in the modelling approach used by Teck to predict acid deposition, which point to uncertainty and underestimation of Teck's prediction of project effects. In ECCC's regional acid deposition assessment, its conclusions on acid deposition used the best available data, which was collected through recent research on acid depositions supported by the Oil Sands Monitoring Program. ECCC concluded that acid deposition resulting from 2013 emission levels of sulphur and nitrogen exceeds the ability of aquatic ecosystems in northern Alberta and Saskatchewan to sustainably buffer. ECCC further stated that the result is that ecosystem damage will occur at 2013 emission levels, and any additional acidifying emissions and transport into the ecosystem will increase exceedance to the critical load and result in ecosystem damage within a short timeframe, where the region at risk is approximately half the size of the province of Alberta.

[704] Teck stated that the potential acid input assessment accounts for NO_x and SO₂ emission sources both in and outside the Lower Athabasca region and for base cations. The updated assessment uses more recent and local ammonium and base cation deposition measurements by the Wood Buffalo Environmental Association. Teck stated that, as a consequence, high potential acid input deposition values are essentially confined to the development areas. The potential acid input values off site tend to be negative, indicating no acidification potential.

[705] ECCC stated that the Makar et al. (2018) study does not support Teck's overall acid deposition assessment in the project update (volume 3, section 4). The difference and resulting conclusion between Teck and ECCC's assessments is likely due to the difference in air quality model chosen, and the methodology used to assess ecosystem effects, the limitations of the Teck model to within 200 kilometres (km) of the surface facilities, and the lack of observation-based corrections in the Teck model predictions.

[706] Based on best available data (Makar et al., 2018), ECCC concludes that any additional acidifying emissions and transport into the ecosystems will increase critical load exceedances, and cause ecosystem damage to occur in a shorter timeframe.

[707] ECCC noted that the Teck assessment identifies that bitumen upgrading will not occur within the Frontier project area local study area. If this upgrading occurs at locations within atmospheric transport distances of the sensitive ecosystem of northern Alberta and Saskatchewan, emissions from the upgrading will also result in ecosystem damage. The net effect of the Frontier project on acidifying deposition may thus be greater than the local study area emissions noted in the Teck assessment. ECCC also notes that any new emission sources, such as the Frontier project, and including any associated upgrading within transport distance of sensitive ecosystem, will accelerate the rate at which ecosystem damage will occur.

[708] Teck maintained that measured pH data of acid-sensitive lakes collected by the Regional Aquatics Monitoring Program (RAMP), where 28 of the lakes exhibited a statistically significant increase in pH, is contrary to ECCC's assertion that lakes are acidifying.

[709] Teck stated that Makar et al. (2018) notes the base cation neutralization but stresses that it is limited to within 140 km of the centre of oil sands mines. The RAMP (2016) dataset clearly shows this limitation is not the case, with pH increasing in nearly all lakes from nearby the mines to up to 340 km away between 1999 and 2015.

[710] ECCC maintains that while the trend of the average and median for the entire period of data across all lakes is towards increased alkalinity, some lakes have nevertheless become more acidic. The number of lakes undergoing acidification, and the rate of acidification, has increased when the final six years of data are compared to the entire period of the RAMP (2016) dataset. The locations of the acidifying lakes are all within the regions predicted to be in exceedance of critical loads for sulphur deposition in Makar et al. (2018). The level of significance for the acidification of lakes has increased, comparing the entire period to the last six years of data.

[711] Teck stated that nitrogen deposition is directly related to the number of NO_x emission sources and the associated emission rates, where the Frontier project emissions increases base case NO_x emissions by 3.3 per cent. Teck stated that nitrogen deposition results from NO_x emission sources in the Lower Athabasca region and from emission sources located outside the region. And when near major emission sources, the predicted nitrogen deposition is strongly influenced by the Lower Athabasca region emissions and less by outside sources. Teck also stated that the more distance from the major sources, the influence of background due to sources located outside the region becomes more important.

Analysis and Findings

[712] Based on Teck's project update assessment on potential acid input, the panel acknowledges that the Frontier project is predicted to have a localized acid deposition effect near the project disturbance area but recognizes that much of the deposition would be neutralized by the base cations.

[713] Teck assumes base cation (from mining activity fugitive dust) neutralizes much of the acid deposition from the Frontier project. ECCC has expressed concerns relating to Teck's assertion, and if

regional fugitive dust is substantially mitigated in the future, there is uncertainty in whether or not the neutralization due to base cations will remain.

[714] ECCC submitted evidence that the location of lakes with measureable acidification are within regions predicted to be in exceedance of critical loads for sulphur deposition. The panel interprets this assertion of sulphur deposition as one of the key drivers for critical load exceedances, as predicted by ECCC. The panel also recognizes that the Frontier project is not a major sulphur emitter, but ECCC asserts that the Frontier projects effect due to upgrading of the product is not accounted for.

[715] ECCC submits that critical load exceedances are occurring or will eventually occur, but Teck maintains that acid-sensitive lakes are actually increasing in pH. The panel recognizes that the risks of critical load exceedances in the ecosystem are present, but there is limited evidence that acid-sensitive lakes are actually acidifying.

[716] The panel recognizes that there is uncertainty in the overall modelling methodology used by Teck and ECCC. Teck evaluates potential acid input as prescribed in the current *Alberta Acid Deposition Management Framework*, but ECCC submits data based on an internationally accepted approach of critical loads that differs from the framework.

[717] The panel finds that the base cation input from mining activity is mitigating acidification, but this mitigation may be negated with additional dust control in the region. The panel recognizes that there are varying opinions relating to the extent of base cation deposition in the region. The panel is of the opinion that, regardless of the extent of base cation deposition, reducing acidifying emission precursors (i.e., NO_x emissions) is essential to mitigate Frontier project acid deposition effects. The panel will require that Teck develop and implement an air quality mitigation, monitoring, and adaptive management plan that incorporates the management of acidifying emissions from the Frontier project.⁶⁵

[718] ECCC and Teck have differing model results and opinions on the Frontier project's effect to acid deposition. The panel finds that Teck's evidence, where the RAMP (2016) dataset of lakes up to 340 km away from the Frontier project (between 1999 and 2015), demonstrates that almost none of the lakes show signs of acidification.

[719] Based on evidence provided by ECCC, the panel recognizes that critical load exceedances in the mineable oil sands area is a potential risk. The panel finds that while the Frontier project has the potential to contribute to critical load exceedances, the magnitude of contribution is likely small.

[720] Soil and surface water acidification is currently being monitored through the Alberta Oil Sands Monitoring Program. Efforts should continue to analyze RAMP data for changing trends. The ongoing

⁶⁵ Draft *EPEA Approval* – Conditions 4.1.51 and 4.1.61

results of this monitoring and analysis should provide the basis for timely additional mitigation of acidifying emissions in the mineable oil sands area as necessary.

[721] The panel finds that the Frontier project's contribution to the cumulative effects of acid deposition will be limited in the local study area and regional study area.

Fine Particulate Matter and Secondary Organic Aerosols

[722] Fine particulate matter ($PM_{2.5}$) are particles of less than 2.5 μm in diameter. In the mineable oil sands area, $PM_{2.5}$ can be emitted from diesel exhaust, stack emissions, construction activity, fugitive dust from mining activity and roads, and secondary $PM_{2.5}$ can be formed in the atmosphere through chemical processes. $PM_{2.5}$ can have respiratory human health effects due to its fine size. As secondary $PM_{2.5}$ is formed downwind in the atmosphere from precursor emissions of various sources, the effects can be considered cumulative.

[723] Volatile organic compounds (VOCs), semivolatile organic compounds, and intermediate volatile organic compounds are precursors that undergo atmospheric processes to form small particles, referred to as secondary organic aerosols. Secondary organic aerosols can make up a component of $PM_{2.5}$ and its effects be considered cumulative, as the formation occurs downwind of emissions sources. In the mineable oil sands area, secondary organic aerosols precursors are emitted from mining and upgrading operations, which subsequently oxidize in the atmosphere and form a component of $PM_{2.5}$.

Project Effects

Evidence

[724] Teck stated that $PM_{2.5}$ due to construction activity is predicted to be 0.017 t/d during the peak construction year. Teck stated that construction dust will be mitigated by using measures that include selection of road materials, limiting vehicle speeds, and surface watering (or equivalent).

[725] Teck stated the Frontier project $PM_{2.5}$ emissions consist of 0.06 t/d from stacks, 0.17 t/d from mine fleet, and 0.33 t/d from fugitive dust. The total Frontier project emission rate of 0.56 t/d represents a 3.7 per cent increase from the base case $PM_{2.5}$ emissions. Mine fleet exhausts and fugitive dust from the mine fleet are the main sources of $PM_{2.5}$ emissions (30 per cent and 59 per cent, respectively).

[726] Teck stated that the Frontier project will be a source of direct $PM_{2.5}$ emissions in the form of primary $PM_{2.5}$ from combustion and fugitive dust sources. Secondary $PM_{2.5}$ can be formed by reactions in the atmosphere that produce sulphate and nitrate; in the project update, Teck assumes that secondary $PM_{2.5}$ contribution is in the form of ammonium sulphate and ammonium nitrate.

[727] Teck stated that the following fugitive dust mitigation measures would be used:

- appropriate road building materials

- enforced vehicle speed limits
- application of water or other dust suppression material
- progressive reclamation
- temporary vegetation of disturbed land
- retained natural or planted vegetation to provide windbreaks

[728] Teck stated that it plans to implement dust control measures as part of the Frontier project's dust management plan to manage fugitive dust emissions; however, a portion of the fugitive emissions will be transported and deposited outside the project disturbance area. Teck also stated that although these dust emissions can neutralize acidic emission contributions, the management of fugitive dust emissions remain a priority in terms of regional air quality.

Analysis and Findings

[729] The Frontier project $PM_{2.5}$ is from stack and mine fleet exhaust emissions and, to a large extent, from fugitive dust. The panel notes that the Frontier project $PM_{2.5}$ emissions would result in a relatively small increase of 3.7 per cent over base case emissions.

[730] In its project update, Teck evaluated secondary $PM_{2.5}$ contributions using the prescribed regulatory air model. There are technical limitations to the ability of the chosen regulatory model to accurately predict secondary particulate formation. The source of secondary particulates is driven by the atmospheric transformation of NO_x , SO_2 , and VOCs to form particulates downwind of the sources. The panel recognizes that secondary particulates can be managed by mitigating NO_x , SO_2 , and hydrocarbon emissions.

[731] With the consideration of organic aerosol contribution to $PM_{2.5}$, the CAAQS is only predicted to be exceeded in Fort McMurray, where the Frontier project effects are not expected to have a material effect relating to $PM_{2.5}$.

[732] The panel finds that stack and mine fleet vehicle exhaust particulate emissions are relatively well understood and can be measured or estimated with reasonable effort. Fugitive dust $PM_{2.5}$ emission estimates have greater uncertainties in how accurate and precise the fugitive dust emissions are predicted. The panel finds that mitigation of fugitive dust emissions is a viable approach to mitigating $PM_{2.5}$ effects. It will require Teck to develop and implement a dust management and mitigation plan that clearly identifies the potential sources of $PM_{2.5}$ and approaches to mitigation. The plan must include adaptive management measures in the event that soil and water chemicals of potential concern exceed predicted levels.⁶⁶

⁶⁶ Draft *EPEA* Approval – Condition 4.1.16

[733] While the panel finds that the effects of PM_{2.5} emissions from the Frontier project are low, it will require Teck to develop and implement an air quality mitigation, monitoring, and adaptive management plan that incorporates the management of PM_{2.5} and secondary organic aerosols precursors (including analytically unresolved hydrocarbons).⁶⁷

[734] The panel will also recommend to Alberta that a mitigation and management plan be developed under the *AQMF* to prevent the proliferation of secondary organic aerosols in the mineable oil sands area.

Cumulative Effects

Evidence

[735] Teck stated that the maximum 1-hour PM_{2.5} values near the Frontier project are predicted to be less than the 1-hour Alberta ambient air quality guideline (AAAQG) and maximum values elsewhere in the local study area are predicted to be greater than the 1-hour AAAQG (80 µg/m³); the Frontier project contribution to the local study area maximum is less than 0.02 per cent. The 1-hour PM_{2.5} along the project disturbance area boundary is predicted to be 21.9 µg/m³ for the base case, 56.0 µg/m³ for the application case, and 56.5 µg/m³ for the planned development case. The 1-hour PM_{2.5} local study area maximum is predicted to be 252 µg/m³ for the base case, application case, and planned development case.

[736] Teck stated that the maximum 24-hour PM_{2.5} values near the Frontier project and within the local study area are predicted to be greater than the 24-hour AAAQO (30 µg/m³). The predictions exceeding the AAAQO are limited to a small 5 km² region northeast of the project disturbance area boundary. Teck noted that the predicted exceedance is primarily due to the assumed fugitive dust emissions and the associated uncertainties in estimation. The predicted maximum at the project disturbance area boundary for the application case is consistent with predictions along other oil sands mine boundaries. The Frontier project contribution to the local study area maximum is less than 0.01 per cent. The 24-hour PM_{2.5} along the project disturbance area boundary is predicted to be 17.5 µg/m³ for the base case, 40.0 µg/m³ for the application case, and 40.5 µg/m³ for the planned development case. The 24-hour PM_{2.5} local study area maximum is predicted to be 122 µg/m³ for the base case, application case, and planned development case.

[737] Teck stated that the 98th percentile 24-hour PM_{2.5} values near the Frontier project, only for the planned development case, are predicted to be slightly greater than the 24-hour CAAQS (28 µg/m³). Teck notes that the planned development case conservatively includes two mine developments whose application have been withdrawn. The predicted maximum 98th percentile 24-hour PM_{2.5} values in the local study area are predicted to be greater than the 24-hour CAAQS; the Frontier project contribution to the local study area maximum is less than 0.04 per cent. The 98th percentile 24-hour PM_{2.5} along the project disturbance area boundary is predicted to be 14.5 µg/m³ for the base case, 27.7 µg/m³ for the application case, and 28.3 µg/m³ for the planned development case. The 98th percentile 24-hour PM_{2.5}

⁶⁷ Draft *EPEA* Approval – Condition 4.1.51

local study area maximum is predicted to be $62.2 \mu\text{g}/\text{m}^3$ for the base case, $62.3 \mu\text{g}/\text{m}^3$ for the application case, and $62.8 \mu\text{g}/\text{m}^3$ for the planned development case.

[738] Teck stated that the annual $\text{PM}_{2.5}$ values near the Frontier project are predicted to be less than the annual $\text{PM}_{2.5}$ CAAQS ($10 \mu\text{g}/\text{m}^3$). The predicted maximum annual $\text{PM}_{2.5}$ values in the local study area are predicted to be greater than the annual $\text{PM}_{2.5}$ CAAQS; the Frontier project contribution to the local study area maximum is less than 0.3 per cent. The annual $\text{PM}_{2.5}$ along the project disturbance area boundary is predicted to be $5.2 \mu\text{g}/\text{m}^3$ for the base case, $7.8 \mu\text{g}/\text{m}^3$ for the application case, and $8.0 \mu\text{g}/\text{m}^3$ for the planned development case. The annual $\text{PM}_{2.5}$ local study area maximum is predicted to be $16.6 \mu\text{g}/\text{m}^3$ for the base case, $16.6 \mu\text{g}/\text{m}^3$ for the application case, and $16.9 \mu\text{g}/\text{m}^3$ for the planned development case.

[739] ECCC stated that secondary organic aerosols precursors are specific VOCs called analytically unresolved hydrocarbons. These are a specific group of VOCs that have a low volatility and are efficient at producing secondary organic aerosols. ECCC stated that it is concerned that the specific group of analytically unresolved hydrocarbons will not be specifically mitigated by Teck.

[740] ECCC stated that secondary organic aerosols can make up a significant proportion of $\text{PM}_{2.5}$, which is known to have negative effects on air quality, human health, and climate. ECCC also stated that emissions of organic compounds contribute significantly to the formation of secondary organic aerosols downwind, which results in increased concentrations of organic aerosols and $\text{PM}_{2.5}$ far from the Frontier project site.

[741] Teck stated that using the estimated hydrocarbon emissions presented in the project update as a surrogate, the Frontier project could potentially increase the regional secondary organic aerosols precursor emissions by approximately 9 per cent, which is a first-order estimate based on available information. Teck also stated that secondary organic aerosols are an emerging issue that will benefit from additional research to improve scientific understanding of secondary organic aerosols precursor emission sources, secondary organic aerosols formation processes, and the significance of secondary organic aerosols formation downwind of the oil sands region. Teck maintains that the proposed mitigation measures to reduce Frontier project fugitive VOC emissions would also reduce secondary organic aerosols precursor emissions.

[742] ECCC stated that it disagrees with Teck's assessment that the contribution of secondary organic aerosols from the Frontier project is minor relative to regional $\text{PM}_{2.5}$ concentrations. The contribution of secondary organic aerosols can make up nearly 50 per cent of total $\text{PM}_{2.5}$ concentrations at locations close to precursor sources, and this contribution is expected to increase further away. ECCC also stated that the secondary organic aerosols will add cumulatively to direct emissions to particulate matter at nearby receptors, and as a result, Teck's modelled concentrations of $\text{PM}_{2.5}$ may be underestimated.

[743] ECCC stated that it considers secondary organic aerosols to be a large unaccounted source of $PM_{2.5}$ in Teck's assessment. This unaccounted-for source is exacerbated by the fact that Teck's model predictions show that nearby communities, such as Fort McMurray, are predicted to have $PM_{2.5}$ concentrations that approach or exceed CAAQS as a result of effects from both existing developments and the proposed project. ECCC also stated that it is not clear whether the proposed mitigation measures aimed at reducing VOC emissions will be effective at reducing secondary organic aerosols precursor emissions from the Frontier project. They maintain that mitigation of analytically unresolved hydrocarbons is necessary since they are the primary precursors for secondary organic aerosols formation.

Analysis and Findings

[744] Teck's project update assessment on $PM_{2.5}$ indicates that $PM_{2.5}$ effects are localized at or near the project disturbance area boundary. $PM_{2.5}$ emissions from the Frontier project appear to have relatively small effects throughout the local study area.

[745] The Frontier project is a potential source for secondary organic aerosols precursors, but the predicted secondary organic aerosols contribution to $PM_{2.5}$ was not clearly determined. Further research would be beneficial to understanding the sources and formation processes of secondary organic aerosols. The panel is of the opinion that mitigation of fugitive VOC emissions may help mitigate the formation of secondary organic aerosols from the Frontier project.

[746] The panel finds that the Frontier project $PM_{2.5}$ emissions have a relatively localized effect on ambient air quality.

[747] The panel recognizes that the Frontier project is a potential source of secondary organic aerosols precursors and that the resulting secondary organic aerosols can add to regional $PM_{2.5}$ concentrations. The panel also notes that ECCC stated that the secondary organic aerosols will add cumulatively to Teck's modelled concentrations of $PM_{2.5}$.

[748] The panel finds that a mitigation and management plan is needed to prevent the proliferation of secondary organic aerosols in the mineable oil sands area. Secondary organic aerosols are not solely attributed to the project and the panel is of the opinion that it should be managed on a regional basis by Alberta.

Recommendation to Government

[749] The panel recommends to Alberta that a mitigation and management plan be developed under the *LARP AQMF* to prevent the proliferation of secondary organic aerosols in the mineable oil sands area.

Total Suspended Particulates, Polycyclic Aromatic Compounds, and Metals

[750] Total suspended particulates consist of coarse particles that are often attributed to disturbance of crustal materials and fugitive dust from mining activity. Total suspended particulates can also be one of the primary contributors to metals and polycyclic aromatic compound deposition as a result of oil sands mining activity. Along with the ecosystem and health effects from polycyclic aromatic compounds and metals deposition, total suspended particulates can be a human respiratory concern and have effects on local visibility.

[751] Polycyclic aromatic compounds (PACs) are substances that can have harmful effects to biodiversity, the ecosystem, and human health. In the mineable oil sands area, mining fugitive emissions and stack emissions are the primary sources of industrial polycyclic aromatic compounds. Non-industrial sources of polycyclic aromatic compounds can include residential wood burning for heating and forest fires.

Project Effects

Evidence

[752] Teck stated that total suspended particulates emissions result from combustion sources and fugitive dust (including mine haul roads, quarries, and coke handling activities). It was assumed that total suspended particulates did not occur from other activities such as highway and community traffic. Fugitive total suspended particulates emissions from mine haul roads, quarries, and coke handling activities are also the main source of metal emissions. About 21 per cent of existing stack polycyclic aromatic compounds emissions are associated with mine upgrader stacks fuelled by coke.

[753] Teck stated that the base case total suspended particulates emissions total 72.8 t/d and consist of 9.9 t/d from stacks, 1.6 t/d from mine fleet, 59.4 t/d from fugitive dust, and 1.9 t/d from non-industrial sources. The Frontier project total suspended particulates emissions consist of 0.06 t/d from stacks, 0.17 t/d from mine fleet, and 10.83 t/d from fugitive dust. The total Frontier project emission rate of 11.06 t/d represents a 15 per cent increase from the base case total suspended particulate emissions.

[754] Teck stated that the base case polycyclic aromatic compounds emissions total 509.2 kg/d and consist of 153.2 kg/d from stacks, 6.1 kg/d from plant fugitives, 29.6 kg/d from mine fleet, 279.2 kg/d from mine face, 16.2 kg/d from fugitive total suspended particulates, and 24.9 kg/d from non-industrial sources. The Frontier project polycyclic aromatic compounds emissions consist of 3.45 kg/d from stacks, 0.48 kg/d from plant fugitives, 3.67 kg/d from mine fleet, 35.28 kg/d from mine face, and 3.06 kg/d from fugitive total suspended particulates. The total project emission rate of 45.94 kg/d represents a 9.0 per cent increase from the base case polycyclic aromatic compounds emissions. Teck predicts that most of the Frontier project polycyclic aromatic compounds emissions will be from mine face emissions.

[755] Teck stated that naphthalene is the only volatile polycyclic aromatic compounds assessed, and when naphthalene is excluded, the main sources of polycyclic aromatic compounds emissions are the mine fleet exhausts and stack emissions. Teck identified that naphthalene was the only polycyclic aromatic compounds emitted from the mine face. The total project polycyclic aromatic compounds emissions with naphthalene is 45.94 kg/d and without naphthalene is 6.84 kg/d.

[756] Teck included the following polycyclic aromatic compounds in its assessment: naphthalene, acenaphthene, fluorene, anthracene, phenanthrene, pyrene, fluoranthene, benzo(ghi)fluoranthene, methylfluoranthene, cyclopenta[cd]pyrene, benzo[a]anthracene, benzo(c)phenanthrene, chrysene, methylchrysene, benzo[a]fluoranthene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[j+k]fluoranthene, indeno[1,2,3-cd]pyrene, benzo[ghi]perylene, benzo(b)chrysene, dibenzo[a,h]anthracene, dibenzo[a,e]pyrene, aromatic C9-C16, and aromatic C17-C34.

[757] Teck stated that the base case metal emissions total 2633 kg/d and consist of 196.6 kg/d from stacks, 8.4 kg/d from mine fleet, 2390 kg/d from fugitive total suspended particulates, and 38.7 kg/d from non-industrial sources. The Frontier project metal emissions consist of 3.64 kg/d from stacks, 0.85 kg/d from mine fleet, and 446.82 kg/d from fugitive total suspended particulates. The total project emission rate of 451.31 kg/d represents a 17 per cent increase from the base case metal emissions. Teck predicts that most of the Frontier project metal emissions will be from fugitive total suspended particulates emissions.

[758] Teck stated that the highest metal emissions are associated with aluminum, zinc, manganese, and barium. The total Frontier project metal emissions with aluminum are 451.31 kg/d and without aluminum are 24.70 kg/d, where 426 kg/d of the aluminum emissions are associated with fugitive total suspended particulates dust.

[759] Teck included the follow metals in its assessment: aluminum (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium(Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), manganese (Mn), mercury (Hg), molybdenum (Mo), nickel (Ni), selenium (Se), silver (Ag), strontium (Sr), tin (Sn), thallium (Tl), vanadium (V), and zinc (Zn).

[760] Teck stated that the following fugitive dust mitigation measures would be used:

- appropriate road building materials
- enforced vehicle speed limits
- application of water or other dust suppression material
- progressive reclamation
- temporary vegetation of disturbed land
- retained natural or planted vegetation to provide windbreaks

[761] Teck stated that it plans to implement dust control measures as part of the Frontier project's dust management plan to manage fugitive dust emissions; however, a portion of the fugitive emissions will be transported and deposited outside the project disturbance area. Teck also stated that although these dust emissions can neutralize acidic emission contributions, the management of fugitive dust emissions remains a priority in terms of regional air quality.

[762] ECCC recommended that Teck implement a follow-up program to validate PACs and metal predictions to assess the accuracy of the application predictions, which would include monitoring a broad range of emissions, their deposition onto land and water, and the concentration of polycyclic aromatic compounds and metals in the receiving environment. ECCC also recommended that Teck develop follow-up programs and mitigation measures as part of an adaptive management strategy in the event that soil and water chemicals of potential concern levels exceed predictions.

Analysis and Findings

[763] The Frontier project is predicted to have notable emissions increase over the base case, where total suspended particulates emissions increase by 15 per cent, polycyclic aromatic compounds emissions increase by 9 per cent, and metals emissions increase by 17 per cent. The panel will also require that Teck develop and implement an air quality mitigation, monitoring, and adaptive management plan that incorporates the management of total suspended particulates, polycyclic aromatic compounds, and metals.⁶⁸

[764] The panel will require that Teck develop and implement an air quality mitigation, monitoring, and adaptive management plan that incorporates the management of total suspended particulates, polycyclic aromatic compounds, and metals.⁶⁹

[765] The panel notes Teck's dust control measures as part of the Frontier project's dust management plan to manage fugitive dust emissions. The panel also will require Teck to develop and implement a dust management and mitigation plan that clearly identifies the potential sources of total suspended particulates and approaches to mitigation.⁷⁰ The panel acknowledges that Teck has entered into participation agreements with Mikisew and Athabasca Chipewyan, which require working with indigenous groups on all plans required for the project, which the panel interprets to include the dust management and mitigation plan. While the panel is of the view that it is the AER's responsibility to determine the adequacy of, authorize, and enforce implementation of such plans, it supports the intent of the proposed conditions and commitments related to engagement and collaboration. The panel expects Teck to seek input from Mikisew, Athabasca Chipewyan, and, where appropriate, other indigenous

⁶⁸ Draft *EPEA* Approval – Condition 4.1.51

⁶⁹ Draft *EPEA* Approval – Condition 4.1.51

⁷⁰ Draft *EPEA* Approval – Condition 4.1.16

groups and make best efforts to incorporate their input into Teck's dust management and mitigation plan before submitting them to the AER for review or approval. As a condition of approval, the panel will require that Teck provide a summary of the outcomes of the engagement it has conducted related to the dust management and mitigation plan. The summary will identify the input it received, how it has been incorporated into the plan and any significant areas of non-agreement.⁷¹

Cumulative Effects

Evidence

[766] Teck stated that the AAAQG for total suspended particulates in industrial areas is 1922 kilograms per hectare per annum (kg/ha/a) and 645 kg/ha/a for residential areas. These values are converted from the AAAQG 30-day dustfall guidelines of 53 milligrams per 100 square centimetres (mg 100 cm⁻²) for residential and recreation areas and 158 mg 100 cm⁻² for commercial and industrial areas.

[767] For the base case, a maximum total suspended particulates deposition is predicted to be 890 kg/ha/a in the CNRL Horizon mine development area. About 4 km² of mine development area is associated with total suspended particulates deposition greater than 645 kg/ha/a, where no greater deposition occurs outside of the mine development areas.

[768] For the application case, a maximum total suspended particulates deposition of 2139 kg/ha/a is predicted to be in the project disturbance area, where the Frontier project contributes to a 140 per cent increase relative to the base case. About 8 km² of the mine development area is associated with total suspended particulates deposition greater than 645 kg/ha/a, where no greater deposition occurs outside of the mine development areas. This represents a 100 per cent increase relative to the base case.

[769] For the planned development case, a maximum total suspended particulates deposition of 2140 kg/ha/a is predicted to be in the project disturbance area, which represents a 140 per cent increase relative to the base case. About 14 km² of the mine development area is associated with total suspended particulates greater than 645 kg/ha/a, where no greater deposition occurs outside of the mine development areas.

[770] Teck stated that for the base case, a maximum polycyclic aromatic compounds deposition (without naphthalene) of 90.9 g/ha/a is predicted. An area of 1341 km² is predicted to have polycyclic aromatic compounds deposition greater than 5 g/ha/a.

[771] For the application case, a maximum polycyclic aromatic compounds deposition (without naphthalene) of 91.1 g/ha/a is predicted, which represents a 0.2 per cent increase relative to the base case.

⁷¹ Draft *EPEA* Approval – Condition 4.1.16

An area of 1520 km² is predicted to have polycyclic aromatic compounds deposition greater than 5 g/ha/a, where the project contributes a 13 per cent increase relative to the base case.

[772] For the planned development case, a maximum polycyclic aromatic compounds deposition (without naphthalene) of 93.4 g/ha/a is predicted, which represents a 2.8 per cent increase relative to the base case. An area of 1716 km² is predicted to have polycyclic aromatic compounds deposition greater than 5 g/ha/a, which represents a 28 per cent increase relative to the base case.

[773] Teck stated that for the base case, a maximum metal deposition of 38.3 g/ha/a is predicted. An area of 1086 km² is predicted to have metal deposition greater than 15 g/ha/a.

[774] For the application case, a maximum metal deposition of 38.3 g/ha/a is predicted, which does not change relative to the base case. An area of 1108 km² is predicted to have metal deposition greater than 15 g/ha/a, where the project contributes a 2 per cent increase relative to the base case.

[775] For the planned development case, a maximum metal deposition of 38.7 g/ha/a is predicted, which represents a 0.8 per cent increase relative to the base case. An area of 1264 km² is predicted to have metal deposition greater than 15 g/ha/a, which represents a 16 per cent increase relative to the base case.

[776] Teck stated that predicted polycyclic aromatic compounds deposition was of similar magnitude when compared to snowpack measurements, whereas predicted metal deposition may be understated. Both the modelled predictions and the snowpack measurements indicate a strong decrease of deposition rates with distance from the oil sands developments, which indicates that oil sands sources are a potential source of polycyclic aromatic compounds and metal deposition.

[777] Teck stated that the maximum total suspended particulates, polycyclic aromatic compounds, and metal depositions tend to occur on the respective development areas and decrease with increasing distance from these areas; given the location of the development areas, the higher deposition values have a north-south bias. Teck also stated that the addition of the Frontier project is predicted to result in high deposition values within the project disturbance area boundary and to extend the north-south bias further to the north.

Analysis and Findings

[778] Teck's project update assessment on total suspended particulates, polycyclic aromatic compounds, and metals indicates that effects are localized at or near the project disturbance area boundary. Total suspended particulates, polycyclic aromatic compounds, and metals emissions from the Frontier project appear to have relatively small effects throughout the local study area. The panel recognizes that the predicted project total suspended particulates do not exceed applicable dustfall standards.

[779] The panel finds that the Frontier project total suspended particulates, polycyclic aromatic compounds, and metals emissions have a relatively localized effect on ambient air quality. The panel also agrees with Teck that fugitive dust from the Frontier project needs to be effectively mitigated and managed.

Hydrocarbons and Reduced Sulphur Compounds

[780] Hydrocarbons include VOCs and polycyclic aromatic compounds. Hydrocarbons in the mineable oil sands area can be emitted by sources such as biogenic natural occurrence, industrial stacks, mine and plant fugitive emissions, and off-road and on-road vehicles. Hydrocarbons can be associated with perceived odour and human health effects and act as a precursor for atmospheric formation of other substances.

[781] Reduced sulphur compounds are substances that contain sulphur in a reduced state. Reduced sulphur compounds in the mineable oil sands area can be emitted by sources such as biogenic natural occurrence, industrial stacks, and mine and plant fugitive emissions. Reduced sulphur compounds are generally associated with strong odours that can be perceived at relatively low concentrations.

Project Effects

Evidence

[782] Teck stated that fugitive mine face and tailings areas are the main sources of hydrocarbon emissions (41 per cent and 37 per cent, respectively). The total Frontier project hydrocarbon emissions are 18.70 t/d, which consist of 0.57 t/d from stacks, 2.22 t/d from tank fugitives, 0.57 t/d process area fugitives, 0.72 t/d from mine fleet, 7.62 t/d from mine face fugitives, and 7.01 t/d from tailings management.

[783] Teck stated that the hydrocarbons considered in the air quality assessment included acetaldehyde, acrolein, benzene, benzo(a)pyrene, ethylbenzene, formaldehyde, n-hexane, styrene, toluene, and xylenes; these hydrocarbons have applicable AAAQOs. Other hydrocarbons were included in the human and wildlife health assessments.

[784] Teck stated that the Frontier project hydrocarbon emission totals are 0.0099 t/d for acetaldehyde, 0.0018 t/d for acrolein, 0.387 t/d for benzene, 0.049 kg/d for benzo(a)pyrene, 0.0032 t/d for ethylbenzene, 0.059 t/d for formaldehyde, 0.334 t/d for n-hexane, 0.023 t/d for styrene, 0.057 t/d for toluene, and 0.208 t/d for xylenes.

[785] Teck stated that the Frontier project fugitive hydrocarbon mitigation measures will include the following:

- Design the tailing solvent recovery unit to extract solvent from tailings in the froth treatment plant to maintain solvent losses to less than 4 volumes per 1000 volumes of bitumen produced.
- Use floating roof tanks where appropriate and a vapour recovery system to condense and recover vapours from tanks and process areas.
- Use dual solvent vapour recovery units to provide full redundancy in vapour recovery.

[786] Mikisew stated that Teck's air quality assessment may have potentially underestimated hydrocarbon emissions. Mikisew notes that hydrocarbon emissions from the Frontier project and other existing operations are underestimated, and a recent publication identified scaling factors to use.

[787] Teck stated that the reduced sulphur compounds considered in the air quality assessment included carbon disulphide (CS₂) and hydrogen sulphide (H₂S); these reduced sulphur compounds have applicable AAAQOs. Other reduced sulphur compounds were considered in the odour assessments.

[788] Teck stated that the Frontier project reduced sulphur compound emission totals are 8.32 kg/d for CS₂ and 2.02 kg/d for H₂S.

[789] Teck stated that fugitive mine face and tailings areas are the main sources of reduced sulphur compound emissions (75 per cent and 21 per cent, respectively). The total Frontier project reduced sulphur compound emissions are 47.24 kg/d, which consist of 0.01 kg/d from stacks, 1.86 kg/d from tank fugitives, 0.21 kg/d process area fugitives, 35.35 kg/d from mine face fugitives, and 9.81 kg/d from tailings management. The base case total reduced sulphur compound was estimated to be 3608 kg/d, where the Frontier project emissions would account for 1.3 per cent increase from base case reduced sulphur compound emissions.

[790] Teck stated that an updated odour assessment was conducted, which focused on predicting ambient concentrations of odour-causing substances at the communities of Fort Chipewyan, Fort McKay and Fort McMurray. 1-hour averages of individual odorants were predicted for these communities and combined into a dimensionless odour unit value to determine odour potential.

[791] Teck evaluated three odorant groups: The first contained NO_x and SO₂. The second contained the hydrocarbons acetaldehyde, acrolein, benzaldehyde, and naphthalene. The third group contained 11 reduced sulphur compounds: carbon disulphide, hydrogen sulphide, pentyl mercaptan, isobutyl mercaptan, methyl ethyl disulphide, methyl mercaptan, carbonyl sulphide, allyl sulphide, dimethyl disulphide, dimethyl sulphide, and a thiophene group.

[792] Teck stated that emission rates do not include intermittent, short-term events associated with large odorant emission rates. These events can be associated with upgrading facilities, diverter stacks, large flow rate upset/emergency flaring, and tailings activities.

[793] Teck stated that project odorant emission rates consisted of 20.94 t/d NO_x, 1.54 t/d SO₂, 0.052 t/d hydrocarbon compounds, and 32.7 kg/d reduced sulphur compound. The base case emission rates consisted of 631.9 t/d NO_x, 307.6 t/d SO₂, 1.347 t/d hydrocarbon compounds, and 3120 kg/d reduced sulphur compound. Compared to base case emissions, the Frontier project is predicted to increase NO₂ and SO₂ emissions by 3.3 per cent and 0.50 per cent, respectively. Hydrocarbon compound odorant emissions increase by 3.9 per cent; and reduced sulphur compound odorant emissions increase by 1.1 per cent.

Analysis and Findings

[794] The mine face accounts for 41 per cent of Frontier project hydrocarbon emissions and 75 per cent of Frontier project reduced sulphur compound emissions. The panel understands that mine face emissions are a result of hydrocarbon and reduced sulphur compound vapours being directly emitted by the exposed bitumen mine face.

[795] The tailings management facilities account for 37 per cent of the hydrocarbon emissions and 21 per cent of the reduced sulphur compound emissions. The panel understands that a portion of tailings management facility emissions are a result of unrecovered solvent being released to tailing ponds.

[796] The Frontier project has the potential to increase the emission of odorous substances to the air. In comparison to the base case emissions, the Frontier project hydrocarbon compound and reduced sulphur compound odorant emissions will increase by 3.9 per cent and 1.1 per cent, respectively.

[797] The Frontier project mine face is predicted to be the most substantial source group for hydrocarbon and reduced sulphur compound emissions. The panel recognizes that there may be feasibility and logistical challenges in managing mine face fugitive emissions. The panel finds that through the Frontier project mine development planning process, Teck should strive to minimize the exposed bitumen mine face.

[798] The Frontier project tailings management facilities are also a notable source group for hydrocarbon and reduced sulphur compound emissions. The panel has required a more stringent solvent recovery factor than that which Teck applied for. It has required Teck to achieve a tailings solvent recovery unit target of 3 volumes per 1000 volumes of bitumen.⁷² This requirement is expected to help mitigate project emissions of hydrocarbons and reduced sulphur compounds.

⁷² Draft *OSCA* Approval – Conditions 28 and 29; Draft *EPEA* Approval – Conditions 4.1.7 and 4.1.34

[799] The panel recognizes that uncertainties exist regarding the estimation and quantification of the mine face and tailings management facility area fugitive emissions. It will require Teck to minimize the exposed bitumen mine face when creating the Frontier project mine development plan.⁷³

[800] The panel finds that improved quantification of these area fugitive sources is needed. The panel will require that Teck develop and implement a hydrocarbon and reduced sulphur compound annual monitoring program that identifies and measures all sources.⁷⁴

[801] The panel notes that the Frontier project hydrocarbon and reduced sulphur compound emissions may increase the potential for odour effects. It will require that Teck develop and implement an air quality mitigation, monitoring, and adaptive management plan that incorporates the management of hydrocarbons, reduced sulphur compounds, and odours.⁷⁵ The panel finds that the mitigation of hydrocarbons and reduced sulphur compounds should also mitigate the odour potential.

Cumulative Effects

Evidence

[802] Teck stated that the maximum 1-hour application case acetaldehyde concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are 2.9 $\mu\text{g}/\text{m}^3$, 2.3 $\mu\text{g}/\text{m}^3$ and 6.9 $\mu\text{g}/\text{m}^3$, respectively, which are less than the 1-hour AAAQO of 90 $\mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are very low.

[803] Teck stated that the maximum 1-hour application case acrolein concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are 0.76 $\mu\text{g}/\text{m}^3$, 0.72 $\mu\text{g}/\text{m}^3$ and 1.1 $\mu\text{g}/\text{m}^3$, respectively, which are less than the 1-hour AAAQO of 4.5 $\mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are very low relative to the base case.

[804] Teck stated that the maximum 24-hour application case acrolein concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are 0.22 $\mu\text{g}/\text{m}^3$, 0.21 $\mu\text{g}/\text{m}^3$ and 0.35 $\mu\text{g}/\text{m}^3$, respectively, which are less than the 24-hour AAAQO of 0.40 $\mu\text{g}/\text{m}^3$. The Frontier project contribution can be considered very low, as the application case predictions are essentially the same as the base case predictions.

⁷³ Draft *EPEA* Approval – Condition 4.1.21

⁷⁴ Draft *EPEA* Approval – Condition 4.1.10

⁷⁵ Draft *EPEA* Approval – Condition 4.1.51

[805] Teck stated that the maximum 1-hour application case benzene concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.6 \mu\text{g}/\text{m}^3$, $6.8 \mu\text{g}/\text{m}^3$ and $2.4 \mu\text{g}/\text{m}^3$, respectively, which are less than the 1-hour AAAQO of $30 \mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are low relative to the base case.

[806] Teck stated that the maximum annual application case benzene concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.35 \mu\text{g}/\text{m}^3$, $0.7 \mu\text{g}/\text{m}^3$ and $0.5 \mu\text{g}/\text{m}^3$, respectively, which are less than the 24-hour AAAQO of $3 \mu\text{g}/\text{m}^3$. The Frontier project contribution can be considered low.

[807] Teck stated that the maximum annual application case benzo(a)pyrene concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.025 \text{ ng}/\text{m}^3$, $0.18 \text{ ng}/\text{m}^3$ and $0.05 \text{ ng}/\text{m}^3$, respectively, which are less than the 24-hour AAAQO of $0.126 \text{ ng}/\text{m}^3$. The Frontier project contribution can be considered low.

[808] Teck stated that the maximum 1-hour application case ethylbenzene concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.08 \mu\text{g}/\text{m}^3$, $1.3 \mu\text{g}/\text{m}^3$ and $0.8 \mu\text{g}/\text{m}^3$, respectively, which are less than the 1-hour AAAQO of $2000 \mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are very low relative to the base case.

[809] Teck stated that the maximum 1-hour application case formaldehyde concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $2.5 \mu\text{g}/\text{m}^3$, $2.3 \mu\text{g}/\text{m}^3$ and $5.6 \mu\text{g}/\text{m}^3$, respectively, which are less than the 1-hour AAAQO of $65 \mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are very low relative to the base case.

[810] Teck stated that the maximum 1-hour application case hexane concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.3 \mu\text{g}/\text{m}^3$, $4.7 \mu\text{g}/\text{m}^3$ and $6.1 \mu\text{g}/\text{m}^3$, respectively, which are less than the 1-hour AAAQO of $21\ 000 \mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are 9.3 per cent, 0.3 per cent and 0.06 per cent, respectively.

[811] Teck stated that the maximum 24-hour application case hexane concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.3 \mu\text{g}/\text{m}^3$, $2.1 \mu\text{g}/\text{m}^3$ and $3.7 \mu\text{g}/\text{m}^3$, respectively, which are less than the 24-hour AAAQO of $7000 \mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 24-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are 6.4 per cent, 0.3 per cent and 0.09 per cent, respectively.

[812] Teck stated that the maximum 1-hour application case styrene concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.02 \mu\text{g}/\text{m}^3$, $0.2 \mu\text{g}/\text{m}^3$ and $0.2 \mu\text{g}/\text{m}^3$, respectively, which are less than the 1-hour AAAQO of $215 \mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are low relative to the base case.

[813] Teck stated that the maximum 1-hour application case toluene concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.9 \mu\text{g}/\text{m}^3$, $3.7 \mu\text{g}/\text{m}^3$ and $5.4 \mu\text{g}/\text{m}^3$, respectively; which are less than the 1-hour AAAQO of $1880 \mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are low relative to the base case.

[814] Teck stated that the maximum 24-hour application case toluene concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.5 \mu\text{g}/\text{m}^3$, $2.2 \mu\text{g}/\text{m}^3$ and $2.3 \mu\text{g}/\text{m}^3$, respectively, which are less than the 24-hour AAAQO of $400 \mu\text{g}/\text{m}^3$. The Frontier project contribution can be considered low.

[815] Teck stated that the maximum 1-hour application case xylene concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.5 \mu\text{g}/\text{m}^3$, $6.6 \mu\text{g}/\text{m}^3$ and $3.4 \mu\text{g}/\text{m}^3$, respectively, which are less than the 1-hour AAAQO of $400 \mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are low relative to the base case.

[816] Teck stated that the maximum 1-hour application case CS_2 concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $2.5 \mu\text{g}/\text{m}^3$, $2.7 \mu\text{g}/\text{m}^3$ and $2.6 \mu\text{g}/\text{m}^3$, respectively, which are less than the 1-hour AAAQO of $30 \mu\text{g}/\text{m}^3$. The predicted values are dominated by the assumed background concentration of $2.46 \mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are low relative to the base case.

[817] Teck stated that the maximum 1-hour application case H_2S concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.007 \mu\text{g}/\text{m}^3$, $0.09 \mu\text{g}/\text{m}^3$ and $0.04 \mu\text{g}/\text{m}^3$, respectively, which are less than the 1-hour AAAQO of $14 \mu\text{g}/\text{m}^3$. The predictions indicate that the Frontier project contribution to the maximum 1-hour values in Fort Chipewyan, Fort McKay, and Fort McMurray are low relative to the base case.

[818] Teck stated that the maximum 24-hour application case H_2S concentrations predicted in Fort Chipewyan, Fort McKay, and Fort McMurray are $0.003 \mu\text{g}/\text{m}^3$, $0.04 \mu\text{g}/\text{m}^3$ and $0.02 \mu\text{g}/\text{m}^3$, respectively, which are less than the 24-hour AAAQO of $4 \mu\text{g}/\text{m}^3$. The Frontier project contribution can be considered low.

[819] For the community of Fort Chipewyan, Teck identified that peak acetaldehyde is predicted to have an odorant base case concentration of $4.21 \mu\text{g}/\text{m}^3$, which exceeds the detection threshold of $2.7 \mu\text{g}/\text{m}^3$ and recognition threshold of $15 \mu\text{g}/\text{m}^3$. The application case and planned development case values are the same as the base case, indicating that the Frontier project is not predicted to increase the frequency of odour detection.

[820] For the community of Fort McKay, Teck identified that peak NO_2 is predicted to have odorant base case and application case concentrations of $275 \mu\text{g}/\text{m}^3$, which exceeds the detection threshold of $226 \mu\text{g}/\text{m}^3$. The peak thiophene group is predicted to have odorant base case and application case concentrations of $8.41 \mu\text{g}/\text{m}^3$, which exceeds the detection threshold of $6.0 \mu\text{g}/\text{m}^3$. The application case is the same as the base case for both NO_2 and the thiophene group, indicating that the Frontier project is not predicted to increase the frequency of odour detection.

[821] For Fort McMurray, Teck identified that peak NO_2 is predicted to have odorant base case and application case concentrations of $322 \mu\text{g}/\text{m}^3$, which exceeds the detection threshold of $226 \mu\text{g}/\text{m}^3$. Peak acetaldehyde is predicted to have odorant base case and application case concentrations of $24.7 \mu\text{g}/\text{m}^3$, which exceeds the detection threshold of $2.7 \mu\text{g}/\text{m}^3$ and recognition threshold of $15 \mu\text{g}/\text{m}^3$. The application case is the same as the base case for both NO_2 and the thiophene group, indicating that the Frontier project is not predicted to increase the frequency of odour detection.

[822] Teck stated that all odorants were considered collectively as an odour unit, where an odour unit concentration was calculated for each odorant and combined to determine a total odour unit concentration. In assessing the regional odour unit, Teck found that the area to the south of the Frontier project, where odours are predicted to occur in the base case, is essentially unchanged due to the project. The influence of the Frontier project on odours is limited to within and near the project disturbance area boundary. The recognition threshold due to the Frontier project emissions is confined to the project disturbance area. The detection threshold due to Frontier project emissions extends slightly beyond the project disturbance area to the south and to the north. Teck concludes that in the area assessed, the most sensitive population members might be able to detect an odour.

[823] Teck stated that its odour assessment indicated the three odorants of potential concern are NO_2 , acetaldehyde, and the thiophene group. Acetaldehyde is likely attributed to community emission sources, where the thiophene group is from upgrading facilities, and NO_2 emissions are influenced by both community and industrial emissions. The odour contribution of the Frontier project appears to be confined within the project disturbance area boundary for the recognition threshold and slightly beyond the project disturbance area boundary for the detection threshold.

[824] Teck stated that it will apply prudent operating practices to manage odorous emissions. Teck also identified that an ongoing communication protocol between operators and community members needs to be established to work within or improve any existing odour management plans.

Analysis and Findings

[825] Of the hydrocarbons assessed by Teck, the panel notes that all hydrocarbons except for hexane had little to no effect on Fort Chipewyan, Fort McKay, and Fort McMurray. Hexane was predicted to have a relative change from the base case, but the predicted concentrations are well below the applicable AAAQO.

[826] Off-site effects of reduced sulphur compounds are not predicted to be substantial. The thiophene group is predicted to be an odorant of potential concern in the region, but the Frontier project is unlikely a large contributor to the thiophene group far beyond the project disturbance area. Modelling predicts application case thiophene group concentration to be $8.41 \mu\text{g}/\text{m}^3$, which is unchanged from the base case concentration of $8.41 \mu\text{g}/\text{m}^3$.

[827] The panel finds that the Frontier project hydrocarbon, reduced sulphur compounds, and odorant emissions have a relatively localized effect on ambient air quality. The panel is of the opinion that the cumulative effects of hydrocarbons, reduced sulphur compounds, and odorants can be managed through an air quality mitigation, monitoring, and adaptive management plan.

[828] The panel finds that, based on the odorants evaluated, the Frontier project odour effects are localized near the project disturbance area boundary and unlikely to substantially increase the odour potential risk for the mineable oil sands region.

Wood Buffalo National Park and Peace-Athabasca Delta

[829] The Frontier project is about 30 km south of the Wood Buffalo National Park border. Through aerial deposition of particles containing contaminants such as polycyclic aromatic hydrocarbons (PAHs), nitrogen oxides, and sulphates, the Frontier project has the potential to affect the Wood Buffalo National Park and the Peace-Athabasca Delta ecosystem. As Wood Buffalo National Park and Peace-Athabasca Delta are relatively distant from the Frontier project, the effects of the Frontier project are intermingled with other emission sources and can be considered cumulative.

Cumulative Effects

Evidence

[830] Parks Canada submitted a mission report for the reactive monitoring mission to Wood Buffalo National Park, conducted by the UNESCO World Heritage Centre. The mission report stated that the Frontier project would move development closer to the southern boundary of Wood Buffalo National Park than any other project, thereby also closer to the Peace-Athabasca Delta. Atmospheric deposition of particles containing contaminants such as PAHs, nitrogen oxides, and sulphates can have potential effects.

[831] Parks Canada submitted a strategic environmental assessment of Wood Buffalo National Park World Heritage Site. The assessment identified that a number of peer-reviewed studies demonstrate that

numerous toxic metals and polycyclic aromatic compounds are currently deposited within 50–75 km of major oil sands developments. These contaminants originate from bitumen upgrading and fugitive dust (from open pit mines, tailings pods, and haul roads). The authors of these studies suggest that metals and polycyclic aromatic compounds deposition in the Peace-Athabasca Delta are near background levels. These studies also imply that new oil sands developments will generate metals and polycyclic aromatic compounds emissions that will also be deposited on the landscape within 50–75 km of these new developments.

[832] The assessment further stated that air quality studies indicate oil sands developments have the potential to cause critical load exceedances. ECCC used a model to predict ecosystem effects in northern Alberta and Saskatchewan, which included parts of Wood Buffalo National Park. The model predictions demonstrated that sulphur and nitrogen compounds can be carried far downwind from the sources, chemically transformed, deposited, and potentially cause ecosystem damage. The model predictions also showed critical load exceedances within Wood Buffalo National Park for terrestrial ecosystems along the southwestern border, aquatic ecosystems from sulphur deposition in the south and southwestern portions of Wood Buffalo National Park, and aquatic ecosystems throughout Wood Buffalo National Park.

[833] The assessment also noted that other studies have reported that no evidence that oil sands emissions have resulted in trace element deposition beyond 50 km and that mercury deposition appears to reflect global atmospheric mercury emissions. Other authors point out that there is no measurable evidence of related far-field airborne metal contamination in the Peace-Athabasca Delta, which is located approximately 200 km north of industry.

[834] The assessment stated that a recent report indicated that aerial deposition of fugitive dust particles and aerosols from oil sands mines, coke piles, and stacks can result in snowmelt that is toxic to larval fish, but the dilution of contaminants in snow as it melts in the spring and mixes with river water is currently sufficient to confer a protective effect for larval fish in local rivers.

[835] The assessment further stated that the Frontier project is located within 30 km of the Wood Buffalo National Park border and has the potential to increase risk to air quality of Wood Buffalo National Park. The authors believed the current downward air quality trend (i.e., reduced quality) is relatively weak. They note that the Frontier project is currently being reviewed, and mitigation measures are not known for the Frontier project. The effect the air quality trend will have on the outstanding universal value of Wood Buffalo National Park is unknown.

[836] Teck stated that the air quality regional study area in the project update includes the Peace-Athabasca Delta and a large portion of Wood Buffalo National Park. Teck maintains that the air quality assessment for the Peace-Athabasca Delta as submitted in the original application remains unchanged. The original application stated that air quality in the Peace-Athabasca Delta can be viewed as being representative of a rural remote location, also referred to as a regional background location. Slight

changes in air quality will be expected in the Peace-Athabasca Delta because of future oil sands developments and the air quality in the Peace-Athabasca Delta is expected to be still regarded as background.

[837] Teck stated that potential acid input predictions for the Peace-Athabasca Delta and Wood Buffalo National Park are less than the most stringent monitoring load for sensitive receptors (less than $0.17 \text{ keq H}^+ \text{ ha}^{-1} \text{ a}^{-1}$). Potential acid input in the Peace-Athabasca Delta was predicted to be 0.004 to $0.020 \text{ keq H}^+ \text{ ha}^{-1} \text{ a}^{-1}$ for the base case, 0.004 to $0.021 \text{ keq H}^+ \text{ ha}^{-1} \text{ a}^{-1}$ for the application case, and 0.007 to $0.026 \text{ keq H}^+ \text{ ha}^{-1} \text{ a}^{-1}$ for the planned development case.

[838] Teck stated that nitrogen deposition values are predicted to be less than the lower (5 kg N/ha/a) and upper (10 kg N/ha/a) critical load limits for boreal forests. Nitrogen deposition in the Peace-Athabasca Delta was predicted to be 1.2 to 2.4 kg N/ha/a for the base case, 1.3 to 2.4 kg N/ha/a for the application case, and 1.4 to 2.4 kg N/ha/a for the planned development case.

[839] Teck stated that although cumulative ambient air quality changes from oil sands emissions might be measureable in the Peace-Athabasca Delta and Wood Buffalo National Park area for some air quality parameters, the levels are much lower than ambient air quality criteria; therefore, adverse effects due to the Frontier project are not anticipated.

[840] Teck stated that polycyclic aromatic compounds and metal deposition decreases with increasing distance from oil sands developments, where air quality modelling indicates deposition in the Peace-Athabasca Delta is equivalent to background levels. Teck referenced a study that indicates no measurable evidence of related far-field airborne metal contamination in the Peace-Athabasca Delta located approximately 200 km to the north, where measureable deposition was influenced by early North American industrial activity. Another study was referenced which concludes that the Peace-Athabasca Delta can be considered representative of background PACs deposition for the oil sands region, based on the collection and analysis of snow samples. Teck stated that these studies support the conclusion that no adverse effects due to the oil sands air emissions are currently occurring or anticipated in Wood Buffalo National Park and Peace-Athabasca Delta.

Analysis and Findings

[841] Evidence exists that indicates there are aerial deposition effects to the Peace-Athabasca Delta and Wood Buffalo National Park from existing oil sands operations and some evidence which fails to find effects. However, the panel believes there is uncertainty as to when this deposition occurred and the origin of the deposited substances (i.e., did deposition occur in early industrial eras where air pollution abatement technology was non-existent).

[842] Teck evaluated the potential effects of the Frontier project on the Peace-Athabasca Delta and Wood Buffalo National Park. Its assessment predicts relatively small aerial deposition of Frontier project emissions.

[843] Given the proximity of the Frontier project to Wood Buffalo National Park and the Peace-Athabasca Delta, the panel finds that there is a potential for the Frontier project to increase some air quality parameters in the Peace-Athabasca Delta and Wood Buffalo National Park. The panel is of the opinion that ongoing efforts towards mitigating emission sources that have the potential to affect the Peace-Athabasca Delta and Wood Buffalo National Park through aerial deposition will help minimize any potential impacts to the Peace-Athabasca Delta and Wood Buffalo National Park.

Significance Determination for Project Effects

[844] Air quality has been a significant focus of regulatory development and monitoring in the mineable oil sands area of the Lower Athabasca region. An air quality management framework has been established under *LARP*. Continuous monitoring is conducted at a number of locations in the region to determine the status of air quality regarding limits and triggers established under the framework and compliance with AAAQO regulatory objectives. Mitigation measures are initiated by operators to address regional air quality concerns—for example, modifying a bitumen upgrader to reduce overall regional sulphur dioxide emissions.

Project Effects

[845] Adverse effects of the Frontier project on air quality are likely. The Frontier project will result in a low or medium increase in emissions of importance in the region.

[846] The magnitude of cumulative effects will be low to medium for emissions. While some exceedances of AAAQO have been recorded in the last five years, emissions from the Frontier project are not expected to result in incremental AAAQO exceedances or *AQMF* level 4 triggers in the local study area or regional study area or Wood Buffalo National Park.

- For nitrogen oxides and sulphur oxides, the emissions are not expected to exceed air quality objectives in most instances, and the magnitude of effects are predicted to be medium for NO_x and low for SO₂.
- Acid deposition levels are predicted to be relatively small and the magnitude is determined to be low.
- Fine particulate matter and secondary organic aerosols (PM_{2.5}) levels are expected to be relatively localized and of medium magnitude.
- Emissions of total suspended particulates, polycyclic aromatic compounds, and metals are expected to affect areas within or at the project disturbance area boundary. The Frontier project contribution to

emissions in the local study area is expected to be small. The magnitude of effects of emissions are determined to be medium.

- Hydrocarbons and reduced sulphur compounds and odorous emissions are expected to have a relatively localized impact near the Frontier project boundary and are unlikely to substantially increase the potential odour risk for the mineable oil sands region. The magnitude of effects on air quality is determined to be medium.
- Wood Buffalo National Park air quality levels are predicted to be much lower than ambient air quality criteria. The magnitude of effects on air quality is determined to be low.

[847] The geographic extent is local or regional. Effects of emissions are predicted to occur in the local or regional study areas depending on the emission being considered.

[848] The duration is medium. Effects of emissions on air quality will occur only during operations.

[849] The frequency will be continuous. Effects are expected to occur throughout the 40 year operational life of the project.

[850] The effects are reversible in the future. Measurable effects are expected to return to levels similar to pre-project levels following cessation of operations.

Cumulative Effects

[851] The addition of the Frontier project emissions to the regional airshed is predicted to result in small changes to air quality prediction throughout the air modelling domain.

[852] For NO₂ impacts beyond the project disturbance area boundary, the impacts are expected to be relatively small. The panel finds that the Frontier project has limited potential to increase NO₂ air quality impacts on a cumulative effects basis. Beyond the project disturbance area boundary, modelling results indicate that the Frontier project will not make a substantive contribution to maxima levels predicted in the domain. The cumulative effects of NO₂ on air quality is medium.

[853] SO₂ emissions from the Frontier project are low in contrast to application and planned development cases. The incremental effects on air quality are expected to be negligible. The cumulative effects of SO₂ on air quality is low.

[854] Teck maintained that the effects of acid deposition are being mitigated by base cation deposition as most lakes being monitored show increasing pH levels. The panel finds that the magnitude of cumulative effects of acidification from the Frontier project is low.

[855] Fine particulate and secondary organic aerosol emissions are a potential source of secondary organic aerosols precursors that can add to regional PM_{2.5} concentrations. Teck maintains that the effects of PM_{2.5} will be local. ECCC maintains that these emissions include secondary organic aerosols

precursors which can have regional effects. The magnitude of cumulative effects of fine particulate and secondary organic aerosol emissions is determined to be low.

[856] Teck stated that effects of polycyclic aromatic compounds, metals, and total suspended particulates are localized and emissions outside the project disturbance area are limited. The magnitude of cumulative effects from the Frontier project is determined to be low.

[857] The project will increase the potential for odours from hydrocarbons and reduced sulphur compounds, but the effects are expected to be localized. The Frontier project is unlikely to substantially increase the potential odour risk for the mineable oil sand region. The magnitude of cumulative effects from these emissions is determined to be medium.

[858] Teck maintained that the emissions from the Frontier project may be detectable at Wood Buffalo National Park and the Peace-Athabasca Delta, but levels will be significantly below air quality criteria, and no adverse effects are anticipated. The magnitude of cumulative effects from the Frontier project is determined to be medium.

Analysis and Findings

[859] In making its determination the panel has relied on Teck's analysis of cumulative effects to air quality. It finds that the project is not likely to contribute to significant cumulative air quality effects in the mineable oil sands area or air quality modelling domain. While the Frontier project will result in some increases in emissions in the area, the magnitude of effects will be low or medium. The predicted effects are based on a number of conservative modelling inputs, which provides an additional level of confidence that the results reflect a conservative or worst-case scenario.

[860] To ensure the magnitude of project effects remain low or medium, the panel requires the installation and operation of an ambient air quality monitoring station to measure project effects.⁷⁶ The panel acknowledges that Teck has entered into participation agreements with Mikisew and Athabasca Chipewyan, which require working with indigenous groups on the placement of the aforementioned ambient air quality monitoring station. While the panel is of the view that it is the AER's responsibility to determine the adequacy of, authorize, and enforce the installation and operation of the ambient air quality monitoring station, it supports the intent of the proposed conditions and commitments related to engagement and collaboration. The panel expects Teck to seek input from Mikisew, Athabasca Chipewyan, and, where appropriate, other indigenous groups and make best efforts to incorporate their input surrounding placement of Teck's ambient air quality monitoring station. The summary will identify the input it received, how it has been incorporated and any significant areas of non-agreement.

⁷⁶ Draft *EPEA* Approval – Conditions 3.2.8(d) and 4.1.42

[861] As part of the panel's assessment, it has identified a number of conditions and recommendations for Teck, Alberta, and Canada that will assist in further mitigating the potential adverse effects of the Frontier project on air quality.

Table 11. Summary of significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Nitrogen oxides	medium	regional	medium	continuous	reversible	not significant
Sulphur oxides	low	regional	medium	continuous	reversible	not significant
Acid deposition	low	regional	medium	continuous	reversible	not significant
Fine particulate and secondary organic aerosols	low	regional	medium	continuous	reversible	not significant
Total suspended particulates, polycyclic aromatic compounds, and metals	medium	local	medium	continuous	reversible	not significant
Hydrocarbons and reduced sulphur compounds	medium	regional	medium	continuous	reversible	not significant
Wood Buffalo National Park	low	regional	medium	continuous	reversible	not significant

Panel Recommendations

To Teck

[862] The panel recommends Teck to develop and implement a plan to provide employee training on minimizing mine mobile equipment idling and the importance of avoiding tampering with emissions control systems.

To Government of Alberta

[863] The panel finds that there is uncertainty in Teck's assumption that all existing mine fleets in the mineable oil sands area will transition to Tier IV emission standards before the Frontier project reaching peak emissions in 2030. The panel also recognizes that the mine fleet transition of existing mines is out of the control of Teck. In order to address the uncertainties, the panel recommends to the Government of Alberta that it develop and implement a plan to facilitate the transition of the mine fleet in the mineable oil sands area to meet Tier IV standards.

[864] The panel recommends that a mitigation and management plan be developed under the *AQMF* to prevent the proliferation of secondary organic aerosols in the mineable oil sands area.

14 Climate Change Considerations and the Effects of the Environment on the Project

[865] Teck considered climate change in the methodology and modelling used for the environmental assessment for the Frontier project and in the design of proposed mitigation measures. Teck outlined findings from recent climate change research that will likely be applicable to the project development area and identified a range of potential climate change effects and trends:

- Air temperatures will be warmer on average and peak temperatures may be higher than historic averages.
- Warmer temperatures may lead to increased evaporation, decreased soil moisture, and a lower water table.
- Degree days are projected to increase, which may lead to a longer growing season and an increase in available heat for plant growth during the growing season.
- Precipitation is expected to increase annually but decrease during the summer months.
- Warmer temperatures are projected to be greatest over land and occur at high northern latitudes.
- It is expected that the total area of snow cover will decrease, and the thaw depth over most permafrost regions will increase.
- There is a potential for a poleward shift of extra-tropical storm tracks with consequent increases in wind, precipitation, and warmer temperatures.

Climate Modelling

[866] To evaluate the potential effects of climate change on the Frontier project, Teck needed to understand how climate variables have been changing and how they may change in the future. Within its assessment, Teck used General Circulation Models 2007 (Intergovernmental Panel on Climate Change Fourth Assessment Report [IPCC4]) to forecast future climate change scenarios in the Athabasca River Basin. The modelling approach involved the selection of five climate change scenarios. Teck selected one scenario that would represent a future “average range” and four other climate change scenarios that would account for future extreme conditions (drier/wetter and cooler/warmer) for precipitation and temperature values.

[867] Teck acknowledged that assessing climate change depends on having both future climate conditions and the baseline climate data for comparison purposes. Teck used the 1961 to 1990 timeframe as the climate baseline period. Teck noted that this timeframe for climate data was based on the recommendation of the Intergovernmental Panel on Climate Change (IPCC 2013). Teck also selected the 2051 to 2080 time period to quantify the potential hydrological effects of future climate change scenarios, as this timeframe represents when reclamation activities will be completed.

Prediction and Assessment Confidence

[868] Teck considered the effects of climate change in its prediction confidence because of the uncertainty associated with which specific changes in climate may occur in the future and how they may affect the project. Consideration of the effects of climate change was limited to those project activities that had the potential to be affected by it.

[869] Teck stated that assessment confidence was derived by considering the quality and quantity of baseline data used in the environmental assessment. It was also based on Teck's confidence in the measurement and analytical techniques used within the assessment, as well as its confidence in the success of project-specific mitigation measures. Teck indicated that assessment confidence took into account potential changes in future environmental conditions, such as climate change effects on groundwater recharge, sediment transport, hydrological and hydrogeological resources, terrain and soils, aquatic and terrestrial resources, and reclamation and closure processes. Teck acknowledged that climate change scenarios have some uncertainty, especially in the aquatics and terrestrial assessments. It considered 37 different climate change scenarios that had changes in temperature and precipitation in their assessment and concluded that the meteorological data used in the modelling is representative when climate change is added.

Analysis and Findings

[870] The panel understands that predicting the future effects of climate change involves significant uncertainty. The panel finds that Teck's use of a number of accepted models and climate change scenarios is a reasonable approach to assessing the project in the context of future changes to the climate.

[871] Teck has considered the effects of future climate change in the assessment of the environmental effects of the project. This is evidenced by Teck's particular focus on the effects that changing climate regimes may have on Teck's ability to withdraw water from the Athabasca River and on Teck's reclamation planning. These effects are discussed in the following sections: [Groundwater](#), [Surface Water Quantity](#), and [Conservation, Reclamation, and Closure](#).

[872] The panel finds that Teck has incorporated climate change considerations as part of its prediction of the environmental effects of the project and the cumulative effects of the Frontier project in conjunction with past, present, and reasonably foreseeable future oil sands operations in the mineable oil sands area.

[873] The panel notes that Teck has developed specific design measures to respond to the effects of climate change on the project such as its surface water management system. Teck has also identified adaptive management as a strategy to address the uncertainties of future climate change for activities such as the selection of species used in its conservation, reclamation, and closure plan to address future climate conditions. Details of these mitigation measures are discussed in other sections of this report. Having

considered these specific measures, the panel finds that Teck's project design has addressed future climate change effects on the project where these can be reasonably anticipated. The panel also accepts that adaptive management plans are an appropriate way to deal with uncertainties regarding changes to the climate that may affect the project in the future.

Effects of the Environment on the Project

Evidence

[874] In its environmental assessment, Teck evaluated environmental events including extreme weather events, forest fires, seismic activity, and insect infestations that could affect the Frontier project.

[875] Teck indicated that potential effects of the environment on the project were taken into consideration during the project design and development of mitigation measures. Teck stated that the project was designed to limit the effects of flooding, drought, wind and wave erosion, seismic events, forest fires, and insect infestations.

[876] Teck's drainage system design includes drainage channels with floodplains to manage peak flood discharges, and wetlands and small lakes to capture surface runoff and seepage from the reclaimed landscape.

[877] Teck's project design includes on-site ponds to accommodate water storage. Teck stated that these ponds provide the flexibility to comply with the phase 1 Athabasca River Water Management Framework during low-flow conditions or manage extreme flooding events.

[878] Teck stated the pit lakes have been engineered to prevent wind- and wave-induced erosion along their shorelines with the use of littoral zones and submerged overburden berms. Erosion could affect long-term stability of shoreward features of tailings areas and drainage channels if no littoral zone is available. Teck indicated that the shorelines will be protected against progressive wave erosion with a layer of large granular material for breakwater protection.

[879] Teck stated that it used design criteria that accounted for the possibility of seismic events in the project area. Teck indicated that there is a low probability that seismic activity would occur over the life cycle of the Frontier project. However, it developed engineered structures, such as mine wall, pit walls, dikes, berms, etc., to withstand seismic events.

[880] Teck outlined mitigation measures for forest fires, including the project's emergency response plan, the development of fire prevention worker training, and identifying the responsibilities of the Municipality of Wood Buffalo in responding to forest fires in the area.

[881] Keepers of the Athabasca raised concerns regarding the risks associated with extreme weather events, such as wind, lightning, and flooding, and their potential effects on the project's facilities. They

indicated that these weather events were not adequately addressed in the environmental assessment.

Keepers of the Athabasca stated that wind speeds are increasing and the predictability of weather patterns is decreasing. They stated that the recent forest fires of Slave Lake (2011) and Fort McMurray (2016) provide examples of how wind speeds and lightning contributed to the uncontrolled nature of those fires.

[882] Keepers of the Athabasca noted that the Frontier project will produce several tonnes of hydrocarbon-related particulate matter emissions. These particulate emissions will be deposited over the northern Alberta boreal forest throughout the life cycle of the project. Keepers of the Athabasca indicated that increased “forest flammability” due to deposition of hydrocarbon particulate matter may be a new scientific concept but should be researched and treated seriously given the amount of the predicted aerial emissions from the Frontier project and the timeframe over which the emissions will occur.

[883] Teck noted an extensive tent caterpillar infestation in the terrestrial local study area and an influx of mountain pine beetle into Alberta. Infestations of this nature could not only impair the progress of vegetation development but could alter species competition in reclaimed communities or lead to an increase in forest floor fuel that could contribute to future wildfires. Teck stated that planting prescriptions may need to be reviewed at the time of reclamation and, if necessary, be replaced with a more resistant stock that is more compatible with the long-term land-use objectives.

[884] As noted above, Teck stated that the results of climate change (e.g., increased occurrence of flooding, drought, forest fires, and infestations) are expected to occur gradually, allowing for the establishment and implementation of adaptive management plans and mitigation measures if observed changes are different from those which were originally anticipated. Teck also indicated that the project has been designed to withstand seismic events and is robust to respond to any unanticipated environmental effects that may affect it.

Analysis and Findings

[885] The panel finds that Teck’s assessment of the effects of floods, forest fires, and climate change on the project is satisfactory and that the design and mitigation measures proposed are appropriate to minimize potential effects. The recommendations and conditions made elsewhere in this report, ongoing regulatory oversight, and Teck’s proposed mitigation measures and adaptive management approach should be sufficient to respond to any unanticipated environmental effects that may affect the project.

15 Greenhouse Gas Emissions

[886] Teck acknowledged the association between greenhouse gas emissions and climate change, and the current regulatory focus on monitoring and reducing these emissions. They state that reducing these emissions is critical to ensure that the production of Canadian oil sands remains globally sustainable.

Project Effects

Evidence

[887] Teck stated that the project's main direct greenhouse gas emission sources are stacks and combustion sources (63%), mine fleet exhausts (28%) and fugitive sources (9%). Teck also stated that emissions associated with construction activities are relatively minor compared to emissions during the project operation.

[888] Teck stated that direct greenhouse gas emissions from construction activities will average 54.2 t/d, or 19.8 kt/a CO₂e. Greenhouse gas emissions from equipment fleet activities associated with mine site preparation activities (i.e., overburden removal) are expected to average 238 t/d or 86.9 kt/a CO₂e.

[889] At full production, total direct and indirect greenhouse gas emissions, which include imported electricity required for project operations, are 11 183 t/d or 4082 kt/a CO₂e.

[890] OSEC notes that the Teck's 4.1 Mt CO₂e per year represents 5.4% of total oil sand emissions based on 2016 data.

[891] Teck stated that the greenhouse gas intensity for the project is calculated based on the annual direct and indirect greenhouse gas emissions divided by the annual numbers of barrels of bitumen produced (277 000 bbl/cd); the increased production due to debottlenecking was accounted for. The direct emission intensity for the project during operations is estimated at 38.4 kg CO₂e/bbl. Direct plus indirect emissions intensity (which accounts for the net emissions from the export and import of electricity) during operations is estimated to be 40.4 kg CO₂e/bbl.

[892] The project will use a paraffinic froth treatment process which lowers the intensity of greenhouse gas compared with traditional oil sands extraction. Teck submitted that bitumen products produced by the paraffinic froth treatment process have among the lowest greenhouse gas intensity compared to all other oil sands production. It stated that it will have a lower emissions intensity than about half of all oil refined in the United States. Teck also stated that the project is consistent with Alberta's and Canada's climate action goals because it offers a lower-intensity greenhouse gas production compared to other sources of oil production from the oil sands.

[893] Teck stated greenhouse gas emissions performance for newer facilities is typically higher than for older facilities, as new facilities are built to higher design standards and because improvements and efficiencies occur as technology evolves over time. Teck provided examples of improvements that are applicable to the project as follows:

- Include cogeneration of heat and power.
- Use a paraffinic froth treatment process that is less energy-intensive than naphthenic froth treatment and approximately equivalent to the average barrel refined in the United States.
- Froth treatment plant equipment has been designed and configured to maximize the recovery of thermal energy using heat exchanges instead of a cooling tower.
- Variable frequency drives are planned for use on the project's boiler feed pumps and ford draft fans, which will reduce electrical energy associated with steam production.
- Use closed-loop cooling water for bitumen product to preheat recycle water.
- Enhanced haul truck fleet maintenance and dispatch systems are planned for the project to optimize efficiency. Teck noted that it has successfully implemented similar approaches at its other mining operations.
- Implement an anti-idling program for the mine fleet similar to what has been done successfully at its other mine operations in cold climates.

[894] Teck stated that the project's greenhouse gas efficiency has been optimized as the project has advanced through the regulatory process. Examples of large and small changes are as follows:

- Mine plan for the project became more efficient because the south development area and associated plant site and utility corridor were removed.
- Project's average haul distance was reduced by 0.5 km (8%).
- Number of ore crushers was increased (from two to three) and more conveyor belts were added.
- Size of the plant site was reduced, resulting in an approximate 25% reduction in piping, which reduces heat losses and fugitive emissions.
- By reducing the size of the plant site, it was possible to move the lodge adjacent to the plant, reducing the amount of bus traffic needed.
- Electric-powered tower cranes are planned for construction instead of diesel-powered mobile cranes.
- Plant site was changed to a location that requires less excavation, filling and pilings.
- Including headwater lakes and submerged overburden berms in pit lakes at closure reduces the need for off-site mining and trucking of erosion protection gravel.

[895] Teck stated that combined mine and extraction operations have a lower greenhouse gas emission intensity than in situ extraction operations. The estimated project greenhouse gas emission intensity falls within the lower end of the range of those calculated and measured for similar mining operations. Teck states that the project will have one of the lowest greenhouse gas intensities of any of the Canadian oil sands projects and be a top quartile best-in-class performer. They note the use of cogeneration facilities to generate power and heat, paraffinic froth treatment, variable frequency drive on boiler feed pumps, and forced draft fans to reduce the electrical energy associated with steam production as some of the key project features resulting in lower greenhouse gas intensity.

[896] ECCC stated that it had determined Teck's greenhouse gas intensity at normal operation of 260 000 bbl/d production to be 43 kg/bbl, where a potential debottlenecking to 277 000 bbl/d production would result in a greenhouse gas intensity of 40.4 kg/bbl. ECCC further stated the greenhouse gas intensity of 40.4 kg/bbl would not be "best in class" when compared to other facilities that operate at a lower emissions intensity. ECCC analysis of greenhouse gas intensities indicate that the project would have a higher intensity than all currently operation standalone oil sands mines (other than mines in a commissioning stage). In ECCC's own calculations, the Shell Muskeg River 2014 intensity was determined to be 32.5 kg/bbl and the Imperial Kearn 2015 intensity was determined to be 38.14 kg/bbl.

[897] ECCC stated that information that Teck has provided to date regarding greenhouse gas emissions or mitigation measures does not demonstrate that the project will be "best in class." Nor has Teck demonstrated how best-in-class performance would be achieved and maintained through the implementation of particular programs or technologies targeting greenhouse gas emission reductions and energy performance. ECCC stated that an ongoing greenhouse gas management plan is required in order for Teck to manage its emissions and demonstrate it is among the lowest emitters.

[898] OSEC stated that Teck has underestimated its greenhouse gas emissions from the project. It noted that Teck did not include emissions from the production of natural gas and diesel fuels used on site, emissions due to land use, and downstream emissions from refining and end use combustion.

[899] Using recent data and benchmarks set by Alberta's Carbon Competitiveness Incentive Regulation, OSEC presented a comparison with other oil sands mining projects that use similar paraffinic froth treatment technology. They stated that the project will have the poorest greenhouse gas emissions intensity of oil sands projects in this group which included Kearn, Fort Hills and the Muskeg River Mine complex. OSEC stated that Teck's greenhouse gas emissions intensity is average in the context of Alberta's Carbon Competitiveness Incentive Regulation and among the lowest performer when compared to other mines using paraffinic froth treatment technology.

[900] Teck disagreed with OSEC's analysis that the project would not see any emissions improvement or reductions over its 41-year operating life. Teck maintained that its design greenhouse gas emissions estimate for the project was calculated on a conservative basis, which is appropriate for the environmental

impact assessment phase of the project. Teck acknowledged that baseline validation of its greenhouse gas emissions will be required using actual data once the project is operating.

[901] Teck noted that greenhouse gas emissions intensity of oil sands mines has decreased by more than 25 per cent from 2009 to 2017, during a period of time when less aggressive carbon regulation existed. It expects this trend to continue. Teck referenced an IHS Markit analysis which predicts that an additional 15 to 24 per cent emissions intensity reduction is possible for paraffinic froth treatment mine operations by 2030.

[902] Teck stated that it supports the vision that the governments of Canada and Alberta have for carbon pricing to increase over time in concert with coordinated global action. Teck agreed that these measures are needed to make the change to a low-carbon economy.

[903] OSEC stated that it does not believe the project should be approved due to the significant greenhouse gas emissions associated with the project, but if the project is allowed to proceed, OSEC recommended that the panel include the following conditions:

- Submission of a detailed greenhouse gas management plan that outlines the mitigation measures Teck will take to ensure that it is in the top quartile of the Carbon Competitiveness Incentive Regulation in the oil sands mining sector. The plan must also demonstrate how the greenhouse gas emissions will be reduced by a further 50% by 2050 to be consistent with Canada's mid-century climate targets.
- Construction of the project shall not commence (a) until the Oil Sands Emissions Limit Act regulations have been enacted, and (b) if the Government of Alberta's 10-year forecast indicates cumulative oil sands greenhouse gas emissions will exceed the 100 Mt carbon dioxide per year limit at any time in the first five years of that forecast.

[904] Teck stated that it participates in and leads research and joint industry initiatives in COSIA to identify and evaluate technologies and practices to reduce greenhouse gas emissions. Teck states that it is committed to continual improvement in efficiency of energy use and emission reduction technologies as part of its plans to reduce project greenhouse gas emission. It anticipates that further improvements in greenhouse gas emissions reductions can be achieved during future stages of project engineering. Teck states that this approach is consistent with Alberta's Climate Leadership Plan and Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy to accelerate reductions in greenhouse gas emissions through continual improvement and implementation of emerging technology.

[905] Teck submitted a high-level draft greenhouse gas management plan. Teck indicated that it will develop a comprehensive greenhouse gas management plan for the project during the feasibility and detailed engineering stages. It will also be informed by guidance from provincial and federal governments and the outcomes of the joint review panel's review.

Analysis and Findings

[906] The panel notes that Teck has proposed a number of technology and operational improvements to support its statement that the project will be “best in class” with respect to greenhouse gas emissions.

[907] The panel recognizes that the intent of the Carbon Competitiveness Incentive Regulation is to encourage operators to strive for continual improvement in greenhouse gas emissions performance. Teck will be required to comply with Alberta’s legislative scheme in relation to greenhouse gas emissions including *Carbon Competitiveness Incentive Regulation (CCIR)* which is a cornerstone of Alberta’s policy to reduce emissions from the oil sands sector. The panel notes Teck’s evidence that significant emission reductions have been achieved by oil sands operations and that additional improvements can be expected. The panel expects that the *CCIR*, as amended, will continue to drive innovation in the sector and that emission improvements are likely.

[908] Teck provided a draft greenhouse gas management plan and committed to finalize it. The panel agrees that a detailed greenhouse gas management plan that outlines the measures Teck will take to ensure that it is in the top quartile of the *CCIR* in the oil sands mining sector is appropriate given Teck’s commitments in this regard. This plan may include specific programs and technologies that Teck will implement that target greenhouse gas emission reductions and specific measurable greenhouse gas emission intensity targets that support its commitment to operate “best in class” in comparison with other similar oil sands operations. The panel makes this a recommendation of this decision in light of the fact that AEP is the entity that regulates industrial greenhouse gas emissions.

[909] The panel finds that the project greenhouse gas emissions will be regulated under Alberta’s legislative scheme in relation to greenhouse gas emissions and that the project will be required to demonstrate continual improvement in greenhouse gas emissions performance. The panel also finds that the project will be a large source of greenhouse gas emissions at 4.1 Mt₂e per year which represents approximately 5.4% of total oil sand emissions in 2016.

Recommendations to Teck

- Develop a final detailed greenhouse gas management plan and an Energy Management System for the Frontier project. The plan would include measures to demonstrate and measure how Teck will achieve emissions intensity “best-in-class” status.
- Provide a public annual report to the AER on efforts and performance in managing greenhouse gas emissions on both an intensity and total emissions basis.
- Demonstrate a commitment to best-in-class greenhouse gas emissions performance through the implementation of relevant technologies and practices over the life of the project.

- Demonstrate a commitment to continually improve the efficiency of energy use and related greenhouse gas emissions in an effort to outperform regulations that are in effect.
- Connect to the electricity grid by the start of phase 1 operations in order to sell its excess low intensity electricity, as available.

Alberta and Canada Climate Plans

Evidence

[910] Based on Environment Canada's 2014 National Inventory Report, Teck states that project emissions represent 0.58% of the total national greenhouse gas emissions and 1.64% of the provincial total.

[911] The Wilderness Committee stated that the Teck Frontier project does not align with the goal of limiting global warming to 1.5 degrees Celsius as set out in the Paris Agreement.

Analysis and Findings

[912] The panel accepts that Teck has committed to be a top quartile performer in oil sands production emissions intensity and that the project includes features that will contribute to lower greenhouse gas emissions. Through the development and implementation of measures in a detailed greenhouse gas plan as recommended by the panel, and a continuous improvement approach, Teck should be able to realize its aspiration.

[913] The panel notes that Alberta's Climate Leadership Plan establishes, under the *Alberta Oil Sands Emissions Limit Act*, a 100 megatonne (Mt) greenhouse gas emissions limit for all oil sands. At the time that this report was created, the Government of Alberta had yet to determine the policy implementation of the 100 Mt greenhouse gas limit. The panel is of the opinion that Alberta's *CCIR* is the primary regulatory tool to manage greenhouse gas emissions intensity and that the 100 Mt limit will act as a regulatory backstop to the cap.

[914] The panel understands that there is uncertainty regarding the policy implementation of the 100 Mt greenhouse gas limit in Alberta's *Oil Sands Emissions Act*, and when or if the limit will be reached. It accepts Teck's evidence that the pace of Alberta's oil sands development has slowed so that the possibility of exceeding the cap in the near term is less likely.

[915] The panel finds that the project satisfies existing Alberta requirements with respect to greenhouse gas emissions and is consistent with Alberta's Climate Leadership Plan. The panel accepts that current oil sands greenhouse gas emissions are well below the 100 Mt limit and would remain below the limit with the approval and development of the project. The panel finds there would be room for the project within the Government of Alberta's Climate Leadership Plan to limit oil sands emissions to 100 Mt. The panel

understands that Alberta's Climate Leadership Plan is a component of Alberta's action in the Pan-Canadian Framework.

[916] In 2016, Canada's greenhouse gas emissions were 704 Mt which included 72 Mt from oil sands mining, in situ, and upgrading. The panel notes that if the project is approved and constructed, it may make it more difficult to achieve Canada's targets of a 30% reduction of 2005 levels by 2030 and a 2050 mid-century target for total Canada greenhouse gas emissions of 150 Mt/year. However, the panel understands that establishing policies and programs to meet Canada's international commitments to reducing greenhouse gas emissions or the implementation of Alberta's Climate Leadership Plan regulations are beyond the scope of this proceeding or the authority of this panel.

Recommendations to Teck

- That Teck develop a final detailed greenhouse gas management plan and an Energy Management System for the Frontier project. The plan would include measures to demonstrate and measure how Teck will achieve emissions intensity "best-in-class" status.
- Provide a public annual report to the AER on efforts and performance in managing greenhouse gas emissions on both an intensity and total emissions basis.
- Demonstrate a commitment to best-in-class greenhouse gas emissions performance through the implementation of relevant technologies and practices over the life of the project.
- Demonstrate a commitment to continually improve the efficiency of energy use and related greenhouse gas emissions in an effort to outperform regulations that are in effect.
- Connect to the electricity grid by the start of phase 1 operations in order to sell its excess low intensity electricity, as available.

16 Noise

[917] A number of parties expressed concerns about noise from the project and its potential effects on the experience of remoteness and solitude.

Evidence

[918] Teck presented an acoustics assessment that concluded that the project's oil sands mining operation would meet the requirements of AER *Directive 038: Noise Control*. Teck included a processing plant, mobile mining equipment, haul trucks, conveyors, a centrifuge plant, pump stations, and a bird deterrent system as the major noise sources in the noise impact assessment. Teck incorporated trapper cabins, traditional trails, the boundary of an acoustical local study area, and indigenous communities outside the acoustics regional noise study areas as receptors for assessment. As a conservative approach, Teck assumed that meteorological conditions enhancing noise propagation existed at all times and that all equipment operated at rated capacity during the nighttime period. It calculated the noise impact at the receptors based on the peak year noise emission. The project's calculated noise levels are below those set out in *Directive 038* at all the identified receptors.

[919] Teck included the approved Suncor Fort Hills project in its assessment of the cumulative noise impact. Fort Hills is the only existing or approved energy-related development in the acoustics regional study area of the project. Teck concluded that the cumulative noise levels from the Suncor Fort Hills project and the project are expected to be below *Directive 038* levels at all the receptors.

[920] Teck presented an acoustics assessment of the project's aerodrome operation, although the noise effects from air traffic are not specifically addressed by *Directive 038*. The key noise sources associated with the aerodrome operations are aircraft during taking-off and approach. Teck adopted the noise exposure forecast used by Transport Canada's *Aviation Land Use in the Vicinity of Aerodromes*. The predicted values at all the receptor locations are much lower than the annoyance threshold of noise exposure forecast 25 recommended by Transport Canada. Teck did not expect that outdoor noise levels from the three aircraft flights per day that it assessed would cause sleep disturbance at the trapper cabins in the acoustical local study area, Chipewyan Indian Reserve 201 G, Fort McKay, or Fort McKay Indian Reserve 174C.

[921] Indigenous communities and area trappers expressed concerns about the potential effect of the project's noise on traditional land use, including the sensory disturbances or impact on the feeling of remoteness. Teck provided the predicted noise levels at the identified trapper cabins, traditional trails, and indigenous communities around the project. During the nighttime period, the predicted change in ambient sound levels for all trapper cabin receptors and Chipewyan Indian Reserve 201 G is less than 1 dB. There is no change predicted for the Fort McKay Indian Reserve, the community of Fort McKay, or the Namur River Indian Reserve.

[922] The project's noise can be perceptible at some receptor locations. Regarding the feeling of remoteness, Teck noted that there was very little literature available to quantify a feeling of remoteness. It used the daytime and nighttime ambient sound levels identified in *Directive 038* as a reference level to quantify the perceptibility of the project's noise effect.

[923] Teck's acoustics assessment indicates that the cumulative change in sound level during the daytime period is less than 1 dB at all receptor locations. During the nighttime period, the change in ambient sound level is less than 1 dB at all trapper cabin receptors. The cumulative change in sound level is expected to be perceptible at some receptor locations. However, sound levels fall below the limits set by *Directive 038* at all receptor locations including Fort McKay, Athabasca Chipewyan Reserve 201 G, Fort McKay Indian Reserve 174C, and Namur River Indian Reserve 174 A.

[924] Teck will continue to engage aboriginal communities to better understand concerns regarding the experience of remoteness and solitude. Teck will work with aboriginal communities to understand baseline ambient sound levels in key locations and how increases in ambient sound levels might lead to concerns about the integrity of feeling remoteness and solitude. In addition, Teck will consider any additional mitigation measures proposed by potentially affected aboriginal communities to address these concerns.

[925] Teck committed to conduct a comprehensive sound level monitoring survey following commissioning of the project to verify it meets *Directive 038* limits. During the hearing, Teck also stated they would implement a site-wide monitoring program early in the operation and annually thereafter to measure the noise emissions from the project to verify they do not exceed *Directive 038* levels. The panel requires Teck to conduct these surveys and submit them to the AER.⁷⁷

Analysis and Finding

[926] The panel finds that the acoustics assessment provided by Teck is technically complete and the project is expected to be below *Directive 038* levels at all the identified receptors.

[927] The panel recognizes that there is no defined technical approach on how to quantify feeling of remoteness and accepts that it is practical for Teck to use the defined ambient sound levels in *Directive 038* to evaluate perceptibility of the project's noise effect. The project's noise can be perceivable at some traditional land-use locations near the local study area boundary; however, the panel believes the noise effect will not be significant. At traditional land-use locations further outside the regional study area of the project, such as Poplar Point Historic Cabins and Ronald Lake Historic Cabin, the project's noise impact is expected to be minor to minimal.

⁷⁷ Draft *OSCA* Approval – Condition 20; Draft *OSCA* Approval – Condition 21

Project Effects

[928] In considering the effects of the project in the local study area and regional study area the panel finds that

- noise levels from the project will be below *Directive 038* limits,
- the magnitude of effects at the boundary of the local study area is expected to moderate to low,
- the magnitude of noise levels at the boundary of the regional study area is expected to be low to negligible,
- the geographic extent of noise effects of the project is local,
- the frequency/duration of noise effects of the project is continuous, and
- the noise effects of the project will be reversible following completion of project activities.

Cumulative Effects

[929] In considering the cumulative noise levels, the panel finds that

- the predicted cumulative noise levels will be below levels specified in *Directive 038*,
- the magnitude of effects due to cumulative sound level change is moderate to low along the local study area boundary and is low to negligible along the regional study area boundary,
- the geographic extent of cumulative noise effects are regional,
- the frequency/duration of cumulative noise effects is continuous, and
- the noise effects are reversible following completion of activities.

[930] The panel finds that the project meets *Directive 038* limits for noise, and the project is not likely to result in significant adverse cumulative effects to ambient sound levels beyond the project disturbance area

[931] While the panel acknowledges that the project will result in an increase in noise in the area, the panel believes that the project will not likely result in significant adverse noise effects or cumulative effects except for people and wildlife in close proximity to the project.

Recommendations

[932] Provide information on the Frontier project noise complaint investigation process to potentially impacted residents and communities.

17 Groundwater

[933] The project could affect groundwater quantity and quality through spills, seepage of process-affected waters, and dewatering and depressurization of surficial deposits and overburden.

[934] Teck assessed the effects dewatering, seepage interception, and basal McMurray aquifer depressurization and injection would have over time on groundwater levels and flow patterns in Quaternary and basal McMurray aquifers.

[935] Seepage from tailings areas is the primary risk to the quality of groundwater and receiving surface waters. Teck assessed seepage quantities, pathways, and attenuation. Teck provided seepage mitigation plans for operation and post-closure phases of the project. Teck also assessed the long-term residual effects of seepage on groundwater and surface water quality.

Dewatering of Surficial Deposits and Depressurization of Basal Water Sands

Evidence

[936] The mine pits will intercept groundwater-bearing strata, resulting in dewatering of the overburden as gravity drainage of the shallow groundwater into the pit occurs. This cannot be avoided during the mining process. The water released from overburden will be sent to the closed water circuit. Drainage water collected outside of the closed-circuit system, such as muskeg and overburden drainage water collected in ditches, sumps, and shallow groundwater wells outside the mine pit, will be discharged to receiving waters.

[937] Teck identified two groundwater units that meet the definition of a “domestic use aquifer” as outlined in appendix E of *Alberta Tier 2 Soil and Groundwater Remediation Guidelines*. They are sandy Quaternary sediments, which are present east of the project development area, and Lower McMurray basal water sands, where present beneath the project development area. The basal water sands aquifer has a discontinuous pod-like distribution and was shown to be saline (total dissolved solids >4000 mg/L) at some locations within the project development area, while fresh at others. Zones containing naturally saline groundwater are not considered to be a “domestic use aquifer.”

[938] A Quaternary channel, which extends north-south along the western edge of the proposed mine pit, is incised into the McMurray or even the Devonian and was found to be filled predominantly with fine-grain deposits and therefore is not classified as an aquifer.

[939] Teck predicts that the extent of drawdown in the Quaternary sediments will be limited. Within the mine footprint, where the Quaternary sediments are not fully mined out, the drawdown within the Quaternary sediments is predicted to be in the order of 10 to 20 m. The maximum extent of drawdown from the boundary of the mined-out area and the external tailings area would occur on the eastern

boundary of the project (due to the seepage control measures around the external tailings area). There, at maximum project buildout, the modelling predicts drawdown of greater than 1 metre in Quaternary sediments extending to a distance of five to ten kilometres. For other areas, the groundwater model predicts that the extent of the water table depression will be up to 4 km from the edge of the mine pits. Teck expects the water table to rebound quickly after mining ends in response to recharge from rainfall and snowmelt.

[940] Depressurization of the basal water sands aquifer also cannot be avoided during the mining process. Depressurization is required to minimize water inflow into the mine pit and ensure safe mining operations. The required volumes may reach 3.4 Mm³/year. Teck submitted that the basal water sands aquifer in the project area is a channel aquifer of variable thickness and is not hydraulically connected with the overlying Quaternary aquifer. Parts of the basal water sands are nonsaline, notably in the western portion of the lease.

[941] The maximum predicted drawdown in the basal water sands aquifer outside of the pit footprint is predicted to be over 10 m at a distance of 10 km west of the pit. The channel/pod shape of the basal water sands aquifer constrains the maximum lateral extent of the drawdown. Since the basal water sands are not hydraulically connected to the Quaternary aquifer, the depressurization of the basal water sands is not expected to have a significant impact on water levels in the Quaternary aquifer. The model predicts groundwater level recovery in the basal water sands within a century after the depressurization ceases.

[942] Teck proposes to install monitoring wells in the basal water sands to monitor groundwater levels and groundwater quality to detect the incursion of the deep Devonian groundwater into the basal water sands or mixing between the saline and nonsaline groundwater within the basal water sands aquifer itself. Teck indicated that changing the depressurization wells' locations, pumping rates, as well as adjusting the mining plan and engineered local reductions to hydraulic conductivity can mitigate unwanted changes to the groundwater flow system in the basal water sands.

[943] Teck proposes to reinject up to 0.94 Mm³ of predominately nonsaline basal water sands groundwater back into the basal water sands aquifer in the western portion of the site for a period of up to three years, subject to obtaining separate AER approvals under *Directive 051: Injection and Disposal Wells – Well Classifications, Completions, Logging, and Testing Requirements* and *Directive 065: Resources Applications for Oil and Gas Reservoirs*.

[944] Mr. Hoffman and the trappers described shallow groundwater use in the vicinity of the project. They stated that they rely on groundwater springs and seeps on the west bank of the Athabasca River. In particular, they have used a groundwater source located approximately 9 km to the north-northeast of the mine boundary, within 600 m of the Athabasca River bank. The trappers stated that depletion of the water source would have an adverse effect on their livelihood.

[945] NRCan and Parks Canada expressed concern that the loss of the groundwater contribution to the watershed resulting from dewatering activities may have an adverse effect on surface water levels in the Lake Claire watershed and in Wood Buffalo National Park. They recommended that Teck be required to monitor for possible groundwater drawdown in these areas by installing monitoring wells near Ronald Lake and at the boundary of Wood Buffalo National Park.

[946] Teck disagreed with NRCan's recommendation to install groundwater monitoring wells near Ronald Lake and the boundary of Wood Buffalo National Park for the purpose of monitoring for possible groundwater drawdown in the Lake Claire watershed and Wood Buffalo National Park. Teck stated that these well locations were remote, at 13 km and 52 km respectively. Teck instead proposed to install monitoring wells in the Quaternary, Cretaceous, and Devonian aquifers proximal to the planned mine footprint between the project development area and Ronald Lake before beginning of construction, with the need for additional monitoring, if any, established through the adaptive management plan that will be part of the finalized groundwater monitoring plan. At the hearing, Canada agreed with Teck's alternative proposal.

[947] Teck confirmed that the Ronald Lake watershed is located within the northernmost extent of the groundwater local study area and that the area of the groundwater model covered the Ronald Lake watershed. Teck confirmed that during operations on the northern boundary of the project and in the direction of the sensitive watersheds of Ronald Lake and Lake Claire, the predicted extent of the drawdown within the surficial aquifers would not be more than 4 to 5 km from the project development area.

[948] NRCan acknowledged that the distances between edge of the mine pits and the sensitive environmental receptors of concern are approximately 15 km for Ronald Lake, 25 km for the closest boundary of Wood Buffalo National Park, and over 45 km for Lake Claire and that the potential effects of mine dewatering were likely to be moderate and could be minimized by the mitigation measures proposed by Teck.

[949] NRCan recommended that monitoring wells be installed to collect water level data from the area to the north of the project development area because currently there is no data in this area. NRCan also asked the panel to recommend that Teck update the groundwater flow and transport models regularly during the life of the project to increase the confidence in its predictions and to devise a groundwater monitoring strategy to aid in assessing the groundwater inputs into the Lake Claire watershed, including the Buckton Creek watershed and Ronald Lake.

[950] Teck proposed an adaptive approach to groundwater monitoring networks in its response to the NRCan and Parks Canada submissions, committing to installing monitoring wells in the Quaternary, Cretaceous, and Devonian aquifers proximal to the mine footprint and between the project area and the Peace-Athabasca Delta and Ronald Lake before beginning construction. Teck proposed to determine the

need for additional monitoring, if any, through its adaptive management plan. Teck agreed to update the groundwater flow and transport models for the project to increase confidence in the model's predictions, such as the extent of the drawdown in the Quaternary aquifer.

Analysis and Findings

[951] The panel accepts that dewatering of surficial Quaternary deposits and depressurization of the basal water sands is necessary to ensure safe mining operations. The panel also accepts Teck's predictions that the effects of overburden dewatering on Quaternary aquifers will be localized and reversible.

[952] The panel notes that the shallow artesian water source identified by Mr. Hoffman and the trappers is located to the north of the area of predicted maximum drawdown, but that the actual drawdown extending from the external tailings area will be determined by the operation parameters of the seepage interception system. The panel understands that Teck intends to install dedicated monitoring wells to monitor the impacts on groundwater related to the seepage interception system operation. The observations of the groundwater levels in these monitoring wells will confirm that drawdown caused by the project does not reach the shallow artesian water sources used by Mr. Hoffman and the trappers.

[953] Due to the localized extent of the drawdown effects, the panel finds that drawdown of the water table in the surficial deposits in the vicinity of the project is not likely to have a significant effect on groundwater or surface water levels in Lake Claire, Ronald Lake, or the Buckton Creek watershed. However the panel agrees with the recommendation that the extent of drawdown in Quaternary sediments should be verified during the life of the project through monitoring and regular analysis of the collected monitoring data. The panel therefore requires that, as part of the groundwater monitoring plan required under the project's *Water Act* licence and *EPEA* approval, Teck include water level monitoring in groundwater wells installed at locations that increase confidence in the predictions that the Lake Claire watershed, including the Buckton Creek watershed and Ronald Lake areas, and the area of groundwater use on the west bank of the Athabasca River are located outside of the maximum extent of the project's impact on the groundwater levels in the Quaternary aquifer.⁷⁸ The panel recommends that the Minister include the requirement for a follow-up program in the decision statement under *CEAA 2012* (see section [38](#)).

[954] As a result of the discontinuous pod-like nature of the basal water sands aquifer and its being at least partially hydraulically isolated from the overlying shallower Quaternary aquifers, the panel finds that the proposed depressurization of the basal water sands aquifer and the corresponding drawdown is not likely to have a significant impact on the surface environment despite the more prolonged predicted recovery period from the depressurization.

⁷⁸ Draft *Water Act* Licence – Conditions 3.21, 3.22, and 3.23; Draft *EPEA* Approval – Conditions 4.5.1(i) and 4.5.1(j)

[955] The panel recognizes Teck's commitment to continuing the investigation of the basal water sands aquifer. The mitigation measures proposed by Teck to avoid significant disruptions to the nonsaline portions of the basal water sands and the incursion of saline water from the Devonian aquifer through monitoring and adjusting the operating parameters of the depressurization network are appropriate. The annual reporting of groundwater levels, quality and pumping rates and volumes in the basal water sands aquifer will be required as a part of the groundwater monitoring plan required under the *EPEA* approval.⁷⁹

Potential Effects to Groundwater Quality from Process-Affected Water

Evidence

[956] Teck proposes to construct two external tailings areas (external tailings area 1 and external tailings area 2) and three in-pit tailings areas (internal tailings area 1, internal tailings area 2 and internal tailings area 3) to store fluid tailings, recycle water, centrifuge cake tailings, and coarse combined tailings. Teck confirmed that no tailings will be placed in the watershed that flows north to Ronald Lake.

[957] Teck conducted groundwater modelling to understand flow rate, direction of flow, and transport of dissolved substances from areas affected by process waters. Teck stated that seepage pathways from both external tailings areas and internal tailings areas were included in the groundwater quality modelling assessment and incorporated into the surface water quality modelling.

Seepage from External Tailings Areas

[958] The external tailings areas will be sited east of the main mine pit over surficial Quaternary deposits, which overlie McMurray Formation bitumen, which overlies Devonian limestone and shale bedrock. In the southern portion of external tailings area 1, the Quaternary deposits directly overlie the Devonian bedrock. The Quaternary deposits are a mixture of sand, silt, and clay and were found to be predominantly sandy and permeable in the area of the external tailings areas. Where present, the McMurray Formation bitumen is expected to act as an effective barrier to downward infiltration from the external tailings areas. Teck characterized the underlying Upper Devonian bedrock as a low-permeability aquitard unit; however, Teck recognized a potential for karst features of higher permeability within the Devonian bedrock.

[959] Teck does not propose to install low-permeability liners at the base of the external tailings areas to minimize leakage. This is consistent with the design of other tailings ponds in the oil sands region. Teck stated that that seepage from external tailings areas will infiltrate into the underlying formations and migrate with groundwater primarily within Quaternary sediments. Teck proposes to control seepage from the external tailings areas by means of hydraulic barriers.

⁷⁹ Draft *EPEA* Approval – Conditions 4.5.1(p) and 4.5.10(y)

[960] Teck proposes a staged approach for the construction of the hydraulic barriers. Teck indicated that, during the operations phase, external tailings area seepage will be controlled by a hydraulic barrier on the north, east, and south of external tailings areas created by seepage collection ditches and approximately 94 interception wells. The wells will fully penetrate sandy Quaternary sediments, will be 30–60 m deep, spaced 250 m apart, and will be pumped at a rate of 200–500 m³/d, sufficient to capture 100% of seepage from both shallow and deep groundwater flow systems. The intercepted seepage will be pumped back to the external tailings areas. The interception wells will be installed before tailings are placed in external tailings areas. Teck stated that the proposed system of pumping wells is robust, flexible, and a proven industry technology to address seepage.

[961] Teck stated that post-closure, seepage control for the external tailings area will consist of an engineered passive low-permeability barrier, perimeter ditches, and reclamation lakes. At the end of mine life, Teck will install a physical cutoff wall, or an equivalent barrier, that will be 24 km long, approximately 50 m deep, and 1 m wide, with a design permeability of 10⁻⁹ m/s or less. Teck provided examples showing that technology is available to construct a wall to the proposed depth and achieving the design permeability. Teck estimated that it will take 11–13 years to construct the barrier wall and that it will be able to complete construction of the wall within the closure time period from 2066 to 2081.

[962] Teck estimated the cost of the barrier construction at \$200–\$500 million. Teck stated that the higher cost estimate of \$500 million was included in the financial model for the project. During the hearing, Teck stated that the \$500 million post-closure budget includes the cost of the barrier itself (estimated at \$350 million), the cost of barrier failure mitigation, and the cost of ongoing performance monitoring.

[963] OSEC raised concerns that the budget allocated to monitoring and mitigating seepage from external tailings areas after the project ended was insufficient to support those activities long term. OSEC questioned whether Teck's \$500 million budget for seepage mitigation, including construction of a passive barrier, was the same budget as the \$500 million for post-closure. Teck stated that \$500 million was allocated for post-2081 activities. Teck implied that the barrier cost will be covered from a pre-2081 portion of the total closure and reclamation budget of \$2.9 billion. OSEC concluded that only \$150 million was allocated for up to 65 years of post-closure monitoring, maintenance, and mitigation, and that that amount was insufficient.

[964] Teck proposed implementing a plan to monitor the performance of the seepage control system. Teck provided evaluation criteria and a conceptual monitoring plan for groundwater levels and quality. Teck stated that additional hydraulic testing, tracer testing, and geotechnical coring and testing may be performed to evaluate performance and integrity of the post-closure physical cutoff wall. Teck stated that the length of post-closure monitoring period will be contingent on the seepage quality meeting regulatory requirements but that it is expected to last 20–40 years.

[965] Teck indicated that a detailed seepage control system performance monitoring plan would be submitted in accordance with the requirements of the *EPEA* approval for review and authorization by the AER.

[966] Teck identified the following potential mitigation measures, should seepage control prove inadequate:

- additional evaluation through monitoring and modelling
- increasing the capacity of the interception wells
- installing additional interception wells
- deepening seepage collection ditches
- repairing and upgrading the hydraulic barrier (e.g., injecting grout at strategic locations)
- extending the operation of the pumping well system into post-closure
- extending the period of post-closure testing and monitoring

[967] Teck acknowledged the uncertainty associated with the current level of characterization of the Quaternary and Devonian units in the vicinity of the external tailings areas and committed to further investigation of the Devonian bedrock during the project development stage and hydraulic pressure monitoring in the Devonian and basal water sands aquifers.

[968] Teck estimated the post-closure seepage from external tailings areas at 63.4 L/s. Teck stated that the majority of post-closure seepage from external tailings areas will be directed to a perimeter surface water drainage system along the toe of the external tailings areas; this seepage will enter one of the two proposed reclamation lakes before discharging to the fish habitat compensation lake. A portion of the shallow seepage from external tailings areas will also flow westward and discharge into the central pit lake. Combined external tailings area seepage discharging into the local drainage system of the reclamation landscape is predicted to be 52.1 L/s.

[969] Teck predicted that a small portion of the seepage from external tailings areas will infiltrate to deeper groundwater units (basal water sands and the Devonian) and ultimately discharge into the fish habitat compensation lake (0.6 L/s), Big Creek (4.6 L/s), and the Athabasca River (6.1 L/s). Teck confirmed that seepage along the deep flow pathways from both external tailings areas and internal tailings areas were included in the groundwater quality modelling assessment and incorporated into the surface water quality modelling.

[970] Teck concluded that the incremental effects on downstream water quality from the deeper flow pathways are negligible given the existing saline water quality of the deeper groundwater and natural attenuation processes over the long time periods for the small amounts of seepage estimated to follow these pathways.

[971] Further discussion of the effects of seepage of process-affected water is provided in the subsections “Residual and Far-future Effects on Groundwater” and “Surface Water Quality.”

Seepage From In-Pit Deposits

[972] Teck did not propose engineered seepage control systems for the internal tailings areas. Teck indicated that during operations, surficial dewatering and depressurization activities act as regional groundwater sinks that cause groundwater flow towards the depressurization areas associated with the pits and therefore mitigate outward migration of seepage from materials placed in-pit. Teck stated that post-closure seepage from in-pit deposits will primarily discharge to the local drainage system of the reclamation landscape and be directed to the central and south pit lakes.

[973] Drainage flow rates from internal tailings areas were estimated to be much lower than the rates from the external tailings areas (internal tailings areas combined 10.9 L/s, external tailings areas combined 63.4 L/s).

[974] Teck predicted that, post-closure, a portion of seepage from the internal tailings areas will infiltrate to deeper groundwater units (basal water sands and the Devonian) and ultimately discharge into Big Creek (1.2 L/s) and the Athabasca River (3.1 L/s).

Risk of Enhanced Migration of Seepage from Internal Tailings Areas Through Karst Pathways into Surface Water Receptors

[975] Teck stated that before placing tailings in the internal tailings areas, scheduled to start 2035–2040, it will have evaluated the potential for karstic conditions in the area of internal tailings areas through application of the karst management plan during the engineering design and operational phases of the project. If a karstic (high-permeability) groundwater pathway is encountered in the shallow Devonian, Teck committed to completing an assessment of its influence on downstream aquatic receptors.

[976] Should the assessment indicate the potential for detrimental effects, Teck is prepared to implement the following mitigation measures:

- Place low-permeability waste material at the base of the pit in the vicinity of the higher-permeability feature.
- Leave a layer of bitumen in place to act as a hydraulic barrier to limit seepage from the internal tailings areas into the karstic pathway.
- Reduce permeability of the bedrock zone through a grouting program.
- Install seepage recovery wells.

Risk of Enhanced Migration of Seepage from Internal Tailings Area 3 Through Quaternary Channel into Downgradient Groundwater and Surface Water

[977] Teck identified a Quaternary channel along the western edge of the main mine pit and the proposed internal tailings area 3. Teck evaluated the risk that the Quaternary channel might constitute a potential migration pathway for seepage from internal tailings area 3. Teck stated that, based on the completed investigations, the Quaternary channel is infilled by low-permeability, clay-rich deposits, and the likelihood of extensive or continuous high-permeability deposits within the channel is considered low. In addition, the elevations in the proposed internal tailings area 3 closure landscape are lower than those of the groundwater in the channel, and therefore the groundwater flow direction in the closure landscape is expected to be from the channel towards internal tailings area 3 and the central pit lake rather than in the opposite direction.

[978] Teck committed to further investigations of the channel to verify the nature and permeability of the channel fill sediments. If investigations indicate that the Quaternary channel could provide a pathway for groundwater seepage from internal tailings area 3, Teck identified the following mitigation options:

- Leave a pillar of low-permeability bitumen along the western edge of the pit to isolate the Quaternary channel.
- Use pumping wells to capture the seepage and redirect it to the closed-circuit system.

[979] NRCan acknowledged that the likelihood of significant environmental effects due to seepage migration through the buried channel is low. NRCan supported Teck's plans for further investigation and monitoring of the Quaternary channel.

Monitoring of Seepage from External Tailings Areas and Internal Tailings Areas

[980] Teck's conceptual monitoring plan for the project includes monitoring wells installed at locations and formations where seepage from external tailings areas and internal tailings areas could occur. Teck stated that monitoring will continue into the post-closure period for 20 to 40 years. Teck indicated that monitoring results will be analyzed for trends and compared against values predicted by the groundwater model. The model will be periodically updated as new information is gathered and used to guide the evolution of the monitoring system.

Residual and Far-future Effects on Groundwater and Surface Water Quality

[981] Teck predicted that in the post-closure period, a portion of the seepage from the external and internal tailings areas will bypass the passive (barrier) seepage control system and move with groundwater flow towards receiving surface water bodies.

[982] Teck estimated groundwater discharge rates from each internal and external tailings area to the receiving water bodies, including south reclamation lake, east reclamation lake, central pit lake, Frontier fish habitat compensation lake (the current Redclay Creek), Big Creek, and the Athabasca River.

[983] Far-future seepage rates from external tailings areas and internal tailings areas discharging to the Athabasca River were estimated at 6.1 and 3.2 L/s, respectively, or 9.3 L/s combined. The combined discharge rate to Big Creek was estimated at 5.8 L/s, and to the fish habitat compensation lake at 0.6 L/s. Teck predicted travel time along the deep groundwater flow pathways to surface water receptors to be on the order of hundreds to thousands of years.

[984] Teck's primary assessment focus for groundwater quality was on the groundwater to surface water pathway. Teck predicted that, with the barrier in place, the effects to aquatic life of tailings-derived contamination discharging to surface water bodies via groundwater will be negligible.

[985] Teck conducted solute transport modelling (using GoldSim batch flush model) to assess the effects of tailings-derived contamination to groundwater and surface water quality. Teck simulated groundwater concentrations for 42 parameters, including metals, nutrients, PAHs, major ions, naphthenic acids, and toxicity at points of discharge to surface water bodies. The model accounted for natural attenuation due to dilution, dispersion, adsorption, and decay. The initial solute concentrations entered into the model were derived from process-water models, a tailings pilot test study, and from existing oil sands operations. The model did not consider background concentrations; therefore, the results represent an incremental increase in concentrations.

[986] Teck presented time-plots for groundwater concentrations of chloride and naphthenic acids at discharge nodes to south reclamation lake, east reclamation lake, central pit lake, south pit lake, fish habitat compensation lake, Big Creek, and the Athabasca River for a period of 2000 years.

[987] Teck provided far-future groundwater quality results/graphs for four scenarios:

- no barrier
- base case with barrier performance as per design
- increased Devonian permeability (from 2×10^{-9} m/s to 3.5×10^{-6} m/s)
- partial barrier failure

[988] The modelling predicted that, in the base case with barrier performance as per design, groundwater concentration of chloride at the discharge points to all water bodies except the Athabasca River is predicted to exceed the guideline concentration of 120 mg/L at some point in the future. Without the barrier, significantly less seepage discharges to the east and south reclamation lakes and instead travels further downgradient to the fish habitat compensation lake and Big Creek and the Athabasca River. Teck stated that the barrier will need to maintain its effectiveness for 230 years post-closure to prevent chronic toxicity effects in the fish habitat compensation lake and Big Creek, but indicated that the estimate of 230 years is the worst-case scenario because it disregards the effects of mixing and dilution.

[989] Teck did not predict chronic toxicity effects in the Athabasca River in any scenario, including no barrier.

[990] Partial barrier failure resulted in marginally increased peak concentrations of conservative contaminants (e.g., chloride) and had no effect on concentrations of reactive contaminants (e.g., naphthenic acids). Chloride concentration increased from ~150 mg/L to ~170 mg/L at groundwater point of discharge to Big Creek and had no perceptible increase above the base case of 30 mg/L at the Athabasca River. In terms of mass flux, partial barrier failure resulted in an increase of peak chloride loading from 30 to 50 metric tons per year at Big Creek and a minimal increase above the base case scenario of 42 metric tons per year at the Athabasca River.

[991] Increased Devonian permeability resulted in marginally increased peak concentration of conservative contaminants and had no effect on concentrations of reactive contaminants. Chloride increased from ~150 mg/L to ~160 mg/L at the Big Creek groundwater discharge point and from ~20 mg/L to ~30 mg/L at the Athabasca River. For mass flux, increased Devonian permeability resulted in increase of peak chloride loading from 30 to 40 metric tons per year at Big Creek, and from 40 to 60 metric tons per year at the Athabasca River.

[992] Teck predicted the peak concentration of a solute at breakthrough to the surface water receptor to be a fraction of its initial concentration at source. In the base case scenario, Teck calculated the attenuation factor for chloride to be 0.47 at the discharge to the fish habitat compensation lake, 0.41 at the discharge to Big Creek, and 0.06 at the discharge to the Athabasca River.

[993] Teck confirmed that regardless of when the peak concentration of individual contaminants occur, whether 500 or 1000 years into the future, that concentration was used in the surface water quality model for all times. Teck predicted that in 2181 concentrations in groundwater discharge nodes to surface water will exceed surface water guidelines or chronic-effects benchmarks or reference criteria for several substances, including aluminum, iron, naphthenic acids, and phosphorus. Although concentrations of certain individual contaminants at the groundwater discharge points to surface water are predicted to exceed the Alberta surface water guidelines, Teck assessed the effects on aquatic life as negligible considering whole-sample toxicity and chronic-effects benchmarks and surface water dilution effects. Teck's conclusions of negligible effects to aquatic life downgradient of external tailings areas are based on evaluation of substance concentrations in the receiving environment rather than in the groundwater matrix. Potential effects to surface water quality and the aquatic environment are discussed further in the section "[Surface Water Quality](#)."

[994] Keepers of the Athabasca expressed concern about seepage of water from tailings ponds into groundwater. They stated that tailings should be fully contained in tanks or that tailings ponds should be lined with double liners and include leachate detection systems similar to municipal landfills.

[995] Keepers of the Athabasca asserted that the groundwater flow through the Quaternary and the underlying Devonian unit between the external tailings area and the Athabasca River is poorly characterized on the local scale, and additional work is needed to make accurate prediction of the groundwater flow and transport of the contaminants towards the Athabasca River. Keepers of the Athabasca stated that the vertical barriers to flow below the external tailings area are either not included in the design (in the case of an engineered liner) or inadequately characterized in the environmental assessment (with respect to the Devonian bedrock surface). Keepers of the Athabasca also expressed concern that the hydraulic barrier wells would capture groundwater that is not impacted by the process. Keepers of the Athabasca noted that Teck relied on old reports and used regional rather than site-specific data for the properties of the hydrostratigraphic units in its models. Overall, Keepers of the Athabasca believed that Teck's groundwater model was unreliable.

[996] Teck acknowledged that there is some uncertainty associated with the parameters used in the groundwater model, particularly for the Devonian and basal water sands. To address this uncertainty, Teck performed model runs increasing the Devonian permeability by 3 orders of magnitude, and this resulted in only marginally higher contaminant concentrations at discharge nodes to surface water. Sensitivity analyses were also run for hydraulic conductivities, recharge, and connectivity between the basal water sands and the Athabasca River.

[997] Teck committed to additional characterization of the Devonian in the southern portion of the external tailings areas area, where the Devonian is in direct contact with sand-dominated Quaternary sediments. If higher-permeability zones are encountered beneath the external tailings areas, Teck identified the following options to mitigate potential effects on downgradient receptors:

- Modify the seepage interception well system to capture groundwater seepage within the shallow Devonian by
 - installing additional deeper interception wells into the Devonian,
 - extending the screens of the proposed Quaternary wells into the Devonian, or
 - increasing pumping rates to effect upward hydraulic gradients from the Devonian.
- Grout the local zones of karstic permeability.
- Re-evaluate effects by updating the flow and transport model.

[998] NRCan accepted that the likelihood of contaminants travelling through the basal water sands and reaching the Athabasca River and causing significant adverse effects to the river is low. NRCan supported Teck's plan to establish a basal water sands monitoring network, including between the pit and the Athabasca River, and monitor pressures and water quality.

[999] NRCan considered the likelihood of adverse environmental effects as a result of seepage from the external tailings areas to be moderate, but was of the opinion that the mitigation, monitoring, and follow-up plans proposed by Teck will minimize these effects. NRCan noted that indigenous groups want to be involved in reviews of seepage performance plans and reports but offered no opinion about whether they should be accommodated. NRCan did not indicate a concern with criteria to terminate post-closure monitoring or with Teck's ability to control the use of potentially contaminated domestic use aquifers. NRCan was supportive of mitigation, monitoring, and follow-up plans proposed by Teck.

[1000] Teck recognized that seepage-derived contamination will impact downgradient domestic use aquifers as defined in *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (2019). Specifically, Teck indicated a potential for contamination of the Quaternary aquifer in a broad area between the project development area and the Athabasca River and of the basal water sands anywhere the aquifer has been mapped between the mine pit and the Athabasca River.

[1001] At the hearing, Teck clarified that their assessment of impacts to domestic use aquifers considered not only the groundwater ingestion criteria but also the more stringent criteria for the aquatic life exposure pathway. After limiting the assessment to just the drinking water criteria, Teck submitted that, based on predicted process-water concentrations in external tailings areas, the impacts to domestic use aquifers would not exceed Tier 1 health-based guidelines for potable groundwater. Only aesthetic-based guidelines for selected parameters, such as manganese and total dissolved solids, might be exceeded. Teck noted that natural background concentrations of several parameters already exceed the drinking water guidelines.

[1002] Teck stated that it does not intend to remediate the domestic use aquifers to meet the drinking water guidelines. As an exclusive holder of the mineral surface lease with consolidated surface rights, Teck will have the ability to restrict groundwater consumption from the potentially affected aquifers. Teck will confirm that the areas of domestic use aquifers that might be affected by the project are contained within the mineral surface lease. Should restrictions on the consumption of groundwater be required after the lease is relinquished, Teck stated that they will work with AEP to determine the form of such restriction.

[1003] Teck stated that there are no current users of the domestic use aquifers in the area. However, Mr. Hoffmann, a trapper, described an artesian well (spring) used as a drinking water source by the trappers and indigenous people in the area. The well is located approximately 600 m west of the Athabasca River on registered fur management area (RFMA) 2346, about 9 km northeast of project development area.

[1004] Mikisew and Teck jointly developed a number of proposed conditions related to construction and operation of the project and requested that they be incorporated as approval conditions, should the project be found to be in the public interest and approved. The Mikisew-Teck jointly proposed conditions included a condition that all plans required for the project be subject to consultation with indigenous

groups. At the hearing, Mikisew expressed an expectation that the AER would have a role in enforcing the consultation conditions. However Teck indicated that did not expect the AER to be involved in assessing the adequacy of consultation with Mikisew on operational plans; rather, Teck intended to work with Mikisew under the joint environmental working group that Teck and Mikisew have established to resolve any disagreements on the plans. If disagreements on specific content of the plans occurred and could not be resolved between the parties, they would be jointly reported to the AER.

[1005] Mikisew and Teck also jointly recommended that the governments of Alberta and Canada implement an effective tracing system (e.g., isotopic tracing) for all tailings ponds near the Athabasca River. At the hearing, Mikisew further recommended that the governments revise the *Lower Athabasca Region Groundwater Management Framework* by adding pH and temperature as indicators and reducing existing water quality thresholds to 75% of the Canadian drinking water guidelines and that the revision occur before the project receives regulatory approval.

[1006] Athabasca Chipewyan and Teck jointly developed commitments related to the project and requested that the panel include these as approval conditions, should the project be approved. The Athabasca Chipewyan and Teck jointly developed commitments included a commitment from Teck to work collaboratively with Athabasca Chipewyan in development and implementation of mitigation monitoring and adaptive management plans, including groundwater monitoring plan and seepage management plan.

Analysis and Findings

[1007] Alberta's *Environmental Protection and Enhancement Act* prohibits contaminant release in excess of what is expressly prescribed by an approval (section 108) and sets out requirements for contaminant release management (section 112). *EPEA* approvals do not have limits for releases to groundwater. Releases that result in exceedance of *Alberta Tier 1 and Tier 2 Soil and Groundwater Remediation Guidelines* (2014) must be remediated or managed according with the guidelines and *EPEA*. Alberta's policy on the management of contaminated sites (*Contaminated Sites Policy Framework*, 2014) allows a management option of "exposure control," which may be accomplished through administrative restrictions (e.g., municipal bylaws or land title restrictions prohibiting groundwater use). However, regulatory closure (e.g., reclamation certificate) is not currently available for sites where contamination is so managed.

[1008] Section 2.5 of the *Alberta Tier 1 and Tier 2 Soil and Groundwater Remediation Guidelines* (2014) defines domestic use aquifers in terms of hydraulic conductivity and yield. It also articulates the policy for protection of the quality of domestic use aquifers stating that "a [domestic use aquifer] is an important current and future groundwater resource and must be protected to the maximum extent possible." The human health groundwater ingestion pathway criteria must be met everywhere within a domestic use aquifer. The groundwater ingestion guidelines cannot be modified based on site-specific

conditions. Where natural concentrations of substances in groundwater exceed applicable remediation guidelines, remediation to below the background levels is not required.

[1009] *LARP* includes the *Lower Athabasca Region Groundwater Management Framework* (2012). The *Supporting Document for the North Athabasca Oil Sands Area* (2013) provides further direction for protection of groundwater quality in the North Athabasca Oil Sands Area by defining priority aquifer management units that require protection and defining regional groundwater quality management triggers and targets. The framework is applicable in general to nonsaline groundwater in near-surface sand and gravel deposits as well as to nonsaline intervals of the basal McMurray aquifer. The framework has not identified any priority aquifer management units in the Teck Frontier area. Currently only interim groundwater quality triggers have been identified and no targets; the implementation of interim triggers is not mandatory. In its current form, the framework does not provide any further restrictions or guidance for groundwater protection in the project area.

[1010] The panel considers the seepage of process-affected water from the external tailings areas to be the primary risk to groundwater quality during operations and post-closure. Seepage of process-affected water from the in-pit tailings disposal areas also has the potential to adversely affect groundwater quality post-closure.

[1011] Other potential sources of contaminants, such as the overburden dumps, basal water sands groundwater storage pond, bitumen processing and storage facilities, containment ponds for process liquids, landfills, hazardous waste storage facilities, and facilities for surface runoff control, are not expected to result in significant effects to groundwater quality given the nature, design, and regulatory controls associated with these features.

[1012] Teck will have to comply with the following standards and guidelines for project activities that carry a risk of groundwater contamination:

- *Hazardous Waste Storage Guidelines* (1988) – siting of hazardous waste storage areas to minimize risk of groundwater contamination⁸⁰

⁸⁰ Draft *EPEA* Approval – Condition 4.3.3

- *Directive 073: Requirements for Inspection and Compliance of Oil Sands Mining and Processing Plant Operations in the Oil Sands Mining Area*, which includes design and construction of containment structures.⁸¹ When Teck applies in the future to develop the landfill⁸² and the brine storage pond,⁸³ the following standards and guidelines will be applicable:
 - *Standards for Landfills in Alberta* (2010) – hydrogeological assessment for landfill siting, landfill design and operation
 - *Guidelines for Alberta Brine Storage Reservoirs* (1978, amended 1991) – storage pond design for basal water sands groundwater
 - *Action Leakage Guideline* (1996) – storage pond design for basal water sands groundwater

[1013] The primary focus of Teck's assessment of effects to groundwater quality was protection of downgradient aquatic receptors. This is consistent with previous environmental impact assessments in the mineable oil sands area.

[1014] The panel recognizes that the groundwater model for the Frontier project has been significantly refined and improved since the application was originally filed in 2011. Remaining uncertainties result from limitations associated with the characterization of site hydrostratigraphy, including site-specific information on the hydraulic permeability and hydraulic heads of the Upper and Middle Devonian units, the spatial extent of the basal water sands, and the hydraulic permeability of the Quaternary channel along the western mine pit boundary. The panel accepts that Teck has made appropriate use of existing data sources and that the level of site characterization is appropriate given the stage of the project. The panel also accepts Teck's commitment to collect additional data as project implementation proceeds and using this data to update and refine the groundwater models. The panel finds this to be an acceptable approach to address uncertainties and mitigate risks. The panel requires that Teck develop and implement a plan for periodic updates to groundwater flow and transport model as new information becomes available from supplementary investigations, groundwater monitoring, and testing.⁸⁴

[1015] The panel understands that should karst zones of higher permeability exist or be activated by mining activity, these features could result in an upwards flow of saline groundwater from the Devonian into basal water sands or the mine pit or, conversely, a downward flow of process-affected seepage, depending on pressure differentials in a particular area. The possibility of high-permeability zones in the Devonian is of particular concern in the southern portion of external tailings area 1, where sandy

⁸¹ Draft *EPEA* Approval – Condition 3.1.3

⁸² Draft *EPEA* Approval – Conditions 3.4.8

⁸³ Draft *EPEA* Approval – Conditions 3.4.10

⁸⁴ Draft *EPEA* Approval – Conditions 4.5.1(o)(iii), 4.5.1(p)(iii), 4.5.10(aa)

Quaternary deposits directly overlie the Devonian. If present, this would provide an enhanced migration pathway through deeper Devonian strata to the Athabasca River.

[1016] The panel finds that Teck has appropriately considered the potential impact of encountering increased Devonian permeability in the groundwater modelling completed to date and the mitigation measures proposed for the project. The panel notes that increasing the Devonian permeability by three orders of magnitude during modelling only resulted in marginally higher contaminant concentrations at discharge nodes to surface water. Further, Teck has committed to implementing a karst management plan to identify potential zones of higher permeability in the Devonian. Teck specifically committed to additional characterization of the Devonian in the southern portion of the external tailings areas area, where the Devonian is in direct contact with sand-dominated Quaternary sediments. Teck also identified a number of mitigation measures that could be implemented if higher-permeability zones are encountered beneath the external tailings areas. The panel finds that the additional characterization and proposed mitigation measures are necessary and appropriate.

[1017] Based on the evidence provided by Teck, the panel believes the risk of the Quaternary channel having significant areas of high permeability and providing a preferential pathway for groundwater seepage from the mined-out pit is low. The panel accepts Teck's commitment to conduct further investigations to verify that the Quaternary channel extending along the western boundary of the proposed pit is filled with low-permeability sediments. The panel requires that Teck provide a detailed plan to gather additional information and to report on the hydrogeology of the Quaternary channel along the western mine pit boundary.⁸⁵ Should further investigations indicate the buried channel could provide a preferential pathway for seepage of contaminants, the panel accepts that there are additional mitigation measures that could be implemented to minimize seepage.

[1018] The panel acknowledges that the solute transport model used by Teck (the GoldSim Batch Flush Model) relies on a number of assumptions that affect the model outputs. The model assumes that background solute concentrations are zero. The input source concentrations are also uncertain as they were derived from process-water models or regional data. This is potentially a significant uncertainty. The panel notes that Teck changed the source water concentrations several times during the review process. For instance, chloride was assumed to be 58 mg/L in the original application, 358 mg/L in the project update, and 105 mg/L Teck's response to Round 5 SIR #4(b)). The model considered solute contributions from the two major source areas, the internal tailings areas and external tailings areas, but not from lesser sources such as the overburden dumps. Collectively, these assumptions may result in underestimated contaminant concentrations at discharge nodes to surface water. However, the underestimated effects may be counterbalanced by the conservative assumptions built into the flow model such as a higher recharge rate, which potentially overestimates seepage rates from the tailings areas. Notwithstanding the

⁸⁵ Draft *EPEA* Approval – Condition 4.5.1(a)(i)

limitations of the model and its assumptions, the panel finds that Teck's modelling assumptions and inputs were reasonable considering the data available at the planning stage of the project.

[1019] The spring (artesian well) used by the trappers is outside of the area in which potential groundwater contamination is expected to occur. However, the presence of this spring highlights the potential for the presence of other springs in a similar topographic setting within the potentially impacted domestic use aquifers east of project development area. If present, such springs could be used opportunistically as sources of drinking water. The panel requires that Teck implement a groundwater monitoring program to provide assurance of groundwater quality in all downgradient receptors, including the natural springs.⁸⁶ The panel recommends that Teck conduct a survey of natural springs and baseline testing of the trappers' spring (artesian well).

[1020] The panel acknowledges that Teck's revised analysis of impact to domestic use aquifers indicates that the likelihood of impacts to human health through ingestion of groundwater is considered low. The panel accepts that Teck will have the ability to restrict groundwater consumption as long as Teck remains a mineral surface leaseholder. Should restrictions on the consumption of groundwater be required after the lease is relinquished, Teck will need to work with the AEP to determine the form of such restriction. The panel notes that under current Alberta policy, restrictions on groundwater use would prevent final closure of the site.

[1021] Teck requires an *EPEA* approval for the project. Standard conditions of the approval require development and implementation of a comprehensive groundwater monitoring and management program to be authorized by the AER.⁸⁷ The plan design will consider locations of contaminant sources, locations of potential environmental receptors and geological formations through which contamination may migrate. The panel requires that the groundwater monitoring program include plans to gather additional information and to report on the hydrogeology of the Quaternary, Cretaceous, and Devonian aquifers proximal to the mine footprint and between the project area and the Peace-Athabasca Delta and Ronald Lake area before construction to ensure that the project is not affecting the Peace-Athabasca Delta and Ronald Lake.⁸⁸

[1022] Teck will also be required to participate in regional groundwater initiatives supporting *the Lower Athabasca Region Groundwater Management Framework* (2012).⁸⁹

[1023] The panel understands that full containment of tailings as proposed by Keepers of the Athabasca is not currently an industry practice. It is assumed that full containment in tanks is not feasible because of

⁸⁶ Draft *EPEA* Approval – Conditions 4.5.1(i) and 4.5.1(j)

⁸⁷ Draft *EPEA* Approval – Section 4.5

⁸⁸ Draft *EPEA* Approval – Condition 4.5.1(a)(ii); Draft *Water Act* Licence – Conditions 3.21, 3.22, and 3.23

⁸⁹ Draft *EPEA* Approval – Condition 4.5.12

the very large volumes of tailings produced by oil sands mines. Similarly, installation of engineered liners over large footprint of tailings ponds is assumed not to be technically or economically feasible. However these assumptions were not tested during the hearing.

[1024] The panel agrees that hydraulic interception is a valid engineering approach to manage seepage but notes that its effectiveness depends on the localized hydraulic properties of the subsurface soils. The panel will require Teck to report on the hydraulic interception system's performance annually as a condition of the *EPEA* approval and record the diverted nonsaline water volumes under the conditions of the *Water Act* licence.⁹⁰

[1025] The panel accepts Teck's commitments to address limitations associated with the characterization of the Devonian bedrock by completing further investigation before constructing the external tailings areas, by developing and implementing a karst management plan, and by periodically updating the groundwater model with new data. These commitments will be reflected as conditions in Teck's approvals.⁹¹ Insufficient site-specific geology and water level data at the project planning stage is not unusual, and supplementing models with values from regional studies is an accepted practice. The panel did not find that Teck's model assumed impermeable Devonian bedrock and lack of connectivity with the Athabasca River as was suggested by Keepers of the Athabasca. Teck modelled the amount of seepage that will be reaching surface water bodies, including the Athabasca River. In addition, Teck evaluated a seepage scenario with Devonian permeability increased by three orders of magnitude and evaluated the effects of the resulting higher flux rates on the surface water receptors. Teck concluded that tailings seepage, which will migrate with groundwater and discharge to surface water, will not have chronic or acute toxicity effects on aquatic life.

[1026] The panel requires Teck to conduct further investigation of the Devonian unit at the locations that would present the highest risk to environment if karst features are present, including external tailings areas 1 and 2, before placing tailings within the external tailings area.⁹²

[1027] The panel finds that risk of enhanced migration of seepage from internal tailings area 3 through the Quaternary channel into downgradient groundwater and surface water is low and adequately mitigated by the additional investigation and measures proposed by Teck.

[1028] The panel acknowledges that Teck has entered into participation agreements with Mikisew and Athabasca Chipewyan, which require collaboration with indigenous groups on all plans required for the

⁹⁰ Draft *EPEA* Approval – Condition 4.5.10(x); Draft *Water Act* Licence – Conditions 3.3(c)(ii), 3.7, 4.4(c), and 4.8(e)

⁹¹ Draft *OSCA* Approval – Conditions 18 and 19; Draft *EPEA* Approval – Conditions 4.5.1(a)(ii), 4.5.10(w), 4.5.10(z), and 4.5.10(aa)

⁹² Draft *EPEA* Approval – Conditions 4.5.1(a)(ii) and 4.5.2

project, which the panel interprets to include the proposed groundwater monitoring, karst management, and seepage control plans. The panel is of the view that it is the AER's responsibility to review, authorize, and enforce the implementation of these plans. However, the panel supports the intent of the proposed conditions and commitments related to engagement and collaboration. The panel expects Teck to seek input from Mikisew, Athabasca Chipewyan and other indigenous groups, where appropriate, and make best efforts to incorporate their input into Teck's monitoring and management plans before submitting them to the AER for review or approval. As a condition of approval, the panel will require that Teck provide a summary of the outcomes of the engagement it has conducted related to the groundwater monitoring, karst management, and seepage control plans. The summary will identify the input it received, how it has been incorporated into the plan, and any significant areas of non-agreement.⁹³

[1029] The panel has considered the other recommendations made by Mikisew to the governments regarding groundwater monitoring and management. The panel is of the view that developing and implementing an effective tracing system such as isotopic tracing for tailings ponds near the Athabasca River may have merit and could address some of the uncertainties around migration of tailings seepage constituents to the Athabasca River and their detection in the Athabasca River. This issue was not explored at the hearing, however the panel recommends that the governments of Canada and Alberta evaluate the merits of implementing an effective tracing system for all tailings ponds near the Athabasca River as part of the tailings risk assessment proposed to be conducted as part of the multijurisdictional action plan for Wood Buffalo National Park World Heritage Site or as part of the Oil Sands Monitoring Program.

[1030] The panel also recommends that the Government of Alberta consider the recommendations made by Mikisew regarding indicator parameters and groundwater quality thresholds when revising and finalizing the *Lower Athabasca Region Groundwater Management Framework*.

Interbasin Transfer of Groundwater

Evidence

[1031] Section 47 of the *Water Act* states that "A licence shall not be issued that authorizes the transfer of water between major river basins in the province unless the licence is specifically authorized by a special Act of the Legislature."

[1032] Section 19, "[Surface Water Quantity](#)," discusses the boundary between the Athabasca River and the Peace/Slave River basins intersecting the project footprint. Teck proposes to place groundwater seeping into the north mine and the northern portion of the main pit (within the Peace/Slave River major

⁹³ Draft *EPEA Approval* – Condition 4.5.1(q)

basin) into the external tailings area (within the Athabasca River major basin) to mix with tailings as a part of the recycled water system.

Analysis and Findings

[1033] The panel cannot issue a groundwater licence for the portion of the Frontier project that is within the Peace/Slave River basin for use in the Athabasca River Basin unless authorized by a special Act of the Legislature.

[1034] More discussion of the *Water Act* licence application and interbasin transfer can be found in section 36, "[Water Act](#)."

Panel Recommendations to Teck Resources Ltd

[1035] The panel recommends that Teck include water level monitoring in groundwater wells installed between the project area and the area of groundwater use on the west bank of the Athabasca River to demonstrate that the impacts to the drawdown in the Quaternary aquifer does not extend to the local users.

[1036] The panel recommends that before starting dewatering activities, Teck

- conduct a survey of springs on the west bank of the Athabasca River downgradient of the project and
- establish baseline groundwater level or flow rate and baseline groundwater chemistry in the spring (artesian well) used by Mr. Hoffmann and the trappers and any other springs that might be in use.

Recommendations to Alberta

[1037] The panel recommends that Alberta evaluate the merits of implementing an effective tracing system (e.g., isotopic tracing) for all tailings ponds near the Athabasca River as part of the tailings risk assessment proposed as part of the multijurisdictional action plan for Wood Buffalo National Park World Heritage Site or as part of the Oil Sands Monitoring Program.

[1038] The panel recommends that Alberta consider the recommendations made by Mikisew regarding indicator parameters and groundwater quality thresholds when revising and finalizing the *Lower Athabasca Region Groundwater Management Framework*.

Recommendations to Canada

[1039] The panel recommends that Canada evaluate the merits of implementing an effective tracing system (e.g., isotopic tracing) for all tailings ponds near the Athabasca River as part of the tailings risk assessment proposed as part of the multijurisdictional action plan for Wood Buffalo National Park World Heritage Site or as part of the Oil Sands Monitoring Program.

Significance Determination for Project Effects

[1040] Based on the criteria provided in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects to groundwater quantity and quality.

Ecological Context

[1041] The project is located within the mineable oil sands area of the Lower Athabasca region. The *Groundwater Management Framework* under LARP has not identified any priority aquifer management units in the Teck Frontier area. There is very limited current use of groundwater in the project area for human consumption or other purposes.

Groundwater Quantity

[1042] The effects of the project on groundwater quantity are likely – dewatering of surficial Quaternary deposits will result in a lowering of the water table in these deposits.

[1043] The magnitude will be low – the most significant drawn down will occur within and immediately adjacent to the mine pits and external tailings areas. Drawn down is predicted to be one metre or less at a distance of 4 to 5 kilometres of the mine pits and 5 to 10 kilometres adjacent to external tailings areas.

[1044] The geographic extent is local – predicted drawdown of the groundwater table in the surficial aquifers is predicted to be limited to the groundwater local study area and within 4 to 5 kilometres of the project development area, except near the external tailings areas where drawn down effects may extend up to 5 to 10 kilometres due to operation of the seepage control system.

[1045] The duration is long term – given that effects will occur during operations and in the first few years post-closure in the surficial Quaternary deposits and up to 100 years post-closure in the basal water sand unit.

[1046] The frequency is continuous – effects are expected to occur throughout the 40 year operational life of the project and to start to recover during the closure period.

[1047] The effects are reversible in the future – 100 years post-closure.

Groundwater Quality

[1048] The effects of the project on groundwater quality in the groundwater local study area are likely – seepage from the external tailings areas and internal tailings areas is predicted to result in increased levels of some contaminants in groundwater

[1049] The magnitude will be low – given that

- contaminant levels in groundwater are predicted to remain below the *Guidelines for Canadian Drinking Water Quality* for most parameters and
- contaminant flux rates from groundwater to surface water are predicted not to cause chronic toxicity effects on aquatic life in the receiving water bodies.

[1050] The geographic extent is local – elevated contaminants are expected to occur in groundwater within the groundwater local study area between the project development area and the Athabasca River.

[1051] The duration is long term – given that groundwater modelling predicts contaminants in groundwater will remain elevated after project closure and into the far future (until at least 2181)

[1052] The frequency is continuous – effects are expected to occur throughout the operational stage and into closure.

[1053] The effects are reversible in the far future.

Summary

[1054] Given the above, the panel finds project effects on groundwater quantity and quality in the groundwater local study area are adverse but not likely to be significant due to the low magnitude and localized extent of the predicted effects.

[1055] Reduced groundwater flows will potentially have localized impact on surface water quantity and wetlands. Details of the hydrology and wetland assessments are further discussed in the sections “[Surface Water Quantity](#)” and “[Vegetation](#).”

[1056] The potential for reduced groundwater quality due to the project to adversely affect surface water quality and the aquatic environment is discussed further in section 18, “[Surface Water Quality](#).”

Cumulative Effects

Evidence

[1057] Teck indicated that the likelihood of cumulative effects on groundwater levels or quality between the project and other operating, approved, or planned developments is very low.

[1058] Teck acknowledged that a potential for overlapping drawdown in the basal water sands exists during depressurization if the Pierre River mine is developed. Teck stated that should this occur, the operators would reduce the withdrawal rates to achieve the necessary depressurization effects.

[1059] Teck also identified the potential for cumulative effects on groundwater quality should the Pierre River mine tailings facility be constructed close to the project development area. However, Teck did not expect cumulative effects to occur because Shell committed to implementing seepage interception.

[1060] In regard to potential project effects on the outstanding universal value of Wood Buffalo National Park via the groundwater pathway, Teck stated that the project is not expected to influence the salt plains and gypsum karst features of Wood Buffalo National Park because

- project development activities will be limited to primarily Cretaceous and Quaternary deposits;
- no active karsting has been identified within the project development area;
- the Upper Devonian formation groundwater has higher mineralization, and the formation shows evidence of low permeability, suggesting limited ambient interaction with overlying groundwater units;
- in the regional west-to-east groundwater flow pattern in the Devonian bedrock, the project is located cross-gradient and at a large distance (60–260 km) from the features of interest, indicating no potential groundwater interaction between the two areas under natural gradient; and
- the potential effects on groundwater levels in the Devonian due to depressurization of the basal aquifer are not expected to extend over distances of 60–260 km.

[1061] Teck stated that no direct effects on groundwater quantity or quality are expected the Peace-Athabasca Delta. Changes in groundwater discharge to the local water bodies and ultimately to the Peace-Athabasca Delta were incorporated in the analysis of surface water quality effects. Teck predicted that the project will cause negligible changes to the flows, water levels, and water quality in Ronald Lake, Lake Claire, the Athabasca River, and, therefore, the Peace-Athabasca Delta.

Analysis and Findings

[1062] The panel finds that the project is not likely to contribute to cumulative effects to groundwater quantity or quality. While the panel finds that the project will result in some adverse effects to groundwater quantity and quality, the panel finds that these effects will be localized and of low magnitude. Because Shell has withdrawn the applications for the Pierre River mine, and there are no other projects in which groundwater effects are expected to overlap with the Frontier project, cumulative effects to groundwater quantity and quality are not expected. Cumulative effects to surface water bodies such as the Athabasca River and Peace-Athabasca Delta are discussed in the sections “[Surface Water Quantity](#)” and “[Surface Water Quality](#).”

18 Surface Water Quality

[1063] This section discusses the effects of the project on surface water quality. Project plans and activities may affect surface water quality within the local study area and downstream of the project. Teck assessed potential project effects to surface water quality using assessment nodes located at Big Creek, Redclay Creek, Ronald Lake, on the Athabasca River immediately downstream of the project, and at Embarras (Old Fort long-term river network monitoring station), just upstream of Lake Athabasca.

Project Effects

Evidence

[1064] Teck summarized the water quality issues and sources of impacts from proposed project plans and activities as follows:

- Watercourse diversions
- Muskeg drainage and overburden dewatering
- Closed-circuiting of mine areas (retention of process-affected water on site)
- Depressurization of basal water sands
- Pit lake water quality and releases
- Seepage of process-affected water from backfilled mine pits and tailings disposal areas
- Operation of the fish habitat compensation lake
- Emissions of nitrogen and sulphur oxides and acidification of water bodies
- Emissions, deposition, and accumulation of substances of concern on snowpack and transport to surface water

[1065] Teck proposed to have five surficial water release points for surface drainage, muskeg dewatering, overburden dewatering, and drainage from overburden and reclamation material storage areas throughout the life of the project. These surficial waters would be treated by a polishing (sedimentation) pond before being discharged to surrounding adjacent water bodies identified as Unnamed Creek 2, Unnamed Creek 5, Unnamed Creek 17, and the Redclay Creek Diversion Channel. The Redclay Creek Diversion Channel will discharge to the Frontier fish habitat compensation lake.

[1066] Teck proposes to operate all sedimentation ponds in batch operations under normal flow conditions and to only run as a flow-through system under flood conditions. The conceptual design proposed is to have a length-to-width ratio of 4:1 to 5:1 (if space is available) with horizontal-to-vertical side slopes of 4:1 or flatter. Flocculants (chemicals which bind sediments into larger particles to allow rapid sinking) would be applied as a last measure to all sedimentation ponds. The type of flocculants and

dosage regime will be evaluated during future stages of engineering. Teck noted that oil skimming technology will be included in the design of sedimentation ponds that collect runoff from overburden storage areas.

[1067] Teck stated that streams and runoff from undisturbed areas will be diverted around the project development area in diversion channels. Several diversion channels will route natural flows from Unnamed Creek 2, Big Creek, Redclay Creek, Unnamed Creek 17, and Unnamed Creek 18 watersheds around areas where mining-related activities will occur. Teck expects some of these diversions to remain operational until the end of closure, which is expected to be in 2081. Teck proposes to release diversion runoff through four surficial water release points into lower reaches of Unnamed Creek 18, Unnamed Creek 17, Redclay Creek, and Big Creek.

[1068] Teck's proposed conceptual design for the diversion channels is for the channels to be non-erodible up to a 10-year flood event and to convey a 100-year-flood peak flow with a minimum freeboard (vertical distance between maximum depth and overtopping elevation) of 0.6 m. These design criteria are based on a flood peak flow velocity of less than 0.5 m/s for a 10-year peak flow for sandy soils, and a flow velocity of less than 0.8 m/s for a 10-year peak flow for clay and silt soils.

[1069] Runoff water from active mine areas, haul roads, plant facilities, tailings impoundments (including seepage), and external disposal areas containing fines is expected to be of poor quality and would be maintained in a closed-circuit system and not released to the environment.

[1070] Further details on water management are provided in section 8, "[Water Management](#)."

[1071] Teck considered additional factors which may impact surface water quality. These included accidents or malfunctions, alteration of temperature due to changes in flows or creation of water bodies, partitioning of contaminants to sediments, and impacts to and from groundwater.

[1072] Teck compared measured and predicted water quality parameter concentrations against Alberta's *Environmental Quality Guidelines for Alberta Surface Waters* and the CCME's *Canadian Environmental Quality Guidelines*. These guidelines were also used by Teck in a screening procedure to determine parameters of concern that would require further evaluation of aquatic health effects. To assess potential downstream effects on the Athabasca River, Teck evaluated predicted water quality against published targets and limits within the *Lower Athabasca Region: Surface Water Quality Management Framework for the Lower Athabasca River*. The project was evaluated against these targets and limits to ensure that it would comply with requirements to remain below these thresholds.

[1073] Teck also compared measured and predicted water quality parameters to site-specific guidelines called chronic-effects benchmarks. Teck submitted that the use of chronic-effects benchmarks allows consideration of regional characteristics of water quality and aligns with federal protocols for deriving

water quality guidelines for the protection of aquatic life (CCME 2007 – A Protocol for the Derivation of Water Quality Guidelines for the Protection of Aquatic Life 2007).

[1074] To quantify potential effects to aquatic health, water quality parameters were passed through a screening procedure. If a substance was greater than 10% above reference conditions, it was included in the aquatic health assessment. However, if the predicted concentration of that substance was below the aquatic life guideline or chronic-effects benchmark derived for the Frontier project, it was removed from further assessment.

[1075] Parameters that were found to be greater than screening criteria in the project application case for the assessed nodes and carried forward to the aquatic health assessment are summarized in [Table 12](#).

Table 12. Parameters greater than screening criteria in the project application case

Assessment node	Application case milestone date			Closure and initial pit lake release (2081)	Far future (2181)
	Construction (2024)	Operation (2050)	Operation (2066)		
Ronald Lake				Al, Fe	Al, Fe
Redclay Creek	Al, Fe, TP	TP	TP	Al, Fe, Li, TN, TP	Al, Fe, Li, TN, TP
Big Creek	Al, Cd, Fe, Li, Mn, S, TPh, TP	Al, NH ₄ , Cd, Cu, Fe, Pb, Li, Mn, TN, TPh	Al, NH ₃ , Cd, Cu, Fe, Pb, Li, Mn, TN, TPh	Al, NH ₃ , Cd, Li, S, TP	Al, NH ₃ , Cd, Fe, Li, S, TP

Parameter abbreviations: Al=aluminum, NH₃=ammonia, Cd=cadmium, Cu=copper, Fe=iron, Pb=lead, Li=lithium, Mn=manganese, S=sulphide, TN=total nitrogen, TP=total phosphorus, TPh=total phenols

[1076] Teck attributed the cause of parameters being greater than screening criteria as follows:

- For Ronald Lake – closed-circuiting of land areas and evaporation in north pit lake
- For Redclay Creek – discharge from central pit lake, muskeg drainage, closed-circuiting of land areas, seepage from external and internal tailings areas
- For Big Creek – muskeg drainage, closed-circuiting of land areas, discharge from south pit lake, diversion of upstream reaches, overburden water (during construction and operation), and seepage from the internal and external tailings areas and overburden (during closure and far future)

[1077] In the application case, no substances were found to be greater than Teck's screening criteria for the Athabasca River node closest to the project area. For the assessment node on the Athabasca River at Old Fort, no substances were more than 10% greater in the application case compared to the base case.

[1078] Teck indicated that warmer pond temperatures during the fall (from stored thermal energy) and large end-pit lakes may affect the thermal regime of receiving water but would be limited to on-site

watercourses because dewatering release water makes up less than 1% of annual lowest 7Q10 (lowest average discharge over a one week period which happens every 10 years) flows in the Athabasca River. Temperature increases for Big Creek and Redclay Creek would remain within 1.7°C of reference conditions and were therefore predicted to have negligible effects.

[1079] Concentrations of metals and PAHs in sediments are predicted to increase in Big and Redclay Creeks but remain below interim sediment quality guidelines and are therefore predicted to have negligible effects on sediment quality.

[1080] Sediment modelling did not account for settling, sorption, or degradation of PAHs, making it conservative.

[1081] To mitigate for potential project-related water quality effects, Teck proposed the following:

- Use of polishing ponds with oil-separation capabilities to treat all surface water collected from muskeg drainage, reclamation stockpiles, overburden dewatering and other non-process-affected areas.
- Monitoring of ponds including temperature and dissolved oxygen. Ponds would be aerated if dissolved oxygen levels are shown to be low.
- Collection of all process-affected water within a closed-circuit system with no release to the receiving environment during operations. Cap water in external tailings area 1 would be transferred to the centre pit lake at closure.
- Developing self-sustaining closure landscape that minimizes erosion and directs seepage and runoff to wetlands, pit lakes, or constructed reclamation lakes during closure to enable water quality treatment before being released to the receiving environment.
- Low-permeability formations or engineered dikes to prevent or reduce flow of process-affected water into receiving waters.
- Not placing tailings in end-pit lakes.
- Development of safety protocols to limit accidents and releases to water bodies. Development of monitoring and response plans should accidental releases to water bodies occur.
- Finalization and implementation of the draft hydrology and water quality mitigation, monitoring, and adaptive management plan.
- Participation in and support of regional monitoring and research initiatives (e.g., Oil Sands Monitoring program and Canadian Oil Sands Innovation Alliance).

[1082] Athabasca Chipewyan and Mikisew both jointly developed a number of commitments and conditions related to the project with Teck. With respect to surface water quality, these include the following:

- Consultation with Athabasca Chipewyan and Mikisew on draft monitoring plans required for the project
- Achieving no greater than negligible project effect on water quality in Ronald Lake, Lake Claire, and Peace-Athabasca Delta
- Annually reviewing monitoring data and regularly updating mitigation, monitoring, and adaptive management plans
- Monitoring contaminant spikes in the Athabasca River during construction
- More-frequent water quality monitoring during rising and falling of the hydrograph
- Snow sampling as part of water quality monitoring
- No placement of tailings in end-pit lakes without consultation with First Nations
- Testing tailings cap water prior to transfer to end-pit lakes

[1083] Teck and Mikisew agreed that the project should have no greater than a negligible effect on water quality in Ronald Lake, Lake Claire, and the Peace-Athabasca Delta. At the hearing, Teck defined negligible effect as being in line with predictions of the environmental assessment. However Mikisew indicated this would need further work as elders would define it as being able to drink water from the river, and negligible effect would need to consider this, indigenous knowledge, and western science. Mikisew indicated this would be resolved at a later date.

[1084] Athabasca Chipewyan expressed concerns with the usefulness and relevance of the single water quality monitoring station on the Athabasca River at Old Fort used by *LARP* to identify potential impacts from oil sands. Athabasca Chipewyan and Teck jointly recommended that the *Lower Athabasca Region: Surface Water Quality Management Framework for the Lower Athabasca River* be revised by 2020 to expand the number of sites and frequency of monitoring beyond the single site at Old Fort (which is sampled monthly) and that the framework incorporate water quality monitoring data from Athabasca Chipewyan and the indigenous-community-based water quality monitoring program.

[1085] ECCC expressed concerns with the accuracy of Teck's predictive aquatic models given that models have inherent uncertainties. ECCC recommended that aquatic models be recalibrated and rerun every five years based on current data to estimate predicted impacts to the environment. Teck stated that the value of updating predictive water quality models was superseded in many cases by direct monitoring, but did agree to ECCC's recommendation to rerun the models every five years.

[1086] Teck assessed each individual water quality parameter and did not specifically account for additive, cumulative, and synergistic effects. When asked about this by OSEC, Teck stated that acute and chronic toxicity effects were looked at to account for effects which cannot be evaluated when assessing each parameter on its own.

[1087] Teck developed a draft hydrology and water quality mitigation, monitoring, and adaptive management plan for the project. The draft plan discusses the following:

- an overview of regulations, approvals and guidelines
- the goals and objectives associated with the plan
- project effects related to hydrology and water quality
- development and consultation for the plan
- the mitigation program adopted by Teck to control hydrology and water quality
- a conceptual monitoring program
- an adaptive management plan
- implementation of the plan

[1088] Teck indicated that if the project were approved, finalization of the draft plan would occur after an approval was issued to Teck from AER which contained conditions outlining the required content of the plan. Submission of a final plan would entail engagement with regulators, indigenous communities, and stakeholders to develop more clarity around the indicators, metrics, threshold, and objectives and would consider future stages of project planning and engineering.

Analysis and Findings

[1089] Development of the mine will result in runoff and seepage from various areas, and this has the potential to impact water quality in receiving waters. Drainage of muskeg and overburden and runoff from overburden storage areas, reclamation stockpiles, and other areas such as roads will contain elevated concentrations of water quality parameters, including salts and organic compounds. At closure, seepage water from backfilled mine pits and tailings areas will contain elevated levels of metals, dissolved ions and salts, organic substances (naphthenic acids), PAHs, total phenolics, acute and chronic toxicity, and tainting potential.

[1090] The panel notes that Teck has separated the different types of surficial water releases into sedimentation pond flows and others that run into diversion channels.

[1091] As it relates to sedimentation ponds, the panel is satisfied with the ponds' conceptual design proposed by Teck, and expects the applicant to submit to the AER final engineering design of the ponds prior to construction. To ensure final pond designs are consistent with the proposed conceptual design, the

panel will require as a condition within the *EPEA* approval, that Teck obtain the AER's authorization before constructing any sedimentation ponds.⁹⁴

[1092] The panel considers the inclusion of oil skimmers in sedimentation ponds that collect runoff from the overburden storage area to be a proactive and appropriate design approach to limit bitumen constituents from entering the surrounding water bodies. To ensure environmental releases of this nature are avoided or minimized, the *EPEA* approval will include monitoring and concentration release limits for oil and grease, BTEX, and F1 to F3 hydrocarbon fractions for all sedimentation pond releases.

[1093] Other sedimentation pond release limits will include total suspended solids, 5-day biochemical oxygen demand (BOD₅), ammonia-nitrogen, chlorides, pH, and acute lethality testing using rainbow trout. The operational batch procedure that Teck proposes for the sedimentation ponds provides an added level of environmental protection because water not meeting regulatory limits will not be released to the surrounding environment but rather diverted to the project's closed-circuit drainage system for water reuse.

[1094] As the diversion channel is collecting water from the surrounding environment, not impacted by mining activities, the environmental risk associated with releases is considered lower relative to other sources of water released to the receiving environment within the mine footprint area (*i.e.*, sedimentation ponds). Any environmental impacts resulting from the use of the diversion channel infrastructure would be related to sediment transport into the surrounding water bodies. To limit this environmental impact, Teck has stated that the diversion channels will be non-erodible up to a 10-year flood event. Therefore, the panel will include conditions within the *EPEA* approval for total suspended solids monitoring and an associated total suspended solids concentration limit for this type of surficial water release.⁹⁵

[1095] The panel finds that Teck's proposed approach of capturing runoff water from active mine areas, haul roads, plant facilities, tailings impoundments (including seepage), and external disposal areas within a closed-circuit area and use it for recycle water is consistent with industry best practice and should minimize the potential for adverse effect to adjacent water bodies. The panel recommends that the Minister include this mitigation measure in the decision statement under *CEAA 2012* (see section 38).

[1096] The panel agrees that Teck's aquatic assessment models are generally conservative and based upon the best available data at the time. However the panel notes that there are uncertainties that have not been accounted for. For instance, prediction confidence for modelled sediments is low given limited data. Due to uncertainties in the model, the panel supports ECCC's recommendation to recalibrate and rerun predictive aquatic models every five years and will include this as a condition of approval.⁹⁶

⁹⁴ Draft *EPEA* Approval – Conditions 3.3.1–3.3.4

⁹⁵ Draft *EPEA* Approval – Conditions 4.2.12 and 4.2.15

⁹⁶ Draft *EPEA* Approval – Condition 4.2.25(h)

[1097] The panel notes that Teck relied on the use of chronic-effects benchmarks in the screening and assessment of water quality parameters. In the absence of provincial or federal water quality guidelines or when the chronic-effects benchmarks are equal to or lower than relevant guidelines, this is an acceptable approach. However, the application and use of chronic-effects benchmarks is not supported when relevant provincial or federal criteria exist as the chronic-effects benchmarks may not have gained acceptance at the provincial or federal level. In the context of this project, the panel accepts the use of chronic-effects benchmarks as a risk-screening tool, but given that chronic-effects benchmarks have not been accepted for use in Alberta, application of chronic-effects benchmarks is not accepted for managing regulated discharges.

[1098] Teck did not dispute that concentrations of parameters of concern would be elevated but submitted that these increases would not be of concern from an aquatic health perspective. While numerous water quality parameters of concern are predicted to be elevated above reference levels as a result of the project, the panel notes that the majority of parameters are predicted to remain below applied water quality screening thresholds and therefore are unlikely to have a significant impact on the aquatic health. Verification of this assumption would occur through an aquatic environment effects monitoring program. This is discussed further under the “Aquatic Health” heading later in this section.

[1099] The proposed mitigation measures are typical for an oil sands mine. Teck will be required to adhere to standard *EPEA* conditions requiring all industrial wastewater from process-affected areas be maintained in the closed circuit and not discharged to the receiving environment. Industrial runoff from other areas will require treatment and monitoring at sedimentation ponds before release and be subject to release limits. The absence of on-site upgrading and coking facilities, Teck’s commitment to not place tailings in end-pit lakes, and Teck’s commitment to not place any process-affected water in the north pit lake will help eliminate water quality impacts and issues from those sources.

[1100] In order for Teck to comply with all surficial water release limits, water quality monitoring is vital. The *EPEA* approval will contain specific water quality parameters for monitoring as well as the associated frequency of sampling.⁹⁷ Typical water quality monitoring not only includes parameters that have concentration release limits but will also measure chemical characteristics such as alkalinity, salinity, nutrients, metals (including ultra-low-level mercury and methylmercury), hydrocarbons, and toxicity testing.

[1101] The panel understands that Teck will advance design of the project’s flocculation systems during future stages of engineering. This will include identifying the required infrastructure, type of flocculants to be used, anticipated dosage, and any contingency or mitigation measures should the flocculation system not function appropriately. To ensure that the AER is provided this information before starting

⁹⁷ Draft *EPEA* Approval – Condition 4.2.15

operations, the *EPEA* approval will require Teck to submit a water management plan that outlines in detail the plan for flocculant use.⁹⁸

[1102] The draft hydrology and water quality mitigation, monitoring, and adaptive management plan outlines proposed monitoring activities, mitigation measures, proposed thresholds and targets, and potential future adaptive management actions that could be implemented if thresholds or targets are exceeded. The panel acknowledges that the plan is still conceptual in nature and that further development is required but finds the plan to be acceptable for this stage of the regulatory process. The panel will include a condition requiring the plan to be finalized and submitted to the AER for approval before construction.⁹⁹ Teck will also be required to participate in regional initiatives and to fund regional monitoring.¹⁰⁰ These strategies are intended to ensure impacts are appropriately monitored for and achieve outcomes that other parties are looking for.

[1103] The panel acknowledges that Teck has entered into participation agreements with Mikisew and Athabasca Chipewyan, which require working with indigenous groups on all plans required for the project, which the panel interprets to include the draft hydrology and water quality mitigation, monitoring, and adaptive management plan. While the panel is of the view that it is the AER's responsibility to determine the adequacy of, authorize, and enforce implementation of such plans, it supports the intent of the proposed conditions and commitments related to engagement and collaboration. The panel expects Teck to seek input from Mikisew, Athabasca Chipewyan, and, where appropriate, other indigenous groups and make best efforts to incorporate their input into Teck's monitoring and management plans before submitting them to the AER for review or approval. As a condition of approval, the panel will require that Teck provide a summary of the outcomes of the engagement it has conducted related to the draft hydrology and water quality mitigation, monitoring, and adaptive management plan. The summary will identify the input it received, how it has been incorporated into the plan and any significant areas of non-agreement.¹⁰¹

[1104] With respect to Athabasca Chipewyan and Mikisew recommendations related to the *Lower Athabasca Region: Surface Water Quality Management Framework for the Lower Athabasca River*, the panel understands the intent of the monitoring site at Old Fort is not to capture short-term events specific to the oil sands mining area, but rather is to document long-term trends in water quality for the entire region. The framework outlines a multistep process that will occur if exceedances of triggers or limits are observed, which includes verification, preliminary assessment, investigation, management actions, evaluation, and communication. Given the broad regional context, the above process can be expected to

⁹⁸ Draft *EPEA* Approval – Conditions 3.3.3 and 3.3.4(c)

⁹⁹ Draft *EPEA* Approval – Conditions 3.3.3 and 3.3.4(k)

¹⁰⁰ Draft *EPEA* Approval – Conditions 4.1.61, 4.2.26, and 4.2.27

¹⁰¹ Draft *EPEA* Approval – Condition 3.3.4(k)(v)

take many years to occur. In contrast, site-specific monitoring conducted by Teck is expected to provide timely and locally relevant monitoring information.

[1105] The panel recognizes that it is not within its mandate to recommend specific government policies as part of this project review and that it would not be appropriate for the panel to unilaterally recommend any specific changes to the framework that were recommended by Athabasca Chipewyan and Mikisew. The panel believes that any changes should be negotiated multilaterally and based on joint collaboration between federal, provincial, and First Nations governments and agencies; industry; and other members of the public. The panel will, however, include a recommendation that Alberta review and consider Athabasca Chipewyan and Mikisew's recommendations related to the number of monitoring stations, updating of triggers and limits for water quality parameters, and incorporation of community-based monitoring results in the framework as part of future review updates.

Recommendations to Alberta

[1106] The panel recommends that Alberta review and consider Athabasca Chipewyan and Mikisew's recommendations related to the number of monitoring stations, inclusion of additional parameters, and inclusion of community-based monitoring data in the *Lower Athabasca Region: Surface Water Quality Management Framework for the Lower Athabasca River* as part of future reviews or updates.

Mercury and Methylmercury

[1107] Teck proposes to construct two off-stream storage ponds and a fish habitat compensation lake. The fish habitat compensation lake would be filled with water from Redclay Creek. One off-stream storage pond would be created within the main pit and filled with water from on-site drainage. The second off-stream storage pond would be excavated within Unnamed Creek 2 and filled primarily with Athabasca River water with some minor inputs from muskeg drainage and surface runoff that would have otherwise flowed to Unnamed Creek 2. Discharge from this pond would be to the downstream section of Unnamed Creek 2, a tributary of Big Creek. Flooding of organic soils and mercury in inflowing waters can result in formation of methylmercury. Mercury biomagnifies through the aquatic food chain, meaning large predatory fish can accumulate significant amounts of mercury in tissues. This may have adverse effects on aquatic biota (including fish) or humans if the fish were consumed.

Evidence

[1108] Teck outlined mitigation and monitoring measures for mercury in the fish habitat compensation lake in the draft detailed fisheries offsetting plan. Mercury methylation is thought to occur from decomposition of soils and vegetation, which promotes microbial methylation of inorganic mercury to organic methylmercury. Teck's primary planned mitigation measure is the removal of organic material from the fish habitat compensation lake before filling. Teck provided evidence from other compensation lakes in the oil sands area that it believed demonstrated that the formation of methylmercury is

significantly reduced when vegetation and organic soils are stripped during construction of the lake. Teck confirmed that removal of organic material would also occur during construction of the off-stream storage pond located in Unnamed Creek 2.

[1109] DFO stated that even with removal of vegetation as a mitigation measure for reducing methylmercury formation, a spike in mercury occurs initially with a subsequent decrease. Teck stated that monitoring from existing compensations lakes supported their view that removal of vegetation and organic soil would mitigate the risk of increased mercury methylation. Horizon Lake was partially excavated while the remainder was left vegetated before flooding. Muskeg Lake was completely excavated removing all vegetation and organic material. Data presented in the detailed fisheries offsetting plan indicated an increase in total mercury concentrations in Horizon Lake and no increase in concentrations in Muskeg Lake.

[1110] Teck stated that in the event methylmercury concentrations were higher than predicted in the fish habitat compensation lake, there were other mitigation measures that could be implemented. These mitigation measures include intensive and selective fishing to remove large-bodied fish that have accumulated high levels of mercury in their tissues, manipulation of growth and food web to prevent bioaccumulation from happening, prohibiting fishing and consumption of fish during the first years of impoundment, and increasing the pH of the water.

[1111] DFO agreed that the additional mercury mitigation measures outlined by Teck would be reasonable measures if mercury concentrations are elevated, but so far they have been untested in the oil sands region.

[1112] ECCC stated that considerable monitoring is needed to confirm levels of mercury for inflowing streams to be used to fill the off-stream storage ponds and fish habitat compensation lake. Teck's sampling of Redclay Creek found mercury water concentrations ranged from $<0.0006 \mu\text{g/L}$ to $0.6 \mu\text{g/L}$. ECCC noted the high variability in mercury concentrations in Redclay Creek based on Teck's data, with maximum concentrations many times chronic and acute guidelines for mercury and many times over concentrations of mercury in water used to fill other compensation lakes.

[1113] ECCC also recommended Teck conduct additional research related to mercury, including the following:

- Conducting soil core flooding experiments
- Measuring baseline food web components including measurements of carbon and nitrogen isotopes, total mercury, and methylmercury in fish, fish-eating wildlife, and lower food web organisms
- Measuring baseline mercury stable isotopes in fish, fish-eating wildlife, and lower food web organisms

- Modelling mercury and methylmercury loading in the fish habitat compensation lake and off-stream storage ponds to identify needed mitigation measures
- Modelling inorganic mercury and methylmercury levels in downstream environment (Athabasca River and Peace-Athabasca Delta)
- Investigating methods to identify potential of downstream environment for mercury methylation to occur
- Identifying and implementing appropriate mitigation measures for downstream loadings

[1114] Teck agreed with the need to collect additional baseline data on mercury concentrations in Redclay Creek and the need for monitoring for mercury and methylmercury concentrations associated with the fish habitat compensation lake, but did not support the additional recommendations made by ECCC.

[1115] Teck stated in their response to ECCC's recommendations that they would agree to a recommendation to collect baseline information to further inform methylmercury formation in the fish habitat compensation lake. Teck stated in their application that fish tissue mercury concentrations higher than baseline range and higher than guidelines for safe human consumption would trigger mitigation measures to reduce mercury concentrations.

[1116] ECCC stated that the recommended stable isotope work would allow the transport of a molecule through an ecosystem to be followed contributing to an improved understanding of how mercury is transferred through the ecosystem.

[1117] DFO confirmed that the additional monitoring and modelling of mercury that ECCC recommended was beyond what other operators have been required to do but believed it is warranted based on additional scientific knowledge gained since establishment of other regional habitat compensation lakes. DFO stated that compensation lakes in the oil sands region are only ten years old and it is not understood if sufficient information has been collected to understand the environmental fate of mercury in these lakes.

[1118] Teck confirmed during the hearing that additional modelling is not planned for the compensation lake as they are proposing to mitigate methylmercury formation by removing the carbon source. Teck stated it is likely that the additional modelling would simply show that the carbon needed to be removed. Teck submitted that rather than additional modelling, gathering additional site-specific water quality data and monitoring of mercury and methylmercury concentrations in the fish habitat compensation lake following construction was a better approach.

[1119] ECCC confirmed during the hearing that there has been no observed increasing trend in mercury concentrations in the Athabasca River at the stations monitored as part of the Oil Sands Monitoring Program.

Analysis and Findings

[1120] The panel finds that Teck's proposed approach to mitigate methylmercury formation in the fish habitat compensation lake and the Unnamed Creek 2 off-stream storage pond is appropriate. Based on experience at other compensation lakes, removal of vegetation and organic soils during construction is expected to significantly reduce methylmercury formation in these water bodies. The in-pit off-stream storage pond would not contain organic soils, and any discharge water would be maintained within the closed-circuit loop and therefore would not represent a risk to the receiving environment.

[1121] The panel will require as a condition of approval that Teck remove all vegetation and organic soils from the footprint of the fish habitat compensation lake and the off-stream storage ponds during their construction to reduce the potential for mercury methylation.¹⁰²

[1122] The panel acknowledges that mercury is present in the waters used to fill the fish habitat compensation lake and the Unnamed Creek 2 off-stream storage pond. Mercury concentrations in the fish habitat compensation lake and Unnamed Creek 2 off-stream storage pond would be expected to reflect mercury concentrations of water used to fill these water bodies irrespective of the proposed removal of organic material during construction. Any inflowing organic carbon added to these water bodies following construction, such as sediments from Redclay Creek or from muskeg drainage, would likely contribute to mercury methylation when combined with mercury in these waters. Mitigation of mercury methylation from inflowing water would require either reducing inflowing mercury concentrations or reducing organic carbon availability. Teck's proposed mitigation measures do not account for these mechanisms. Should mercury methylation be identified as a concern after construction and filling of the lake or Unnamed Creek 2 off-stream storage pond, additional mitigation measures may be required. The panel expects these would be addressed as part of Teck's proposed monitoring and adaptive management program for the fish habitat compensation lake.

[1123] The large variation in mercury concentrations in Redclay Creek based on a limited number of samples requires resolution. Teck has not documented why this variability exists. Additional sampling of inflowing streams to the fish habitat compensation lake and Unnamed Creek 2 off-stream storage pond are required to more accurately determine mercury concentrations and whether there are other factors affecting mercury concentrations, such as sediment concentrations or seasonal variability. The panel supports ECCC's recommendation that Teck collect high-frequency total mercury and methylmercury measurements in water to be used in the fish habitat compensation lake and Unnamed Creek 2 off-stream storage pond to resolve this uncertainty. The panel will require Teck to complete additional baseline measurement of mercury and methylmercury in the water flowing into the fish habitat compensation lake and Unnamed Creek 2 off-stream storage pond as a condition of approval.¹⁰³

¹⁰² Draft *EPEA* Approval – Condition 3.3.8

¹⁰³ Draft *EPEA* Approval – Condition 3.3.4(e)

[1124] If it is confirmed that mercury concentrations are as high as 0.6 µg/L, Teck will need to re-examine mercury methylation risks and establish mitigation measures for inflowing mercury before filling the fish habitat compensation lake and Unnamed Creek 2 off-stream storage pond with this water because these levels of mercury present a risk to the fish habitat compensation lake and the downstream receiving environment from Unnamed Creek 2 off-stream storage pond regardless of removal of organic carbon during construction. Should this situation occur the panel requires that Teck develop a mitigation plan to address elevated mercury concentrations in source waters which may result in methylmercury production at levels harmful to aquatic life.¹⁰⁴

[1125] Given that Teck has committed to removing vegetation and organic soils from the fish habitat compensation lake and Unnamed Creek 2 off-stream storage pond during construction and this will be included as a condition of approval, the panel is not convinced that the soil core flooding experiments recommended by ECCC would produce additional meaningful information that would inform project design or mitigation measures for mercury and methylmercury. The panel agrees with Teck that direct monitoring of mercury and methylmercury concentrations in the fish habitat compensation lake and in fish tissues will be more useful and will inform the need for additional mitigation measures. The panel recommends that the Minister include mitigation measures and a follow-up program in the decision statement under *CEAA 2012* (see section [38](#)).

[1126] With respect to the stable isotope studies recommended by ECCC, the panel understands that such studies may be helpful in better understanding mercury transfer within the ecosystem and guiding future monitoring efforts. However given the limited size of the fish habitat compensation lake (1.2 km²) and the proposed mitigation measures, the project is not expected to make a significant incremental contribution to mercury or methylmercury concentrations in downstream receiving environments. Further, the panel believes that such studies, to the extent they are needed to address uncertainties related to mercury transfer within Athabasca River ecosystem, should be conducted as part of regional monitoring efforts rather than required of an individual proponent. The panel therefore does not require Teck to undertake such work before establishing the fish habitat compensation lake.

[1127] Notwithstanding the above, the panel recognizes that the detailed fisheries offsetting plan is still draft and needs to be finalized by Teck and approved by DFO. DFO will ultimately determine what monitoring and other requirements apply to the fish habitat compensation lake.

The panel notes that, to date, monitoring within the Athabasca River has not shown a trend of increasing mercury concentrations that might be expected if habitat compensation lakes were acting as significant sources of mercury or methylmercury. Given the limited size of the proposed fish habitat compensation lake and off-stream storage ponds and Teck's proposed mitigation measures, it is unlikely that the project will result in a detectable increase in mercury concentrations in the Athabasca River. Increases in mercury

¹⁰⁴ Draft *EPEA* Approval – Condition 3.3.4(f)

concentrations as a result of formation of the fish habitat compensation lake and off-stream storage ponds would be expected to be limited to the local areas. The panel expects that monitoring of mercury and other substances in the Athabasca River will continue as part of regional monitoring which Teck will be required to fund as an operator in the region.

Lake Acidification

[1128] The Frontier project will be a source of acid-forming emissions such as oxides of nitrogen and sulphur. These emissions may result in acidification of water bodies if their respective buffering capacities (critical loads) are exceeded.

Evidence

[1129] The acidification potential of 285 water bodies within the air quality regional study area were assessed by Teck for the following cases: predevelopment (pre-1968), existing (as of 2009–2013), base, application, and planned development. Acidification potential was determined from net potential acid input, which is calculated as the difference between deposited acidifying NO_x and SO_x emissions and acid-buffering base cations, expressed in H^+ equivalents. Acidification potential was assessed by considering whether potential acid input was greater than critical loads in water bodies based on model results (following Alberta and Cumulative Environmental Management Association [CEMA] recommendations), whether predicted changes between cases in areas exposed to acid deposition were greater than or equal to $0.17 \text{ keq H}^+/\text{ha/a}$ (Alberta monitoring level which triggers additional monitoring when exceeded), predicted changes in deposition of NO_x , SO_x , and potential acid input to the 285 water bodies assessed, and changes in the number of assessed water bodies with net potential acid input greater than critical loads between cases.

[1130] The lakes assessed by Teck spanned a wide range of water chemistry, although Teck indicated most of the lakes were highly buffered. Only 13% of assessed water bodies had a critical load (defined as the highest annual input of acid deposition that does not cause unacceptable change, in this case acidification) below the $0.25 \text{ keq H}^+/\text{ha/a}$ value Alberta uses as the maximum potential acid input allowed, which will protect the most sensitive water bodies from acidification. Only 9% had critical loads less than the Alberta monitoring limit of $0.17 \text{ keq H}^+/\text{ha/a}$, indicating that most water bodies assessed were highly buffered and not sensitive to acidifying emissions.

[1131] Teck's assessment assumed simultaneous emissions from all sources at the maximum approved rates of emissions. Under existing conditions, 27 of 285 assessed water bodies have a net potential acid input that exceeds critical loads and would be susceptible to acidification under existing conditions. This number increases to 28 under base case and remains at 28 for the application case.

[1132] Using a different model (GEM-MACH), ECCC identified widespread exceedances of critical loads in aquatic systems. To support their modelled results, ECCC conducted regression analysis of lake

pH data from the 2010–2015 RAMP dataset and showed decreasing (acidifying) pH trends in 10 lakes. Over the complete RAMP record, ECCC indicated 5 lakes showed acidifying trends.

[1133] In response, Teck conducted an analysis of the RAMP data from 1999 to 2015, which indicated increasing pH in nearly all lakes up to 340 km away and stated that the lack of acidification may be due to base cations being deposited at higher rates than potentially acidifying inputs of SO_x and NO_x. Further, the most recent RAMP report concluded no increasing trends in acidification for the lakes sampled.

[1134] ECCC stated that acidifying compounds would carry further downwind than dust containing acid-neutralizing base cations. In response, Teck analyzed 2012–2014 RAMP snow data, which indicated that levels of calcium and magnesium alkalinity would buffer potential acidity from snow in distances exceeding 150 km. Base cation concentrations did not appear to be correlated to measures of total suspended solids in snowpack which Teck indicated would be expected if these cations were associated with dust as proposed by ECCC.

[1135] ECCC noted that irrespective of predicted results, any new emission sources represent an increase in acidification and will accelerate the rate of ecosystem damage.

[1136] Given conflicting model results and Teck's assessment of RAMP data which did not support ECCC's findings, Teck did indicate support of ECCC's recommendation for observation-based correction of model-simulated deposition as a means to correct model predictions.

Analysis and Findings

[1137] The project will contribute acidifying emissions to the assessed area, primarily through an increase in NO_x emissions. The only SO_x emissions from the project are trace emissions from diesel and natural gas combustion. Increased emissions do not mean that lakes will acidify, only that they have the potential to acidify. Lakes lacking base cations would be at higher risk as they don't have the capacity to buffer against the increased nitrogen and sulphur deposits.

[1138] The panel notes that Teck conducted its assessment of potential acidification effects of lakes using standard methods and models used in other oil sands mine environmental impact assessments. ECCC has presented alternative methods and models that may require further evaluation and potential incorporation in future assessments. The panel is satisfied that the models and methods used by Teck for the application were appropriate.

[1139] The panel accepts Teck's assertion that current modelled predictions for acid input are conservative in that maximum emissions from all sources simultaneously are unlikely to occur. Based on Teck's modelling, the predicted effect of acidifying emissions from the project is negligible, affecting the same number of lakes (28) in both the base case and application case.

[1140] Both ECCC and Teck analyzed data collected by RAMP to support their modelled results and to present different findings. While ECCC showed decreasing trends in lake pH in several lakes, Teck showed an increasing trend in the majority of the lakes surveyed by RAMP over the monitoring record. The panel notes that the most recent RAMP report concluded no significant change in pH in the lakes. The panel therefore finds that widespread acidification of lakes does not appear to be occurring. However given the differing professional opinions related to the interpretation of the monitoring results, it is important that regional monitoring of acid-sensitive lakes continues as this provides meaningful data used to confirm and refine model predictions and provides a direct measure of impacts of mineable oil sands to regional water bodies from acidifying emissions. The panel will require that Teck participate in regional initiatives to monitor acid deposition.¹⁰⁵

Conditions

[1141] Teck must

- participate in, on an ongoing basis, an acid deposition monitoring program for aquatic and terrestrial ecosystems through regional initiatives or another program authorized in writing by the Director;
- support the program results of the acid deposition monitoring program; and
- support the program design of the acid deposition monitoring program, including monitoring frequency, timing, aerial coverage, and endpoints, to ensure it is sufficiently robust as to detect potential impacts in the receiving environment as determined by periodic peer review conducted by regional initiatives or another program authorized in writing by the Director.

[1142] Participation in the above may be in the form of providing financial and in-kind support, scientific guidance, and consultation with regional stakeholders.¹⁰⁶

Aerial Deposition of Metals and Polycyclic Aromatic Hydrocarbons (PAHs)

[1143] Emissions from the project will result in aerial transport and deposition of metals and PAHs, and these emissions may affect surface water quality. Project emission sources include stacks, mine fleet, fugitive dust, and tailings. Models were used to evaluate the contribution of snowmelt to PAHs and metal concentrations in surface waters of three watersheds closest to the proposed mine area (Big Creek, Redclay Creek, and Ronald Lake).

Evidence

[1144] Teck provided predicted mean annual concentrations for metals and PAHs in snowmelt for three zones within the local study area: Big Creek, Redclay Creek, and Ronald Lake areas. Overall the trend

¹⁰⁵ Draft *EPEA* Approval – Conditions 4.1.57 and 4.1.61

¹⁰⁶ Draft *EPEA* Approval – Condition 4.1.62

was for metal and PAH snowmelt concentrations to increase from base case to application case due to atmospheric emissions and fugitive dust. The planned development case was not modelled due to low prediction confidence. The relationship between snow chemistry and the chemistry of receiving water bodies was not examined by Teck.

[1145] Teck indicated that modelling approaches are still under development and results are preliminary in nature. Teck indicated that models would be validated when sufficient field data are available. The model used by Teck generally predicted lower snow PAH concentrations than what were measured, likely due to the model assuming some retention of PAHs during snowmelt by the terrestrial environment.

[1146] Teck noted that the project does not include an upgrader or coke handling and storage facilities, which have been estimated to contribute 50 per cent or more to the deposition of PAHs associated with oil sands facilities.

[1147] Athabasca Chipewyan proposed conducting snowmelt sampling to resolve uncertainties. Teck committed to conducting snowmelt sampling within the project area in response to this request. Teck also committed to further evaluating the aerial deposition model through its involvement with COSIA. Teck indicated that the initial list of monitoring parameters for snowmelt sampling would be based on both modelled and measured results, however Teck proposed finalizing the list at a later date based on discussions with indigenous groups and regulators. Teck also stated that regional monitoring of air deposition effects should be conducted through regional monitoring programs, such as the Oil Sands Monitoring Program.

Analysis and Findings

[1148] The project will emit metals and PAHs from multiple sources (stacks, mine fleet, fugitive dust, and tailings), and some portion of these metals and PAHs will make their way into aquatic ecosystems. Project-related impacts are anticipated to be highest at areas closest to sources contributing metals and PAHs and diminish with distance from these sources. Although the project will be a source of metal and PAH emissions, the panel recognizes that the project does not include an upgrader or coke handling and storage operations, which can be significant sources of PAH and metal emissions.

[1149] Teck committed to implementing mitigation measures to minimize emissions from the project, including PAH and metal emissions, in its draft air quality mitigation, monitoring, and adaptive management plan. Mitigation measures applied for aerial emissions would reduce deposition and potential impacts to surface water quality.

[1150] The panel is not aware of any monitoring in the Athabasca River that has documented seasonal increases in metals or PAHs which are attributed to snowmelt inputs. The panel recognizes, however, that this may be related to the timing of monitoring in the Athabasca River compared to periods of snowmelt and runoff, or may reflect small snowmelt inputs masked by inputs from other sources and by the

significant flows observed during spring freshet. Collectively, these factors may make it difficult to identify potential exceedances of water quality guidelines within the local study area associated with snowmelt as part of regional monitoring of water bodies and watercourses. The panel also acknowledges that even low levels of metals and PAHs entering receiving water bodies (below water quality guidelines) may contribute to increased loading or accumulation in downstream depositional environments. This is discussed further in the following section on the Peace-Athabasca Delta and Wood Buffalo National Park.

[1151] The panel notes that while some metals and PAHs are predicted to be above surface water quality guidelines in snowmelt water, these guidelines are not directly applicable to concentrations in snowmelt water given that these concentrations do not reflect concentrations in receiving waters. Elevated parameters in snowmelt water may be diluted or retained in the terrestrial environment prior to reaching water bodies or watercourses. For this reason, including parameters in snowmelt above guidelines for assessment of potential project-related impacts is considered a conservative approach.

[1152] The panel acknowledges that there is a high degree of uncertainty in modelled predictions of metals and PAHs in snowmelt. While the model has used conservative assumptions, this uncertainty reduces confidence in assessing impacts to water quality. Additional monitoring is therefore required to validate predictions in the environmental assessment.

[1153] The panel accepts Teck's commitment to conduct additional snow and snowmelt sampling in the project area to address some of the uncertainties identified. The panel will require Teck to develop and implement this program as a component of its *EPEA* water management plan for the project. The panel expects that if monitoring indicates inputs from snowmelt are of concern, Teck will identify and implement additional mitigation measures related to air emissions or surface water as part of its adaptive management programs.¹⁰⁷

[1154] The panel also accepts Teck's commitment to further research through COSIA to resolve uncertainties in the snowmelt models. This will be included as a condition of approval and will assist with evaluating future impacts.¹⁰⁸

[1155] The panel will also include a recommendation to Alberta and Canada that regional monitoring of PAHs and metals in soils, sediments and surface waters, including deposition to surrounding regions such as Wood Buffalo National Park and the Peace-Athabasca Delta, should be conducted as part of the Oil Sands Monitoring Program.

[1156] The panel finds that the mitigation and monitoring measures proposed by Teck related to aerial deposition of metals and PAHs are appropriate. The panel also finds that with implementation of the

¹⁰⁷ Draft *EPEA* Approval – Condition 3.3.4(g)

¹⁰⁸ Draft *EPEA* Approval – Condition 3.3.4(g)

proposed mitigation and monitoring measures, the project is not likely to result in adverse effects to surface water quality due to aerial deposition of metals or PAHs.

Recommendation to Alberta

[1157] The panel recommends that Alberta ensure that regional monitoring of PAHs and metals in soils, sediments, and surface waters, including deposition to surrounding regions such as Wood Buffalo National Park and the Peace-Athabasca Delta, be conducted as part of the Oil Sands Monitoring Program.

Recommendation to Canada

[1158] The panel recommends that Canada ensure that regional monitoring of PAHs and metals in soils, sediments, and surface waters, including deposition to surrounding regions such as Wood Buffalo National Park and the Peace-Athabasca Delta, be conducted as part of the Oil Sands Monitoring Program.

End-Pit Lakes

[1159] End-pit lakes are a common feature of oil sands mines and have the potential to impact water quality in the closure landscape.

Evidence

[1160] Teck proposes to construct three end-pit lakes (south, central, and north pit lakes) in portions of the mined-out pits. The north pit lake will discharge to Ronald Lake, the central pit lake to Redclay Creek, and the south pit lake to Big Creek. Teck committed to not placing tailings in any of the end-pit lakes; however, Teck proposes to place tailings cap water resulting from the consolidation of tailings in the central pit lake at closure.

[1161] End-pit lake water will be composed of process-affected water, natural watershed runoff, reclaimed overburden runoff, groundwater seepage, and water from the Athabasca River. Littoral zones will be constructed using clean reclamation material and constitute approximately 20% of the pit lake surface area. At closure, site drainage would be directed through end-pit lakes and then to the receiving environment. End-pit lakes are designed to treat incoming poor-quality water so that it meets regulatory requirements and can be discharged to the receiving environment.

[1162] Teck considered CEMA's *End-Pit Lakes Guidance Document 2012* in the design of the end-pit lakes for the project, used industry standard pit lake water quality models, incorporated previous experience with establishing pit lakes at other mining projects, and incorporated conservative assumptions when predicting future water quality conditions for proposed end-pit lakes. Examples of conservative assumptions included assuming the upper range of water quality seepage predictions, shortest seepage travel times, and slowest decay rates for constituents. While uncertainties in predicted water quality

concentrations exist, Teck stated that by incorporating conservative assumptions the approach may have in fact overestimated predicted concentrations.

[1163] Teck predicted increases in several parameters in all three end-pit lakes. However, all parameters were below guidelines and/or chronic-effects benchmarks except for aluminum in the central pit lake. Predicted increases in aluminum concentrations in the central pit lake are approximately 2.5 times Athabasca River concentrations and 3 times other lakes. Teck concluded that aluminum levels are naturally high in the aquatics local study area and likely associated with the particulate phase (suspended sediments), and therefore less bioavailable to aquatic life. Lake water quality is not predicted to be acutely toxic to freshwater life.

[1164] Teck outlined several management and mitigation measures to address water quality and enable pit lakes to meet future discharge requirements:

- Excluding tailings from pit lakes
- Maintaining water balance of pit lakes with sufficient inflows to compensate for evaporative losses
- Managing rate of Athabasca River water input to ensure water quality filling targets are met while complying with low-flow restrictions
- Reusing in-pit process-affected water while project is still operational
- Retaining water in pit lakes beyond 2081 to allow longer bioremediation
- Adding nutrients to pit lakes to increase productivity and biological treatment
- Increasing efficiency and size of wetlands that drain to pit lakes
- Actively or passively treating pit lake outflows by adding wetlands and settling basins to discharge channels

[1165] Teck indicated that mitigation measures could be applied to the entire lake or to individual streams of incoming water depending on monitoring data. Active treatment options for inflows could include adsorption, microfiltration, ultrafiltration, nanofiltration, reverse osmosis, advanced oxidation, or constructed wetlands.

[1166] Teck stated that \$500 million would be allocated for post-2081 closure activities to deal with issues such as seepage, monitoring, and mitigation. Active treatment of water beyond mine closure is not expected to be required. Teck stated that monitoring would include water, sediment, and biota in the lakes and inflows and outflows for approximately 40 years.

[1167] Teck indicated that in the future it may want to place tailings in end-pit lakes if it results in an overall improvement to the project, although at this time the commitment is to not place tailings in end-pit

lakes. As part of the proposed commitments, Athabasca Chipewyan requested that Teck consult with them before placing tailings in end-pit lakes.

Analysis and Findings

[1168] The panel accepts Teck's commitment to not place tailings in the end-pit lakes and will include this as a condition in the AER approvals.¹⁰⁹ Should Teck want to place tailings in end-pit lakes in the future, it will need to apply for amendment to project approvals. The amendment application would need to include the information necessary to assess the environmental effects of the proposed change.

[1169] The panel agrees that Teck used conservative assumptions for its end-pit lake water quality model inputs. These assumptions were appropriate and needed given that site-specific data was not available, data from other oil sands pit lake research is limited, and other oil sands pit lakes will not be identical (physically, chemically, or biologically) to the proposed end-pit lakes at Frontier. Future monitoring and research data can be used to update models for proposed end-pit lakes. However, given the significance of end-pit lakes and uncertainties in the models used to predict end-pit lake water quality, the panel recommends Teck continue to use conservative assumptions to account for uncertainties and ensure water quality targets can be met through natural development of the lakes and implemented mitigation measures.

[1170] Given that none of the end-pit lakes will have tailings placed directly in them, and that only the central pit lake will have tailings water diverted to it (<10% of the total volume), water quality should be much better relative to oil sands end-pit lakes with tailings placed in them. Over time, water quality should improve with in-lake degradation of contaminants of potential concern and ongoing flushing of the reclaimed landscape and pit lakes. Teck's statement that predicted increases in aluminum in central pit lake are expected to be associated with particulate and not bioavailable requires verification through additional monitoring as part of the end-pit lake research and development report.

[1171] The panel will include a condition that no industrial wastewater is to be placed in any end-pit lake unless written authorization is obtained from the AER.

[1172] At this time, end-pit lakes have not been accepted as closure features by the Government of Alberta for the mineable oil sands area. If accepted, it is unknown what water quality criteria will need to be met for discharge to the receiving environment; however, it is expected that any criteria would be in place before Teck's proposed 2081 release date. In the absence of provincial policy, Teck assumed if water quality meets guidelines or chronic-effects benchmarks it will be suitable for discharging. Irrespective of Teck's assumptions, water will not be permitted to be released from pit lakes unless it meets future regulatory criteria developed by the Government of Alberta. If release is allowed, the end-pit lakes will represent an increased source of loading to the receiving environment for any parameters

¹⁰⁹ Draft *EPEA* Approval – Condition 4.3.12

elevated above receiving environment conditions. It is expected that Government of Alberta policy will address issues of loading from end-pit lakes.

[1173] Being prepared to implement mitigation measures at multiple steps in the development of end-pit lakes is necessary to ensure the success of end-pit lakes. Teck appears to recognize this, although more details on planned mitigation measures will be required as development of the end-pit lakes proceeds. If mitigation measures are required to meet water quality targets, monitoring must be able to assess effectiveness of these mitigation measures. At this time, it is unknown what, if any, mitigation measures would need to be applied.

[1174] A robust monitoring plan will also be required for end-pit lakes through all stages of end-pit lake life to ensure that water quality is evolving as predicted by models and that the lakes are suitable for aquatic life as proposed. Given that development of the project's end-pit lakes is many years away, and industry's understanding of end-pit lakes will increase during this time as additional experience is gained, the panel finds that the level of information provided by Teck with respect to its future monitoring plans for end-pit lakes is sufficient at this stage of the regulatory process. However the panel will require Teck to submit an end-pit lake research and development report which must be updated every two years to incorporate site-specific and regional research and monitoring.¹¹⁰

[1175] Teck will be required to contribute to regional research on end-pit lakes and incorporate these findings in the development of its proposed end-pit lakes.¹¹¹ Teck will also be required to support and participate in the development of end-pit lake performance criteria and targets through regional initiatives, to the satisfaction of the AER.¹¹²

[1176] In the absence of policy for the integration of end-pit lakes into the boreal landscape and approved criteria for the release of waters from end-pit lakes, there is some uncertainty about when final closure of the reclaimed project area will occur. There is also uncertainty about whether the estimates provided by Teck for closure costs are sufficient for all monitoring and mitigation measures associated with the end-pit lakes. These issues are discussed further in the sections "[Conservation, Reclamation, and Closure](#)" and "[Economic Effects](#)."

Panel Recommendations to Teck

[1177] The panel recommends that Teck continue to use conservative assumptions related to end-pit lakes to account for uncertainties and ensure water quality targets can be met through natural development of the lakes and implemented mitigation measures.

¹¹⁰ Draft *EPEA* Approval – Condition 5.2.1

¹¹¹ Draft *EPEA* Approval – Conditions 5.2.2(p) and 5.2.4

¹¹² Draft *EPEA* Approval – Condition 5.2.5

Aquatic Health

[1178] For the purposes of the aquatic health assessment, Teck considered aquatic health to include the ecological integrity of fish, invertebrates, aquatic plants, and algae in watercourses of the aquatics local study area, end-pit lakes, and Athabasca River. This includes survival, reproduction, development, and growth of life stages, individual, and populations of aquatic species.

[1179] The aquatic health assessment did not consider potential risks associated with human consumption of fish. These effects were considered in the human health risk assessment (section [29](#)).

Evidence

[1180] Teck predicted that levels of chronic and acute toxicity in Ronald Lake, Redclay Creek, and Big Creek will remain below guidelines recommended by Alberta Environment which represent no-effects thresholds for sensitive aquatic organisms. End-pit lakes are not predicted to have acute or chronic toxicity above thresholds at closure.

[1181] Teck assessed aquatic health effects for parameters that were predicted to be greater than screening criteria within the local study area (exceeded 10% beyond reference and/or exceeded relevant guidelines/chronic-effects benchmarks). Predicted concentrations in the water column for these substances were evaluated considering their relative concentrations (compared to baseline concentrations) and absolute concentrations (compared to published or derived toxicity thresholds) to determine potential impacts to aquatic biota.

[1182] Potential fish tissue metal concentrations were estimated based on median metal concentrations in water multiplied by parameter specific bioconcentration factors. Exceptions were for selenium and mercury, which bioaccumulate and biomagnify differently than other metals. Teck indicated the bioconcentration factors estimated for fish and selenium and mercury effects concentrations would require validation through focused studies of fish and other biota in the project area to address assumptions and limitations of the estimated bioconcentration factors. These assumptions and limitations include

- assuming constant bioconcentration factors irrespective of water quality concentrations (bioconcentration factors are inversely related with metal concentrations, so this assumption will overestimate fish tissue concentrations at higher water quality concentrations),
- assuming bioconcentration factors are representative of typical fish consumed by humans in the area,
- values relate water quality to whole-body fish concentrations and not fillet or muscle concentrations, and
- values are designed to predict long-term average concentrations in fish at equilibrium.

[1183] Teck indicated that proposed mitigation measures and monitoring for water quality, sediment quality, and pit lakes would also protect aquatic health. However Teck did not propose completing the identified focused studies of fish and other biota to address the assumptions and limitations noted above.

[1184] Substances carried forward in the application case assessment included aluminum, ammonia, cadmium, copper, iron, lead, manganese, sulphide, total phenolics, and nutrients (total nitrogen and phosphorus). The worst-case scenario for a substance was selected, and the concentration under that scenario was applied to the entire aquatic local study area. For pit lakes, the only substance that was greater than screening criteria and considered in the aquatic health assessment in the application case was aluminum.

[1185] Teck submitted that predicted exceedances for parameters greater than the screening criteria were generally natural in origin, unlikely to affect aquatic organisms because the guidelines and chronic-effects benchmarks are conservative, barely exceeded the guidelines or chronic-effects benchmarks, or the potential effect may be overestimated because not all of the predicted concentration of a given parameter is biologically available.

[1186] Fish tissue metal concentrations were predicted to be below fish tissue effects concentrations for all substances considered. On the basis of no effects determined in upstream project area, Teck concluded no effects would be predicted to occur in the Athabasca River.

[1187] Teck stated that water quality exposure predictions incorporate multiple conservative assumptions regarding sources, loading, and fate of substances. Chronic-effects benchmarks represent numerical values for a given water quality parameter below which low-level chronic effects (defined as a 10–20% sublethal response) are predicted to occur to no more than 5% of species in the ecosystem. Teck stated that toxicity-modifying factors are often not accounted for when deriving chronic-effects benchmarks, making them even more conservative.

[1188] Teck followed CCME's guidance to evaluate potential aquatic health effects, which states that effects on 15–20% of exposed individuals is considered to be the threshold level for negative effects, with no negative effects defined as effects on 10% or fewer exposed individuals. Teck further followed the recommended criterion of establishing an HC5, which is a concentration that is hazardous to no more than 5% of species in the community as long as the list of species used to calculate an HC5 do not include species or taxa with particular ecological importance.

[1189] Teck noted that lab-derived toxicity values do not account for potential interactions among substances such as additive, antagonistic, or synergistic effects. Further, Teck indicated that toxicity predictions would not address responses linked to tissue-to-tissue bioaccumulation, eutrophication, genotoxicity, or endocrine disruption effects.

[1190] OSEC identified concerns about the potential for cumulative, interactive, or synergistic effects that may not have been addressed by Teck's approach of evaluating single substances. In response, Teck confirmed that had used multiple lines of evidence in its analysis, including predicted whole effluent toxicity.

Analysis and Findings

[1191] The panel acknowledges that Teck assessed potential aquatic health impacts using methods that incorporated several conservative assumptions. However, toxicity predictions do not account for subtle, nontoxic effects such as tissue bioaccumulation, eutrophication, endocrine disruption, or reproductive or teratogenic effects. Additive, antagonistic, and synergistic effects are not accounted for when single substance toxicity tests are examined. Teck's assumption that whole effluent toxicity testing would account for these effects may still result in missing subtle effects. Similarly, the assumption that metals are less bioavailable if associated with particulates may not be correct given that sediment consumption by some organisms does occur.

[1192] Teck's assessment of no effects to aquatic health for parameters that exceeded chronic-effects benchmarks often relied on statements that conservatism was involved when estimating concentrations or that the chronic-effects benchmarks being assessed against were conservative. This calls into question the use and suitability of chronic-effects benchmarks in assessing aquatic health if exceedances are considered inconsequential because they are considered conservative.

[1193] The panel recognizes that site-specific factors were not available for some aspects of the aquatic health assessment (e.g., selenium bioaccumulation), and this is common in environmental assessments. However, the assumptions used in the assessment will need to be verified through collection of monitoring data. If effects are observed, additional mitigation will be required. The focus on fish tissue quality and use of water column data as a proxy for aquatic health effects was appropriate for the submission but also requires validation through direct monitoring given uncertainties in the assumptions.

[1194] Although Teck proposes to use water and sediment quality monitoring as the primary mechanism to prevent impacts to aquatic health, direct measures of aquatic health should also be completed because Teck indicated that focused studies of fish and other aquatic biota would be needed to resolve assumptions and limitations used in the assessment of aquatic health. The panel will require Teck to develop and implement an aquatic environmental effects monitoring plan within the project area to conduct ongoing aquatic effects monitoring for potential effects from the operation of the plant, including atmospheric emissions. The aquatic environment effects monitoring plan will include monitoring of water, snow and sediment quality, fisheries, benthic invertebrates and aquatic habitat. This monitoring

plan will also include requirements to develop mitigation or adaptive management strategies for observed effects or observed harmful effects to aquatic biota.¹¹³

Conditions

[1195] Teck must submit an aquatic environmental effects monitoring plan which must outline plans for ongoing aquatic environment effects monitoring for potential effects from the operation of the plant including atmospheric emissions on water, snow and sediment quality, and resident aquatic biota. The plan must include downstream monitoring and mitigation plans for any harmful effects to aquatic health.¹¹⁴

Peace-Athabasca Delta and Wood Buffalo National Park

[1196] Water quality in the Peace-Athabasca Delta and Wood Buffalo National Park could potentially be affected by project activities through three pathways: releases from the project area to the Athabasca River, which would flow into the Peace-Athabasca Delta; releases from the project area to the Ronald Lake watershed, which would flow via Buckton Creek into Lake Claire; and aerial deposition of metals, PAHs, or acidifying compounds from the project which could affect water quality within the Peace-Athabasca Delta and Wood Buffalo National Park. Each of these pathways was assessed by Teck.

Evidence

[1197] In Teck's assessment of potential project effects on the outstanding universal value of Wood Buffalo National Park, they identified the following activities as having potential to affect surface water quality:

- Diversion of watercourses and release of clean diversion water to the environment.
- Release of muskeg drainage and overburden dewatering waters of acceptable quality into Redclay and Big Creeks and the Athabasca River.
- Creation of three pit lakes with discharge to Ronald Lake (north pit lake), Redclay Creek (central pit lake), and Big Creek (south pit lake). Releases from Redclay and Big Creeks would eventually discharge to the Athabasca River.
- Construction and operation of the fish habitat compensation lake and the Unnamed Creek 2 off-stream storage pond.

¹¹³ Draft *EPEA* Approval – Conditions 4.2.4 and 4.2.5

¹¹⁴ Draft *EPEA* Approval – Conditions 4.2.4 and 4.2.5

- Surface runoff, seepage, and flux water flow from the external tailings areas (ETAs), in-pit tailings deposits, overburden dumps, and reclaimed pit surfaces at closure.
- Atmospheric emissions of acidifying emissions (sulphur and nitrogen oxides), metals, and PAHs.

[1198] Assessment of effects on the outstanding universal value of Wood Buffalo National Park used by Teck were based on multiple lines of evidence including development of a conceptual model based on peer-reviewed literature, assessment of upstream and downstream water and sediment quality data from the proposed development area, and modelling of water quality in water bodies within and near the proposed development area.

[1199] Teck summarized historical trends for water quality parameters upstream of the Peace-Athabasca Delta, which found varying trends in individual parameters. Overall, current and historical monitoring in the Athabasca River and Lake Athabasca indicated no adverse change in sediment quality and biological endpoints and no discernible long-term trends in water quality. Teck assessed the impacts of the project to the Peace-Athabasca Delta as negligible with all parameter concentrations predicted to be within 10% of baseline concentrations or below applicable aquatic health thresholds. Teck stated that mitigation measures applied within the project area would provide protection for the downstream Peace-Athabasca Delta area.

Athabasca River

[1200] For the application case, Teck predicted that in the Athabasca River at Embarras upstream of the Peace-Athabasca Delta, levels of acute and chronic toxicity and fish tainting potential would remain below guideline values, and the project was not expected to change the predicted levels of these parameters from the base case. Concentrations of total dissolved solids were predicted to remain within the range of concentrations predicted under the base case and would remain below chronic-effects benchmarks. Labile and refractory naphthenic acids were also predicted to remain within range of concentrations predicted under base case. All other substances were predicted to be within the range of concentration under base case at Embarras and were not considered further in their assessment.

[1201] Teck stated that current and historical monitoring showed no evidence of adverse change in sediment quality or biological endpoints in the Athabasca River and Lake Athabasca. Teck referenced the RAMP 2010 report which indicated no increasing or decreasing long-term trends in sediment quality parameters or benthic invertebrate endpoints. Because Teck predicted no effects on water quality at Embarras based on model results, Teck concluded that adverse effects at points beyond Embarras, including the Peace-Athabasca Delta, would not occur.

[1202] Parks Canada submitted that the project would likely have adverse effects on water quality in the Peace-Athabasca Delta. In conducting their assessment of potential impacts to the Peace-Athabasca Delta, Parks Canada applied the precautionary principle on the basis that there is uncertainty in modelled results.

Parks Canada assumed water quality changes expected within the Peace-Athabasca Delta would be similar to impacts observed at the project. Teck stated this assumption was not correct based on the above multiple lines of evidence, including previous research and monitoring results.

[1203] As part of their response to Parks Canada, Teck referenced previous studies by ECCC and the Mikisew community-based monitoring program indicating water quality indicators related to oil sands inputs are either below guidelines or at background levels by the time the river reaches Wood Buffalo National Park. While some water quality parameters of concern highlighted by Parks Canada may be above guidelines, they were within concentration ranges observed in areas upstream of the Mineable Oil Sands Region. Teck also summarized historical studies, some of which found increases in certain PAHs in the delta but attributed the sources to natural outcrops of bitumen along the Athabasca River.

[1204] ECCC and Parks Canada both submitted that the project was potentially a significant source of methylmercury effects and that Teck's assessment of these effects was not sufficient. ECCC recommended that Teck conduct additional modelling of mercury and methylmercury concentrations in the downstream environment from the fish habitat compensation lake, including the Athabasca River and Peace-Athabasca Delta. Teck indicated that while they would be willing to collect additional baseline mercury data, they believe the mitigation, monitoring, and adaptive management plan included with the draft detailed fisheries offsetting plan would address potential mercury issues in the receiving environment. In addition, during the hearing, ECCC confirmed they had not observed increases in mercury concentrations within the Athabasca River.

[1205] In response to concerns surrounding potential tailings dam failures, Parks Canada recommended development of a spill and emergency response plan with project- and site-specific mitigation and response measures to minimize environment impacts to Wood Buffalo National Park. Teck agreed to the proposed recommendations.

[1206] The strategic environmental assessment completed by Parks Canada found the following with respect to water quality in the Peace-Athabasca Delta:

- Western-based science monitoring over six years showed a stable trend in the Peace-Athabasca Delta water quality; however, indigenous land users reported changes in surface water quality in the rivers and lakes of the Peace-Athabasca Delta over the last five to six decades, predominantly linked to a lack of springtime flushing combined with effluents from multiple sources (oil sands, pulp and paper, agricultural and municipal effluents).
- Water quality effects in the Peace-Athabasca Delta are difficult to quantify due to changing flow rates and sediment loading, changes in Peace-Athabasca Delta river flows, lack of predevelopment water quality data, and difficulties in consistent monitoring (geographically and consistent parameters).

- Community-based monitoring reported a CCME water quality index of “fair” for all sites monitored in the Peace-Athabasca Delta, meaning “water quality is usually protected but occasionally threatened or impaired; conditions sometimes depart from natural or desirable levels.”
- The Athabasca River has shown increasing concentrations of several parameters resulting in reduced water quality. These included magnesium, sodium, dissolved aluminum, total selenium, dissolved iron, dissolved arsenic, and PAHs and polycyclic aromatic compounds, although not necessarily attributable solely to mineable oil sands inputs.
- There is a general lack of monitoring within the Peace-Athabasca Delta and Wood Buffalo National Park and apparent lack of incorporating community-based monitoring in regulatory decision making.
- Based on a precautionary approach, a recommendation of implementing water quality improvement plans for each watershed draining into the Peace-Athabasca Delta was made.

[1207] Parks Canada summarized trends from other reports (joint oil sands monitoring), which generally found no specific trends in parameters when adjusted for flow but several parameters which exceeded relevant guidelines. Parks Canada also summarized Mikisew community-based monitoring results for PAHs in the Peace-Athabasca Delta, which noted that elevated levels of PAHs with a petroleum-derived fingerprint were detected. Mikisew indicated that the derived fingerprint was likely a combination of both natural and anthropogenic input.

[1208] The strategic environmental assessment indicated an overall decreasing trend in water quality in the Athabasca River. However, within the Peace-Athabasca Delta, the Parks Canada’s strategic environmental assessment indicated a decreasing trend in water quality based upon indigenous traditional knowledge and a consistent “fair” trend over the six years of assessed data.

[1209] Teck, in general, agreed with Parks Canada’s recommendations for regional monitoring but stated that this would be part of the Oil Sands Monitoring Program which Teck is required to fund. Parks Canada stated that while Teck would be required to fund the Oil Sands Monitoring Program, Teck would not have oversight on which sites would be monitored.

Ronald Lake/Lake Claire

[1210] For Ronald Lake, Teck predicted that concentrations of most substances would remain within reference condition ranges. Teck stated that Ronald Lake is not expected to experience acute or chronic toxicity, tainting potential, or labile naphthenic acid because process-affected water from the project would not reach Ronald Lake or its tributaries. Concentrations of total dissolved solids, refractory, and total naphthenic acids were predicted to remain within the range of concentrations predicted under reference conditions and were not considered further in the assessment.

[1211] As a result of concerns about project development impacts on the Ronald Lake watershed, Athabasca Chipewyan First Nation and Mikisew Cree First Nation requested further consultation and

monitoring before developing the north pit. Specifically, the agreed-upon commitments between Teck and Mikisew Cree First Nation include a commitment to achieve no greater than negligible effect on water quality within the Ronald Lake watershed and the southern end of Lake Claire. As part of achieving this commitment, Teck is not proposing to place any tailings or tailings cap water within the north pit end-pit lake.

[1212] Parks Canada submitted that the project was likely to adversely affect surface water quality in the Ronald Lake because Teck predicted increases in water quality parameters as a result of the project but acknowledged that there was high uncertainty about the predicted effects of the project due to limited data collection. Parks Canada recommended that water quality monitoring occur in Ronald Lake, Buckton Creek, and Lake Claire at least five years before development. Parks Canada further recommended that Teck demonstrate that water quality in the Ronald Lake watershed meets objectives set by Parks Canada in collaboration with indigenous groups and demonstrate that development within the watershed would not exceed objectives. Parks Canada confirmed that the proposed objectives have not been set yet and there is currently no structure in place for doing so.

[1213] Parks Canada stated that historical regional monitoring has not included Buckton Creek or Lake Claire, the two monitoring sites Parks Canada recommended. To ensure monitoring of these locations occurs in the future, Parks Canada recommended Teck be responsible for their monitoring.

[1214] Teck stated that it would agree to a recommendation that Teck monitor the Ronald Lake watershed as part of its finalized hydrology and water quality mitigation, monitoring, and adaptive management plan and that this include preconstruction baseline monitoring. Teck stated that monitoring at near-field sites for discharges, snowpack monitoring, and regional oil sands monitoring of biological components would confirm its conclusions of no effects in Lake Claire and the Peace-Athabasca Delta.

Aerial Emissions

[1215] The project application identifies potential increases in aerial emissions (NO_x, SO_x, metals, and PAHs) as a result of project activities. However, Teck concluded that project-related effects would be negligible.

[1216] In the outstanding universal value assessment, Teck indicated that air quality monitoring at Fort Chipewyan concluded that current air quality was representative of a rural remote location or regional background location. Because project-related effects on water quality from aerial emissions was predicted to be negligible, Teck indicated that there would be no potential to have greater effects at greater distances (i.e., within the Peace-Athabasca Delta and Wood Buffalo National Park).

[1217] Parks Canada and ECCC both submitted that water bodies in the Peace-Athabasca Delta and Wood Buffalo National Park in general were already experiencing acid deposition rates in excess of their buffering capacity, causing ecosystem damage, and believed that the project would accelerate this effect.

In contrast, Teck's assessment found that under existing conditions, 27 of 285 assessed water bodies have a net potential acid input that exceeds critical loads and would be susceptible to acidification under existing conditions. This number increased to 28 under base case and remained at 28 for the application case.

[1218] Teck stated that aerial deposition of PAHs in the Peace-Athabasca Delta is assumed to be low based on previous studies showing deposition of these substances occurs within 20–30 km of oil sands mines. Teck also noted that the project does not include upgrading or coke storage and handling facilities, significantly reducing potential PAH and metal emissions from the project.

[1219] Parks Canada and ECCC submitted that air deposition of PACs and metals were underestimated by Teck. While they acknowledged there were large uncertainties about the magnitude of the effect, they believed that the effect was potentially significant.

[1220] ECCC recommended implementing a follow-up monitoring program to validate metal and PAH deposition predictions based on the regional oil sands monitoring program monitored parameters. In response, Teck indicated that they would support regional monitoring of emissions and deposition to the surrounding environment, including Peace-Athabasca Delta and Wood Buffalo National Park, through funding provided to a regional monitoring program such as Oil Sands Monitoring.

Analysis and Findings

[1221] The project will result in water discharges and aerial emissions that will increase concentrations and loadings of some surface water quality parameters within the local study area. Given predicted increases within the local study area, it is plausible that changes in water quality may be detected further downstream or downwind. However, the panel expects that these effects will be minimal given the low magnitude of changes predicted at the local study area level and the distance between the project and the Peace-Athabasca Delta and Wood Buffalo National Park, which will further reduce contaminant concentrations in air and water before they reach these areas. Notwithstanding that measurable changes to water quality are not expected to occur as a result of the project, the panel understands that contaminant loading in the Peace-Athabasca Delta remains a concern, and the project could contribute to this loading. The panel also understand that the Peace-Athabasca Delta is a dynamic system with a high degree of inherent variability in water quality, making it difficult to detect low-level effects.

Athabasca River

[1222] Teck asserted that water quality concentrations will only diminish as they flow downstream from the source. While correct, this does not consider potential loading of sediment and associated contaminants within the Peace-Athabasca Delta. Given the association of metals, nutrients, and PAHs with sediments is well-documented, downstream loading and deposition of contaminants may still be a concern, even if minimal changes to water quality are predicted. An important mitigation measure for

sediments during operations is the use of polishing ponds. In the closure landscape, wetlands and end-pit lakes will reduce sediment concentrations in receiving water bodies such as the Athabasca River and the Ronald Lake watershed. The panel accepts that these measures will significantly reduce sediment transport and contaminant loading from the project to the Athabasca River and the Peace-Athabasca Delta.

[1223] However, even with these mitigation measures in place, the project will contribute to cumulative loading of water quality constituents. Far downstream locations like Lake Athabasca and Lake Claire represent a potential repository for these constituents which may build up over time. Current monitoring and research (such as that conducted by the Oil Sands Monitoring Program, ECCC, independent university researchers and community-based monitoring) have not identified any consistent trends in water or sediment quality within the Peace-Athabasca Delta that are attributable to loadings from the oil sands mining industry. The panel recognizes, however, that the Peace-Athabasca Delta is a highly dynamic system and therefore subtle effects would likely be missed.

[1224] The panel agrees that project effects on water quality in the Peace-Athabasca Delta and Wood Buffalo National Park from the Athabasca River are likely to be negligible. However, the potential for effects of increased loadings in combination with other mine operators in the region was not well addressed in the application and research gaps remain. While water quality changes were determined to be negligible, Teck will be increasing loads to the Athabasca River, and in combination with other mine discharges, this would represent a net increase in constituents of concern in downstream environments.

[1225] Mitigation measures implemented for the project, along with required monitoring of project effects by Teck, should serve as an early warning indicator of potential downstream adverse effects. Additional regional monitoring and research is required because the Peace-Athabasca Delta and Wood Buffalo National Park have been less studied relative to the inflowing Athabasca River but are of high importance to the region. To better understand the regional contributions the proposed project may be having on water quality in the Peace-Athabasca Delta and Wood Buffalo National Park, Teck will be required to fund regional water quality monitoring programs.¹¹⁵ It is expected that results of the regional monitoring will be considered when further developing and refining the monitoring, mitigation, and adaptive management plans.

[1226] It is recommended that Teck explore opportunities to incorporate monitoring being conducted under the community-based monitoring program, which has relevance to local project-related effects. This monitoring represents useful data collected from the Peace-Athabasca Delta and upstream Athabasca River that has not been incorporated into assessment of results from other oil sands monitoring programs to date.

¹¹⁵ Draft *EPEA* Approval – Condition 4.2.27

[1227] The Parks Canada recommendation that the project be subject to water quality objectives established for Buckton Creek and Lake Claire by Parks Canada cannot be supported at this time given that objectives have not been developed and no structure for doing so currently exists. It is anticipated that any water quality objectives would consider the influence of other oil sands mines, industrial activities, municipalities, and other development within the region influencing water quality in the Peace-Athabasca Delta and Wood Buffalo National Park.

Ronald Lake and Lake Claire

[1228] Given the mitigation measures proposed by Teck, its commitments to Mikisew and Athabasca Chipewyan regarding protection of the Buckton Creek / Ronald Lake watershed, and the panel's conditions related to development of the north pit, the panel finds that the project is not likely to have an adverse effect on water quality in Ronald Lake or Lake Claire.

[1229] The panel recognizes that Teck has no oversight role with respect to regional monitoring decisions, including monitoring locations selected by the regional Oil Sands Monitoring Program. Therefore, the panel will require Teck to monitor for potential project effects at Ronald Lake and Buckton Creek to confirm its prediction of negligible effects.¹¹⁶ The panel will also include a recommendation to Alberta and Canada that monitoring of Lake Claire be incorporated into the Oil Sands Monitoring Program to address the desire for additional monitoring data.

[1230] While Teck views monitoring in the Peace-Athabasca Delta and Wood Buffalo National Park as the responsibility of provincial and federal governments, they do have a responsibility to monitor for downstream effects should local monitoring show potential impacts. Monitoring conducted at near-site locations should be conducted to develop an adaptive monitoring system where additional monitoring by Teck at sites such as Lake Claire is undertaken should observations at near-field sites exceed established triggers as a result of project activities. This principle should be incorporated in monitoring, mitigation, and adaptive management plans.

Aerial Emissions

[1231] Teck's assessment of potential aerial deposition effects to the Peace-Athabasca Delta and Wood Buffalo National Park relied upon its assessment of project effects, which it found to be negligible.

[1232] As discussed previously, the panel agrees with Teck that that the predicted effects of acidifying emissions from the project are expected to be negligible. This is based on Teck's modelling, which shows no increase in the number of lakes affected by acidification between the base case and the application case. The panel recognizes that ECCC used a different model and came up with different results,

¹¹⁶ Draft *EPEA* Approval – Condition 3.3.4(m)

highlighting the need to continue regional monitoring of acidification effects to validate predictions from the different models and inform future modelling choices.

[1233] The panel also found in a previous section that with implementation of Teck's proposed mitigation and monitoring measures, the project was not likely to result in adverse effects to surface water quality due to aerial deposition of metals or PAHs. While the panel generally agrees with Teck's findings, the panel acknowledges that there is a great deal of uncertainty with regards to modelling of snowmelt contributions of metals and PAHs from project activities.

[1234] Additional monitoring at a local scale is required to confirm Teck's conclusions of negligible effects of aerial emissions on surface water quality. If Teck's monitoring indicates adverse effects from aerial emissions, additional monitoring extending further would be required in addition to implementation of mitigation measures to address exceedances.

[1235] The panel recommends to Alberta and Canada that regional monitoring of PAHs and metals in soils, sediments, and surface waters, including deposition to surrounding regions such as Wood Buffalo National Park and the Peace-Athabasca Delta region, should be conducted as part of the regional oil sands monitoring program.

Recommendation to Teck

[1236] The panel recommends that Teck explore opportunities to incorporate monitoring being conducted under the community-based monitoring program, which has relevance to local project-related effects.

Recommendation to Alberta and Canada

[1237] The panel recommends to Alberta and Canada that monitoring of water quality in Lake Claire be considered in the future design of regional oil sands monitoring programs.

[1238] The panel recommends to Alberta and Canada that regional monitoring of PAHs and metals in soils, sediments, and surface waters, including deposition to surrounding regions such as Wood Buffalo National Park and the Peace-Athabasca Delta region, should be conducted as part of the regional oil sands monitoring program.

Significance of Project Effects

[1239] Based on the criteria provided in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects to surface water quality in the local study area:

[1240] Ecological context – the project is located in the mineable oil sands area downstream of other oil sands mines. It will be the closest oil sands mine to Wood Buffalo National Park and the Peace-Athabasca Delta.

[1241] The effects of the project on surface water quality are likely – project activities are expected to result in an increase in concentrations of some chemicals of potential concern in surface water bodies

[1242] The magnitude will be low – while concentrations of some chemicals of potential concern are predicted to increase in surface water bodies, in most cases the increase is expected to be within 10% of reference conditions, and concentrations in receiving water bodies are expected to remain below the regulatory guidelines or CEBs.

[1243] The geographic extent is local – exceedances of water quality criteria are expected to be limited to water bodies in the local study area. Potential direct loadings to the Athabasca River and to the Peace-Athabasca Delta (via the Athabasca River or Ronald Lake and Buckton Creek) are expected to be limited based on required mitigation measures applied at the project site. Ongoing loading of contaminants of concerns at levels below guidelines but above background may accumulate within the Peace-Athabasca Delta. Given the distance to the Peace-Athabasca Delta, and significant dilution volumes, it is not expected that these loadings will contribute significantly to water quality effects in the Peace-Athabasca Delta.

[1244] The duration is medium – effects will occur over the 40 year operational life of the project and during the closure period. The source of potential effects to water quality will vary over the course of the mine life. During construction, major sources of effects to water quality will include muskeg drainage and dust production. During operations, the major sources of effects to water quality will include seepage releases from overburden storage, water diversion, the fish habitat compensation lake and off-site storage pond, and aerial emissions from the plant and fleet. During closure, the major potential sources of effects to water quality will include seepage and runoff from reclaimed areas and pit lake releases.

[1245] The frequency is periodic – effects will occur throughout the construction, operations, and closure phases, however the location and nature of the effects are expected to change throughout the phases as mining progresses.

[1246] The effects are reversible after project operations cease and closure is complete.

[1247] Given the above points, the panel finds project effects to surface water quality in the local study area are adverse but not likely to be significant due to the low magnitude, local extent, and reversibility of the predicted effects.

Cumulative Effects

[1248] In the planned development case, for surface water discharges, levels of all contaminants of concern assessed by Teck were predicted to be below guideline values or chronic-effects benchmarks or were predicted to increase less than 10% relative to the base case. For future end-pit lake discharges, all pit lakes were included in the application case for the local study area. As a result, no cumulative effects assessment is required.

[1249] In the planned development case, Teck identified a valid linkage for acidifying emissions. In the planned development case, the potential acid input, SO_x , and NO_x loadings are predicted to increase slightly, although none of the 285 water bodies would be exposed to a total potential acid input greater than $0.17 \text{ keq H}^+/\text{ha}/\text{a}$. Net potential acid input was greater than the critical load in 30 water bodies in the planned development case, representing an increase of two water bodies with net potential acid input greater than the critical load relative to the application case. A small increase in area (49 km^2) subject to a total potential acid input greater than the Alberta monitoring limit of $0.17 \text{ keq H}^+/\text{ha}/\text{a}$ is expected under the planned development case. As a result of the small increase in area, and small increase in total lakes with a potential acid input exceeding the critical load (2 of the 285 lakes included), the overall cumulative effect is expected to be negligible. Future monitoring and updates to models are required to validate Teck's predictions and resolve uncertainties and assumptions in the models.

[1250] Prediction confidence in the modelling of surface water quality deposition of PAHs and metals (via snowmelt monitoring) was low, thus the planned development case was not included in the application. This is to be resolved through future monitoring, research, and development updates to the models.

19 Surface Water Quantity

[1251] This section discusses the effects of the project on surface water quantity and flow. The project will affect the hydrology of the project development area through the removal and diversion of existing watercourses, use of surface water during operations, and the creation of new watercourse and water bodies such as end-pit lakes in the closure landscape. Because of these effects, the project will require approvals and licences under the Alberta *Water Act* and the Alberta *Environmental Protection and Enhancement Act*.

Flow Reductions due to Closed-Circuit Area

Evidence

[1252] Teck proposes to establish a closed-circuit area to capture surface water runoff that may have come into contact with bitumen. A description of the closed-circuit system is provided in section 8, “[Water Management](#).”

[1253] Teck will require a surface runoff *Water Act* licence to account for water that would have flowed downstream of the project but cannot be released because of Government of Alberta policies that do not permit the release of water that has potentially come into contact with bitumen. Water collected within the closed-circuit area will be incorporated into the industrial water use recycling stream and partially offset water demand from the Athabasca River.

[1254] Based on observed flows in local tributaries in 2008 to 2010, Teck found that winter, pre-spring freshet and late autumn flows naturally decline to zero for drainage areas of up to 100 km². The closed-circuit area will remove several unnamed creeks, each of which drains less than 100 km².

[1255] Teck has applied for a surface runoff *Water Act* licence for up to 14.9 million m³/year based on a maximum project closed-circuit area of 226.9 km² in 2066 and a 1 in 10-year wet annual precipitation volume.

Analysis and Findings

[1256] The project is not expected to reach its full extent until 2055 with the development of the north mine pit. The actual volume of water prevented from flowing downstream will be proportionately higher in wet years than in dry years and in high-flow seasons (spring and summer) than in low-flow seasons (fall and winter). As such, this water use represents a significantly lower risk to the downstream environment than direct withdrawals from the Athabasca River, which cannot be as readily scaled in proportion to natural variation in water availability. Direct withdrawals from Athabasca River are limited by the pump capacity of the intake (in this case to 4.2 m³/s). This puts an upper limit on how much the project can take advantage of high flows and also reduces the project's ability to reduce withdrawals

during low flows and still meet project water needs. In contrast, capturing all surface runoff in the closed-circuit system allows full utilization of water availability during high-flow conditions, particularly during spring runoff. This is an example of maximizing diversions during high flows and minimizing during low flows.

[1257] Because natural low flows at the project site naturally approach zero flow, the panel concludes that this licence represents a negligible risk to downstream low flows in the Athabasca River and the Peace-Athabasca Delta.

Big Creek

Evidence

[1258] Teck proposes to construct a flow splitter on Big Creek in 2037, when off-stream storage pond 2 is built. The stated intention is to reduce the risk of geomorphic change to the mid-reaches of Big Creek due to water diverted around the project site that would otherwise join Big Creek farther downstream. Teck described the increase in flow that would occur in Big Creek without the splitter as a 23% increase in flow for 16 years (years 2021 to 2036) as a small risk and a 9% increase in flow for 45 years (years 2037 to 2081) as a moderate risk. When asked at the hearing to explain how they came to this conclusion, Teck stated that the assessment approach used was qualitative. Teck subsequently committed to monitoring the geomorphic conditions of Big Creek and potentially constructing the flow splitter earlier if changes are outside the range predicted. At the hearing, Teck committed to monitor flows in the diversion channel upstream of off-stream storage pond 2 and use gates to release equivalent volumes downstream to Big Creek to ensure no net filling of the off-stream storage pond with Big Creek water.

[1259] OSEC argued during closing argument that because the diversion is not for the sole purpose of channel realignment, section 1(1)(m) of the *Water Act* requires a *Water Act* licence. The diversion channel will add water to off-stream storage pond 2, where it will mix with licensed water from the Athabasca River. Therefore, some of this Big Creek water will inevitably be used in industrial oil sands processing. OSEC further argued that Teck did not apply for a *Water Act* approval, as required by the *Water Act* in the absence of a licence.

Analysis and Findings

[1260] The panel notes that Teck did apply for a *Water Act* approval to construct and operate the water management facilities in the “Water Management” section of the project update, which included the realignment channel from Big Creek to off-stream storage pond 2.

[1261] The panel notes that the proposed flow splitter would be constructed 16 years after the upstream diversions are initiated and at a time when the projected change in flows is expected to decrease from +23% to +9%. It is not clear to the panel that this splitter is actually needed because a 9% change in flow

is not normally considered significant enough to warrant significant mitigation infrastructure, and 16 years of increased flows could be sufficient to induce a geomorphological response in Big Creek.

[1262] Teck is proposing to mix unlicensed water that has been removed from Big Creek with licensed water from the Athabasca River and then use this mixed water for an industrial purpose. The panel is not aware of any similar precedent in Alberta. Licensed water is normally kept separate from unlicensed water.

[1263] Although Teck committed at the hearing to release an equivalent volume of water downstream of the storage pond as it diverts into the storage pond from the Big Creek splitter, the panel is not aware of any precedent in Alberta where such an activity has been approved without a *Water Act* licence.

[1264] As Teck has not provided sufficient justification to demonstrate the need for the proposed flow splitter on Big Creek, the panel does not approve its construction as part of the *Water Act* approval. The panel requires Teck to develop and implement a geomorphic monitoring program for Big Creek as part of its water management plan.¹¹⁷ Should monitoring results indicate the need for the splitter, Teck can apply for its construction at a later date based on information gathered from the geomorphic monitoring program.

Redclay Creek

Evidence

[1265] Teck proposes to build a fish habitat compensation lake on the lower reach of Redclay Creek. The lake will be created by building a dam structure in the creek valley. To ensure adequate downstream flows during initial filling, Teck will construct a temporary bypass channel that will divert at least 83% of the upstream flow below the dam with the remainder used to fill the compensation lake. Teck expects it will take about 13 months to fill the fish habitat compensation lake depending on flow conditions. Teck stated that the mine site water balance in their *Water Act* licence application did not include water for the filling the fish habitat compensation lake and they would apply for a separate licence once the fisheries offsetting plan for the project is finalized and the detailed engineering of the lake is complete. Teck expects this to occur in 2019 or 2020, before the lake construction period, 2021 to 2023.

Analysis and Findings

[1266] Details of this bypass structure were not provided but will need to be submitted before construction and operation can begin. The panel will include a condition to this effect in the *Water Act* approval.¹¹⁸

¹¹⁷ Draft *Water Act* Approval – Conditions 3.23(a) and 3.24

¹¹⁸ Draft *Water Act* Approval – Condition 3.33

[1267] The panel will include a condition in the *Water Act* licence stating that the licence cannot be used to fill the fish habitat compensation lake.¹¹⁹

[1268] The fish habitat compensation lake is also discussed in section 20, "[Fish and Fish Habitat](#)."

North Flow Splitter, Ronald Lake, Buckton Creek, and Lake Claire

Evidence

[1269] Teck proposes to collect upstream water from unnamed tributaries near the north mine pit into a single diversion channel that will run through the northern end of the project footprint (south of north mine pit and north of central mine pit). Some of these tributaries naturally contribute to Unnamed Stream 17, which is itself a tributary to Ronald Lake in the Buckton Creek and Lake Claire watersheds, and some would flow to Redclay Creek, which is a direct tributary of the Athabasca River. Teck proposes to construct a flow splitter to partition this flow to Unnamed Stream 17 and Redclay Creek. As stated in section 8, "[Water Management](#)," the north flow splitter will be designed to convey sufficient flow to account for the north watershed area that will be close-circuited.

[1270] Because of limited baseline flow monitoring available at this time, Athabasca Chipewyan and Mikisew are concerned that the splitter may not partition flow appropriately. Athabasca Chipewyan and Mikisew are also concerned about long-term operation and maintenance of the splitter. Athabasca Chipewyan and Mikisew want to be involved and consulted in the final design process.

[1271] After final closure, the presence of an end-pit lake at the north mine pit will reduce peak flows in the Ronald Lake watershed. Teck estimated that 1 in 10-year and 1 in 100-year peak outflows from Ronald Lake will be reduced from predevelopment levels of 9.4 m³/s and 20.7 m³/s, respectively, to 7.0 m³/s and 13.5 m³/s, respectively. The presence of the end-pit lake is expected to increase winter flows by 40% and decrease open water flows by 4%, while annual average flows remain largely unchanged from the predevelopment state (-0.2%). At all states of project development and at closure, 10th percentile, median, and 90th percentile water levels in Ronald Lake are expected to be essentially unchanged from the predevelopment condition (within 1 cm).

[1272] Ronald Lake watershed area is 335 km², or 27% of the 1257 km² Buckton Creek and 1.7% of the 20 000 km² Lake Claire watershed (not including inflows from Peace River during river flooding events). At closure, the north mine pit lake is expected to capture runoff from a 25.4 km² watershed.

[1273] Parks Canada recommended that five years before development of the watershed draining into Ronald Lake, Teck should be required to submit for approval an analysis that demonstrates that Lake Claire water levels meet regime objectives determined by Parks Canada in collaboration with indigenous

¹¹⁹ Draft *Water Act* Licence – Condition 3.36

groups and others and that development of the watershed draining into Ronald Lake will not result in project impacts to flow in Buckton Creek of more than 5% of natural flows in perpetuity.

[1274] Parks Canada also recommended that Teck be required to monitor flows in Buckton Creek for 15 years before development in the watershed draining into Ronald Lake.

Analysis and Findings

[1275] The panel understands that because the diverted water represents a relatively small fraction of the total drainage area of Ronald Lake and Redclay Creek, it should be sufficient to design the splitter based on available baseline flow data, additional data collected between now and when the splitter will be built, and the known relative contributing areas. The panel expects that the splitter will function passively, and maintenance should be mostly limited to regular checks to ensure the splitter is functioning as designed.

[1276] The panel will include a condition requiring Teck, as part of its north flow-splitter operational plan, to monitor flows in Redclay Creek and Unnamed Creek 17 for at least ten years prior to construction of major water management works in the Buckton Creek watershed.¹²⁰

[1277] Teck will be required to submit to the regulator for approval, preliminary engineering designs of all major water management works in the Buckton Creek watershed, including the north flow splitter, at least five years before construction of the individual works and final engineering designs at least one year before construction of the individual works.¹²¹

[1278] Downstream impacts to surface water levels and flow volumes should be negligible as long as the splitter is designed to account for the closed-circuit mine area within the Ronald Lake watershed and the splitter is properly maintained. Impact monitoring should focus on Ronald Lake because that lake would be the best indicator of change. As part of its water management plan, Teck will be required to develop a Ronald Lake monitoring plan prior to the commencement of the project and that monitoring of Ronald Lake starts 10 years prior to construction of major water management works in the Buckton Creek watershed.¹²²

[1279] The panel notes that at closure, Teck's estimates of changes to peak Ronald Lake outflows are not consistent with the closure drainage area of the north mine end-pit lake. The 25.4 km² contributing area of the north mine end-pit lake is less than 8% of the 335 km² Ronald Lake watershed, while Teck predicts changes in peak Ronald Lake outflows of 25% to 35%, which it attributes to attenuation from the north mine end-pit lake.

¹²⁰ Draft *Water Act* Approval – Conditions 3.23(b) and 3.25

¹²¹ Draft *Water Act* Approval – Conditions 3.17 through 3.21

¹²² Draft *Water Act* Approval – Conditions 3.23(c) and 3.26

[1280] The panel will include a condition requiring Teck to re-evaluate its closure plan before developing the north mine pit to demonstrate to the AER that changes to Buckton Creek peak, average, and low flows are within 5% of natural conditions.¹²³ The panel believes that meeting this condition would be sufficient to demonstrate negligible project impacts on Ronald Lake, Buckton Creek, and Lake Claire.

Oakley Lake and Small Sandy Lake

Evidence

[1281] Teck proposes to bury two lakes, referred to by Teck as Unnamed Lakes 1 and 2, but named Oakley Lake and Small Sandy Lake in Government of Alberta hydrography databases, under external disposal area 2.

[1282] Unnamed Lake 1 was sampled and documented to contain forage fish and was included in the offset calculation for the draft detailed fisheries offsetting plan. Unnamed Lake 2 was determined to be non-fish-bearing with no connectivity to fish-bearing water bodies.

[1283] Transport Canada stated that these lakes are likely to be deemed to be navigable.

Analysis and Findings

[1284] Based upon the fisheries assessment completed by Teck, sport fish are not found in the lakes. Although indigenous groups did not raise specific concerns about infilling of the lakes at the hearing, the panel notes that submissions received before the hearing indicated that some limited use of the lakes for fishing may occur. The panel recognizes that these lakes may provide stopover habitat for migratory birds, and infilling of the lakes will contribute to the loss of stopover habitat.

[1285] The panel understands that filling the lakes may require approval from Transport Canada under the *Navigable Waters Protection Act*, including, if required, a Governor in Council exemption if it is deemed to be in the public interest.

End-Pit Lake Filling

Evidence

[1286] Teck proposes to divert up to 60 million m³/year from the Athabasca River for 10 or more years to fill the central and north end-pit lakes after mine life ends.

¹²³ Draft *EPEA* Approval – Condition 7.3.7

[1287] Athabasca Chipewyan recommended updating the *Lower Athabasca Region: Surface Water Quantity Management Framework for the Lower Athabasca River (SWQuanMF)* to not allow diversion to fill “storage ponds” when flows are below 600 m³/s.

Analysis and Findings

[1288] The diversion of Athabasca River water to fill the end-pit lakes is the largest sustained water demand during project life. Unlike during mine operations, this demand could be more easily focused on periods of higher flow, and there is no inherent reason why this diversion should be managed using off-stream storage pond storage or withdrawn during low flows (open water or ice cover season).

[1289] The panel concludes that the most effective way to minimize potential environmental impacts during low flows is to establish a threshold below which water cannot be diverted from the Athabasca River for end-pit lake filling. The panel will include a condition requiring that no water be diverted from the Athabasca River for end-pit lake filling when Athabasca River flows at the Fort McMurray station are below 600 m³/s.¹²⁴ This condition should be amended or updated at a future renewal if and when the *SWQuanMF* is updated to include withdrawal restrictions for end-pit lake filling.

Interbasin Transfer of Water

Evidence

[1290] The northern 27 km² of the project closed-circuit area drains to Ronald Lake and is within the Lake Claire watershed. This area includes the north mine and northern portion of the main pit. The remaining 199.9 km² of the project closed-circuit area drains to the Athabasca River. This area includes external tailings areas where the water will mix with tailings and become part of the bitumen processing recycled water system.

[1291] As defined in the *Water Act (Ministerial) Regulation*, Lake Claire is in the Peace/Slave River major basin and Athabasca River is in the Athabasca River major basin.

[1292] Section 47 of the *Water Act* states that “A licence shall not be issued that authorizes the transfer of water between major river basins in the province unless the licence is specifically authorized by a special Act of the Legislature.”

Analysis and Findings

[1293] The panel cannot issue a surface water runoff licence for the portion of the project closed-circuit area that is within the Peace/Slave River major river basin for use in the Athabasca River major river basin. The panel also cannot issue a licence from the Athabasca River to be used to fill an end-pit lake in

¹²⁴ Draft *Water Act* Licence – Condition 3.32

the Peace/Slave River major river basin. The panel will include conditions in the *Water Act* licence to prevent the diversion of water from one major basin for use in the other major basin.¹²⁵

[1294] More discussion of the *Water Act* licence application and interbasin transfer can be found in section 36, “[Water Act](#).”

Athabasca River and Peace-Athabasca Delta

Teck Evidence

[1295] Most of Teck’s assessments of downstream impacts assumed a constant project withdrawal rate of 4.2 m³/s, which is the pumping capacity of Teck’s proposed Athabasca River intake and is equivalent to 132 million m³/year. Teck has applied for a *Water Act* licence to withdraw water from the Athabasca River: 98 million m³/year for the early phase of project development (2025–2036) and 60 million m³ for the main project phase (2037–2066) and for the end-pit lake filling phase (2066–2080). In most years during operations, but before end-pit lake filling, withdrawals will typically range from 10 to 40 million m³/year under average conditions, with average annual diversion during mining operations of 21.3 million m³/year, or an average diversion rate of 0.68 m³/s. During the expected 15 year end-pit lake filling stage, Teck expects to withdraw at a sustained annual rate of 60 million m³/year, or an average rate of 1.9 m³/s.

[1296] Teck analyzed its water needs under the rules of the *SWQuanMF* and concluded that their planned off-stream storage ponds will allow them to maintain operations across a wide range of Athabasca River flow conditions. As a new mine, under the *SWQuanMF*, Teck will be cut off from withdrawing water from the Athabasca River when river flows fall below 87 m³/s. Teck analyzed its storage requirements under scenarios where Athabasca River flows remained below 87 m³/s for one to three months. Under the three-month scenario, Teck found that they would need 28 million m³ and 16 million m³ of storage during the 2025–2036 and 2037–2066 phases of the project, respectively. Teck proposed to build two off-stream storage ponds: a 34 million m³ pond for 2025–2036 and a 22 million m³ pond for 2037–2066.

[1297] Teck noted that there are no month-long periods in the Athabasca River flow record where flows averaged less than 87 m³/s. Based on tree ring records, Teck estimated that the probability of a given year having a three-month period with average flow under 87 m³/s to be 0.3%.

[1298] Teck assessed the effect of maximum project withdrawals on water depth at the navigation pinch point identified in the *SWQuanMF*. Under historical flow conditions, the project and *SWQuanMF* impacts ranged from 0.3 to 1.0 cm. The average change in flow depth was 0.6 cm.

¹²⁵ *Water Act* Licence – Conditions 3.33 and 3.34

[1299] Teck assessed how often flows would drop below $400 \text{ m}^3/\text{s}$, which is the flow at which the depth at the pinch point is equal to 1.2 m. 1.2 m is the depth that has been identified by First Nations as the aboriginal safe navigation depth. Teck found that under historical conditions, flows were below this level 6.3% of the time, and with climate change, these could occur 7.4% to 25.7% of the time, depending on the specific climate change projection. A sustained project withdrawal of $4.2 \text{ m}^3/\text{s}$ would increase these to 6.7%, 7.6%, and 26.1%, respectively.

[1300] Teck predicts that a sustained withdrawal of $4.2 \text{ m}^3/\text{s}$ from their Athabasca River intake would result in a 1.4 cm decrease in average water level in Lake Athabasca. This is based on their analysis of the relationship between historical inflows to Lake Athabasca and changes in Lake Athabasca water levels. These estimates were derived from observed daily changes in Lake Athabasca water levels in response to changes in total lake inflow and did not include the effect of lake outflows. Teck concluded that this was equivalent to assuming no lake outflow, which would result in high estimated changes in lake level due to withdrawals.

Athabasca Chipewyan and Mikisew Evidence

[1301] Athabasca Chipewyan and Mikisew both identified late summer and fall as a key time for navigational use of the Athabasca River, the Athabasca Delta, the broader Peace-Athabasca Delta, and tributaries of the lower Athabasca River.

[1302] Athabasca Chipewyan and Mikisew identified a safe navigation depth for a fully loaded outboard motor boat, including start-up, as 1.2 m. This depth was initially associated in 2010 with an approximate flow rate in the Athabasca River of $400 \text{ m}^3/\text{s}$, which was defined as the aboriginal extreme flow.

[1303] In the Athabasca River mainstem between Fort McMurray and the Athabasca Delta, Mikisew identified navigation hazards and lost access to side and back channels that become progressively more prominent as flows in the Athabasca River decline below $600 \text{ m}^3/\text{s}$.

[1304] Athabasca Chipewyan and Mikisew's community-based monitoring program has been measuring water levels in the Athabasca River Delta and have developed relationships between river flow at Fort McMurray and water depth. Community-based monitoring data show that, although there is significant variation in water flow depth at given locations for the same river flow rates, depths at key tributary and distributary points in the delta are often less than 1.2 m when flow at Fort McMurray is less than $500 \text{ m}^3/\text{s}$ and is usually more than 1.2 m when flow is above $700 \text{ m}^3/\text{s}$. Based on this data, Athabasca Chipewyan and Mikisew revised the aboriginal extreme flow from $400 \text{ m}^3/\text{s}$ to $500 \text{ m}^3/\text{s}$.

[1305] Mikisew used community-based monitoring data to estimate water level changes at key navigation points in the Athabasca River and its delta due to a sustained $4.2 \text{ m}^3/\text{s}$ withdrawal range from 0.6 cm (Jackfish Creek) to 2.5 cm (Richardson River). The average change in depth across the navigation points is 1.1 cm for a maximum project withdrawal of $4.2 \text{ m}^3/\text{s}$.

[1306] Athabasca Chipewyan and Mikisew recommended weekly withdrawal limits when Athabasca River flows are below 700 m³/s during the open-water (non-ice cover) season.

[1307] Athabasca Chipewyan and Mikisew recommended that 500 m³/s should be a cutoff threshold for withdrawals from the Athabasca River during open-water conditions. Athabasca Chipewyan explicitly acknowledged in their closing argument that Teck “are better placed than all other oil sands operators to try to meet this threshold. Teck has also indicated that perfect compliance with the 500 m³/s threshold is not currently economically or technically achievable.”

Athabasca Chipewyan and Mikisew Proposed Project Conditions and Management Commitments

[1308] Athabasca Chipewyan and Mikisew each proposed project conditions (Mikisew) and management commitments (Athabasca Chipewyan) that were jointly agreed to with Teck. Many of the conditions related to surface water quantity were common to both lists—specifically, Teck should work collaboratively with indigenous groups in the ongoing development and implementation of environmental monitoring, operational and adaptive management plans, Teck should regularly update indigenous groups on the operational status of the project with respect to these plans, Teck should minimize water withdrawals from the Athabasca River when river flows are below 500 m³/s, and Teck should manage water associated with the north mine such that the project impact on Ronald Lake, Buckton Creek, and Lake Claire are negligible.

[1309] In addition, the Athabasca Chipewyan list included that Teck should install hydraulic gauges immediately upstream and downstream of the project. The Mikisew list included that Teck should design their water storage pond to operate for a minimum of 90 days without using the Athabasca River water intake system.

Analysis and Findings

[1310] The panel notes that Teck’s analysis did not take into account that a decrease in the level of Lake Athabasca would also reduce outflow, which means that the actual change in water level due to upstream withdrawals is less than their estimate. Teck’s analysis also assumed a constant withdrawal of 4.2 m³/s, which is the maximum instantaneous withdrawal rate of their intake and is equivalent to 132 million m³/year. Based on their projected year-to-year water demand, their maximum demand in any year will never exceed 98 million m³ from the Athabasca River, and average annual diversions during the mining operational phases of the project are 21.3 million m³/year. The panel therefore concludes that Teck’s estimates of changes to water levels and flows in the Athabasca River, Lake Athabasca, and the Peace-Athabasca Delta are very conservative as they are at the upper limit of the short-term potential impact on downstream water levels. Because the proposed level of withdrawal is relatively small compared with flow rates in the Athabasca River and into Lake Athabasca and the Peace-Athabasca Delta, the long term average effect of withdrawal can be approximated as linear. Therefore, on average,

the panel expects that water level changes during the operational mining phases of the project will be approximately one-sixth of the impacts predicted in their assessments because 21.3 million m³ is approximately one-sixth of 132 million m³.

[1311] The panel notes that the Athabasca Chipewyan and Mikisew community-based monitoring program water depth data show a relatively clear relationship of a 2 mm drop in flow depth per 1 m³/s drop in flow rate, although there is considerable uncertainty in interpreting the change in flow depth at low flows due to the significant scatter in the community-based monitoring data. Broadly, these results are consistent with Teck's assessment that the effect of a sustained withdrawal of 4.2 m³/s is a decrease in flow depth of approximately 1 cm across a wide range of flows, both in the lower Athabasca River and its delta.

[1312] The joint agreements between Teck and Athabasca Chipewyan and Mikisew call for Teck to minimize withdrawals when flows drop below 500 m³/s, with Athabasca Chipewyan acknowledging that Teck has indicated that perfect compliance with the 500 m³/s threshold is not currently economically or technically achievable. Nevertheless, during closing argument, both Athabasca Chipewyan and Mikisew asked the panel to recommend the *SWQuanMF* be updated to include a 500 m³/s cutoff that applies to all water users, including Teck. The panel notes that 500 m³/s is a relatively common open-water flow. For April to October, flows are below 500 m³/s approximately 15% of the time and much more frequent from September to October, average October flows from 1957 to 2013 being 539 m³/s at the Fort McMurray station.

[1313] These requests contradict each other, although the panel recognizes that they can be aligned by interpreting the request for an absolute 500 m³/s open-water cutoff as being a management goal to be reached sometime in the future as new technology comes available. To that end, the panel fully supports the development of water management strategies that are targeted to minimize water withdrawals when open-water Athabasca River flows are less than 500 m³/s.

[1314] The panel recognizes that it is not possible to write an enforceable approval condition requiring Teck to minimize withdrawals during low flows without a precise definition of "minimize." The panel will therefore include a condition that requires Teck to develop a minimization strategy as part of their water management plan. The panel will require that these plans discuss minimization strategies including, but not limited to: maximizing use of fresh water storage capacity, avoiding filling of fresh water storage during low flows, maximizing diversions to fill storage during higher flows, and avoiding non-essential water use during periods of low flow.¹²⁶

¹²⁶ *Water Act* Licence – Conditions 3.25(a) and 3.26

[1315] The panel will include a condition in the *Water Act* approval requiring Teck to include a strategy for maintaining at least 90 days of fresh water storage.¹²⁷ Because off-stream storage should not be used to manage end-pit lake filling needs, this strategy should not include storage requirements for the purpose of end-pit lake filling.

[1316] To avoid adverse effects to surface water quantity, the panel recommends that the Minister include mitigation measures in the decision statement under *CEAA 2012* (see section 38).

[1317] The panel notes that even under ideal conditions, river flow measurements are generally accurate to within a few percent, and because the Athabasca River is a mobile sand bed river, accurate flow monitoring on the Athabasca River is a significant challenge. The panel is not convinced that Athabasca River flow monitoring should be required by the AER immediately upstream and downstream of the Teck project. The panel believes that Athabasca River flow monitoring should be left to government agencies. The panel also notes that there are long-term government flow monitoring stations upstream and downstream of the project near Fort McMurray and Embarras, respectively.

Assessment of Significance of Project Effects

[1318] Based on the criteria provided in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects to surface water quantity and flows in the local study area:

[1319] Ecological context – the project is located within the Athabasca and Peace/Slave River basins. Surface water flows and water levels in these basins are subject to the combined effects of climate change, flow regulation, and industrial water withdrawals.

[1320] The effects of the project on surface water quantity and flow is likely – the project will withdraw water from the Athabasca River, and surface runoff from the closed-circuit area will be captured for use.

[1321] The magnitude will be low – the reduction in flow is a very small percentage of total flows in the Athabasca River, and water levels changes to the Athabasca River and Lake Athabasca are less than 1 cm.

[1322] The geographic extent is regional – impacts on the order of up to 1 cm of water level are expected to extend to Lake Athabasca and the Peace-Athabasca Delta.

[1323] The duration is medium – effects will occur over the 40 year operational life of the project and during filling of the end-pit lakes during the early stages of closure.

¹²⁷ *Water Act* Approval – Conditions 3.23(d) and 3.27

[1324] The frequency is continuous – diversion of surface water and water withdrawal from the Athabasca River will occur throughout the 40 year operational life of the project and until the end-pit lakes have been filled and connected to the surrounding watershed.

[1325] The effects are reversible after project operations cease and filling of the end-pit lakes is complete.

[1326] Given the above points, the panel finds project effects to surface water quantity in the local study area are adverse but not likely to be significant due to the low magnitude and reversibility of the predicted effects.

Cumulative Effects

Athabasca River and Peace-Athabasca Delta

Teck Evidence

[1327] Most of Teck's assessments of downstream impacts assumed a constant project withdrawal rate of 4.2 m³/s, which is the pumping capacity of Teck's proposed Athabasca River intake and is equivalent to 132 million m³/year. Teck has applied for a *Water Act* licence from the Athabasca River for 98 million m³/year for the early phase of project development (2025–2032) and 60 million m³ for the main project phase (2033–2066) and the end-pit lake filling phase (2067–2081). In most years during operations, but before end-pit lake filling, withdrawals will typically range from 10 to 40 million m³/year under average conditions, with average annual diversion during mining operations of 21.3 million m³/year, or an average diversion rate of 0.68 m³/s. During the expected 15 year end-pit lake filling stage, Teck expects to withdraw at a sustained annual rate of 60 million m³/year, or an average rate of 1.9 m³/s.

[1328] Teck presented climate change modelling results showing fall Athabasca River flows are likely to be lower in the mid to late twenty-first century than have been observed in the recent historical record. Teck's model predicted changes in fall flows in the 2060s ranging from –22.6% to +6.3% relative to the baseline period of 1961–1990. The predicted ranges for the other seasons are –13.2% to +28.0% for spring, –42.7% to +14.7% for summer, and –10.0% to +28.0% for winter. Annual changes in river flow range from –22.2% to +17.1%.

[1329] Teck assessed the effect of the maximum rate of withdrawal permitted under the *SWQuanMF* on water depth at the navigation pinch point identified in the *SWQuanMF*. Under historical flow conditions, the impacts of this level of withdrawal ranged from 1.4 to 6.8 cm. The average change in flow depths was 3.7 cm. Under the Teck climate change scenarios, the average change in flow depth ranged from 3.6 to 4.1 cm under maximum withdrawals.

[1330] Teck evaluated the impact of maximum allowable cumulative withdrawals from the Athabasca River under the *SWQuanMF* weekly withdrawal limits on the flow distribution in the major Athabasca River delta distributary channels. At the maximum allowable withdrawal rate under winter conditions, flows to the Embarras and Fletcher Channels would decrease by less than 0.5% and 0.8%, respectively. At the Goose Island and Big Point Channels, flow reductions would vary from 2.1% to 3.3% and 2.8% to 5.2%, respectively. At the maximum allowable withdrawal rate under open-water conditions, flows to the Embarras and Fletcher Channels would decrease by less than 1%.

[1331] Teck assessed how often flows would drop below 400 m³/s at the navigation pinch point identified in the *SWQuanMF*. Teck found that under historical conditions, flows were below this level 6.3% of the time, and with climate change these could occur 7.4% to 25.7% of the time. At the maximum *SWQuanMF* withdrawal rate of 29 m³/s for all oil sands operations, this would increase to 8.4%, 8.7%, and 29.1%, respectively.

[1332] Teck estimated the impact of maximum *SWQuanMF* withdrawals on water levels in Lake Athabasca to be 6.4 cm. This is based on their analysis of the relationship between historical inflows to Lake Athabasca and changes in Lake Athabasca water levels. These estimates were derived from observed daily changes in Lake Athabasca water levels in response to changes in total lake inflow and did not include the effect of lake outflows. Teck concluded that this was equivalent to assuming no lake outflow, which would result in high estimated changes in lake level due to withdrawals.

[1333] Teck estimated the cumulative impact on Lake Athabasca water levels due to maximum *SWQuanMF* withdrawals and five climate change scenarios for the 2060s. The predicted changes ranged from an increase of 38.9 cm to a decrease of 46.1 cm, which includes a 6.4 cm decrease due to withdrawals.

Athabasca Chipewyan and Mikisew Evidence

[1334] Athabasca Chipewyan and Mikisew stated that the Peace-Athabasca Delta has become drier since the 1970s, and this was attributed to a combination of decreased Peace River flooding due to flow regulation, climate change, and water withdrawals. This drying has had effects on local vegetation, wildlife, and traditional use of the area.

[1335] Mikisew presented climate change modelling results showing that fall Athabasca River flows are likely to be lower in the mid to late twenty-first century than have been observed in the recent historical record. The model predicted changes to fall flows of -24% by the 2050s and -28% by the 2080s relative to a 1971–2000 baseline. Summer flows were projected to decrease by 26 to 34% by the 2080s, and spring and winter flows were projected to increase.

[1336] Community-based monitoring data were used to derive estimates of water level changes at key navigation points in the Athabasca River and its delta due to the maximum *SWQuanMF* diversion rate of

29 m³/s. The estimated change in water levels ranged from 3.8 cm (Jackfish Creek) to 20.5 cm (Richardson River). The average change in depth across the navigation points was 7.0 cm.

[1337] Athabasca Chipewyan and Mikisew criticized the *SWQuanMF*. Specifically, the *SWQuanMF* does not include weekly cumulative withdrawal limits for open-water flows relevant to indigenous navigation, and the framework's aboriginal navigation index does not distinguish changes to navigability when Athabasca River flow is below 300 m³/s. The aboriginal navigation index was criticized for being based on the flow-depth relationship at a single location, while the adaptive management trigger associated with the aboriginal navigation index is based on average seasonal navigability and focuses on the incremental impact of oil sands withdrawals. Also, the aboriginal navigation index trigger is implemented in an adaptive management process that is evaluated on an annual basis to determine after the fact whether or not the *SWQuanMF* needs to be reviewed.

[1338] Athabasca Chipewyan and Mikisew recommended a higher level of assurance that can be more directly applied with weekly withdrawal limits when the Athabasca River flow is below 700 m³/s during the open water (non-ice cover) season.

[1339] Athabasca Chipewyan and Mikisew recommended that the *SWQuanMF* be revised to include a cumulative withdrawal limit of 20 m³/s when Athabasca River flows are below 700 m³/s, a cut off for all operators when open-water flows are below 500 m³/s, a cut off for all operators when ice covered flows are below 100 m³/s, and a new navigation index that has a value of zero at 500 m³/s and negative values for flows less than 500 m³/s. Athabasca Chipewyan recommended that the framework should be revised such that all oil sands operators will only be allowed to fill water storage ponds when the river flow is above 600 m³/s.

[1340] Athabasca Chipewyan explicitly acknowledged in their closing argument that Teck "are better placed than all other oil sands operators to try to meet this threshold. Teck has also indicated that perfect compliance with the 500 m³/s threshold is not currently economically or technically achievable."

Government of Canada

[1341] ECCC stated that Teck's methodology for estimating changes in Lake Athabasca water levels due to the project and the *SWQuanMF* would be more reliable if they were based on a model of Lake Athabasca and the Peace-Athabasca Delta that accounted for the complex dynamics of the delta. ECCC recommended that Teck should re-evaluate its estimates of project and *SWQuanMF* impacts on water levels in the Peace-Athabasca Delta with a hydraulic modelling approach.

[1342] ECCC recommended that, as part of its adaptive management plan, Teck should update its water level modelling every five years to demonstrate the predicted change in water levels in the Peace-Athabasca Delta, including project and cumulative water withdrawals under both historical and climate change contexts.

[1343] At the hearing, Dr. Daniel Peters of the ECCC stated that impacts of withdrawals on lake water levels are increased during periods of high flow in the Peace River when outflow from the lake is blocked by high water levels in Peace River.

[1344] Parks Canada included their 2018 strategic environmental assessment for Wood Buffalo National Park World Heritage Site report in their hearing submission. This report includes a review of available research about the complex hydrodynamics of the delta. Key features of the delta are hydraulic damming of outflows from the Peace-Athabasca Delta during high flows in the Peace River, open-water flow reversals from Peace River into the Peace-Athabasca Delta during very high flows in the Peace River, and ice jam flooding from the Peace River into the Peace-Athabasca Delta. Ice jam floods produce the highest flood levels in the Peace-Athabasca Delta and are described as “a lifeline for the perched basins, as they would not receive recharge water otherwise.”

[1345] The report quantifies the changes in peak summer Peace River flows due to hydroelectric development in British Columbia. Two-year return period peak flow was 10 000 m³/s before construction of Bennett Dam (1960 to 1967) and 5400 m³/s after the dam was completed and filled (1972 to 2010). Hydroelectric flow regulation has also increased average winter flows from 500 m³/s to 1500 m³/s. The reduction in summer Peace River flows have reduced the hydraulic damming and open-water flow reversals from the Peace River into the Peace-Athabasca Delta. No attribution was made to water withdrawals on either the Peace River or Athabasca River.

[1346] The observed frequency of Peace River ice jam floods at the Peace-Athabasca Delta have reduced since construction of Bennett Dam. From 1880 to 1968, there were 13 observed ice jam floods at the Peace-Athabasca Delta, for an average of one every 6.8 years. From 1971 to 2017, there were 4 observed ice jam events, for an average of one every 11.8 years. This change was attributed to increased winter flows, resulting in ice freezing in at a high elevation, which increases the flow rate required to mechanically break the ice to create jams capable of flooding the perched lakes and wetlands in the Peace-Athabasca Delta. The strategic environmental assessment report quoted research that estimated that flow regulation accounts for two-thirds of the reduction in ice jam flood frequency, with the remaining one-third due to climate change. No attribution was made to water withdrawals on either the Peace River or Athabasca River.

[1347] The strategic environmental assessment summarized several environmental conditions, identified by researchers and First Nations, which must exist for ice jam flooding in the Peace-Athabasca Delta to occur. These were a mechanical ice break-up, Peace River flow of at least 4000 m³/s at Peace Point, the formation of an ice jam within 50 km of the Peace River, low freeze up elevations, clear and thick ice, consistent temperatures between -5 and -10 degrees Celsius, an ice jam duration of at least one week at a critical pinch point, and the presence of rubble, logs, and branches.

[1348] As a joint federal-provincial effort, two permanent submerged weirs were constructed in 1975/76 in the Peace-Athabasca Delta in response to declining water levels after construction of Bennett Dam. These weirs “have apparently been partially successful in restoring water levels in Lake Athabasca and the central Peace-Athabasca Delta lakes, such as Lake Claire and Mamawi Lake,” with average Lake Athabasca water levels increasing by 0.5 m relative to regulated water levels without the weirs. The weirs have generally restored average summer Lake Athabasca water levels to pre-regulation levels but have also increased winter water levels, resulting in a decreased variation in seasonal water levels. The weirs have not been successful at increasing recharge to the perched lakes and wetlands.

[1349] Athabasca River flows have declined by approximately 20 to 30% over the period of record (1958–2012) at the Athabasca River below Fort McMurray flow station. These changes are attributed to a combination of climate change and water withdrawals, but the relative size of these factors is not provided in the studies referenced, although one study noted that more than 67% of the variation in annual runoff variability can be explained by changes in precipitation since 1958.

[1350] Parks Canada argued that, given the current state of water levels in the Peace-Athabasca Delta, small effects of incremental change should not be considered negligible. It was Parks Canada’s opinion that the effects of the project are likely to adversely affect the outstanding universal value of Wood Buffalo National Park and reduce Canada’s ability to restore desired outcomes to the Peace-Athabasca Delta.

[1351] Parks Canada stated that the *SWQuanMF* is a necessary and appropriate regulatory tool to manage cumulative withdrawals on the Athabasca River but that it needed to be amended to provide confidence that the river flow regime would meet the ecological requirements of the Peace-Athabasca Delta.

[1352] Parks Canada also stated that management of the outstanding universal value of Wood Buffalo National Park included meeting the requirements of indigenous peoples in the park. Parks Canada based their assessment of indigenous needs on the Athabasca Chipewyan and Mikisew submissions to the hearing and did not provide any additional independent assessment of indigenous needs.

[1353] Although Parks Canada did not provide an ecological flow requirement for the Athabasca River to meet the needs of the Peace-Athabasca Delta, Parks Canada recommended that Teck not be permitted to withdrawal water from the Athabasca River when flows at the Fort McMurray station are below the 500 m³/s aboriginal extreme flow. Parks Canada stated that it expects that adverse environmental effects of the project would be insignificant if this recommendation was implemented.

[1354] Parks Canada and ECCC stated at the hearing that they are in the early stages of collecting data to support a modern hydrodynamic model of the Peace-Athabasca Delta as part of Parks Canada’s ongoing

work developing management strategies for the park. The current ECCC model, which is likely the most sophisticated hydrodynamic model of the Peace-Athabasca Delta, dates to the early 1980s.

[1355] Transport Canada stated that it has initiated a study of navigation in the lower Athabasca River, but no specific information was available at the time of the hearing.

NWT Métis

[1356] The NWT Métis submitted that the Peace-Athabasca Delta has been impacted by hydroelectric projects and industrial projects and that the unique topography of the Peace-Athabasca Delta makes it disproportionately vulnerable to climate change.

Analysis and Findings

[1357] The *SWQuanMF* allows up to 29 m³/s of cumulative withdrawals during the summer/fall season (June 11 to October 28) when Athabasca River flows are above 111.6 m³/s. The panel notes that despite this, the framework includes several adaptive management rules that would be triggered by such a level of withdrawal.

[1358] The “cumulative oil sands water use relative to weekly flow” trigger is reached when oil sands use is equal or greater than 6% of the flow for six weeks or more during the open-water period of any given year. The panel notes that 29 m³/s is 6% of 483 m³/s.

[1359] The “high water use during low summer/fall flows” trigger is reached when cumulative oil sands water use exceeds 16 m³/s during any week in the summer/fall season in which the average weekly flow is less than 400 m³/s.

[1360] According to the *SWQuanMF* document, the “preliminary aboriginal navigation index” trigger would have been reached in five different years between 1996 and 2012 under a sustained cumulative diversion rate of 16 m³/s.

[1361] The *SWQuanMF* document also anticipates some of the Athabasca Chipewyan and Mikisew criticisms of, and recommendations for, the framework. The framework states that during late summer and fall of dry years, stream flows can drop substantially, and a protracted withdrawal of 29 m³/s may not follow the general framework principle of reduced withdrawals during declining flows.

[1362] The aboriginal navigation index is defined in the framework as preliminary and is described as being based on a single critical navigation point. The framework goes on to say that further development is anticipated including information from other navigation points along the Athabasca River, tributary access, and navigation in the Athabasca Delta.

[1363] The framework includes a commitment to augment the Athabasca Chipewyan and Mikisew community-based monitoring system to facilitate enhanced understanding of the relationship between

river navigability and stream flow; it further states that knowledge and understanding derived through the system will be used to inform updates of the preliminary navigation index over time.

[1364] The framework also references the impact of Athabasca River withdrawals on aboriginal navigation as a knowledge gap to be the subject of future reviews and potential framework updates.

[1365] The panel notes that most of the navigation information provided by Athabasca Chipewyan and Mikisew for this hearing was not available when the *SWQuanMF* was adopted in February 2015.

[1366] The panel concludes from all the above that the *SWQuanMF* implies that additional summer/fall weekly cumulative withdrawal limits are required when Athabasca River flow approaches 500 m³/s, and that updates to the framework were intended to be based, to a significant degree, on information collected by the community-based monitoring program.

[1367] The panel concludes that the Government of Alberta should review and update the *SWQuanMF* as part of the *LARP* review process.

[1368] The panel does not have an opinion on what the results of such a review should be. The panel recognizes that it is not within its mandate to recommend specific government policies. The panel also recognizes that a successful lower Athabasca River water management framework must be based on joint collaboration between federal, provincial, and First Nations governments and agencies, industry, and other members of the public.

[1369] The panel encourages the Government of Alberta to update the *SWQuanMF* with an emphasis on developing rules under low open-water flows and updating the navigation index and trigger.

[1370] The panel believes that it would not be appropriate for the panel to unilaterally recommend any specific changes to the *SWQuanMF* that were recommended by Athabasca Chipewyan and Mikisew as these should be negotiated multilaterally.

[1371] The panel notes that once completed, Transport Canada's study of navigation in the lower Athabasca River may be valuable for updating *SWQuanMF* and indicators, triggers and limits relating to navigation.

[1372] With respect to the Peace-Athabasca Delta, the panel concludes from the Parks Canada strategic environmental assessment report that the dominant cause of the observed changes to the hydrological condition of the Peace-Athabasca Delta has been changes to high water and flooding events on the Peace River, and that these changes have been attributed in the technical literature primarily to hydropower flow regulation in Peace River in British Columbia, followed by climatic changes in the Peace-Athabasca Basin since the 1970s.

[1373] The panel notes that frequent Peace River ice jam flooding was identified as the most important mechanism for recharging the Peace-Athabasca Delta, and in particular the perched lakes and wetlands. No process was identified in the record for this proceeding demonstrating how water withdrawals from the Athabasca River of the magnitude allowed by the *SWQuanMF* could have any effect, directly or indirectly, on ice jam floods or the conditions required for a significant ice jam flood to occur.

[1374] While water withdrawals in the Athabasca River Basin have been identified as a risk factor to water levels in the Peace-Athabasca Delta, no estimates of these impacts were provided to the panel other than Teck's assessment that project impacts would be limited to changes of 1 cm or less, and that maximum withdrawals under the terms of the *SWQuanMF* would be limited to less than 7 cm. Also, no information has been provided to the panel that disputes Teck's assessment that these estimates overstate the potential impacts because their methodology does not include the mitigating effects of outflows from Lake Athabasca.

[1375] Furthermore, Dr. Peters of ECCC testified that the effect of the withdrawals could be higher during periods of high flow on the Peace River and less during periods of low flow, but he was not able to provide specific numbers. Qualitatively, this implies that the effects of the project, and other upstream withdrawals, are significantly less than the values predicted by Teck since these assumed no outflow, which is similar to the high Peace River flow scenario described by Dr. Peters—that is, when the Peace River acts as a hydraulic barrier blocking outflow.

[1376] The panel notes that although the Parks Canada environmental assessment extensively discusses the importance of flooding mechanisms for water levels in the Peace-Athabasca Delta, Parks Canada did not recommend any water withdrawal limitations during periods of high flow on the Athabasca River. Furthermore, the panel notes that Parks Canada did not provide any information about ecological flow requirements in the Peace-Athabasca Delta during low-flow seasons. Instead, Parks Canada recommended that Teck should not be allowed to withdraw water from the Athabasca River when river flow was below the aboriginal extreme flow, which is a navigation-based flow requirement and not an ecology-based one.

[1377] The panel finds that protection and maintenance of the outstanding universal value of Wood Buffalo National Park and the Peace-Athabasca Delta requires coordinated federal and provincial initiatives, which includes managing withdrawals from the Athabasca River. However, the potential benefits of measures related to river withdrawals are negligible relative to those that can address the impacts more directly—for example, hydropower flow regulation and hydraulic structures in the delta.

[1378] The panel notes that Parks Canada is leading a collaborative effort to develop a modern model of the Peace-Athabasca Delta. The panel understands that such a model is needed to assess open-water and ice jam flooding as well as identifying ideal designs of new or modified hydraulic control structures in the delta. This level of work is well outside the scope of the Frontier project but nevertheless should be

encouraged because it is likely the only way significant progress will be made in mitigating effects of a changing climate and Peace River flow regulation on the delta.

[1379] The panel recommends that Parks Canada and ECCC work with First Nations and other indigenous groups; the governments of Alberta, British Columbia, Northwest Territories, and Saskatchewan; and industry and other interested parties to develop and implement the Wood Buffalo National Park World Heritage Site Action Plan to address the cumulative impact of hydropower development, climate change, and water withdrawals on the Peace-Athabasca Delta and Wood Buffalo National Park.

Recommendations to Alberta

[1380] The panel recommends that the Government of Alberta update the *SWQuanMF* with an emphasis on developing rules under low open-water flows and updating the navigation index and trigger.

Recommendations to Canada

[1381] The panel recommends that the Parks Canada and ECCC work with First Nations and other indigenous groups; the governments of Alberta, British Columbia, Northwest Territories, and Saskatchewan; and industry and other interested parties to implement the Wood Buffalo National Park World Heritage Site Action Plan to address the cumulative impact of hydropower development, climate change, and water withdrawals on the Peace-Athabasca Delta.

Slave River Delta and Tributaries

Evidence

[1382] The Deninu K'ue First Nation said that the number of channels in the Slave River Delta had declined. Where there were once 20 or 30 channels, there are now only three. Loss of access results in them not being able to harvest animals by hunting and trapping.

[1383] Smith Landing First Nation described how water levels in the Slave River are lower since development of Bennett Dam and that they cannot access locations they could in the past. They have lost or reduced access to La Butte Creek, Hornaday River, Murdock Creek, Ryan Creek, Dog River, and Pine Lake. These water levels have decreased to the point that they were sometimes no longer usable with a canoe.

[1384] This loss of access has led to them not being able to harvest animals. Eco-tourism, a local industry they plan on developing, depends on reasonable water levels so that people can travel without damaging their boats.

[1385] Water levels and seasonal flow rates in the Peace-Athabasca Delta, Athabasca River, Peace River, and Slave River have changed over decades, likely due to combined impacts of water withdrawals, water regulation, and climate change.

[1386] Dr. Daniel Peters of ECCC testified that the impacts of Athabasca River withdrawals, which have historically averaged approximately 4 m³/s, on the geomorphological character of the Slave River and its delta are negligible relative to the much larger changes in peak flows caused by Peace River regulation (historically, approximately 4000 m³/s).

Analysis and Findings

[1387] The panel agrees with Dr. Peters' assessment that since river geomorphology is largely controlled by high river flow rates, and there is a difference of three orders of magnitude between hydropower regulation impacts on Slave River peak flows as compared to oil sands water withdrawal impacts, it is not plausible that the Frontier project will have any meaningful impact on the Slave River and its delta.

[1388] With respect to the Slave River tributaries, these water bodies are not downstream of the project because they are separate tributaries of the Slave River. While there is no reason to doubt that the changes observed are real, there is no plausible physical mechanism or process by which the project can have any impact on the hydrology of these streams and lakes.

[1389] The panel recommends that the Government of Canada work with First Nations and other indigenous groups, provincial and territorial governments, and industry and other interested parties to develop and implement an action plan to address the cumulative impact of hydropower development, climate change, and water withdrawals on the Slave River Delta.

Recommendations to Canada

[1390] The panel recommends that the Government of Canada work with First Nations and other indigenous groups, provincial and territorial governments, and industry and other interested parties to develop and implement an action plan to address the cumulative impact of hydropower development, climate change, and water withdrawals on the Slave River Delta.

Assessment of Significance of Cumulative Effects

[1391] Based on the criteria provided in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of cumulative effects to surface water quantity, flows and levels in the Athabasca River, Peace-Athabasca Delta and Slave River Delta:

[1392] Ecological context – Peace River flow regulation, regional climate change, and cumulative water withdrawals alter the hydrological regime of the Peace-Athabasca Delta. Regional climate change and

cumulative water withdrawals alter the hydrological regime of the Athabasca River. These changes are associated with effects to aquatic habitat and traditional land use.

[1393] Cumulative effects to surface water quantity, flows, and levels are likely (certain) – Flows in the Athabasca River and water levels in the Peace-Athabasca Delta have demonstrably declined due to the combined effect of flow regulation, climate change, and, to a lesser extent, oil sands water withdrawals.

[1394] The magnitude of the cumulative effect is moderate to high – Since 2000, late summer and autumn Athabasca River flows and perched basin water levels in the delta are significantly lower than they were before 1980.

[1395] The geographic extent is regional – Impacts extend to the Slave River Delta in the Northwest Territories.

[1396] The duration is long – The effects of oil sands mine water withdrawals will end when mining is complete. The effects of hydropower flow regulation also end with the hydropower projects, but hydropower project lifetime is not well defined as a hydropower dam could operate indefinitely with sufficient maintenance. The future effects of climate change are long term, highly uncertain, and potentially permanent.

[1397] The frequency is continuous – The effects will occur throughout the life of the projects and into the far future.

[1398] The effects are partially reversible – The effects of oil sands mines and hydropower regulation are reversible at the end of project life. The effects of climate change are only reversible if regional climate returns to the historical range. The impacts in the Peace-Athabasca Delta are potentially partially mitigatable with well-designed hydraulic structures and changes to operational practices of hydropower flow regulation.

[1399] Given the above points, the panel finds that cumulative effects to surface water quantity, flows, and water levels in the Athabasca River, Peace-Athabasca Delta, and Slave River Delta are already adverse and significant but due predominantly to hydropower regulation and regional climate change, with industrial water withdrawals playing a minor role. The project is not expected to significantly add to existing impacts.

20 Fish and Fish Habitat

[1400] The terms of reference for the environmental impact assessment required Teck to assess potential impacts to fish, fish habitat and other aquatic resources and to identify project design features and other mitigation measures to minimize effects to fish and fish habitat or to offset any loss in the productivity of the fish habitat.

[1401] This section considers the effects of the Frontier project on fish and fish habitat and the proposed mitigation measures to minimize risk to the fisheries resource and offset losses in the productivity of fish habitat. Effects to other aquatic resources are discussed in section 18, "[Surface Water Quality](#)."

[1402] Teck used a local and a regional aquatics study area in its assessment. The aquatics local study area includes surface water resources that could be directly or indirectly affected by the Frontier project in combination with other oil sands developments. It includes the project disturbance area and the watersheds that contain watercourses that flow into or downstream of the project development area. The aquatics regional study area includes the aquatics local study area and the reach of the Athabasca River from Fort McMurray to Embarras Portage.

Evidence

[1403] The project has the potential to impact the productivity of the fisheries resource due the destruction and permanent alteration of fish habitat. In accordance with *Fisheries Act* requirements, Teck developed a draft detailed fisheries offsetting plan that estimated species-specific fish habitat losses and gains in the project area and Teck's approach to offset the losses.

[1404] DFO indicated that the development of the project will result in the destruction and permanent alteration of approximately 1 589 621 m² of fish habitat. This includes 497 276 m² of fish habitat within the Redclay Creek watershed, 1 082 755 m² of fish habitat within the Big Creek watershed, and 9590 m² of fish habitat within the Athabasca River.

[1405] Teck said that the fish habitat being impacted is mainly attributed to forage fish use. Sport fish are found in the lower portions of Redclay and Big Creeks, the Athabasca River, Ronald Lake and Unnamed Waterbody 19.

[1406] Impacts to the fish habitat in the Redclay Creek and Big Creek watersheds are primarily the result of mine construction directly removing fish habitat or associated flow reductions decreasing fish habitat area. Fish habitat impacts in the Athabasca River, are attributed to the proposed bridge across the Athabasca River and the footprint of the raw water intake and associated access bridge. The proposed raw water intake site is located on the east side of Dalkin Island and includes an access bridge over the side channel between the west bank of the Athabasca River and the west side of Dalkin Island.

[1407] The draft detailed fisheries offsetting plan indicates that the primary mitigation measure for the impacts to the fisheries resource will be the creation of a fish habitat compensation lake and its associated outlet that will be connected to the Athabasca River. The fish habitat compensation lake is anticipated to provide recreational and indigenous fishing opportunities once established and functioning as a fishery. The draft detailed fisheries offsetting plan also describes additional offsetting options of complementary measures that are the subject of ongoing consultation with indigenous communities, regulators, and other stakeholders.

[1408] Teck stated that the fish habitat compensation lake fully offsets the project's effects on fish habitat. It will have a surface area of 123 ha and will provide permanent, year-round lake habitats consisting of sport fish, sucker, and forage fish species. The outlet channel will be designed to provide habitat for Athabasca River fish species, including spawning habitat for migratory large-bodied fish species that use rocky riffle habitats for spawning and egg incubation. The draft detailed fisheries offsetting plan also describes how suitable habitat will be created to support benthic invertebrate production and diversity.

[1409] Additional mitigation measures identified by Teck included the following:

- Whenever possible, activities will be scheduled to avoid sensitive time periods in downstream fish-bearing watercourses.
- Best management practices, including sediment and erosion control measures, will be implemented during construction.
- Watercourse crossings associated with access roads will be constructed in accordance with regulatory guidelines and best management practices to avoid interference with fish passage and prevent habitat fragmentation, as required by the *Water Act Code of Practice for Watercourse Crossings* and DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat*.
- A fish rescue plan will be developed and implemented according to regulatory requirements in instances where development activities (e.g., watercourse diversions) result in the isolation or dewatering of fish-bearing habitats.
- Should incidental observations of fish occur during dewatering in habitats considered non-fish-bearing, Teck will notify Fisheries and Oceans Canada (DFO) and discuss potential requirements for fisheries offsetting for the relevant habitats at that time.
- Teck will develop and implement an access management plan to limit access by the general public to fish-bearing watercourses or water bodies.
- Project personnel will be prohibited from fishing in watercourses or water bodies in the project development area.

[1410] DFO notes that although sensitive habitat is not present at the raw water intake site, construction of the access bridge and raw water intake will result in the permanent alteration of 8655 m² of fish habitat. However, DFO confirmed that the potential effects of the fish habitat impacts have been considered within the draft detailed fisheries offsetting plan.

[1411] DFO noted that operation of the raw water intake will result in water withdrawals from the Athabasca River and that the conditions of an authorization issued under section 35(2)(b) of the *Fisheries Act* will require compliance with the water withdrawal regime defined in the *Surface Water Quantity Management Framework for the Lower Athabasca River*. DFO also noted that screening of the raw water intake would be required, in accordance with DFO's freshwater intake end-of-pipe screening guidelines, to prevent impingement and entrainment of fish and mitigate localized impacts on fish populations. Teck confirmed that the raw water intake will be screened in compliance with regulatory guidelines for screen size and appropriate water velocities through the screen to limit potential impacts to fish.

[1412] Teck and DFO stated that a detailed fish and fish habitat survey had not yet been completed for the proposed Athabasca River bridge crossing site but is planned as part of the detailed design phase. However the potential effects of the construction and operation of the bridge crossing have been considered as part of the draft detailed fisheries offsetting plan, which will be modified based on the detailed bridge design. Teck indicated that watercourse crossings associated with the project will be constructed in accordance with the *Water Act Code of Practice for Watercourse Crossings*.

[1413] Teck indicates that none of the fish species in the aquatics local or regional study areas are listed under SARA. Teck notes that five fish species occurring in the aquatics local and regional study area are listed under the *Alberta Species at Risk Program*. Arctic grayling, lake trout and northern redbelly dace are provincially listed with a general status of "sensitive." Arctic grayling has been recorded in the Athabasca River, lower Redclay Creek, and lower Big Creek. Lake trout occur occasionally in the Athabasca River. Northern redbelly dace occurs in the Athabasca River and portions of the lower Redclay Creek drainage. Spoonhead sculpin are provincially listed as "may be at risk" and occur in the Athabasca River and the lower portions of Redclay Creek and Big Creek. Bull trout, which occur occasionally in the Athabasca River or some of its tributaries are listed as threatened. No other fish species at risk occur in the aquatics local and regional study area.

[1414] The Original Fort McMurray First Nation identified concerns regarding fish spawning grounds associated with compensation lakes. They wanted to know where walleye, jackfish, and arctic grayling will spawn. He also expressed concern about the time lag between the fish habitat being impacted and the ability to access the fish in the compensation lake. The Original Fort McMurray First Nation noted that there was a lot of fish habitat being removed by oil sands projects in the region and compensation lakes being created, but they were uncertain whether the compensation lakes could be accessed for fishing. They asked DFO if the compensation lakes being created compensate for this loss of use.

[1415] DFO indicated that the offsetting lake proposed for the project has been designed to incorporate features for fish spawning. DFO explained that the outlet channel connecting the lake to the Athabasca River would incorporate substrates to appeal to spawning sport fish, as would the lake itself. DFO added that fish will be able to migrate from the Athabasca River into the outlet tributary to spawn or go further up in the tributary into the lake to spawn. DFO stated that the fish habitat compensation lake would be built with certain habitat features, and it was expected that it would naturally colonize with fish from the Athabasca River. DFO said that once the lake is built it will take about two years to fill, and as soon as fish start using it, they will be contributing downstream to Athabasca River productivity. DFO stated that it expected the lake could be used by northern pike, white suckers, long-nose suckers, and different forage fish species.

[1416] DFO said that, the offsetting measures will be constructed at the start of the project to minimize lag time associated with impacts to fish and fish habitat. There will be some lag time, to allow for these newly created habitats to function in an ecological manner. As such, offsetting has been proposed at a greater than 1:1 ratio (habitat gains to habitat losses) to account for uncertainty and the lag time needed to attain a more natural ecological function.

[1417] DFO acknowledged that there is some uncertainty associated with lag time between when the habitat destruction or permanent alteration occurs and when the offsetting habitat is functional. DFO stated that the intent of the offsetting lakes is to maintain productivity in the system, not necessarily to have immediate access to fishing. DFO stated that while the five offsetting lakes constructed to date in the mineable oil sands region have not fully realized their potential, they are currently on a positive trajectory, producing some fish and making some contribution to productivity.

[1418] The draft detailed fisheries offsetting plan includes a monitoring program for the offsetting lake. Teck stated that the goal of the monitoring program is to document mitigation and offsetting effectiveness and identify where adaptive management actions are required. Teck stated that monitoring is designed to confirm predictions related to project effects on fish habitat productivity and validate models used in the assessment. Parameters such as fish habitat characteristics, water and sediment quality, plankton composition, density and biomass, and benthic community composition and density; fish populations and fish mercury concentrations will be documented. Regarding the outlet channel for the fish habitat compensation lake, water quality, fish habitat characteristics, fish passage characteristics, attached algal mass, benthic invertebrate community composition and density, and fish population data will be documented. Teck indicated that it will participate in regional monitoring programs designed to monitor fish communities, fish health, and water quality parameters in the Athabasca oil sands region. Monitoring results will be used, as appropriate, to inform Teck's adaptive management plan for the project.

[1419] Teck stated that, with the proposed offsetting, there will be no residual adverse project effects on overall fish abundance.

[1420] DFO stated that, should the project be approved, it believed that the detailed draft fisheries offsetting plan, once finalized and implemented, would fully offset project effects to fish and fish habitat.

[1421] DFO noted that the objective of the detailed draft fisheries offsetting plan is to maintain and enhance the productivity of the recreational and aboriginal fishery in the project area. Should the offsetting habitat not meet DFO's requirements or the objectives and principles of DFO's *Fisheries Productivity Investment Policy*, Teck will be required to provide other habitat offsetting measures. Any deviations from the proposed draft detailed fisheries offsetting plan will be undertaken in consultation with DFO and indigenous communities.

[1422] DFO stated that should the project be approved and a *Fisheries Act* authorization be issued by DFO, the authorization would include conditions to ensure mitigation measures are implemented to protect fish and fish habitat, that monitoring and follow-up programs are undertaken to validate and verify predictions, and that impacts to fish and fish habitat are adequately offset.

[1423] DFO noted that, historically, oil sands projects with approved fisheries offsetting plans were not considered to contribute to adverse cumulative effects to fish and fish habitat in the region. However indigenous communities have raised concerns about cumulative effects from oil sands projects, including but not limited to potential impacts to water quality and quantity, fish health, the removal of tributary habitat and replacement of it with lake habitat, potential alterations to fish species assemblages, and effects to the Peace-Athabasca Delta.

[1424] In light of these concerns, and in response to a recommendation from a previous joint panel review (Jackpine Mine Expansion), DFO initiated work in 2015 to identify information requirements and the considerations necessary for DFO to assess regional aquatic cumulative effects. DFO indicated that this work is continuing and it will continue to work with interested parties in the oil sands region to develop an aquatics cumulative effects program to further inform decision making in the region. DFO recommended that Teck participate in this initiative as part of its recommendations to the panel.

[1425] DFO made twelve recommendations in relation to the project:

[1426] Recommendation 1: The joint review panel's report include a recommendation to Teck. to participate in the regional cumulative effects assessment being led by DFO. This participation may include leading some components of the cumulative effects assessment and/or providing financial resources or appropriately qualified technical expertise.

[1427] Recommendation 2: The joint review panel's report include a recommendation to Teck to complete detailed design and implementation of the detailed fisheries offsetting plan. This plan should meet the provisions of the *Fisheries Protection Policy Statement*, October 2013 and the *Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting*, November 2013. The plan must consider designs for fish passage from the offsetting lake to the Athabasca River. Teck should consult

with stakeholders and indigenous communities to solicit input as to the target fish species in the lake, design of aquatic and terrestrial habitat features and the potential to include other components of cultural significance. The plan should include feedback received during consultation and describe how the information was considered.

[1428] Recommendation 3: The joint review panel's report include a recommendation to Teck to further delineate aquatic impacts and habitat availability in the locations of the raw water intake, associated infrastructure and the Athabasca River bridge. Teck should further undertake an options analysis for the location of the raw water intake. This information should be incorporated into the detailed fisheries offsetting plan.

[1429] Recommendation 4: This recommendation pertains to the Ronald Lake bison herd and is therefore not relevant to the fisheries section. Conditions and recommendations related to the Ronald Lake bison herd are discussed in section 23, "[Wildlife](#)."

[1430] Recommendation 5: The joint review panel's report include a recommendation that requires Teck to collect baseline information to further inform methylmercury modelling in the offsetting lake and downstream environments. Teck should consult on the results of the baseline data collection and any further mitigation measures proposed with DFO, ECCC, indigenous communities and other potentially interested stakeholders.

[1431] Recommendation 6: The joint review panel's report include a recommendation that supports the further development of alternative offsetting measures as outlined in Fisheries and Oceans Canada's *Fisheries Productivity Investment Policy*. Teck should consult with indigenous communities and other stakeholders regarding research opportunities that would form part of the offsetting plan.

[1432] Recommendation 7: The joint review panel's report include a recommendation that Teck complete a detailed monitoring plan to monitor and report on the mitigation and offsetting measures. The plan should include but not be limited to the following:

- monitoring and reporting requirements to demonstrate that the offsetting measures have been effective in counterbalancing the impacts to fish and fish habitat;
- undertake a validation of the habitat suitability index models used to predict the impacts to fish and fish habitat and determine the amount of offsetting required;
- report on mitigation measures applied and any changes to the mitigation measures;
- any corrective actions or contingency measures used to ensure further habitat destruction or permanent alteration to habitat does not occur; and
- how feedback received during indigenous consultation on the plan has been considered or incorporated, as appropriate.

[1433] Recommendation 8: The joint review panel's report include a recommendation that Teck maintain involvement in the Fisheries Sustainable Habitat Committee with the goal of validating the habitat suitability index models. DFO recommends that the joint review panel's report include a recommendation that Teck use the validated watercourse habitat suitability index models to verify and report on predictions made in the environmental assessment related to the quality and quantity of fish habitat impacted by the project. DFO recommends that the joint review panel's report include a recommendation that Teck validate and verify the predictions made by the water body habitat suitability index models.

[1434] Recommendation 9: The joint review panel's report include a recommendation that Teck further develop and implement an adaptive management strategy to monitor and update plans related to the mitigation strategies and offsetting plans. Teck should consult with appropriate government agencies as well as indigenous communities in the development of the strategy. Teck should include how feedback received during the consultation sessions has been considered or incorporated, as appropriate.

[1435] Recommendation 10: The joint review panel's report include a recommendation that Teck finalize a monitoring program specific to the construction and operation of the raw water intake. This monitoring should include velocity and flow measurements across fish exclusion screens to verify predictions made in the detailed design.

[1436] Recommendation 11: The joint review panel's report include a recommendation that Teck further develop and implement an adaptive management strategy for the closure and reclamation landscape. Teck should consult with appropriate government agencies as well as indigenous communities in the development of the strategy. Teck should include how feedback received during the consultation sessions has been considered or incorporated, as appropriate.

[1437] Recommendation 12: The joint review panel's report include a recommendation that Teck design closure landscapes such that they may be integrated into the natural environment. Teck should work with DFO during the design phase and throughout the life of the project to design, implement, and monitor aquatic habitat on the reclaimed landscape. Teck should maintain involvement in regional groups and undertake consultations with indigenous communities with regards to the closure landscape. Teck should report on how the feedback received during consultations has been considered or incorporated, as appropriate.

[1438] Teck agreed with all of the recommendations except a portion of recommendation 3. Teck indicated it does not plan to update the options analysis for the raw water intake that was provided in the 2015 project update. Teck indicated it would agree with a recommendation that Teck finalize the detailed fisheries offsetting plan for the project, including required fisheries offsets for the river water intake and bridge, to the satisfaction of DFO.

[1439] Mikisew and Teck jointly developed a number of conditions related to construction and operation of the project and requested that they be incorporated as approval conditions, should the project be found to be in the public interest and approved. One of the jointly proposed conditions is related to fish and the water intake. The condition requires Teck to design its Athabasca River water intake system in accordance with the application and to

- allow for complete shutoff of the intake system and
- minimize entrainment and impingement of fish.

[1440] Athabasca Chipewyan and Teck jointly developed objectives and commitments for the project and requested that the panel include these as approval conditions, should the project be found to be in the public interest and approved. The objective for fish and fish habitat committed the parties to ensuring that mitigation and compensation for project impacts to fish habitat are implemented in a manner that is locally and cultural appropriate and supports Athabasca Chipewyan aboriginal and treaty rights to harvest fish in Athabasca Chipewyan territory.

[1441] The specific commitments require Teck to

- work collaboratively with Athabasca Chipewyan through a participation agreement implementation with respect to Teck's mitigation, monitoring, and adaptive management plans, including those that pertain to fish and fish habitat;
- use best available information to identify fish habitat within the lower Athabasca River basin that can be replaced, restored, or enhanced by Teck, to the satisfaction of Athabasca Chipewyan, for Teck to create fish habitat compensation units and advance the fish objectives;
- design the water intake to minimize entrainment and impingement of fish;
- as approved by regulatory authorities, implement fish habitat mitigation and compensation measures to advance the fish objectives within Athabasca Chipewyan harvesting areas identified collaboratively with Athabasca Chipewyan in lieu of, at least in part, the fish habitat compensation lake;
- engage Athabasca Chipewyan on Teck's complementary measures program to identify opportunities for Teck funding for Athabasca Chipewyan-led initiatives to enhance fish productivity and habitat in Athabasca Chipewyan's harvesting areas; and
- undertake regular monitoring of fish habitat, fish tissue quality (including mercury levels), fish species diversity, and benthic biodiversity in Athabasca Chipewyan harvesting areas.

[1442] Athabasca Chipewyan and Teck also jointly developed a recommendation for Crown action related to fish and fish habitat and requested that the panel make the following recommendations to Canada in its report:

By 2019, constructive engagement between the DFO, Teck, ACFN, and other interested indigenous communities regarding the acceptability of identifying fish habitat mitigation and compensation measures to achieve the fish objective in lieu of, at least in part, the currently proposed fish habitat compensation lake.

[1443] DFO stated that it would continue to consult with indigenous groups in relation to project offsetting for impacts to fisheries. DFO also noted that it will continue to work cooperatively with all stakeholders, including the Teck, to ensure that its interests in the protection of fish and fish habitat are addressed.

[1444] Fort McKay did not identify any specific concerns or recommendations related to the project but requested that the panel make recommendations to the governments of Canada and Alberta on a range of issues related to cumulative effects to aquatic resources including regional aquatic environmental effects monitoring, consultation between Fort McKay and the Crown, use of traditional knowledge in assessing and managing aquatic environmental effects and the need for further baseline data and assessment of effects to Fort McKay's Moose Lake reserve, Namur/Gardiner Lakes, and the Ells and MacKay Rivers. Fort McKay's recommendations are included in [Appendix 6](#).

Analysis and Findings

[1445] The panel finds that project will result in the destruction and permanent alteration of fish habitat that is part of or supports a recreational or aboriginal fishery. The panel recognizes that offsetting is the accepted mitigation approach for impacts under the *Fisheries Act* and that Teck has prepared a draft detailed fisheries offsetting plan intended to satisfy the requirements of the act. While DFO has not yet approved a final detailed fisheries offsetting plan, DFO did not raise any concerns about the draft detailed fisheries offsetting plan and stated that it believed that, when finalized and implemented, the detailed fisheries offsetting plan would fully mitigate the effects of the project. The panel accepts that the mitigation measures outlined in the draft detailed offsetting plan are appropriate and will effectively mitigate the effects of the project on fish and fish habitat, if implemented as proposed.

[1446] The panel notes that Teck agreed with all of DFO's recommendations, except for the part of recommendation 3 which recommended that Teck further undertake an options analysis for the location of the raw water intake. Teck completed an options analysis for the raw water intake as part of the 2011 integrated application for the project and updated its analysis in the 2015 project update. It is not clear why DFO is recommending further analysis of options at this stage of the process, and this was not pursued by DFO during this hearing. The panel therefore does not support this part of recommendation 3.

The panel does however support the other recommendations made by DFO related to fish and fish habitat and will include them in its recommendations to Teck.

[1447] While recognizing the Original Fort McMurray First Nation's concerns regarding the lag time for fish habitat offsetting programs to demonstrate results, the panel is satisfied with DFO's explanation regarding offsets as a means of maintaining fishery productivity.

[1448] With respect the Mikisew-Teck proposed condition related to screening of the raw water intake, Teck confirmed that the river water intake will be screened in compliance with regulatory guidelines related to screen size and appropriate water velocities through the screen. DFO also confirmed this would be a condition of the *Fisheries Act* authorization, should the project be approved.

[1449] With respect to the Mikisew-Teck condition related to the raw intake being designed so it can be shut off completely, the panel notes that the *Surface Water Quantity Management Framework* under *LARP* requires Teck to cut off water withdrawals when river flows are below 87 m³/s. Teck will therefore need to design its raw water intake to allow it to be shut off completely.

[1450] With respect to the Athabasca Chipewyan–Teck jointly developed commitments, the panel expects Teck to work collaboratively with Athabasca Chipewyan and other indigenous communities with respect to the development and implementation of Teck's mitigation, monitoring, and adaptive management plans, including those that pertain to fish and fish habitat. As Teck has committed to working collaboratively with Athabasca Chipewyan, and Athabasca Chipewyan and Teck have entered into a participation agreement, the panel does not believe an approval condition is required. With respect to proposed conditions related to the offsetting program and complementary measures, the panel has included recommendations to Teck on these matters in response to DFO's recommendations. The panel recommends that the DFO, Teck, Athabasca Chipewyan, and other interested indigenous communities work collaboratively to explore the acceptability of identifying fish habitat mitigation and compensation measures in lieu of, at least in part, the currently proposed fish habitat compensation lake.

[1451] With respect to design of the water intake, this will be addressed through regulatory requirements and DFO conditions. Monitoring of fish habitat and mercury levels in fish in the fish habitat compensation lake and the health of aquatic ecosystems will be conditions of approval.¹²⁸

[1452] The panel supports the intent of the Athabasca Chipewyan–Teck recommendation related to engagement between the DFO, Teck, Athabasca Chipewyan, and other interested indigenous communities regarding the acceptability of identifying fish habitat mitigation and compensation measures in lieu of, or at least in part of, the currently proposed fish habitat compensation lake and has included this as a recommendation to Canada.

¹²⁸ Draft *EPEA* Approval – Conditions 3.3.4(e), 4.2.5(a), and 4.2.5(d)

[1453] The panel notes that Fort McKay has entered into a long-term sustainability agreement with Teck and did not raise any project-specific concerns at the hearing. The panel also understands that, notwithstanding Fort McKay's position on the project, it continues to be concerned about the cumulative effects of development on Fort McKay's treaty and aboriginal rights and interests. The recommendations Fort McKay is asking the panel to make cover a broad range of issues related to the management of cumulative effects to the aquatic environment, including effects to areas adjacent to Fort McKay and Fort McKay's Moose Lake reserve. Given that the recommendations are not related to project effects, the panel believes it would be inappropriate for it to make specific and detailed recommendations to the governments on these matters as part of this proceeding. However the panel recommends that Alberta and Canada consider Fort McKay's recommendations as part of their work on cumulative effects assessment and management in the oil sands.

Panel Recommendations to Teck

[1454] The panel recommends that Teck:

- Participate in the regional cumulative effects assessment being led by DFO. This participation may include leading some components of the cumulative effects assessment or providing financial resources or appropriately qualified technical expertise.
- Finalize and implement the fisheries offsetting plan and associated monitoring program for the Frontier project. This plan should meet the provisions of the *Fisheries Protection Policy Statement*, October 2013, and the *Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting*, November 2013. The plan should consider designs for fish passage from the offsetting lake to the Athabasca River. Teck should engage with stakeholders and indigenous communities to solicit input as to the target fish species in the lake, design of aquatic and terrestrial habitat features, and the potential to include other components of cultural significance. The plan should include feedback received during engagement and describe how the information was considered.
- Further delineate aquatic impacts and habitat availability in the locations of the raw water intake, associated infrastructure, and the Athabasca River bridge. This information should be incorporated into the fisheries offsetting plan.

[1455] Following the collection of additional baseline information to further inform methylmercury modelling in the offsetting lake and downstream environments, Teck should engage with DFO, ECCC, indigenous communities, and other potential interested stakeholders on the results and any further mitigation measures proposed.

[1456] Consider further development of alternative offsetting measures as outlined in Fisheries and Oceans Canada's *Fisheries Productivity Investment Policy*. Teck should engage with indigenous

communities and other stakeholders regarding research opportunities that would form part of the offsetting plan.

[1457] Complete a detailed monitoring plan to monitor and report on the mitigation and offsetting measures. The plan and reporting should include but not be limited to the following:

- monitoring and reporting requirements to demonstrate that the offsetting measures have been effective in counterbalancing the impacts to fish and fish habitat,
- undertake a validation of the habitat suitability index models used to predict the impacts to fish and fish habitat and determine the amount of offsetting required,
- report on mitigation measures applied and any changes to the mitigation measures,
- any corrective actions or contingency measures used to ensure further habitat destruction or permanent alteration to habitat does not occur, and
- how feedback received during indigenous consultation on the plan has been considered or incorporated, as appropriate.

[1458] Maintain involvement in the Fisheries Sustainable Habitat Committee with the goal of validating the habitat suitability index models. Teck should use the validated watercourse habitat suitability index models to verify and report on predictions made in the environmental assessment related to the quality and quantity of fish habitat impacted by the project. Teck should validate and verify the predictions made by the waterbody habitat suitability index models.

[1459] Further develop and implement an adaptive management strategy to monitor and update plans related to the mitigation strategies and offsetting plans. Teck should engage with appropriate government agencies as well as indigenous communities in the development of the strategy. Teck should include how feedback received during the engagement sessions has been considered or incorporated, as appropriate.

[1460] Finalize a monitoring program specific to the construction and operation of the raw water intake. This monitoring should include velocity and flow measurements across fish exclusion screens to verify predictions made in the detailed design.

[1461] Further develop and implement an adaptive management strategy for the closure and reclamation landscape. Teck should engage with appropriate government agencies as well as indigenous communities in the development of the strategy. Teck should include how feedback received during the engagement sessions has been considered or incorporated, as appropriate.

[1462] Design closure landscapes such that they may be integrated into the natural environment. Teck should work with DFO during the design phase and throughout the life of the project to design, implement, and monitor aquatic habitat on the reclaimed landscape. Teck should maintain involvement in regional groups and engage with indigenous communities with regards to the closure landscape. Teck

should report on how the feedback received during engagement has been considered or incorporated, as appropriate.

Panel Recommendations to Alberta

[1463] The panel recommends that Alberta consider Fort McKay's recommendations related to cumulative effects to the aquatic environment as part of Alberta's efforts to assess and manage cumulative effects within the Lower Athabasca region.

Panel Recommendations to Canada

[1464] The panel recommends that the DFO, Teck, Athabasca Chipewyan, and other interested indigenous communities work collaboratively to explore the acceptability of identifying fish habitat mitigation and compensation measures in lieu of, at least in part, the currently proposed fish habitat compensation lake.

[1465] The panel recommends that Canada consider Fort McKay's recommendations related to cumulative effects to the aquatic environment as part of Canada's efforts to assess and manage cumulative effects within the Lower Athabasca region.

Assessment of Significance of Project Effects

[1466] Based on the criteria provided in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects to fish and fish habitat:

[1467] Ecological context – The project development area includes areas that are part of a recreational or aboriginal fishery (Athabasca River, lower reaches of Redclay and Big Creeks). The project is also located in an area where other oil sands mining projects are contributing to the destruction and permanent alteration of fish habitat.

[1468] The effects of the project on fish and fish habitat are likely—the project will result in the destruction and alteration of fish habitat the proposed mitigations are designed to offset for the effects of the project.

[1469] The magnitude will be low – once the detailed fish habitat offsetting plan is finalized and implemented, there should be no residual effects to fish or fish habitat. The offsetting plan has been designed to fully mitigate for impacts to fish and fish habitat.

[1470] The geographic extent is local – measureable effects are generally limited to the local study area and tributaries of the Athabasca River.

[1471] The duration is medium term – given that the compensation lake will be constructed at the start of the project it is expected to start contributing to productivity of the fishery during the operational phase of the project. Effects will occur until the fish habitat compensation lake is fully functional

[1472] The frequency is periodic – loss of fish habitat will occur during construction of certain portions of the mine and associated infrastructure.

[1473] The effects are reversible – it is anticipated that once the detailed fisheries offsetting plan is finalized and implemented and the fish habitat compensation lake is fully functional, the project will not result in a loss of fisheries productivity.

[1474] Given the above points, the panel finds project effects to fish and fish habitat are adverse but not likely to be significant due to the low magnitude, limited geographic extent, and reversibility of the predicted effects.

[1475] As the project is not expected to result in residual effects to fish and fish habitat after mitigation, an assessment of cumulative effects to fish and fish habitat is not required. The panel acknowledges that DFO is undertaking a regional cumulative effects assessment and that Teck has accepted DFO's recommendation that Teck participate in the study.

21 Terrain and Soils

[1476] This section discusses the effects of the Frontier project on terrain and soils. The environmental impact assessment terms of reference required Teck to provide baseline information, discuss how the Frontier project could affect soil quality, and provide mitigation and monitoring plans for terrain and soils.

[1477] *EPEA* requires operators to conserve and reclaim specified land and obtain a reclamation certificate. The *CCR* states that the objective of conservation and reclamation of specified land is to return it to an equivalent land capability.

[1478] Mitigating the effects on terrain and soils is fundamental to successfully reclaiming the landscape to meet reclamation outcomes. The goal of reclamation for the project is to create self-sustaining, stable landforms with soils that establish moisture and nutrient regimes that will support locally common boreal forest ecosystems.

[1479] The following key issues were identified and assessed for terrain and soil:

- Change in topographic diversity
- Change in soil series diversity
- Change in land capability class
- Soil acidification

[1480] The key issues for terrain and soils were assessed based on the terrestrial local study area (43 349 hectares), which encompassed the project disturbance area (29 217 hectares) plus a buffer of 500 metres except where it has been extended on the eastern edge to border the Athabasca River. Potential acid input was also assessed for the potential acid input study area, 1 195 560 hectares.

[1481] Because soil handling can affect soil quality, including reclamation suitability and land capability classification, the panel will address project-specific soil handling concerns and mitigations. Teck's approach to conservation and reclamation is further discussed in section 10, "[Conservation, Reclamation, and Closure](#)."

Soil Handling

Evidence

[1482] The Frontier project will directly affect terrain and soils within the project disturbance area. Due to the lifespan and size of the Frontier project, construction, operations, and reclamation activities could be simultaneously occurring on various areas of the Frontier project. During construction and operations,

Teck will salvage reclamation material from disturbed areas and directly place it on recontoured areas or store the material in stockpiles for future use during reclamation.

[1483] Reclamation material will be progressively salvaged for either direct placement on sites ready for reclamation or stockpiled for future reclamation. Teck stated it is not planning on salvaging areas of deep peat (organic soil) except those occurring in the external tailings areas.

[1484] Teck indicated that land will be reclaimed by direct placement of subsoil and topsoil on the closure landscape when the opportunity exists. Teck currently plans to use direct placement of reclamation material on approximately 22 per cent of the Frontier project disturbance area.

[1485] Teck indicated that reclamation material of different textures (coarse upland, fine upland, organic, fine fluvial fan material) and depths (coversoil, subsoil) will be separated during soil salvage and stockpiling. Teck's approach is summarized in [Table 6](#), in section [10](#), "[Conservation, Reclamation, and Closure](#)."

[1486] Teck plans to use overburden material as a subsoil replacement. Teck indicated 86.1 per cent upper lift and 85.6 per cent second lift have a poor reclamation suitability rating, with mainly texture and reaction causing the poor rating.

[1487] Teck identified a high compaction risk for 63 per cent of topsoil and subsoil in the terrestrial local study area, associated with high soil moisture content and fine-textured material. Additionally, 39 per cent of terrestrial local study area has high rutting risk. Teck will drain areas with high water content before salvaging soil and indicated that two years might be an appropriate length of time to drain ahead of soil salvage. Teck indicated measures for minimizing soil compaction includes salvaging soil during frozen conditions, employing reclamation monitors during construction, and using appropriate equipment. Compaction during reclamation will be minimized by conducting soil handling only when conditions are suitable and by limiting vehicle traffic on reclaimed areas, and if compaction does occur mitigate by deep ripping or use of a cultivator.

[1488] Teck rated 80 per cent of topsoil as high to severe risk, and 43 per cent of subsoil is rated as high to severe risk for wind erosion. Teck stated the assumptions used to rate wind erosion risk for soils were conservative. Soils are most at risk during handling at construction and reclamation. Teck's mitigation measures to minimize the risk from wind erosion included progressive timber salvage to minimize exposed bare soil during construction, planning to salvage soil during frozen conditions, leaving rough surfaces after soil placement, using coarse woody debris, physical barriers, and packing on reclaimed areas and revegetating as soon as possible.

Analysis and Findings

[1489] The panel is encouraged by the area of reclaimed land where direct placement of reclamation material may occur. The panel requires Teck apply direct placement of reclamation material on recontoured portions of the disturbed land whenever possible.¹²⁹ Direct placement of material results in less land disturbance due to reduction in area required for stockpiles. The panel expects Teck to reclaim disturbed land as soon as suitable areas become available in order to minimize the area under disturbance at any given time.

[1490] The small percentage of organic soils in the Frontier project disturbance area is distinct from other oil sands mines. The panel understands not all the reclamation material on the Frontier project will be required for reclamation purposes. The panel expects Teck to salvage and store a sufficient volume of material to be used for reclamation where direct placement cannot be applied. The AER's *Specified Enactment Direction 003: Direction for Conservation and Reclamation Submissions Under an Environmental Protection and Enhancement Act Approval for Mineable Oil Sands (SED 003)* was released by the AER on December 18, 2018. It contains tables for tracking capping material and reclamation material to assist with oversight of material balances.

[1491] The panel agrees with Teck's segregation of reclamation material during salvage and stockpiling and will include a condition to minimize mixing of different reclamation materials types during salvage and stockpiling.¹³⁰

[1492] In addition to the previous condition regarding stockpiling, the panel will include a condition to comply with best management practices 11–16 of *Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region of Alberta* (Alberta Environment and Water, 2012).¹³¹

[1493] The large spatial extent of imperfectly to poorly drained soils contributes to the high per cent of reclamation material at risk from compaction or rutting. The measures provided by Teck to mitigate compaction and rutting risks are reasonable at this stage of the project. As discussed in *Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region of Alberta*, severe compaction can be difficult to ameliorate. The panel requires the operator understands and complies with best management practices and approval conditions. *EPEA* approval conditions will require suspension of soil salvage or placement activities when conditions degrade reclamation material.¹³²

¹²⁹ Draft *EPEA* Approval – Condition 3.6.12

¹³⁰ Draft *EPEA* Approval – Condition 3.6.18

¹³¹ Draft *EPEA* Approval – Condition 3.6.19

¹³² Draft *EPEA* Approval – Condition 3.6.10

[1494] The panel agrees that the assumptions used to determine the risk to soils from wind erosion are conservative. Mitigation measures to minimize wind erosion are acceptable. *EPEA* approval conditions will require suspension of soil salvage or placement activities when conditions will result in the loss or degradation of reclamation material from erosion.¹³³

[1495] The panel will include a condition requiring Teck to suspend salvage or placement of reclamation material under adverse weather conditions.¹³⁴

Topographic Diversity

Evidence

[1496] Teck assessed changes to topography by looking at the distribution and extent of modal slope classes which are the categories for range of slope gradients that occur most often in the data set. A decrease of one-half slope class is predicted from the current landscape to the closure landscape. Teck is anticipating an increase in topographic diversity at closure, but overall the landscape will be flatter. The area of land that can support upland ecosite phases will increase by 4399 hectares, wetlands decrease by 8489 hectares, and open water will increase by 3995 hectares at closure.

[1497] The predisturbance topography is almost flat for a large portion of the Frontier project; the terrain will be altered with novel landforms (overburden dump, tailings storage areas, mine pits, etc.) being created. Teck stated that changes in topography associated with the closure landscape will be visible from a number of locations and will affect visual characteristics.

[1498] OSEC raised concerns that the project would result in the loss of wetlands and peatlands and the increase the number of open-water bodies.

[1499] Teck stated that effects on topographic diversity are within only the terrestrial local study area, of medium duration, irreversible, and of moderate environmental consequence.

Analysis and Findings

[1500] The panel notes that, as a result of oil sands mining operations, including overburden storage areas and pit mining, the reclaimed landscape will be predominantly composed of upland habitat and open water with less wetlands and peatlands than the predisturbance landscape. While the panel understands Teck used changes in slope class to evaluate impacts to topographic diversity, it notes that the construction, operation, and reclamation of the mine will result in landforms not present before the disturbance. The panel disagrees with Teck's rating of "medium duration" for the Frontier project effects

¹³³ Draft *EPEA* Approval – Condition 3.6.10

¹³⁴ Draft *EPEA* Approval – Condition 3.6.10

on topographic diversity within the terrestrial local study area. The resulting landforms will remain on the landscape permanently.

[1501] As a requirement of the life of mine closure plan that will be submitted as per *SED 003*, the closure landscape, among other considerations, is to have a natural appearance consistent with the region and be integrated into the adjacent landscape. The panel expects Teck to adaptively manage and consider topographic diversity and integration of landforms with the surrounding topography when adjusting its closure and reclamation plans throughout mine life.

Soil Series Distribution and Diversity

Evidence

[1502] Baseline soils information was gathered through soil surveys at a density to meet the minimum soil survey intensity level specified in the environmental impact assessment terms of reference, or survey intensity level 2 (SIL2). Soil maps were produced at a 1:20 000 scale. Teck assessed soil series diversity at the terrestrial local study area scale by comparing the extent of soil series in the base case with the application case and at closure.

[1503] The Frontier project will directly impact the soils in the project disturbance area through construction and removal of soils to be used in reclamation.

[1504] The large extent of the fluvial fan in the terrestrial local study area (42 per cent) and accompanying long, gentle slopes in combination with local flooding have created a complex patchwork of mostly poorly developed mineral soils.

[1505] The Asphalt soil series, a Rego Gleysol, is the most common soil series in the terrestrial local study area, covering 33 per cent. Periodic flooding with discharges that arise on the flanks of the Birch Mountain escarpment makes up a significant part of the annual water budget for the Rego Gleysols.

[1506] The Namur soil series, Gleyed Regosol, is the second most common soil series in the terrestrial local study area, covering approximately 17 per cent of the terrestrial local study area.

[1507] The Frontier project will cause a 30 per cent decrease in Gleysolic soils, which Teck stated will be reversible through reclamation. Teck stated that much of the Frontier project disturbance area will have poor drainage regimes at closure, which will lead to the formation of Gleysolic soils over time. Teck stated that reclamation soil prescriptions with imperfect to very poorly drained soil moisture regimes developed through interactions with groundwater have more uncertainty given the variability and timescale in groundwater recovery from mining operations.

[1508] Organic soils cover only 2982 hectares (6.9 per cent) of the terrestrial local study area. Teck confirmed that peatlands are not currently included in the closure plan. Teck expects reclaimed marshes and swamps will accumulate peat over time and become peatlands.

[1509] The Frontier project will remove three Luvisolic soils from the terrestrial local study area (Horse River, Kilome, and Winefred soil series).

[1510] To mitigate the expected reduction in soil diversity, Teck plans to create a diverse closure landscape that will support a diversity of soil types. Teck proposed 19 soil prescriptions with the reestablishment of soil functions over time based on reclamation material type, soil moisture, landscape position and other assumptions.

[1511] Teck indicated it will participate in research programs such as COSIA, and will develop and implement a reclamation monitoring program. Teck provided a draft reclamation monitoring plan, which included identifying preliminary soil characteristics on reclaimed areas.

[1512] Teck stated that effects to soil diversity are within only the terrestrial local study area, are of long duration, are reversible and are of low environmental consequence. However, Teck notes the ratings does not apply to effects to organic soils (peatlands) that might be irreversible.

Analysis and Findings

[1513] The soil survey intensity level completed by Teck meets the required terms of reference. The panel understands that other oil sands mines conduct additional soil surveys at a higher soil survey intensity level (SIL1) ahead of disturbance. It is expected Teck will gather additional soil information prior to disturbance to refine their reclamation material salvage plans as directed in *SED 003*.

[1514] The 19 soil prescriptions were proposed as mitigation for loss of soil diversity, with the reestablishment of soil functions over time based on reclamation material type, soil moisture, and landscape position. While the soil prescriptions cannot be directly compared to predisturbance soil series, it is acceptable to estimate characteristics of the soil prescriptions for comparison purposes. Some of Teck's assumptions for soil prescription development and characteristics of the reclaimed soil profile are unproven at this stage of the project (i.e., tailings sand will be nonsaline and nonsodic by the time reclamation proceeds, water table level reestablishment within the closure landscape at a depth to facilitate development of Gleysolic soils, etc.). Teck's ability to successfully establish soil prescriptions will impact revegetation success and end land use.

[1515] The panel recognizes that the large extent of fluvial fan, and associated Gleysolic and Regosolic soils, is distinct from other approved oil sands mines. The baseline soil distribution is a function of the landscape, which is reliant on overland flooding from the Birch Mountains. The closure landforms and closure drainage system will determine water movement from the Birch Mountains through the reclaimed

landscape. The panel notes that the intricacies of surface hydrology and hydrogeology are complex and there is uncertainty associated with predicting moisture regimes on reclaimed landscapes yet to be built. The panel finds that there is also uncertainty with Teck's assumption that Gleysols will become reestablished.

[1516] The panel notes Teck's reliance on the use of adaptive management as a mitigation technique. Planning and active oversight during reclamation activities is necessary to ensure outcomes are being met. A discussion of Teck's proposed reclamation monitoring and adaptive management plan occurs in section 10, "Conservation, Reclamation, and Closure." Regulatory oversight of reclamation material balances and placement activities will be provided through review of mine reclamation plans and the annual reclamation progress tracking reports, as per *SED 003*.

[1517] As reclamation research and monitoring at the Frontier project and other oil sands operations progresses, the panel understands that reclamation soil prescriptions may evolve to improve reclamation outcomes.

[1518] The panel will include a condition requiring Teck to cap material not suitable for vegetation growth with a minimum of 1.0 metre of suitable overburden or tailings sand before placing reclamation material.¹³⁵

[1519] The panel will include a condition specifying minimum average reclamation material placement depths.¹³⁶

[1520] The panel will include a condition requiring Teck to conduct a survey of reclamation material after placement to ensure approval conditions have been met and to check for parameters that might impact establishment of vegetation.¹³⁷

Land Capability Class

Evidence

[1521] Teck calculated and assessed the forest land capability for the soil series mapped in the terrestrial local study area, as well as for reconstructed soils at closure. The reconstructed soils were based on anticipated characteristics and assumptions of the 19 proposed soil prescriptions.

[1522] Teck used the *Land Capability Classification System for Forest Ecosystems in the Oil Sands, 3rd Edition* (AENV 2006), a system with five classes, to rate the potential for and limitations to productive forest use for baseline soils and soil prescriptions at closure. The modal, or the value that occurs most

¹³⁵ Draft *EPEA* Approval – Condition 7.4.7

¹³⁶ Draft *EPEA* Approval – Condition 7.4.8

¹³⁷ Draft *EPEA* Approval – Condition 7.4.10

often in a dataset, forest land capability class will decrease two classes at closure, from class 2 to class 4, indicating a trend away from land that can support forestry. Teck made the decision to increase wetland extent and the valuable habitats they represent to be consistent with recent regulatory direction such as the *Alberta Wetland Policy* (Government of Alberta 2013) and related guidance and with commitments made to indigenous communities.

[1523] OSEC indicated they have concerns about changes in land capability, particularly the decrease in class 1 and class 2 lands, and the increase in water bodies on the closure landscape.

[1524] Teck stated that effects on forest land capability are only within the terrestrial local study area, of medium duration, reversible, and of low environmental consequence.

Analysis and Findings

[1525] The panel finds that the methods used by Teck to assess forest land capability satisfy the terms of reference for the project and are acceptable. The panel notes the limitations of the land capability classification system identified in the *Land Capability Classification System for Forest Ecosystems in the Oil Sands, 3rd Edition*, Page II: “Because the link between LCCS [land capability classification system] rating and forest productivity is currently undemonstrated, the LCCS should be considered as one in a suite of tools for site evaluation and reclamation planning, rather than a comprehensive system that alone will ensure replacement and documentation of equivalent land capabilities.”

[1526] Teck’s ability to return forest land capability is contingent on a well-designed closure landscape and diverse and successful reclamation soil prescriptions. While there are decreases in high and moderate capability to support productive forestry in the closure landscape, the panel recognizes that the increase in areas with wetland potential is consistent with recent regulatory direction and commitments made to indigenous communities. The panel understands that policy direction guiding end land uses is evolving. Accordingly, the panel expects Teck to adaptively manage and modify its closure and reclamation plans throughout mine life to incorporate stakeholder feedback as appropriate and ensure that reclamation outcomes align with policy direction and achieve equivalent land capability.

Potential Acid Input

Evidence

[1527] Potential acid input is defined as the sum of acidifying sulphur and nitrogen compound contributions minus the neutralizing contribution of base cations (e.g., calcium base cation [Ca²⁺] and magnesium base cation [Mg²⁺]). To determine the effect of the Frontier project on soil acidification, Teck used potential acid input air modelling results, soil map units, and critical loads of each soil unit. Modelling of project and cumulative emissions which may contribute to soil acidification or potential acid input are discussed in section 14, “[Air Quality](#).”

[1528] Teck assessed the potential impacts on soil from acid deposition in the potential acid input study area, which aligns in extent with the vegetation and wildlife regional study area, encompassing 1 195 560 hectares. The potential acid input study area includes areas where potential acid input loading levels of $0.17 \text{ keq H}^+ \text{ ha}^{-1} \text{ a}^{-1}$ (kiloequivalents of hydrogen ion deposition per hectare per year) were anticipated under the planned development case. This loading is the level for sensitive soils that triggers monitoring or research under the current *Acid Deposition Management Framework* (AENV 2008). The most sensitive areas contain high proportions of coarse-textured upland soils.

[1529] The *Guide to Preparing Environmental Impact Assessment Reports in Alberta* (Government of Alberta, 2013) contains recommendations for soil surveys but no hard criteria for the soil survey intensity level required for the regional study area. Teck stated they did not collect soil inspection data outside the terrestrial local study area to confirm the accuracy of the potential acid input area study area soil map. As such, Teck did not meet the survey intensity recommendations but stated that the effort of soil sampling and ground-truthing for the potential acid input is consistent with other oil sands mine applications. In response to an information request, Teck evaluated the spatial accuracy of the soil critical loads associated with map units in the potential acid input study area soil map and found the median accuracy was below the threshold of accuracy of a high-quality soil map, but Teck maintained a moderate level of confidence in their assessment.

[1530] Teck adjusted their potential acid input modelling in the project update to include buffering from base cation deposition associated with dust, thus reducing the risk of soil acidification. The inclusion of dust was based on recent measurements of base cation deposition being greater than previously assumed (Fenn et al. 2015), and that Watmough et al. 2014 showed base cation deposition minimized the risk of soil acidification. Fewer soil series were affected by potential acid input above critical loads as a result of the increased base cation deposition.

[1531] Teck assessed the potential changes in soil acidification by comparing the terrestrial extent predicted to receive emissions greater than the 50-year fixed-case critical loads from base case to the application case and planned development case. Teck stated the 50-year fixed case is the lowest critical load determined for the literature-based value of 0.1 for base saturation, ratio of base cations to aluminum (mineral soils), or ratio of base cations to hydrogen (organic soils). Teck stated the 50-year fixed case is appropriate for assessment predictions because it represents the critical load threshold where chemical change is expected.

[1532] Teck's modelling results showed that base case already exceeded the 50-year fixed-case critical loads on 8.7 hectares. The area predicted to receive emissions greater than the 50-year fixed-case critical load increased by 0.4 hectares, or less than 0.1 per cent of the potential acid input study area, from base case to 9.1 hectares in the application case. Exceedances of fixed-case critical loads occur within two townships, 095-11W4M and 096-11W4M.

[1533] Teck also provided 50-year mid-case critical load calculations, which they stated represent a change in soil chemistry is halfway to the chemical change threshold. The 50-year mid-case estimates the critical load that is likely to cause a 50 per cent reduction in base saturation, ratio of base cations to aluminum, or ratio of base cations to hydrogen. Teck indicated the 50-year mid-case represents an appropriate threshold for monitoring but is not appropriate for assessment predictions as it is overly conservative and does not represent an effects threshold. The area exceeding the 50-year mid-case soil critical loads at base case is 58.6 hectares and at application case is 60.4 hectares.

[1534] Teck stated the critical load exceedances for soil in the potential acid input study area are regional in extent, long duration, reversible, and of low environmental consequence. Teck predicted low environmental consequence because no four-township floating block had total areas above the 10 000 ha threshold as recommended in *Recommendations for the Acid Deposition Management Framework for the Oil Sands Region of North-Eastern Alberta* (CEMA, 2004) in Teck's modelling.

[1535] Teck considers potential acid input impacts reversible due to soil weathering and base cation production, eventually allowing a return to a natural steady state.

[1536] No mitigation measure was provided as the threshold recommended in CEMA (2004) was not exceeded. Teck indicated it would be involved in regional monitoring, including the Terrestrial Environment Effects Monitoring working group of the Wood Buffalo Environmental Association.

Analysis and Findings

[1537] The panel finds that significant adverse effects are not likely because the areas with greater than fixed-case critical load and mid-case critical load will increase by less than 0.1 per cent of the potential acid input study area, and the threshold recommendations in CEMA 2004 are not met. The panel notes that Teck did not meet the soil survey intensity level recommended for determining effects of potential acid input on soil quality as per the *Guide to Preparing Environmental Impact Assessment Reports in Alberta* (Government of Alberta, 2013) and the calculated median accuracy of the soils map was below the threshold of accuracy of a high-quality soil map. The panel is of the view that the soils map used in the potential acid input modelling is at a large scale that does not identify smaller soil polygons and this might understate the extent of sensitive soils and potential impacts. Additional soil inspections within the potential acid input study area may have changed the soil map, but as the increase in area above critical loads was small, it is unlikely there would have been a change in effect magnitude. The panel finds Teck's approach to the potential acid input assessment is sufficient to predict potential impacts from the Frontier project.

[1538] The panel notes that the increase in area is less than 0.1 per cent for both the 50-year fixed-case critical load and the 50-year mid-case critical load change from baseline to application case is very small compared to the size of the study area, suggesting a very low-magnitude effect. The townships identified

exceeding 50-year mid-case soil critical loads and 50-year fixed-case critical loads are 095-11W4 and 096-11W4, which are adjacent to current operating oil sands facilities south of the Frontier project.

[1539] The panel notes that Teck did not provide any specific mitigation strategies because it emphasized that the Frontier project's acidification effects will be negligible. The panel understands Teck may consider the potential acid input impacts reversible, but the time required for such impacts to reverse is unknown.

[1540] The panel will include a condition requiring Teck participate in and support regional acid deposition monitoring programs for terrestrial ecosystems.¹³⁸ The panel believes that involvement in regional monitoring will provide the data to ensure that acid deposition effects are identified in a timely manner.

[1541] The panel recommends that Alberta consider the recent research on base cation deposition from dust and the potential implications to soil acidification.

Recommendation to Alberta

[1542] The panel recommends that Alberta consider the recent research on base cation deposition from dust and the potential implications to soil acidification as part of its *Alberta Acid Deposition Management Framework*.

Assessment of Significance of Project Effects

[1543] Based on the criteria provided in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects to soils and terrain:

[1544] Ecological context – the project development area does not overlap with other projects or activities that would impact terrain or soils, with the exception of the effects of potential acid input. The project development area contains a high proportion of poorly developed, imperfect and poorly drained soils which are subject to compaction and rutting.

[1545] The effects on soils and terrain are likely – the Frontier project will result in changes to terrain, soil series diversity and land capability.

[1546] The magnitude will be low to moderate – given that predicted changes to soil quality are generally small and soil quality and terrain are expected to support ecosystem function at closure.

[1547] The geographic extent is local – project effects will be limited to the disturbance footprint.

¹³⁸ Draft EPEA Approval – Condition 4.1.61

[1548] The duration is long term – some effects will extend into the far future (post-closure).

[1549] The effects are largely reversible – soil profiles will become reestablished following closure; however, the loss of peatland/organic soils will likely be permanent. Gleysolic soils may become reestablished in some areas in the far future, but this is uncertain.

[1550] Given the above points, the panel finds project effects to soils and terrain are adverse but not likely to be significant due to the low magnitude and limited geographic extent of the predicted effects.

[1551] [Table 13](#) provides a summary of the panel’s significance determinations for project effects related to terrain and soils.

Table 13. Summary of panel significance determinations for project effects

VC	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Topographic diversity	low	local	long term	continuous	irreversible	not significant
Soil series diversity	low	local	long term	continuous	reversible	not significant
Land capability	low	local	long term	continuous	reversible	not significant
Potential acid input	low	regional	long term	continuous	reversible	not significant

Cumulative Effects

Potential Acid Input

Evidence

[1552] Teck’s modelling showed that base case emissions are greater than 50-year fixed-case critical loads on 8.7 hectares. The area predicted to receive emissions greater than 50-year fixed-case critical load in the planned development case is 119.8 hectares. Exceedances of the 50-year fixed-case critical loads occur within two townships, 095-11W4 and 096-11W4. The modelled change in area with potential acid input greater than the fixed-case critical load from base case to planned development case is an increase of 111.1 hectares, or less than 0.1 per cent of the potential acid input study area.

[1553] Teck also provided 50-year mid-case critical load calculations, which represent a change in soil chemistry halfway to the fixed case. The mid-case critical load represents an appropriate threshold for monitoring but not an effects threshold that is appropriate for assessment predictions. The area receiving greater than the 50-year mid-case soil critical loads totals 58.6 hectares in the base case and 188.4 hectares in the planned development case.

Analysis and Findings

[1554] The panel notes that the area exceeding the 50-year fixed-case critical load from the base case to the planned development case is 111.1 hectares. The increase in soils exceeding critical load is associated

with emissions from the additional projects included in the planned development case. The panel understands that the regulatory applications for some of these projects (such as Voyageur South) have been withdrawn, so the effects predicted in the planned development case may not occur. The panel also notes that the increase in area exceeding critical loads is very small compared to the size of the study area, suggesting a very low-magnitude effect.

[1555] The panel also notes that the areas in the planned development case in which the critical loads are exceeded occur to the south of the Frontier project and do not appear to be influenced by the addition of the Frontier project.

[1556] The panel therefore concludes that the Frontier project's contribution to soil critical load exceedances in the cumulative effects case is negligible to low.

22 Vegetation

[1557] Teck assessed project and cumulative effects on vegetation resources in the context of the following spatial boundaries:

- project development area (29 217 ha)
- terrestrial local study area (43 349 ha)
- vegetation and wildlife regional study area (1 195 560 ha)

[1558] To assess the potential environmental effects of the Frontier project on vegetation resources in the region, Teck selected four key indicators:

- landscape diversity
- community diversity
- species diversity
- effects of air emissions on vegetation health and diversity

[1559] The key issues Teck assessed are summarized in [Table 14](#). For each key indicator, measurable parameters were selected to quantify the effects. These parameters are discussed in the following sections.

Table 14. Key issues – vegetation

Project phase	Key issue	Relevance to project
Construction	Changes in landscape, community and plant species diversity	Direct effects due to vegetation clearing. Removal of vegetation could change plant species and community and landscape diversity.
Operation – Land-based component	Changes in community and plant species diversity	Changes in terrain and hydrology might directly affect soil conditions and might indirectly affect wetlands through changes in water tables and surface water quality. Indirect effects on wetlands might change community and plant species diversity.

Project phase	Key issue	Relevance to project
Operation – Air-based component	Changes in vegetation health and diversity	Air emissions from fossil fuel combustion and other fugitive sources might affect vegetation health. Effects of air emissions on vegetation could occur directly through fumigation and fertilization and indirectly through changes in soil chemistry.
Reclamation and closure	Changes in landscape, community and plant species diversity	Alterations to regional terrain and hydrology means the closure landscape will change from existing conditions. Future climate change could require reclamation that will result in further landscape differences from predevelopment conditions.

[1560] Ecosystems were classified and mapped at a detailed ecosite- and wetland-class level in the local study area and at a coarser-grained cover class classification level in the regional study area. Ecosites and wetland classes mapped in the local study area were converted to cover classes in the regional study area.

[1561] The updated vegetation assessment incorporates two regional cumulative assessment scenarios:

- a worst-case scenario, which includes all developments at maximum buildout without progressive reclamation for all assessment cases, and
- a best-case scenario, which includes mitigation and legal requirements identified in *EPEA* approvals for progressive reclamation.

[1562] The year 2066 was used for the temporal snapshot for these scenarios as it represents maximum project buildout.

[1563] Teck took account of the concerns of aboriginal communities, which included loss of ecological diversity; the integrity and sustainability of the vegetation landscape; the amount of disturbed land and reclamation timelines; fragmentation of the landscape; accessibility to preferred sites and resources for traditional use; reclamation success, what constitutes success, and a desire to put the land “back the way it

was;” a decrease in the quantity and quality of traditional land-use species, including berries and medicinal plants; effects of project emissions on overall vegetation health; loss of wetlands; and loss of Jack pine forest.

[1564] However Teck confirmed that it subsequently entered into agreements with 14 First Nations or aboriginal communities most directly affected by the project, and these aboriginal communities have withdrawn their objections to the project.

Landscape Diversity

Evidence

[1565] Teck assessed whether the Frontier project would contribute to cumulative changes in landscape diversity, whether by fragmentation or homogeneity. The measurable parameters selected for landscape diversity were patch number and size and patch perimeter length. Landscape diversity was considered only at the scale of the regional study area.

[1566] At base case, for the worst-case scenario (no progressive reclamation) Teck reported that

- the number of patches for all vegetation cover classes and structural stages generally increases relative to predevelopment and
- the mean patch area and total edge generally decrease for all vegetation cover classes and structural stages relative to predevelopment.

[1567] Teck stated that these results reflect classic fragmentation patterns where disturbance creates more patches that are smaller in size.

[1568] At base case, for the best-case scenario, Teck reported that, in general, the following patterns are expected:

- Patch number will decrease and the average size and total edge will increase for vegetation cover classes and structural stages that are typically included in progressive reclamation of oil sands mines.
- Patch number will increase and average size and total edge will decrease for vegetation cover classes and structural stages that are *not* typically included in reclamation planning in the region (e.g., reclamation of bogs and fens) or structural stages that are age-dependent and require many decades to develop (e.g., mature and old-growth forest).
- Patch number and total edge will increase and average size will decrease for pole (sapling) forest. This change would result from reclamation of linear disturbances, including low-impact seismic.

[1569] At application case, for the worst-case scenario, Teck reports that

- the number of patches for all vegetation cover classes and structural stages generally increases relative to predevelopment and
- the mean patch area and total edge generally decrease for all vegetation cover classes and structural stages relative to predevelopment.

[1570] Teck stated that these results also align with classic fragmentation patterns.

[1571] At application case, for the best-case scenario, Teck reports that the pattern of fragmentation is similar to the best-case scenario for base case, although the number of patches decreases and become smaller because the project at maximum buildout results in the removal of patches.

[1572] At planned development case, for the worst-case scenario, Teck reports that

- the number of patches for all vegetation cover classes and structural stages generally increases relative to predevelopment and
- the mean patch area and total edge generally decrease for all vegetation cover classes and structural stages relative to predevelopment.

[1573] According to Teck, this reflects a shift from classic fragmentation patterns to removal of patches from development by large oil sands mines.

[1574] At planned development case, for the best-case scenario, Teck reports that the pattern of fragmentation is similar to the best-case scenario for base case and application case, although the number of patches decreases and become smaller as additional developments included as part of the planned development case result in the removal of patches.

[1575] Teck acknowledged that the Frontier project will result in a temporary, localized decline in patch diversity and an increase in disturbed lands during construction and operation. However the removal of existing linear disturbances and the integration of these areas into the reclamation landscape will, in the long-term, decrease fragmentation effects in the vegetation and wildlife regional study area.

[1576] Teck stated that progressive reclamation is the primary mitigation for effects to landscape diversity.

[1577] Teck stated that through reclamation, a sustainable landscape will be generated that is designed to maximize diversity through the generation of landforms that include

- topographic diversity and associated diversity in moisture regimes,
- aspect diversity,

- substrate diversity, including both fine- and coarse-grained landforms, and
- mesotopography.

[1578] To mitigate the project's incremental contribution to regional changes in diversity, Teck stated that it will work with the governments of Alberta and Canada and look to their guidance on the development of a conservation agreement.

[1579] Teck proposes to apply an adaptive management approach to account for the effects of climate change on reclamation planning and outcomes. This is discussed in section 10, "[Conservation, Reclamation, and Closure](#)."

[1580] Teck concluded that, because of reclamation, effects from fragmentation are generally rated as having a low to moderate environmental consequence at existing conditions, base case, application case, and planned development case. Teck's conclusion is based on the magnitude and reversibility of the change.

Analysis and Findings

[1581] The panel recognizes that the mineable oil sands area is highly fragmented as a result of existing developments and oil and gas exploration in the region, particularly in the area to the south of the Frontier project.

[1582] Land clearing and preparation for construction and mining activities for the Frontier project will further fragment large segments of the landscape, increase the number of patches, and reduce the mean patch area and the patch perimeter distance. Effects from the project will begin to reduce as progressive reclamation occurs after 2034. However, despite the use of progressive reclamation, project effects will persist throughout operations and into closure because some areas will not be reclaimed until after the end of mine life. The effects are reversible in the long term – more than 100 years post-closure.

[1583] The panel is satisfied that Teck has adequately assessed the project's potential effects on landscape diversity. The panel agrees that it is appropriate to assess effects to landscape diversity at the regional rather than local scale as effects related to fragmentation and connectivity are generally realized on a regional scale determined by the interaction between the landscape and the movement potential of a species rather than at the scale of an individual project.

[1584] The panel agrees with Teck's assessment that while the Frontier project will result in a temporary, localized decline in patch diversity and an increase in disturbed lands during construction and operation, the removal of existing linear disturbances and the integration of these areas into the reclamation landscape through progressive reclamation will, in the long-term, decrease fragmentation effects within the regional study area.

[1585] The panel notes that for the regional study area, the most significant predicted change to patch number, mean patch area, and total patch edge occurs between predevelopment and base case. The predicted per cent magnitude change ranges from 37% to more than 1600% depending upon the parameter. In contrast, the magnitude change between the base case, application case, and planned development case is generally less than a few per cent.

[1586] Based on the forgoing, the panel finds that project effects on landscape diversity within the regional study area are expected to be of low magnitude, long term in duration but reversible. In contrast, the cumulative effects of the project combined with other existing, approved, and planned project in the regional study area are considered to be of high magnitude and long term in duration but reversible.

Community Diversity

[1587] Community diversity is defined using the provincial guidelines for ecological land classification whereby vegetation communities that occupy similar biophysical characteristics of soil moisture and nutrient status as dictated by climate, topography, parent material, soil texture, and landscape position including slope and aspect are subdivided into distinct classes called ecosite phases and wetland classes. Additionally, community diversity is defined based on the structural stage of the vegetation community to define the tallest dominant vegetation community. Where trees are the dominant vegetation stratum, the age of the stand further characterizes its structural stage.

[1588] The key question Teck considered was: would the project contribute to cumulative changes in vegetation community diversity? The assessment focused on changes to the area of vegetation types, including upland ecosite phases, wetland classes, and structural stages in the terrestrial local study area, and vegetation cover classes and structural stages in the vegetation and wildlife regional study area.

[1589] Teck concluded that community diversity effects range from moderate to high environmental consequence for existing conditions, base case, application case, and planned development case.

Effects on Upland Ecosite Phases

Project Effects

Evidence

[1590] Teck stated that uplands dominate the terrestrial local study area, covering 56.4% of the area. Wetlands cover 43.6% of the local study area with the most common wetland class being forested to hardwood swamps. Water and nonvegetated land cover less than 0.1% of the local study area.

[1591] Construction and operation of the Frontier project will remove all vegetation within the project development area.

[1592] Within the local study area, Teck predicted the following:

- A 61.0% (14 906.8 ha) decline in upland ecosite phases for the application case at maximum buildout relative to predevelopment.
- The greatest magnitude change for upland cover classes that experience a decline occurs for upland grasslands that occur as small patches on the predevelopment landscape because they are not included in typical reclamation plans.
- None of the ecosite phases are eliminated from the local study area.
- A 15.6% (3 815 ha) increase in upland ecosite phases for the application case at closure relative to predevelopment.

[1593] Upland ecosite phases in the closure landscape of the local study area include b3: aspen-white spruce/blueberry (5%), c1: mesic Jack pine-black spruce/Labrador tea (7%), d3: white spruce-aspen/low-bush cranberry (7%), and g1: subhygric black spruce- Jackpine/Labrador tea (10%).

[1594] Within the regional study area, Teck predicts the following:

- For the worst-case scenario, 23.5% decline in upland vegetation cover classes at base case relative to predevelopment.
- For the best-case scenario, 3.9% increases in upland vegetation cover classes at base case relative to predevelopment.
- For the worst-case scenario, 26.9% declines in upland vegetation cover classes at application case relative to predevelopment.
- For the best-case scenario (with progressive reclamation) Teck predicts, a 0.5% increase in upland vegetation cover classes at application case relative to predevelopment.

[1595] Reclamation is the primary way to mitigate effects to community diversity. Teck stated that its reclamation measures will incorporate research results and strategies as summarized in provincial reclamation guidelines and manuals and make use of adaptive management processes to incorporate new best practices. Teck also confirmed that they will follow new guidance documents as they become available.

[1596] Teck stated that the 2010 update to the *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* (2nd Edition) (ESRD 2010) represents over ten years of guided research. The update now allows for the use of the site type concept. The site type approach allows greater revegetation flexibility because it allows for species overlap between ecosite phases.

[1597] Teck plans to incorporate the results of ongoing oil sands reclamation research to improve vegetation community diversity. This includes the following:

- varying slope and aspect on the reclaimed landscape,
- conserving islands of native vegetation within the project development area wherever it is feasible to do so,
- use of direct placement methods, and
- use of coarse woody debris as an amendment to provide microsites that assist the establishment and growth of native species.

[1598] Teck further stated that, based on their extensive reclamation knowledge and experience from elsewhere in western Canada, diversity will be improved by planting additional species to supplement those recommended in provincial reclamation guidelines.

[1599] Teck committed to collecting native tree and shrub species to be used in reclamation. Teck will also harvest and collect seeds of species of cultural importance as land is cleared for use in propagation and revegetation. Teck also committed to progressively reclaim the project development area.

[1600] To mitigate the project's incremental contribution to regional changes in diversity, Teck will work with the governments of Alberta and Canada and look to their guidance on the development of a conservation agreement. Teck stated that development of a conservation agreement will form part of their biodiversity management plan.

[1601] OSEC questioned Teck about how continued settlement of tailings deposit areas would impact forest growth and harvest ability on reclaimed uplands. Teck stated that incremental settlement on reclaimed tailings deposit areas would be seven to nine metres after year 20. Teck stated that some differential settlement is expected and would be beneficial in terms of providing more natural-looking terrain in the longer term, including the formation of opportunistic wetlands. Teck also stated that the vegetation communities that are proposed for the internal tailings areas consist of shrubby swamps along the watercourses, marshes at lower elevations surrounding those swampy areas, and some upland communities, including the c1-mesic Jack pine-black spruce/Labrador tea, g1- subhygric black spruce-Jack pine/Labrador tea, h1- white spruce-black spruce/Labrador tea and d1- aspen/low-bush cranberry ecosites, which get progressively drier. Teck indicated that as those areas subside, there may be an increase in some of the littoral wetland areas associated with the water bodies and that wetland development will occur as these areas become wetter. Teck indicated that those communities are generally not associated with tree species; they are dominated by shrubs and graminoid species.

[1602] Teck stated that the environmental consequence for upland ecosite phases is moderate following reclamation.

Analysis and Findings

[1603] The project will result in an approximately 15% increase in upland ecosite phases at closure within the local study area and a 0.5% increase in upland ecosite phases at closure within the regional study area. The panel notes that the increase in area of upland cover classes for the project area following reclamation reflects the trend for oil sands mines to reclaim to a higher proportion of upland than wetland classes.

[1604] The panel accepts that reclamation of upland areas is likely to be successful, although the panel recognizes that it may be some time before predisturbance levels of community and species diversity become reestablished. The panel finds that because proposed reclamation will increase upland ecosite area, the project will have a moderate impact on upland ecosite phases in the regional study area.

[1605] The panel notes that while the project is not expected to have a significant adverse environmental effect on upland ecosite phases, the proportion of upland ecosites to wetland classes in the closure landscape may differ from Teck's conceptual plan due to uncertainties surrounding the reclamation of areas that contain tailings deposits. Areas reclaimed to forested communities on tailings deposits may experience flooding during heavy rain events as settlement of tailings continues to occur. As well, portions of reclaimed uplands that sufficiently experience settlement could form opportunistic wetlands or shallow lakes within the reclaimed forested areas.

[1606] As discussed in section 10, "[Conservation, Reclamation, and Closure](#)," the panel accepts Teck's plans to use reclamation monitoring and adaptive management and to incorporate new best practices for reclamation and to follow new guidance documents as they become available. The panel will include a condition requiring Teck to submit a finalized reclamation monitoring program. The program must include methods to track and report on cumulative increases in vegetation species, ecosite phases, and wetland classes as reclamation proceeds throughout the life of the mine. The reclamation monitoring program must also include the monitoring of settlement on revegetated upland areas.¹³⁹

[1607] The panel will also include a condition that Teck address continuous improvement in biodiversity potential at the species and community level during progressive reclamation that targets the capability for long-term biodiversity.¹⁴⁰

[1608] The panel finds that project effects to upland ecosite phases will be moderate in magnitude and long term but reversible in the future. While upland ecosite phases will be removed during project construction and mining, there will be an increase in the amount of upland ecosite phases in the closure landscape relative to predisturbance. Despite the use of progressive reclamation, a large extent of the project development area will not be reclaimed until after the end of mine life, and it will take time for the

¹³⁹ *SED 003* and Draft *EPEA* Approval – Conditions 7.5.1, 7.5.2, and 7.5.4

¹⁴⁰ Draft *EPEA* Approval – Conditions 7.3.5(d) and 7.3.5(e)

reclaimed upland communities to become reestablished. Ultimately it is expected that reclamation will result in functioning upland vegetation communities that are equivalent to what existed before project construction and operation.

Cumulative Effects

Evidence

[1609] Within the regional study area, Teck predicts the following:

- For the worst-case scenario, 26.9% declines in upland vegetation cover classes at application case relative to predevelopment.
- For the best-case scenario, a 0.5% increase in upland vegetation cover classes at application case relative to predevelopment.
- For the worst-case scenario, 29.0% declines in upland cover classes at planned development case relative to predevelopment.
- For the best-case scenario, 2.1% declines in upland cover classes at planned development case relative to predevelopment.

Analysis

[1610] The panel recognizes there is some uncertainty associated with the timing of progressive reclamation associated with other oil sands operations in the region and Teck's predictions related to the best-case scenario. However the panel accepts that reclamation of upland areas will occur at other operations and expects it will be successful, recognizing that it will take time for predisturbance levels of community and species diversity to become reestablished.

[1611] Recognizing this uncertainty, the panel finds that the predicted 0.5% increase to 2.1% decrease in upland ecosite phases under the best-case scenario for the application and planned development cases in 2066 represents a low- to moderate-magnitude effect that is long term in nature but reversible in the long term.

Effects on Wetlands

Project Effects

Evidence

[1612] Wetlands cover 43.6% of the local study area, with the most common wetland class being forested and hardwood swamps.

[1613] The Frontier project will directly remove all wetlands from the project development area during construction and operation of the project.

[1614] While wetlands in the local study area could also be lost indirectly through groundwater drawdown during project operations, Teck stated that the extent of drawdown within the Quaternary is limited to the local study area and would extend to no more than 4 or 5 km from the project development area. Teck also stated that predicted groundwater drawdown simulated for Quaternary deposits during operations was not expected to propagate to the surface and affect surface water levels or reclaimed vegetation species, and this was supported by observations at other oil sands mines. As a result, Teck did not document the aerial extent of wetlands in the local study area that would be affected by the drawdown.

[1615] ECCC agreed with Teck that there was minimal effect on adjacent wetlands from drawdown in the project area.

[1616] Within the local study area,

- Teck predicts a 76.8% (14 517.0 ha) decline in wetland classes for the application case at maximum buildout relative to predevelopment.
- Teck stated that none of the wetland classes are eliminated.
- While groundwater drawdown is expected to influence surface water quantities in wetlands that are within the zone of influence of the project development area, the level of influence will not significantly affect wetlands in the local study area.
- At closure, Teck predicts a 47.1% (8905.7 ha) decrease in wetland classes for the application case relative to predevelopment.

[1617] Within the regional study area, Teck predicts the following:

- For the worst-case scenario, 14.1% declines of wetland cover classes at base case relative to predevelopment.
- For the best-case scenario, wetland cover classes increase by 7.4% at base case relative to predevelopment in the regional study area.
- For the worst-case scenario, 15.8% declines in wetland cover classes in the application case relative to predevelopment.
- For the best-case scenario, 9.1% decreases in wetland cover classes at application case relative to predevelopment.

[1618] Teck's primary way of mitigating effects on wetlands is reclamation using current and future provincial guidelines, applying research strategies focused on wetland research through adaptive

management, and implementation of a site-specific reclamation monitoring program to ensure reclamation success.

[1619] Teck stated that numerous marsh wetlands have been constructed in the oil sands region and elsewhere, and much has been learned. Teck indicated opportunistic establishment of marsh wetlands has also been observed in depressions on landscapes reclaimed with overburden.

[1620] Teck's reclamation plan indicates that 6500 ha of wetlands will be reclaimed. Reclaimed wetlands will primarily be composed of shrubby swamps and marshes (5614 ha), with less than 1% each of forested swamps and shallow open-water wetlands. In addition to the area that is proposed to be reclaimed as shrubby swamps and marshes, Teck's reclamation plan includes 886 ha of littoral areas or shallow transitional wetlands around end-pit lakes. The depth of the proposed littoral areas includes water bodies that are greater than 2 metres in depth.

[1621] Teck did not include reclamation to peatlands in their closure, conservation, and reclamation plan. Teck stated that given the amount of time required for these ecosystems to develop naturally, many consider it unlikely that peatland ecosites can be developed in the time period typically considered for oil sands reclamation (i.e., 100 years).

[1622] Teck acknowledged that the establishment of peatland ecosites (fens and bogs), which develop naturally over several thousand years, are just beginning to be tested in the oil sands region. Both Syncrude and Suncor are testing the viability of fen reclamation. Other research in northern Alberta related to peatland reclamation is being carried out on well pads and include testing the feasibility of establishing peatlands on mineral soils.

[1623] Teck noted that, in the oil sands region, hydrological conditions suitable for peatland establishment are considered feasible, with high salinity and fluctuating water tables posing the greatest impediment to peatlands establishment. Recent studies provide evidence that several boreal peatland species, especially graminoids, are able to survive in wetlands with elevated concentrations of parameters associated with oil sands process material. While graminoids have been shown to survive and reproduce in oil sands process water, mosses are less successful; further research is needed to determine the success of moss reestablishment in oil sands process water.

[1624] Teck stated that it recognizes that peatlands are an important traditional use area for aboriginal communities, and therefore Teck will make an effort to include peatland reclamation in the closure, conservation, and reclamation plan should research results and recommendations prove to be feasible and appropriate.

[1625] Teck stated that the environmental consequence is high in the base case, application case, and planned development case for wetland cover classes because bog and fen cover classes are not typically included in reclamation planning for oil sands development.

Analysis and Findings

[1626] Wetlands serve many functions, including providing flood control and carbon sequestration, supporting biodiversity, and serving as habitat for many species of waterfowl, migratory birds, and other wildlife, including some species at risk. Loss of wetlands directly impacts old-growth forests, rare and special plant communities, and habitat for wildlife species that are reliant on specific classes of wetlands, including marshes and peatlands. Wetlands also contain vegetation species used by indigenous communities such as Labrador tea, berries, and lichens.

[1627] Project effects on wetlands are considered high. The project will impact 14 517 ha of wetlands in the local study area. This includes an irreversible loss of 3295 ha of peatlands. After reclamation, there will be a net loss of approximately 8900 ha of wetlands.

[1628] The panel acknowledges that the 2016 Government of *Alberta Wetlands Policy* for the Green Area does not apply to the Frontier project because the environmental assessment and applications for the project were submitted before the effective date of the policy.

[1629] While Teck's reclamation plan includes 6500 ha of reclaimed wetlands (marshes, swamps, and littoral areas), peatlands (bogs and fens) are not included. Loss of peatlands is considered irreversible because currently there are no methods that have proven to be successful for the reclamation of peatlands. Research into peatland reclamation in the oil sands region is just beginning and besides pilot fens constructed at 2 operating oil sands mines, there are no examples of successfully reclaimed peatlands.

[1630] The panel agrees with Teck's decision to not include peatland reclamation as part of its closure, conservation, and reclamation plan. However, given the importance of wetlands and the need for ongoing research into peatland reclamation, the panel requires Teck to advance organic wetland reclamation research and knowledge by constructing a pilot bog or fen community as part of its reclamation plan for the Frontier project.¹⁴¹

[1631] The panel also notes that Teck reported that 886 ha of littoral areas will become wetlands. This may overstate the amount of wetlands that will be created. The *Alberta Wetland Classification System* and the *Canadian Wetland Classification System* define wetlands as areas including open-water areas that are less than 2 m deep and have wetland characteristics (saturated soils and water loving vegetation). Teck stated that most of the littoral area will be greater than 2 metres deep but did not indicate how much of the 886 ha was less than or equal to 2 metres deep. In order to accurately report the extent of Teck's planned reclaimed wetland area relative to what will be disturbed by the project, the panel recommends that Teck revise the total area of proposed littoral areas that will meet the definition for wetland class in future submissions of updated reclamation and closure plans.

¹⁴¹ Draft *EPEA Approval – Conditions 5.3.3(b)*

[1632] The panel also notes that Teck relies on opportunistic wetlands that may form on tailings deposit areas to contribute to the total area of wetlands at closure. Opportunistic wetlands may or may not form on the reclaimed landscape. The panel acknowledges that the ecological functionality of opportunistic wetlands as habitat for vegetation and wildlife species may not be realized due to potential physical or chemical limitations.

[1633] Given the above, the panel finds that project effects on wetland classes are high magnitude, long term, and partially irreversible because some wetland types, such as peatlands, cannot be reclaimed.

Recommendation to Teck

[1634] The panel recommends that Teck revise the total area of proposed littoral areas that will meet the definition for wetland class in future submissions of updated reclamation and closure plans, in order to accurately report the extent of Teck's planned reclaimed wetland area relative to what will be disturbed by the project.

Cumulative Effects

Evidence

[1635] Within the regional study area, Teck predicts the following:

- For the worst-case scenario, a 15.8% (104 069 ha) decline in wetland cover classes in the application case relative to predevelopment.
- For the best-case scenario, a 9.1% (60 052 ha) decrease in wetland cover classes at application case relative to predevelopment.
- For the worst-case scenario, a 17.9% (118 317 ha) decline in wetland cover classes at the planned development case relative to predevelopment.
- For the best-case scenario, an 11.5% (75 920 ha) decline in wetland cover classes at the planned development case relative to predevelopment.

[1636] Teck found a high environmental consequence for the application case and planned development case for wetland cover classes because bog and fen cover classes are not typically included in reclamation planning for oil sands development.

Analysis and Findings

[1637] The Frontier project will contribute to regional losses of wetlands (including peatlands), which constitute a loss of habitat for wetland-dependent species of vegetation and wildlife, including species at risk.

[1638] The panel notes that under the best-case scenario, there will be a decline in wetland area of between 9.1% and 11.5% in the application and planned development cases, respectively. Under the worse-case scenario the decline would be between 15.8% and 17.9% for the application and planned development cases. This amounts to a net loss of 60 052 ha to 75 920 ha of wetlands in the regional study area under the best-case scenario and a decline of more than 100 000 ha under the worse-case scenario. While the panel does not expect the worse-case to occur, the panel understands there is some uncertainty about the timing and degree of success of wetland reclamation that could cause the regional effect to be higher than that provided in the best-case scenario. Given the amount of wetland being lost in the region, and recognizing that some types of wetlands cannot be reclaimed; the panel considers this to be a high-magnitude effect. The panel finds that the cumulative effects to wetland classes will be long term and irreversible because wetland types, such as peatlands, cannot be reclaimed.

Effects on Old-Growth Forests

Project Effects

Evidence

[1639] Within the local study area,

- Teck reports there were 4021 ha of old-growth forest in the predevelopment scenario.
- Teck predicts a 64.6% (2598 ha) decline in old-growth forests for the application case at maximum buildout and at closure relative to predevelopment.
- At closure, there will be 1423 ha of old-growth forests remaining in the local study area, and most (14 111.9 ha) of the reclaimed forest stands will be at a juvenile (pole sapling) forest stage.

[1640] Within the regional study area, Teck predicts the following:

- For the worst-case scenario, a decline of 38.2% in old-growth forest at base case relative to predevelopment.
- For the best-case scenario, a 38.2% decline of old-growth forests at base case relative to predevelopment.
- For the worst-case scenario, a 40.3% decline in old-growth forests at the application case relative to predevelopment.
- For the best-case scenario, a 40.3% decline in old-growth forests at the application case relative to predevelopment.

[1641] Teck's mitigation strategy for old-growth forests is progressive reclamation. Teck acknowledged that mature forests take some time to establish but expected that with significant progressive reclamation

starting to occur by 2034, they would expect to see some mature forests back on the landscape by around 40 years post-closure (after 2081).

[1642] Teck acknowledged that the project will incrementally contribute to a loss of old-growth forests in the region. Teck stated that the predicted declines of mature and old growth constitute a high-magnitude change for base case, application case, and planned development case.

Analysis and Findings

[1643] The panel notes that while mature forests over 80 years old are dominated by coniferous or deciduous tree species, old-growth forests in the Athabasca Oil Sands Area include forests that are more than 120 years old for deciduous stands and more than 140 years old for coniferous stands.

[1644] If areas are reforested at the time of revegetation, it would take up to 100 years to achieve old-growth status for deciduous species and 120 to 140 years for mixed deciduous/coniferous stands and coniferous stands, respectively. The panel therefore concludes that, on average, old-growth forest availability in the local study area will be limited for more than 100 years past end of mine life, with the earliest reclaimed sites (2034) needing a minimum of and at least 80 years after closure in 2081. This implies a loss of habitat for many species of old-growth-reliant species, including species at risk, until at least 100 years following closure.

[1645] The panel also notes that uncertainties around settlement of tailings deposit areas could delay the start of reclamation on such sites, thus delaying development of old-growth forests on areas of the reclaimed project development area.

[1646] Given the importance of old-growth forests as wildlife habitat and their limited distribution, the panel finds that the loss of all old-growth forest within the project development area is a high-magnitude effect. The effect will be long term given that amount of time required for reforested areas to achieve old-growth status. While the effect is ultimately reversible, this will not occur for more than 100 years post-closure. Based on the above, the panel finds that the project is likely to result in significant adverse effects to old-growth forests.

Cumulative Effects

Evidence

[1647] Within the regional study area, Teck predicts the following:

- For the worst-case scenario, a 40.3% (61 013 ha) decline in old-growth forests at the application case relative to predevelopment.
- For the best-case scenario, a 40.3% (61 013 ha) decline in old-growth forests at application case relative to predevelopment.

- For the worst-case scenario, a 44.8% (67 716 ha) decline in old-growth forest at planned development case relative to predevelopment.
- For the best-case scenario, a similar decline in old-growth forest of 44.8% (67 716 ha) at planned development case relative to predevelopment.

[1648] Teck acknowledged that the project will incrementally contribute to a loss of old-growth forests in the region. Teck stated that the predicted declines of mature and old growth constitute a high-magnitude change for the base case, application case, and planned development case.

[1649] Teck concluded that there was moderate environmental consequence for existing conditions through to planned development case for old-growth forests. Teck ranked the effect as moderate because it is assumed that old-growth forests will return to the landscape when reclamation is complete.

Analysis and Findings

[1650] The panel notes that, despite Teck's closure date of 2081, there will be an extended timeline for the return of old-growth forests. At closure, no old-growth forests will be present in the project development area and the oldest forest stands will be less than or equal to 40 years of age. Forest stands are considered old-growth forests at 140 years for coniferous species and 100–120 years for deciduous and mixed-wood forests, respectively. Reclamation at other oil sands projects has been limited so far; it is expected that the spatial extent of old-growth forests in the region will be limited for more than 100 years because most oil sands mines are in the early stages of reclamation.

[1651] Old-growth forests serve as habitat for old-growth-forest-reliant species, including at-risk species of birds and wildlife, while also contributing to biodiversity in the region.

[1652] The current state of reclamation in the oil sands region is such that less than 25% of the disturbances have been reclaimed. In addition, the presence of tailings deposits on oil sands sites may delay reclamation timelines, thus delaying development to old-growth status.

[1653] The panel notes that fire could also have a confounding effect on the availability of old-growth forests disturbed by the project. Frequent fires can delay forest regeneration and attainment of old-growth forest status. Boreal forests naturally recover from a fire within 50 to 200 years (100 years on average). But historical suppression of fires and potential drier and warmer temperatures could result in fires that can spread over long distances and burn more intensely. More-frequent fires could result in delays in the development of old-growth forests at reclaimed sites. More-frequent fires could also lead to old-growth forest stands that are dominated by trees such as Jack pine and aspen that are more tolerant of fires or can easily reestablish after a fire. For example, fires occurred in the area of the regional study area in 2011 and 2016. Both fires burned hundreds of hectares of forests. Trees such as white spruce and balsam fir with no special adaptations to forest fires may not reestablish as quickly on the reclaimed landscape if

interrupted by fires. Most oil sands revegetation programs use white spruce on a large part of plantings, resulting in further delay for reestablishment of old-growth forest stands if fires become more frequent.

[1654] The panel considers the loss of more than 60 000 ha of old-growth forest in the regional study area to be a high-magnitude effect. The panel finds that the project in combination with other operating and planned developments in the vegetation and wildlife regional study area will result in significant adverse cumulative effects to old-growth forests. This is due to the amount of loss resulting from the project; the very long time for reclaimed forest stands to reach old-growth forest stage (more than 100 years after closure), their importance to species at risk and biodiversity, and the potential for delayed stand maturity due to forest fires.

Effects on Species Diversity

[1655] Species diversity focuses on the changes to the area occupied by vegetation communities considered to have high species diversity potential. Teck assessed the effects of the project on species diversity by considering species diversity potential, the location of rare species, and the integrity of plant species as measured by the prevalence of invasive non-native species in the local and regional study areas.

Species Diversity Potential

[1656] Species diversity is a measure of the distribution and occurrence of species across a landscape. One measureable parameter of species diversity is the number of species present in a landscape.

Project Effects

Evidence

[1657] Species diversity potential in the terrestrial local study area was rated using upland ecosite phases and wetland classes. Ratings for the vegetation and wildlife regional study area were based on vegetation cover classes.

[1658] Teck reported that 559 plant species were identified in the terrestrial local study area, including 427 vascular plants and 132 bryophytes.

[1659] Within the local study area for the application case, Teck predicts the following:

- There will be a 69.3% (5941 ha) decline in the area of high species diversity potential at maximum buildout relative to predevelopment.
- The relatively large decrease occurs because the project development area represents most of the terrestrial local study area.

- At project closure, there will be a decline of 0.6% (51.5 ha) in the area of high species diversity potential relative to predevelopment.
- This decline is not as large as at maximum buildout because some ecosite phases and wetland classes with high potential to support a diverse assemblage of species (e.g., marshes, shrubby swamps) are included in the closure plan for the project.
- There will be a 74.2% (19 941 ha) decline in the area of moderate species diversity potential at maximum buildout relative to predevelopment.
- At project closure, there will be a decline of 40.2% (10 791 ha) in the area of moderate species diversity potential.
- At project closure, there will be a 72.8% (5748 ha) increase in the area of low species diversity potential.

[1660] Within the regional study area at base case, Teck predicts the following:

- For the worst-case scenario, a 20.7% (43 889 ha) decline in the area of high diversity potential for vegetation species relative to predevelopment.
- For the best-case scenario, a 6.1% (12 838 ha) decline in the area of high diversity potential for vegetation species relative to predevelopment.
- For the worst-case scenario, a 13.3% (85 836 ha) decline in the area of moderate diversity potential for vegetation species relative to predevelopment.
- For the best-case scenario, a 4.8% (30 669 ha) decline in the area of moderate diversity potential for vegetation species relative to predevelopment.

[1661] Within the regional study area at application case, Teck predicts the following:

- For the worst-case scenario, areas of high diversity potential decrease by 23.0% (48 652 ha) relative to predevelopment.
- For the best-case scenario, areas of high diversity potential decrease by 8.3% (17 603 ha) relative to predevelopment.
- For the worst-case scenario, areas of moderate diversity potential decrease by 15.0% (96 577 ha) relative to predevelopment.
- For the best-case scenario, areas of moderate diversity potential decrease by 6.4% (41 559 ha) relative to predevelopment.

[1662] Both upland and wetland vegetation cover classes decline at application case relative to predevelopment for the worst-case scenario, resulting in a decline in the area of low, moderate, and high diversity potential for vegetation species.

[1663] In the best-case scenario for vegetation cover classes typically included in reclamation planning, declines are not as large as for the worst-case scenario.

[1664] Teck concluded that effects to species diversity include a high environmental consequence because of regional loss of provincially rare plants and a decline in specific wetland classes in the region.

Analysis and Findings

[1665] The panel notes that construction and operation of the project will remove areas with high and moderate potential to support species diversity. This includes peatlands that are not included in Teck's closure, conservation, and reclamation plan. The closure landscape will include an increase in areas of low species diversity potential relative to predevelopment conditions. While species diversity may continue to improve over time and into the far future, the degree and rate of improvement is uncertain.

[1666] The panel considers the magnitude of the effect to be moderate. Despite the use of progressive reclamation, many species may not return to the area for an extended period of time, and the effect is expected to persist past closure. While most species have the potential to return to reclaimed areas, plant species that are unique to peatlands and rare plants are permanently lost. The effect is long term, extending past closure. While the panel expects that species diversity may continue to improve over time, this is uncertain, and some effects are expected to be irreversible.

Cumulative Effects

Evidence

[1667] Within the regional study area for the application case, Teck predicts the following:

- For the worst-case scenario, areas of high diversity potential decrease by 23.0% (48 652 ha) relative to predevelopment.
- For the best-case scenario, areas of high diversity potential decrease by 8.3% (17 603 ha) relative to predevelopment.
- For the worst-case scenario, areas of moderate diversity potential decrease by 15.0% (96 577 ha) relative to predevelopment.
- For the best-case scenario, areas of moderate diversity potential decrease by 6.4% (41 559 ha) relative to predevelopment.

[1668] Within the regional study area for the planned development case, Teck predicts the following:

- For the worst-case scenario, areas with high diversity potential decrease by 25.6% (54 166 ha) relative to predevelopment.

- For the best-case scenario, areas with high potential to support species diversity decline by 11.3% (24 010 ha) relative to predevelopment.
- For the worst-case scenario, areas with moderate diversity potential decrease by 16.9% (108 824 ha) relative to predevelopment.
- For the best-case scenario, areas with moderate potential to support species diversity decline by 8.5% (55 076 ha).

Analysis

[1669] The project, in combination with other planned and operating projects in the region, will contribute to the removal of areas with high and moderate species diversity potential from the region.

[1670] The panel notes that under the best-case scenario, assuming progressive reclamation, the predicted loss of high biodiversity potential areas within the regional study area is 8.3% and 11.3% for the application and planned development cases, respectively. Similarly, under the best-case scenario, the predicted loss of moderate biodiversity potential areas is 6.4% and 8.5% for the application and planned development cases, respectively. The panel considers this to be a moderate-magnitude effect.

[1671] The panel acknowledges that under the worst-case scenario, the losses are considerably higher than the best-case scenario, ranging from 23.0 to 25.6% for high biodiversity potential areas and 15.0 to 16.9% for moderate biodiversity potential areas. While these would represent a high-magnitude effect (Teck defined losses that are greater than 20% to have a high-magnitude effect), the panel does not believe this magnitude of effects is likely to occur. The panel accepts that progressive reclamation will occur as reclamation is a regulatory requirement, however the timing and degree of progressive reclamation is somewhat uncertain.

[1672] The project, in combination with planned and operating projects, is not expected to result in significant adverse cumulative effects to species diversity potential. Despite the loss of some wetland types, regeneration of species in the region has already begun on reclaimed sites, and by the time the Frontier project closes, significant additional reclamation will have occurred on older operating sites. As well, a large portion of the region still remains undisturbed.

Effects on Rare Plants

Project Effects and Cumulative Effects

Evidence

[1673] Construction and operation of the Frontier project will remove all vegetation species, including rare plants, from the project development area. Teck stated that 8 of the 10 rare vascular plant species in the local study area will experience declines, and 7 of the rare vascular plant species that were found in

the project development area will be eliminated from the terrestrial local study area. Teck also reported that 18 of the 23 rare bryophytes species will be impacted, with 11 of the rare bryophyte species that occurred only in the project development area being eliminated from the terrestrial local study area.

[1674] Teck has indicated that it will mitigate effects on rare plant species through avoidance whenever possible.

[1675] Teck stated that it will examine the potential to introduce rare species into the reclamation landscape as another possible mitigation measure. However Teck considered this potential mitigation measure for rare species as being experimental and did not use it as mitigation to reduce project effects and the associated environmental consequence ratings. Teck confirmed that because introduction of rare species to the reclamation landscape is considered experimental, it assumed that rare plant species disturbed by the project will not reestablished.

[1676] Based on available data (i.e., Alberta Conservation Information Management System and Alberta Biodiversity Management Institute databases and project-specific field surveys), Teck reported that four rare vascular species (*Carex umbellata*, *Chamaesaracha grandiflora*, *Dryopteris cristata* and *Sparganium glomeratum*) and two rare bryophytes (*Buxbaumia aphylla* and *Splachnum vasculosum*) will be disturbed by project construction and eliminated from the regional study area. Teck noted that, although provincially rare, these species are not listed under the *SARA* and are considered globally apparently secure to secure, though some ratings are uncertain.

[1677] Teck concluded that project effects on rare species are expected to be of high environmental consequence given that some rare species will be eliminated from the vegetation and wildlife regional study area as a result of the Frontier project.

[1678] Teck stated that in the planned development case, two additional rare bryophytes (*Plagiochila porelloides* and *Riccia fluitans*) will be lost from the regional study area based on available data. Teck noted that these species are not listed by *SARA* and are considered globally secure.

[1679] Teck concluded that effects on rare species are expected to be of high environmental consequence given that some rare species will be eliminated from the vegetation and wildlife regional study area as a result of the project.

Analysis and Findings

[1680] The panel understands that there are no viable mitigation measures to counter the loss of rare plants that are eliminated during project construction, and that rare plant species disturbed by the Frontier project will not be reestablished. The panel notes that Teck's use of avoidance and minimization during construction, operation, and closure will not be effective because all vegetation will be removed from the project development area during vegetation clearing and surface disturbance.

[1681] The panel notes that previous rare plant surveys on existing oil sands mines in the regional study area did not record the presence of rare vascular plants and mosses that will be lost from the region. The Alberta Conservation Information Management System and Alberta Biodiversity Management Institute databases for rare plants in Alberta are updated annually based on the frequency that a species is recorded during rare plant surveys in the region. As well in the intervening years more surveys would have occurred in the region that would either add to the list of species identified as rare or reclassify the current species on Teck's list of rare species.

[1682] The panel finds that the project is likely to have a significant adverse effect on rare plant species as some rare plant species will be eliminated from the regional study area, and these effects are irreversible. However the project, in combination with other existing, approved, and planned projects, is not expected to result in significant adverse cumulative effects to rare plants in the region given the moderate magnitude of the effect.

Effect of Non-Native Invasive Species

Project Effects and Cumulative Effects

Evidence

[1683] Teck reports that invasive non-native species are not common in the terrestrial local study area. No prohibited noxious weeds were found in the terrestrial local study area; however, four noxious weed species, as defined by the *Weed Control Regulation* were found as part of field surveys at six sites.

[1684] Teck stated although oil sands reclamation aims to establish locally common plant communities, it is recognized that non-native vegetation species can become invasive and hinder the establishment of native flora in reclaimed lands.

[1685] Teck also acknowledged that while weeds are not common in the local study area, effects of the project combined with other operating and planned projects in the regional study area could increase the potential for the proliferation and spread of weeds and non-native species populations in the regional study area during all stages of the Frontier project.

[1686] Teck stated that to mitigate the effects of invasive non-native species, a weed management plan will be implemented throughout the life of the project, including during reclamation and at closure

Analysis and Findings

[1687] The panel agrees that, with implementation of an effective weed management program, the potential for the project to contribute to increased proliferation of non-native and noxious weed species in the region is low, and the number of invasive non-native species should not pose a risk to species diversity.

[1688] The panel accepts Teck's commitment to implement a weed management plan to limit the spread of non-native invasive species and noxious weeds and will make this a condition of the approval.¹⁴²

Effects on Traditional Use Potential

Project Effects and Cumulative Effects

Evidence

[1689] Teck reported that the loss of traditional use plants, including species of berries and medicinal plants was raised as a concern during consultation with potentially affected aboriginal communities. In addition, the ability of the reclaimed landscape to support a diverse assemblage of species similar to those currently present was also raised as a concern.

[1690] Teck examined the potential of vegetation cover classes to support plants for traditional, medicinal, and cultural purposes as part of its assessment. Traditional plant species were identified from reports prepared for previous assessments in the Athabasca Oil Sands Area. Vegetation cover classes were assigned a traditional use plant potential (i.e., low, moderate, or high) based on the number of known traditional use plant species observed at sites visited during vegetation field surveys. Nonvegetated lands (i.e., water, mineral soil, disturbed lands) were not rated.

[1691] For the traditional land-use regional study area Teck reported the following:

- For predevelopment conditions, 68% (808 005 ha) of the vegetation and wildlife regional study area was composed of combined high and moderate traditional use plant potential.
- At base case, combined high and moderate traditional use plant potential is 54% (647 502 ha) of the area.
- The Frontier project will contribute an additional decrease of 25 024 ha.
- At application case the combined high and moderate traditional plant use potential is 52% (622 479 ha).
- At the planned development case, coverage is expected to be 50%.

[1692] Within the terrestrial local study area, Teck predicts the following:

- At predevelopment conditions, 56% is composed of high and moderate traditional use plant potential.
- At base case, this is reduced to 55%.

¹⁴² Draft *EPEA* Approval – Condition 3.6.20

- At application case it is further decreased to 22%.
- At closure, it is expected that combined high and moderate traditional use plant potential will be reestablished and compose 65% of the area.

[1693] Vegetation cover classes with high traditional use species potential were primarily uplands and included coniferous white spruce leading, mixed-wood Jack pine leading, mixed-wood white spruce leading and deciduous and mixed-wood-deciduous leading cover classes.

[1694] Teck stated that the reclamation and revegetation plan for the Frontier project has focused on a diversity of vegetation types that include species of importance to aboriginal communities (e.g., trees, berry-producing shrubs, and species used for medicinal and cultural purposes). Teck stated that based on its extensive reclamation history from other parts of western Canada, and to align with corporate biodiversity policies, Teck will plant additional species to supplement those indicated in the *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* (2nd edition) (ESRD 2010). Teck indicated it would also experiment with including rare species present in the terrestrial local study area in reclamation planning with the goal of maintaining genetic diversity.

[1695] Teck stated that as land is cleared, Teck will harvest and collect seeds and individuals (as appropriate) of rare and culturally important species for use in propagation and revegetation efforts. Teck stated that this work will involve potentially affected aboriginal communities. Further, Teck committed to co-creating a reclamation working group with potentially affected aboriginal communities to guide more detailed reclamation planning and monitoring to determine reclamation success. It anticipates that species of traditional importance will be identified by the reclamation working group and incorporated into reclamation planning as feasible.

[1696] Teck anticipated that, with reclamation of the project, the decline in traditional use potential will be reversible.

Analysis and Findings

[1697] The panel notes that because Teck did not assess ecosite phases and wetland classes that were mapped at a larger scale than cover classes, it was difficult to determine the area of traditional use potential that will be directly affected by the project.

[1698] The Frontier project will result in changes to traditional plant potential and affect traditionally important vegetation such as berries and other vegetation used for medicinal and spiritual purposes. Vegetation clearing during construction and operation of the Frontier project will remove all traditional use plants from the local study area. The project will also contribute to the incremental loss of these plants in the region.

[1699] The project will result in the loss of peatlands and other land-cover classes important to indigenous communities. From a vegetation perspective, land-cover classes that harbour species that are used for traditional use include upland and wetland areas where berries are common. Other species of interest include rat root (which is common in marshes and the margins of shallow open-water wetlands), lichens, Labrador tea, and mint. Mint is common in riparian and wetland margin habitats across the region. Vegetation communities important as habitat for traditionally important wildlife species such as bison, moose, and woodland caribou will also be removed by the project.

[1700] The panel considers the loss of 14 400 ha of high and moderate traditional use potential area within the local study area a high-magnitude effect. The panel notes that while reclamation of the project will return some areas of traditional use potential, not all effects can be restored as some wetland classes or ecosite phases cannot be reclaimed, such as peatlands. Further, reclaimed areas may not be suitable or available for traditional use until many years after project closure and reclamation occurs. As a result, some effects may be irreversible.

[1701] The panel notes that the project in combination with planned and operating projects will result in the loss of 185 526 and 206 718 ha for the application and planned development cases, respectively. This represents a loss of 22% to 25% in the traditional land-use regional study area. The panel considers this to be a high-magnitude effect. The project in addition to other operating, approved, and planned projects in the region will reduce the extent of high and moderate traditional use potential areas as more land-cover classes with vegetation used for food, medicines, and other uses is cleared for mining and other industrial developments in the region. Further, besides limited access to areas that can be used for plant collecting, the time to return to a state where all reclaimed areas can be used for plant collection and other traditional use will be extended (more than 100 years).

Effects of Air Emissions on Vegetation Health and Diversity

[1702] Project and cumulative effects from air emissions have the potential to affect vegetation health and diversity. Teck considered the potential effects of SO₂ and NO₂ as well as loading from nitrogen and dust.

[1703] The effects of air emissions on vegetation health and diversity were considered at the regional study area level only and within the context of the vegetation and wildlife regional study area.

[1704] Teck concluded that effects range from low to moderate environmental consequence, with localized effects predicted adjacent to oil sands developments.

Effects of Sulphur Dioxide (SO₂) Fumigation

Project and Cumulative Effects

Evidence

[1705] Teck reported that vegetation cover classes that are considered sensitive to sulphur dioxide (critical level of 10 µg/m³) are those with high amounts of lichen including coniferous Jack pine leading, wooded poor fen, wooded rich fens, and wooded bogs.

[1706] In the application case, Teck predicted that the Frontier project will slightly increase the area of highly and moderately sensitive cover classes exposed to critical levels of SO₂ relative to base case. The area of vegetated land affected by SO₂ fumigation increases by 3.0 ha (less than 0.1%) relative to base case due to project emissions. This includes an increase of 3.0 ha (less than 0.1%) of vegetation cover classes with a high potential to support traditional use berry species.

[1707] For the planned development case, Teck predicted that there will be a slight increase in the area of highly and moderately sensitive cover classes exposed to critical levels of SO₂ relative to base case. The area of vegetated land affected by SO₂ fumigation increases by 209 ha (less than 0.1%) relative to base case because of emissions. This includes an increase of 183 ha (less than 0.1%) of vegetation cover classes with a high potential to support traditional use berry species. Teck further stated that no individual vegetation cover classes are predicted to be exposed to levels above the critical level for SO₂ by more than 1%.

[1708] Teck assessed the environmental consequence of SO₂ fumigation on vegetation cover classes with high amounts of lichen to be low because cover classes with that are considered sensitive to SO₂ exceed by less than 0.1% for base case, application case, and planned development case. Effects are also considered to be reversible.

[1709] Teck said that while effects are considered reversible, some species might not recover.

Analysis and Findings

[1710] As discussed in section 14, "[Air Quality](#)," SO₂ emissions from the Frontier project are estimated to be 1.54 t/day compared to base case emissions of 307.6 t/d. Project SO₂ emissions therefore represent a small increase (approximately 0.5%) in regional SO₂ emissions. The panel considers the 0.1% predicted increase in the area of vegetated land affected by SO₂ fumigation due to the addition of the project to be negligible.

[1711] While there is a small increase in the area of highly and moderately sensitive cover classes exposed to critical levels of SO₂ for the planned development case relative to base case, the panel considers this a low-magnitude effect. The panel also notes that the affected areas occur to the south of

the project area in the vicinity of mining operations with upgrading facilities. The project's contribution to this increase is negligible.

Effects of Nitrogen Dioxide (NO₂) Fumigation

Project and Cumulative Effects

Evidence

[1712] Teck reported that at base case, NO₂ concentrations are greater than the critical level of 30 µg/m³ for 46 234 ha (4%) of the study area. This includes 37 265 ha of vegetation cover classes with a high potential to support traditional use berry species.

[1713] For existing conditions and base case, no individual vegetation cover classes are predicted to have more than 20.0% affected. According to Teck this represents a moderate-magnitude effect.

[1714] For the application case, the Frontier project is predicted to slightly increase the area exposed to critical level of NO₂ relative to base case. The area of vegetated land affected by NO₂ fumigation increases by 1558 ha (1%) relative to base case as a result of project emissions. This includes an increase of 1037 ha (1%) of vegetation cover classes with a high potential to support traditional use berry species. These areas occur in the area of existing oil sands mining operations and within portions of the project development area.

[1715] For the planned development case, Teck predicted that there will be a slight increase in the area exposed to critical levels of NO₂ relative to base case. The area of vegetated land affected by NO₂ fumigation increases by 12 828 ha (3%) relative to base case because of emissions. This includes an increase of 9 252 ha (2%) of vegetation cover classes with a high potential to support traditional use berry species.

[1716] For the application case and planned development case, some individual vegetation cover classes have more than 20.0% above the critical level, which according to Teck represents a high-magnitude effect. The upland grassland cover class has the largest proportion of individual cover class affected at the planned development case, with 28.2% of the area above the critical load, an increase of 20.9% relative to base case.

[1717] Teck noted that while localized effects of fumigation have been noted in the oil sands region in the vicinity of active mines, widespread effects have not been documented.

[1718] Teck assessed the environmental consequence of NO₂ fumigation on vegetation cover classes with high amounts of lichen to be low.

Analysis and Findings

[1719] The panel agrees with Teck's assessment that project effects from NO₂ fumigation on vegetation species with high amounts of lichen are low. The Frontier project will result in a small incremental increase to overall emissions effects in the vegetation and wildlife regional study area. Furthermore, the increase in areas exposed to critical levels of NO₂ relative to base case resulting from the project are all occur within the immediate vicinity of the project development area.

Effects of Nitrogen Deposition

Project and Cumulative Effects

Evidence

[1720] For the application case, Teck predicted there will be a slight increase in the area of cover classes exposed to critical loads of nitrogen deposition relative to base case. The area of vegetated land affected by nitrogen deposition increases by 7268 ha (3%) relative to base case as a result of project emissions in the regional study area. This includes an increase of 6035 ha (3%) of vegetation cover classes with a high potential to support traditional use berry species. The coniferous Jack pine leading cover class has the largest proportion of individual cover class affected at application case, with 37.9% of the area above the critical load, an increase of 9.2% relative to base case.

[1721] For the planned development case, Teck predicted that there will be a slight increase in the area of cover classes exposed to critical loads of nitrogen deposition relative to base case. The area of vegetated land affected by nitrogen deposition increases by 38 432 ha (7%) relative to base case because of emissions. This includes an increase of 28 956 ha (6%) of vegetation cover classes with a high potential to support traditional use berry species. The coniferous Jack pine leading cover class has the largest proportion of individual cover class affected at the planned development case, with 40.5% of the area above the critical load, an increase of 11.7% relative to base case.

[1722] Teck noted that although localized effects on sensitive vegetation species from nitrogen deposition have been documented in the oil sands region, broad, regional effects from air emissions have not been noted.

Analysis and Findings

[1723] The panel acknowledges that the Frontier project will result in a small increase (3%) in the area of vegetated land affected by critical loads of nitrogen deposition, and this will contribute to cumulative effects related to nitrogen deposition. However all of the areas predicted to be affected by project emissions occur within the immediate vicinity of the project development area. The panel therefore finds that project effects related to nitrogen deposition represent a low-magnitude effect, are localized, and are reversible.

[1724] While areas of nitrogen deposition exceeding critical loads represent 12% and 16% of the regional study area for the application and planned development cases, respectively, these effects are limited to the immediate vicinity of existing and proposed development footprints. This appears to be consistent with Teck's observation that while localized effects of nitrogen deposition on sensitive receptors have been identified, broad, regional effects have not been noted. The panel therefore concludes that cumulative effects related to nitrogen deposition are likely to be low in magnitude, localized, and reversible in the future.

Significance Determination for Project Effects

[1725] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

Ecological Context

[1726] The project is located within the mineable oil sands area of the Lower Athabasca region. The mineable oil sands area is experiencing significant development activity. Portions of the region are highly fragmented as a result of existing developments and oil and gas exploration in the region, particularly to the south of the Frontier project. Wetlands cover 43% of the local study area for the project. Due to an inability to reclaim certain types of wetlands (particularly bogs and fens), the trend is for oil sands mines to reclaim to a higher proportion of upland than wetland classes.

Likelihood

[1727] Project effects are likely for the majority of key vegetation indicators related to landscape, community, and species diversity. Land clearing and preparation for construction and mining activities will remove most vegetation from the project development area and result in the direct loss of upland ecosite phases, wetlands, old-growth forests, areas of high species diversity potential, rare plant potential, and traditional use potential. While reclamation will mitigate these effects, some residual effects will remain at closure.

[1728] Project effects to vegetation health and diversity resulting from NO₂ fumigation and or nitrogen deposition are also likely.

[1729] Project effects are not likely to result from SO₂ fumigation due to the project's negligible to low contribution to these emissions.

Magnitude

[1730] The panel finds that the project will have high-magnitude effects to wetlands, old-growth forests, rare plant potential, and traditional use potential.

[1731] Project effects to upland ecosite phases and species diversity potential are considered to be moderate in magnitude, while project effects related to landscape diversity, invasive non-native species, SO₂ and NO₂ fumigation, and nitrogen deposition are considered to be low magnitude.

Geographic Extent

[1732] The panel finds the geographic extent of project effects to landscape diversity, upland ecosite phases, wetlands, old-growth forests, species diversity potential, rare plant potential, invasive non-native species, and traditional use potential are local. This is because land clearing and disturbance will be limited to the project development area within the local study area.

[1733] Project effects associated with SO₂ and NO₂ fumigation and nitrogen deposition are also considered to be local in extent. While air emissions have the potential to be regional in extent, modelling of vegetation effects associated with SO₂ and NO₂ fumigation and nitrogen deposition indicate effects will be limited to the immediate vicinity of the project development area.

Duration

[1734] The panel finds that all project effects to vegetation will be long term as they will occur through the construction and operational phases (in excess of 40 years), into closure, and sometimes beyond.

[1735] Despite the use of progressive reclamation, a significant portion of the project area will not be reclaimed until after the end of mine life in 2066. Following reclamation and revegetation, species diversity is expected to require time to become reestablished and may only approach predisturbance levels in the far future, if at all.

Frequency

[1736] The majority of effects to vegetation are considered to be continuous because the effects are expected to occur throughout the operational life of the project and recover during or after closure. While Teck identified some effects as being isolated (species diversity potential, rare plants), given that the effect continues after the initial clearing, the panel considers the effects to be continuous once the clearing has occurred and until vegetation is reestablished. The effects to invasive non-native species are expected to be isolated if an effective weed management program is implemented.

Reversibility

[1737] The panel considers project effects to wetlands and rare plant potential to be irreversible as some wetland types (such as peatlands) and rare plants cannot be reclaimed.

[1738] The panel considers project effects related to landscape diversity, uplands, old-growth forests, and invasive non-native species to be reversible. It is expected that reclamation will result in functioning upland vegetation communities that are equivalent to what exist prior to project construction and operation. Effects to old-growth forests are reversible but only in the far future due to the amount of time required for forests to mature to this stage.

[1739] Effects to species diversity potential and traditional use potential are potentially reversible; however, there is some uncertainty associated with the degree of reversibility and how long it will take to occur. Some high biodiversity features such as wetlands may not return to equivalent levels of biodiversity for many years, if at all. The ability to reestablish traditional use potential areas will depend in part on the nature of species planted.

[1740] Project effects resulting from SO₂ and NO₂ fumigation and nitrogen deposition are reversible in the long term; although if effects to sensitive species occur, some species may not recover.

Significance

[1741] Considering the above factors, the panel finds that the project is likely to result in significant adverse effects to wetlands, old-growth forests, rare plant potential, and traditional use potential. Project effects to wetlands and rare plant potential are likely to be significant due to the high magnitude and irreversibility of some predicted effects. Project effects are likely to be significant for old-growth forests due to the importance and limited distribution of old-growth forests, the high magnitude of effects, and the very long time required for old-growth forests to become reestablished. Project effects to traditional plant potential are likely to be significant due to the magnitude and potential irreversibility of some effects.

[1742] The panel finds that the project is not likely to result in significant adverse environmental effects to landscape diversity, upland ecosite phases, and invasive non-native species due to the local nature and reversibility of effects.

[1743] The project is not likely to result in significant adverse effects to species diversity potential. While some effects are considered irreversible, others are reversible, and species diversity is expected to improve over time resulting in a moderate-magnitude effect which is local in extent.

[1744] Project effects related to SO₂ and NO₂ fumigation and nitrogen deposition are not likely to be significant due to the low magnitude of predicted effects.

Table 15. Significance of project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Landscape diversity	low	local	long term	continuous	reversible	not significant
Community diversity – Uplands	moderate	local	long term	continuous	reversible	not significant
Community diversity – Wetlands	high	local	long term	continuous	irreversible	significant
Community diversity – Old-growth forests	high	local	long term	continuous	reversible	significant
Species diversity – Potential	moderate	local	long term	continuous	irreversible	not significant
Species diversity – Rare plants	high	local	long term	continuous	irreversible	significant
Species diversity – Non-native species	low	local	long term	isolated	reversible	not significant
Species diversity – Traditional use potential	high	local	long term	continuous	may be reversible	significant
Vegetation health – SO ₂	low	local	long term	continuous	reversible	not significant
Vegetation health – NO ₂	low	local	long term	continuous	reversible	not significant
Nitrogen deposition	low	local	long term	continuous	reversible	not significant

Significance Determination for Cumulative Effects

[1745] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of cumulative effects

Ecological Context

[1746] The project is located within the mineable oil sands area of the Lower Athabasca region. The mineable oil sands area is experiencing significant development activity. Portions of the region are highly fragmented as a result of existing developments and oil and gas exploration in the region, particularly to the south of the Frontier project. Wetlands cover 43% of the local study area for the project. Due to an

inability to reclaim certain types of wetlands (particularly bogs and fens), the trend is for oil sands mines to reclaim to a higher proportion of upland than wetland classes.

Likelihood

[1747] Cumulative effects are likely for the majority of vegetation indicators related to landscape, community, and species diversity. The region is highly fragmented from existing mining and other industrial activities, and land clearing, construction, and mining activities will remove most vegetation from the project development area. The project will contribute to regional loss of upland ecosite phases, wetlands, old-growth forests, areas of high species diversity potential, rare plant potential, and traditional use potential. While reclamation will mitigate these effects, some residual effects will remain at closure.

[1748] Cumulative effects to vegetation health and diversity resulting from NO₂ fumigation and or nitrogen deposition are also likely.

[1749] Cumulative effects to vegetation health resulting from SO₂ fumigation due to the project are not likely due to the projects negligible to low SO₂ emissions.

Magnitude

[1750] Cumulative effects to old-growth forests, wetlands, and traditional use potential are considered to be high-magnitude effects. Considering the existing level of disturbance, the effects of forest fires and future development activity, more than 40% of the old-growth forest within the regional study area will be removed and will not be recreated for more than 100 years after reclamation. While the relative loss of wetlands is predicted to be around 10% under the best-case scenario and less than 20% under the worst-case scenario, wetlands will decline by more than 60 000 ha under the best-case scenario, and some types of wetlands cannot be reclaimed. Areas of high and moderate traditional use potential are expected to decline by 22% to 25% before reclamation.

[1751] Cumulative effects to landscape diversity, species diversity potential, and rare plant potential are considered to be moderate in magnitude at the regional scale. Cumulative effects to upland ecosite phases are considered to be of low to moderate magnitude at the regional scale.

[1752] The magnitude of cumulative effects related to invasive non-native plants, SO₂ and NO₂ fumigation, and nitrogen deposition are considered to be low.

Geographic Extent

[1753] As cumulative effects to vegetation are assessed at the regional scale, all effects are considered to be regional in extent.

Duration

[1754] As for project effects, the panel finds that most cumulative effects to vegetation are long term because the effect continues throughout the construction and operations phases of oil sands projects, which typically last in excess of 40 years. Some effects continue into closure or beyond. Despite the use of progressive reclamation, to date only a small portion of the area disturbed by oil sands mining projects have been reclaimed.

Frequency

[1755] As for project effects, all effects to vegetation are considered continuous because the effects are expected to occur throughout the operational life of the various projects and recover during or after closure. While Teck identified some effects as being isolated (species diversity potential, rare plants), given that the effect continues after the initial clearing, the panel considers these effects to be continuous once the clearing has occurred and until vegetation is reestablished. The effects to invasive non-native species may be isolated if effective weed management practices are implemented.

Reversibility

[1756] As for project effects, the panel considers project effects to wetlands, species diversity potential and rare plant potential to be irreversible because some wetland types (such as peatlands) and rare plants cannot be reclaimed.

[1757] The panel considers project effects related to landscape diversity, uplands, old-growth forests, and invasive non-native species to be reversible. It is expected that reclamation will result in functioning upland vegetation communities that are equivalent to what exist prior to project construction and operation. Effects to old-growth forests are reversible but only in the far future due to the amount of time required for forests to mature to this stage.

[1758] Effects to species diversity potential and traditional use potential are potentially reversible; however, there is some uncertainty associated with the degree of reversibility and how long it will take to occur. Some high biodiversity features such as wetlands may not return to equivalent levels of biodiversity for many years, if at all. The ability to reestablish traditional use potential areas will depend in part on the nature of species planted.

[1759] Effects resulting from SO₂ and NO₂ fumigation and nitrogen deposition are reversible in the long term; although, if effects to sensitive species occur, some species may not recover.

Significance

[1760] Given the above points, the panel finds that the project, in combination with other existing and planned projects, is likely to result in significant adverse cumulative environmental effects to wetlands and old-growth forests. Significant adverse cumulative effects to wetlands are likely due to the high

magnitude and irreversibility of some predicted effects. Significant adverse cumulative effects to old-growth forests are likely due the high magnitude of effects, the limited availability and importance of old-growth forests and the long time required to reestablish old-growth forests.

[1761] The project in combination with planned and operating projects is also likely to result in significant adverse cumulative effects to traditional use potential in the region due to the magnitude of the loss, the regional extent, and the long amount of time potentially required to return the lands to a state that can be used for plant collection and traditional use.

[1762] The project in combination with planned and operating projects is not likely to result in significant adverse cumulative effects to species diversity potential. While some effects are considered irreversible, others are reversible, and species diversity is expected to improve over time, resulting in a moderate-magnitude effect. Furthermore, regeneration of some species in the region has begun on sites that are reclaimed. As well, a large portion of the region still remains undisturbed.

[1763] The project in combination with planned and operating projects is not likely to result in significant adverse cumulative effects to rare plants in the region due to the magnitude of the predicted effect.

[1764] The project in combination with planned and operating projects is not likely to result in significant adverse cumulative effects related to landscape diversity, upland ecosite phases, invasive non-native, SO₂ and NO₂ fumigation, and nitrogen deposition due to the low to moderate magnitude and reversibility of predicted effects.

Table 16. Significance of cumulative effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Landscape Diversity	moderate	regional	long term	continuous	reversible	not significant
Community Diversity – Uplands	low to moderate	regional	long term	continuous	reversible	not significant
Community Diversity – Wetlands	high	regional	long term	continuous	irreversible	significant
Community Diversity – Old-Growth Forests	high	regional	long term	continuous	reversible	significant
Species Diversity – Species Diversity Potential	moderate	regional	long term	continuous	irreversible	not significant
Species Diversity – Rare Plants	moderate	regional	long term	continuous	irreversible	not significant

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Species Diversity – Non-Native Species	low	regional	long term	isolated	reversible	not significant
Species Diversity – Traditional Use Potential	high	regional	long term	continuous	may be reversible	significant
Vegetation Health – SO ₂	low	regional	long term	continuous	reversible	not significant
Vegetation Health – NO ₂	low	regional	long term	continuous	reversible	not significant
Nitrogen Deposition	low	regional	long term	continuous	reversible	not significant

23 Wildlife

[1765] The panel's terms of reference require it to consider wildlife and wildlife habitat for valued species including federally and provincially listed species at risk and migratory birds. In addition the terms of reference for the environmental impact assessment stated that Teck must describe wildlife resources, wildlife habitat, including key indicator species and species at risk; project components and activities that may affect wildlife and wildlife habitat must also be described. In preparing its assessment Teck was also required to provide a strategy and mitigation plan to minimize impacts and a monitoring program.

[1766] Project activities that may affect wildlife include construction, operation, and reclamation and closure phases. The project may affect habitat availability or carrying capacity, landscape or habitat connectivity, mortality risk (direct and indirect), and species abundance, distribution and diversity. The key wildlife species considered include the Ronald Lake bison herd, woodland caribou, moose, fur-bearers, listed species at risk (federal and provincial), breeding birds, migratory waterfowl and Whooping Crane. Teck also assessed effects to wildlife biodiversity.

[1767] Teck prepared a draft wildlife mitigation and monitoring plan that addresses impacts to wildlife and its habitat. Its mitigation objectives are to: reduce direct and indirect habitat loss; reduce change to landscape connectivity; and, reduce wildlife mortality risk. Teck will monitor the effectiveness of these mitigation measures. Teck will apply adaptive management if mitigation is not working as planned; the plan includes thresholds or triggers when adaptive management measures will be taken.

Key Wildlife Biodiversity Zone and Biodiversity Stewardship Area

[1768] The project development area is located within a "key wildlife and biodiversity zone," which has been delineated to identify key ungulate winter ranges and river corridors where ungulates concentrate. Key wildlife biodiversity zones establish areas of important winter ungulate habitat and higher habitat potential for biodiversity within the province. Typically these areas are associated with major river valley areas. The key wildlife biodiversity zone that overlaps the Teck Frontier and Ronald Lake area is bounded on the south by the Ells River, extends westward from the Athabasca River towards the Birch Mountains and northwards to Wood Buffalo National Park, fully containing the Frontier project.

[1769] The existing guidelines for key wildlife biodiversity zone include:

- Minimize industrial activities that would lead to vegetation removal;
- Minimize activities during winter months, where activities are authorized;
- Reduce access development; and
- Follow specified timing restrictions.

[1770] During the panel hearings the Athabasca Chipewyan First Nation and the Mikisew Cree First Nation proposed a biodiversity stewardship area as a permanently protected area of sufficient size, ecological capacity and habitat quality to support First Nation biodiversity objectives, the exercise of aboriginal and treaty rights, and the culturally important relationships between First Nations and local wildlife including the Ronald Lake bison. The proposed biodiversity stewardship area would lie north of the project and provide a buffer against further industrial development along the eastern boundary of the Birch River Conservation Area, the southern boundary of Wood Buffalo National Park and western and southern boundaries of Richardson Wildland Park.

[1771] Aboriginal communities' concerns expressed during the project review process have been taken into account by the panel and are reflected in this report; not all of these concerns were tested by cross-examination at the hearings. However, the panel notes that, with one exception, the 14 First Nations with whom Teck has entered into agreements have withdrawn their objections to the project. The Mikisew Cree First Nation, in its letter to federal minister of Environment and Climate Change, Crown-indigenous relations and indigenous services dated September 28, 2018, and in its evidence before the panel, indicate its consent for the project is conditional on responsible parties developing "a comprehensive suite of mitigation and accommodation measures," one of which is the establishment of the biodiversity stewardship area.

Analysis

[1772] Subsequent to the close of the hearing the Alberta government established the Kitaskino Nuwenëné Wildland Provincial Park which incorporates much of the land area proposed by the First Nations to be included in the biodiversity stewardship area. While the panel was and continues to be supportive of this initiative, recognizing that new protected areas have already been established, the panel did not feel it necessary to make recommendations related to the establishment of the biodiversity stewardship area. However the panel has included recommendations to Alberta and Canada that a co-management approach be implemented for the Ronald Lake bison involving Mikisew, Athabasca Chipewyan, and other interested indigenous groups. These recommendations are discussed below.

Ronald Lake Bison Herd

[1773] The Ronald Lake bison herd is a small population of disease-free genetically distinct wood bison whose range is known to overlap the eastern and northern portion of the project disturbance area as well an area south east of it. Several indigenous groups have indicated that they harvest Ronald Lake bison, and consider the herd to be critical for maintaining their culture and traditional land-use activities. The use of the Ronald Lake bison by indigenous peoples is dependent on it remaining disease-free. The wood bison found in and near Wood Buffalo National Park are prone to infection from bovine tuberculosis and brucellosis. There is a concern that development of the Frontier project could cause the Ronald Lake

bison herd to move northward into Wood Buffalo National Park, which may result in the herd coming into contact with the herds within the park, which are known to carry bovine tuberculosis or brucellosis.

[1774] Ronald Lake bison are protected as “subject animals” under Alberta’s *Wildlife Act* and are a listed species under *SARA*. In August 2018, ECCC released the final *Recovery Strategy for the Wood Bison (Bison bison athabascaae) in Canada* under *SARA*.

[1775] After considering the project’s effects on Ronald Lake bison, Teck concluded that while the project might cause the bison to move northward, potentially increasing the risk of interaction with diseased bison in Wood Buffalo National Park, such movement is already occurring and the risk already exists. Teck’s conclusion is that the project would not increase that risk.

[1776] To assess project effects on the Ronald Lake bison, Teck addressed habitat availability and disturbance, landscape connectivity, bison abundance, and described proposed mitigation. Teck evaluated project effects in the context of the following development scenarios:

- base case, which includes developments that are currently operating or under construction, and activities approved but not yet constructed in 2013
- application case, which includes developments and activities in the base case with the project added
- planned development case, which includes the application case and developments that have been disclosed or applied for, but not yet approved

[1777] Teck also included two cumulative assessment scenarios:

- a best-case scenario (that considers progressive reclamation and is used to determine environmental consequence) which is aligned with the project development plan
- a worst-case scenario (that examines effects without considering any reclamation and with all developments represented as fully developed) that is only hypothetical.”

[1778] The best-case scenario base case typically has a larger area for high and moderate habitat suitability when compared to the worst-case scenario. Although the worst-case scenario may present a lower disturbance (per cent and ha) the starting habitat suitability is less than for the best-case.

[1779] Teck assessed cumulative changes in regional wildlife population levels “qualitatively in terms of wildlife abundance and distribution using conclusions drawn from habitat availability, landscape connectivity and mortality risk assessments.”

[1780] The assessment also identified reference conditions which are those conditions predicted to have existed on the landscape prior to the introduction of industrial development or disturbance. These conditions provide a reference point for which the cumulative effects of the base case, application case and planned development case can be assessed.

[1781] The base case (2066) used as a reference point in Teck's assessment considers existing and approved developments, existing and simulated forest fires; planned and simulated logging and forest age. The worse-case scenario base case (2066) considers the above along with all developments at maximum buildout.

Study Areas

[1782] To assess the project's potential effect on the Ronald Lake bison, Teck identified the terrestrial local study area, the vegetation and wildlife regional study area, and a distinct area – the Ronald Lake bison study area. Teck also developed a regional bison winter habitat assessment study area.

[1783] The terrestrial local study area includes the project disturbance area and a 500 m wide buffer area, corresponding to the largest wildlife modelling zone of influence. The terrestrial local study area is 43 349 ha; the project disturbance area lies within it and is 29 217 ha.

[1784] The vegetation and wildlife regional study area represents an area planned for intensive industrial use surrounding the project and now includes part of the recently announced Kitaskino Nuwenéné Wildland Provincial Park, portions of which were proposed during the hearing as the biodiversity stewardship area. The regional study area is 1 195 560 ha

[1785] Additionally, Teck used a distinct study area to assess project impacts to the Ronald Lake bison, in response to aboriginal community concerns. This Ronald Lake bison study area is 156 065 ha and overlaps 80.2 per cent of the terrestrial local study area. It extends from the terrestrial local study area north to the boundary of Wood Buffalo National Park and west from the top of the Athabasca River escarpment to the eastern perimeter of Birch Mountains, also including part of the Kitaskino Nuwenéné Wildland Provincial Park. The Ronald Lake bison study area was chosen based on information and data from Government of Alberta, specifically Environment and Sustainable Resource Development (ESRD), and indigenous knowledge from Athabasca Chipewyan and Mikisew.

[1786] However, based on information it had from bison that are fitted with collars and provide telemetry data, wallow surveys, incidental observations from fieldwork, indigenous knowledge, and anecdotal sightings from Firebag River, Teck acknowledges that the Ronald Lake bison distribution may be more widespread than the area defined by the Ronald Lake bison study area.

[1787] Teck also established a regional bison winter habitat assessment study area recognizing that uncertainty exists regarding the Ronald Lake bison herd range, that project development will remove some habitat within the range and could displace the herd from portions of its current range. This study area is 1 605 280 ha and overlaps the terrestrial local study area and Ronald Lake bison study area. It extends from Marguerite River Wildland Provincial Park to the east, north to Lake Claire, west to Birch Mountains and south to McClelland Lake.

[1788] Teck's assessment of project effects on Ronald Lake bison focuses on the Ronald Lake bison study area and the regional bison winter habitat study area.

[1789] The Mikisew Cree First Nation estimation of the Ronald Lake bison range also included regions that lie west of the Athabasca River, from Lake Claire in Wood Buffalo National Park to Fort McKay in the south, and Namur Lake in the west. Athabasca Chipewyan First Nation and Mikisew Cree First Nation stated that bison used the habitat core range but also extended this range into the southern boundary of the project disturbance area. This is a further extension than what was presented by Teck.

[1790] Parks Canada, ECCC, Athabasca Chipewyan and Mikisew believed that the data used by Teck to delineate the Ronald Lake bison range did not incorporate traditional knowledge.

Habitat Availability

[1791] Wood bison are generally grazers, relying on a variety of grasses and sedges found in meadows in early succession habitats. They show strong seasonal changes in diet, tending to use wet meadows with predominantly sedges and grasses. Changes in habitat availability may result from a direct loss, such as vegetation clearing or from indirect loss such as sensory effects.

[1792] In assessing range or use of habitat currently available, Teck used utilization distribution in assessing the potential effects of the project. Utilization distribution provides a quantitative measure of the areas that are used most frequently by bison that are fitted with collars and provide telemetry data. In other words, areas of greater use fall within the delineated area while other areas not used as heavily are excluded. Assessment using this method assumes that the areas which are used more frequently are likely of greater importance. Utilization distributions are expressed as percentages. The higher the utilization distribution percentage used in the assessment, the more fully the range is delineated and areas which are not as heavily used, are included.

[1793] Habitat availability can also be assessed in terms of "preferred habitat" where high-suitability habitat may be more representative of critical habitat for a species and moderate-suitability habitat may be an area less preferred (not as critical) but still of higher importance.

[1794] In the Ronald Lake bison study area there will be a reduction in available habitat for the Ronald Lake bison.

[1795] Under the best-case scenario (with progressive reclamation) Teck reports that for the application case at maximum project buildout (2066) there will be

- A reduction of 3979.7 ha (25.6 per cent) of high-suitability habitat compared to the base case (15 568.0 ha)
- A reduction of 11 351.6 ha (29.6 per cent) of moderate-suitability habitat compared to the base case (38 347.2 ha)

[1796] Under the worst-case scenario (no progressive reclamation) Teck reports that for the application case at maximum project buildout (2066) there will be

- A reduction of 1663.9 ha (14.5 per cent) of high-suitability habitat compared to the base case (11 493.2 ha)
- A reduction of 4594.4 ha (16.2 per cent) of moderate-suitability habitat compared to the base case (28 338.1 ha)

[1797] Teck stated that the portion of the Ronald Lake bison study area that overlaps the project development area will be reclaimed as part of the closure, conservation, and reclamation plan. The closure, conservation, and reclamation plan was designed with the goal of constructing sustainable terrain, soils and drainage features that will allow diverse vegetation communities and associated habitats to reestablish. At closure, total bison winter feeding habitat availability decreases in the Ronald Lake bison study area relative to base case. While the closure landscape of the portion of the project disturbance area within the Ronald Lake bison study area contains more high-suitability habitat relative to base case, there is a greater loss of moderate-suitability habitat.

[1798] Teck provided evidence about habitat loss that may occur within three bison ranges using telemetry data and indigenous knowledge. These ranges included a female winter 80 per cent utilization distribution, a population-level 95 per cent utilization distribution and Teck's winter bison study area. The areas more frequently used by collared bison are considered core or high use areas.

[1799] Teck stated the following findings:

- The project disturbance area does not overlap with the female calving ranges, as delineated using the 80 per cent or 95 per cent utilization distribution.
- There is minimal overlap of the project disturbance area and female spring and winter ranges across years.
- Compared to other seasons, the greatest overlap with the project disturbance area is with female summer/fall ranges across all years.
- Overlap with the female ranges was highest in 2013 followed by 2016.
- Based on one year of data, overlap of the project disturbance area with male ranges was relatively high across all seasons.

[1800] ECCC recognize that the 80 per cent and 95 per cent distribution utilization, used by Teck, can define core range, and is generally appropriate for this purpose; however, they point out issues related to the limitations of telemetry data. First, the data was collected following a period of intensive disturbance from 2006 to 2013 in the southern part of the herd's core range, such as corehole programs, logging, exploration activities and extensive works related to oil and gas. This may have caused a shift in the

herd's core range. Second, the data mainly represents female bison and few males. ECCC stated that males are less sensitive than females; therefore males may not shift their core range to the same extent.

[1801] ECCC's analysis indicated that the herd may be forage limited at application case (maximum project buildout). They stated that the Ronald Lake technical team has recently looked at a 99 per cent utilization distribution. The 99 per cent utilization distribution looks at the full distribution of the herd rather than areas where there is a higher concentration. The use of 99 per cent reflects a fuller extent of the range of the bison including areas where they may occur less frequently, whereas 80 per cent or 95 per cent reflect smaller "core" areas. The 99 per cent utilization distribution may also account for the potential underestimation of male bison, as there is not much data for collared male bison (one year worth).

[1802] ECCC stated that they found the project would result in substantial loss of range and habitat for the herd. Based on its assessment using the 99 per cent utilization distribution, ECCC concluded that at maximum buildout, the project will affect 14 per cent of winter foraging habitat with the terrestrial local study area. ECCC stated that the project will affect 7.4 per cent of the highest selected winter foraging habitats, where the majority of these are concentrated in an area south, west and northwest of Ronald Lake, north of the project disturbance area but south of Wood Buffalo National Park.

[1803] Teck disagreed with ECCC's use of the 99 per cent utilization distribution to define the herd's range. Teck stated that ECCC's figures related to habitat loss are inflated when compared to the range defined by the 80 per cent and 95 per cent utilization distribution, which are the utilization distribution values most commonly used in the scientific literature.

[1804] Teck's analysis suggested a low magnitude of change to habitat availability based on the modelling of telemetry data and corresponding information from the utilization distribution analysis. Higher concentrations of selected habitats were found in the northern portion of the Ronald Lake bison study area than the south. Teck stated that the magnitude associated with habitat availability in application case is moderate as the Ronald Lake bison are considered species at risk and habitat loss is less than 10%.

[1805] ECCC disagreed with Teck's statements that the core range of the Ronald Lake bison occurs primarily to the north and that sensory disturbance is unlikely to affect the herd's range. ECCC acknowledged however that the critical habitat for the Ronald Lake herd had not yet been defined under the recovery strategy.

[1806] According to ECCC, under the recovery strategy, the identification of wood bison populations' critical habitat, defined as "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy..." is the highest priority and should be anticipated for 2019. However, the challenge in identifying critical habitat is insufficient information regarding the herd's range and habitat usage. The Wood Bison Recovery Strategy

also states that the long-term health effects and cumulative impacts of pollution, disturbance and habitat modifications by industrial developments is unknown.

[1807] Notwithstanding its agreement with Teck, Mikisew continues to have concerns regarding the Ronald Lake bison herd. The expressed concerns include the following: potential impact of the project on the Ronald Lake herd's population viability, reduced ability to exercise Mikisew's cultural and traditional rights, and uncertainty regarding Teck's proposed mitigation measures to minimize effects. Mikisew's disagreement with Teck's assessment is described in various reports including the Bison Indigenous Use study, Rights and Culture study, the MSES Bison Report, and was also expressed throughout the hearing. Mikisew stated that the Ronald Lake bison may lose as much as 24 per cent of total high-quality habitat, with an average of 18 per cent across all seasons and ranges used by cows and bulls. Mikisew Cree First Nation also stated that Teck's assumptions may influence the accuracy of the bison habitat classification for areas outside of the project terrestrial local study area.

[1808] The Athabasca Chipewyan – Teck joint letter to the panel commits Teck “to include restoration of high-quality bison habitat as quickly as reasonably possible as a key reclamation objective.”

Analysis and Findings

[1809] The panel is satisfied with the approach Teck took to assessing the project's effects on Ronald Lake bison; it is satisfied with the several study areas relied on by Teck for its research and analysis.

[1810] While using a 99 per cent utilization distribution may more accurately reflect habitat used by bison, the panel is satisfied that Teck's use of 80 per cent and 95 per cent utilization distribution is sufficient to determine the project's effects on bison habitat. Based on the evidence provided by Teck and the other parties however, it is evident that the information and data available regarding bison habitat requirements is incomplete. Uncertainty regarding location of critical habitat requires further data collection and analysis of utilization distribution by both Teck and Canada.

[1811] There is also insufficient data to determine core or critical habitat of the Ronald Lake bison. Determining this critical habitat as required by the recovery strategy should be an urgent priority. The panel understands that ECCC expects to complete the determination of critical habitat of the Ronald Lake bison in 2019. The panel recommends that ECCC complete its work to identify the critical habitat as required by the recovery strategy as soon as possible so that the results can be used to inform federal decisions related to the Frontier project.

[1812] Similar to the approach used by Teck, the panel assumes that species at risk have a lower tolerance than other valued species for changes to habitat availability. Where the panel would typically apply a 20 per cent change threshold to identify high-magnitude changes for habitat availability for valued species, for species at risk the panel considers a greater than 10 per cent change to be a high-

magnitude effect. Given that the loss of high and moderate bison habitat will be more than 25 per cent under the best-case scenario, the panel considers this to be a high-magnitude effect.

Disturbance and the Potential for Dislocation of the Ronald Lake Bison

[1813] If the Ronald Lake bison herd moves northward into Wood Buffalo National Park, it may result in the herd coming into contact with the herds within the park, which are known to carry bovine tuberculosis or brucellosis.

[1814] Teck stated that there is a lack of evidence to suggest that the herd will move north to avoid project disturbances. Teck states that during their 2013 winter drilling program (Application for Oil Sands Evaluation Well Licences, Decision 2013 ABAER 017), monitoring indicated that the herd did not abandon their core range. Teck noted that the panel reviewing that application concluded that the winter drilling program could potentially disturb the Ronald Lake bison, however, it would not likely result in bison moving large distances or not returning to the area after the disturbance.

[1815] ECCC stated that although that panel did make this conclusion, the comments were provided in 2013 and there has been considerably more information on the Ronald Lake bison collected since then. ECCC stated that both indigenous people and local trappers indicated that Teck's exploratory drilling work affected the distribution of the Ronald Lake bison, moving them out of the southern portion of their range. ECCC also stated that the herd may be affected by project-related aircraft as there have been observations of herd dispersal when helicopters are in proximity.

[1816] Teck incorporated the effects of sensory disturbance into their habitat models by delineating zone of influence; these zones of influence take into consideration anthropogenic disturbances and how they may influence habitat use. Teck stated that bison may habituate to anthropogenic disturbance and that bison seemingly respond more to hunting pressures.

[1817] ECCC states that there is evidence suggesting that the herd's current distribution may have been affected by recent disturbances. Data from ongoing telemetry studies also indicate that Ronald Lake bison avoid disturbances, in particular active disturbances during winter. ECCC also states that majority of the telemetry data used was collected after disturbance; therefore it becomes difficult to compare pre- and post-disturbance.

[1818] The Mikisew expert panel stated that both indigenous knowledge and western science indicates that female wood bison strongly avoid areas of human activity suggesting a real risk that the herd will move northward into Wood Buffalo National Park.

Analysis

[1819] The panel notes that there is clearly overlap of the project disturbance area and the bison seasonal habitat. It is possible that previous exploration activity and unregulated hunting could have resulted in

some displacement of the Ronald Lake bison and affected the distribution Teck used to define the range used by the bison. The project has the potential to displace the Ronald Lake bison although the direction and amount of displacement is uncertain.

[1820] The panel is of the view that while a drilling program may not have caused bison to move permanently from habitat where such activity takes place, because the drilling program was not continuous, this project will remove bison habitat over a substantial area for a long period of time before reclamation results in the reestablishment of bison habitat. Thus the project disturbance area is likely to displace bison to other habitat.

Carrying Capacity and Ronald Lake Bison Abundance

[1821] Teck's argued that within the herd's current range, loss of forage from direct and indirect effects of the Frontier project does not create food limitations. Teck suggests there is sufficient forage for the herd to not only maintain itself, but to grow.

[1822] Teck's estimate for carrying capacity is primarily based on forage quantity (kg/ha) in selected Ducks Unlimited Ecological Wetland Classification cover types. Teck provides an assessment of the Ronald Lake bison herd range and an indication of frequency of use. These values assess the potential effects of the project as they provide a quantitative measure of the areas that are used most frequently by collared bison. Using the utilization distribution estimates determines the effects of the project on nutritional carrying capacity of the range. Based on the analysis provided, Teck concludes that the Ronald Lake bison herd is not forage limited at base case and that the project (application case) will not affect the ability of the Ronald Lake bison range to support the herd at its current size.

[1823] Teck provided updates to winter forage carrying capacity estimates, which have been recalculated to consider the most current data available. These estimates are provided within the table below, compared against ECCC's carrying capacity estimates.

Table 17. Teck's and ECCC's comparative analysis of Ronald Lake bison range carrying capacity under base case and application case

Case	Teck		ECCC	
	Constraints	Carrying Capacity (Animals)	Constraints	Carrying Capacity (Animals)
Base case	Winter female 80% utilization	302	no constraints	502
	Population-level 95% utilization distribution	513	Forage constraint (sedge only)	342
	Bison study area	1 163	Land-cover constraint (non-treed habitat)	408

			Forage and land-cover Constraints	282
Application case	Winter female 80% utilization distribution	302	no constraints	305
	Population-level 95% utilization distribution	499	Forage constraint (sedge only)	215
	Bison study area	1 041	Land-cover constraint (non-treed habitat)	245
			Forage and land-cover constraints	177

[1824] Teck provided a population viability and carrying capacity analysis of the Ronald Lake bison with the following objectives:

- Develop baseline population models based on the best available information on wood bison demographics. Did not include harvest data.
- Conduct a sensitivity analysis of the baseline model to determine which parameters have the greatest effects.
- Determine effect of additional harvest-related mortality on abundance and viability.
- Determine effects of habitat loss that could result from the project.

[1825] Teck stated that all estimates of carrying capacity, a population size in which an environment can sustain a species indefinitely, exceeded the current population size of the Ronald Lake bison based on aerial survey data (133 animals in 2018), indicating that the herd is below the predicted carrying capacity of the ranges.

[1826] ECCC stated that the existing carrying capacity for bison in the area, delineated with a 99.9 per cent utilization distribution, is 502 bison in existing conditions and 305 bison in application case in a no forage or land-cover constraint scenario. In ECCC worst-case scenario, which include forage and land-cover constraints, these numbers drop to 282 bison in existing conditions and 177 bison in application case. This is below the upper confidence limit for population estimates, suggesting that the herd may become forage limited. ECCC stated that it is likely that under base case conditions the winter nutritional capacity does not limit the current herd size. However, ECCC's calculations suggest that the winter nutritional carrying capacity of the undisturbed portion of the herd's range in application case was lower than the current maximum estimated herd size, suggesting that the herd may become forage limited at full project buildout. ECCC acknowledged that additional studies are required to test and validate these findings.

[1827] Teck stated that based on recent results, the winter nutritional carrying capacity in the base case and the application case is not a limiting factor.

[1828] Mikisew used indigenous knowledge and western science to analyze predictions. Mikisew believed that the herd size is within the range of 150-200 and based on recent data from the Alberta government and indigenous knowledge that the population seems to be relatively stable. Mikisew stated that at average productivity, the Ronald Lake bison shows 73 per cent viability (chance to persist for 100 years). They also stated that a relatively high mortality rate or low productivity rate is currently keeping the Ronald Lake bison at about 200 individuals, regardless of carrying capacity. They also stated that there is potential for industrial activity to decrease viability of Ronald Lake bison due to the separation of males from females. The Mikisew expert panel said that the proposed project would reduce carrying capacity and increase predation, reducing the viability of Ronald Lake bison. They suggested viability can be increased with population persistence for the next 100 years only if calf production increases, mortality decreases and sufficient habitats are maintained.

[1829] Mikisew provided a cultural zone of influence, which is a cultural footprint area overlaid with preferred harvesting locations and industrial impact. They stated that, 3.5 per cent of preferred areas are currently impacted and that with foreseeable development this goes up to 11 per cent impacted and then with the Frontier project it goes up to 91 per cent impacted. The Mikisew expert panel stated that the majority of the unused high-quality habitat outside of the current home range is located within Wood Buffalo National Park and south of the project disturbance area. For female bison, 3 per cent of high-quality summer habitat and 2 per cent of high-quality winter habitat exists east of the current home range and outside of Wood Buffalo National Park. Less than 0.05 per cent of high-quality winter habitat is located in an area west of the current home range and south of Wood Buffalo National Park.

[1830] Based on Mikisew knowledge, the entirety of the project development area is within the wood bison range, which includes bison kill sites and bison environmental features. Mikisew states that they have observed that the current home range extends only as far south as the end of the proposed project development area.

[1831] Athabasca Chipewyan acknowledged that there may be habitat to which the Ronald Lake bison may move because of the project but note that such habitat is outside of the areas where they have traditionally hunted bison. Athabasca Chipewyan and Mikisew said they seek certainty that the Ronald Lake bison will be protected for cultural and indigenous use. Many indigenous communities in the area, including Mikisew and Athabasca stated their concern regarding subsistence use of bison, particularly due to restricted hunting of wildlife in the Wood Buffalo National Park.

[1832] Several hearing participants expressed concern that the proposed mine would disrupt critical habitat for the Ronald Lake bison herd and undermine the rights of local First Nations.

Analysis

[1833] The panel is satisfied that Teck's analysis of the carrying capacity of the Ronald Lake bison range as delineated by the 80 per cent and 95 per cent utilization distribution is reasonable and sufficient to enable projections as to the herd's numbers and sustainability given that these are the utilization distribution scenarios generally relied upon in the scientific literature. The panel finds that based on the information provided by Teck and the other parties that the Ronald Lake bison numbers are not limited by range carrying capacity. Even relying on the lower 80 per cent utilization distribution of available habitat Teck projects a carrying capacity of just over 300 bison, which is more than double the current population estimate.

[1834] The panel understands that the carrying capacity estimates developed by ECCC are lower than those developed by Teck and suggest that under certain conditions, the herd could become forage limited. However, the approach used by ECCC uses a number of very conservative assumptions and ECCC agreed that additional work was required to test and validate its findings. The panel acknowledges that there are alternative methods of calculating the carrying capacity of the range and that the use of different methods and inputs will produce differing results. The panel also recognizes that all of the results, including Teck's, are subject to some degree of uncertainty. The panel expects that as further work is completed as part of the federal recovery strategy for wood bison, that there will be an improved understanding of the location of critical habitat for the Ronald Lake bison and the carrying capacity of this habitat.

[1835] With respect to the population viability analysis provided by Mikisew and Athabasca Chipewyan, the panel notes that Mikisew suggests that a relatively high mortality rate or low productivity rate appears to be keeping the Ronald Lake bison at about 200 individuals, regardless of carrying capacity. However the panel acknowledges Mikisew and Athabasca Chipewyan's concern that by reducing habitat, the project will affect the carrying capacity of the range and this may in turn affect the viability of the herd.

Mortality

[1836] The Recovery Strategy for the Wood Bison (*Bison bison athabascae*) in Canada recognizes that the greatest threat to wood bison is the presence of exotic bovine diseases (brucellosis and tuberculosis). The short-term goal of the recovery strategy is maintaining Ronald Lake bison's disease-free status. This is meant to build the long-term strategies to build the population and distribution. The recovery strategy stated that one or more actions plans for wood bison will be complete by 2022.

[1837] Teck stated that as there is no clear evidence of an impermeable barrier between Ronald Lake bison and diseased bison in the park, the risk of disease transmission already exists in the base case. Teck acknowledged that should the Ronald Lake bison come into contact with the diseased bison in the park and become diseased, this would be of high environmental consequence. However Teck maintained that the Ronald Lake bison are unlikely to shift their range northward and the risk of disease transmission will not increase as a result of the project. Teck concludes that as there is evidence of northerly travel by two

collared bison between 2013 and 2017, it is possible the Ronald Lake bison might move further north, with or without the project.

[1838] Parks Canada and ECCC maintained that the project will increase the risk of disease transmission, as it will push the Ronald Lake bison herd further north, into closer contact with diseased Wood Buffalo National Park bison. These agencies also suggest that increased linear disturbances in the herd's range will result in increased wolf predation. Teck countered that this is unlikely as the mine is not a linear disturbance.

[1839] Mikisew Cree First Nation expressed concern that the project would increase the potential for predation on bison.

[1840] The Ronald Lake bison was subject to unregulated hunting until 2016, when it was listed under the provincial *Wildlife Act*, restricting the non-indigenous hunt. The total numbers harvested annually to that time are unknown, however Mikisew Cree First Nation referred to a "bison slaughter" with bison sometimes being killed and only the head being taken. A member of the trapper panel also mentioned large numbers of bison being killed by non-indigenous hunters and expressed the view that poaching of bison by non-indigenous hunters might continue despite the bison being protected under the *Wildlife Act*.

[1841] First Nations members have voluntarily stopped hunting bison because of their reduced numbers.

[1842] Teck stated that reduction in mortality due to harvest restrictions should result in an increase in population abundance or stability.

Analysis

[1843] Based on the evidence the panel finds that the potential for interaction between the Ronald Lake bison and Wood Buffalo National Park herds is currently high. There are no known barriers which prevent interaction between the Ronald Lake bison and the bison in the park and there is evidence that some Ronald Lake bison already travel as far north as the park. What is less certain is the degree to which the project may increase the risk of contact and disease transmission. Given the loss of bison habitat, some displacement of the Ronald Lake bison will occur. How far, in what direction, and for how long is uncertain but the panel cannot rule out the possibility that the Ronald Lake bison could be displaced to the north, towards the park. Should the Ronald Lake bison be displaced to the extent that they come into contact with the bison in the park and become diseased, this would be a significant adverse effect of the project. Understanding what options exist to prevent or mitigate the Ronald Lake bison's potential interactions with diseased park bison is therefore necessary. Teck's proposed mitigation measures are discussed later in this section.

[1844] The new access the project affords the public may facilitate illegal hunting of the Ronald Lake bison. The panel shares the First Nations' view that the restriction on hunting of bison by non-indigenous

should continue to be enforced. The panel recommends that Alberta maintain the current prohibition on non-indigenous hunting of the Ronald Lake bison herd until a management plan is complete for the herd and the ongoing viability of the herd is assured.

Landscape Connectivity

[1845] Impacts to landscape connectivity may influence how the animals move across the landscape, affecting their access to forage and shelter and their interactions with predators and prey. Landscape connectivity is defined as the degree to which the landscape facilitates or impedes movement for wildlife.

[1846] Teck assessed the landscape connectivity as a measure of how animal movements across a landscape are facilitated or impeded by habitat features and the energy (amount of energy used to access something) costs associated with quality of their habitat (forage, shelter, predator-prey interactions). The objectives of the connectivity modelling included:

- Assess within-seasonal range and regional landscape connectivity
- Assess the effects of the project on connectivity within and around the range
- Assess the connectivity of bison habitat between the Ronald Lake bison range and range of diseased bison in Wood Buffalo National Park.

[1847] Teck's analysis suggested that higher concentrations of selected habitats are found in the northern part of the Ronald Lake bison study area than in the southern part. This assessment for landscape connectivity found that the north-south movement corridors are not restricted.

[1848] Teck's landscape connectivity model showed that 7.29 ha and 105.30 ha of regional high-connectivity spring and summer-fall habitat would be lost. There is no high-connectivity winter habitat within the project disturbance area. Within the spring and summer-fall home range of Ronald Lake bison, 6.48 ha (1.12 per cent) and 102.87 ha (3.95 per cent), respectively, of high-connectivity habitat would be lost. In spring and summer, habitat connectivity without the project is greater in the Ronald Lake bison 95 per cent utilization distribution as compared to with the project disturbance area, and in winter there is a less than 1 percentile difference in the mean habitat connectivity. Teck did not consider any of the differences to represent a significant change.

[1849] Connectivity of bison habitat within the 95 per cent utilization distribution varies spatially and temporally, with connectivity highest in the spring season. The connectivity by season speaks to the ability to move to certain habitat preferences during certain times of the year for calving, feeding, overwintering, etc. This also provided insight into any constraints or limitations the bison may be exposed to throughout the seasons.

[1850] In the winter, a large area of low connectivity is located in the south and east side of the 95 per cent utilization distribution but good north-south connectivity exists further west. In the summer-fall

seasons, the north-south connectivity is good further east (95 per cent utilization distribution) and poorer to the west. Teck concludes that although the range shifts seasonally, there are no year-round barriers to movement within the Ronald Lake bison range. Teck also concludes that the area covered by the project disturbance area does not appear to provide an important north-south movement corridor in spring and winter, and therefore, is predicted to have little to no effect on the ability of the Ronald Lake bison to move around the project disturbance area in these seasons. In the summer, a relatively higher amount of high-connectivity habitat within the proposed project footprint exists on land to the west, and average connectivity is marginally higher within the 95 per cent utilization distribution. Teck stated that the habitat connectivity between the project and the Athabasca River is similar or better than that within the project disturbance area. Therefore, Teck concludes, that the summer north-south movement west of the project should not be constrained.

[1851] ECCC stated that the slopes of the Birch Mountains form a semipermeable barrier and that along the east side of the Athabasca River the recent forest fire reduced their potential preferred habitat so movement eastwards would be unlikely. ECCC agrees that there is high permeability across the landscape, but when movements of individuals are considered, there is an existing trail system that bison use on the landscape and a prominent ridge that is heavily used extending from the north end of Teck lease all the way up to Ronald Lake and Diana Lake (local name for Dianne Lake). Indigenous evidence supports this as well. This existing movement is corroborated with Teck's wallow study, showing a line of wallows along this ridge. ECCC stated that the bison will most likely move in that northerly direction following the path of least resistance while some individuals may move elsewhere on the landscape.

[1852] Athabasca Chipewyan's view is that although the bison may be able to move into other suitable habitat, not all of this habitat is suitable for the practice of indigenous use and will affect bison harvest.

[1853] Mikisew Cree First Nation stated that the current home range is relatively well connected to habitats south and northwest of the project disturbance area in summer and winter. There is low to medium-low connectivity to areas west of the home range in all seasons; there are opportunities for connectivity to the northwest of home range (especially during winter). Indigenous knowledge suggests that the areas north of the home range are too wet in the summer. Mikisew Cree First Nation stated that there is also high-quality habitat available and accessible outside of the current range of the Ronald Lake bison. Mikisew Cree First Nation state the project disturbance area will sever connectivity to the south, causing a loss of 20 per cent of high-quality summer habitat and 7 per cent of winter habitat. Mikisew Cree First Nation state that the Ronald Lake bison appear largely unwilling to cross the McIvor River and Buckton Creek, therefore habitat loss in the southern portion of their home range may have serious negative implications for their long-term viability.

[1854] Mikisew Cree First Nation elders stated that although the Ronald Lake bison herd seems to still be healthy, they attribute this to their accessibility to wetlands. However, in some regions where bison once roamed, water has dried up and bison are no longer observed.

[1855] Mr. Beauchamp, of Birch Mountain Outfitter Corp., stated that currently the bison use the area around Dianne Lakes (known locally as Diana Lake) and Ronald Lake for winter feeding, and again, the bison go north around the lakes in May to have their calves. He also stated that a natural barrier of thistles keeps the Ronald Lake bison from interacting with bison in Wood Buffalo National Park.

[1856] Mr. D. Shevolup (trapper) stated that the Buckton Creek muskeg and watershed are essential for bison winter forage and suggests that the project will displace Ronald Lake bison from this area.

Analysis

[1857] The panel heard differing evidence as to the project's potential effect and the degree of such effect on landscape, and therefore, habitat connectivity. Based on the information provided by Teck's landscape connectivity model and its other evidence, as well as evidence provided by ECCC, the panel is satisfied that sufficient connectivity between Ronald Lake bison seasonal habitat will remain to enable seasonal movement although the project disturbance area will eliminate some connectivity.

[1858] The panel notes that the project has the potential to cause the northward movement of Ronald Lake bison since a south to north-trending ridge has been identified as already being used for this purpose.

[1859] The panel understands the concern expressed by Mikisew Cree First Nation that the project disturbance area will prevent the bison from accessing habitat to the south of it. The panel notes that Mikisew has withdrawn its objection to the project, subject to certain conditions being met.

Proposed Mitigation and Monitoring

[1860] Teck provided mitigation strategies in its draft Ronald Lake bison mitigation, monitoring, and adaptive management plan. Teck's Ronald Lake bison mitigation program overview includes limiting access, carrying out progressive reclamation, reduce predator accessibility, assessment of biological factors influencing risk of disease and reduce noise/light pollution within safety limits. Teck stated that the goals of the plan are as follows:

- Reduce changes in bison habitat, landscape connectivity and mortality risk.
- Monitor effectiveness of mitigation designed to reduce direct and indirect habitat loss and change in landscape connectivity and mortality risk.
- Adapt mitigation designed to reduce changes in bison habitat, landscape connectivity and mortality risk, based on monitoring outcomes.
- Assess biophysical factors influencing the risk of contact between the Ronald Lake herd and the Wood Buffalo National Park bison to inform surveillance and risk management strategies.

[1861] Teck committed to participate in the Ronald Lake technical team until 2020; as a member they will attend meetings and work with the team to meet its mandate. If the project is approved, Teck would consider further in-kind and financial assistance. If requested, Teck will participate in the co-management of the herd. The work of the technical team is to gather information on the spatial distribution of the Ronald Lake bison, forage and habitat, predation interactions, mitigation strategies and reclamation so as to reduce the potential adverse effects of the project. The technical team's findings will be incorporated into the Ronald Lake bison monitoring and adaptive management plan.

[1862] Teck proposed the following options to mitigate the risk of Ronald Lake bison contacting diseased bison:

- Negotiate a joint management framework.
- Construct a bison fence at the southern edge of the Wood Buffalo National Park diseased Delta bison population range. A buck and pole fence design has been used in Yellowstone National Park to limit bison movement.
- Bison management and control zone south of a proposed fence. A bison control area is a "bison-free area." In the bison control area all signs of bison are reported, which are then investigated and bison removed (lethal). This prevents diseased bison from coming in contact with disease-free bison.
- Captive-breeding and reintroduction programs to preserve genetics and reestablish healthy populations in case the Ronald Lake bison become diseased.
- Maintain available habitat above Ronald Lake bison resource requirements. This would require working with AEP through a cooperative management plan. If densities increase beyond carrying capacity, Teck has suggested the following adaptive management strategies.
- Increased hunting pressure.
- Use prescribed fires to increase winter nutritional carrying capacity.

[1863] Parks Canada addressed some of Teck's mitigation measures. It submitted that fences would have ecological consequences such as habitat fragmentation, terrain logistics and ensuring habitat availability for Ronald Lake bison. Control zones would have ecological implications to both the Ronald Lake bison and the Delta subpopulation of bison. Monitoring and surveillance is unlikely to be effective due to access constraints. Prescriptive burns require an environmental setting which may not exist for 5 to 10 years and in the meantime the two herds may come into contact.

[1864] ECCC's view is that the project represents a high risk to the Ronald Lake bison and that some of Teck's proposed mitigation measures are uncertain or potentially ineffective.

[1865] ECCC suggested Teck fund an independent evaluation of mitigation measures to prevent range shift and contact between the Ronald Lake herd and diseased Delta wood bison herd in Wood Buffalo

National Park. The results of the evaluation should be used by Teck to update its mitigation measures and adaptive management planning throughout the life of the mine.

[1866] ECCC advocated for Teck to continue to fund studies, as part of a follow-up monitoring program, on the Ronald Lake bison herd movements, habitat use, and behaviour of the herd prior to, during and following project construction. The studies should be undertaken for the duration of the project, and used to inform Teck's development of mitigation measures and adaptive management efforts to reduce project effects.

[1867] ECCC requested Teck fund an independent study of the landscape features and habitats between the Ronald Lake and Delta wood bison herds to identify potential movement corridors between the herds to inform mitigation measure and adaptive management planning. ECCC also recommended Teck to financially support an independent study to assess the range, movements and habitat use of diseased Delta bison in Wood Buffalo National Park to inform the development of mitigation measures and adaptive management planning. These studies should be completed prior to project construction. Lastly, ECCC suggested that Teck fund an independent study to monitor the disease status of the Ronald Lake herd at regular intervals throughout the duration of the project.

[1868] Parks Canada recommended that Teck fund an independent evaluation of its proposed mitigation measures by a committee of scientific and indigenous knowledge experts to prevent range shift and contact between the Ronald Lake bison herd and the diseased Delta bison herd in Wood Buffalo National Park. The results of this evaluation should be used by Teck to inform mitigation and adaptive management planning. Parks Canada Agency recommended that mitigation measures should be implemented in a timely manner to prevent potential adverse project effects on the Ronald Lake bison and monitoring of the herd should proceed throughout the life cycle of the mine.

[1869] Parks Canada supported a recommendation for Teck to fund an independent study of the landscape features and habitats between the Ronald Lake bison and diseased Delta bison herds in Wood Buffalo National Park to identify potential movement corridors between the herds to inform mitigation and adaptive management planning. The study should be completed prior to project construction. Parks Canada Agency suggested another independent study for Teck to undertake in order to assess the range, movements and habitat use of diseased Delta bison in Wood Buffalo National Park for the development of mitigation measures. This study should be completed prior to project construction

[1870] The Agency outlined its support for the bison protection measures being currently developed by federal departments. ECCC is completing a Species at Risk Imminent Threat Analysis for the wood bison and as part of that work and has been consulting with Mikisew Crew First Nation and other indigenous groups in the area. The Agency is encouraged by the co-management approach for the Ronald Lake bison with the Province of Alberta and Indigenous groups.

[1871] The Agency stated it is of the preliminary view that the biodiversity stewardship area along the southern boundary of Wood Buffalo National Park, as proposed by Mikisew Cree First Nation, could assist in serving multiple federal objectives that includes the protection of important habitat for the Ronald Lake bison and also habitat for other species (e.g., caribou, migratory birds).

[1872] Dr. Gilbert (Fort McMurray panel) stated that vaccination and treatment of wood bison against the bovine diseases are not feasible. Preventive measures are the only way to avoid disease transmission as there are currently no suitable vaccinations. He stated that monitoring and management of Ronald Lake bison and Wood Buffalo National Park bison is needed. There is potential for buffer zones, monitoring of sick animals, co-management with indigenous communities, and bison-proof fencing.

[1873] Mikisew Cree First Nation stated that if the project goes ahead, the focus needs to be on managing the threats to the herd and that the Ronald Lake bison technical team is a research focused initiative. A strong emphasis is placed on both the provincial and federal management of the herd to ensure its existence.

[1874] Mikisew Cree First Nation stated that the proposed biodiversity stewardship area is intended to mitigate the effects of the project, in particular habitat relating to Ronald Lake bison. Indigenous communities, including Athabasca Chipewyan First Nation, Mikisew Cree First Nation, Fort McKay First Nation, Fort McKay Métis, and Métis Local 1935 stated that the core winter range of the herd from Redclay Creek to Ronald Lake should be established as a conservation area as part of an overall wood bison management plan which integrates traditional knowledge

[1875] Mikisew, Athabasca Chipewyan and other indigenous communities recommended that Alberta commit to developing and funding a co-management plan for the herd and other wildlife in the area as a form of mitigation and monitoring.

[1876] The Athabasca Chipewyan First Nation and Teck jointly requested the following recommendations; that by 2020, key provincial and federal strategies and initiatives for management of the Ronald Lake bison be finalized, including the

- provincial Bison Management Plan,
- Parks Canada's bison disease transmission management plan, and
- federal Recovery Strategy and Action Plan for Wood Bison.

[1877] Teck's proposed monitoring program will measure the effectiveness of the abovementioned mitigation in reducing changes to the Ronald Lake bison habitat, landscape connectivity and mortality risk. Teck provided a monitoring program overview, which would include the following:

- Monitor bison use of reclaimed habitats across the project disturbance area to determine the composition and relative abundance of bison.

- Monitor the composition and abundance of bison in undisturbed plots within the zone of influence and comparable natural habitats to evaluate sensory disturbance effects.
- Monitoring the effectiveness of wildlife passage under the Athabasca River bridge and the river water intake to Dalkin Island for the north-south movement of bison.
- Investigate cause of bison mortality, if any, as a result of contact with project infrastructure or vehicles.

[1878] Teck also proposes potential support for government programs, camera programs and monitoring study of the Delta bison subpopulation in Wood Buffalo National Park.

Analysis and Findings

[1879] Based on the evidence provided by Teck and the other parties, it is evident that there is a lack of information and data available regarding bison habitat requirements, landscape connectivity, disease risk and degree of displacement of the Ronald Lake bison. There also exists disagreement regarding habitat carrying capacity and bison abundance.

[1880] In light of these knowledge and data limitations, assessing the need for, feasibility and effectiveness of mitigation strategies for the Ronald Lake bison is challenging. Management agencies and indigenous groups do not agree that the proposed mitigation measures will work in reducing project-related impacts to the Ronald Lake bison herd.

[1881] The primary mitigation for effects to wildlife and Ronald Lake bison is reclamation. While progressive reclamation is planned, significant reclamation does not begin until after 2035 and much of the project development area will not be reclaimed to a state that supports the return of wildlife until project closure sometime after 2066.

[1882] The panel notes that the Kitaskino Nuwenëné Wildland Provincial Park was established after the close of the hearing and includes much of the area of the proposed biodiversity stewardship area. While the new protected area provides a buffer for Wood Buffalo National Park and may offer some protection for caribou, it is not clear how it will mitigate effects to Ronald Lake bison.

[1883] Although the Frontier project will result in a loss of bison habitat for an extended period of time, this loss of habitat by itself is not expected to result in population-level effects to the Ronald Lake bison as the carrying capacity of the range appears to be sufficient to support the herd if the project is built. However the panel recognizes that there is some uncertainty associated with the amount and location of core habitat available and the carrying capacity of that habitat and would have benefited from more definitive information on the location and carrying capacity of core habitat. The panel recommends that as part of its work under the recovery strategy, ECCC complete its work to identify critical habitat and its carrying capacity for the Ronald Lake herd as soon as possible.

[1884] Of greater potential concern is the degree to which the project may displace the Ronald Lake bison to the north and increase the risk of the Ronald Lake bison coming into contact with the diseased bison within Wood Buffalo National Park. While Teck is of the view that the project will not increase the risk of contact and disease transmission, the panel is not as confident. Although Teck has identified a number of possible mitigation measures to reduce the potential for contact between the herds and disease transmission, the panel is concerned that none of the mitigations provided have been demonstrated to be effective. Some of the measures cannot be implemented by Teck alone as they would require the cooperation of provincial and federal land and wildlife management agencies. Other measures may not be feasible, are of uncertain effectiveness or may result in effects to other species. Given the uncertainties associated with the degree to which the project may increase the risk of contact and disease transmission and the importance of ensuring that the project does not increase this risk, further work on mitigation measures is required.

[1885] Prior to construction of the Frontier project, Teck is required to finalize its Ronald Lake bison mitigation, monitoring, and adaptive management plan and submit it to the AER for approval. The panel recommends that the Minister include this plan in the decision statement under *CEAA 2012* (see section 38). Development of the plan must include input from indigenous communities and relevant provincial and federal land and wildlife management agencies.¹⁴³ The plan must also consider the conditions below.

[1886] The panel agrees with Parks Canada and ECCC's recommendation that Teck fund an independent evaluation of its proposed mitigation measures to prevent range shift and contact between the Ronald Lake bison herd and the diseased Delta bison herd in Wood Buffalo National Park by a committee of scientific and indigenous knowledge experts. The results of this evaluation should be used to by Teck to inform mitigation and adaptive management planning. The panel will include this as a condition of approval.¹⁴⁴ The panel recommends that the Minister include the requirement for a follow-up program in the decision statement under *CEAA 2012* (see section 38).

[1887] The panel also agrees with ECCC's recommendation that Teck continue to fund studies, as part of a follow-up monitoring program, on the Ronald Lake bison herd movements, habitat use, and behaviour of the herd prior to, during and following project construction and will make this a condition of the project's approval.¹⁴⁵ The studies should be undertaken for the duration of the project, and used to inform Teck's development of mitigation measures and adaptive management efforts to reduce project effects. Given uncertainties about the degree to which the project may displace the herd and concerns about contact with the diseased bison in the park, ongoing monitoring is necessary. The panel recognizes that

¹⁴³ Draft *EPEA* Approval – Conditions 4.6.13 and 4.6.14(k)

¹⁴⁴ Draft *EPEA* Approval – Condition 4.6.28

¹⁴⁵ Draft *EPEA* Approval – Condition 4.6.24

Teck has committed to continue to provide in-kind and financial support for the work of the Ronald Lake Bison Technical Advisory Team and the work of this group may be used to satisfy this condition. However, as Teck does not directly control the work of the Technical Advisory Team, there is no certainty that this work will continue over the life of the project. In the event that the work of the Technical Advisory Team is discontinued before project closure, Teck must find an alternate way of monitoring the effects of the Frontier project on the Ronald Lake bison.

[1888] Given the importance of its work, the panel recommends that Alberta and Canada continue to support the work of the Ronald Lake Bison Technical Advisory Team to monitor the status of the Ronald Lake herd, inform recovery planning and identify the need for additional management actions. The panel also recommends that Alberta complete, in a timely manner, its provincial Bison Management Plan consistent with the requirements of the Wood Bison Recovery Strategy. The provincial plan should include a management plan for the Ronald Lake bison herd that identifies core habitat and is consistent with the requirements of the Wood Bison Recovery Strategy.

[1889] The panel supports the recommendations made by Athabasca Chipewyan and Mikisew related to a co-management approach for the Ronald Lake bison. Given the cultural importance of the Ronald Lake bison to Athabasca Chipewyan, Mikisew and other indigenous communities and their knowledge of the bison, their involvement in mitigation planning, monitoring and adaptive management is appropriate. The panel recommends that Alberta implement a co-management approach for the Ronald Lake bison involving indigenous groups, industry and relevant provincial and federal authorities.

[1890] The panel considered ECCC's recommendation that Teck fund an independent study to monitor the disease status of the Ronald Lake herd at regular intervals throughout the duration of the project. While the panel considers ongoing monitoring of the health of the herd to be important, the panel believes that monitoring the health of the herd is within the mandate of provincial wildlife management agencies and not something an individual proponent should be required to do. We have included a recommendation that Teck continue to support studies designed to monitor the health of the herd.

[1891] The panel also considered ECCC and Parks Canada's recommendation that Teck financially support an independent study to assess the range, movements and habitat use of diseased Delta bison in Wood Buffalo National Park to inform the development of mitigation measures and adaptive management planning. While the panel sees the value in such a study, our view is that such a study would more properly be undertaken by Parks Canada who are responsible for management of the herd within the park. The panel has therefore included a recommendation that Parks Canada complete this work. Further, the panel supports Athabasca Chipewyan's recommendation that Parks Canada develop a management plan to minimize the risk of disease transmission from diseased bison within the park and has included this as a recommendation to Parks Canada.

[1892] The panel understands that ECCC is currently completing an imminent threat assessment for wood bison. While the results of this assessment were not available in time to inform the panel's assessment of effects resulting from the Frontier project, the panel is satisfied that it has sufficient information to understand potential project effects and the adequacy of proposed mitigation measures. The panel recommends that ECCC complete the Species at Risk Imminent Threat Analysis for wood bison currently underway as soon as possible so that the results may be used to further inform federal decisions related to the Frontier project.

[1893] Given the uncertainties associated with the degree to which the Frontier project may displace the Ronald Lake bison and the feasibility and effectiveness of mitigation measures to prevent them from coming into contact with diseased bison within the park (a risk that already exists), the panel believes that establishing a Ronald Lake bison captive-breeding program to maintain a disease-free genetically distinct wood bison strain, one of the mitigations proposed by Teck, may be prudent. The panel recommends that Alberta and Canada, with input from indigenous groups, Teck and other stakeholders, consider the need and feasibility of establishing a captive-breeding herd nucleus of Ronald Lake bison that could be used to reestablish a disease-free herd in the event that the herd cannot be prevented from interacting with diseased Wood Buffalo National Park bison and becomes diseased.

Recommendations for Teck

[1894] The panel recommends that Teck

- Continue to provide in-kind and financial support to facilitate the research, data collection and analysis work of the Ronald Lake bison herd technical advisory team and support monitoring and mitigation measures undertaken by AEP or the Parks Canada Agency to maintain the health and viability of the Ronald Lake bison herd over the life of the project.
- Draw on work undertaken by the Ronald Lake bison herd technical team and information obtained through the implementation of Ronald Lake bison mitigation, monitoring, and adaptive management plan to guide studies Teck may fund on the herd over the life of the project.
- Support studies commissioned by responsible authorities to monitor disease status of the Ronald Lake bison over the life the project based on guidance of the Ronald Lake bison herd technical team.

Recommendations for Alberta

[1895] The panel recommends that Alberta

- Continue to support the work of the Ronald Lake Bison Technical Advisory Team to monitor the status of the Ronald Lake herd, inform recovery planning and identify the need for additional management actions.

- In collaboration with federal agencies, complete its provincial Bison Management Plan consistent with the requirements of the Wood Bison Recovery Strategy. The provincial plan should include a management plan for the Ronald Lake bison herd that identifies core habitat and is consistent with the requirements of the Wood Bison Recovery Strategy.
- Implement a co-management approach for the Ronald Lake bison involving indigenous groups, industry and relevant provincial and federal authorities.
- Maintain the current prohibition on non-indigenous hunting of the Ronald Lake bison herd until a management plan is complete for the herd and the ongoing viability of the herd is assured.
- Consider the need and feasibility of establishing a captive-breeding herd nucleus of Ronald Lake bison that could be used to reestablish a disease-free herd in the event that the herd cannot be prevented from interacting with diseased Wood Buffalo National Park bison and it becomes diseased.

Recommendations for Canada

[1896] The panel recommends that

- ECCC continue to support the work of the Ronald Lake Bison Technical Advisory Team to monitor the status of the Ronald Lake herd, inform recovery planning and support adaptive management.
- ECCC complete the Species at Risk Imminent Threat Analysis for the wood bison currently underway as soon as possible so that the results of the assessment may be used to further inform federal decisions related to the Frontier project.
- ECCC complete its work to define critical habitat for the Ronald Lake bison population as required by the *Recovery Strategy for the Wood Bison (Bison bison athabasca) in Canada* as soon as possible so that this work can further inform federal decisions related to the Frontier project.
- Parks Canada undertake a study to assess the range, movements and habitat use of diseased bison in Wood Buffalo National Park to inform the development of mitigation measures and adaptive management planning to protect the Ronald Lake bison; and, that Parks Canada complete its bison disease transmission management plan by 2020.
- ECCC consider the need and feasibility of establishing a captive-breeding herd nucleus of Ronald Lake bison that could be used to reestablish a disease-free herd in the event that the herd cannot be prevented from interacting with diseased Wood Buffalo National Park bison and it becomes diseased.
- ECCC participate in a co-management approach for the Ronald Lake bison involving indigenous groups, industry and relevant provincial and federal authorities should such an approach be established.

Significance of Project Effects

[1897] Based on the criteria provided in CEEA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

Ecological Context

[1898] The Ronald Lake bison herd is a small population of disease-free genetically distinct wood bison. There is a concern that development of the Frontier project could cause the Ronald Lake bison herd to move northward into Wood Buffalo National Park, which may result in the herd coming into contact with the herds within the park, which are known to carry bovine tuberculosis or brucellosis. Ronald Lake bison are protected as "subject animals" under Alberta's *Wildlife Act* and are a listed species under *SARA*. They are subject to the 2018 *Recovery Strategy for the Wood Bison (Bison bison athabascaae) in Canada* under *SARA*.

- Project effects on the Ronald Lake bison herd are likely. There will be a loss of bison habitat as Teck will clear most of the terrestrial local study area (the project disturbance area) and the critical habitat for the Ronald Lake bison has not been confirmed. The loss of habitat is likely to affect the distribution of the herd as some displacement of the herd will occur as a result of the project. However, the degree of displacement and the extent to which the project will increase the risk of the Ronald Lake bison herd contacting diseased bison in Wood Buffalo National Park is uncertain.
- The magnitude of project effects to bison habitat is considered high given that the loss of bison habitat will be over 20 per cent within the regional study area and habitat loss is a primary threat to bison sustainability. The potential for the Ronald Lake bison to become diseased through contact with diseased bison in Wood Buffalo National Park is also considered a high-magnitude effect. While this threat exists today without the project and there is uncertainty about the degree to which the project will increase this risk, if it were to occur it would represent a high-magnitude effect.
- Project effects to herd abundance and distribution and landscape connectivity are rated as moderate. While some displacement will occur the extent is uncertain. Habitat loss will have some effect on landscape connectivity; however significant connectivity is expected to remain during construction and operation of the project. It is expected that the magnitude of direct and indirect mortality effects will be low.
- The geographic extent of most effects is regional. As the Ronald Lake herd has relatively large home ranges and make use of a large south-north corridor as well as east-west movements, the affect will extend beyond the terrestrial local study area and regional study area. To the extent that they occur, mortality effects are expected to be local as they would occur in proximity to the project.

- The effects will be long term. Teck will not be able to reclaim the habitat lost, even with progressive reclamation, until after project closure. It may take until after closure for bison to return to successfully reclaimed landscapes.
- Most effects will be continuous occurring throughout the construction and operations phases and into closure. Mortality effects are expected to be periodic.
- Most effects are reversible in the long term. While the loss of the habitat in the project disturbance area will extend over a long period of time, progressive reclamation of the project area is expected to occur. However, should the Ronald Lake bison contract the bovine diseases, the effects would be irreversible.

Table 18. Summary table for significance of project effects to Ronald Lake bison herd

Ronald Lake bison	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Habitat availability	high	regional	long term	continuous	reversible	significant
Abundance & distribution	moderate	regional	long term	continuous	reversible	not significant
Mortality risk	low	local	long term	periodic	reversible	not significant
Disease transmission	high	regional	long term	continuous	irreversible	significant
Landscape connectivity	moderate	regional	long term	continuous	reversible	not significant

[1899] Based on the above, the panel finds that the project is likely to result in significant adverse effects to the Ronald Lake bison herd as a result of project effects to habitat availability and disease transmission. While project effects to habitat availability are expected to be reversible in the future, this will not occur for many years. Given the at-risk status of the herd and uncertainties associated with the location and carrying capacity of critical habitat for the herd, the panel believes that application of the precautionary principle is warranted in this circumstance and that it supports a determination of significant adverse effect. With respect to project effects related to disease transmission, the panel acknowledges that there is significant uncertainty about the degree to which the project may increase the risk of disease transmission. The panel also acknowledges that this risk exists today, without the project. However, should the effect occur, it would have significant consequences for the herd and the asserted rights, use and cultural practices of indigenous communities who are connected to the herd. The panel therefore concludes that it is appropriate to again rely on the precautionary principle and that this necessitates a finding of significance adverse effect.

[1900] While some effects to abundance and distribution, mortality risk and connectivity of the landscape are anticipated, the panel finds that these effects are not likely to be significant given the magnitude and reversibility of effects.

Cumulative Effects

[1901] Where there will be a residual effect of the project after mitigation, an assessment of cumulative effects is required.

Habitat Availability

[1902] For the Ronald Lake bison study area, under the best-case scenario, Teck reports

- A reduction of 888.2 ha (5.4 per cent) of high-suitability habitat at base case relative to predevelopment conditions (16 456.2 ha)
- A reduction of 3979.7 ha (25.6 per cent) of high-suitability habitat at application case relative to the base case (15 568.0 ha)
- A reduction of 4575.1 ha (29.4 per cent) of high-suitability habitat at planned development case relative to the base case (15 568.0 ha)
- A reduction of 1756.7 ha (4.4 per cent) of moderate-suitability habitat at base case relative to predevelopment conditions (40 103.9 ha)
- A reduction of 11 351.6 ha (29.6 per cent) of moderate-suitability habitat at application case relative to the base case (38 347.2 ha)
- A reduction of 11 784.8 ha (30.7 per cent) of moderate-suitability habitat at planned development case relative to the base case (38 347.2 ha)

[1903] For the Ronald Lake bison study area, under the worst-case scenario, Teck reports that for the planned development case there will be

- A reduction of 4963.0 ha (30.2 per cent) of high-suitability habitat at base case relative to predevelopment conditions
- A reduction of 1663.9 ha (14.5 per cent) of high-suitability habitat at application case relative to the base case (11 493.2 ha)
- A reduction of 2065.4 ha (18.0 per cent) of high-suitability habitat at planned development case relative to the base case (11 493.2 ha)
- A reduction of 11 765.8 ha (29.3 per cent) of moderate-suitability habitat at base case relative to predevelopment conditions

- A reduction of 4594.4 ha (16.2 per cent) of moderate-suitability habitat at application case relative to the base case (28 338.1 ha)
- A reduction of 4887.2 ha (17.2 per cent) of moderate-suitability habitat at planned development case relative to the base case (28 338.1 ha)

[1904] Teck states that high- and moderate-suitability bison winter feeding habitat occurs mainly in the east and northwest portions of the Ronald Lake bison study area.

[1905] Habitats selected by female bison in the winter at 80 per cent utilization distribution showed an additional 0.6 per cent loss at the planned development case. This core female winter range, as suggested by Teck, does not overlap the project development area. Habitat selection at the population level for all seasons at 95 per cent utilization distribution showed a 2.5 per cent loss from base case for the planned development case. Habitat selected within the winter Ronald Lake bison study area demonstrated a 7.0 per cent loss from base case to planned development case. Of the three ranges considered, Teck suggests that the Ronald Lake bison study area overlaps the most with the project development area.

[1906] Generally, there was a higher concentration, based on Teck's analysis, of selected habitats in the northern portion of the winter Ronald Lake bison study area, which included the shoulders of the Birch Mountains and on the east and north sides of winter Ronald Lake bison study area extending to Lake Claire in Wood Buffalo National Park.

[1907] Teck states that the risk of disease transmission might be related to habitat availability and forage availability at base case and then the direct or indirect losses of these associated with the project and other planned developments. As the female winter range and the population-level range have little overlap with the project area, the additional footprint of the project in addition to other potential developments has little effect. Teck states, as such, the project is not predicted to increase the likelihood of disease transmission between the diseased Wood Buffalo National Park population and the disease-free Ronald Lake bison. However, the magnitude associated with mortality risk is high because of the base case assessment of mortality risk associated with the risk of disease transmission.

[1908] ECCC states limitations in forage availability resulting in decreasing habitat could cause the bison to shift their ranges and seek new forage resources. It is critical to understand forage availability within the Ronald Lake herd's range and the associated carrying capacity to determine if application case or planned development case could trigger a dispersal of the Ronald Lake bison.

[1909] Teck stated that a loss of habitat for the predicted ranges and development cases would be unlikely to cause a shift in annual or seasonal ranges as a function of carrying capacity. Teck assessed the effects of direct habitat loss by modifying the carrying capacity of specific ranges under consideration (winter female 80 per cent utilization distribution, population-level utilization distribution 95 per cent and winter Ronald Lake biodiversity stewardship area) – each under varying development cases.

- Under scenarios that assumed no harvest, the Ronald Lake bison grew in abundance, approaching the carrying capacity estimated for each scenario. No scenarios indicated extinction in 100-year time span. Teck concluded that in the absence of non-project mortality factors, there is a negligible effect on the viability of the Ronald Lake bison.
- The addition of an annual harvest rate of 2.5 per cent also allowed the herd to grow in most cases; however, uncertainty around the trajectory over 100 years exists. Teck indicates that across all scenarios, the Ronald Lake bison showed a survival probability greater than or equal to 81 per cent during 100-year simulations.
- With a harvest increase to 5 per cent of initial herd size, the overall effect was a substantial reduction in population growth rates with greater variation around growth rates and mean population sizes. Teck stated this lowers the probability of survival for all scenarios, with herd-survival at 47.4 per cent during the 100-year period.

[1910] Teck stated that the magnitude of change for landscape connectivity, influencing habitat availability, at application and planned development case is low. Teck suggests that although selected habitat patches are not directly connected, there are no substantial impediments to movement across all the ranges.

Analysis and Findings

[1911] The panel finds that in the bison study area there is a substantial loss of both high and moderate potential bison habitat in the application and planned development cases relative to the predevelopment and base case conditions. The project accounts for the majority of this loss. For the best-case scenario, there is a 5.4% reduction in high potential habitat and 4.4% reduction in moderate potential habitat in the base case relative to predevelopment conditions. The project results in a loss of 25.6% of high potential and 29.6% of moderate potential habitat relative to the base case. In the planned development case this increases to a loss of 29.4% and 30.7% for high and moderate potential habitat respectively, relative to the base case.

[1912] The loss of this habitat and physical displacement from high utilization areas of their range will cause the bison to move. As some members of the Ronald Lake bison are known to travel northward into Wood Buffalo National Park there is the potential for Ronald Lake bison to interact with diseased park bison.

Significance of Cumulative Effects

[1913] As the Frontier project would be the largest industrial disturbance in the bison study area and accounts for the majority of bison habitat that would be lost, cumulative effects are similar to project effects.

- The effects are likely – project, combined with existing, approved and planned developments and activities will remove a significant per cent age of bison habitat in the bison study area, which may displace Ronald Lake bison northward. Some loss of habitat connectivity is also likely.
- The magnitude of effect on habitat availability and disease transmission is high. Under the best-case scenario at the planned development case there will be a 29.6 per cent loss of high-suitability habitat and a 30.7 per cent loss of moderate-suitability habitat. The habitat loss will result in displacement of the Ronald Lake bison increasing the potential for them to interact with diseased Wood Buffalo National Park bison.
- The geographic extent is regional – Ronald Lake bison have a large range, including a south-north movement corridor, as well as east-west movement; the effect will extend beyond the terrestrial local study area and regional study area into Wood Buffalo National Park.
- The duration is long term. It will take until the post-closure period to reestablish bison habitat within the project disturbance area and for bison to occupy it.
- The majority of effects are continuous throughout the construction and operations phases of the project.
- The majority of effects are reversible. Habitat loss is reversible in the long term but should the Ronald Lake bison become diseased through displacement and contact with diseased Wood Buffalo National Park bison, these effects would be irreversible.

Table 19. Summary of significance of cumulative effects to Ronald Lake bison herd

Ronald Lake bison	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Habitat availability	high	regional	long term	continuous	reversible	significant
Abundance & distribution	moderate	regional	long term	continuous	reversible	not significant
Mortality risk	moderate	local	long term	periodic	reversible	not significant
Disease transmission	high	regional	long term	continuous	irreversible	significant
Landscape connectivity	moderate	regional	long term	continuous	reversible	not significant

[1914] The panel concludes that the project, together with other existing, approved and reasonably foreseeable projects, is likely to result in significant adverse cumulative effects to the Ronald Lake bison herd as a result of effects to habitat availability and disease transmission.

[1915] While some effects to abundance and distribution, mortality risk and connectivity of the landscape are anticipated, the panel finds that these effects are not likely to be significant given the magnitude and reversibility of effects.

Woodland Caribou

[1916] Woodland caribou populations are declining across most of their range due to human activities and they are listed as a threatened species under *SARA*. Provincially, they are listed as “threatened” under the *Alberta Wildlife Act*.

[1917] The woodland caribou population is the subject of the Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Woodland Population, in Canada (Environment Canada 2012a). The recovery goal for woodland caribou is to achieve self-sustaining local populations. Critical habitat for woodland caribou is identified for all ranges and the recovery strategy identifies a minimum threshold of 65 per cent undisturbed habitat for self-sustaining populations.

[1918] Boreal caribou conservation and recovery in Alberta is guided by the *Alberta Woodland Caribou Recovery Plan* (Alberta Woodland Caribou Recovery Team 2005) and *A Woodland Caribou Policy for Alberta* (Government of Alberta 2011). Alberta’s caribou policy states that “planning will focus at the caribou range level and...caribou population habitat objectives and specific measurable targets...[will be] range-specific.”

[1919] The Alberta Caribou Action Plan and Range Planning project was established in response to the federal *Recovery Strategy for the Woodland Caribou*. The project focuses on developing range plans and one or more action plans for the 15 woodland caribou populations in Alberta, including those in the vegetation and wildlife regional study area (Government of Alberta 2013b). Range plans are expected to outline how land and resource use will be managed to attain a minimum of 65% undisturbed habitat over time as identified in the federal recovery strategy. At the time of the hearing for the Frontier project, Alberta’s caribou range planning process had not been completed and range plans for the Red Earth, Richardson, and West Side Athabasca ranges were not available.

[1920] The project disturbance area is located between three woodland caribou ranges; the Richardson range to the east, the Red Earth range to the west, and the West Side Athabasca range well to the southwest. Although the project disturbance area does not overlap with any of these ranges Teck assessed the project’s potential effects on woodland caribou and their habitat. Teck considered caribou presence, habitat availability, landscape connectivity, mortality risk, abundance and distribution and then addressed mitigation and monitoring.

Study Area

[1921] The terrestrial local study area for wildlife includes the project disturbance area and a buffer area which is 500 m wide, except where it has been extended or truncated along the eastern margin of the Athabasca River. The wildlife local study area does not overlap the woodland caribou ranges. The closest distance to the Red Earth woodland caribou range from the terrestrial local study area is 5.9 km, and the closest distance to the Richardson range is 2.2 km. The Richardson range is located on the east side of the Athabasca River and the Red Earth and Richardson woodland caribou ranges are located about 32 km from each other. The vegetation and wildlife regional study area overlaps portions of the three caribou ranges.

[1922] Developed in response to indigenous community concerns, Teck's caribou range study area is a distinct study area established to quantitatively assess direct effects of the project and cumulative effects on boreal caribou within their identified ranges. The study area is 309 600 ha and includes portions of the Red Earth, Richardson and West Side Athabasca River ranges that overlap the vegetation and wildlife regional study area. The caribou range study area Teck used to evaluate effects overlaps the following caribou ranges as follows; Red Earth by 2.1 per cent, West Side Athabasca River by 2.3 per cent, and Richardson by 31.5 per cent.

Analysis

[1923] The panel is satisfied that the study areas defined and used by Teck are appropriate for the purposes of determining the project's potential effects on woodland caribou.

Habitat Availability

[1924] Woodland caribou are typically found in lowland muskeg (peatland) areas with low snowpack. Their winter diet consists primarily of terrestrial lichens and forbs. Mature and old-growth coniferous forests are important for woodland caribou year round as lichens are most abundant in these forests. There are instances where they occasionally feed in young stands after fire.

[1925] Teck's evidence of woodland caribou using the terrestrial local study area during baseline surveys is limited to a single incidental observation (pellet survey). Teck reported that 2005 to 2014 caribou collar data provided by ESRD in the Red Earth, Richardson, and West Side Athabasca River ranges, indicate that caribou are primarily restricted to their respective ranges. The data also showed that five woodland caribou from the Red Earth caribou herd (of 42 collared individuals) were within or near the northwest portion of the terrestrial local study area boundary at some point between 2011 and 2014. The data also indicated seasonal home range overlap with the terrestrial local study area, which was limited to late winter and early spring, with activity limited to the northwest perimeter. See map in [Figure 6](#) for potential movement corridors.

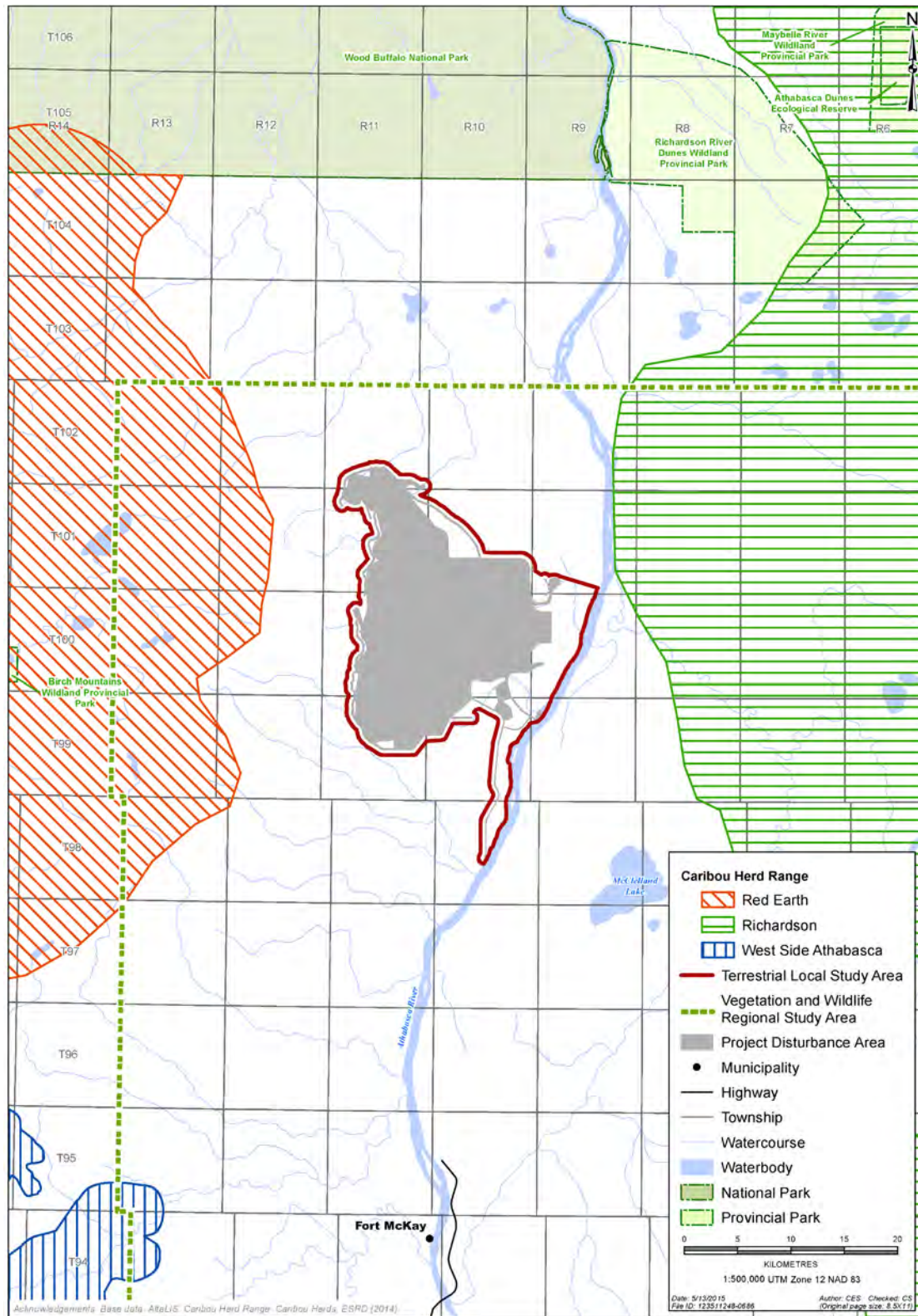


Figure 6. Caribou ranges

[1926] Teck acknowledged that development of the north pit is expected to have direct effects on habitat with high and moderate suitability for caribou. Woodland caribou are typically found in lowland peatland areas with low snowpack which occur in this area.

[1927] Within the terrestrial local study area, Teck reported that

- there is 345 ha of high suitability and 140 ha of moderate-suitability caribou habitat available at base case (2066).
- at application case (maximum buildout in 2066) there is a reduction in high-suitability habitat of 304.5 ha (88.3 per cent reduction) and a reduction in moderate-suitability habitat of 101.1 ha (72.2 per cent reduction) relative to the base case.

[1928] Teck indicates that within the terrestrial local study area, woodland caribou winter habitat decreases from base case, to application case, and prior to reclamation. Some scattered high- and moderate-suitability winter habitat along the eastern edge of the terrestrial local study area is expected to remain. Teck concludes that the environmental consequence of the project's geographic extent will be regional, with a long duration and isolated frequency. The effects are irreversible due to the lack of peatland reclamation success, resulting in a moderate consequence. Teck recognized that the project will have an effect on high- and moderate-suitability habitat and that the environmental consequence for the regional study area is considered high as peatlands are not routinely reclaimed. However, Teck stated that this predicted magnitude should be considered conservative as peatlands are found elsewhere in the region.

[1929] In the vegetation and wildlife regional study area, Teck reports the following reductions in habitat availability:

- Under the best-case scenario
 - A reduction of 315.0 ha (or 0.5 per cent) for high-suitability habitat in the application case at maximum buildout (2066) relative to the base case (69 801.6 ha).
 - A reduction of 205.0 ha (0.1 per cent) for moderate-suitability habitat in the applications case at maximum buildout (2066) relative to the base case (157 663.8 ha).
- Under the worst-case scenario
 - A reduction of 309.0 ha (0.7 per cent) for high-suitability habitat in the application case at maximum buildout (2066) relative to the base case (45 064.7 ha).
 - A reduction of 96.6 ha (0.1 per cent) for moderate-suitability habitat in the application case at maximum buildout (2066) relative to the base case (111 375.1 ha).

[1930] In the caribou range study area, Teck reports the following reductions in habitat availability:

- Under the best-case scenario
 - A reduction of 5180 ha (16.1%) for high-suitability habitat for the base case relative to predevelopment conditions (32 151.4 ha)
 - A reduction of 1000 ha (1.8%) for moderate-suitability habitat for the base case relative to predevelopment conditions (55 561.2 ha).
- Under the worst-case scenario
 - A reduction of 12 360 ha (38.4%) for high-suitability habitat for the base case relative to predevelopment conditions (32 151.4 ha)
 - A reduction of 10 316 ha (18.6%) for moderate-suitability habitat for the base case relative to predevelopment conditions (55 561.2 ha)

[1931] In the caribou range study area, there is no further decrease at application case or planned development case because neither the project nor any planned developments overlap the caribou range study area.

[1932] ECCC agreed that the project occurs outside of the designated caribou ranges as delineated. ECCC stated that although critical habitat will not be affected by the project, the project will affect woodland caribou. Critical habitat for woodland caribou is identified within areas designated as caribou range in the recovery strategy. However, the information on ranges is limited and may be updated as more information is provided. The recovery strategy also recognizes the importance of areas between ranges to connectivity. These regions are deemed “important areas” and can be within or outside of designated caribou ranges. The northwest portion of the project overlaps a portion of the “important area” identified for the Red Earth caribou herd.

[1933] ECCC noted that although the area impacted represents a small amount of habitat relative to what is available within the range, it contributes to the cumulative loss of habitat in the area.

[1934] Indigenous knowledge indicates potential habitat and connectivity for caribou also exists within the central and southern portions of the terrestrial local study area. Subsistence hunting, kill site locations, and recreational use maps provided by Mikisew and Athabasca Chipewyan identify historical and current use of the habitat within the project disturbance area. Although an important species in the past, with multiple kill sites recorded in the regional study area, they are not hunted by Mikisew due to their scarcity.

[1935] Athabasca Chipewyan stated that their baseline information sources include spatial data from approximately 100 interviews conducted the elders and land users. From this, Athabasca stated that the regional study area includes areas of known core caribou habitat, including calving areas and winter habitat.

Analysis

[1936] The panel notes that the currently defined ranges of the Red Earth, Richardson and West Side Athabasca woodland caribou herds do not overlap the terrestrial local study area. While the Frontier project is not located within core caribou habitat as currently defined, based on the incidental observation and radio collar data the panel accepts that woodland caribou are occasionally found in and use the northern portion of the terrestrial local study area. Based on indigenous knowledge, the panel also accepts that the terrestrial local study area has in the past provided woodland caribou habitat.

[1937] The panel finds that while the development of the north pit of the project will result in the loss of some caribou habitat, it is not currently defined as core habitat and is a small percentage of such habitats available within the regional study area.

[1938] Based on ECCC's evidence the panel understands that areas adjacent to the two herds' ranges may constitute "important" areas within the meaning of the caribou recovery strategy. However the frequency and extent of use and the importance of the northern portion of the terrestrial study area to be disturbed by the Frontier project in terms of habitat and connectivity between the existing ranges is not known. In the absence of completed range plans for the Red Earth and Richardson herds, it is difficult to fully understand the impact of developing this area and its potential impact on future recovery efforts.

[1939] The panel notes that range plans for woodland caribou in Alberta, including plans for the Red Earth and Richardson herds, are overdue. Although completion of the Alberta caribou range plans may be necessary to fully understand the impact of developing the north portion of the project disturbance area, should the project proceed development of this area will not occur for more than 30 years so there is time for Alberta to complete its range management planning process before development of this area occurs. The panel recommends that Alberta complete its range planning process for woodland caribou under the federal recovery strategy to inform the need for further mitigation measures and adaptive management for the Frontier project.

Landscape Connectivity

[1940] Teck stated that overall woodland caribou populations have high fidelity to traditional range and are largely non-interacting, even in the presence of disturbance. However, genetic evidence suggests there is a higher level of interchange between northeast caribou ranges compared to the northwest ranges, so Teck stated that it may be possible to have interchange between the Red Earth and Richardson ranges. Provincial experts generally assume that the two woodland caribou populations (Red Earth and Richardson) are largely separate and non-interacting.

[1941] ECCC said that although western science is limiting, indigenous knowledge, particularly from the Athabasca Chipewyan First Nation, indicates connectivity between the Red Earth and Richardson ranges. Over 40 per cent of suitable caribou habitat within the terrestrial local study area has been lost from recent disturbances which could account for the lack of collared caribou in the central and southern portions.

[1942] Both Teck and Athabasca Chipewyan identified the northern portion of the project area to be of importance as a movement corridor.

[1943] ECCC concluded that the project is likely to directly impact the Red Earth and possibly the Richardson caribou herds based on information provided by Teck and Indigenous groups, which identified movement corridors within the project disturbance area.

Analysis

[1944] Based on the radio collar data and other information presented by Teck and the indigenous groups, the panel accepts that the northern portion of the terrestrial local study area may still serve as a caribou movement corridor. However, given the limited number of individuals that appear to be using this area, the frequency and current importance of this area as a movement corridor is uncertain.

Mortality Risk

[1945] Teck stated that direct mortality from the project could result from collisions during vegetation removal, overburden grading, excavation and vehicle traffic. Teck considered the probability of caribou contact with equipment to be low because recent data indicates that caribou do not frequent the project disturbance area and the project does not overlap identified caribou ranges. Given the low density of caribou in the terrestrial local study area, Teck stated that the mortality risk from vehicle collisions is negligible.

[1946] Teck indicated that the direct mortality risk for caribou associated with habitat loss within the caribou range study area is negligible; however several indirect effects on caribou are of concern. The construction, operation, reclamation and closure may affect abundance and distribution of predators. Teck stated this could increase predation on caribou in adjacent areas.

[1947] Teck stated that altered habitats and altered predator-prey dynamics cause the decline in woodland caribou. Predator numbers that are elevated due to alternative prey (deer or moose), add to this effect and continue the decline in caribou populations. Caribou which exhibit extra-range movements including north of the project disturbance area, may be at risk from heightened competition. Based on habitat suitability modelling for moose, habitat found along the eastern margin of Red Earth range (west) is low to nil for moose and deer, thus should not result in an increased number of predators there. The browse species which emerge following the Richardson fire may encourage higher densities of competitive ungulates adjacent to the caribou ranges. Thus, caribou using habitat north of the project disturbance area might be at higher risk of predation compared to predevelopment due to overlap of suitable habitat for moose and deer. At application case, increased human presence and development might displace wolves, moose and deer to areas where these species will be in closer proximity to caribou, increasing mortality risk. However, due to low habitat suitability adjacent to the Red Earth range

and limited anthropogenic disturbance to the north of the project disturbance area, Teck stated this is not an effect that will dramatically increase mortality.

[1948] ECCC's view is that the main threat to woodland caribou is the unnaturally high predation resulting from habitat fragmentation and human-caused loss of habitat. The project may affect direct habitat loss and affect movement of individuals between ranges. As a result, incidental predation could increase on the caribou that remain in close proximity to the mine.

[1949] Teck argues that the mine development is not similar to linear development when referring to the consequences of habitat fragmentation. Teck stated that predation rates on caribou along the periphery of the disturbance are a speculative conclusion from the Neilson and Boutin (2017) study referenced by ECCC. It is still unclear what influence the mine may have on caribou predation rates.

[1950] Elder Earl Evans of Northwest Territories Métis Nation spoke to the potential of chronic wasting disease and the impacts of the project on potential habitat for caribou, potentially pushing them into contact with chronic wasting disease.

Analysis

[1951] The panel is satisfied that the project's contribution to direct mortality risk to woodland caribou will be negligible. Since the project disturbance area lies between the two defined caribou ranges and woodland caribou from the adjacent ranges only appear to use the area occasionally, they are not likely to interact with project activities.

[1952] The panel accepts that increased linear disturbance and changes to predator-prey relationships can result in increased indirect mortality effects for caribou. However, the disturbance created by construction and operation of the project is not a linear disturbance in the same way that seismic lines and roads are. While it is possible that predation rates on caribou could increase along the periphery of the disturbance, the panel agrees with Teck that this is somewhat speculative and not likely to represent a significant source of increased mortality given that caribou do not appear to use the local study area with any frequency. The panel accepts that the project may displace predators (such as wolves) and other prey species (moose, deer) towards areas that are frequented by caribou and this could increase predation and the risk of indirect mortality. However, due to the low habitat suitability adjacent to the Red Earth range and limited anthropogenic disturbance to the north of the project disturbance area, the panel finds that this is likely to be a low to moderate-magnitude effect if it occurs at all.

Abundance and Distribution

[1953] Teck acknowledged that boreal caribou are declining across most of their range. Based on 2010 data, the Red Earth herd had an estimated population of 172 to 206 individuals and was declining at about 16 per cent annually. The Richardson herd had an estimated population of 150 individuals but the

population status was unknown. For the West Side Athabasca River herd the population was estimated to be 204–272 individuals and declining at about 22% annually.

[1954] Teck stated that the level of disturbance in both the Richardson and the Red Earth portions of the caribou range study area exceeds the disturbance management threshold identified in the recovery strategy with approximately 20 per cent undisturbed habitat remaining. The woodland caribou recovery strategy identifies 65 per cent undisturbed habitat as the minimum disturbance management threshold to sustain a population. This disturbance is expected to remain relatively stable for all of the assessment cases. The table below provides information regarding the disturbance footprint and indicates the area of anthropogenic and natural disturbance that currently exists within the caribou range study area.

Table 20. Area of disturbance at existing conditions

Caribou range	Caribou study area (km ²)	Area of disturbance (km ²)	Disturbance (%)
Richardson	510.6	413.9	81.0
Red Earth	2 223.0	1 816.5	81.7
West Side Athabasca	363.2	164.2	45.2

[1955] Teck stated that at application case the abundance and distribution of woodland caribou in the vicinity of the project within the regional study area will be influenced by the change in habitat availability followed by mortality risk.

[1956] Teck's position is that woodland caribou are only occasionally found in the local study area, based on radio collar data. Radio collar data between 2011 and 2014 indicated a small number of Red Earth caribou were using the northern extent of the terrestrial local study area (5 of 42 collared individuals). Teck's view is that this low use is not likely to represent a large cohesive group. Teck stated that the Frontier project may cause indirect changes to caribou interactions with moose or deer and habitat suitability due to predatory-prey interactions. Interactions are assumed to be minimal in the eastern portion of the Red Earth range, due to unsuitable habitat for moose or deer. Teck stated that project factors influencing caribou abundance and distribution are not expected to threaten the sustainability of the regional population.

[1957] ECCC does not agree with Teck's analysis of low probability of effects due to the low occurrences of the Red Earth caribou outside of designated range. However, since the range has not been extended to include this area, ECCC stated no conclusion can be made on whether the project will impact critical habitat.

[1958] ECCC stated that due to the disturbances in the area, there is potential that there are baseline information and data gaps for woodland caribou. While ECCC agrees with Teck that the project occurs outside of the caribou ranges, these ranges are based on the best available information provided at the time the caribou recovery strategy was developed. Therefore, occurrences of caribou outside of their

ranges should not be considered “extra-range” movements. ECCC states, that collectively, the information provided by Teck provides evidence that the range of the Red Earth herd is more extensive than the designated range shown in the recovery strategy and may extend northeastward into the Wood Buffalo National Park, overlapping with the northern portion of the project terrestrial local study area. This evidence corroborates Government of Alberta’s recent delineation of an “important area” for the Red Earth caribou, extending northeast of their range. This important area reflects the locations of collared caribou and the potential presence of biophysical habitat for caribou.

[1959] Indigenous groups stated that woodland caribou is an important species and resource, and changes to the distribution and abundance of the species may affect the groups’ cultural heritage or ability to continue to practice traditional land-use activities.

[1960] Smith Landing First Nation has observed changes to the woodland caribou over the years as a result of development, including impacts to behaviour, habitat, ranging areas, population size, and predator-prey relationships. These changes are having an impact on Smith Landing First Nation ability to continue its cultural way of life and pass on traditional knowledge to future generations.

[1961] Mikisew and other indigenous communities stated that there are research gaps that should be fulfilled prior to the establishment of adaptive management actions. Many of the Mikisew, Athabasca Chipewyan and other indigenous communities’ concerns are related to caribou conservation policy gaps and the lack of policy enforcement by both federal and provincial governments.

[1962] Mr. Mark Worthing of Sierra Club BC stated that the project is completely incompatible with meeting the recovery and wellness strategies for caribou. Mr. Worthing states that there is not enough information regarding caribou movement, health and impacts from industrial habitat fragmentation.

Analysis

[1963] The panel acknowledges the importance of caribou to indigenous culture and their ability to practice treaty or aboriginal rights. With respect to Smith Landing First Nation’s concern about woodland caribou the panel notes that the caribou to which they referred are not adjacent to the project and thus not affected by it.

[1964] The panel acknowledges that woodland caribou populations are declining across most of their range due to human activities and some populations may decline to extirpation without significant management intervention. The panel also understands that Alberta recently suspended its caribou range management planning process pending further discussion with Canada concerning the social and economic effects of meeting the requirements of the federal recovery strategy for woodland caribou.

[1965] While the project will result in the loss of some caribou habitat and there is some evidence that caribou use this habitat, the habitat that will be lost is not located within any currently defined caribou

range or within an area that appears to experience significant use by caribou. The amount of habitat lost is also relatively small; approximately 300 ha of high-suitability habitat and 100 ha of moderate-suitability habitat. For these reasons, the panel finds that loss of caribou habitat due to the Frontier project is not likely to have a material effect on the abundance and distribution of caribou in the Red Earth, Richardson or West Side Athabasca herds. The panel acknowledges however that there is some potential for displacement and increased indirect mortality associated with predation and that this could affect the abundance and distribution of caribou. While the panel considers this effect to be of low magnitude, given the low population numbers and declining or uncertain status of the Red Earth and Richardson herds, these indirect effects may affect Alberta's ability to meet the *Recovery Strategy for the Woodland Caribou Population in Canada*.

Mitigation and Monitoring

[1966] Progressive reclamation is Teck's primary mitigation measure for effects to wildlife. Teck also stated that it would consider the use of conservation offsets to provide additional mitigation for residual project effects where necessary.

[1967] At closure, small patches of peatland habitat will occur in undisturbed areas within the terrestrial local study area. Reclamation will include habitat that will become moderately suitable for woodland caribou after a suitable cover of terrestrial lichens regenerate. Teck indicated that lichens would be included as part of reclamation. However no high- and moderate-suitability winter habitats are assumed to be created through reclamation as peatlands are not routinely included in reclamation planning as the research is in its infancy stages. The success of peatland restoration is unknown and is not currently a viable mitigation measure.

[1968] ECCC agreed that reclamation of peatland is not currently possible, and lichen regeneration typically occurs in stands of greater than 51 to 120 plus years of age.

[1969] Teck stated that its project-specific mitigation will aid in reclaiming contiguous blocks of suitable habitat that will facilitate woodland caribou movement in the northwest portion of the regional study area following closure. As for connectivity within the northern portion of the project disturbance area, the mining sequence suggested by Teck will allow for this area to remain undisturbed for up to 30 years after project start-up. Teck committed to participate in caribou-focused habitat restoration projects and opportunities to restore linear features, including committing additional funds, outside of the project disturbance area, to reclaim linear disturbances in response to community concern. Teck gave this as a commitment, during the hearing proceedings, rather than an acceptance of a condition as part of their approval. Habitat restoration areas have not yet been identified by Teck but the Athabasca Chipewyan indicated some of those could occur within the proposed biodiversity stewardship area.

[1970] Teck's draft wildlife mitigation and monitoring plan does not specifically address monitoring of woodland caribou. However Teck indicated that if warranted it will implement mitigation and monitoring measures related to changes in incidental predation on caribou. Indigenous communities stated that there is a need to consider mitigation measures related to landscape connectivity specific at the north end of the project.

[1971] Athabasca Chipewyan First Nation and Mikisew Cree First Nation stated there is little to no assurance of government policy and stated that more protection effort needs to be prioritized, with additional efforts placed on restoring linear features and preventing further disturbances. Efforts should be focused on addressing the threat of fragmentation and restoration of existing ranges through the completion of the Alberta government's draft range plans.

[1972] Athabasca Chipewyan and Teck jointly developed objectives and mitigation and management commitments related to caribou. The jointly agreed to objective for caribou is to restore and maintain healthy, stable and self-sustaining woodland caribou herds in the Red Earth and Richardson ranges of sufficient size and stability to support Athabasca Chipewyan biodiversity objectives, Athabasca Chipewyan traditional and cultural uses (including harvesting), and the cultural relationship between Athabasca Chipewyan and the caribou.

[1973] As part of the jointly developed mitigation and management commitments, Teck agreed to

- work collaboratively with Athabasca Chipewyan through participation agreement implementation with respect to Teck's wildlife mitigation, monitoring, and adaptive management plans, including those that pertain to caribou;
- direct progressive reclamation of the project with a view to restoring high-quality caribou habitat in the project area as quickly as reasonably possible;
- participate in caribou habitat restoration projects and opportunities to restore linear features outside the project development area in the ranges of the Red Earth and Richardson ranges, to be informed by Teck's collaboration with Athabasca Chipewyan on Teck's biodiversity management planning processes;
- establish policies restricting employees from conducting any hunting while employed by Teck;
- establish policies regarding use of roads to avoid collisions with caribou and other wildlife; and
- participate in and support regional initiatives regarding management of caribou, including working collaboratively on those Crown strategies and plans set out below.

[1974] Athabasca Chipewyan and Teck jointly requested the panel make the following recommendations to the Crown in support of the caribou objectives:

- By 2020, the implementation of critical provincial and federal management plans regarding woodland caribou in northeastern Alberta, particularly the Red Earth and Richardson range herds, that will advance the federal goal of 65% undisturbed habitat, including
 - the provincial Woodland Caribou range protection plan and
 - the federal Recovery Strategy and Action Plan for Woodland Caribou.
- A co-management role for Athabasca Chipewyan in the development and implementation of the abovementioned Crown management plans related to the woodland caribou.
- By 2020, the development and implementation of a conservation offset program to allow Teck, as prioritized through collaboratively developed biodiversity management plan, to participate in the reclamation of linear disturbances in caribou habitat outside of the project area.
- By 2020, the development and implementation of criteria, indicators and thresholds to track and validate the health, stability and sustainability of the caribou, including
 - population numbers and demographics and
 - the quality and quantity of habitat, including critical habitat.

[1975] The Mikisew-Teck jointly proposed conditions and recommendations did not provide any specific recommendation related to caribou but Mikisew and Athabasca Chipewyan both developed jointly proposed conditions and recommendations with Teck related to development of the north pit and establishment of the biodiversity stewardship area which have implications for caribou. These conditions and recommendations are discussed in the sections “[Mine Planning and Resource Conservation](#)” and “[Biodiversity](#).”

[1976] Mikisew Cree First Nation stated that Teck did not provide concrete mitigation measures that could be employed to alleviate impacts on caribou habitat and caribou movement north of the project disturbance area. Mikisew stated that there is need for research gaps to be fulfilled prior to adaptive management actions. Mikisew also suggests a habitat restoration program.

[1977] ECCC recommended that Teck develop and implement a habitat compensation plan within the Red Earth caribou range prior to project construction to mitigate loss and reduce cumulative effects. ECCC recommended that Teck use a compensation plan ratio of 4:1 based on the amount of moderate and high-quality caribou habitat the project would disturb whether within a defined range or not. Teck noted that the project is not located in a caribou range and suggested that this is not an appropriate condition. Teck stated that it does have the ability to become involved in caribou-focused habitat restoration projects and has committed funds to reclaim linear disturbance in response to indigenous concerns.

[1978] ECCC recommended that Teck complete a comprehensive field study to determine movements of Red Earth and Richardson caribou across the Athabasca River and that movement of caribou across the Athabasca River adjacent to the mine should be monitored throughout the project. Teck argued it does not have scope of authority to conduct this work as industry cannot deploy radio collars on animals. Teck will however support further study of potential caribou movement corridors if work is prioritized by the Oil Sands Monitoring Program.

[1979] ECCC recommended that Teck monitor wolves and caribou in the vicinity of the mine prior to and following project construction to determine if incidental predation on caribou increases following mine construction. ECCC suggested Teck work with Alberta to implement appropriate mitigation measures.

[1980] Athabasca Chipewyan First Nation discussed how the biodiversity stewardship area is needed to accommodate caribou species that they rely on. Indigenous communities stated that there is a need to consider mitigation regarding landscape connectivity at the north end of the project area.

Analysis

[1981] As discussed for bison, while reclamation is the primary mitigation measure for project effects to wildlife, significant reclamation does not begin until after 2035 and much of the project development area will not be reclaimed to a state that supports the return of wildlife until project closure sometime after 2066. Additionally, for caribou, the inability to reclaim peatlands and the long time required for lichens to become reestablished in the reclaimed landscape means that areas of high- and moderate-suitability habitat lost as a result of the project will not be reestablished in the closure landscape, at least for the foreseeable future.

[1982] While Teck has indicated it will consider the use of conservation offsets to mitigate the residual effects of the project where necessary, it did not provide or commit to any specific offset proposals related to caribou. Teck did state that it could participate in caribou-focused habitat restoration projects and had committed funds to reclaim linear disturbances in response to indigenous concerns. Teck also stated that it is willing to enter into conservation agreements with ECCC, with input from AER and AEP, to achieve conservation and biodiversity offsets while acknowledging that the Government of Alberta has no legislation or policies in place to accommodate such offsets, as discussed in section 25, "[Biodiversity](#)."

[1983] In the absence of a regulatory requirement and policy direction for the use of offsets and given that the caribou habitat that will be lost as a result of the project is relatively small and not located in an area currently defined as core caribou range, the panel does believe a condition prescribing a specific level of offset is warranted. The panel accepts Teck's commitment that it will participate in caribou restoration projects and recommends that Teck work with AEP and indigenous communities to identify appropriate caribou-focused restoration projects to participate in.

[1984] With respect to the Athabasca Chipewyan–Teck recommendation that Alberta develop and implement a conservation offset program the panel has included a recommendation that Alberta consider providing further policy direction or guidance on the use of conservation offsets as part of any future updates to *LARP*. This is discussed in section [25](#), “[Biodiversity](#).”

[1985] The panel has included a recommendation that Alberta complete its range planning process for woodland caribou. If the range plans identify the northern portion of the project as an important area for caribou as suggested by ECCC, the need for conservation offsets can be reconsidered at that time. Development of the northern portion of the project area will not occur for about 30 years.

[1986] The panel also supports the joint Athabasca Chipewyan–Teck recommendation that Alberta and Canada develop and implement criteria, indicators and thresholds to track and validate the health, stability and sustainability of the woodland caribou, including population numbers and demographics and the quality and quantity of habitat, including critical habitat.

[1987] The panel supports the concept of a co-management role for Athabasca Chipewyan, Mikisew and other indigenous groups in the development and implementation of management plans for woodland caribou given the cultural importance of caribou and indigenous knowledge related to this species. The panel recommends that Alberta and Canada consider implementing a co-management role for indigenous communities in the development and implementation of management plans for the Red Earth and Richardson herds.

[1988] The panel notes the commitments Teck has made with respect to woodland caribou including monitoring of predation, restoration of linear disturbance habitat outside of the project area, progressive reclamation of disturbed habitat, policies with respect to avoiding vehicle collisions, and collaborative planning with respect to north pit development. The panel expects Teck to honour these commitments.

[1989] The panel agrees with Teck that monitoring caribou movements is not something that individual operators have been required or can do and that if further information on caribou movements is required, that work should be prioritized and conducted as part of regional monitoring efforts. The panel accepts Teck’s commitment that it will support further study of potential caribou movement corridors if that work is prioritized by the Oil Sands Monitoring Program.

[1990] The panel does agree however with ECCC’s recommendation that Teck should monitor wolves and caribou in the vicinity of the mine prior to and following project construction to determine if incidental predation on caribou increases following mine construction. The panel will require that Teck describe, in its wildlife mitigation, monitoring and adaptive management plan for the project how it will monitor effects of the project on caribou, such as incidental predation, and how it will determine whether additional mitigation measures related to caribou are required.¹⁴⁶ The panel recommends that the Minister

¹⁴⁶ Draft *EPEA* Approval – Condition 4.6.9 and 4.6.10(c)

include a mitigation, monitoring, and adaptive management plan in the decision statement under *CEAA 2012* (see section [38](#)).

Recommendations to Teck

[1991] The panel recommends that Teck

- Participate in caribou-focused habitat restoration projects and opportunities to restore linear features outside the project disturbance area in the ranges of the Red Earth and Richardson herds. Work with AEP and indigenous communities to identify appropriate caribou-focused restoration projects to participate in.
- Support further study of potential caribou movement corridors across the Athabasca River if such work is prioritized by the Oil Sands Monitoring Program, which Teck is mandated to fund in accordance with section 2 of Alberta's *Oil Sands Environmental Monitoring Program Regulation*.

Recommendations to Alberta

[1992] The panel recommends that Alberta

- Complete and implement critical range management plans for woodland caribou in northeastern Alberta, particularly for the Red Earth and Richardson range herds.
- In cooperation with federal agencies, develop and implement criteria, indicators and thresholds to track and validate the health, stability and sustainability of the woodland caribou, including population numbers and demographics and, the quality and quantity of habitat, including critical habitat.
- Consider implementing co-management roles for Athabasca Chipewyan, Mikisew, and other indigenous groups in the development and implementation of the range management plans for the Red Earth and Richardson herds.

Recommendations to Canada

[1993] The panel recommends that Canada

- Complete the federal Recovery Strategy and Action Plan for Woodland Caribou, as it pertains to the Red Earth and Richardson range herds.
- In cooperation with provincial agencies, develop and implement criteria, indicators and thresholds to track and validate the health, stability and sustainability of the woodland caribou, including population numbers and demographics and, the quality and quantity of habitat, including critical habitat.

- Consider implementing co-management roles for Athabasca Chipewyan, Mikisew, and other indigenous groups in the development and implementation of the federal Recovery Strategy and Action Plan for Woodland as it relates to the Red Earth and Richardson range herds.

Significance of Project Effects

[1994] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

[1995] Boreal caribou are declining across most of their range and are listed under *SARA* as "threatened." Provincially, boreal caribou are considered at risk and are listed as "threatened" under the *Alberta Wildlife Act* because of reduced distribution, declines in the number and size of provincial populations, and threats of continued declines associated with human activities.

- The loss of caribou habitat is likely. Within the project disturbance area along the northern portion, high- and moderate-suitability habitat will be removed. This includes removal of peatlands which will not be recovered. Additionally, there is potential for the project to affect the habitat in the northern portion of the project disturbance area which may be providing landscape connectivity between herds.
- The magnitude will be moderate. The amount of habitat lost is relatively small and is not located within a designated caribou range. While there is some evidence of use of the northern portion of the project area by members of the Red Earth herd, use appears to be limited. While ECCC suggested this area may be an "important area" for caribou from the Red Earth herd, the importance of this area is not currently clear.
- The geographic extent is regional. While project effects to habitat will be limited to the project disturbance area, given that critical habitat for caribou is nearby the connectivity between ranges may be affected by structural changes to the landscape.
- The duration is long term. While development of the northern portion of the project area will not occur until relatively late in the life of the mine, reclamation will not return caribou habitat to its former state and function for many years and peatland restoration has yet to be demonstrated within the oil sands region.
- The frequency is isolated. Development of the northern portion of the project occurs relatively late in the life of the mine.
- Some of the effects to habitat are reversible in the long term, however loss of peatland habitat is considered irreversible.

[1996] Considering the above factors, the panel finds that the project is not likely to result in significant adverse effects to woodland caribou due to the limited amount of habitat lost as a result of the project, its location outside of currently defined caribou ranges and limited current use of the area by caribou.

Cumulative Effects

[1997] Where there will be a residual effect of the project after mitigation, an assessment of cumulative effects is required.

[1998] In the vegetation and wildlife regional study area, for the best-case scenario (with progressive reclamation) Teck reports the following reductions in habitat availability:

- From predevelopment to base case:
 - A reduction of 36 707 ha (34.5 per cent) for high-suitability habitat
 - A reduction of 5056 ha (3.1 per cent) for moderate-suitability habitat
- From predevelopment to application case at maximum buildout (2066):
 - A reduction of 37 021 ha (34.8 per cent) for high-suitability habitat
 - A reduction of 5261 ha (3.2 per cent) for moderate-suitability habitat
- From predevelopment to planned development case at maximum buildout (2066):
 - A reduction of 41 096 ha (38.6 per cent) for high-suitability habitat
 - A reduction of 7369 ha (4.5 per cent) for moderate-suitability habitat

[1999] In the vegetation and wildlife regional study area, for the worst-case scenario (no progressive reclamation) Teck reports the following reductions in habitat availability:

- From predevelopment to base case:
 - A reduction of 61 443 ha (57.7 per cent) for high-suitability habitat
 - A reduction of 51 345 ha (31.5 per cent) for moderate-suitability habitat
- From predevelopment to application case at maximum buildout (2066):
 - A reduction of 61 753 ha (58.0 per cent) for high-suitability habitat
 - A reduction of 51 442 ha (31.6 per cent) for moderate-suitability habitat
- From predevelopment to planned development case at maximum buildout (2066):
 - A reduction of 62 804 ha (59.0 per cent) for high-suitability habitat
 - A reduction of 53 044 ha (32.6 per cent) for moderate-suitability habitat

[2000] In the caribou range study area, for the best-case scenario (with progressive reclamation) Teck reports the following reductions in habitat availability:

- from predevelopment to the base case
 - a reduction of 5180 ha (34.5 per cent) for high-suitability habitat
 - a 1000 ha (1.8 per cent) reduction for moderate-suitability habitat
- There is no further decrease at application case or planned development case because neither the project nor any planned developments overlap the caribou range study area.

[2001] In the caribou range study area, for the worst-case scenario (no progressive reclamation) Teck reports the following reductions in habitat availability:

- from predevelopment to the base case
 - a reduction of 12 360 ha (38.4 per cent) for high-suitability habitat
 - a reduction of 10 316 ha (18.6 per cent) reduction for moderate-suitability habitat
- There is no further decrease at application case or planned development case because neither the project nor any planned developments overlap the caribou range study area.

[2002] Teck acknowledges that at planned development case, there is potential to have increased levels of human access as a result of newly created roads and other linear features which might increase probability of predators coming into contact with caribou; however, much of this activity may be spatially separated from designated caribou ranges.

[2003] The assessment showed that high- and moderate-suitability habitat remains relatively constant at base case through to planned development case in the regional study area and caribou range study area.

[2004] Teck suggested that at base case there is a low magnitude of change to connectivity. Teck found that data collected from 2008 and 2017 using radio collars does not show movement of the Richardson herd across the Athabasca River. Additionally, telemetry data collected for the Red Earth herd between 1995 and 2017 does not show caribou movement across the southern and central regions of the terrestrial local study area. The project is not located within any defined local woodland caribou population ranges; however Teck's base case assessment predicts potential caribou movements (therefore connectivity) between local populations which could suggest a potential affect

[2005] Teck stated that the cumulative effects assessment is conservative in terms of impact as the regional study area is not occupied by caribou. This conclusion aligns with the joint review panel decision report for the Jackpine mine expansion (*Decision 2013 ABAER 011*), in that the majority of caribou do not occupy habitat outside of their boundary range and much of the peatland loss caused by the project will not alter abundance and distribution.

[2006] Teck predicted a high environmental consequence for base case through to planned development case in the regional study area and a moderate environmental consequence for base case through to planned development case in the caribou range study area and that caribou will likely experience irreversible changes in a subset of their usable habitat.

Analysis and Findings

[2007] With respect to habitat loss, the panel does not expect the worst-case scenario to occur as reclamation is a regulatory requirement, and progressive reclamation is expected to occur. The panel acknowledges however that there is uncertainty about the amount and timing of reclamation throughout the regional study area and it is possible that the best-case scenario is overly optimistic.

[2008] Recognizing these uncertainties, for the best-case scenario the panel finds that the predicted losses of 34 to 38 per cent for high-suitability habitat in the vegetation and wildlife regional study area for the application and planned development cases relative to predevelopment conditions to be a high-magnitude effect. However most of this loss is predicted to occur at base case and the project and additional planned developments make only small contributions to this loss.

[2009] Similarly, the panel finds that a loss of 34.5 per cent of high-suitability habitat in the portions of the caribou ranges within the caribou range study area for the base, application and planned development cases to be a high-magnitude effect. However this loss exists in the base case and the project and other planned developments do not increase the amount of habitat loss within these portions of the caribou ranges.

Significance of Cumulative Effects

[2010] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project cumulative effects.

- The effects are likely. Loss of caribou habitat within the regional study area has already occurred and the project and additional planned developments will contribute to this loss.
- The magnitude of project effects combined with habitat loss in regional study area is high, given the level of woodland caribou habitat disturbance in the regional study area and adjoining herds' ranges. However the project makes a minimal contribution to this effect given the limited amount of high and moderate caribou habitat to be disturbed by the project.
- The geographic extent is regional. Habitat loss occurs throughout the regional study area and connectivity between ranges may be impacted.

- The duration of the effects is long term given the life of the project and other existing and planned developments, the time required for reclamation to return caribou habitat to its former state and function and that peatland restoration has yet to be demonstrated within the oil sands region.
- The effects are continuous as they occur throughout the construction and operations phases of resource development projects.
- Some of the effects on habitat are reversible in the long term, such as reclamation efforts completed in priority areas or compensation reclamation of linear features in the regional study area, but peatland reclamation is not considered achievable.

[2011] Considering the above factors, the panel finds that the project, in combination with other existing, approved and planned projects is likely to result in significant adverse effects to woodland caribou. Caribou may be declining to extirpation, the level of disturbance in the caribou ranges is high and provincial caribou range plans have not yet been finalized. However the project is not located within currently defined caribou ranges and makes a minimal contribution to the effect.

Moose

[2012] Moose are an important species for indigenous groups, which rely on access to moose as a food source and for the practice of traditional activities. The panel heard that moose are the most common species hunted by several indigenous groups and are main subsistence species available in the project area, as other subsistence species, such as caribou and bison, are no longer hunted due to their sensitivity. Indigenous groups expressed concerns that the Frontier project would cause a reduction in moose populations and reduce their ability to practice traditional harvest activities.

[2013] Teck considered the potential effects of the project on moose by looking at habitat availability, landscape connectivity, mortality risk, abundance and distribution, and how effects will be mitigated and monitored.

Study Areas

[2014] In assessing potential effects on moose Teck relied on the same terrestrial local study area and regional study area as for other ungulate species; a terrestrial local study area including the project disturbance area and a 500 m buffer, and the vegetation and wildlife regional study area.

[2015] Mikisew noted that there are 19 wildlife management units in the *LARP* and these units contain approximately 15 000 moose. The terrestrial local study area lies almost entirely within the Birch Mountains wildlife management unit (WMU) 531. Additional discussion on wildlife management units and *LARP* is provided in section 26, "[Land Use](#)."

Habitat Availability

[2016] Teck stated that suitable winter habitat for moose is highly dependent on the availability of browse and shelter, and that browse growth following a fire may increase forage quantity and quality; however, Teck stated that the Richardson fire may have reduced the overall suitable habitat, when compared to predevelopment conditions.

[2017] Moose winter habitat decreases from base case to application case due to development of the Frontier project, including the access road, and associated sensory disturbance.

[2018] For the terrestrial local study area, Teck showed that the habitat suitability changes for moose will be

- from base case to application case,
 - a reduction of high-suitability habitat of 1342.9 ha (51.5 per cent);
 - a reduction of moderate-suitability habitat of 9808 ha (67.6 per cent).

[2019] For the regional study area changes to habitat suitability for moose will be:

- Under the best-case scenario
 - A reduction of 2979.0 ha (4.3 per cent) of high-suitability habitat at application case relative to base case (68 971.9 ha)
 - A reduction of 22 582.9 ha (3.9 per cent) of moderate-suitability habitat at application case relative to base case (581 780 ha)

[2020]

- Under the worst-case scenario
 - A reduction of 1343.0 ha (3.6 per cent) of high-suitability habitat at application case relative to base case (37 809.5 ha).
 - A reduction of 9808.1 ha (3.3 per cent) of moderate-suitability habitat at application case relative to base case (299 810.1 ha).

[2021] Teck stated that moose require mature conifer forest for core security habitat areas; therefore, high-suitability habitat on the project disturbance area may not be available for 40 to 50 years after closure. Teck states that patches of high- and moderate-suitability moose winter habitat is expected to remain in the terrestrial local study area, primarily along the Athabasca River in upland forest types with high preferred browse and conifer cover.

[2022] Changes in core secure area in the regional study area will be

- Under the best-case scenario
 - from base case to application case there is a reduction of 26 548.8 ha (2.7 per cent).
- Under the worst-case scenario
 - from base case to application case there is a reduction of 8525.5 ha (1.9 per cent).

[2023] Mikisew’s consultant MSES stated that moose habitat has been steadily declining for more than 15 years in portions of their territory and they have found little evidence to suggest that moose return to reclaimed areas.

[2024] Canada, indigenous communities, and other stakeholders identified uncertainties related to the effects of noise pollution, increased traffic, infrastructure from construction and operations and aircraft noise levels on various species, including moose. These uncertainties relate to preferred habitat availability within both the terrestrial local study area and regional study area, as different disturbances may provide varying levels of sensory disturbance. Teck did provide disturbance ratings adjustments for moose zone of influence; however, the concern lies with the uncertainties around the level of impact.

Analysis

[2025] Based on the information provided by Teck, the panel finds that there will be substantial loss of high- and moderate-suitability moose habitat in the terrestrial local study area resulting from project activities. This will lead to a reduction of moose within the terrestrial local study area. In addition to the physical reduction in habitat availability usable moose habitat may be reduced due to disturbances such as noise and traffic.

Landscape Connectivity

[2026] Teck’s showed that potential effects to moose movement would be associated with habitat loss and anthropogenic barriers in the regional study area and along the Athabasca River and its tributaries.

[2027] Predicted changes for landscape connectivity for moose in the regional study area between the base case and application case are summarized in [Table 21](#) and [Table 22](#):

Table 21. Changes in landscape connectivity for moose in the regional study area, best-case scenario

Key indicator	Movement hindrance	Base case (ha)	Application case (ha)	Change (ha)	Change (%)
Moose	High	61 467.5	89 194.5	27 727.0	45.1
	Moderate	59 294.7	53 108.5	-6 186.2	-10.4
	Low	494 509.5	487 349.0	-7 160.5	-1.4
	Minimal	580 288.1	565 907.8	-14 380.3	-2.5

Table 22. Changes in landscape connectivity for moose in the regional study area, worst-case scenario

Key indicator	Movement hindrance	Base case (ha)	Application case (ha)	Change (ha)	Change (%)
Moose	High	592 424.8	603 542.9	11 118.1	1.9
	Moderate	191 349.5	183 884.7	-7 464.8	-3.9
	Low	261 876.3	259 901.0	-1 975.3	-0.8
	Minimal	149 909.2	148 231.1	-1 678.1	-1.1

[2028] Teck acknowledged that the project may disrupt east-west movement patterns across the terrestrial local study area. The seasonal movements are between high elevation summer habitat in the Birch Mountains and low elevation habitat along the Athabasca River during winter and spring. The extent of these movements, across the terrestrial local study area, is unknown.

[2029] Teck stated that at existing conditions, hindrances to moose movement are greatest around large oil sands developments primarily concentrated in the centre of the vegetation and wildlife regional study area and the communities of Fort McMurray and Fort McKay as well as linear developments throughout the regional study area. Remaining contiguous blocks of habitat occur mainly in the northeast and southwest corners of the vegetation and wildlife regional study area, as well as west and northeast of the terrestrial local study area around the periphery of the mineable oil sands area. At base case, contiguous blocks of minimal and low hindrance habitat remain throughout the vegetation and wildlife regional study area, including west of the terrestrial local study area.

[2030] For the application case, the project disturbance area (rated entirely as high hindrance) replaces some of the smaller features that in the base case might have altered moose movement patterns, such as roads. Contiguous blocks of minimal and low hindrance habitat remain throughout the vegetation and wildlife regional study area. Teck maintained that connectivity for moose between the Birch Mountains and the Athabasca River will be possible through portions of the project disturbance area during mine operation because of progressive reclamation of the project and the mining sequence.

[2031] Within the vegetation and wildlife regional study area, the Athabasca River valley is recognized as a key wildlife and biodiversity zone because it provides an important movement corridor for wildlife. Teck completed an assessment of changes to wildlife connectivity in an area 400 m from the valley break of the Athabasca River and its major tributaries in the vegetation and wildlife regional study area in response to supplementary information requests from regulators and importance of the area to potentially affected indigenous communities. Teck stated that the intent of this analysis was to determine whether changes in movement hindrances differ along the Athabasca River and its major tributaries compared to those predicted for the vegetation and wildlife regional study area. Predicted changes for movement

hindrances along the west side of the Athabasca River and major tributaries for moose are summarized in [Table 23](#) and [Table 24](#).

Table 23. Changes in landscape connectivity for moose in the Athabasca River and major tributaries study area, best-case scenario

Key indicator	Movement hindrance	Base case (ha)	Application case (ha)	Change (ha)	Change (%)
Moose	High	27 505.0	30 629.0	3 124.0	11.4
	Moderate	21 065.0	20 450.0	-615.0	-2.9
	Low	137 632.0	137 230.0	-402.0	-0.3
	Minimal	217 391.0	215 285.0	-2 106.0	-1.0

Table 24. Changes in landscape connectivity for moose in the Athabasca River and major tributaries study area, worst-case scenario

Key Indicator	Movement Hindrance	Base Case (ha)	Application Case (ha)	Change (ha)	Change (%)
Moose	High	197 841.4	199 426.1	1 584.7	0.8
	Moderate	66 481.9	65 544.4	-937.6	-1.4
	Low	81 546.7	81 380.1	-166.6	-0.2
	Minimal	57 724.0	57 243.5	-480.5	-0.8

[2032] Teck stated that at existing conditions, much of the Athabasca River and major tributaries study area is classified as having hindrances to moose movement potential. Hindrances are greatest around large oil sands developments and communities. At base case, minimal and low hindrance habitat remains along much of the Athabasca River and its tributaries.

[2033] At application case, inclusion of the project increases movement hindrances (relative to base case) along the west side of the Athabasca River and several of its major tributaries; however, the percent loss of minimal and low hindrance habitat is less than that for the vegetation and wildlife regional study area.

[2034] Teck maintained that due to the project's distance from the Athabasca River, moose movement along the river valley should not be inhibited. Teck concluded that while movement patterns of moose will be affected by the project, there was no evidence that key portions of the vegetation and wildlife regional study area such as that Athabasca River corridor will become unavailable to moose as a result of landscape fragmentation.

[2035] Teck considered the effects on landscape connectivity for moose to be reversible due to inclusion of suitable habitat in reclamation planning and of low environmental consequence in the regional study area for the base, application and planned development cases.

Analysis

[2036] The panel finds that the project will result in a loss of landscape connectivity across the terrestrial local study area and existing movement corridors within the local study area will be disrupted. However the panel finds the effect to be of low magnitude. While there is a predicted increase in areas of high movement hindrance as a result of the project, the loss of low and minimal hindrance habitat is less than two to three per cent in the regional study area and considerable low and minimal movement hindrance habitat remains in the regional study area at full project buildout under the best and worst-case scenarios.

[2037] Similarly, for the Athabasca River and majority tributaries study area, while there is an increase in high hindrance habitat, the amount of low and minimal hindrance habitat lost is less than one per cent and considerable low and minimal hindrance habitat remains at full project buildout and before reclamation.

[2038] The panel concludes that landscape connectivity will remain to the north and south of the project disturbance area and along the Athabasca River. The remaining available habitat will continue to provide seasonal and dispersal movement opportunities for moose.

Mortality Risk

[2039] Direct mortality risk for moose associated with vehicle collisions was assessed using traffic volume and wildlife mortality data along Highway 63 published by Alberta Transportation. Historic collision rates were used to estimate collision mortality for moose using traffic volume projections for the project. Teck stated that from 2001 to 2012, 50 vehicle-related moose injuries or fatalities were reported on Highway 63. The annual number of moose collisions tended to increase with increasing traffic volume.

[2040] Teck stated that while wildlife collision data are not available for the project access road because it does not yet exist, because the project development area does not support high-speed traffic and speed limits will be enforced by Teck, it assumed that any additional wildlife mortality on this road will be negligible, particularly compared with vehicle-wildlife collisions on Highway 63. Teck acknowledged that although the risk is low or negligible, project-related mortality risk to moose as a result of increased traffic resulting from the project and vehicle collisions will remain until closure.

[2041] Teck stated that access for hunters is facilitated through linear disturbances and that from 2009 to 2013 average moose harvest in the wildlife management units overlapping the regional study area was 146 individuals per year. Teck reported that there are five wildlife management units overlapping the regional study area and that the combined area of these is larger than the regional study area. Teck stated that at application case the addition of the project and associated linear developments slightly decrease the core security area for moose, restricting the remaining core security area to the northeast and southeast of the vegetation and wildlife regional regional study area, where patches greater than 220 ha exist. However Teck did not anticipate that annual moose harvest will increase due to the project as no new access will be created outside the terrestrial local study area and access to the project development area will be

monitored and this is anticipated to dissuade some prospective hunters. Teck concluded that the annual moose harvest should be similar to what is anticipated during base case.

[2042] Dr. Gilbert, for the Original Fort McMurray First Nation, referred to the potential mortality that may be associated with animal contact with tailings or accidental mortality or injury related to infrastructure and vehicle-wildlife collisions. He is concerned with the potential increase of tailings in the area and the potential increase of animals accessing the plant infrastructure and tailings ponds. He also stated that there is uncertainty about the potential effects of hydrocarbons or heavy metals that may be ingested by animals.

Analysis

[2043] The panel acknowledges that estimating moose mortality resulting from collisions with project-related traffic is challenging but finds the approach used by Teck to be satisfactory. The panel agrees with Teck's assessment that the project will add incrementally to moose mortality due to vehicle collisions as a result of increased traffic on Highway 63 but the magnitude of the effect is expected to be negligible to low.

[2044] The panel also agrees that it is unlikely the numbers of moose killed by hunters in the project disturbance area will increase significantly as a result of the project. Access monitoring may alleviate the potential for increase in non-indigenous hunter presence.

Abundance and Distribution

[2045] Teck stated that there are several project-related effects that will influence the abundance and distribution of moose in the project vicinity and the vegetation and wildlife regional study area. At application case, the change in habitat availability will be the primary driver in affecting moose abundance and distribution, followed by changes in landscape connectivity and mortality risk.

[2046] Teck stated that between 2006 and 2010, 469 occurrences of moose, including 233 systematic moose observations were recorded in the terrestrial local study area. During early winter aerial surveys for the project a total of 87 moose were observed in 2007 and 2009, with a density of 0.6/km² in 2007 and 0.3/km² in 2009. During late winter aerial surveys conducted in 2006, 2008 and 2010, 97 moose were observed with densities of less than 0.1/km² in 2006, 0.2/km² in 2008 and 0.3/km² in 2010.

[2047] Teck reported that the abundance of moose in the project disturbance area is generally higher than has been reported for the wildlife management units overlapping the vegetation and wildlife regional study area and that habitat loss associated with the project will measurably affect moose abundance and distribution within portions of the vegetation and wildlife regional study area.

[2048] Teck stated that given the low densities of moose observed over much of the vegetation and wildlife regional study area and associated wildlife management units it is unlikely that moose abundance

is habitat constrained. Moose displaced from the terrestrial local study area during application case will have suitable habitat north and south of the project disturbance area to use as well as along the Athabasca River.

[2049] While the project will present a hindrance to moose movement between the Birch Mountains and the Athabasca River during construction and operations, Teck maintained that that connected habitat will persist throughout the mine life north of the project disturbance area as well as to the south and moose should be able to move uninhibited along the Athabasca River valley. Therefore, while movement patterns of moose will be affected by the project, Teck concluded that it is unlikely that predevelopment moose abundance will be measurably affected by hindrances to movement patterns.

[2050] Teck also stated that mortality risk associated with the project is not expected to measurably change the abundance of moose in the vegetation and wildlife regional study area. Unlike other industrial developments that contribute to new access potential for hunters and predators, the project will create a footprint during construction and operations that will not enhance either prey availability or access potential. While the project will result in the redistribution of hunting and predator activities within the vegetation and wildlife regional study area, Teck concludes that harvest pressures on moose will not increase as a result of the project. While the project will contribute to a slight increase in traffic volume Teck expects this to result in a negligible increase in road mortality risk for moose and therefore a negligible effect on moose abundance.

[2051] Teck expected that moose numbers in the vegetation and wildlife regional study area will experience a decline at application case of less than 10% based largely on habitat loss, relative to predevelopment (2066) conditions. Teck expected that that the majority of moose remaining in the vegetation and wildlife regional study area during mine operations will concentrate along the eastern and western edges of the vegetation and wildlife regional study area, near the Athabasca River, and along the northern perimeter of the vegetation and wildlife regional study area away from the oil sands developments, particularly after the development of early successional vegetation communities on the reclamation landscape.

[2052] Overall, Teck concluded that while movement patterns and habitat loss will be affected by the project, it is not expected to have a measureable change on the abundance of moose in the regional study area and project factors influencing moose abundance are not expected to threaten the suitability of the regional population.

[2053] Athabasca Chipewyan and Mikisew submitted that moose are currently the most commonly hunted large mammal and the most frequently harvested in the terrestrial local study area. Mikisew and Athabasca Chipewyan stated that the project overlaps with preferred areas required for subsistence hunting, stating that there are over 100 recorded harvesting sites within 5 km of the project footprint. They submit that there will also be direct impact to preferred moose harvesting along the Athabasca River

and areas near Diana and Ronald Lakes and into Lake Claire. The area is of high cultural importance and community concern is high.

[2054] Indigenous groups expressed concern regarding the subsistence use of moose in the area. They said historically they have harvested 10 moose per family annually, and this is decreasing to 2 to 3 moose per family. Mikisew stated that 15 per cent of the preferred harvesting places for moose have been removed in the regional study area and that with the Frontier project this increases to 32 per cent removal.

[2055] Fort McKay First Nation recommended that moose should be a *LARP* biodiversity management framework indicator and the Government of Canada and Alberta should work together to ensure adequate management of moose populations and their habitat. Fort McKay First Nation also recommended that moose should be considered a species at risk in wildlife management units where populations are well below Government of Alberta goals.

Analysis

[2056] The panel finds that moose will be displaced as a result of loss of habitat in the local study area and the combined effects of changes in habitat availability and connectivity will alter the distribution of moose in the vegetation and wildlife regional study area.

[2057] The panel finds that the combined effect of changes in habitat availability, connectivity and mortality risk are not likely to result in measurable changes to moose abundance. Mortality effects are expected to be negligible and moose displaced from the project development area are likely to find suitable habitat elsewhere in the regional study area. The relatively low moose densities observed in the wildlife management units within the regional study area suggest moose are not habitat limited. The panel agrees with Teck's assessment that overall, change in moose abundance due to the project is likely to be low and is not expected to alter the sustainability of the regional moose population.

[2058] The panel acknowledges that changes in moose abundance and distribution in the area where indigenous hunters take their moose may reduce harvesting success of indigenous hunters. This is discussed further in section 32, "[Effects on Indigenous Traditional Use of Lands and Resources, Culture, and Asserted Rights.](#)"

[2059] The panel believes there is merit in the Fort McKay First Nation recommendation that moose should be a *LARP* biodiversity management framework indicator given the importance of moose to indigenous communities. The panel recommends that Alberta consider including moose as a *LARP* biodiversity management framework indicator.

Mitigation and Monitoring

[2060] Teck's primary form of mitigation for loss of moose habitat is progressive reclamation. As part of its reclamation and closure plan, Teck includes proposed to restore high- and moderate-suitability habitat

for moose including shrubby swamps along drainage features, young deciduous and mixed-wood deciduous leading stands, young coniferous stands dominated by Jack pine, black spruce and white spruce, young mixed-wood white spruce leading stands and young mixed-wood Jack pine leading stands.

[2061] Teck's draft wildlife mitigation and monitoring plan said it will

- monitor wildlife within reclaimed habitat and compare with control areas outside the project disturbance area,
- monitor use of habitat adjacent to the project disturbance area prior to and during construction and operations, and
- monitor use of bridge underpasses under both sides of Athabasca River bridge and river water intake.

[2062] Teck stated that connectivity between Birch Mountains and the Athabasca River will be possible through portions of the project disturbance area during mine operations due to progressive reclamation. Teck stated that reclaiming contiguous blocks of suitable moose habitat in the northwest portion of the regional study area following closure will reestablish connectivity.

[2063] The Athabasca Chipewyan First Nation stated that the biodiversity stewardship area is important as it is intended to protect wildlife species. The Athabasca Chipewyan–Teck joint letter says that the biodiversity stewardship area should be of sufficient size, ecological capacity and habitat quality to support Athabasca Chipewyan's biodiversity objectives, the exercise of Athabasca Chipewyan aboriginal and treaty rights, and the culturally important relationships between Athabasca Chipewyan and local wildlife.

Analysis

[2064] Reclamation is the primary mitigation measure for project effects to wildlife, however significant reclamation does not begin until after 2035 and much of the project development area will not be reclaimed to a state that supports the return of wildlife until project closure sometime after 2066.

[2065] Early seral upland ecosites will provide suitable feeding habitat for moose however moose also require mature conifer forest for shelter. High-suitability winter habitat will not be available in the project disturbance area for 40 to 50 years after closure. Winter habitat is expected to improve in the terrestrial local study area as reclaimed upland forest areas mature.

[2066] As a condition of approval the panel requires that Teck complete its wildlife mitigation and monitoring plan and include a section specifically addressing the project's effects on moose and moose habitat.

Recommendations to Alberta

[2067] The panel recommends that Alberta consider including moose as a *LARP* biodiversity management framework indicator.

Significance of Project Effects

[2068] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

- The effects are likely. Teck will reduce high- and moderate-suitability habitat for moose within the terrestrial local and regional study areas and moose will be displaced from the project disturbance area.
- The magnitude of effects is low. Under best- and worst-case scenarios, the habitat reduction will be about 3 to 4 per cent for both high- and moderate-suitability moose habitat in the regional study area and suitable habitat is available both north and south of the project. There is a 40 to 50 year time lag for reclamation to provide suitable winter habitat for moose. Effects to landscape connectivity and mortality are also expected to be low.
- The geographic extent is regional given the range of moose and that their population limits extend beyond the terrestrial local study area.
- The duration is long term. Effects will occur throughout the project construction and operations phases of the project. Given the life history characteristics of moose, they may not return to reclaimed habitat for more than 40 years.
- The effects are continuous as they will occur over the life of the project until operations cease and closure is complete.
- The effects are reversible following reclamation and recolonization of reclaimed habitat post-closure.

[2069] Considering the above factors, the panel finds that the project is not likely to result in significant adverse effects to moose due to the low magnitude and reversibility of effects.

Cumulative Effects

[2070] Where there will be a residual effect of the project after mitigation, an assessment of cumulative effects is required.

Habitat Availability

[2071] Teck stated that change in habitat availability within the regional study area will be the primary driver of effects to moose, followed by landscape connectivity, and mortality risks.

[2072] Predicted changes to habitat suitability in the regional study area for the best-case scenario are:

- For high-suitability habitat
 - A reduction of 26 948.1 ha (28.1 per cent) at base case relative to predevelopment (95 920.0 ha)
 - A reduction of 2979.0 ha (4.3 per cent) at application case relative to base case (68 971.9 ha)
 - A reduction of 9169.9 ha (13.3 per cent) at planned development case relative to the base case (68 971.9 ha)
- or moderate-suitability habitat
 - A reduction of 7093.1 ha (1.2 per cent) at base case relative to predevelopment (588 873.8 ha)
 - A reduction of 22 582.9 ha (3.9 per cent) at application case relative to base case (581 780 ha)
 - A reduction of 43 004.6 ha (7.4 per cent) at planned development case relative to base case (581 780 ha)

[2073] Predicted changes to habitat suitability in the regional study area for the worst-case scenario are:

- For high-suitability habitat
 - A reduction of 58 110.5 ha (60.6 per cent) at base case relative to predevelopment (95 920.0 ha)
 - A reduction of 1343.0 ha (3.6 per cent) at application case relative to base case (37 809.5 ha)
 - A reduction of 4467.3 ha (11.8 per cent) at planned development case relative to the base case (37 809.5 ha)
- For moderate-suitability habitat
 - A reduction of 289 063.7 ha (49.1 per cent) at base case relative to predevelopment (588 873.8 ha)
 - A reduction of 9808.1 ha (3.3 per cent) at application case relative to base case (299 810.1 ha)
 - A reduction of 19 479.5 ha (6.5 per cent) at planned development relative to base case (299 810.1 ha)

[2074] Preferred winter habitat for moose (high and moderate) within the regional study area is predicted to decrease by 8.7 per cent at application case relative to predevelopment conditions and by 12.6 per cent at planned development case relative to predevelopment conditions. Teck predicted that at project closure, there would be a 4.9 per cent decrease in preferred habitat within the regional study area due to progressive reclamation.

[2075] Teck considered the environmental consequence for habitat availability to be low for the base and application cases and moderate for the planned development cases as the effects can be mitigated by

progressive reclamation. Teck suggested that the predicated regional magnitude loss of habitat be considered conservative and reversible, as other oil sands developments in the area include reclamation of high- to moderate-suitability habitat.

Landscape Connectivity

[2076] Teck found that under the best-case scenario, the base case, application case and planned development cases all showed an increase in movement hindrance for moose.

[2077] Predicted changes for landscape connectivity for moose in the regional study area between the base case and planned development case are summarized in [Table 25](#) and [Table 26](#):

Table 25. Changes in landscape connectivity for moose in the regional study area, best-case scenario

Key indicator	Movement hindrance	Base case (ha)	Planned development case (ha)	Change (ha)	Change (%)
Moose	High	61 467.5	116 846.1	55 378.6	90.1
	Moderate	59 294.7	53 099.7	-6 195.0	-10.4
	Low	494 509.5	482 739.8	-11 769.7	-2.4
	Minimal	580 288.1	542 874.2	-37 413.9	-6.4

Table 26. Changes in landscape connectivity for moose in the regional study area, worst-case scenario

Key indicator	Movement hindrance	Base case (ha)	Planned development case (ha)	Change (ha)	Change (%)
Moose	High	592 424.8	617 218.2	24 793.4	4.2
	Moderate	191 349.5	176 694.3	-14 655.2	-7.7
	Low	261 876.3	256 388.0	-5 488.3	-2.1
	Minimal	149 909.2	145 259.2	-4 650.0	-3.1

[2078] At predevelopment conditions (2066), Teck reports there were 510 766.0 ha of low movement hindrance and 684 793.7 ha of minimal movement hindrance habitat in the regional study area. There were no high or moderate movement hindrance areas identified for predevelopment conditions. Between predevelopment conditions and the base case Teck reports a 3.2 per cent reduction in low movement hindrance areas and a 15.3 per cent per cent reduction in minimal movement hindrance areas for the best-case scenario.

[2079] Predicted changes for movement hindrances along the west side of the Athabasca River and major tributaries for moose are summarized in [Table 27](#) and [Table 28](#).

Table 27. Changes in landscape connectivity for moose in the Athabasca River and major tributaries study area, best-case scenario

Key indicator	Movement hindrance	Base case (ha)	Planned development case (ha)	Change (ha)	Change (%)
Moose	High	27 505.0	41 509.0	14 004.0	50.9
	Moderate	21 065.0	20 377.0	-688.0	-3.3
	Low	137 632.0	135 519.0	-2 113.0	-1.5
	Minimal	217 391.0	206 189.0	-11 202.0	-5.2

Table 28. Changes in landscape connectivity for moose in the Athabasca River and major tributaries study area, worst-case scenario

Key indicator	Movement hindrance	Base case (ha)	Planned development case (ha)	Change (ha)	Change (%)
Moose	High	197 841.4	205 380.3	7 538.9	3.8
	Moderate	66 481.9	62 531.2	-3 950.8	-5.9
	Low	81 546.7	79 836.3	-1 710.4	-2.1
	Minimal	57 724.0	55 846.2	-1 877.8	-3.3

[2080] At predevelopment conditions (2066), Teck reports there were 146 588.0 ha of low movement hindrance and 257 006.1 ha of minimal movement hindrance habitat in the Athabasca River and major tributary study area. No areas of high or moderate movement hindrance habitat were identified during predevelopment conditions. Between predevelopment conditions and the base case Teck reports a 6.1 per cent reduction in low movement hindrance areas and a 15.4 per cent reduction in minimal movement hindrance areas for the best-case scenario.

[2081] Teck found that the magnitude of effect to landscape connectivity for moose in the regional study area is low in application case and planned development case. The environmental consequence in the regional study area and the river / major tributary study area is moderate.

[2082] Mikisew and Athabasca Chipewyan stated that the east-west movement corridor is an important environmental feature for moose habitat and calving areas along the Athabasca River. Athabasca Chipewyan and Mikisew also stated that the proposed project includes a unique and important moose movement corridor and have identified areas along the Athabasca River for moose calving and crossing.

[2083] Mr. C. Shevolup (trapper) stated that the moose migration used to take place from the base of the Birch Mountains to the river every winter; however, since the Frontier exploration program this migration has declined. Mr. D. Shevolup stated that they are uncertain where the moose finish their migration, some may stop at the river; others may cross.

Mortality

[2084] Teck stated that mortality from predation increases only slightly from base case primarily in the southern portion of the regional study area.

Abundance and Distribution

[2085] Teck stated that the combined effect of changes in habitat availability, connectivity and mortality risk will alter the distribution of moose in the vegetation and wildlife regional study area but that measurable change in abundance, if any, would be low. Teck predicted a low-magnitude change for moose abundance and distribution within the vegetation and wildlife regional study area at application case relative to predevelopment, increasing to moderate magnitude for the planned development case.

Analysis and Findings

[2086] The panel does not expect the worst-case scenarios to occur as reclamation is a regulatory requirement and progressive reclamation is expected to occur. However the panel accepts that there is some uncertainty about the degree and timing of progressive reclamation within the regional study area and the best-case scenario could prove to be overly optimistic.

[2087] For the best-case scenario, at base case there is a 28 per cent loss of high-suitability habitat relative to predevelopment conditions and the loss increases by a further 4.3 per cent and 13.3 per cent in the application and planned development cases. For moderate-suitability habitat there is a 1.2 per cent loss at base case relative to predevelopment conditions and further losses of 3.9 and 7.4 per cent in the application and planned development cases. The panel considers a loss of 30 to 40 per cent of high-suitability habitat in the application and planned development cases to be a moderate-magnitude effect. This is because significant moose habitat is still available within the regional study area and progressive reclamation is expected to restore moose habitat over time. The panel recognizes that a large portion of the habitat loss occurs in the base case as the regional study area includes most of the mineable oil sands area, an area of intensive development.

[2088] The panel finds that under the best-case scenario, there is an increase in movement hindrance for moose in the base, application and planned development cases and that landscape connectivity is reduced.

[2089] For the regional study area, there is a reduction of low and minimal movement hindrance areas of 3.2 and 15.3 per cent between predevelopment conditions and the base case, for the best-case scenario. At application case (maximum buildout) there is a further reduction of 1.4 and 2.5 per cent for low and minimal movement hindrance areas respectively, increasing to a reduction of 2.4 and 6.4 per cent for the planned development case.

[2090] For Athabasca River and major tributary study area, there is a reduction of low and minimal movement hindrance areas of 6.1 and 15.4 per cent between predevelopment conditions and the base case, for the best-case scenario. At application case (maximum development) there is a further reduction of

0.3 and 1.0 per cent for low and minimal movement hindrance areas respectively, increasing to a reduction of 1.5 and 5.2 per cent in the planned development case.

[2091] The panel considers these to be moderate-magnitude effects as connectivity is expected to continue to be available in the regional study area and along the Athabasca River and its major tributaries. Within the regional study area and Athabasca River and major tributary study area, significant areas of low and minimal movement hindrance areas remain. Hindrance to moose movements is expected to decrease and landscape connectivity increase as progressive reclamation occurs in the regional study area.

[2092] The panel accepts that direct and indirect mortality effects in the application and planned development cases will be low and that the combined effects of changes to habitat availability, landscape connectivity and mortality are not likely to affect the viability of moose populations.

Significance of Cumulative Effects

[2093] Based on the criteria provided in CEEA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine cumulative effects.

- The effects are likely. Habitat loss has already occurred in the regional study area and clearing of the project disturbance results in removal of a large area of suitable moose habitat, with the result that moose which occupied that habitat will have to move elsewhere in the region.
- The magnitude of the effect is moderate given the availability of suitable moose habitat in the surrounding areas and maintenance of landscape connectivity.
- The geographic extent is regional. Moose from the local study area will be dispersed within the regional study area.
- The duration is medium to long term because of the length of time required for vegetation required by moose to become established and for moose to move back to such restored habitat.
- The effects are continuous as once projects are constructed and habitat removed, the effects will occur over the life of the project until operations cease and closure is complete.
- The effects are reversible with successful reclamation of moose habitat and moose colonization of such habitat.

[2094] Considering the above factors, the panel finds that the project, in combination with other existing, approved and reasonably foreseeable projects is not likely to result in significant adverse cumulative effects to moose due to the moderate magnitude and reversibility of effects.

Fur-bearers

[2095] In assessing the project's effects on fur-bearers, Teck considered habitat availability, landscape connectivity, mortality risk, abundance and distribution and mitigation and monitoring.

[2096] Several indigenous groups identified trapping as an important cultural and economic activity. Several of the groups indicated that their members hold registered fur management areas that may be affected by the Frontier project. The health and abundance of fur-bearing species such as muskrat, wolverine, fisher, beaver, black bear and Canada lynx are therefore important for indigenous groups. For the Mikisew and Athabasca Chipewyan, trapping of fur-bearing species, including beaver and muskrat, was of historical importance to their livelihood.

[2097] Teck provided analysis for the following fur-bearing species: muskrat, wolverine, fisher, beaver, black bear, and Canada lynx. All of these carry cultural significance and importance to indigenous peoples. Teck provided recorded occurrences of these species during baseline surveys from 2005–2014 whether observed in a systematic survey or incidentally. The following numbers were recorded; muskrat 1(systematic) 2(incidental); wolverine 0(systematic) 4(incidental); fisher 56(systematic) 82(incidental); beaver 514(systematic) 7(incidental); black bear 0(systematic) 52(incidental); Canada lynx 3(systematic) 17(incidental).

Habitat Availability

[2098] Teck stated that moderate to high effects on the availability of preferred habitat for fur-bearers is predicted at base case and these are expected to be regional in nature extending beyond the terrestrial local study area.

[2099] The Frontier project will result in the disturbance of registered fur management areas which overlap the terrestrial local study area, such as RFMA 2016. Teck stated that the effects to trapping of traditionally important fur-bearing species are considered to be a combination of disturbance, changes in accessibility to preferred use areas, effects on preferred habitat availability of key species and sensory disturbances.

[2100] The 2011 Richardson fire affected stand age and structural stage throughout much of the terrestrial local study area. The fire reduced the amount of mature and old-growth forest stands in the 2066 landscape.

[2101] Predicted changes in habitat availability for fur-bearer species in the terrestrial local study area from base case to application case are as follows:

[2102] Black Bear:

- Decrease of 216.4 ha (86.7 per cent) high-suitability habitat; decrease of 16 396.6 ha (69.4 per cent) moderate-suitability habitat.

- Base case shows a decrease in black bear fall foraging habitat. Some moderate habitat is expected to remain along the boundary of the terrestrial local study area (eastern edge).
- Environmental consequence is considered to be low as effects are considered reversible.

[2103] Fisher:

- Decrease of 1402.8 ha (64.2 per cent) high-suitability habitat; decrease of 2140.2 ha (52.9 per cent) moderate-suitability habitat.
- Base Case shows a decrease in fisher winter habitat availability compared to predevelopment (2066) conditions.
- Environmental consequence indicated to be moderate as effects are considered reversible.

[2104] Canada lynx:

- Decrease of 998.1 ha (49.4 per cent) high-suitability habitat; decrease of 5689.4 ha (65.7 per cent) moderate-suitability habitat.
- Base case shows a decrease in winter habitat availability; high and moderate habitat is expected to remain along the eastern edge of terrestrial local study area.
- Environmental consequence moderate.

[2105] Muskrat:

- Decrease of 1625.8 ha (72.2 per cent) high-suitability habitat; no change to moderate-suitability habitat as none identified at base case.
- Base case shows a decrease in habitat availability; high habitat is expected to remain along northern edge and southern most peripheries.
- Environmental consequence is low.

[2106] Beaver:

- Decrease of 961.4 ha (57.5 per cent) high-suitability habitat; decrease 1473.3 ha (61.1 per cent) moderate-suitability habitat.
- Base case shows decrease in habitat availability, high- and moderate-habitat expected to remain along northern and east-central edge.
- Environmental consequence low.

[2107] Predicted changes in habitat availability for fur-bearer species in the regional study area from base case to application case are summarized in [Table 29](#) and [Table 30](#).

Table 29. Habitat suitability for fur-bearers in regional study area, best-case scenario

Key indicator	Habitat suitability rating	Base case (ha)	Application case (ha)	Change (ha)	Change (%)
Black bear	High	42 376.2	42 139.4	-236.8	-0.6
	Moderate	488 133.7	468 808.5	- 19 325.2	-4.0
Fisher	High	29 093.5	27 140.0	-1 953.5	- 6.7
	Moderate	76 388.5	73 455.7	- 2 932.8	- 3.8
Canada lynx	High	77 810.7	74 768.4	- 3 042.3	-3.9
	Moderate	330 461.0	318 755.7	- 11 705.3	-3.5
Muskrat	High	16 431.7	14 805.9	-1 631.8	-9.9
	Moderate	0.00	0.00	0.0	N/A
Beaver	High	73 816.5	72 847.4	-969.1	-1.3
	Moderate	67 465.4	65 959.1	-1 506.3	-2.2

Table 30. Habitat suitability for fur-bearers in regional study area, worst-case scenario

Key indicator	Habitat suitability rating	Base case (ha)	Application case (ha)	Change (ha)	Change (%)
Black bear	High	34 287.7	34 071.3	-216.4	-0.6
	Moderate	382 932.1	366 535.5	-16 396.6	-4.3
Fisher	High	20 763.7	19 360.9	-1 402.8	-6.8
	Moderate	52 207.5	50 067.3	-2 140.2	-4.1
Canada lynx	High	37 696.4	36 698.3	-998.1	-2.6
	Moderate	222 175.5	216 486.1	-5 689.4	-2.6
Muskrat	High	8 688.6	7 062.8	-1 625.8	-18.7
	Moderate	0.0	0.0	0.0	N/A
Beaver	High	53 346.2	52 384.8	-961.4	-1.8
	Moderate	54 951.4	53 478.1	-1 473.3	-2.7

[2108] Teck concluded that the environmental consequence for changes to habitat availability was moderate at the application case for fisher and Canada lynx and low for black bear, muskrat and beaver.

[2109] Mikisew and Athabasca Chipewyan stated that although beaver populations seem to be recovering, muskrat populations are reported to be very low in the regional study area. Communities link these declines to water quality and reduced water levels resulting in losses of wetland habitats along the Athabasca River, Buckton Creek and Lake Claire. Indigenous communities said that the reduced water availability in certain areas is no longer able to support species such as muskrat and beaver.

[2110] Indigenous communities expressed concerns about the decrease in habitat availability for fur-bearing wildlife and uncertainties associated with the potential success of progressive reclamation, which is the main mitigation measure for effects to wildlife. They stated that end land users need to be included in reclamation decision making to ensure successful reclamation.

[2111] Indigenous communities stated that while Teck references particular sites that have been reclaimed these areas have yet to be reestablished to the point of understanding whether the reclamation was successful. There is uncertainty regarding the success of reclamation and ability to reclaim wildlife habitat of quality similar to that which existed prior to development. Indigenous communities were concerned that Teck's reliance on progressive reclamation and reversibility of effects as the primary mitigation for project effects may mean that projects effects are worse than predicted if reclamation is not successful.

Analysis and Findings

[2112] The project will reduce available habitat for all of the fur-bearer species considered in the assessment to varying degrees. The project will result in the removal of a substantial portion of the available habitat from the local study area as the project disturbance area makes up a large portion of the local study area. However some habitat will remain along the margins of the project disturbance area.

[2113] Within the regional study area, the amount of habitat lost is small for most species, ranging from less than 1 per cent to about 6 per cent for high- and moderate-suitability habitat under the best-case scenario. The exception is muskrat where the amount of high-suitability habitat lost is close to 10 per cent for the best-case scenario. The amount of high- and moderate-suitability habitat lost under the worst-case scenario is similar, except for muskrat, where the loss increases to 18.6%.

[2114] At closure, habitat will be restored as a result of reclamation, however for species such as fisher that prefer wintering in mature forests, equivalent habitat will not be reestablished within the project disturbance area for at least 50 to 60 years after closure.

[2115] While indigenous groups expressed concern about loss of fur-bearer habitat, the majority of groups likely to be affected by the project have signed participation agreements with Teck and have confirmed they no longer have project-specific concerns.

Landscape Connectivity

[2116] Teck assessed the connectivity of habitat in the vegetation and wildlife regional study area for black bears, wolverine, fisher and Canada lynx.

[2117] At existing conditions, hindrances to movement for all species are highest around large oil sands developments primarily concentrated in the centre of the vegetation and wildlife regional study area and the communities of Fort McMurray and Fort McKay as well as linear developments throughout the

regional study area. Remaining contiguous blocks of habitat occur mainly in the southwest corner and the northern portion of the vegetation and wildlife regional study area as well as west and northeast of the terrestrial local study area around the periphery of the mineable oil sands area.

[2118] At base case, contiguous blocks of minimal and low hindrance habitat remain throughout the vegetation and wildlife regional study area, including north and west of the terrestrial local study area around the periphery of the mineable oil sands area.

[2119] At application case, the project disturbance area (rated entirely as high hindrance) replaces some of the smaller features in the base case that might have altered movement patterns, such as roads. At application case, contiguous blocks of minimal and low hindrance habitat remain throughout the vegetation and wildlife regional study area. Teck maintained that connectivity between the Birch Mountains and the Athabasca River will be possible through portions of the project disturbance area during mine operation because of progressive reclamation of the project and the mining sequence.

[2120] Predicted changes in landscape connectivity for the regional study area are summarized in [Table 31](#) and [Table 32](#).

Table 31. Changes in landscape connectivity in the regional study area, best-case scenario

Key indicator	Movement hindrance	Base case (ha)	Application case (ha)	Change (ha)	Change (%)
Black bear	High	56 172.5	84 127.2	27 954.7	49.8
	Moderate	86 044.0	78 822.9	-7 221.1	-8.4
	Low	607 530.0	596 712.2	-10 817.8	-1.8
	Minimal	445 813.3	435 897.5	-9 915.8	-2.2
Wolverine	High	83 233.0	110 523.7	27 290.7	32.8
	Moderate	71 228.6	61 323.3	-9 905.3	-13.9
	Low	469 825.9	465 887.6	-3 938.3	-0.8
	Minimal	571 272.3	557 825.1	-13 447.2	-2.4
Fisher	High	75 003.2	100 373.4	25 370.2	33.8
	Moderate	91 073.7	85 108.4	-5 965.3	-6.5
	Low	936 011.3	919 531.7	-16 479.6	-1.8
	Minimal	93 471.6	90 546.3	-2 925.3	-3.1
Canada lynx	High	80 192.7	101 648.3	21 455.6	26.8
	Moderate	69 703.4	65 033.2	-4 670.2	-6.7
	Low	688 893.7	681 437.8	-7 455.9	-1.1
	Minimal	356 770.0	347 440.5	-9 329.5	-2.6

[2121] For the regional study area, Teck assessed changes to landscape connectivity as being low in magnitude for bears, wolverine, fisher and Canada lynx for the base, application and planned development cases. Teck concluded that the environmental consequence was low for the above species and assessment cases.

[2122] In the Athabasca River and major tributary study, at existing conditions, much of the Athabasca River and major tributaries study area is classified as having hindrances to black bear, wolverine, fisher and Canada lynx movement potential. Hindrances are greatest around large oil sands developments and communities. Under the best-case scenario, at base case, minimal and low hindrance habitat occurs along much of the Athabasca River and its tributaries. Percent loss of minimal and low hindrance habitat (relative to predevelopment [2066] conditions) is similar to that for the vegetation and wildlife regional study area. At application case, inclusion of the project increases movement hindrances (relative to base case) along the west side of the Athabasca River and several of its major tributaries; however, the percent loss of minimal and low hindrance habitat is less than that for the vegetation and wildlife regional study area.

[2123] Changes in landscape connectivity in the Athabasca River and major tributaries study area are summarized in [Table 32](#).

Table 32. Changes in landscape connectivity in the river and major tributary study area, best-case scenario

Key indicator	Movement hindrance	Base case (ha)	Application case (ha)	Change (ha)	Change (%)
Black bear	High	26 055.0	29 190.0	3 135.0	12.0
	Moderate	37 989.0	37 245.0	-744.0	-2.0
	Low	197 255.0	196 106.0	-1 149.0	-0.6
	Minimal	142 296.0	141 052.0	-1 244.0	-0.9
Wolverine	High	36 127.0	39 225.0	3 098.0	8.6
	Moderate	24 137.0	23 152.0	-985.0	-4.1
	Low	129 595.0	129 388.0	-207.0	-0.2
	Minimal	213 735.0	211 829.0	-1 906.0	-0.9
Fisher	High	30 998.0	33 905.0	2 907.0	9.4
	Moderate	35 398.0	34 780.0	-618.0	-1.7
	Low	302 989.0	301 120.0	-1 869.0	-0.6
	Minimal	34 209.0	33 789.0	-420.0	-1.2
Canada lynx	High	31 749.0	34 288.0	2 539.0	8.0
	Moderate	26 654.0	26 111.0	-543.0	-2.0
	Low	205 116.0	204 540.0	-576.0	-0.3
	Minimal	140 074.0	138 655.0	-1 419.0	-1.0

[2124] As the results of the landscape connectivity assessment for the Athabasca River and major tributaries study area for fur-bearers were similar to the results of the regional study area assessment, Teck's conclusions are similar. The magnitude of effects is low for all fur-bearer species assessed in all assessment cases and the environmental consequence ratings are low.

[2125] Mikisew and Athabasca Chipewyan were uncertain how preserved areas will provide feasible quality habitat when there is lack of connectivity due to surrounding disturbances.

Analysis

[2126] The panel notes that for the fur-bearer species considered the landscape connectivity habitat as a result of the project disturbance area is not seriously affected; hindrance to movement is low because connectivity remains adjacent to the project disturbance area in the regional study area.

[2127] While high movement hindrance habitat increases in the regional study area between the base and application, reductions in low and minimal hindrance areas are in the order of 2 to 3 per cent and significant amounts of low and minimal movement hindrance areas remain at full project buildout in the best-case scenario. Although the worst-case scenario is not reproduced in the evidence section above, the results are similar.

[2128] Similarly, for the Athabasca and major rivers study area, high movement hindrance habitat increases but significant amounts of low and minimal movement hindrance areas remain at full project buildout in the best and worst-case scenarios.

Mortality Risk

[2129] Teck assessed direct and indirect mortality for fur-bearers.

[2130] Potential causes of direct mortality included the potential for wildlife interaction with vehicles and equipment. The risk of direct mortality was assessed qualitatively for black bear, wolverine and fisher.

[2131] Potential causes of indirect wildlife mortalities result primarily from changes to the habitat characteristics and access availability on the landscape and include hunting of large mammals (black bear) and trapping of fur-bearing mammals. Teck provided an assessment for black bear, wolverine and Canada lynx through an analysis of core security areas. Core security areas are defined as areas that are adequately buffered from disturbance and mortality risk associated with roads and other industrial developments. Indirect mortality risk for muskrat, beaver and fisher were assessed qualitatively.

[2132] Black bear

- Black bear-vehicle collisions may contribute to black bear mortality. However, based on the small increase in daily traffic volume associated with the project, Teck considered the increase in black bear mortality due to collisions to be negligible.
- Bears are vulnerable to interaction with project equipment during winter vegetation clearing activities. Collision with clearing equipment can lead to direct mortality of denning bears or den abandonment. Bears are sensitive to disturbance in proximity to den sites, and disturbance effects are particularly acute when disturbance occurs less than 200 m from the den. Teck considered the probability of collision with a bear den to be low. Based on density estimates for wildlife management unit 531, Teck estimated approximately 20 black bear could occur with the project disturbance area.
- At application case, the remaining core security area for black bears is limited to the east side of the vegetation and wildlife regional study area and directly west of the terrestrial local study area, where patches greater than 900 ha remain. Teck did not anticipate that the annual black bear harvest will increase due to the project as access to the project disturbance area will be monitored and this is anticipated to dissuade some prospective hunters.

[2133] Wolverine and fisher

- Direct mortality could result from vegetation clearing, overburden grading, excavation and vehicle traffic. Teck stated that as wolverines in boreal landscapes do not have access to high elevation habitat to avoid mortality risk, road density is an important predictor of wolverine mortality risk. Risk has been shown to increase when road densities are above 0.44 km/km^2 . According to Teck a similar threshold for fisher is not described in the literature, though a generic road density threshold of 0.6 km/km^2 has been suggested to maintain naturally functioning landscapes for large mammals. Teck projects that even in the worst-case scenario road density will not exceed 0.24 km/km^2 .
- Male wolverines have larger home ranges which may increase their risk of coming into contact with roads or human infrastructure. Females and young may be at higher risk during denning activities. Denning occurs between mid-February and the end of April and dens in boreal systems are often located in substrate, such as fallen trees which are vulnerable to disturbance from vegetation clearing activities. Denning fishers are at lower risk as their denning typically occurs in April, outside of the projects potential winter clearing. Given the low density of wolverine and fisher in the area based on local trapping data and baseline surveys and their tendency to avoid areas of high human use, project-related mortality risk from vehicle collisions and den site disturbance is considered low.
- For wolverine, at application case patches of secure habitat greater than 2300 ha remain around the outermost edge of the vegetation and wildlife regional study area. Small amounts of core security

habitat patches also remain in the north and south-central areas of the vegetation and wildlife regional study area.

- For fisher, at maximum buildout of the project, indirect mortality risk increases slightly from base case primarily in the northwest portion of the vegetation and wildlife regional study area as a result of habitat loss from development of the project and associated linear developments. Teck does not expect the annual harvest of fisher to increase as access into the project disturbance area will be managed.

[2134] Canada lynx

- The core security area for Canada lynx occurs in areas away from most human disturbances and is currently limited in the regional study area due to oil sands development.
- At application case, core security area decreases slightly in the vegetation and wildlife regional study area. This further restricts remaining core security area to the east side of the vegetation and wildlife regional study area and directly west of the terrestrial local study area where patches greater than 2300 ha remain.
- Between 2003 and 2012, trappers in the regional study area harvested a five-year average of 62 lynx and a low of 13 lynx. Teck does not anticipate that annual Canada lynx harvest will increase due to the project as access to the project development area will be monitored and it is anticipated this will dissuade prospective trappers.

[2135] Beaver and muskrat

- At maximum project buildout, indirect mortality may increase slightly in the regional study area compared to the base case due to the development of the project and associated linear disturbances, facilitating access for trappers and predators. Both species within the project disturbance area will be trapped out prior to site clearing, which may increase annual harvest locally.

[2136] Predicted changes in core security areas from the base case to application case at maximum project buildout for black bear, wolverine and Canada lynx are in the order of two per cent in the best-case scenario and two to three per cent for the worst-case scenarios.

[2137] Teck's draft wildlife mitigation, monitoring and adaptive management plan identifies mitigation measures designed to minimize the potential risk of direct and indirect mortality to wildlife, including furbearers. This includes but is not limited to such measures as restricted activity periods for clearing activities, employee and contractor awareness training related to wildlife interactions, posting and enforcing speed restrictions, prohibition of hunting and trapping by employees and contractors while at work, measures to reduce the attraction of nuisance wildlife, implementation of an access management plan and progressive reclamation.

Analysis

[2138] The panel accepts that some direct mortality of fur-bearers may result from vegetation clearing, overburden grading, excavation and vehicle traffic. However, the panel finds that the magnitude of these effects will be low. Teck's proposed wildlife mitigation and monitoring and adaptive management plan contains numerous mitigation measures designed to minimize the potential for and consequences of interactions between project vehicles and equipment. The panel finds that measures such as employee and contractor training related to wildlife awareness and interactions, enforcement of speed restrictions and implementing measures to reduce wildlife attractants are appropriate and should reduce the risk of direct mortality effects for wildlife.

[2139] While some indirect mortality may occur as a result of changes to habitat characteristics and access availability, the panel also finds the magnitude of these effects to be low. Measures in Teck's draft wildlife mitigation monitoring and adaptive management plan, such as the prohibition on employee and contractor hunting and trapping while at work, implementation of an access management plan and progressive reclamation, are expected to reduce the potential for indirect mortality.

[2140] The panel acknowledges that as the project disturbance area expands, there will be a reduction in areas where trapping can take place and this may affect trapping related mortality.

Abundance and Distribution

[2141] Teck assessed potential project effects on the abundance and distribution of fur-bearers.

[2142] Black bear

- Habitat loss will be the primary driver in affecting abundance and distribution. Given the low observed density of black bear in the regional study area, Teck stated it is unlikely that abundance is habitat constrained. Mortality and habitat connectivity may also lead to potential reduction in abundance and distribution; however, habitat to the north and south of the project disturbance area will remain intact. Teck concluded that there should be a minor effect on black bear abundance due to the project, while distribution will be altered during operations.
- Combined effects are predicted to result in a moderate-magnitude effect with low environmental consequence.

[2143] Wolverine

- Loss of prey habitat will likely be the primary driver for changes in abundance and distribution, with minor decline in numbers in the regional study at application case relative to predevelopment conditions. However the project will affect the distribution of wolverine in the regional study area.
- Combined effects are predicted to result in a moderate-magnitude effect with low environmental consequence.

[2144] Fisher

- Habitat loss will be the primary driver for changes in abundance and distribution. Overall, Teck predicts a minor effect on fisher abundance and a change in distribution during project operations.
- Combined effects are predicted to result in a high-magnitude effect with moderate environmental consequence.

[2145] Canada lynx

- Habitat loss will be the primary driver for changes in abundance and distribution. Overall, Teck predicts a minor effect on Canada lynx abundance due to the project, while distribution will be altered during project operations.
- Combined effects are predicted to result in a high-magnitude effect with moderate environmental consequence.

[2146] Muskrat

- Habitat loss and mortality risk are the prominent drivers for changes in abundance and distribution. Overall, Teck predicts a minor effect on muskrat abundance due to the project, while distribution will be altered during project operations.
- Combined effects predicted to result in a moderate-magnitude effect with and low environmental consequence.

[2147] Beaver

- Habitat loss and mortality risk are the prominent drivers for changes in abundance and distribution. Teck predicts there should be a minor effect on beaver abundance due to the project, while distribution will be altered during project operations.
- Combined effects predicted to result in a moderate-magnitude effect with low environmental consequence.

[2148] Canada stated that the potential of reduced water levels along the Athabasca River and at Diana and Ronald Lakes and within Buckton Creek watershed will likely reduce muskrat and beaver populations.

[2149] Indigenous and other trappers stated how changes to the Peace-Athabasca Delta and associated declines in population numbers have been significant. They used to be able to trap thousands of fur-bearers in a year, particularly muskrats, providing subsistence and income. They were also concerned about the predictability of water levels and the reliability of indigenous use of waterways. Both indigenous and other trappers said that areas they used to trap in, they no longer have access to. Gates are present, notice is needed to the operators and visitation passes are required; there is concern of similar

requirements for the project disturbance area. Fort McKay First Nation stated that new access interferes with the current trails used by the community members, impacting their access to their trap lines. Additionally, concerns were expressed regarding the increased noise pollution, disturbing both animals and trappers alike, requiring them to access regions further from their traditional land use.

Analysis

[2150] The panel agrees with Teck that habitat loss is likely to be the primary driver of changes in the abundance and distribution of fur-bearers, followed by mortality and loss of habitat connectivity. The decline in fur-bearer abundance as a result of the project will vary with the species, but is expected to be low for all species as a result of the project as other habitat remains available in the regional study area. However the project will affect the distribution of fur-bearers as they are displaced to adjacent habitats. The magnitude of predicted effects for most species does not change appreciably between the base case and the application case with the exception of black bear which does show an increase. The panel therefore finds the magnitude of project effects to be low for wolverine, fisher, Canada lynx, beaver and muskrat and moderate for black bear. The panel acknowledges however that the magnitude of effects in the regional study area are already considered high for fisher and Canada lynx and moderate for wolverine, muskrat and beaver at base case.

[2151] The panel notes that indigenous concerns are mainly related to the availability of fur-bearers for harvesting and that these concerns are closely linked to water levels in the rivers and the Peace-Athabasca Delta and other access issues. These concerns are addressed in other sections of this report.

Mitigation

[2152] Teck's primary means of mitigating direct project effects on fur-bearer habitat will be through progressive reclamation of the landscape and the reestablishment of forest vegetation and wetland areas. Mitigation objectives outlined in Teck's draft wildlife mitigation and monitoring plan include the reduction of direct and indirect habitat loss; retaining landscape connectivity; reducing vehicle-wildlife collisions and reducing wildlife interactions with infrastructure. Monitoring will lead to adaptive management measures if desired outcomes are not being achieved.

[2153] Some specific mitigation measures to address effects to fur-bearers from the draft wildlife mitigation and monitoring plan are:

- Develop an access management plan to manage public access to and through the project disturbance area
- Implement deactivation for roads that are no longer in use
- Prohibit personnel and contractors from hunting and trapping while working

- Provide coarse woody debris along wildlife underpass at the Athabasca River bridge to provide cover and increase use by fur-bearers
- Development of food waste management strategies to prevent attracting nuisance animals and prevent wildlife harassment and feeding to avert habituation.

[2154] The draft plan identifies a number of fur-bearer species when indicating how it would meet its mitigation objectives.

Analysis

[2155] While reclamation will ultimately restore habitat for fur-bearer species, this habitat will not be available for many years, particularly for species that require mature forests. However due to the nature of the project, the mitigation measures available are limited. Teck's use of progressive reclamation is one such mitigation measure that should reduce the length of project effects. In addition, Teck's draft wildlife mitigation and monitoring plan outlines other mitigation measures for wildlife, including fur-bearers. The panel finds that progressive reclamation, along with the measures outlined in Teck's wildlife mitigation and monitoring plan are appropriate for mitigating effects to fur-bearers.

[2156] The panel requires Teck to finalize and implement its proposed nuisance wildlife prevention protocol for the Frontier project including requirements for rodent and pest management as part of its final wildlife mitigation and monitoring program.¹⁴⁷

Significance of Project Effects

[2157] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

[2158] The project is located within the mineable oil sands area, an area that has experienced significant industrial development. While suitable habitat remains in the regional study area for all species, high-magnitude effects to species abundance and diversity are predicted to exist for some species (fisher, Canada lynx) in the base case.

- The effects are likely. Habitat for each of the fur-bearing species will be reduced within the terrestrial local study area.
- The effects are low in magnitude. While high-magnitude effects will occur to habitat availability, landscape connectivity and species distribution in the local study, the project's contribution to habitat

¹⁴⁷ Draft EPEA Approval – Conditions 4.6.9 and 4.6.10(j)

availability, landscape connectivity and species abundance and diversity within the regional study area is low. The magnitude of mortality effects is also expected to be low.

- The geographic extent is regional for species with larger home ranges and local for those which have smaller ranges.
- The duration is medium to long term. Some species may be able to colonize early seral habitat of reclaimed regions while others may require older habitats which will not be available until many years after reclamation or closure.
- The frequency is continuous. Project effects will occur at the time of disturbance and continue until the habitat is restored.
- The effects are largely reversible. The majority of habitat types impacted by the project can be restored. However reversibility will be dependent upon the ability of the different species to recolonize the reclaimed areas.

[2159] Considering the above factors, the panel finds that the project is not likely to result in significant adverse effects to fur-bearers due to the low magnitude and reversibility of effects.

Cumulative Effects

[2160] Where there will be a residual effect of the project after mitigation, an assessment of cumulative effects is required.

Habitat Availability

[2161] Predicted changes to habitat availability in the regional study area for the best-case scenario are

[2162] Black Bear

- There is 13 228.6 ha of high-suitability habitat and 498 719.0 ha of moderate-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat increases by 29 147.6 ha (220.3 per cent) and moderate-suitability habitat declines by 10 585.3 ha (2.1 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 236.8 ha (0.6 per cent) and moderate-suitability habitat declines by 19 325.2 ha (4.0 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 1459.4 ha (3.4 per cent) and moderate-suitability habitat declines by 38 437.2 ha (7.9 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2163] Fisher

- There is 47 463.0 ha of high-suitability habitat and 86 600.2 ha of moderate-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat declines by 18 369.5 ha (38.7 per cent) and moderate-suitability habitat declines by 10 211.7 ha (11.8 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 1953.5 ha (6.7 per cent) and moderate-suitability habitat declines by 2932.8 ha (3.8 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 4245.2 ha (14.6 per cent) and moderate-suitability habitat declines by 8225.4 ha (10.8 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2164] Canada lynx

- There is 112 645.6 ha of high-suitability habitat and 396 425.7 ha of moderate-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat declines by 34 834.9 ha (30.9 per cent) and moderate-suitability habitat declines by 65 964.7 ha (16.6 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 3042.3 ha (3.9 per cent) and moderate-suitability habitat declines by 11 705.3 ha (3.5 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 10 982.4 ha (14.1 per cent) and moderate-suitability habitat declines by 24 906.3 ha (7.5 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2165] Muskrat

- There is 12 421.4 ha of high-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat increases by 4016.3 ha (32.3 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 1631.8 ha (9.9 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 1907.8 ha (11.6 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2166] Beaver

- There is 56 994.7 ha of high-suitability habitat and 64 167.4 ha of moderate-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat increases by 16 821.8 ha (29.5 per cent) and moderate-suitability habitat increases by 3298.0 ha (5.1 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 969.1 ha (1.3 per cent) and moderate-suitability habitat declines by 1506.3 ha (2.2 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 2821.3 ha (3.8 per cent) and moderate-suitability habitat declines by 3738.5 ha (5.5 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

Connectivity

[2167] Under the best-case scenario, the base case, application case and planned development cases all show an increase in movement hindrance for fur-bearers compared to predevelopment conditions.

[2168] At base case, contiguous blocks of minimal and low hindrance habitat remain throughout the vegetation and wildlife regional study area, including north and west of the terrestrial local study area around the periphery of the mineable oil sands area.

[2169] For the application case, the project disturbance area (rated entirely as high hindrance) replaces some of the smaller base case features that might have altered movement patterns, such as roads. Contiguous blocks of minimal and low hindrance habitat still occur throughout the vegetation and wildlife regional study area. Teck maintains that connectivity between the Birch Mountains and the Athabasca River will be possible through portions of the project disturbance area during mine operation because of progressive reclamation of the project and the mining sequence.

[2170] Teck said that additional developments in the planned development case could affect movement patterns west of the Athabasca River; however contiguous blocks of minimal and low hindrance habitat will persist throughout the regional study area.

[2171] [Table 33](#) summarizes the changes in landscape connectivity in the regional study area for the base, application and planned development cases relative to predevelopment conditions for the best-case scenario. The application and planned development cases represent maximum buildout.

Table 33. Changes in landscape connectivity in the regional study area, best-case scenario

Key indicator	Movement hindrance	Predevelopment conditions (ha)	Change from predevelopment conditions to base case (ha%)	Change from base case to application case (ha%)	Change from base case to PDC (ha%)
Black bear	High	0.0	56 172.5	27 954.7	55 601.9
			N/A	49.8%	99.0%
	Moderate	0.0	86 044.0	-7 221.1	-8 829.1
			N/A	-8.4%	-10.3%
	Low	683 612.2	-76 082.2	-10 817.8	-19 312.5
			-11.1%	-1.8%	-3.2%
	Minimal	511 947.5	-66 134.2	-9 915.8	-27 460.3
			-12.9%	-2.2%	-6.2%
Wolverine	High	0.0	83 233.0	27 290.7	54 056.2
			N/A	32.8%	64.9%
	Moderate	0.0	71 228.6	-9 905.3	-10 977.9
			N/A	-13.9%	-15.4%
	Low	510 766.0	-40 940.1	-3 938.3	-7 261.8
			-8.0%	-0.8%	-1.5%
	Minimal	684 793.7	-113 521.4	-13 447.2	-35 816.5
			-16.6%	-2.4%	-6.3%
Fisher	High	0.0	75 003.2	25 370.2	52 106.6
			N/A	33.8%	69.5%
	Moderate	0.0	91 073.7	-5 965.3	-6 911.9
			N/A	-6.5%	-7.6%
	Low	1 061 496.6	-125 485.3	-16 479.6	-35 508.0
			-11.8	-1.8%	-3.8%
	Minimal	134 063.1	-40 591.5	-2 925.3	-9 686.7
			-30.3%	-3.1%	-10.4%

Key indicator	Movement hindrance	Predevelopment conditions (ha)	Change from predevelopment conditions to base case (ha%)	Change from base case to application case (ha%)	Change from base case to PDC (ha%)
Canada lynx	High	0.0	80 192.7	21 455.6	48 678.4
			N/A	26.8%	60.7%
	Moderate	0.0	69 703.4	-4 670.2	-3 723.1
			N/A	-6.7%	-5.3%
	Low	686 488.5	2 405.2	-7 455.9	-16 823.5
Minimal	509 071.2	0.4	-1.1%	-2.4%	
		-152 301.2	-9 329.5	-28 131.9	
			-29.9%	-2.6%	-7.9%

[2172] For the Athabasca River and major tributaries study area, at base case minimal and low hindrance habitat occurs along much of the Athabasca River and its tributaries. The per cent loss of minimal and low hindrance habitat relative to predevelopment (2066) conditions is similar to that for the vegetation and wildlife regional study area.

[2173] At application case, inclusion of the project increases movement hindrances relative to the base case along the west side of the Athabasca River and several of its major tributaries; however, the percent loss of minimal and low hindrance habitat is less than that for the vegetation and wildlife regional study area.

[2174] At planned development case, additional developments further increase movement hindrance along the west side of the Athabasca River and several major tributaries. Contiguous patches of minimal and low hindrance habitat remain elsewhere in the Athabasca River and major tributary study area. The percent loss of minimal and low hindrance habitat is slightly lower than that for the vegetation and wildlife regional study area.

Abundance and Distribution

[2175] Teck said that habitat availability was likely to be the most significant driver of changes to fur-bearer abundance and distribution, followed by landscape connectivity and mortality. Teck considered mortality effects to be negligible to low.

[2176] Teck predicted the following changes to species abundance in the regional study area:

- For black bear, a potential reduction of less than 5 per cent at application case relative to predevelopment conditions.
- For fisher, declines of less than 30 per cent at application case relative to predevelopment conditions.

- For wolverine, numbers will experience a minor decline at application case, relative to predevelopment conditions.
- For Canada lynx, declines of less than 25 per cent are at application case relative to predevelopment conditions.
- For muskrat, numbers may experience an increase of up to 20 per cent relative at application case relative to redevelopment conditions due to progressive reclamation in the regional study. However this will be dependent on their ability to recolonize the closure landscapes in the region.
- For beaver, numbers may experience an increase of up to 15 per cent at application case relative to predevelopment conditions due to habitat reclamation. However this will be dependent on their ability to recolonize the closure landscapes in the region.

[2177] Teck stated that at planned development case, development south of the project might further affect the abundance and distribution of all species in the northwest portion of the vegetation and wildlife regional study area but abundance for most species should remain unchanged due to the presence of suitable habitat.

Analysis and Findings

[2178] The panel finds that under the best-case scenario, effects to habitat availability in the regional study area are low for black bear, muskrat and beaver at base case, application case and planned development case. Large increases in high-suitability habitat are predicted for the base case due to reclamation in the regional study area, followed by small to moderate decreases in application and planned development cases. The panel considers the magnitude of effects to be high for fisher and Canada lynx at base case, application case and planned development cases. The pattern is the similar for the worst-case scenario, although the predicted amount of habitat loss differs. The panel does not expect the worst-case scenario to occur as reclamation is a regulatory requirement and progressive reclamation is expected to occur.

[2179] The panel considers the magnitude of effects to landscape connectivity to be moderate for black bear and wolverine at base case, application case and planned development case. For black bear there is an 11.1 and 12.9 per cent decline in low and minimal hindrance habitat in the regional study area at base case relative to predevelopment conditions. There are further declines of 1.8 and 2.2 per cent at application case and 3.2 and 6.2 per cent at planned development case. For wolverine there is an 8.0 and 16.6 per cent decline in low and minimal hindrance habitat at base case relative to predevelopment conditions with further declines of 0.8 and 2.4 per cent at application case and 1.5 and 6.3 per cent at planned development case.

[2180] For fisher and Canada lynx, the panel considers the magnitude of effects to landscape connectivity to be high at base case, application case and planned development case. For fisher, there are

declines of 11.8 and 30.3 per cent in low and minimal hindrance habitat in the regional study area at base case relative to predevelopment conditions. There are further declines of 1.8 and 3.1 per cent at application case and 3.8 and 10.4 per cent at planned application case. For Canada lynx, there is an increase of 0.4 per cent and a decrease of 29.9 per cent in low and minimal hindrance habitat in the regional study area at base case relative to predevelopment conditions. There are further declines of 1.1 and 2.6 per cent at application case and 2.4 and 7.9 per cent at planned application case.

[2181] However for all fur-bearer species, the project makes only a small contribution to the loss of low and minimal hindrance habitat in the regional study area and for all assessment cases a large amount of low and minimal hindrance habitat remains available in the regional study area.

[2182] The panel considers the magnitude of effects on species abundance and distribution to be low for black bear, wolverine, muskrat and beaver at application and planned development cases given the predicted small negative or positive changes to population levels. The magnitude of effects to fisher and Canada lynx are considered high at base case, application case and planned development case given population changes of as high as 25 to 30 per cent are predicted at application case. Notwithstanding the high magnitude of effects to fisher and Canada lynx in all assessment cases, the panel agrees with Teck's assessment that the sustainability of regional populations should not be threatened as significant habitat still remains within the regional study area.

[2183] The panel acknowledges there are uncertainties regarding the timing and success of reclamation within the oil sands region, which may impact the time it may take to restore habitat and for fur-bearers to recolonize the reclaimed project disturbance area.

Significance of Cumulative Effects

[2184] Based on the criteria provided in CEEA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine cumulative effects.

- The effects are likely – habitat for each of the fur-bearing species will be reduced within the regional study area.
- The magnitude of effects are low to moderate for black bear, wolverine, muskrat and beaver and high for fisher and Canada lynx.
- The geographic extent is regional for most species with the exception of muskrat.
- The duration is long term for species within the regional study area. Effects will occur from the time habitat is disturbed until it is restored and recolonizes, which will take many years for some habitat types.

- The frequency is continuous. Once habitat is disturbed the effects continue until the habitat is restored and recolonized.
- The effects are reversible. Most habitat types impacted regionally will be reclaimed.

[2185] Considering the above factors, the panel finds that the project, in combination with other existing, approved and reasonably foreseeable projects is not likely to result in significant adverse cumulative to black bears, wolverine, muskrat and beaver. This is due to the low magnitude and reversibility of effects.

[2186] The panel finds that the project, in combination with other existing, approved and reasonably foreseeable projects is likely to result in significant adverse cumulative to fisher and Canada lynx. This effect is the result of high-magnitude effects to habitat availability and landscape connectivity. However these high-magnitude effects exist at base case. The application case and planned development cases make an incremental contribution to these effects.

Breeding Birds

[2187] In considering potential project effects to breeding birds, Teck considered birds and their habitats within the terrestrial local study area and the regional study area. Teck relied on key indicator species to represent project effects. Teck chose the following species at risk:

- Northern Goshawk (*Accipiter gentilis*) - Listed provincially as “sensitive,” ecologically important, representative of raptor guild
- Horned Grebe (*Podiceps auritus*) Listed provincially as “sensitive” and federally as Special Concern by Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
- Common Nighthawk (*Chordeiles minor*) Listed provincially as “sensitive” and federally as “threatened” in Schedule 1 of *SARA*; federal recovery strategy
- Yellow Rail (*Coturnicops noveboracensis*) Listed provincially as undetermined and federally as special concern in Schedule 1 of *SARA*
- Canada Warbler (*Cardellina canadensis*) Listed provincially as “sensitive” and federally as “threatened” in Schedule 1 of *SARA*; federal recovery strategy
- Olive-Sided Flycatcher (*Contopus cooperi*) Listed provincially as “may be at risk” and listed federally as threatened in Schedule 1 of *SARA*; federal recovery strategy
- Short-Eared Owl (*Asio flammeus*) Listed provincially as “may be at risk” and listed federally as special concern in Schedule 3 of *SARA*
- Rusty Blackbird (*Euphagus carolinus*) Listed provincially as “sensitive” and federally as special concern in Schedule 1 of *SARA*

[2188] Teck also assessed project effects on waterfowl and Whooping Crane which are addressed in subsequent sections of this report. Of these species, waterfowl, Horned Grebe, Common Nighthawk, Canada Warbler and Olive-Sided Flycatcher were all recorded during the surveys between 2005 and 2014.

[2189] Teck conducted breeding bird surveys between 2005 and 2014 and followed standard practices for environmental impact assessments in the oil sands region. During the breeding bird survey in 2012, 70 bird species—the highest number—were recorded, including incidental observations.

[2190] Of the breeding bird species recorded in 2012, two—Canada Warbler and Olive-Sided Flycatcher—are federally listed species of management concern. A third SARA-listed songbird species, two Rusty Blackbirds, were observed incidentally in the terrestrial local study area in 2008.

[2191] Teck also conducted surveys for Yellow Rails, Common Nighthawk, and Short-Eared Owls in the terrestrial local study area.

[2192] Overall, 46 breeding bird species were systematically documented at 487 distinct territories in the terrestrial local study area. The relative abundance of breeding bird species in the terrestrial local study area is comparable with results from other breeding bird surveys conducted in the regional study area. Teck also indicated there are potentially 55 waterfowl and water bird species that might occur in the terrestrial local study area during spring or fall migration. Observations (systematic/incidental) include eight bird species of management concern that are federally listed (COSEWIC 2014): Short-Eared Owl, Horned Grebe, Common Nighthawk, Yellow Rail, Barn Swallow, Canada Warbler, Olive-Sided Flycatcher, and Rusty Blackbird.

[2193] Teck stated that change in habitat availability is expected to be the primary project-related effect that will influence the abundance and distribution of breeding birds in the vegetation and wildlife regional study area.

[2194] ECCC expected that the Frontier project will contribute to likely existing significant cumulative regional effects on terrestrial and wetland-dependent SARA-listed migratory bird species. Further, the effects of the project on Canada Warbler may be high-magnitude and thus significant at the regional scale. ECCC said that the success of reclamation is currently uncertain. Loss of old-growth forests will be long term and loss of peatlands may be permanent. ECCC recommended that if the project is approved, the panel request Teck develop and implement a compensation plan within the regional study area to protect from future disturbance habitat for old-growth, wetland and other SARA-listed migratory bird species equivalent to that which would be disturbed by the project, for the purpose of maintaining migratory bird populations in the regional study area. ECCC recommended the compensation plan be developed in consultation with the Government of Alberta, ECCC and indigenous groups.

Northern Goshawk

[2195] The Northern Goshawk typically nests in mature deciduous-dominated and mixed-wood forests in Alberta. Generally, nest stands consist of multiple canopy layers, canopy gaps, a diversity of tree ages, and large standing and fallen dead trees. Older structural stages are important for Northern Goshawk nesting across North America. Closed canopy stands are preferred for nesting. While Northern Goshawk foraging territories are much larger than nesting territories, the nest stand, typically from 8 ha to 50 ha in size, is considered the critical core area.

[2196] Teck indicated at base case there is a decrease in Northern Goshawk breeding habitat availability compared to predevelopment conditions. High- and moderate-suitability Northern Goshawk breeding habitat is expected to remain in small patches along the boundary of the terrestrial local study area, primarily along the eastern edge where mature upland forests remain. High- and moderate-suitability Northern Goshawk breeding habitat is expected to remain largely through the centre of the regional study area, and in the northwest around the terrestrial local study area in areas of mature upland forest.

[2197] Old-growth forest covers 1422.9 ha (3.3 per cent) of the terrestrial local study area for the application case at closure, representing a decline of 2598.0 ha (64.6 per cent reduction) relative to predevelopment. Consequently, habitat for Northern Goshawk, which relies on mature and old-growth forest for many of their life requisites, will likely not be available on the closure landscape for 50 to 60 years after closure.

[2198] Under the best-case scenario in the regional study area there will be

- A reduction of 10 441.1 ha case (13.7 per cent) of high-suitability habitat at application case (maximum buildout) relative to the base case (74 042.4 ha).
- A reduction of 6681.1 ha case (5.1 per cent) of moderate-suitability habitat at application case (maximum buildout) relative to the base case (130 154.0 ha).

[2199] Under the worst-case scenario in the regional study area there will be

- A reduction of 10 930.6 ha (18.7 per cent) of high-suitability habitat at application case (maximum buildout) relative to the base case (58 440.9 ha).
- A reduction of 6143.9 ha (6.7 per cent) of moderate-suitability habitat at application case (maximum buildout) relative to the base case (92 226.5 ha).

Horned Grebe

[2200] Horned Grebe nest on small water bodies with a mixture of open water and emergent vegetation. Water bodies surrounded by emergent vegetation between 0.3 ha and 2 ha are preferred. Ponds, lakes, marshes, rivers, creeks and other open-water environments are considered suitable breeding and foraging habitat for Horned Grebe. Some high- and moderate-suitability Horned Grebe breeding habitat is

expected to remain in small isolated patches, mostly along the northern edge of the terrestrial local study area where small water bodies are present.

[2201] In the terrestrial local study area, changes in habitat suitability ratings from base case to application case show a decrease of 168.7 ha (78.9 per cent reduction) for high-suitability habitat and a decrease of 326.9 ha (79.1 per cent reduction) for moderate-suitability habitat.

[2202] At closure, project reclamation will include habitat that is suitable for Horned Grebe. Suitable habitat included as part of the reclamation landscape at closure is represented by wetland land units used for breeding. This includes small water bodies (i.e., less than or equal to 2 ha), watercourses and marsh and wet meadow areas associated with project water bodies. In addition to planned wetlands Teck anticipates that small, opportunistic wetlands will develop on the closure landscape due to preferential settling of reclamation prescriptions. These wetlands will also represent suitable habitat for Horned Grebe.

[2203] Teck expects that at closure, total Horned Grebe breeding habitat availability will increase in the terrestrial local study area relative to base case although the habitat gain consists of low-suitability habitat.

[2204] Under the best-case scenario in the regional study area there will be

- A reduction of 159.7 ha (6.3 per cent) of high-suitability habitat at application case (maximum buildout) relative to base case (2534.8 ha).
- A reduction of 264.4 ha (7.2 per cent) of moderate-suitability habitat at application case (maximum buildout) relative to base case (3660.0 ha).

[2205] Under the worst-case scenario in the regional study area there will be

- A reduction of 168.7 ha (8.3 per cent) of high-suitability habitat at application case (maximum buildout) relative to base case (2041.9 ha).
- A reduction of 327.0 ha (10.2 per cent) of moderate-suitability habitat at application case (maximum buildout) relative to base case (3195.0 ha).

Common Nighthawk

[2206] Common Nighthawk uses a variety of habitats for nesting throughout its range. Preferred habitat is open and semi-open areas with little ground cover. Results of the 2012 field survey confirm relatively high use of recently burned-over areas and preference for disturbed sites and habitat with lower structural stages. Small patches of high- and moderate-suitability Common Nighthawk breeding habitat are expected to remain in open conifer-dominated forest located primarily along the eastern edge of the terrestrial local study area.

[2207] In the terrestrial local study area, changes in habitat suitability ratings from base case to application case show a decrease of 307.0 ha (84.3 per cent reduction) for high-suitability habitat and a decrease of 10 565.2 ha (83.3 per cent reduction) for moderate-suitability habitat.

[2208] At closure, project reclamation will include moderate-suitability habitat for Common Nighthawk that includes coniferous Jack pine leading ecosites and marsh and wet meadow areas associated with project water bodies.

[2209] Under the best-case scenario in the regional study area there will be

- A reduction of 297.0 ha (2.2 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (13 703.1 ha).
- A reduction of 10 126.4 ha (9.2 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (109 550.1 ha).

[2210] Under the worst-case scenario in the regional study area there will be

- A reduction of 307.1 ha (4.0 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (7741.6 ha).
- A reduction of 10 565.2 ha (8.2 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to base case (122 092.0 ha).

Yellow Rail

[2211] Yellow Rail's preferred breeding habitat, attributed to COSEWIC by Teck, includes "marsh habitat with dense, fairly low herbaceous vegetation with little or no standing water (generally 0 cm to 12 cm) where the substrate remains saturated throughout the summer," including the upper levels of estuarine and salt marshes. Actual nest sites are typically associated with marshes dominated by sedges, true grasses and rushes as well as open fen habitat. High- and moderate-suitability Yellow Rail breeding habitat is expected to remain in small patches along the northern edge and in the southern most periphery of the – terrestrial local study area where open wet areas with graminoid vegetation occur.

[2212] In the terrestrial local study area, changes in habitat suitability ratings from base case to application case show a decrease of 1520.4 ha (80.0 per cent reduction) for high-suitability habitat and a decrease of 603.9 ha (63.5 per cent reduction) for moderate-suitability habitat.

[2213] Teck stated that, at closure, project reclamation will include some high- and moderate-suitability habitat for Yellow Rail, including marsh and wet meadow areas associated with project water bodies. High-suitability peatland (i.e., open fen) habitat will not be created through reclamation because peatlands are not typically included in reclamation planning for oil sands developments.

[2214] Under the best-case scenario in the regional study area there will be

- A reduction of 2026.3 ha (3.8 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (52 809.1 ha).
- A reduction of 103.5 ha (4.6 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (2241.1 ha).

[2215] Under the worst-case scenario in the regional study area there will be

- A reduction of 1520 ha (4.3 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (35 170.7 ha).
- A reduction of 603.9 ha (6.7 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (9040.0 ha).

Canada Warbler

[2216] Canada Warbler breeding habitat in Alberta includes thick stands of willow and alder along watercourses, as well as mesic deciduous and mixed-wood forests taller than 10 m with tall, rich deciduous undergrowth. At closure, total Canada Warbler breeding habitat availability decreases in the terrestrial local study area relative to base case.

[2217] In the terrestrial local study area, changes in habitat suitability ratings from base case to application show a decrease of 5855.4 ha (84.1 per cent reduction) for high-suitability habitat and a decrease of 7371.1 ha (83.2 per cent reduction) for moderate-suitability habitat.

[2218] Progressive reclamation will provide some moderately suitable habitat for Canada Warbler at closure. Specifically, planned reclamation will result in deciduous-dominated forest stands, including aspen/low-bush cranberry and balsam poplar–aspen/dogwood ecosites with a structural stage of 5 at closure. However, as this species prefers to nest in mature deciduous-dominated and mixed-wood forests, the early closure landscape will not provide high-suitability habitat in the short term. Old-growth forest covers 1422.9 ha (3.3%) of the terrestrial local study area for the application case at closure, representing a decline of 2598.0 ha (64.6% reduction) relative to predevelopment. Consequently, habitat for Canada Warbler, which relies on mature and old-growth forest for many of their life requisites, will likely not be available on the closure landscape for 50 to 60 years after closure.

[2219] Under the best-case scenario in the regional study area there will be

- A reduction of 6993.2 ha (16.6 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (42 163.3 ha).
- A reduction of 6797.1 ha (7.1 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (95 912.8 ha).

[2220] Under the worst-case scenario in the regional study area there will be

- A reduction of 5855.4 ha (18.8 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (31 202.4 ha).
- A reduction of 7371.2 ha (12.4 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (59 481.1 ha).

Olive-Sided Flycatcher

[2221] Olive-Sided Flycatcher breeding habitat in Alberta is characterized by semi-open coniferous and mixed-wood forests, often near water, as well as bogs and muskegs, open areas with snags (e.g., burns and cutblocks) and lakes with standing dead trees. At closure, total Olive-Sided Flycatcher breeding habitat decreases in the terrestrial local study area relative to base case as this species prefers nesting areas in mature to older forest stands, which will likely not be available on the closure landscape for at least 50 to 60 years after closure.

[2222] In the terrestrial local study area, changes in habitat suitability ratings from base case to application case show a decrease of 137.3 ha (59.2 per cent reduction) for high-suitability habitat and a decrease of 1251.1 ha (65.4 per cent reduction) for moderate-suitability habitat.

[2223] At closure, project reclamation will include high- and moderate-suitability habitat for Olive-Sided Flycatcher; however, because this species prefers mature forests associated with openings, the early closure landscape will not provide high to moderate-suitability habitat in the short term. Mature forest will be present in the long term as a result of reclamation. Consequently, habitat for Olive-Sided Flycatcher which relies on mature and old-growth forest for many of their life requisites will likely not be available on the closure landscape for 50 to 60 years after closure.

[2224] Under the best-case scenario in the regional study area there will be

- A reduction of 157.2 ha (2.0 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (7671.5 ha).
- A reduction of 1449.2 (3.8 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (38 202.4 ha).

[2225] Under the worst-case scenario in the regional study area there will be

- A reduction of 137.3 ha (2.2 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (6203.4 ha).
- A reduction of 1251.1 ha (3.9 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (31 994.0 ha).

Short-Eared Owl

[2226] Teck reports that Short-Eared Owls typically nest on the ground in open treeless areas, preferring large open habitats but may use smaller ones. In the woodland forest this species uses a variety of open habitats for breeding, including grasslands and the fringes of bogs, marshes, wetlands and clear cuts; as ground-nesters, these open habitats provide important habitat. Nest sites tend to be on relatively dry ground that might be slightly elevated. Preferred nesting sites are likely influenced by local abundance of prey species; Short-Eared Owls prey mostly on voles, as well as a variety of other small rodents and birds, especially when voles are scarce.

[2227] In the terrestrial local study area, changes in habitat suitability ratings from base case to application case, show a decrease of 2048.3 ha (77.2 per cent reduction) for high-suitability habitat and a decrease of 1116.7 ha (80.7 per cent reduction) for moderate-suitability habitat.

[2228] Short-Eared Owl breeding habitat decreases from base case to application case prior to complete reclamation of the project. At closure, Teck's planned reclamation will include high-suitability habitat for Short-Eared Owl, including marsh and wet meadow areas associated with project water bodies.

[2229] Under the best-case scenario in the regional study area there will be

- A reduction of 1854.7 ha (3.1 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (59 332.5 ha).
- A reduction of 1053.1 ha (1.7 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (63 348.5 ha).

[2230] Under the worst-case scenario in the regional study area there will be

- A reduction of 2055.9 ha (4.7 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (43 710.2 ha).
- A reduction of 1116.1 ha case (1.6 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (69 666.0 ha).

Rusty Blackbird

[2231] Rusty Blackbird prefers to breed in riparian habitats in forested areas and rarely uses forest interiors, generally nesting over or near water in a tree or shrub, usually in coniferous forested wetlands. This species also uses shrubby riparian areas in coniferous and mixed-wood forests. Although nest sites are most often associated with water and coniferous forests, wet, open areas in mixed-wood forests or disturbed areas such as burns and clear cuts with nearby dense coniferous growth are also used.

[2232] Rusty Blackbird breeding habitat availability decreases from base case to application case due to the direct loss of breeding habitat in the terrestrial local study area from development of the project and

associated sensory disturbances. High- and moderate-suitability Rusty Blackbird breeding habitat is expected to remain primarily along the eastern side of the terrestrial local study area with a few remnant patches in the north, where large patches of mixed-wood and wet coniferous forest remain.

[2233] In the terrestrial local study area, changes in habitat suitability ratings from base case to application case, show a decrease of 7548.5 ha (72.2 per cent reduction) for high-suitability habitat and a decrease of 4083.1 ha (63.1 per cent reduction) for moderate-suitability habitat.

[2234] Teck's reclamation plan will include some habitat that has high suitability for Rusty Blackbird, such as shrubby swamps and long drainage features where Awned Sedge will be included in plantings.

[2235] Under the best-case scenario in the regional study area there will be

- A reduction of 8790.7 ha (1.9 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (471 309.5 ha).
- A reduction of 3292.2 ha (or 2.7 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (123 253.6 ha).

[2236] Under the worst-case scenario in the regional study area there will be

- A reduction of 7548.5 ha (2.0 per cent) for high-suitability habitat relative at application case (maximum buildout) relative to the base case (374 786.2 ha).
- A reduction of 4083.1 ha (2.6 per cent) of moderate-suitability habitat at application case (maximum buildout) relative to the base case (155 685.9 ha).

Analysis

[2237] We agree that habitat availability, both direct loss and sensory disturbance, is likely to be the primary project-related effect that will influence species abundance and distribution for breeding birds.

[2238] Similar to the approach used by Teck, the panel assumes that species at risk have a lower tolerance than other valued species for changes to habitat availability. Where the panel would typically apply a 20 per cent change threshold to identify high-magnitude changes for habitat availability for valued species, for species at risk the panel considers a greater than 10 per cent change to be a high-magnitude effect. As all of the key indicator species for breeding birds are species at risk, the panel will use a 10 per cent threshold to assess project effects to breeding birds.

[2239] The panel finds that the magnitude of habitat loss within the terrestrial local study area is high for all species. This is expected as the project disturbance area comprises most of the terrestrial local study area. Within the regional wildlife and vegetation study area, the amount of high- and moderate-suitability habitat lost as a result of the project under the best-case scenario, is less than ten per cent for most species. The exceptions are Northern Goshawk where the amount of high- and moderate-suitability habitat lost as

a result of the project is 13.7 and 5.1 per cent and Canada Warbler where the amount of high- and moderate-suitability habitat lost is 16.6 and 7.1 per cent respectively. Therefore the magnitude of project effects to habitat availability for Northern Goshawk and Canada Warbler are considered high and the effects to other species moderate. While the habitat suitability ratings differ in the worst-case scenario, the magnitude of effects is about the same.

[2240] Teck's primary mitigation measure for effects to wildlife, including breeding birds, is reclamation. While this will ultimately restore habitat for most species, high-suitability habitats such as peatland (i.e., open fen), will not be created through reclamation because peatlands are not included in Teck's conservation, reclamation and closure plan because the successful reclamation of peatland has not been demonstrated. This will have project effects for various species which rely on this habitat type, including Yellow Rail and Rusty Blackbird.

[2241] Other high-suitability habitats, such as mature forests, will take at least 50 to 60 years post-closure to become established. This will have a detrimental effect on those species which heavily rely on these habitat types, such as the Olive-Sided Flycatcher, Canada Warbler, and Northern Goshawk.

[2242] Given the nature of the project, the panel accepts that there are limited mitigation measures available to mitigate these effects. The use of conservation offsets is one possible measure which Teck has indicated it is willing to use. However Teck has not provided any specific conservation offset proposals as part of its applications. Project effects to biodiversity and the use of conservation offsets is discussed further in section [25](#), "[Biodiversity](#)."

[2243] In the absence of mitigation measures demonstrated to be effective for mitigating effects to habitat availability for breeding birds, the panel finds that the project will result in significant adverse effects to some species of breeding birds, particularly those reliant on old-growth forest and wetland habitat.

[2244] While the panel does not feel it is appropriate to establish specific offset requirements for the project in the absence of evidence about specific offset proposals or the availability of offset opportunities, given predicted project effects to breeding birds, all of which are species at risk, the panel adopts the recommendation made by ECCC related to development and implementation of a compensation plan. The panel recommends that Teck work with ECCC, with input from the AER, AEP and indigenous communities to develop and implement a compensation plan within the regional study area that protects habitat for old-growth, wetland and other *SARA*-listed migratory bird species. The panel also recommends that ECCC consider the need for conservation offsets and a compensation plan to further mitigate effects to old-growth, wetland and other *SARA*-listed migratory bird species prior to making its decisions related to the Frontier project.

Recommendation to Teck

[2245] The panel recommends that Teck work with ECCC, with input from the AER, AEP and indigenous communities to develop and implement a compensation plan within the regional study area that protects habitat for old-growth, wetland and other SARA-listed migratory bird species.

Recommendations to Canada

[2246] The panel recommends that Canada consider the need for conservation offsets and a compensation plan to further mitigate effects to old-growth, wetland and other SARA-listed migratory bird species prior to making its decisions related to the Frontier project.

Significance of Project Effects

[2247] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

[2248] All of the breeding birds selected as indicator species are species at risk. The Frontier project is located within the mineable oil sands area which is an area that has and continues to experience significant industrial development.

- The effects are all likely – high- and moderate-suitable habitat loss will occur for each species as a result of the project activities such as vegetation clearing.
- The magnitude of effect is moderate to high and varies among species based on their life history, percent change in high- and moderate-suitable habitat and the success of reclamation to recover appropriate habitat.
- The geographic extent for each will be regional – given that the populations of the breeding birds within the terrestrial local study area are part of the regional population, the effects extend beyond the boundary of the terrestrial local study area.
- The duration of the effects will be long term – effects occur during construction and operation of the project and into closure. Some effects to habitat availability are irreversible (loss of Yellow Rail peatland habitat) while other effects may persist for 50 to 60 years post-closure (old-growth forest habitat of Canada Warbler and Northern Goshawk).
- The frequency of effects is continuous – once habitat is removed the effects continue until the habitat is restored.
- The effects are mostly reversible – although the loss of certain wetlands and peatlands are not reversible, other habitat types may be reclaimed and lead to the above over time.

[2249] Considering the above factors, the panel finds that the project is likely to result in significant adverse effects to wetland and old-growth-reliant breeding birds due to the magnitude and duration and irreversibility of some effects.

Cumulative Effects

Northern Goshawk

[2250] Within the regional study area for the best-case scenario

- There is 156 104.6 ha of high-suitability habitat and 127 543.9 ha of moderate-suitability habitat under predevelopment conditions (2066)
- High-suitability habitat decreases by 82 062.2 ha (52.6 per cent) and moderate-suitability habitat declines by 2610.1 ha (2.0 per cent) in the base case relative to predevelopment conditions
- High-suitability habitat declines by 10 144.1 ha (13.7 per cent) and moderate-suitability habitat declines by 6681.1 ha (5.1 per cent) in the application case at maximum buildout (2066) relative to the base case
- High-suitability habitat declines by 17 031.7 ha (23.0 per cent) and moderate-suitability habitat declines by 10 149.9 ha (7.8 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2251] Overall, Teck expected that Northern Goshawk numbers in the regional study area will experience a decline at application case of less than 35 per cent based largely on habitat loss, relative to predevelopment conditions. Teck said that the majority of Northern Goshawk remaining in the vegetation and wildlife regional study area during mine operations will persist throughout the vegetation and wildlife regional study area away from the oil sands developments. Teck also said that project factors influencing Northern Goshawk abundance and distribution are not expected to threaten the sustainability of the regional population.

[2252] Teck concluded there would be a moderate environmental consequence at the base, application and planned development cases as effects can be considered reversible due to the inclusion of suitable habitat in reclamation planning.

Horned Grebe

[2253] Within the regional study area for the best-case scenario

- There is 2618.5 ha of high-suitability habitat and 4321.9 ha of moderate-suitability habitat under predevelopment conditions (2066)
- High-suitability habitat decreases by 83.7 ha (3.2 per cent) and moderate-suitability habitat declines by 661.9 ha (15.3 per cent) in the base case relative to predevelopment conditions

- High-suitability habitat declines by 159.7 ha (6.3 per cent) and moderate-suitability habitat declines by 264.4 ha (7.2 per cent) in the application case at maximum buildout (2066) relative to the base case
- High-suitability habitat declines by 228.4 ha (9.0 per cent) and moderate-suitability habitat declines by 365.2 ha (10.0 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2254] Overall, Teck expected that Horned Grebe numbers in the regional study area will experience a decline at application case of less than 20 per cent based largely on habitat loss, relative to predevelopment conditions and that the majority of Horned Grebe remaining in the vegetation and wildlife regional study area during mine operations will persist throughout the vegetation and wildlife regional study area away from the oil sands developments. Teck said that project factors influencing Horned Grebe abundance and distribution are not expected to threaten the sustainability of the regional population.

[2255] Teck concluded that there would be a moderate environmental consequence for Horned Grebe at base case through to planned development case because wetland cover classes of the preferred size are not typically included in reclamation planning for oil sands development largely due to trade-offs associated with achieving equivalent land capability. While wetland cover classes such as marsh and wet meadow are typically included in reclamation planning for oil sands developments and provide potential Horned Grebe habitat, the amount of suitably sized wetlands planned for reclamation will decrease compared to predevelopment (2066) conditions.

Common Nighthawk

[2256] Within the regional study area for the best-case scenario

- There is 28 442.7 ha of high-suitability habitat and 191 326.3 ha of moderate-suitability habitat under predevelopment conditions (2066)
- High-suitability habitat decreases by 14 739.6 ha (51.8 per cent) and moderate-suitability habitat declines by 81 776.2 ha (42.7 per cent) in the base case relative to predevelopment conditions
- High-suitability habitat declines by 297.0 ha (2.2 per cent) and moderate-suitability habitat declines by 10 126.4 ha (9.2 per cent) in the application case at maximum buildout (2066) relative to the base case
- High-suitability habitat declines by 1828.0 ha (13.3 per cent) and moderate-suitability habitat declines by 17 010.5 ha (15.6 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2257] Overall, Teck expected that Common Nighthawk numbers in the vegetation and wildlife regional study area will experience a decline at application case of less than 50% based largely on habitat loss, relative to predevelopment (2066) conditions, and that the majority of Common Nighthawk remaining in the vegetation and wildlife regional study area during mine operations will persist throughout the vegetation and wildlife regional study area away from the oil sands developments. Teck said that project factors influencing Common Nighthawk abundance and distribution are not expected to threaten the sustainability of the regional population.

[2258] Teck predicted a moderate environmental consequence for base case through planned development case for Common Nighthawk because effects are considered reversible as reclamation planning will allow for the generation of bare open ground and upland grasslands that will provide high-suitability habitat.

Yellow Rail

[2259] Within the regional study area for the best-case scenario

- There is 59 562.6 ha of high-suitability habitat under predevelopment conditions (2066). No moderate-suitability habitat is identified under predevelopment conditions (2066).
- High-suitability habitat decreases by 6752.9 ha (11.3 per cent) in the base case relative to predevelopment conditions. There is 2247.1 ha of moderate-suitability habitat in the base case.
- High-suitability habitat declines by 2026.3 ha (3.8 per cent) and moderate-suitability habitat declines by 103.5 ha (4.6 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 3281.0 ha (6.2 per cent) and moderate-suitability habitat declines by 136.0 ha (6.1 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2260] Overall, Teck expected that Yellow Rail numbers in the vegetation and wildlife regional study area will experience a decline at application case of less than 15% based largely on habitat loss, relative to predevelopment (2066) conditions. Teck predicted that the majority of Yellow Rail remaining in the vegetation and wildlife regional study area during mine operations will persist throughout the vegetation and wildlife regional study area away from the oil sands developments. Project factors influencing rail abundance and distribution are not expected to threaten the sustainability of the regional population, but will be contributing to cumulative reductions of regional management concern.

[2261] Teck anticipates a moderate environmental consequence at base case and high environmental consequence for Yellow Rail for both application case and planned development case, because of the loss of wetland cover classes such as the open fen. Changes are likely irreversible or largely irreversible because the current body of knowledge on peatland reclamation is still in the early stages. Wetland cover

classes such as marsh and wet meadow cover classes are typically included in reclamation planning for oil sands developments and do provide potential Yellow Rail habitat. However, because of an increase in upland topography on the closure landscape, the area of wetland on the landscape will decrease in general and remain below predevelopment (2066) conditions.

Canada Warbler

[2262] Within the regional study area for the best-case scenario

- There is 88 726.0 ha of high-suitability habitat and 78 359.2 ha of moderate-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat decreases by 46 562.7 ha (52.5 per cent) and moderate-suitability habitat increases by 17 553.6 ha (22.4 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 6993.2 ha (16.6 per cent) and moderate-suitability habitat declines by 6797.1 ha (7.1 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 10 970.4 ha (26.0 per cent) and moderate-suitability habitat declines by 9426.4 ha (9.8 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2263] Overall, Teck expected that Canada Warbler numbers in the vegetation and wildlife regional study area will experience a decline at application case of less than 30% based largely on habitat loss, relative to predevelopment (2066) conditions. Teck expected that the majority of Canada Warbler remaining in the vegetation and wildlife regional study area during mine operations will persist throughout the vegetation and wildlife regional study area away from the oil sands developments. Project factors influencing Canada Warbler abundance and distribution are not expected to threaten the sustainability of the regional population.

[2264] Teck concluded there would be a moderate environmental consequence for base case through planned development case for Canada Warbler. This is because effects are considered reversible; particularly as reclamation planning for oil sands development makes extensive use of upland deciduous and mixed-wood forests, which are considered preferred Canada Warbler habitat.

Olive-Sided Flycatcher

[2265] Within the regional study area for the best-case scenario

- There is 12 052.0 ha of high-suitability habitat and 54 492.1 ha of moderate-suitability habitat under predevelopment conditions (2066).

- High-suitability habitat decreases by 4380.5 ha (36.3 per cent) and moderate-suitability habitat declines by 16 289.7 ha (29.9 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 157.2 ha (2.0 per cent) and moderate-suitability habitat declines by 1449.2 ha (3.8 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 874.2 ha (11.4 per cent) and moderate-suitability habitat declines by 5022.1 ha (13.1 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2266] Overall, Teck expects that Olive-Sided Flycatcher numbers in the vegetation and wildlife regional study area will experience a decline at application case of less than 35% based largely on habitat loss, relative to predevelopment (2066) conditions, and that the majority of Olive-Sided Flycatcher remaining in the vegetation and wildlife regional study area during mine operations will persist throughout the vegetation and wildlife regional study area away from the oil sands developments. Project factors influencing Olive-Sided Flycatcher abundance and distribution are not expected to threaten the sustainability of the regional population.

[2267] Teck concluded that there would be a moderate environmental consequence for base case through planned development case for Olive-Sided Flycatcher. This is because effects to habitat are considered reversible over the long term due to the species' preference for mature/old-growth stands with interspersed edge habitats.

Short-Eared Owl

[2268] Within the regional study area for the best-case scenario

- There is 87 585.2 ha of high-suitability habitat and 75 159.1 ha of moderate-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat decreases by 28 252.7 ha (32.3 per cent) and moderate-suitability habitat declines by 11 810.6 ha (15.7 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 1854.7 ha (3.1 per cent) and moderate-suitability habitat declines by 1053.1 ha (1.7 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 4365.0 ha (7.4 per cent) and moderate-suitability habitat declines by 2918.2 (4.6 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2269] Overall, Teck expected that Short-Eared Owl numbers in the vegetation and wildlife regional study area will experience a decline at application case of less than 30% based largely on habitat loss,

relative to predevelopment (2066) conditions. Teck expected that the majority of Short-Eared Owl remaining in the vegetation and wildlife regional study area during mine operations will persist throughout the vegetation and wildlife regional study area away from the oil sands developments. Project factors influencing Short-Eared Owl abundance and distribution are not expected to threaten the sustainability of the regional population.

[2270] Teck concludes that there will be a moderate environmental consequence for base case through to planned development case for Short-Eared Owl as wetland cover classes such as bog and fen cover classes are not typically included in reclamation planning for oil sands development.

Rusty Blackbird

[2271] Within the regional study area for the best-case scenario

- There is 525 479.1 ha of high-suitability habitat and 119 517.8 ha of moderate-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat decreases by 54 169.6 ha (10.3 per cent) and moderate-suitability habitat declines by 3735.8 ha (3.1 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 8790.7 ha (1.9 per cent) and moderate-suitability habitat declines by 3292.2 ha (2.7 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 27 452.4 ha (5.8 per cent) and moderate-suitability habitat declines by 5300.4 ha (4.3 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2272] Overall, Teck expects that Rusty Blackbird numbers in the vegetation and wildlife regional study area will experience a decline at application case of less than 10% based largely on habitat loss, relative to predevelopment (2066) conditions, and that the majority of Rusty Blackbird remaining in the vegetation and wildlife regional study area during mine operations will persist throughout the vegetation and wildlife regional study area away from the oil sands developments. Project factors influencing Rusty Blackbird abundance and distribution are not expected to threaten the sustainability of the regional population, but will be contributing to cumulative reductions of regional management concern.

[2273] Teck concludes that there will be a moderate environmental consequence for base case and application case and high environmental consequence at planned development case for Rusty Blackbird as wetland cover classes such as bog and fen cover classes are not typically included in reclamation planning for oil sands development. As a result changes are likely irreversible or largely irreversible because the current body of knowledge on peatland reclamation is still in the early stages.

Analysis

[2274] Using the 10% change threshold, the panel finds that there are high-magnitude effects to habitat availability for all breeding bird indicator species in the regional study area at application case and planned development case relative to predevelopment conditions. For all species except Horned Grebe, high-magnitude effects already exist at base case. For Horned Grebe effects to habitat are moderate at base case compared to predevelopment conditions.

[2275] For most species the largest reduction in habitat availability occurs between predevelopment conditions and the base case. For Northern Goshawk, Common Nighthawk and Canada Warbler the decline in high-suitability habitat in the regional study area is more than 50 per cent at base case relative to predevelopment conditions. For Olive-Sided Flycatcher and Short-Eared Owl there is a more than 30 per cent reduction in high-suitability habitat at base case relative to predevelopment conditions.

[2276] The panel also finds that there are high-magnitude effects to breeding bird abundance for all indicator species except Rusty Blackbird at application case relative to predevelopment conditions. For species other than Rusty Blackbird predicted reductions in numbers range from less than percent for Yellow Rail to less than 50 per cent for Common Nighthawk at application case relative to predevelopment. For Rusty Blackbird the reduction in numbers is predicted to be less than 10 per cent at application case relative to predevelopment conditions.

[2277] Species that prefer mature and old-growth forests experience the largest effects to habitat availability and abundance. The panel expects progressive reclamation will occur in the region and will ultimately restore mature and old-growth habitat, however this will not occur for more than 80 years following reclamation. While some wetland habitat will be restored during reclamation in the region, there will be a substantial net loss of wetlands as typical reclamation and closure plans for oil sands mines include in increase in uplands and open water at the expense of wetlands. Effects to species such as Yellow Rail are amplified by the irreversibility of effects as some types of wetlands, such as peatland cannot be reclaimed.

Significance of Cumulative Effects

[2278] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine cumulative effects.

- The effects in the regional study area are likely – there has already been a significant loss of high- and moderate-suitability habitat for breeding birds in the regional study area and the project will contribute to this loss.

- The magnitude of effects are high – while the magnitude varies by species, all species experience a loss of more than 10 per cent of high- and moderate-suitability habitat and some species experience a loss of more than 50 per cent.
- The geographic extent is regional – given that the population limits of the breeding birds extend beyond the regional study area boundary.
- The duration of effects is long term – given that the habitat requirements of many of the breeding birds listed, the reclamation abilities are either irreversible (Yellow Rail) or will occur 50–80+ years post-closure.
- The frequency of effects is continuous – the effects occur from the time habitat is lost until it is restored and recolonized.
- The effects are partially reversible – the loss of certain wetlands and peatlands are not reversible, other habitat types including old-growth forests may be restored but recovery of such habitat types will take decades.

[2279] Considering the above factors, the panel finds that the project, in combination with other existing, approved and reasonably foreseeable projects is likely to result in significant adverse cumulative effects to breeding birds that are reliant upon wetlands and old-growth forests.

Waterfowl

[2280] Waterfowl (ducks, geese and swans) are an important component of biodiversity and are important species for indigenous and non-indigenous harvesting activities. The oil sands region provides an important corridor for migrating waterfowl, particularly during the fall. Changes to bird populations migrating through this corridor due to birds landing on external tailings areas and other industrial water bodies could affect waterfowl populations in the Peace-Athabasca Delta and elsewhere. Migratory birds in Canada are protected by the *Migratory Birds Convention Act*.

[2281] In assessing the project's potential effects on waterfowl, Teck conducted one waterfowl survey in 2012 to assess breeding populations and reproductive success, evaluated waterfowl habitat and habitat loss, considered the effects of tailings ponds on water fowl and water birds and identified mitigation and monitoring measures. These measures are outlined in Teck's draft waterfowl protection plan.

Waterfowl Surveys and Results

[2282] To determine the potential effects of the project on waterfowl, Teck conducted waterfowl aerial surveys during the 2012 breeding season. Teck documented the habitat use, diversity and abundance of ducks, geese, swans and other water birds, with a focus on species of management concern. These surveys were conducted to assess the status of the breeding population and their reproductive success. Although waterfowl surveys were not carried out during spring and fall migration, the high density of open water in

the central portion of the terrestrial local study area, including several shallow lakes, indicates this area also provides important stopover and feeding habitat for waterfowl migrants travelling through the terrestrial local study area.

[2283] A total of 325 adult waterfowl, representing 13 species, were systematically recorded by Teck. A total of 122 waterfowl broods containing 590 juveniles were observed in 59 of the 90 wetlands (66 per cent) surveyed in the terrestrial local study area. The large number of waterfowl broods and high number of juveniles observed per adult pair suggests that the terrestrial local study area contains functional waterfowl breeding habitat. The relatively large number of observations, including broods and species of management concern, in the central portion of the terrestrial local study area suggests this area contains important breeding habitat for waterfowl relative to other wetland habitat in the terrestrial local study area. Waterfowl aerial survey observation data indicates that Unnamed Lake 1 and Unnamed Lake 2 are used by waterfowl.

Waterfowl Habitat Availability

[2284] Both the regional study area and terrestrial local study area contain waterfowl habitat that will be negatively affected by the project. Ponds, lakes, marshes, rivers, creeks and other open-water environments are considered suitable foraging habitat for waterfowl. Preferred nesting habitat varies by species and includes areas of emergent vegetation in wetlands, uplands near wetlands and tree cavities.

[2285] Teck reported that under predevelopment conditions, moderate and high-suitability waterfowl breeding habitat existed in patches throughout most of the terrestrial local study area where water bodies or watercourses are present and are associated with adjacent shrub or grass cover, and mature trees with cavities.

[2286] Teck indicated that at application case, waterfowl breeding habitat decreases in the terrestrial local study area from base case due to the direct loss of breeding habitat and sensory disturbances associated with the project. A decrease of 6938.1 ha (67.9 per cent reduction) for high-suitability habitat and a decrease of 6336.6 ha (66.9 per cent reduction) for moderate-suitability habitat is predicted. High- and moderate-suitability waterfowl breeding habitat is expected to remain in small isolated patches where water bodies or watercourses remain, primarily along the eastern and northern boundary of the terrestrial local study area.

[2287] In the regional study area, under the best-case scenario there will be

- A reduction of 6740.4 ha (2.0 per cent) for high-suitability habitat at application case (maximum development) relative to the base case (328 804.8 ha).
- A reduction of 6475.2 ha (4.0 per cent) for moderate-suitability habitat at application case (maximum development) relative to the base case (161 081.7 ha).

[2288] In the regional study area, under the worst-case scenario there will be

- A reduction of 6943.4 ha (2.4 per cent) of high-suitability habitat at application case (maximum buildout) relative to the base case (283 413.1 ha).
- A reduction of 6331.4 ha (5.3 per cent) of moderate-suitability habitat at application case (maximum buildout) relative to the base case (118 589.1 ha).

[2289] Indigenous communities reported that Unnamed Lakes 1 and 2 within the project disturbance area are important breeding and rearing areas.

[2290] ECCC also expressed concern regarding the loss of these two small lakes as they may provide important spring staging, nesting and brood-rearing habitat. ECCC recommended a compensation plan as mitigation for the loss of this habitat. This is discussed further in the section on mitigation below.

Tailings Ponds and Other Impacts on Waterfowl

[2291] Teck said that tailings areas are the main cause of mortality risk to migrating or breeding waterfowl in the mineable oil sands area. Tailings areas are an integral part of the bitumen mining and extraction process and contain a mixture of process-affected water, residual hydrocarbons and other substances. Migratory bird contact with process-affected water and residual hydrocarbons is a concern. Tailings areas are of particular concern because the oil sands region lies along the convergence zone of flyways for migratory waterfowl on their way to and from the Peace-Athabasca Delta. The risk to waterfowl associated with tailings areas interactions is difficult to quantify as the total numbers of birds migrating through the oil sands region is not known with any scientific rigour. Recent estimates suggest that the Peace-Athabasca Delta hosts as many as 1.5 million birds each spring and fall.

[2292] Industry self-reported mortality data puts the average yearly number of waterfowl deaths due to tailings areas at approximately 65 bird deaths per year. Other recent estimates put the mortality rate higher but still less than 200 birds per year. Also of concern are the birds which land on tailings ponds and fly away. It is not known what the results of contact with process-affect water and residual hydrocarbons may be. Oil or other chemical products in the pond might cause feather fouling, or the liquid might be harmful if ingested. Additionally, birds that might use the pond for a period of time, then leave, might be subject to harm in the future as they preen their feathers, or if oiled feathers rub against eggs in a bird's nest.

[2293] Teck considered the environmental consequence for waterfowl landing in tailings management areas as high but the likelihood of these accidents occurring to be low.

[2294] ECCC indicated that numerous migratory birds continue to land on process-affected water bodies (including tailings areas) despite the presence of best available bird deterrent technology.

[2295] Mikisew and Athabasca Chipewyan raised the concern that migration patterns are changing, resulting in a large decrease of waterfowl travelling along traditional corridors to and through the Peace-Athabasca Delta. Members stated that these changes have been caused by the reductions in water levels within the Peace-Athabasca Delta.

[2296] Kátl'odeeche First Nation indicated that there is potential for effects to migratory birds due to changes in availability of food and habitat, contamination of water, food, and sediments, and alteration of migration routes because of the project. Kátl'odeeche First Nation is also concerned about bird exposures to contaminated tailing and non-tailings water bodies and airborne pollution.

[2297] Other indigenous groups also expressed concerns about project effects on waterfowl including that tailings areas and other industrial water features associated with the project will result in the direct mortality or contamination of waterfowl. They expressed concern that impacts on current flyways and migration routes for waterfowl will adversely affect the ability of indigenous groups to hunt waterfowl, and loss of waterfowl habitat, including staging and nesting habitat.

[2298] Canadian Parks and Wilderness Society (CPAWS) indicated that with the close proximity of the project's tailings ponds to Wood Buffalo National Park and the Peace-Athabasca Delta, the number of birds exposed to process-affected water will increase in the future. It said that process-affected water can negatively impact migratory birds through direct exposure, ingestion or inhalation, which can ultimately lead to decreased fitness and death. CPAWS described the migration corridor for waterfowl and water birds, including Whooping Crane, on their way to and from Wood Buffalo National Park as passing over the mineable oil sands area, including the project. CPAWS argued that despite the implementation of extensive bird deterrent programs, tailings areas within the region represent a mortality risk to migratory birds if direct exposure occurs.

Mitigation and Monitoring

[2299] To mitigate effects to waterfowl habitat in the terrestrial local study area, Teck said that project reclamation will include habitat that has high suitability for waterfowl. High-suitability habitat included as part of the reclamation landscape at closure is represented by areas near wetlands used for breeding and includes the following:

- water bodies and watercourses and surrounding vegetation
- shrubby swamps along drainage features
- marsh and wet meadow areas associated with project water bodies

[2300] Surrounding wetlands and water bodies in upland areas will provide additional moderate-suitability habitat in the closure landscape and suitable nesting habitat for upland nesting waterfowl species.

[2301] With respect to waterfowl interaction with project infrastructure such as tailings ponds, Teck stated that mitigation options will be evaluated based on best practices identified by the Research on Avian Protection project and other recent literature as well as through consultation with other operators. This information will be used to develop detailed construction and operational procedures, and mitigation measures to reduce wildlife mortality risk during tailings area start-up and operation. Teck said that currently, on-demand, radar-based detection and deterrent systems are considered the best available method to deter birds from tailing areas. Teck anticipated that this type of system will be used for tailings areas. Teck said that based on the industry record of tailings pond-related bird deaths, even the best bird deterrent systems can be optimized. Teck committed to using state of the art bird deterrent systems.

[2302] Indigenous groups and Dr. Cassidy-St. Clair (expert witness for CPAWS), expressed doubts about the overall effectiveness of bird deterrent systems, especially during inclement weather events. Dr. St. Clair stated that three major landings of birds in tailings ponds in 2008, 2010, and 2014 had similar characteristics in that the landings occurred at night during a storm. She stated it has also been reported that anthropogenic light disproportionately appears to attract birds during foul weather and during cloud cover. Dr. St. Clair also stated there is concern regarding the habituation to most kind of deterrents and how industry has responded by introducing radar systems to only fire when birds are detected.

[2303] Dr. St. Clair stated that there are several limitations of bird deterrent systems that are not unique to any one system. One such limitation is the efficacy of long-range acoustic devices given observations that birds were landing regardless of the sound. Additionally, Dr. St. Clair identified the potential for collateral damage from long-range acoustics, as noise pollution may also affect other wildlife, particularly songbirds in the woodland.

[2304] CPAWS suggested that due to the proximity of the project to the Peace-Athabasca Delta, Teck could have greater difficulty deterring birds because they are likely to receive greater traffic. However, CPAWS acknowledged that the birds can also make use of Ronald Lake, Lake Claire and other lakes in the area.

[2305] Additional monitoring and mitigation measures are set out in Teck's draft waterfowl protection plan which applies both to waterfowl and Whooping Crane. The draft waterfowl protection plan provides a high-level introduction to the mitigation and monitoring measures to be implemented. These include, but are not limited to, the following:

- Reduce migratory water bird use of ponds and potential attractiveness by limiting vegetation.
- Remove any peat mats that float to the surface of the tailings.

- Manage the use of anthropogenic lighting and restrict the use of lighting around wastewater ponds or tailings areas unless required for safe operations.
- Incorporate bird deterrent systems through a variety of auditory, visual and physical radar-linked and non-radar-linked deterrents to discourage bird use of wastewater ponds and tailings areas.

[2306] ECCC recommended that Teck conduct a study, in collaboration with other oil sands mine operators as part of regional monitoring efforts, to determine the extent of off-site effects on migrating birds resulting from contact with oil sheen. ECCC suggested this study should also include research and development into alternative designs for its external tailings areas, which could include covering external tailings areas to prevent bird landings, reducing the size of external tailings areas and continuously removing all bitumen and oil from the surface of external tailings areas.

[2307] Teck agreed, in part with ECCC's recommendation. Teck stated they are willing to support regional monitoring if prioritized by the Oil Sands Monitoring Program, which Teck is mandated to fund. Teck also agreed that they would participate in the Oil Sands Monitoring Program.

[2308] Parks Canada suggested additional baseline studies to contribute to the better understanding of potential environmental effects to migratory birds and to reduce the uncertainty associated with them. Parks Canada recommended that Teck be required to complete baseline studies on stopover habitat use by migratory waterfowl in the project development area prior to construction.

[2309] Teck agreed with the recommendation to complete baseline studies on stopover habitat prior to construction.

[2310] Because of the potential for significant residual local scale effects on migratory bird habitat, in particular stopover habitat because of the loss of Unnamed Lake 1 and Unnamed Lake 2, and uncertainty in the success of end-pit lakes, Parks Canada and ECCC recommended that Teck develop and implement a compensation plan within the regional study area. This plan would be to protect against future disturbance to stopover habitat equivalent to that disturbed by the project (in particular lake habitat). ECCC suggested that the compensation plan should be developed in consultation with Alberta, indigenous groups and ECCC.

[2311] Teck agreed in part with ECCC's recommendation. Teck said it is willing to pursue biodiversity offsets for residual environmental effects related to the project. It committed to:

- Completing the biodiversity management planning process to identify preferred biodiversity elements to be considered for offsetting residual project effects. This would be done with the understanding that the draft biodiversity management plan can only provide context for negotiation of a conservation agreement because there are practical limitations to realizing meaningful biodiversity offsets in Alberta.

- Engaging with regulators, indigenous communities and stakeholders during the biodiversity management planning process and during ongoing work to understand and define how biodiversity offsets might be realized in Alberta.
- Negotiating a conservation agreement with Environment & Climate Change Canada, this includes input from the AER and AEP.
- Providing routine reports to ECCC, AER, and AEP after the project is operating that summarize progress on realizing meaningful biodiversity offsets for the Frontier project.

[2312] Parks Canada believed that to reduce the uncertainty and contribute to better understanding of effects of this project and to inform future project proposals, additional studies on migration routes are needed to understand waterfowl monitoring data during the lifetime of the project and to measure success of the reclamation program after project closure. To achieve this, Parks Canada recommended Teck be required to participate in the oil sands bird technical team and contribute to studies and research on regional waterfowl, including waterfowl migration routes.

[2313] Teck agreed to participate and support the oil sands bird technical team, whose work is to provide support to understanding the regional and local effects of migrating birds that come in contact with bitumen and other process-affected waters.

[2314] Athabasca Chipewyan and Teck jointly developed objectives and commitments related to migratory birds. The objectives include avoiding acute and chronic mortality of migratory birds in tailing ponds, maintaining sufficient and adequate stopover habitat in Lower Athabasca region, and supporting Athabasca Chipewyan's aboriginal and treaty rights to hunt migratory birds in Athabasca Chipewyan territory. The mitigation and management commitments include working collaboratively with Athabasca Chipewyan with respect to Teck's mitigation, monitoring and adaptive management plans, including those related to migratory birds; initiating reclamation of areas disturbed by the project as soon as reasonably possible; consulting with Athabasca Chipewyan and implementing best practices for the bird deterrent system; implementing wetland offsets; and developing adaptive management plans with quantitative targets and thresholds.

[2315] Athabasca Chipewyan recommended that Alberta and Canada implement short and long-term regional migratory bird studies to assess the acute and chronic impacts of oil sands development to migratory birds.

Analysis

[2316] The panel notes that Teck conducted waterfowl surveys during only one season which may not be fully representative of waterfowl use of the area and may not have covered all waterfowl habitat that may be affected by the project. This results in some uncertainty about the robustness of the baseline information, mostly with respect to spring and fall migrations. While it may have been helpful to have

additional survey information to improve confidence in Teck's assessment, the panel is satisfied that it has sufficient information to assess the project's effects on waterfowl and waterfowl habitat.

[2317] The panel accepts Teck's commitment to complete baseline studies on stopover habitat use by migratory waterfowl in the project development area prior to construction and has made this a condition of approval.¹⁴⁸

[2318] The project will result in the eventual removal of all waterfowl habitat within the project disturbance area, an area of 292 km². As this includes more than 60 per cent of the high-suitability habitat within the terrestrial local study area, and Unnamed Lakes 1 and 2, this represents a high-magnitude effect at the level of the local study area. The loss of this habitat may also have consequences for indigenous harvesting of waterfowl within the terrestrial local study area. The panel notes however that not all of this habitat loss occurs at once. The habitat loss will occur over the 41 year life of the mine as it advances, so some waterfowl habitat will remain within the project disturbance area for many years before it is disturbed.

[2319] Within the regional study area, for the best-case scenario the amount of waterfowl habitat removed as a result of the project is about 2 per cent for high-suitability habitat and 4 per cent for moderate-suitability habitat. For the worst-case scenario, the predicted losses are only marginally higher. The panel finds these to be low magnitude effects.

[2320] The panel accepts that Unnamed Lakes 1 and 2 may provide for habitat for spring staging, nesting and brood-rearing however no evidence was presented to indicate they are uniquely important. Additionally, large amounts of high- and moderate-suitability habitat for waterfowl remain available within the regional study area.

[2321] With respect to Parks Canada and ECCC's recommendation that Teck develop and implement a compensation plan within the regional study area to protect against future disturbance to stopover habitat (in particular lake habitat) the panel has included a recommendation in section 25, "[Biodiversity](#)" that Teck work with ECCC, Alberta and Indigenous communities to determine if additional conservation agreements may be necessary to achieve Teck's conservation and biodiversity objectives. The recommendation is not specific to the protection of stopover habitat as it is intended to accommodate Teck's intention to use its biodiversity management planning process to identify preferred biodiversity elements for offsetting.

[2322] The panel acknowledges that migratory pathways and the preference of migratory birds for landing sites within the mineable oil sands region are not fully understood. Additional studies and research may be beneficial in better understanding these issues and may inform future assessment of effects and mitigation measures. The panel accepts Teck's commitments to contribute to studies and

¹⁴⁸ Draft EPEA Approval – Condition 4.6.6(d)

research on regional waterfowl and to participate in the oil sands bird technical team. The panel has made these commitments conditions of approval.¹⁴⁹

[2323] The panel requires Teck to finalize and submit its waterfowl protection plan (bird protection plan) to the AER for approval prior to construction of the project. The plan must include measures to prevent wildlife from coming into contact with industrial wastewater including but not limited reducing the attractiveness of ponds to birds through design, construction and operational measures; prevention of and elimination of floating or emergent vegetation from the ponds; minimizing the presence of floating bitumen from the ponds; and bird deterrent systems. The plan must also include measures for monitoring and documenting avian mortality or contact with industrial wastewater.¹⁵⁰

[2324] The panel accepts that even with advanced bird deterrent systems and the other proposed mitigation measures, some avian landing will still occur and some mortality may result. Any mortality is regrettable however considering the large numbers of waterfowl and other migratory birds that fly over the oil sands region, the number of birds observed to land in tailings ponds is low and the amount of direct mortality lower still. The panel accepts however that not all landings and mortality may be observed or reported and that there are concerns about the potential for longer term or chronic as well as acute effects. Notwithstanding these uncertainties, the panel is satisfied that Teck's proposed mitigation measures and the panel's conditions will minimize the potential for avian landings and mortality. As result the panel considers the magnitude of effects associated with waterfowl mortality resulting from landing in tailings ponds to be low.

Significance of Project Effects

[2325] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

[2326] Large numbers of migratory birds fly over the Lower Athabasca region and the Frontier project area during spring and fall migrations to and from the Peace-Athabasca Delta and Wood Buffalo National Park. The project area may provide important breeding, rearing and stopover habitat for migratory waterfowl.

- The effects are likely – the project disturbance area will be cleared and habitat for waterfowl will be removed.

¹⁴⁹ Draft EPEA Approval – Conditions 4.6.6(b) and 4.6.23

¹⁵⁰ Draft EPEA Approval – Conditions 4.6.1, 4.6.5, 4.6.6, 4.6.17, and 4.6.18

- The magnitude of the effect is low – although thousands of hectares of high- and moderate-suitability habitat will be removed within the project disturbance area, this represents only 2 and 4 per cent of the habitat available in the region. Mortality effects to wildlife due to the project are also expected to be low.
- The geographic extent is regional for effects to habitat availability and international for mortality risk as waterfowl migrate across jurisdictional boundaries.
- The duration is long term – given the timeframe to reestablish migratory habitat, typically made up of wetlands, it may take 80 or more years to restore such areas to full function.
- The frequency is continuous – effects to habitat availability will occur from the time habitat is removed until it is restored. Mortality effects would be periodic.
- The effects are partially reversible – while wetland and open-water habitat will be restored at closure, there will be a net loss of wetlands and some wetland types, such as peatlands will not be restored. At closure, project effects related to mortality will cease.

[2327] Considering the above factors, the panel finds that the project is not likely to result in significant adverse effects to waterfowl given the low magnitude of effects.

Cumulative Effects

[2328] Where there will be a residual effect of the project after mitigation, an assessment of cumulative effects is required.

[2329] Within the regional study area for the best-case scenario

- There is 365 931.1 ha of high-suitability habitat and 146 344.6 ha of moderate-suitability habitat under predevelopment conditions (2066)
- High-suitability habitat decreases by 37 126.3 ha (10.1 per cent) and moderate-suitability habitat increases by 14 737.1 ha (10.1 per cent) in the base case relative to predevelopment conditions
- High-suitability habitat declines by 6740.4 ha (2.0 per cent) and moderate-suitability habitat declines by 6475.2 ha (4.0 per cent) in the application case at maximum buildout (2066) relative to the base case
- High-suitability habitat declines by 17 506.1 ha (5.3 per cent) and moderate-suitability habitat declines by 10 519.3 ha (6.5 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2330] Teck concludes there is a low environmental consequence for base case through to planned development case for waterfowl. This is because effects are considered reversible as reclamation planning

for oil sands developments will include the creation of wetland cover classes such as marsh and wet meadow as well as open water that will provide potential waterfowl habitat.

[2331] Indigenous communities are concerned about the cumulative reduction in waterfowl habitat quantity and quality in mineable oil sands area and the increasing numbers of tailings ponds. Decreased health of waterfowl populations is another concern. Athabasca Chipewyan stated that hundreds of migratory birds are landing in industrial water bodies in the oil sands and becoming oiled and flying away. The fate and long-term health of these birds is unknown and to date no studies have tracked where these birds go, whether they survive, or whether there are impacts to individual fitness. This is of serious concern to the Athabasca Chipewyan as land users who consume waterfowl and eggs in the Peace-Athabasca Delta and Wood Buffalo National Park.

Analysis and Findings

[2332] In the regional study area, under the best-case scenario, high- and moderate-suitability habitat for waterfowl decreases by less than 20 per cent at base, application and planned development cases relative to predevelopment conditions. The panel considers this to be a moderate magnitude effect. While the decreases in high- and moderate-suitability habitat are slightly higher than 20 per cent under the worst-case scenario, the panel does not expect this scenario to occur. Reclamation is a regulatory requirement and progressive reclamation is expected to occur.

[2333] Waterfowl mortality due to waterfowl landing on tailings ponds or interacting with other industrial infrastructure is also expected to be of low magnitude.

Significance of Cumulative Effects

[2334] Based on the criteria provided in CEEA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of cumulative effects.

- The effects are likely – some loss of habitat has occurred and the project will contribute to this loss.
- The magnitude of effects is moderate – the loss of and high- and moderate-suitability habitat is less than 20 per cent for the application and planned development cases and sufficient waterfowl habitat remains to sustain waterfowl populations.
- The geographic extent is regional for habitat loss and international for mortality risk as waterfowl migrate across jurisdictional boundaries.
- The duration is long term – given the time it takes to restore waterfowl habitat.

- The frequency is continuous – the effects occur from the time the habitat is disturbed until it is restored.
- The effects are partially reversible – while wetland and open-water habitat will be restored, there will be a net loss of wetlands and some wetland types, such as peatlands will not be restored.

[2335] Considering the above factors, the panel finds that the project, in combination with other existing, approved and reasonably foreseeable projects is not likely to result in significant adverse cumulative effects to waterfowl due to the low magnitude of effects and the availability of remaining habitat within the regional study area.

Whooping Crane

[2336] According to ECCC, Whooping Crane are one of the rarest bird species in North America and are listed as endangered in both Canada and the United States of America. International conservation efforts have successfully increased population levels from near extinction in the 1940s to approximately 757 individuals in 2017, with the majority of birds occurring within the Aransas-Wood Buffalo population. The recovery goal for Whooping Crane is to protect, restore and manage the species to be self-sustaining in the wild, with a long-term goal of establishing 1000 individuals in at least one self-sustaining population in North America by 2035.

[2337] The majority of Whooping Crane (431 individuals in 2017) occur within the Aransas-Wood Buffalo population.

[2338] ECCC stated that the probability of species' extinctions over the next 100 years is considered to be low (less than 15 per cent), if current environmental conditions do not deteriorate.

[2339] Teck acknowledged a valid link between migratory birds including the Whooping Crane and the project. The migration corridor for waterfowl and water birds, including Whooping Crane, to Wood Buffalo National Park passes over the mineable oil sands area, including the project. Despite the implementation of extensive bird deterrent programs, tailings areas within the region present a mortality risk to migratory birds if direct exposure occurs. Data from individuals fitted with collars suggests the Whooping Crane migratory corridor for some individuals of the Aransas-Wood Buffalo population overlaps the mineable oil sands area and the regional study area. Recent data indicates five confirmed and two probable sightings of Whooping Crane have been recorded in the oil sands region.

Habitat

[2340] Teck reported that potential effects to Whooping Crane habitat apply only to stopover habitat used during migration as this species is known not to breed within the regional study area. Whooping Crane use a variety of wetlands along their migration corridor, favouring temporary and seasonal wetlands in the spring, and semi-permanent or permanent wetlands in the fall. Ponds, lakes, marshes,

rivers, creeks and other shallow open-water environments are considered suitable stopover habitat for Whooping Crane.

[2341] In the terrestrial local study area there is a 2894.5 ha (98.6 per cent reduction) of high-suitability habitat from base case to application case. A small amount of Whooping Crane stopover habitat is expected to remain along the eastern edge of the terrestrial local study area where small water bodies are present.

[2342] In the regional study area, under the best-case scenario there will be

- A reduction of 2747.1 ha (4.1 per cent) for high-suitability habitat at application case relative to base case (58 368.0 ha). No moderate-suitability habitat is identified for any of the assessment cases.

[2343] Under the worst-case scenario in the regional study area there will be

- A reduction of 3158.8 ha (7.6 per cent) of high-suitability habitat at application case relative to the base case (41 386.3 ha). No moderate-suitability habitat is identified for any of the assessment cases.

[2344] *The Recovery Strategy for the Whooping Crane (Grus americana) in Canada* identifies critical habitat within the Wood Buffalo National Park with no additional critical habitat identified outside of the Park.

[2345] Teck predicts that the closure landscape will provide conditions conducive to the reestablishment of Whooping Crane stopover habitat. Wetland communities will be supported by the reestablishment of drainage courses and areas of open water. At closure, total Whooping Crane stopover habitat availability increases in the terrestrial local study area relative to base case. However habitat gain consists of low-suitability habitat. High-suitability Whooping Crane stopover habitat is expected to occur in shallow open water bodies mainly throughout the western portion of the terrestrial local study area habitat.

[2346] ECCC stated that the loss of migrating habitat and increase in development in the woodland forest, along the bird's migration route, represents a potential threat to the species.

[2347] Parks Canada indicated that the project will contribute directly to the loss of stopover habitat for Whooping Crane. Parks Canada stated the project would remove up to 2747 ha (best-case scenario) to 3159 ha (worst-case scenario) of high and moderate quality Whooping Crane stopover habitat, and contribute an approximately 5 per cent cumulative decline in high and moderate quality stopover habitat in the regional study area.

Mortality Risk

[2348] Mortality risk for Whooping Crane is associated with interactions with tailings ponds during spring and fall migration, however the risk of Whooping Crane interactions with tailings areas or other project-related infrastructure is largely unknown.

[2349] Since the project update was filed in 2015, ECCC, as part of the Whooping Crane tracking partnership, has collected additional data on Whooping Crane migration and stopovers in the mineable oil sands area. Collar data reported by ECCC from 2010 to 2016 shows that most cranes migrate over the mineable oil sands area: 76 per cent in the spring (50 per cent to 90 per cent) and 92 per cent in the fall (84 per cent to 100 per cent). Of the individual cranes flying over the mineable oil sands area, relatively few stopped over: 16 per cent in the spring (11 per cent to 25 per cent) and 14 per cent in the fall (8 per cent to 21 per cent). For cranes that did, the stopovers were generally short in duration (one to two nights) and far from tailings areas (a distance of 23.0 km with a variability of plus or minus 15.7 km). However, some individual cranes have been observed to land on or adjacent to tailings areas (e.g., at the Muskeg River and Mildred Lake mines).

[2350] Teck initially assessed mortality risk to Whooping Crane from potential project effects as low at application case. Teck stated, as part of their review and response to ECCC, under conservative scenarios and considering most recent data and deployment of bird deterrents that the low magnitude of mortality risk would likely be more of a moderate magnitude. Mortality risk is characterized by Teck as how likely it is that a fatality may occur based on the likelihood of an interaction occurring. Overall, Teck concluded that mortality risk will not result in a change in abundance of Whooping Crane population and distribution, although the loss of stopover habitat might alter their distribution during migration. Teck also indicated that the project is not expected to threaten the sustainability of the regional population of Whooping Crane and the breeding population of Wood Buffalo National Park. Teck notes that numbers of crane breeding pairs and total population numbers have been increasing over the period of oil sands development.

[2351] Athabasca Chipewyan and Mikisew expressed concern that the proposed project could affect Whooping Crane through increased habitat fragmentation, reduced habitat connectivity, cumulative stopover habitat removals, and increased risk of mortality associated with contact with industrial wastewater and tailings management areas at the mine site.

[2352] CPAWS said that with the close proximity of the project's tailings ponds to Wood Buffalo National Park, the number of birds exposed to process-affected water will increase in the future. It stated that process-affected water can negatively impact migratory birds through direct exposure, ingestion or inhalation, which can ultimately lead to decreased fitness and death. CPAWS was concerned that the migration corridor for the Whooping Crane passes over the mineable oil sands area, including the project. CPAWS said that despite the implementation of extensive bird deterrent programs, tailings areas within the region provide a mortality risk to migratory birds if direct exposure occurs.

[2353] ECCC stated it was concerned about Whooping Crane mortality associated with contact with deleterious substances (e.g., oil, bitumen, heavy metals) in tailings ponds and other process-affected water bodies, as well as collisions with mine infrastructure and loss of migratory or stopover habitat.

[2354] Parks Canada said that inexperienced cranes, such as juveniles and sub-adults, may be at higher risk of being exposed to tailings management areas or other industrial sites during migration.

Mitigation and Monitoring

[2355] Teck said that project reclamation will include some high-suitability habitat for Whooping Crane. Suitable stopover habitat included as part of the reclamation landscape at closure is represented by wetland cover classes and includes:

- littoral zone of water bodies and watercourses
- marsh and wet meadow areas associated with project water bodies

[2356] Teck referred to studies and research completed through the Research on Avian Protection Project and the Oil Sands Bird Contact Monitoring Program. The research completed under these programs is to monitor the effectiveness of various bird deterrents in the region. Continued efforts to deter migratory birds from tailings areas should help protect Whooping Crane from exposure. For any event involving a Whooping Crane, Teck committed to complying with directions from the Canadian Wildlife Service (ECCC).

[2357] The concerns raised by Dr. Cassidy-St. Clair (CPAWS) related to bird deterrent systems for waterfowl are also relevant for Whooping Crane. This includes the efficacy of long-range acoustic bird deterrent systems and the potential for these systems to affect other wildlife, particularly song birds.

[2358] CPAWS provided mitigation recommendations which include: a standardized monitoring program of all ponds; engagement of the public; and address the standardization of bird protection via deterrence.

[2359] ECCC recommended Teck research and implement new technologies to deter Whooping Crane from external tailings areas that could include the use of drones to continuously patrol potential landing and stopover areas during the migration season, and prevent cranes from landing in these areas.

[2360] Teck agreed in part with ECCC's recommendation. Teck said that the draft waterfowl protection plan identifies monitoring, mitigation and adaptive management necessary to deter waterfowl, including Whooping Crane and the adaptive management program will identify alternate designs for external tailings areas. Teck proposed to finalize and implement the waterfowl protection plan for the Frontier project.

[2361] ECCC wanted Teck to monitor the occurrence, movements and habitat use of Whooping Crane on and adjacent to Teck's lease lands to determine the response of birds to project activities of the Frontier mine, and to inform development of mitigation measures. ECCC also suggested information be collected on interactions of Whooping Crane with external tailings areas and other industrial water bodies

and be used by Teck to evaluate the success of mitigation measures and to improve performance of these measures and adaptive management plans.

[2362] Teck agreed with this recommendation through the finalization and implementation of the waterfowl protection plan.

[2363] ECCC also indicated that Teck should contribute funding to a regional monitoring program for Whooping Crane in the oil sands region, to inform understanding of broader cumulative effects and risks posed by oil sands developments. Parks Canada Agency supported of ECCC's proposed mitigation measures

[2364] Teck agreed in part with this recommendation. Teck said it will participate in the Oil Sands Monitoring Program and will support the regional monitoring of Whooping Crane if prioritized by program managers.

[2365] The joint letter from Athabasca Chipewyan and Teck included commitments to work collaboratively to implement mitigation, monitoring and adaptive management plans that pertain to migratory birds and their habitat. The letter also commits Teck to using industry best practices with respect to tailings pond bird deterrent systems but does not address Whooping Crane specifically.

Analysis

[2366] The panel understands that there is no critical Whooping Crane habitat outside of Wood Buffalo National Park. However, the panel accepts that members of the Aransas-Wood Buffalo Whooping Crane population migrate over the mineable oil sands region, including the project area, and that stopover habitat exists in the area. The project will remove almost all (98.6 per cent) of the high-suitability habitat for Whooping Crane within the terrestrial local study area. Within the regional study area, the amount of high-suitability habitat removed by the project is less than 10 per cent relative to the base case for both the best and worst-case scenarios. Using the 10 per cent change threshold for species at risk, the panel considers this a moderate magnitude effect.

[2367] Reclamation should restore stopover habitat in the long term, however reclaimed habitat is expected to be predominantly low-suitability habitat as the wetlands included in Teck's closure plan are larger than those preferred by Whooping Crane.

[2368] Based on the evidence provided by ECCC the panel accepts that Whooping Crane do use areas around oil sands mining operations and there is therefore some potential for them to come into contact with process-affected water or bitumen in tailings ponds. However the data indicates that relatively few cranes stopover in the mineable oil sands area and those that do seem to prefer areas far from tailings facilities. This appears to be consistent with the lack of observed mortality for Whooping Crane associated with landings in tailings ponds. The panel recognizes however that it is possible for some

landings and mortality to go undetected. However, based on the available evidence, the panel concludes that the risk of Whooping Crane mortality resulting from contact with process-affected water or bitumen in tailings ponds is low to moderate.

[2369] Most of the mitigation measures and conditions implemented for migratory waterfowl will also mitigate effects to Whooping Crane. The panel is satisfied that the proposed mitigation measures and commitments made by Teck, together with the panel's conditions, will minimize the potential for mortality effects to Whooping Crane. As a result, the panel finds that project effects to Whooping Crane abundance and distribution are expected to be low and not likely to affect the sustainability of the Whooping Crane population.

[2370] As discussed for waterfowl, the panel acknowledges that bird deterrent systems are not 100 per cent effective at deterring birds from landing on tailings ponds. Ongoing research into deterrent systems will be necessary to further reduce the potential for avian contact with tailings ponds and other process-affected waters. The panel is satisfied with Teck's commitment to participate on ongoing research and adopt the most advanced bird deterrent systems available when the project goes into operation.

[2371] The panel accepts Teck's commitment to consider and identify alternative designs and mitigation measures for the project's tailings ponds as part of its waterfowl protection plan and requires that this be a component of the plan to be submitted to the AER.¹⁵¹ The panel has included submission of the completed waterfowl (bird) protection plan to the AER as a condition of approval.

[2372] The panel also accepts Teck's commitment to monitor the occurrence, movements and habitat use of Whooping Crane on and adjacent to Teck's lease including interactions with tailings areas and will require this as part of the final waterfowl (bird) protection plan.¹⁵²

[2373] The panel acknowledges Teck's commitment to support regional monitoring initiatives through participation in the Oil Sands Monitoring Program. This is a regulatory requirement and has been included as a condition of approval.¹⁵³

[2374] In order to mitigate potential adverse effects of the Frontier project on migratory birds including Whooping Crane, and confirm the results of the assessment, the panel recommends that the Minister include a waterfowl protection plan and a follow-up program in the decision statement under *CEAA 2012* (see section [38](#)).

¹⁵¹ Draft *EPEA* Approval – Conditions 4.6.5 and 4.6.6

¹⁵² Draft *EPEA* Approval – Condition 4.6.6(e)

¹⁵³ Draft *EPEA* Approval – Condition 4.6.23

Significance of Project Effects

[2375] Based on the criteria provided in CEEA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

[2376] Whooping Crane are listed as endangered in both Canada and the United States of America. Whooping Crane from the Aransas-Wood Buffalo population fly over the Frontier project area on their way to and from their breeding grounds in Wood Buffalo National Park. While there is not critical Whooping Crane habitat outside of Wood Buffalo National Park, the project area contains stopover habitat that may be used during migration.

- The effects of the project are likely – the project will remove suitable stopover habitat that could be available to Whooping Crane.
- The magnitude of the effects is moderate for habitat availability and low for abundance and distribution. Low to moderate-magnitude effects are predicted for mortality associated with contact with tailings ponds or other project infrastructure.
- The geographic extent is international – given that the Whooping Crane population may use habitat within the boundary of the terrestrial local study area but is a migratory species with a route that extends from northern Wood Buffalo National Park to southern North America.
- The duration of effects is long term – given the timeframe required to reclaim Whooping Crane habitat (approximately 80+ years), such as wetlands, to a functional status.
- The duration of effects is continuous – as the effect occurs from the time the habitat is lost until the habitat is restored.
- The effects are partially reversible in the long term – while wetland and open-water habitat will be restored at closure, there will be a net loss of wetlands and a loss of wetlands of the size preferred by Whooping Crane. At closure, project effects related to mortality will cease.

[2377] Considering the above factors, the panel finds that the project is not likely to result in significant adverse effects to Whooping Crane given the low magnitude of effects.

Cumulative Effects

[2378] Where there will be a residual effect of the project after mitigation, an assessment of cumulative effects is required.

[2379] Within the regional study area for the best-case scenario

- There is 66 458.1 ha of high-suitability habitat under predevelopment conditions (2066). No moderate-suitability habitat is identified for predevelopment conditions or for any of the assessment cases.
- High-suitability habitat declines by 8089.9 ha (12.2 per cent) at base case relative to predevelopment conditions.
- High-suitability habitat declines by 2747.1 ha (4.7 per cent) at application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 4010.2 ha (6.9 per cent) at planned development case at maximum buildout (2066) relative to the base case.

[2380] Teck concluded that the loss of high-suitability stopover habitat for Whooping Crane would be of moderate environmental consequence for all assessment cases (base case through to planned development case). Teck said wetland cover classes such as marsh/wet meadow are typically included in reclamation planning for oil sands developments so effects on stopover habitat are considered reversible.

[2381] Teck predicted low-magnitude effects to Whooping Crane abundance and distribution in the regional study area for at base case, application case and planned development case. Teck concluded these were of low environmental consequence as effects can be considered reversible as reclamation planning for oil sands developments will include the creation of wetland cover classes such as marsh/wet meadow cover classes as well as open water that will provide potential stopover habitat. In addition, reclamation will eliminate active tailings areas in the oil sands region, thereby minimizing mortality risk.

Analysis and Findings

[2382] Using the 10 per cent change threshold for at-risk species, for the best-case scenario, there are high-magnitude effects to Whooping Crane stopover habitat availability in the base, application and planned development cases in the regional study area under the best-case scenario. The most significant reduction in high-suitability habitat occurs from predevelopment conditions to the base case.

[2383] Although the loss of stopover habitat exceeds the 10 per cent threshold, the population of Whooping Crane is increasing, and existing disturbance and oil sands development does not appear to be limiting population recovery goals. Under existing conditions, the cumulative effect of development in the region does not appear to be resulting in an adverse effect on Whooping Crane abundance and distribution. This appears to support Teck's assessment that effects to Whooping Crane abundance and distribution are likely to be low for all assessment cases.

Significance of Cumulative Effects

[2384] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

- The effects are likely – stopover habitat for Whooping Crane has been removed in the regional study area and the project will remove additional habitat.
- The magnitude of effects is high for habitat availability but low for Whooping Crane abundance and distribution.
- The geographic extent is international – given that the Whooping Crane population movement extends beyond the boundary of the Canada, migrating to southern North America.
- The duration of effects is long term – given the timeframe for much of the habitat required to be reclaimed.
- The frequency is continuous as effects will occur until the disturbed habitat is restored.
- The effects are partially reversible in the long term – while wetland and open-water habitat will be restored as disturbances are reclaimed, there will be a net loss of wetlands and a loss of wetlands of the size preferred by Whooping Crane as these are not typically included in closure plans.

[2385] Considering the above factors, the panel finds that the project, in combination with other existing, approved and reasonably foreseeable projects is not likely to result in significant adverse cumulative effects to Whooping Crane. While loss of stopover habitat exceeds the threshold for a high-magnitude effect for all assessment cases, population recovery is occurring indicating that loss of stopover habitat is not adversely affecting Whooping Crane recovery or the abundance and distribution of Whooping Crane.

Other SARA Wildlife – Myotis Species

[2386] Teck assessed the potential of the project to affect Myotis species because several of them are of management concern. Teck carried out echolocation surveys and mist net surveys in 2005, 2008 and 2010. Echolocation calls permit general bat community and species group activity patterns to be observed. Capturing bats using fine mist nets can allow identification to the species level. Teck also considered the effects of the project on Myotis species habitat.

[2387] Four bat species of management concern were observed in the terrestrial local study area during the bat systematic surveys: hoary, silver-haired, little brown (designated as Endangered by COSEWIC), and Northern Myotis (designated as “endangered” by COSEWIC). Eastern red bats were observed incidentally in the terrestrial local study area.

[2388] Little Brown (*Myotis lucifugus*) and Northern Myotis (*Myotis septentrionalis*) were listed in 2014 as endangered under SARA. The Little Brown Myotis is listed provincially as “may be at risk.” Little Brown and Northern Myotis were the key indicator species for which Teck assessed potential project effects.

[2389] Little Brown and Northern Myotis are small bats dependent on forest interiors and edges. These species generally avoid open non-forested areas. They rely on preexisting rock and tree cavities as sites for roosting, raising young and maternity colonies. The generally preferred roosting habitats are mature forest stands because of the abundance of snags and senescent trees suitable as roosting sites. Both deciduous and mixed-wood stands are used with preference given to those near water.

[2390] Teck also reports that mortality of Little Brown Myotis and Northern Myotis associated with the fungal white nose syndrome has reduced known hibernating populations by more than 94 per cent in eastern Canada (COSEWIC 2013a). However, in 2009, the provincial population of Little Brown Myotis was estimated at 1 to 1.5 million individuals (ASRD and ACA 2009). The population of the Northern Myotis are unknown in Alberta, although recent survey efforts suggest that Northern Myotis might be more abundant than previously thought in northern Alberta (ASRD and ACA 2009). There are no density estimates for Little Brown or Northern Myotis; therefore, effects of the project on Myotis are discussed qualitatively based on habitat availability.

[2391] The Government of Canada has Recovery Strategies in place for both Little Brown and Northern Myotis species. Action plans are still in development.

Habitat Availability

[2392] The 2011 Richardson fire decreased the availability of suitable Myotis roosting habitat by reducing the amount of mature and old-growth forest stands.

[2393] Within the terrestrial local study area, the changes in habitat suitability rating from base case to application case indicate a decrease of 6653.7 ha (85.6 per cent reduction) for high-suitability habitat and a decrease of 8826.0 ha (81.5 per cent reduction) for moderate-suitability habitat.

[2394] At closure, total Myotis roosting habitat availability decreases in the terrestrial local study area relative to base case. Small patches of high- and moderate-suitability roosting habitat are expected to occur along the boundary of the terrestrial local study area, with a few larger patches of moderate-suitability habitat located in the centre in reclaimed deciduous-dominated areas. These areas are expected to become more suitable as they mature. However, such habitat will likely not be available on the closure landscape for 50 to 60 years after closure.

[2395] In the regional study area, under the best-case scenario there will be

- A reduction of 8072.8 ha (18.5 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (43 590.7 ha).
- A reduction of 8217.0 ha (5.7 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (144 468.3 ha).

[2396] In the regional study area, under the worst-case scenario there will be

- A reduction of 6653.7 ha (20.4 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (32 602.5 ha).
- A reduction of 8825.9 ha (9.1 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (96 650.9 ha).

[2397] The Government of Canada has Recovery Strategies in place for both Little Brown and Northern Myotis species. Action plans are still in development.

Mitigation

[2398] Mitigation proposed by Teck is primarily restoration of habitat through reclamation. Since Myotis roosting habitat requires mature to senescing old growth it will be several decades after closure before such habitat is available.

Analysis and Findings

[2399] Teck's surveys demonstrate that Myotis species are present in the terrestrial local study area. Project activities will result in the removal of more than 80 per cent of the roosting habitat available to them in the terrestrial local study area. This represents a high-magnitude effect within the local study area. Within the regional study area, using the 10 per cent threshold for species at risk, there is also a high-magnitude effect to habitat availability for Myotis species. However roosting habitat remains available within the regional study area.

[2400] Reclamation may ultimately restore Myotis habitat but only in the long term given that these species prefer mature forest stands for roosting habitat.

[2401] Habitat loss may result contribute to a decrease in abundance and altered distribution of Myotis species in the vegetation and wildlife regional study area.

[2402] The panel understands these Myotis species have been listed by COSEWIC because their numbers are reduced and this reduction is due in part to "white nose syndrome."

Significance of Project Effects

[2403] Based on the criteria provided in CEEA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

- The effects are likely – Myotis habitat will be removed within the project disturbance area as a result of the project.
- The magnitude of the effect is high – there will be a reduction of more than 10 per cent of high-suitability habitat in the regional study area as a result of the project.
- The geographic extent is regional – Myotis populations occurring within the terrestrial local study area will seek out habitat in the surrounding regional study area.
- The duration is long term – given the time required for old-growth forest to return to the project disturbance area.
- The frequency is continuous – effects will occur from the time the habitat is removed until the habitat is restored.
- The effects are reversible in the long term – as the forested areas within the reclaimed project disturbance area mature.

[2404] Considering the above factors, the panel finds that the project is likely to result in significant adverse effects to Myotis species given the magnitude of habitat loss and that habitat will not be restored for at least 50 to 60 years post-closure.

Cumulative Effects

[2405] Where there will be a residual effect of the project after mitigation, an assessment of cumulative effects is required.

[2406] Within the regional study area for the best-case scenario:

- There is 88 726.0 ha of high-suitability habitat and 144 218.8 ha of moderate-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat decreases by 45 135.3 ha (50.9 per cent) and moderate-suitability habitat increases by 249.5 ha (0.2 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 8072.8 ha (18.5 per cent) and moderate-suitability habitat declines by 8217.0 ha (5.7 per cent) in the application case at maximum buildout (2066) relative to the base case.

- High-suitability habitat declines by 12 070.6 ha (27.7 per cent) and moderate-suitability habitat declines by 16 528.1 ha (11.4 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2407] Teck states that although at application case and planned development case there is a decrease in habitat availability, high- and moderate-suitability *Myotis* roosting habitat remains in patches throughout most of the vegetation and wildlife regional study area in mature and old-growth deciduous and mixed-wood stands.

[2408] Teck assesses the environmental consequence for *Myotis* species as moderate for habitat availability from base case through to planned development case in the regional study area as effects are considered reversible, particularly as reclamation planning for oil sands development makes extensive use of upland deciduous and mixed-wood forests, which are considered preferred *Myotis* roosting habitat.

Analysis and Findings

[2409] In the regional study area, under the best-case scenario, there are high-magnitude (greater than 10 per cent change) effects to habitat availability for *Myotis* species at base, application and planned development cases relative to predevelopment conditions. While the most significant reduction in high-suitability habitat occurs from predevelopment conditions to the base case, large additional losses occur at application and planned development cases as additional mature forest habitat is removed from the regional study area.

Significance of Cumulative Effects

[2410] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of cumulative effects.

- The effects are likely – existing development has already removed *Myotis* habitat and additional habitat will be removed by the project.
- The magnitude of the effect is high – loss of high-suitability habitat is greater than 10 per cent for all assessment cases.
- The geographic extent is regional – *Myotis* populations are expected to move beyond the terrestrial local study area.
- The duration is long term – due to the length of time it will take for mature forest to return to the reclaimed areas.
- The frequency is continuous – effects will occur from the time the habit is disturbed until it is restored.

- The effects are reversible in the long term – it will take more than 50 to 60 years following closure mine for mature forest habitat to become reestablished.

[2411] Considering the above factors, the panel finds that the project, in combination with other existing, approved and reasonably foreseeable projects is likely to result in significant adverse cumulative effects to *Myotis* species given the magnitude of habitat loss and that preferred roosting habitat will not be restored until at least 50 to 60 years post-closure.

Other SARA Wildlife – Amphibians

[2412] Teck assessed potential project effects to amphibian species and their habitat. The amphibian findings were based on nocturnal surveys conducted from May 21 to 28, 2013, and from May 23 to June 2, 2014, as well as visual encounter surveys conducted in 2013. In 2013, 61 sites were surveyed in the terrestrial local study area and an estimated 1767 amphibians were recorded, including Canadian toad (n=21), wood frog (n=82) and woodland chorus frog (n=1664). Amphibians were heard at 84 per cent (n=51) of survey sites. In 2014, 95 sites were surveyed in the terrestrial local study area and 11 442 amphibians were recorded. These comprised two species, wood frog (n=97) and woodland chorus frog (n=11 354). Amphibians were heard at 97 per cent (n=92) of survey sites.

[2413] Teck selected the western toad (*Anaxyrus boreas*) and the Canadian toad (*Anaxyrus hemiophrys*) as key indicator species. The western toad is listed provincially as “sensitive” and federally as special concern in Schedule 1 of SARA. The Canadian toad is a CEMA Priority I species, listed provincially as “may be at risk.”

[2414] Teck reported that three amphibian species of management concern were recorded in the terrestrial local study area: Canadian toad, western toad and wood frog. Canadian toad was recorded at eight locations systematically and once (a single juvenile) incidentally; western toad was recorded once incidentally (a single juvenile in 2008); and wood frog was recorded at 150 locations systematically and at six locations incidentally. In the terrestrial local study area, Canadian toad was observed in adult and juvenile life stages, and wood frog was observed in all three life stages (adult, juvenile and tadpole). Wood frog was observed throughout regions of the terrestrial local study area that were surveyed.

[2415] Amphibian observations were distributed throughout wetlands in the terrestrial local study area, and species abundance and richness was greatest in the central part. Western toad was not detected during acoustic surveys, nor was it detected systematically during 2006 and 2008 baseline tadpole surveys. As indicated, a juvenile western toad was observed once incidentally in the northeast corner of the terrestrial local study area in 2010.

Canadian Toad

[2416] Teck states that Canadian toads require breeding habitat reasonably close to summer foraging and winter thermal shelter for the non-breeding portion of the year. Canadian toads overwinter in coarse-textured soils below the frost line, with hibernation starting in late August and early September.

[2417] Canadian toad was observed at two sites along the south-central periphery of the terrestrial local study area and at another site along the northcentral periphery of the terrestrial local study area near Unnamed Waterbody 29.

[2418] In the regional study area, under the best-case scenario there will be

- A reduction of 1203.4 ha (2.0 per cent) for high-suitability habitat at application case (maximum development) relative to the base case (61 468.1 ha).
- A reduction of 7481.1 ha (1.7 per cent) for moderate-suitability habitat at application case (maximum development) relative to base case (452 033.0 ha).

[2419] In the regional study area, under the worst-case scenario there will be

- A reduction of 1320.7 ha (2.2 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (59 584.5 ha).
- A reduction of 7816.1 ha (2.1 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (36 4262.1 ha).

[2420] Teck considered the effects to be reversible because wetland cover classes and sandy upland classes are typically included in reclamation planning for oil sands developments.

[2421] Teck predicted some mortality would occur during winter site clearing.

Western Toad

[2422] Teck said that the western toad requires breeding habitat reasonably close to summer foraging and winter thermal shelter for the non-breeding portion of the year. Toads breed in a variety of natural and artificial aquatic habitats with or without tree or shrub canopy cover, coarse woody debris, or emergent vegetation, including ponds, stream edges, margins of lakes, ditches and road ruts. Outside of the breeding season, adult toads move to summer ranges that can include upland, and breeding or non-breeding wetland habitats, including forested areas and wet shrublands.

[2423] Western toad was not detected during 2013 and 2014 nocturnal amphibian surveys in the terrestrial local study area but a single western toad was observed incidentally in 2010

[2424] In the regional study area, under the best-case scenario there will be

- A reduction of 10 235.4 ha (3.0 per cent) for high-suitability habitat at application case (maximum development) relative to the base case (341 887.3 ha).
- A reduction of 13 347.2 ha (4.5 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (295 040.2 ha).

[2425] In the regional study area, under the worst-case scenario there will be

- A reduction of 8992.6 ha (3.6 per cent) for high-suitability habitat at application case (maximum buildout) relative to the base case (250 793.3 ha).
- A reduction of 12 592.0 ha (4.6 per cent) for moderate-suitability habitat at application case (maximum buildout) relative to the base case (272 843.2 ha).

[2426] Teck considered the effects to be reversible as the closure landscape of the project contains marshes, shrubby swamps, open water and littoral zones adjacent to suitable upland habitats which will provide suitable year-round habitat for western toad. However Teck noted that wetland cover classes such as bog and fen are not typically included in reclamation.

[2427] Teck expected some mortality would occur for western toad during winter site clearing.

Mitigation

[2428] Teck will conduct additional surveys for western toad at suitable breeding wetlands in the project disturbance area prior to any disturbances associated with the project. If western toads are encountered, Teck will consult with AEP and the Alberta Conservation Association to develop appropriate methods to translocate toads to suitable wetlands outside the project development area.

[2429] Teck's reclamation plan includes an additional 2387 ha of shrubby swamp on the closure landscape (compared to predevelopment) along with marshes and water and littoral habitat will provide breeding habitat for Canadian toad and western toad.

Analysis

[2430] The panel accepts that Canadian toad and the western toad occur in the terrestrial local study area.

[2431] The project will result in the removal of available habitat within the project disturbance area but the panel considers this be a moderate-magnitude effect as the loss of high- and moderate-suitability habitat within the regional study area is less than ten per cent under the best and worst-case scenarios. Additionally, Teck's reclamation plan includes shrubby swamp breeding habitat and other habitat for these two species.

[2432] The panel expects that some mortality will result from winter clearing activities but this is unavoidable. The panel is satisfied with Teck's commitment to carry out further surveys for western toad

prior to carrying out any disturbance associated with the project. This will reduce the potential for mortality effects.

Significance of Project Effects

[2433] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects.

- The effects of habitat reduction are likely – habitat for the Canadian toad and the western toad will be removed within the project disturbance area as a result of the project.
- The magnitude of the effect is moderate – loss of high- and moderate-suitability habitat is less than ten per cent for Canadian toad and western toad.
- The geographic extent is local – there will be a loss of habitat within the terrestrial local study area for both species.
- The duration of the effects is medium term – some habitat is expected to be recreated during progressive reclamation.
- The frequency is continuous – the effects will occur from the time habitat is disturbed until the time it is restored.
- The effects are reversible – habitat will be restored through reclamation.

[2434] Considering the above factors, the panel finds that the project is not likely to result in significant adverse effects to Canadian toad and western toad given the geographic extent, magnitude, and reversibility of effects.

Cumulative Effects

[2435] Where there will be a residual effect of the project after mitigation, an assessment of cumulative effects is required.

Canadian Toad

[2436] Within the regional study area for the best-case scenario

- There is 63 312.6 ha of high-suitability habitat and 466 987.4 ha of moderate-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat decreases by 1844.5 (2.9 per cent) and moderate-suitability habitat decreases by 14 954.4 ha (3.2 per cent) in the base case relative to predevelopment conditions.

- High-suitability habitat declines by 1203.4 ha (2.0 per cent) and moderate-suitability habitat declines by 7481.1 ha (1.7 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 3084.8 ha (5.0 per cent) and moderate-suitability habitat declines by 19 132.9 ha (4.2 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2437] Teck concluded that there was a low environmental consequence associated with effects to habitat availability for Canadian toad for all assessment cases (base case, application case and planned development case) relative to predevelopment conditions. This is because wetland cover classes and sandy upland classes are typically included in reclamation planning for oil sands developments and therefore effects are considered reversible.

[2438] Teck also concluded there was a low environmental consequence associated with effects to Canadian toad abundance and distribution for all assessment cases relative to predevelopment conditions.

Western Toad

[2439] Within the regional study area for the best-case scenario

- There is 413 744.2 ha of high-suitability habitat and 337 676.0 ha of moderate-suitability habitat under predevelopment conditions (2066).
- High-suitability habitat decreases by 71 856.9 ha (17.4 per cent) and moderate-suitability habitat decreases by 42 635.8 ha (12.6 per cent) in the base case relative to predevelopment conditions.
- High-suitability habitat declines by 10 235.4 ha (3.0 per cent) and moderate-suitability habitat declines by 13 347.2 ha (4.5 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 26 984.3 ha (7.9 per cent) and moderate-suitability habitat declines by 23 466.45 ha (8.0 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

[2440] Teck concluded there was a moderate environmental consequence associated with effects to habitat availability for western toad for all assessment cases relative to predevelopment conditions. Teck considers the effects to be reversible or largely reversible because adequate amounts of breeding, foraging and overwintering habitat will exist within suitable proximity to each other on the closure landscape.

[2441] Teck also concluded that there a moderate environmental consequence associated with effects to western toad abundance and distribution all assessment cases relative to predevelopment conditions.

Analysis and Findings

[2442] Using the 10 per cent change threshold, changes to habitat availability for the Canadian toad are moderate for all assessment cases relative to predevelopment conditions. For western toad, changes to habitat availability are high for all assessment cases relative to predevelopment conditions. While some change to abundance and distribution is likely in all cases relative to predevelopment conditions, the magnitude of the effect is not likely to threaten the sustainability of regional populations.

Significance of Cumulative Effects

[2443] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of cumulative effects.

- The effects are likely – a loss of habitat has already occurred in the regional study area and the project will result in further loss.
- The magnitude of the effect is moderate for the Canadian toad and high for the western toad.
- The geographic extent is regional – habitat loss is occurring in the region.
- The duration of the effects is medium term – some habitat will be created as progressive reclamation occurs in the region.
- The frequency is continuous – effects occur from the time habitat is disturbed until it is restored.
- The effects are reversible – habitat will be restored through reclamation.

[2444] Considering the above factors, the panel finds that the project, in combination with other existing, approved and reasonably foreseeable projects is likely to result in significant adverse cumulative effects to some amphibian species, such as western toad due to the high magnitude of habitat loss in the region.

Wildlife Biodiversity

Evidence

[2445] Teck acknowledged that construction, operation and closure of the Frontier project will physically alter wildlife habitat and its connectivity and may contribute to cumulative direct and indirect effects to wildlife mortality. The project may therefore affect the abundance and distribution of wildlife and contribute to changes in wildlife biodiversity in the region.

[2446] Methods used to assess effects to wildlife biodiversity potential were based on the vegetation species diversity assessment in the 2015 project update and the Oil Sands Biodiversity Ranking Update as used by Golder (2011). The two methods were used to estimate and rank plant species diversity and vegetation community diversity to determine change in distribution of wildlife biodiversity potential as an

indicator of overall biodiversity. The Golder method (2011) was used to assign biodiversity ranking indices based on two levels; landscape and ecosystem composition. Each land unit was ranked based on a combined score against four landscape- and ecosystem-based biodiversity indices quantifying components of biodiversity: rarity of land units (e.g., vegetation type), total wildlife species richness, overlap of wildlife species (i.e., proportion of species shared with other land units) and potential for rare or special status wildlife species.

[2447] For both the local and regional study areas, wooded (poor) fens and shrubby swamps were determined to have high biodiversity potential based on the wildlife-based indices. None of the upland classes were ranked high for biodiversity potential. Seven of the nineteen upland vegetation types were ranked medium for biodiversity potential and only the marsh class in wetlands was ranked moderate for biodiversity potential.

[2448] Within the terrestrial local study area, Teck reported that

- From predevelopment to base case there is a 109.5 ha (2.6 per cent) decline in areas of high biodiversity potential and a 333.3 ha (2.2 per cent) decline in areas of moderate biodiversity potential.
- From base case to application case, there is a decline of 2978.4 ha (71.2 per cent) in areas of high biodiversity potential and a decline of 9897 ha (67.3 per cent) in areas of moderate biodiversity potential at maximum buildout. The relatively large decrease occurs because the project development area represents most of the terrestrial local study area.
- From base case to application case, there is a 2978 ha (71.2 per cent) decline in high biodiversity areas at maximum buildout. This includes a 920.8 ha (49.1 per cent) decline in high biodiversity potential wooded fen and a 2057.6 ha (89.1 per cent) decline in high biodiversity potential shrubby swamps at maximum buildout.
- At closure there will be a 1466.8 ha (35.1 per cent) increase in land with high biodiversity potential compared to base case.
- The predicted increase at closure is because shrubby swamps, which have a high biodiversity potential will be reclaimed. However the high biodiversity wooded fen will be lost at closure as wooded fens are not included in the reclamation plan.
- At closure there will be an 1682 ha (11.4 per cent) decline in areas with moderate biodiversity potential compared to the base case.

[2449] Teck acknowledged that a reclaimed ecosystem at closure will likely not have the level of species diversity found in a natural ecosystem but expected that heterogeneity would recover over time.

[2450] Within the vegetation and wildlife regional study area, for the best-case scenario (with progressive reclamation) Teck reported that

- There will be a 1099. ha (0.9 per cent) decline in high biodiversity potential area at base case relative to predevelopment.
- Areas of high biodiversity potential will decrease by a 2555 ha (2.0 per cent) at application case relative to base case (2066). This includes a decrease of less than 5.3 ha (1.0 per cent) in the area of high biodiversity potential wooded fen and a 263 ha (0.3 per cent) decrease in the area of high biodiversity potential shrubby swamps due to construction of the project.

[2451] Within the vegetation and wildlife regional study area, for the worst-case scenario (no progressive reclamation) Teck reported that

- There will be a 20 334 ha (18.8 per cent) decline in high biodiversity potential area at base case relative to predevelopment (2066).
- Areas of high biodiversity potential decrease by 2558 ha (2.4 per cent) at application case relative to base case (2066). This includes a decrease of less than 5.3 ha (1.0 per cent) in the area of high biodiversity potential wooded fen and a 2553 ha (3.7 per cent) decrease in the area of high biodiversity potential shrubby swamps due to construction of the project.

[2452] Teck confirmed that reclamation is the key mitigation measure for effects to biodiversity. In addition, mitigation for effects to wildlife biodiversity potential will be achieved through the implementation of a wildlife monitoring and management program to mitigate effects to wildlife and wildlife habitat in the terrestrial local study area during all phases of the project. Teck also stated that, if necessary, it would use additional mitigation measures to further mitigate potential residual effects of the project after reclamation as outlined in its proposed biodiversity management plan. Teck stated that it was its intention to provide offsets for wildlife and wildlife habitat diversity through a conservation agreement that will be developed in conjunction with provincial and federal regulators and involve consultation with potentially affected aboriginal communities.

[2453] Teck, Athabasca Chipewyan, and Mikisew have advanced the establishment of a biodiversity stewardship area to protect lands to the north of the Frontier project. The biodiversity stewardship area was proposed to buffer Wood Buffalo National Park from industrial development coming any closer to the park than the Frontier project. While Mikisew and the Athabasca Chipewyan consider the biodiversity stewardship area as a way to mitigate project impacts, Teck stated that they did not consider the biodiversity stewardship area as mitigation for the effects of the Frontier project and did not account for the proposed biodiversity stewardship area in its assessment of project effects.

[2454] Teck’s approach to managing project effects to biodiversity, including its proposed biodiversity management plan and the potential use of conservation offsets, are discussed further in section [25](#), “[Biodiversity](#).”

[2455] Teck initially determined that changes in high wildlife biodiversity potential were considered to have low environmental consequence for the base case, application case and planned development case based on low magnitude of change (i.e., less than 10% change from predevelopment). However, based on direction provided by regulators, Teck reassessed changes in biodiversity following the logic used by the Joint Review Panel Decision Report for the Jackpine Mine Expansion. Teck stated that the revised approach recognizes that the results of other wildlife key issues assessed as part of the project—together with operating, approved and planned developments—will incrementally contribute to a regional decline in biodiversity. This decline is predicted to be largely associated with a decline in the abundance of wetlands and habitat for wetland-dependent species. As with the assessment of wetlands, this decline is predicted to have a high-magnitude effect that is considered irreversible, and this change is considered to have a high environmental consequence to biodiversity without consideration of Teck’s biodiversity management plan. In addition, there will be a regional decline in mature and old-growth forest in the vegetation and wildlife regional study area, and a decline in available habitat for species that depend on these ecosystems. Based on the revised approach, Teck concluded that the change in wildlife biodiversity was considered to have a high environmental consequence.

[2456] Teck stated that overall prediction confidence for change in wildlife biodiversity is low. The quality and quantity of habitat availability information is moderate as baseline field surveys done throughout the terrestrial local study area targeted certain key indicators and literature on species habitat requirements was used for model development. No wildlife baseline information was collected in the vegetation and wildlife regional study area outside the local study area. Confidence in analytical techniques was also low as there is no established methodology for measuring biodiversity.

[2457] Teck noted that some developments included in the assessment that have now been withdrawn (i.e., Pierre River mine, the Joslyn North mine). As such, the assessment is conservative as it includes changes to habitat availability, and thus abundance and distribution, which are no longer planned.

Analysis and Findings

[2458] Wildlife biodiversity potential is a key contributor to overall biodiversity of an area. Project construction and operation will result in physical alteration to wildlife habitat and its connectivity and loss of areas with high wildlife biodiversity potential. The displacement of wildlife species during construction and operation of the project and the direct loss of habitat for wildlife species including *SARA*-listed species is also a contributor to loss of biodiversity.

[2459] The panel notes that the maintenance of biodiversity in Alberta is primarily related to providing protection of wildlife and wildlife habitat. Wildlife habitat availability is dependent on the spatial distribution of healthy ecosystems. Therefore consideration of the biodiversity of an area must take into account the diversity of biophysical factors that make up ecosystems. Species that are reliant on peatland communities will lose habitat permanently and contribute to the loss of biodiversity. The permanent loss of peatlands will result in the loss of habitat for peatland dependent wildlife and birds including but not limited to Yellow Rail, Rusty Blackbird and Horned Grebe, all SARA-listed species. Wildlife species that are dependent on old-growth forests will be impacted for an extended period of time after closure.

[2460] The panel recognizes that the Frontier project is located within an area identified by Alberta as a key wildlife and biodiversity zone. Key wildlife and biodiversity zones establish areas of important winter ungulate habitat and higher habitat potential for biodiversity within the province. Requirements for activities within a key wildlife and biodiversity zone are regulated by *Public Lands Act* dispositions, for which applications are not currently before the panel. If an applicant is unable to meet the requirements then the application must propose mitigation that would be deemed acceptable to the AER. This issue is discussed further in section 26, "[Land Use](#)."

[2461] The panel acknowledges that wooded fens lost due to the project will not be reclaimed and that the return of areas of high wildlife biodiversity potential relies on the reestablishment of shrubby swamps. Based on the limited areal extent of predicted project effects within the local and regional study areas under the best and worst-case scenarios, the panel considers the magnitude of effects to areas of high wildlife biodiversity to be low.

[2462] In assessing the effects of the project on wildlife biodiversity, the panel has not considered the use of conservation offsets as Teck has not proposed any specific conservation offsets at this point in time. Similarly, the panel has not relied on the establishment of the proposed biodiversity stewardship area as Teck indicated its support of this initiative was not intended as mitigation for project effects and at the time of the hearing, the status of this initiative was uncertain.

[2463] Teck's proposed biodiversity management plan and the potential future role of conservation offsets and the proposed biodiversity stewardship area are discussed further in section 25, "[Biodiversity](#)."

Significance Determination for Project Effects

[2464] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects to wildlife biodiversity potential.

[2465] Ecological Context – the project is located within an area identified by Alberta as a key wildlife and biodiversity zone. Key wildlife and biodiversity zones establish areas of important winter ungulate habitat and higher habitat potential for biodiversity within the province.

- The effects of the project on wildlife biodiversity potential are likely—land preparation for construction and mining activities will remove areas with high wildlife biodiversity potential from the project development area.
- The magnitude of the effect are low—while most species have potential to return to reclaimed areas, plants and wildlife dependent on peatlands will not return and wildlife dependent upon old-growth forests will not return for more than 100 years.
- The geographic extent is local—land clearing will be limited to the project development area in the local study area.
- The duration is long term—despite the use of progressive reclamation, many suitable habitats will not be available for an extended period of time.
- The frequency is continuous – effects are expected to occur throughout the construction and operation phases of the project and past closure.
- Some effects are irreversible – while reclamation is expected to result in functioning vegetation communities that are equivalent to what existed prior to project construction and operation, some types of high biodiversity potential habitats such as the wooded fen peatlands will not be reclaimed and old-growth forests will not become reestablished for more than 100 years. Due to the loss of some habitat types and the long time required for the reestablishment of others, some species might not recover, particularly at-risk species.

[2466] Based on the above considerations, the panel finds that the project is not likely to result in significant adverse project effects to wildlife biodiversity due to the local nature and low magnitude of effects.

Cumulative Effects

Evidence

[2467] Within the vegetation and wildlife regional study area, for the best-case scenario (with progressive reclamation) Teck reported that

- Areas of high biodiversity potential will decrease by 3654 ha (2.8 per cent) at application case relative to predevelopment (2066).
- Areas of high biodiversity potential will decrease by 8130 ha (6.3 per cent) at planned development case relative to base case (2066).

[2468] Within the vegetation and wildlife regional study area, for the worst-case scenario (no progressive reclamation) Teck reported that

- Areas of high biodiversity potential decrease by 22 893 ha (17.8 per cent) at application case relative to predevelopment (2066).
- The area of high biodiversity potential decreases by 26 976 ha (21.0 per cent) at planned development case relative to predevelopment (2066).

Analysis and Findings

[2469] The panel recognizes that there is some uncertainty associated with the rate and degree of success of progressive reclamation in the mineable oil sands area and as a result, the best-case scenario may be overly optimistic. However, the panel does not expect the worst-case scenario will occur. Reclamation is occurring within the regional study area and it is an expectation of *LARP* and the *AER* that progressive reclamation occur. The panel therefore expects that the magnitude of cumulative effects related to wildlife biodiversity potential will likely to be somewhere between the best-case and worst-case scenarios with actual effects determined by the rate and degree of success of reclamation within the region. Based on this uncertainty, the panel considers a moderate-magnitude effect is likely.

[2470] The panel acknowledges however that there will be a decline in some types of high wildlife biodiversity habitats such as wooded fens, within the mineable oil sands area.

Significance Determination for Cumulative Effects

[2471] Based on the criteria provided in CEAA's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of cumulative effects to wildlife biodiversity potential.

[2472] Ecological Context – the project is located within an area identified by Alberta as a key wildlife and biodiversity zone. Key wildlife and biodiversity zones establish areas of important winter ungulate habitat and higher habitat potential for biodiversity within the province.

- The effects of the project, in combination with other existing, approved and planned project on wildlife biodiversity potential are likely—the project combined with other existing, approved and planned projects will contribute to the removal of areas with high wildlife biodiversity potential from the region and contribute to a loss of high species diversity potential in the region.
- The magnitude of the effect will be moderate – the magnitude will depend on the rate of progressive reclamation and the degree of success with reestablishing areas of high wildlife biodiversity potential such as shrubby fens.
- The geographic extent is regional.

- The duration is long term—despite the use of progressive reclamation, oil sands mines operate for a long time (more than 40 years).
- The frequency is continuous – effects are expected to occur throughout the operational life of the project and past closure.
- Some effects are irreversible – while reclamation is expected to result in functioning vegetation communities that are equivalent to what existed prior to project construction and operation, some types of high biodiversity habitats will not be reclaimed and old-growth forests will not become reestablished for more than 100 years. Due to the loss of some habitat types and the long time required for the reestablishment of others, some species might not recover, particularly at-risk species.

[2473] Based on the above considerations, the panel finds that the project in combination with other existing, approved and planned projects is not likely to result in significant adverse cumulative effects to wildlife biodiversity due to the moderate magnitude and reversibility of most effects.

24 Wildlife Health

[2474] The environmental impact assessment terms of reference for the project require Teck to assess the potential effects on wildlife as a result of changes to air and water quality, including both acute and chronic effects on animal health, with specific reference to wildlife key indicator species. Teck responded to this requirement with its wildlife health risk assessment, which was conducted in accordance with regulatory guidelines. The primary focus of the assessment was on birds, mammals, and amphibians and is one of three health-related studies related to the project, the other two being human health (section 29, “[Public \(Human\) Health](#)”) and the health of aquatic organisms (see subsection within section 18, “[Surface Water Quality](#)”).

Evidence

[2475] Teck’s wildlife health risk assessment describes the nature and extent of potential adverse population-level effects to wildlife that might be associated with chemical emissions to air and releases to water from the project. Teck engaged with indigenous communities in the design of the assessment. It applies to all project phases.

[2476] Teck’s assessment examined short-term (acute) and long-term (chronic) health risks to wildlife populations that may be attributable to the project, combined with existing, approved, and planned developments in the area. It evaluated the potential risks to wildlife health associated with chemicals of potential concern (COPCs) emitted from the project to air and water. To assess the potential risks to wildlife health, Teck compared predicted chemical exposures to toxicological reference values intended to be protective of the health of wildlife populations.

[2477] Teck considered the overall risk to wildlife to be low. In the few cases where elevated risks were predicted, Teck noted the elevations were modest and likely attributable to the conservative nature of the wildlife health risk assessment. The estimated risks for base case and application case were consistently similar, and Teck concluded that the project will not contribute to the overall risks to wildlife health.

[2478] The overall conclusion of Teck’s wildlife health risk assessment is that any project-related changes in air, water, and soil quality were not expected to result in population-level effects to wildlife health in the 110 km × 110 km local study area surrounding the project, the same study area as for the air quality assessment. Moreover, population-level effects on wildlife health as a result of the combined influence of the project with existing, approved, and planned developments in the study area were not expected.

[2479] Teck noted that their wildlife health risk assessment followed a conventional four-stage risk assessment framework:

- Problem formulation – Defines the scope of the assessment through the selection of the COPCs associated with the project, the selection of the receptors of potential concern (ROPCs) that might be affected by the COPCs, and the identification of exposure pathways by which the ROPCs might be affected.
- Exposure assessment – Quantifies the amount or dose of each COPC that might be received by the ROPCs through the relevant exposure pathways.
- Hazard/effects assessment – Determines the levels of exposure at which adverse population-level effects would not be expected to occur in wildlife following exposure for a prescribed pathway (i.e., inhalation and multiple pathway exposure) and period (i.e., short-term and long-term exposure).
- Risk characterization – Quantifies the potential risks to wildlife through the comparison of estimated exposures (identified in the exposure assessment) with the dose levels at which no adverse effects would be expected (identified in the hazard/effects assessment).

[2480] The framework includes consideration of the uncertainty that can surround the prediction of any risks, regardless of type or source. Uncertainty is accommodated, in part, through the use of conservative assumptions that are intentionally selected to represent reasonable worst-case conditions of exposure. Using this approach, any health risks identified by the assessment may be considerably overstated.

[2481] Teck's wildlife health risk assessment was conducted in the context of the following development scenarios: base case, application case, and planned development case.

[2482] Teck's selection of COPCs and ROPCs included input from indigenous communities and other interested parties.

[2483] Teck considered a full suite of COPCs for air, including criteria air contaminants, which include carbon monoxide (CO), nitrogen dioxide (NO₂), fine particulate matter (PM_{2.5}), and sulphur dioxide (SO₂); chlorinated hydrocarbons; metals such as arsenic, cadmium, chromium and mercury; petroleum hydrocarbon fractions; PAHs; reduced sulphur compounds; and VOCs. Emissions containing these COPCs might originate from project stacks, the mine fleet, and fugitive plant, mine face, and tailings management sources. Teck also used toxicological reference values for both inhalation and ingestion pathways of exposure, using values created by scientific or regulatory authorities such as Alberta Environment and Sustainable Resource Development (now Alberta Environment and Parks), the CCME, and the U.S. Environmental Protection Agency. Teck noted that the development of toxicological reference values can be problematic in wildlife health assessments because there are fewer chemical substances with well-established guidelines for many species of interest. Teck established toxicological reference values for over 90 COPCs potentially in air emissions that could affect wildlife health.

[2484] Teck also modelled the release of chemicals into the aquatic environment as a result of project-related activities. Examples of project sources of releases of water that might contain concentrations of organic compounds above those in the receiving environment include muskeg drainage and seepage and runoff from overburden dumps. At project closure, process-affected waters from seepages and flux waters from backfilled mine pits and external tailings areas will contain water-soluble forms of some metals, dissolved ions and salts, and organic substances such as naphthenic acids, PAHs, and total phenolics. Also at closure, seepage from overburden might contain higher levels of dissolved salts and organics than corresponding concentrations in receiving waters. Teck established toxicological reference values for over 40 COPCs potentially in surface water releases that could affect wildlife health. Teck was unable to create a toxicological reference value for naphthenic acids due to an absence of sufficient data. Teck identified pathways of concern of COPCs to identified receptors based on understanding the various relevant food sources available to wildlife in the region; pathways included inhalation, drinking water, and ingestion of contaminated food sources.

[2485] Teck assumed wildlife species that frequent the area, both resident and migratory populations, could potentially be exposed to the chemicals emitted to air and released to water from the project. Teck identified twenty-two indicator species as ROPCs. Teck stated they had engaged with various parties, including local communities, on which key indicator species should be included. Some were selected because they are included in lists prepared by provincial or federal authorities some were chosen because they are listed as priority indicators by CEMA or because they are species of ecological, economic, or cultural importance. The species were then divided into receptor species to represent mammal, bird, and amphibian classes (aquatic and terrestrial) and further divided into herbivorous, insectivorous, piscivorous, omnivorous or carnivorous feeding guilds. Teck explained that surrogates were used to represent some species classes and feeding guilds (e.g., woodland caribou also represented wood bison and wolverine also represented fisher and Canada lynx).

[2486] Relying on the toxicological reference values, Teck estimated maximum exposure levels in the assessed animal populations, comparing them to established safe limits. This included both acute and chronic exposures and risks and considered multiple exposure pathways. Teck used a combination of data available from monitoring studies and predictive exposure modelling to estimate maximum exposure levels in this wildlife health risk assessment.

[2487] Teck stated the wildlife health risk assessment follows established procedures to ensure a population is protected but does not attempt to predict potential effects in the most susceptible individual animal in the population. Teck also compared toxicological reference values and calculated maximum exposures in order to identify risk; risk was derived by dividing the calculated maximum exposure by the toxicological reference value to create a “hazard quotient,” where a hazard quotient >1 indicates potential risk requiring further review and assessment. Teck stated that the exposure estimates were typically expressed as the daily dose of the COPC that might be received, normalized by body weight (e.g.,

micrograms of chemical per kilogram of body weight per day [$\mu\text{g}/\text{kg bw}/\text{day}$]). Alternatively, if the only significant pathway of exposure involves the direct inhalation of the chemicals, the exposure estimates were expressed simply as the concentration of the chemical in air (e.g., micrograms of chemical per cubic metre of air [$\mu\text{g}/\text{m}^3$]).

[2488] Teck's estimates of acute inhalation risk, expressed as hazard quotients, were based on exposure periods that last from a few hours to a few days. Teck found that predicted acute hazard quotients for air inhalation COPCs do not exceed 1 under the existing condition or for any of the three assessment cases for any of the ROPCs, indicating that short-term air concentrations are not anticipated to have an adverse impact on either mammalian or avian wildlife in the region.

[2489] Teck's estimates of chronic inhalation risk estimates, expressed as hazard quotients, were based on exposure periods that last from a few months to a few years, to possibly a lifetime. With the lone exception of NO_2 for the mammalian ROPC, Teck found that chronic hazard quotient values do not exceed 1 under the existing condition or any of the assessment cases for mammalian and avian ROPCs.

[2490] Teck noted that hazard quotients above 1 were predicted for NO_2 on a chronic basis under all assessment cases. In some instances hazard quotients in the range of 5 were predicted for the application case, and the planned development case. However, Teck noted that the project does not contribute substantially to an increase of NO_2 . Teck also noted that interpretation of the chronic risks for NO_2 must consider not only the assessment uncertainties, but also the conservatism incorporated into the exposure estimate (i.e., predicted annual average air concentration of NO_2) as well as the toxicological reference value.

[2491] Teck stated that the predicted chronic multiple pathway hazard quotient values were below 1 for most of the COPCs, with the following exceptions for the avian ROPCs: manganese, methylmercury, selenium, and thallium, which were above conservative risk-based levels but, for those instances where there was an increase above the existing condition or the base case, the increase was very small. The predicted chronic multiple pathway hazard quotient values for mammalian ROPCs were below 1 for most of the COPCs, with the following exceptions: antimony, cadmium, manganese, methylmercury, selenium, thallium, and zinc. Teck noted that the lack of regional monitoring data for metals in aquatic plants was a primary source of uncertainty in this regard and committed to a monitoring program to reduce these uncertainties. The predicted hazard quotient values for the base case and application case were similar for most of the COPCs, suggesting that the contributions of the project with respect to predicted changes in air and water quality (and subsequently other environmental media) in the local study area will have a low impact on wildlife health.

[2492] While Teck identified the Canadian toad and western toad as key indicators in the updated wildlife assessment, the current state of knowledge regarding amphibian exposure characterization and toxicology is not adequate to permit a quantitative assessment of risk to amphibians.

[2493] Many groups expressed general concerns about the effect of chemical contaminants on wildlife health. One specific concern, exposure to naphthenic acids, was raised by several groups, including OSEC, CPAWS, OFMFN/Clearwater River Band, Keepers of the Athabasca and Mikisew.

[2494] Teck noted that naphthenic acids are known to be naturally present in the area because they are present in petroleum sources such as oil sands; but they are also concentrated in tailings ponds as a result of the extraction process and thus are of concern as pollutants. Teck committed to maintaining water quality in the area with respect to naphthenic acids contamination by capturing runoff, using mitigation measures for seepage, and using collection wells. Based on their assessment, Teck concluded that the project would not result in increased risk from naphthenic acids, although there is currently no oral toxicological reference value available to quantify the risk in the multiple pathway analysis conducted within this section.

[2495] Health concerns resulting from methylmercury exposure in water and sediment and subsequent impacts on wildlife and human health were raised by several groups including Smith's Landing, Keepers of the Athabasca, Athabasca Chipewyan, Mikisew and Fort McKay, as was the need for additional monitoring.

[2496] Smith's Landing, Fort McKay, and Mikisew expressed concerns about the number of tumours and deformities they have seen in wildlife and fish and made observations about the deteriorating quality of meat from some local wildlife sources.

[2497] OSEC and others raised concerns about the potential long term health effects associated with migratory waterfowl coming into contact with process-affected water or bitumen in tailings ponds. They were concerned about the potential for chronic effects where mortality did not occur immediately. Indigenous groups were concerned about the impact on the health of the birds as well as the potential for health effects for people who harvest the birds.

[2498] Teck and Athabasca Chipewyan jointly requested that the panel recommend to the Crown that it conduct through the Oil Sands Monitoring program and with the participation of Athabasca Chipewyan, indigenous communities, and oil sand operators as appropriate, broader studies, monitoring and tracking of the health, stability, and sustainability of migratory birds.

Mitigation and Monitoring

[2499] Teck submitted a draft wildlife mitigation and monitoring plan, but it does not directly address wildlife health. Teck stated that it plans to collect samples of aquatic plants in the local study area to accurately characterize the existing concentrations of PAHs and metals in these plants.

[2500] The joint letter sent by Teck and Athabasca Chipewyan to the panel requested that the panel recommend to the Crown that it develop criteria, indicators, and thresholds to track and validate the

health, stability, and sustainability of migratory birds and carry out studies in conjunction with First Nation communities to address these criteria.

Analysis and Findings

[2501] The panel is satisfied that the approach used by Teck within the wildlife health risk assessment is consistent with existing regulatory guidelines. Further, this approach provides the information required to address stakeholder and local community concerns with respect to the impact of the proposed project by itself and in combination with other existing, approved and reasonably foreseeable projects in the region.

[2502] The panel is satisfied that the wildlife health risk assessment was conducted in a reasoned and responsible manner and that its conclusions can be used to inform decisions on potential impacts on wildlife health. The panel notes that the conclusions of the wildlife health risk assessment were not contested during the hearing.

[2503] The panel notes that there is limited information on the possible health effects of naturally occurring naphthenic acids or on background levels in the local environment. Although Teck's wildlife health risk assessment addressed naphthenic acids, it could not quantify the risk due to lack of an accepted toxicological reference value. The panel acknowledges that the limited information and absence of a regulatory standard for naphthenic acids does not allow fully informed conclusions about potential risks. The panel recognizes Teck's proposals to maintain water quality but finds that monitoring and surveillance for naphthenic acid concentrations and trends in the local environment is required. The panel therefore requires that Teck include monitoring of concentrations of naphthenic acids in the aquatic environment as part of its surface water quality and aquatic effects monitoring programs.¹⁵⁴ The panel is aware that research on naphthenic acids is continuing under the Oil Sands Monitoring Program and that efforts are being made at the federal level to develop a water quality guideline for oil-sands-derived naphthenic acids. The panel has included a recommendation to Canada that it complete the development of a water quality guideline for naphthenic acids as soon as possible as this has been a long-standing concern for communities and has been a recommendation in previous joint review panel reports.

[2504] The project is not expected to contribute to increased risk to wildlife health as a result of methylmercury. For conditions associated with monitoring and surveillance of levels and trends in methylmercury concentrations in wildlife and aquatic species, and potential exposure to local residents, see the sections "[Surface Water Quality](#)" and "[Fish and Fish Habitat](#)."

[2505] The panel agrees with Teck's conclusion that the project would only contribute to minor increases in potential exposure of wildlife in the region to COPCs. The panel notes that of the few exceedances (including for NO₂), most occur under existing conditions and base case scenarios. The panel therefore concludes that the project is not likely to result in significant adverse effects to wildlife health.

¹⁵⁴ Draft *EPEA* Approval – Conditions 4.2.5(a) and 4.2.13

[2506] The panel notes that Teck's assessment included commitments to collect samples of aquatic plants in the local area to better characterize the existing concentrations of PAHs and metals in these plants and, subsequently, to the food chain that depends upon them. Given the concerns of indigenous communities about wildlife health, the panel believes this work is necessary and may improve community confidence in assessment predictions. The panel therefore requires that Teck collect baseline data on heavy metal and PAH concentrations in aquatic plants in the project area and include monitoring of future heavy metal and PAH concentrations in aquatic plants as part of its environmental effects monitoring programs.¹⁵⁵ Monitoring programs should be developed in collaboration with indigenous communities. Teck will be required to provide a summary of community input received, how it has been incorporated into the monitoring program, and any significant areas of disagreement.

[2507] If concentrations of any COPCs in soil or water exceed CCME guidelines or other criteria relevant to the protection of wildlife health, Teck shall reassess risks to wildlife health and consider additional mitigation measures as appropriate.¹⁵⁶

[2508] The panel understands the concerns expressed by community members about cumulative effects in the region including observations of tumours and deformities in wildlife and fish and comments about the quality of meat from some local wildlife sources. However there is no information on prevalence and trends to allow any meaningful conclusion about the cause of these effects.

[2509] The panel acknowledges the joint letter from Teck and Athabasca Chipewyan setting out recommendations related to wildlife and wildlife health. It also notes the joint commitments and recommendations made by Mikisew and Teck. The panel has based some of its recommendations on the contents of these documents.

[2510] With respect to the Teck–Athabasca Chipewyan joint recommendation related to migratory birds, the panel understands the importance of healthy water fowl to indigenous harvesters. The panel also recognizes there are concerns and uncertainties about the potential effects to migratory waterfowl that come into contact with process-affected water and then fly off. The panel recommends that Canada consider the need for broader studies, monitoring and tracking of the health, stability, and sustainability of migratory birds, including short-term acute and chronic effects of oil sands development, as recommended by Teck and Athabasca Chipewyan.

Recommendations for Canada

[2511] The panel recommends that Canada consider the need for broader studies, monitoring and tracking of the health, stability, and sustainability of migratory birds, including short-term acute and chronic effects of oil sands development, as recommended by Teck and Athabasca Chipewyan.

¹⁵⁵ Draft *EPEA* Approval – Conditions 4.2.5(a) and 4.2.5(d)

¹⁵⁶ Draft *EPEA* Approval – Condition 4.2.5(b)

Significance of Project Effects

[2512] Based on the criteria provided in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project effects to wildlife health:

- The effects are likely – the evidence provided demonstrates that some COPCs will exceed the hazard quotients established for the key indicator species or receptors.
- The magnitude of the effect is negligible – Teck demonstrated that only a few of the COPCs exceed the hazard quotients and that the changes from base case to application case were minimal.
- The geographic extent is regional – the COPCs will disperse beyond the project disturbance area.
- The duration is medium to long term – most of the airborne COPCs will cease at closure, but seepage from the project water bodies could carry waterborne COPCs beyond closure.
- The frequency is periodic to continuous – the COPCs will be emitted or released during the life of the project and some of the beyond closure.
- The effects are reversible – most of the COPCs will return to levels similar to those present before the project disturbance upon closure.

[2513] Given the above points, the panel finds that the project is not likely to result in significant adverse effects to wildlife health.

[2514] Given the project's negligible contribution to increased risks to wildlife health, a cumulative effects assessment is not required.

25 Biodiversity

[2515] Biodiversity is a term that refers to the diversity of all living things, from genetic diversity to species diversity and the diversity of ecosystems across landscapes. The construction, operation, reclamation, and closure of the Frontier project will impact biodiversity in the local and regional study areas by impacting the diversity of topography, soils, vegetation, and wildlife.

[2516] The final terms of reference for the Frontier project required Teck to consider project's effects on biodiversity and fragmentation. Teck was also required to discuss measures to minimize anticipated changes in regional biodiversity and fragmentation, how any residual effects would be managed, and to describe monitoring programs to measure changes in biodiversity and fragmentation and the effectiveness of mitigation plans.

[2517] In its assessment, Teck addressed effects to biodiversity under a number of topic headings, including topographic diversity, soil series diversity, landscape diversity, vegetation community and species diversity, air emissions and vegetation health and diversity, and wildlife biodiversity.

[2518] Teck considered effects to elements of biodiversity at the scale of the project disturbance area (29 217 ha), local study area (43 349 ha) and regional study area (1 195 560 ha).

Topographic Diversity

[2519] Project effects to topographic diversity are discussed in section [21](#), "[Terrain and Soils](#)."

[2520] The panel's conclusions and findings related to topographic diversity are:

- project effects to topographic diversity would be low in magnitude, local in extent, long term, continuous and irreversible; and
- due to the low magnitude and local extent of effects, the project is not likely to result in significant adverse effects to topographic diversity.

Soil Series Diversity

[2521] Project effects to soil series diversity are discussed in section [21](#), "[Terrain and Soils](#)."

[2522] The panel's conclusions and findings related to soil series diversity are:

- project effects to soil series diversity will be low in magnitude, local in extent, long term, continuous and reversible; and
- due to the low magnitude, local extent and reversibility of effects, the project is not likely to result in significant adverse effects to soil series diversity.

Landscape Diversity

[2523] Project and cumulative effects to landscape diversity are discussed in section 22, "[Vegetation.](#)"

[2524] The panel's conclusions and findings related to landscape diversity are:

- project effects to landscape diversity within the regional study area would be low in magnitude, local in extent, long term, continuous and reversible; and
- cumulative effects to landscape diversity within the regional study area as a result of the project in combination with other existing, approved and planned projects would be of moderate magnitude, regional, long term, continuous and reversible.

Community Diversity

[2525] Project and cumulative effects to community diversity are discussed in section 22, "[Vegetation.](#)"

[2526] The panel's conclusions and findings related to community diversity are:

- project effects to upland ecosite phases will be moderate in magnitude, local, long term, continuous and reversible and not likely to be significant;
- cumulative effects to upland ecosite phases in the region represent a low to moderate-magnitude effect that is long term but reversible and not likely to be significant;
- project effects on wetland classes are high magnitude, long term, continuous, partially irreversible and likely to be significant;
- cumulative effects on wetlands resulting from the project in combination with other existing, approved and planned projects would be of high magnitude, long term, partially irreversible and likely to be significant;
- project effects to old-growth forests are high magnitude, local, long term, continuous, reversible, and likely to be significant; and
- the project in combination with other operating and planned developments in the regional study area is likely to result in significant adverse cumulative effects to old-growth forests in the vegetation and wildlife regional study area.

Species Diversity

[2527] Project and cumulative effects to species diversity are discussed in section 22, "[Vegetation.](#)"

[2528] The panel's conclusions and findings related to species diversity are as follows:

- Project effects to species diversity potential are moderate in magnitude, local, long term, continuous and irreversible but not likely to be significant.

- The project in combination with other existing, approved, and planned projects will contribute to the removal of areas with high and moderate species diversity potential from the region and the effects are moderate in magnitude, regional, long term, continuous and irreversible but not likely to be significant.

Air Emissions and Vegetation Health and Diversity

[2529] Project and cumulative effects to vegetation health and diversity resulting from air emissions are discussed in section [22](#), “[Vegetation](#).”

[2530] The panel concluded that the project is expected to have minimal effects on vegetation resources as a result of air emissions;

- project effects are expected to be low in magnitude, local, long term, continuous but reversible and not likely to be significant;
- cumulative effects of the project in combination with other existing, approved and planned projects are expected to be low in magnitude, regional, long term, continuous but reversible and not likely to be significant.

Wildlife Biodiversity

[2531] Project and cumulative effects to wildlife biodiversity potential are discussed in section [23](#), “[Wildlife](#).”

[2532] The panel’s conclusions and findings related to wildlife biodiversity potential are:

- project effects to wildlife biodiversity potential are low in magnitude, local, long term, continuous and irreversible but not likely to be significant; and
- the project in combination with other existing, approved and planned projects will contribute to the removal of areas of high wildlife biodiversity potential are moderate in magnitude, regional, long term, continuous and irreversible but not likely to be significant.

Summary of Significance Determinations

[2533] [Table 34](#) and [Table 35](#) summarize the significance determinations for project and cumulative effects to biodiversity from the sections “[Terrain and Soils](#),” “[Vegetation](#),” and “[Wildlife](#).”

Table 34. Summary table for significance of project effects to biodiversity

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Topographic diversity	low	local	long term	continuous	irreversible	not significant
Soil series diversity	low	local	long term	continuous	reversible	not significant
Landscape diversity	low	local	long term	continuous	reversible	not significant
Community diversity – Uplands	moderate	local	long term	continuous	reversible	not significant
Community diversity – Wetlands	high	local	long term	continuous	irreversible	significant
Community diversity – Old-growth forests	high	local	long term	continuous	reversible	significant
Species diversity potential	moderate	local	long term	continuous	irreversible	not significant
Wildlife biodiversity potential	moderate	local	long term	continuous	irreversible	not significant

Table 35. Summary table for significance of cumulative effects to biodiversity

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Landscape diversity	moderate	regional	long term	continuous	reversible	not significant
Community diversity – Uplands	low to moderate	regional	long term	continuous	reversible	not significant
Community diversity – Wetlands	high	regional	long term	continuous	irreversible	significant
Community diversity – Old-growth forests	high	regional	long term	continuous	reversible	significant
Species diversity potential	moderate	regional	long term	continuous	irreversible	not significant
Wildlife biodiversity potential	moderate	regional	long term	continuous	irreversible	not significant

Mitigation of Effects to Biodiversity

Evidence

[2534] Teck stated that protecting and enhancing biodiversity is integral to Teck's approach to sustainability and its vision is to achieve a net positive impact on biodiversity as a result of its activities and presence in a region. Teck believes this vision is achievable through a combination of mitigation actions, with on-site rehabilitation playing a primary role and off-site conservation offsets contributing additional benefits, if required.

[2535] In its 2015 project update, draft biodiversity management plan, and in its closure, conservation, and reclamation plan, Teck set out how it intends to accomplish its vision for biodiversity. Four categories of mitigation are identified: avoid impacts to biodiversity to the extent practicable; minimize impacts that cannot be avoided; rehabilitate, restore, and reclaim affected areas; and offset biodiversity impacts that cannot be fully mitigated.

[2536] The draft biodiversity management plan is a high-level document that addresses how Teck will work towards a net positive impact on biodiversity in the project region. It discusses plan development and consultation, spatial and temporal scales, management plan components, which include priority biodiversity elements (ecosystems, species and ecosystem services), net positive impact accounting and prioritization, application of the biodiversity mitigation hierarchy, and monitoring and feedback management. Teck stated that an underlying goal of the biodiversity management plan is to optimize reclamation during operations to reduce the need for offsetting of residual environmental effects.

[2537] Teck stated that reclamation is the key mitigation measure for biodiversity. Teck expects that biodiversity would be limited during the early stages of reclamation and revegetation but increase over time as habitats become established and ecological succession provides greater variation across the landscape.

[2538] Teck indicated that they will plant additional species to supplement those indicated in the guidelines prescribed by the province (*Guidelines for Revegetation to Forest Vegetation in the Athabasca Oil Sands Region*; Government of Alberta, 2010) in order to mitigate species loss and a decrease in biodiversity of traditional use resources. Teck further stated that the number and type of species that they plant during reclamation will be influenced by consultations with indigenous groups to fulfil conditions of agreements signed with each group.

[2539] The draft biodiversity management plan does not include the use of offsets to account for residual environmental effects. Teck acknowledged that the Government of Alberta has no legislation or policies in place to accommodate such conservation offsets. Conservation offsets are actions that a company takes to provide physical compensation for significant adverse impacts resulting from development, including

impacts to biodiversity. Teck stated that it is willing to enter into conservation agreements with the ECCC, with input from the AER and AEP, to achieve conservation and biodiversity offsets.

[2540] Specifically Teck stated that they would use conservation offsets in addition to reclamation to mitigate for loss of biodiversity and achieve net positive impact. Conservation offsets would be applied if, after reclamation is accounted for, there were residual effects on biodiversity resulting from the project.

[2541] As discussed in section 23, “Wildlife,” ECCC expects that the project will contribute to significant existing cumulative effects to migratory birds. ECCC recommended that should the project be approved, the panel request Teck develop and implement a compensation plan within the regional study area to protect from future disturbance habitat for old-growth, wetland and other SARA-listed migratory bird species equivalent to that which would be disturbed by the project, for the purpose of maintaining migratory bird populations in the regional study area. ECCC recommended that the compensation plan be developed in consultation with the Government of Alberta, ECCC and indigenous groups.

[2542] OSEC argued that the project should not proceed until thresholds had been identified to manage cumulative effects under *LARP*. While *LARP* was released in August 2012, biodiversity management frameworks have not been completed at this point, which precludes responsible decision-making under a cumulative effects management approach.

[2543] OSEC noted that *LARP* stated that a new biodiversity management framework for the Lower Athabasca region would be developed by the end of 2013, and it would set targets for selected biodiversity indicators (vegetation, aquatic and wildlife) and address caribou habitat needs in alignment with provincial caribou policy. OSEC also noted that Alberta's regional sustainable development strategy was released in 1999 and promised that biodiversity objectives for management in the oil sands would be completed within two years.

[2544] OSEC stated that its member organizations have participated in good faith for many years, as founding members of CEMA, to help advance this work through participation in CEMA and government land-use planning processes. However, nineteen years later, Alberta and Canada are no closer to managing the cumulative impacts of projects in the oil sands for biodiversity or setting objectives for acceptable impacts on biodiversity values.

[2545] OSEC stated that they were concerned that Teck has committed to similar inadequate mitigation of impacts to biodiversity as the Shell Jackpine mine expansion project. OSEC acknowledged that Teck has made a number of very positive statements about their company-wide commitment to biodiversity and their commitment to a net positive impact to biodiversity, but also noted Teck's statement that the development of detailed mitigation measures or offset plans should not occur until the anticipated approval for the project is received and consultation with regulators and potentially affected aboriginal communities and stakeholders is completed.

[2546] OSEC disagreed with Teck's position. OSEC argued that to assess if mitigation is adequate, it was necessary to know now what level of offsetting and mitigation Teck will be required to achieve and whether such a level of mitigation is adequate. OSEC stated that Teck should be more specific about what mitigation they will deliver and that it was essential these mitigation measures be made binding conditions in any decision.

[2547] OSEC noted that the panel for the Shell Jackpine project also identified the importance of the proposed biodiversity management framework and encouraged Alberta to complete and implement the frameworks, plans, and thresholds identified in *LARP* as quickly as possible, noting that future project reviews would benefit greatly from the completion of this regional approach. OSEC also observed that the Shell Jackpine panel acknowledged in its decision that offsets may be necessary as a form of mitigation to address impacts to biodiversity. OSEC argued that all of these findings still apply and are more urgent with respect to the proposed Teck Frontier project. The biodiversity management framework must be in place and Teck must be conditioned to establish compensatory mitigation through conservation offsets before the project proceeds.

[2548] OSEC argued that because Alberta has not completed the biodiversity management frameworks, it is not possible for the panel to responsibly determine if the project has acceptable impacts on biodiversity or not. OSEC recommended that the project be rejected, or approval is conditional on Alberta completing the *LARP* biodiversity management frameworks and the Red Earth caribou range plan. OSEC also recommended the panel sanction Alberta, in the strongest terms possible, for its failure to implement biodiversity and caribou management frameworks and plans which are necessary to support responsible decision making. Alternatively, if the project is recommended for approval, OSEC recommended the panel include conditions that, at a minimum, require there is a net positive impact on biodiversity, as Teck have noted in many of their materials. OSEC recommended a specific mandatory requirement for conservation offset actions at a mitigation ratio of at least 4:1 to ensure project impacts are fully mitigated.

[2549] Fort McKay First Nation, Athabasca Chipewyan, and Mikisew do not oppose approval of the Frontier project but all expressed ongoing concerns related to regional cumulative effects and the lack of effective management frameworks for managing these effects. They noted that the proposed biodiversity management framework under *LARP* is many years overdue and that currently there are no indicators or thresholds being used to manage cumulative effects to biodiversity. Fort McKay and Mikisew believe that the Alberta Biodiversity Monitoring Institute program, while appropriate for measuring long-term changes to biodiversity at the provincial scale, is not adequate for monitoring or managing changes to biodiversity within the Lower Athabasca region given the scale and pace of oil sands development and the spatial and temporal scale of the monitoring program.

[2550] Fort McKay First Nation, Athabasca Chipewyan, and Mikisew all stated that Alberta needs to work cooperatively with their communities to effectively co-manage the regional cumulative effects of development, including effects to biodiversity.

[2551] Fort McKay stated the protection of biodiversity, including moose, caribou, and healthy berries, are necessary to support the practice of its aboriginal and treaty rights. Fort McKay provided a number of recommendations related to the monitoring and management of regional cumulative effects, and these are included in [Appendix 9](#). Recommendations related to biodiversity were as follows:

- Moose should be a biodiversity management framework indicator under *LARP*, and the Government of Canada and Alberta should work together to ensure adequate management of moose populations and their habitat. Moose should be considered a species at risk in wildlife management units where populations are well below Government of Alberta goals.
- The governments of Canada and Alberta should develop protocols that can effectively measure cumulative effects in the oil sands region. The current Alberta Biodiversity Monitoring Institute grid pattern and rotation frequency is ineffective at measuring meaningful biodiversity indicators (e.g., species at risk) at scales smaller than the province of Alberta (e.g., WMU and the *LARP* area).
- The governments of Canada and Alberta should develop an effective monitoring program that measures changes in wildlife populations in a timely manner (e.g., every five years) and provides sound data to determine mitigation and recovery plan effectiveness.
- The Government of Canada should work with the Government of Alberta to develop a formal process for conservation offsets and habitat protection that preserve the suite of species (e.g., species at risk and culturally important wildlife species) and ecosystems and maintain local and regional biodiversity in consideration of traditional territories of aboriginal communities.

[2552] Athabasca Chipewyan and Mikisew both worked with Teck to jointly develop objectives and commitments related to the Frontier project and recommendations for Crown action to address regional cumulative effects. Their recommendations to the panel are included in [Appendix 9](#).

[2553] Teck, Athabasca Chipewyan, and Mikisew have advanced the establishment of a biodiversity stewardship area to protect lands to the north of the Frontier project. The biodiversity stewardship area was proposed to buffer Wood Buffalo National Park from industrial development coming any closer to the park than the Frontier project. Teck committed to relinquishing or transferring its Twin Lake leases and the northernmost portion of lease 840 to a regulatory authority for the purpose of permanently protecting the biodiversity stewardship area once the authority has established an appropriate mechanism for establishing it.

[2554] While Mikisew and the Athabasca Chipewyan consider the biodiversity stewardship area as a way to mitigate project impacts, Teck stated that they did not consider the biodiversity stewardship area

as mitigation for the effects of the Frontier project and did not account for the proposed area in its assessment of project effects.

[2555] Teck and Athabasca Chipewyan agreed that the biodiversity stewardship area should be sufficient in size, ecological capacity, and habitat quality to support Athabasca Chipewyan biodiversity objectives, the exercise of Athabasca Chipewyan aboriginal and treaty rights, and the culturally important relationships between Athabasca Chipewyan and local wildlife, including the Ronald Lake bison herd.

[2556] To support this objective, Teck and Athabasca Chipewyan jointly recommended the following Crown action:

- By 2020, establish the biodiversity stewardship area as a legislated protected area, taking steps to consolidate, purchase, or otherwise transfer the leases in this area to it.
- Include Athabasca Chipewyan in the governance of the area in a joint management and shared decision-making role.
- Incorporate legislative and regulatory means in the area to protect the Ronald Lake bison herd, caribou, and migratory bird critical habitat to support associated objectives.

[2557] Mikisew and Teck also jointly recommended that the biodiversity stewardship area be established to protect bison, their habitat, and associated traditional and cultural use. Specifically, they recommended that

- the governments of Alberta and Canada commit to implementing the full biodiversity stewardship area proposed by Mikisew by the time project construction starts, and
- before issuance of final licences and permits for the project, the Government of Alberta co-develop and commit meaningful funding to a management plan and cooperative management arrangement for the area.

[2558] Mikisew also recommended that governments develop legally binding thresholds for moose, the Ronald Lake bison herd population, and other indicators needed to maintain treaty rights before issuing final approvals.

Analysis and Findings

[2559] The Frontier project will contribute to a loss of biodiversity at the species, community, and landscape levels.

[2560] Vegetation species and communities are an important contributor to biodiversity. Project construction and operations will lead to a loss of vegetation species and communities within the project development area. Losses within the project development area will directly affect the proportion of each component in the local and regional study area and contribute to the cumulative loss of species,

communities, and specific structural stages in the region. The loss of vegetation communities will also affect the wildlife species that depend upon them, affecting wildlife biodiversity.

[2561] It is expected that biodiversity of the closure landscape will be lower than predevelopment conditions because the number of species planted will be less than the number of species in naturally occurring communities. While biodiversity is expected to improve over time following reclamation due to natural ingress of additional species and processes of ecological succession, a gradual process by which ecosystems change and develop over time, the rate and degree of improvement in biodiversity is uncertain. It is unclear whether or when equivalent areas of high biodiversity potential will be recreated in the closure landscape. Furthermore, some species (rare plants) and vegetation communities (wooded fens and peatlands) will be permanently lost, and significant areas of old-growth forests will not return for at least 100 years after closure.

[2562] The presence of rare plants is an important component of the biodiversity of an area as rare plants often occupy specialized niches within ecosystems that are stable. Stable ecosystems typically exhibit high states of biodiversity potential. The project will incrementally contribute to the loss of rare plants in the local and regional study area because Teck's reclamation plans do not include revegetation with rare plant species.

[2563] Wetlands and old-growth forests are key contributors to biodiversity. They provide important habitat for wildlife and provide areas for indigenous communities to harvest culturally important vegetation and wildlife species. Old-growth forests provide habitat for species of birds and other wildlife such as caribou that have specialized habitat requirements. The major contributors to project impacts on community diversity are the permanent loss of peatlands and the extended timelines to return old-growth forests to the project development area.

[2564] The project will contribute to further fragmentation of a landscape that has already become fragmented from forestry operations, energy development and other industrial activities, particularly to the south of the Frontier project. Fragmentation is a key contributor to the loss of biodiversity as it results in the division of large, continuous ecosystems or habitats into a greater number of smaller patches of lower total area, isolated from each other by a matrix of dissimilar habitats, with little connectivity. Landscape fragmentation can result in the loss of or reduction in small but specialized habitats such as rare and special plant communities and habitats that would harbour rare plant species and associated wildlife species. Wildlife migration corridors may be interrupted; vegetation cover classes, old-growth forests, wetland complexes, and specialized upland and wetland communities within the landscape matrix may become isolated as the landscape becomes fragmented. Landscape fragmentation during construction and operation of the project could also displace the Ronald Lake bison herd northward as connectivity will be changed. Movement of the herd between the Athabasca River and habitats to the west will be interrupted by loss of connectivity between the river and the Birch Mountains to the west.

Biodiversity Management Plan

[2565] The panel recognizes that Teck's stated goal of achieving a net positive impact on biodiversity in the region of the project is aspirational and that Teck has not relied on achieving this goal in its assessment of project effects on biodiversity. Similarly, the panel has not relied on this concept in assessing project effects on biodiversity. The panel found that there was insufficient information in Teck's proposed biodiversity management plan or its application materials to provide confidence that this goal could be achieved or how it would be achieved.

[2566] Of the four possible categories of mitigation identified by Teck for biodiversity, the first two—avoiding impacts to biodiversity and minimizing effects that cannot be avoided—have limited application in the context of the Frontier project. Given the size of the project development area and that all vegetation will be removed from this area, there is no opportunity to avoid project effects to vegetation biodiversity. While there may be some opportunity to minimize effects to wildlife biodiversity, this is largely limited to avoiding project effects resulting in wildlife mortality through implementation of Teck's proposed wildlife mitigation and monitoring plan. To the extent that wildlife diversity depends on wildlife habitat that will be removed by the project, there are no significant opportunities to minimize effects. That leaves two mechanisms—the rehabilitation, restoration, or reclamation of affected areas and the use of biodiversity or conservation offsets for residual effects that cannot be fully mitigated.

Reclamation

[2567] Reclamation is the primary mechanism that Teck is relying on to mitigate project effects to biodiversity. However not all species or plant communities that will be disturbed as a result of the project are included in Teck's reclamation program. Additionally, the panel expects that Teck's revegetation program will not achieve areas of high species diversity potential for an extended period of time, if at all.

[2568] While Teck's proposed planting prescriptions for reclaimed uplands satisfy the minimum number of species recommended in the provincial *Guidelines for Revegetation to Forest Vegetation in the Athabasca Oil Sands Region* (Government of Alberta, 2010), they would be insufficient to accelerate the return of biodiversity potential to the project development area. The panel accepts Teck's commitment to plant additional species to supplement those indicated in the provincial guidelines and finds that this is necessary to mitigate species loss and a decrease in biodiversity of traditional use resources. As discussed in section 10, "[Conservation, Reclamation, and Closure](#)," Teck will be required to report on its planting prescriptions and biodiversity monitoring as part of its reporting under *SED 003*.

[2569] The panel is satisfied that reclamation along with Teck's plan to incorporate reclamation research will adequately mitigate the loss of upland ecosite phases and contribute to the return of biodiversity in the project development area.

[2570] However, while most upland classes have potential to be reclaimed, only shrubby swamps, marshes, and shallow open-water wetlands have been included in Teck's closure, conservation, and reclamation plan. Teck's reclamation plan indicates that while 15 of 19 upland vegetation types will be reclaimed, only 3 of 15 wetland types (3 of 5 wetland classes) will be reclaimed.

[2571] The loss of wetlands resulting from the project is a key contributor to the effect of the project on biodiversity. While Teck's reclamation plan includes 6500 ha of reclaimed wetlands, the project will result in a net loss of 8905.7 ha of wetlands, including 3295 ha of peatlands (bogs and fens) in the project development area. Peatlands are specialized ecosystems that are characterized by an accumulation of peat or organic matter that accumulated over thousands of years. Once disturbed by draining, vegetation clearing, and soil stripping, peatlands cannot be reclaimed using currently available techniques.

[2572] Peatlands and wooded and forested swamps are not included in the reclamation plan. While there is potential for shrubby swamps to develop into forested or wooded swamps, peatlands cannot be reclaimed and will therefore be permanently lost. Project effects on biodiversity are high because peatlands cannot be reclaimed.

[2573] Opportunistic wetlands cannot be relied upon to compensate for loss of biodiversity resulting from the project. While the potential for opportunistic wetlands to form on the reclaimed landscape is high in light of expected settlement of landforms containing tailings deposits, their location, extent, and viability are uncertain. As well, benchmarks for defining the ecological viability of the potential opportunistic wetlands have not been defined. As a result, the panel was not able to consider the development of opportunistic wetlands as mitigation for the loss of wetlands or biodiversity.

[2574] As noted in section 22, "[Vegetation](#)," the Frontier project is not subject to the *Alberta Wetland Policy* because the environmental impact assessment for the project was complete before July 4, 2016.

[2575] Reclamation will not result in old-growth forests at closure. At closure, less than 50% of the project area will be revegetated. Forest stands will not attain old-growth forest status for more than 100 years for deciduous stands and 140 years for coniferous stands. It will therefore take a minimum of an additional 60–100 years after closure for old-growth forests to contribute to the level of biodiversity in the region.

[2576] Recognizing the above limitations, the panel finds that Teck's plans to use strategies in provincial reclamation guidelines, incorporate research results and best management practices, and use adaptive management to restore biodiversity in the closure landscape are appropriate and reasonable. However, given the identified limitations, the panel finds that reclamation alone will not be sufficient to fully mitigate effects to biodiversity, at least for the foreseeable future.

Conservation Offsets

[2577] Conservation offsets are actions that a company takes to provide physical compensation for significant adverse impacts resulting from development. While the potential use of conservation offsets was discussed by Teck in its draft biodiversity management plan, elsewhere in its application materials, and at the hearing, no specific offset proposals were identified. As a result, the panel has not relied on the use of conservation offsets when assessing the effects of the project.

[2578] Currently there are no regulatory requirements that mandate the use of conservation offsets, and the Government of Alberta has not yet implemented a policy for the use of conservation offsets in Alberta. While *LARP* refers to the potential role of conservation offsets, no specific direction or guidelines are provided.

[2579] The panel acknowledges that Mikisew, Athabasca Chipewyan, and Teck have worked collaboratively to advance the establishment of a biodiversity stewardship area to protect lands to the north of the Frontier project. The panel also understands that Teck, Mikisew, and Athabasca Chipewyan have differing views on whether the biodiversity stewardship area is required to provide mitigation for the effects of the Frontier project. The panel did not consider the effects of the proposed biodiversity stewardship area when assessing project effects to wildlife or biodiversity. At the time of the hearing, the panel could not be certain whether or when the proposed biodiversity stewardship area would be created and therefore could not rely on it as a mitigation measure. This approach is also consistent with Teck's view that the proposed biodiversity stewardship area was not intended as mitigation for project effects.

[2580] The panel is aware that after the close of the hearing but before issuance of its decision, Alberta announced a series of new protected areas in the area of the proposed biodiversity stewardship area. The panel supports this initiative and recommends that Alberta consider Athabasca Chipewyan and Mikisew recommendations related to management of any new protected areas in the vicinity of the Frontier project and Wood Buffalo National Park.

[2581] In the absence of regulatory requirements or policy direction for the use of conservation offsets and the lack of any specific offset proposal, the panel does not believe it would be appropriate to establish a specific offset requirement for the Frontier project. Rather, the panel accepts Teck's commitment to use conservation offsets as necessary to further mitigate the loss of biodiversity and to progress towards its vision of having a net positive impact on biodiversity. The panel acknowledges Teck's willingness to enter into conservation agreements with ECCC, with input from the AER and AEP, to achieve conservation and biodiversity offsets. The panel has included a recommendation that Teck work with ECCC, with input from the AER, AEP and indigenous communities, to develop and implement a compensation plan that protects habitat for old-growth, wetland and other *SARA*-listed migratory bird species. The panel further recommends that Teck work with ECCC, Alberta, and indigenous communities to determine if additional conservation agreements may be necessary to achieve Teck's conservation and biodiversity objectives.

[2582] Because proponents and decision makers would benefit from further direction on the need for and use of conservation offsets in the Lower Athabasca region, the panel recommends that Alberta consider providing further policy direction or guidance on the use of conservation offsets as part of any future updates to *LARP*.

Biodiversity Management Framework

[2583] The panel acknowledges that the biodiversity management framework and associated landscape management plan under *LARP* are long overdue. The panel is aware that a draft biodiversity management framework was released in 2014; however, it has not been finalized and the status of the framework is not known.

[2584] The panel agrees with the observations made by the Shell Jackpine joint review panel in 2013 that project reviews such as this one would benefit greatly from the completion of the biodiversity management and other frameworks and plans. However, *LARP* is clear that a decision maker must not adjourn, defer, deny, refuse, or reject any application, proceeding, or decision-making process before it by reason only of the incompleteness by the Crown or anybody of any direction or commitment made in a provision of either the *LARP* Strategic Plan or *LARP* Implementation Plan. The panel therefore cannot defer making a decision on the applications until Alberta finalizes and implements the biodiversity management framework. It would also be inappropriate for the panel to attempt to bind the Crown by making approval of the project subject to completion of the biodiversity management framework as OSEC has requested. In summary, while the biodiversity framework would be helpful to the panel, it is not necessary for the panel to assess the effects of the project or to make a decision on the project.

[2585] Notwithstanding the above, consistent with the panel's view that project reviews would benefit greatly from completion of the biodiversity management framework, the panel recommends that Alberta finalize and implement the biodiversity management framework under *LARP* as soon as possible.

Conclusions

[2586] The panel finds that the project will result in adverse effects to biodiversity at the species, community, and landscape levels and that project effects will contribute to adverse cumulative effects at the regional level. Significant adverse project and cumulative effects are primarily related to the permanent loss of wetlands and the long time required to reestablish old-growth forests and the associated impacts on wetland and old-growth-dependent wildlife species.

[2587] Reclamation alone is not expected to fully mitigate effects to biodiversity. At the same time, there is a lack of policy direction and guidance for the use of conservation offsets in the oil sands region, and no specific offset proposals have been identified.

[2588] As discussed in section 10, “[Conservation, Reclamation, and Closure](#),” the recently released *SED 003* includes requirements that address biodiversity throughout the life of an oil sands mine. All oil sands operators must submit conservation and reclamation information according to specifications in *SED 003*. Teck must comply with the requirements of *SED 003*, and the panel has included a condition requiring this in Teck’s approval.¹⁵⁷ The panel has also included conditions requiring Teck to submit a final reclamation monitoring plan that addresses how reclamation will optimize and accelerate the return of high biodiversity potential to the region, requiring reporting on changes to biodiversity throughout the life of the mine¹⁵⁸ and requiring participation in research related to the reclamation of peatlands.¹⁵⁹

Recommendations to Teck

[2589] The panel recommends that Teck work with ECCC, Alberta, and indigenous communities to determine if additional conservation agreements may be necessary to achieve Teck’s conservation and biodiversity objectives.

Recommendations to Alberta

[2590] The panel recommends that Alberta review and consider the recommendations made by Fort McKay First Nation, Athabasca Chipewyan, and Mikisew related to monitoring and management of regional cumulative effects as part of any current or future reviews of *LARP* and Alberta’s frameworks for managing cumulative effects.

[2591] The panel recommends that Alberta consider Athabasca Chipewyan and Mikisew recommendations related to funding and co-management of any protected areas established in the area of the proposed biodiversity stewardship area.

[2592] The panel recommends that Alberta consider providing further policy direction or guidance on the use of conservation offsets as part of any future updates to *LARP*.

[2593] The panel recommends that Alberta finalize and implement the biodiversity management framework under *LARP* as soon as possible.

Recommendations to Canada

[2594] The panel recommends that Canada review and consider the recommendations made by Fort McKay First Nation, Athabasca Chipewyan, and Mikisew related to monitoring and management of regional cumulative effects in the oil sands region for areas of federal responsibility.

¹⁵⁷ Draft *EPEA* Approval – Conditions 7.3.4, 7.3.11, and 7.6.2

¹⁵⁸ Draft *EPEA* Approval – Condition 7.5.1 and 7.5.2

¹⁵⁹ Draft *EPEA* Approval – Conditions 7.3.5(d), 7.3.5(e), 7.5.1, and 7.5.2

26 Land Use

[2595] The terms of reference for the Frontier project environmental impact assessment require Teck to identify current land uses on the proposed project area, including oil and gas development, agriculture, forestry, tourism, cultural use, food collection, trapping, fishing, hunting, and other outdoor recreational activities. As well, Teck must identify any land-use policies or resource management initiatives and discuss how the Frontier project will be consistent with the intent of these initiatives. Teck must also identify the potential impact of the Frontier project on these land uses.

[2596] The Frontier project would be located on Alberta public lands. These lands currently accommodate existing land and resource-use activities including traditional and cultural land use, forest management, and harvesting, trapping, hunting, guide outfitting, aggregate exploration, tourism, and other outdoor recreational pursuits.

Applicable Land-Use Legislation and Policy

[2597] The provincial legislation and policies about public land and land use that Teck must comply with for the Frontier project include the *Public Lands Act* and regulation, the *ALSA*, the accompanying *Alberta Land-Use Framework*, and *LARP*. Also applicable to a part of the project infrastructure is the *Fort McMurray-Athabasca Oil Sands Subregional Integrated Resource Plan (IRP)*. As well, the project footprint lies entirely within a key wildlife and biodiversity zone; development projects proposed within a key wildlife and biodiversity zone must comply with standards specific to the zones set out in the guidance documents.

Public Lands Act

[2598] The applications before the panel do not include *Public Lands Act* applications.

Analysis and Findings

[2599] Under the *Public Lands Act*, dispositions will be required to support oil sand mining activities. Teck must obtain all required *Public Lands Act* dispositions before being able to proceed with project-related activities. The panel understands that, pursuant to *REDA* and its regulations, that some of the Frontier project activities fall under AER jurisdiction while others fall under the jurisdiction of AEP. Before applying for *Public Lands Act* applications, Teck would need to review the current jurisdiction and apply appropriately.

[2600] The panel understands that the primary *Public Lands Act* disposition for oil sands mining is a mineral surface lease. MSLs give the right to use public lands for purposes in connection with or incidental to the recovery and production of mines and minerals. MSLs and other leases under the *Public Lands Act* can exclude other uses of the land within the boundaries of lease and therefore may impact other existing and future land uses.

[2601] Consent from certain existing users, including forest management area agreement holders and timber licence holders, are required as part of the *Public Lands Act* application process. Consent is not required from RFMA holders. The mineral surface leaseholder is required to provide these users a ten-day notice before entering the lands contained within the disposition.

[2602] The panel recognizes that, historically, oil sands mining MSLs have initially been issued to include lands for the first 10–15 years of mining development. Additional lands are added over time as required to continue the development progression. This is done in part to minimize the impact to other resource users and values. Some interested parties have requested that MSLs be issued sequentially for the Frontier project for this reason. One such recommendation (CEAA #571) from Athabasca Chipewyan First Nation is that Teck meet certain north pit objectives before submitting a mineral surface lease application for the north pit mine area.

[2603] The applications before the panel do not include *Public Lands Act* applications. However, the panel expects that Teck will submit the required *Public Lands Act* applications and any amendments in a phased manner as land is required instead of applying for all lands at once. Accordingly, the panel has included a condition requiring Teck to submit an amended application under the *Public Lands Act* prior to any disturbance in the Buckton Creek watershed two years prior to any disturbance within it. This is discussed further in section 4, [“Mine Planning and Resource Conservation.”](#)

Alberta Land Stewardship Act/Land-Use Framework

[2604] In 2008, Alberta released the *Land-Use Framework* in response to the need for regional planning to better manage competing activities and interests on land in the province. To provide legal support for regional planning, *ALSA* was proclaimed in 2009, with amendments in 2011. *LARP*, the first regional plan to be completed under the act, was released in 2012. *LARP* established regional outcomes associated with a healthy economy, environment, and communities. To meet these outcomes, the plan identifies strategies to improve integration and reclamation; establish management frameworks for air, water, and biodiversity; establish new conservation and recreation/tourism areas; improve infrastructure; and include indigenous people in land-use planning.

Evidence

[2605] Respecting other land and resource users in the project area, Teck identified the following proposed mitigations:

- Conducting clearing, construction, and reclamation activities progressively.
- Ensuring that access management planning and stakeholder engagement continues through the predevelopment and development timelines of the project.

- Ensuring that project activities are integrated with each other and where present, integrated with other users, to limit the impacts to resource values and other uses. For example the proposed access and utilities necessary to support the river water intake development should align into a single corridor to maximize integration.

[2606] Teck argued that the panel is required to act in accordance with *LARP* as it exists, despite concerns raised regarding components of *LARP*, such as the *Surface Water Quantity Management Framework*. Approval of the project would be in accordance with *LARP*.

[2607] Mikisew argued that treaty rights were not taken into account when *LARP* was developed, that compliance with *LARP* does not confirm compliance with the *Constitution Act* of 1982, and that *LARP* frameworks cannot be relied upon to mitigate project effects on Mikisew Cree First Nation rights and culture. Mikisew Cree First Nation also said that *LARP* frameworks do not help mitigate project effects on the outstanding universal value of Wood Buffalo National Park. Mikisew asked the panel to recommend the Surface Water Quantity Management Framework under *LARP* be revised to be more protective of indigenous navigation and of the outstanding universal value of Wood Buffalo National Park.

[2608] OSEC submitted that the project should not proceed until the biodiversity management framework, mandated by *LARP*, is put in place, in part to deal with issues related to caribou.

Analysis and Findings

[2609] The panel understands that *LARP* promotes multiple benefits to be achieved from the landbase while ensuring that impacts are minimized to other users and the environment. It is also understood that the Frontier project is located within the *LARP* mixed use resource area, which accommodates oil sands mining activities.

[2610] *LARP* does not specifically speak to trade-offs associated with oil sands development or provide priorities of one industry over another within the region. It instead focuses on ways to minimize the impact of development activities. In reference to oil sands development, the plan states that “Alberta is committed to optimizing the economic potential of the resource [oil sands hydrocarbons], but will do so in ways that are environmentally sustainable and socially acceptable.” The panel understands that Mikisew and OSEC have concerns about *LARP*. However the panel does not have the mandate to make changes to *LARP* and cannot defer making a decision on the Frontier project until changes are made to *LARP*. However this does not mean that the panel could not come to the conclusion that there will be adverse effects from the project, in spite of *LARP*. The concerns raised by Mikisew and OSEC are addressed in the sections “[Effects on Indigenous Traditional Use of Lands and Resources, Culture, and Asserted Rights](#),” “[Surface Water Quality](#),” “[Surface Water Quantity](#),” “[Wood Buffalo National Park and the Frontier Oil Sands Project](#),” and “[Biodiversity](#).”

[2611] To support multiple benefits and other land uses within the project area, the panel expects that mitigations proposed by Teck and will be implemented by Teck.

[2612] From a land- and resource-use perspective, and recognizing the mitigations proposed by Teck, the panel finds that the project aligns with *LARP*.

Fort McMurray-Athabasca Oil Sands Subregional Integrated Resource Plan (IRP)

Evidence

[2613] The *IRP* was established in 1997 to improve and direct the management of public land and its resources. The *IRP* states that it “may influence regulatory decisions, but will not result in the categorical approval or rejection of energy proposals.”

[2614] Teck said the *IRP* is relevant to the project as the local study area overlaps a small portion of both the Athabasca-Clearwater and Mildred-Kearl Lakes resource management areas. Teck states that it is compliant with the plan and its goals. Teck provides an assessment of the bridge and access road as part of the evidence which includes a preliminary bridge design and mitigation.

Analysis and Findings

[2615] The panel understands that the Athabasca-Clearwater resource management area includes lands within 100 m of the Athabasca River valley break. The *IRP* states that, within this management area, river crossings for access and utility purposes should, wherever possible, use existing or planned crossing locations. The panel understands that the project access road and Athabasca River bridge crossing crosses the Athabasca-Clearwater resource management area.

[2616] The panel recommends that the final bridge design, its location, and necessary mitigations will be addressed as part of the *Public Lands Act* application for the access road and bridge crossing. In addition this process would be expected to address any relevant resource plan direction.

[2617] Key wildlife and biodiversity zones establish areas of important winter ungulate habitat and higher habitat potential for biodiversity within the province. Typically these areas are associated with major river valley areas.

[2618] The project is fully contained within the key wildlife and biodiversity zone. Teck stated that the intent of the key wildlife and biodiversity zone as provided in the *Recommended Land Use Guidelines for Key Wildlife and Biodiversity Zones* is to

- maintain the long-term integrity and productivity of ungulate winter ranges and river corridors where ungulates concentrate,
- maintain local and regional movement corridors for wildlife,

- conserve habitat diversity and regionally significant habitat types, and
- provide hiding and thermal cover for wildlife.

[2619] The *Guidelines* provide strategies to minimize impacts, including the following:

- Minimize industrial activities that would lead to vegetation removal
- Minimize activities during winter months, where activities are authorized
- Reduce access development
- Follow specified timing restrictions

[2620] Teck said that construction and operation activities will overlap the key wildlife and biodiversity zone timing restriction (Jan 15–April 30) and may affect north-south movement along the Athabasca River and east-west movement, specifically for moose and wood bison.

[2621] Teck has provided several mitigation options to reduce impacts to wildlife and biodiversity. These are discussed in the sections “[Wildlife](#),” “[Biodiversity](#),” and “[Effects on Indigenous Traditional Use of Lands and Resources, Culture, and Asserted Rights](#).”

Analysis and Findings

[2622] The panel understands that the key wildlife and biodiversity zone guidelines and their strategies have been incorporated into the *Public Lands Act* application process as accepted standards; if an applicant is unable to meet the standards, then the applicant must propose mitigation that would be deemed acceptable to the regulator.

[2623] The panel has conducted an analysis of the wildlife and biodiversity considerations in those respective sections and the wildlife mitigation measures Teck has proposed and as outlined in their draft wildlife mitigation, monitoring and adaptive management plan. The panel is satisfied that the measures proposed by Teck are consistent with those in the key wildlife and biodiversity zone guidelines. The panel expects that mitigations presented in the wildlife and biodiversity sections that are relevant to the key wildlife and biodiversity zone will be included or referenced in any subsequent *Public Lands Act* application required to support the project.

Traditional Use

Evidence

[2624] Evidence provided to the panel by Teck and indigenous groups have identified the traditional use of the project disturbance area by several First Nation and Métis groups in the region. These groups have used and continue to use this area for hunting, fishing, gathering, trapping, and other cultural activities.

Their uses of the area were not contested by Teck. As well, the area contains several traditional trails that provide access to areas beyond the project area.

Analysis and Finding

[2625] Section 32, [“Effects on Indigenous Traditional Use of Lands and Resources, Culture, and Asserted Rights,”](#) provides details on these traditional uses and an assessment of the project’s effects on them.

Aggregate and Mineral Resources

Evidence

[2626] In addressing whether the project could affect aggregate (sand, gravel, crushed stone, or other granular material used for construction or industrial purposes) and mineral resources, Teck states that there are no operating aggregate pits or mineral development activities in the local study area. However, there are existing applications for aggregate exploration activities and several existing metallic mineral rights in the area.

[2627] Teck reports that, based on its assessments, there is low-quality aggregate material (mostly sand) present in the project area. Teck will require aggregate material to support the project, and, based on its submission, the bulk of this material will be sourced from two proposed sand pits within the project area and existing pits in the region, including an existing limestone quarry on the east side of the Athabasca River, near the CNRL Muskeg River mine. In addition Teck will use overburden and interburden materials from the mine pit that meet a defined specification for construction purposes.

[2628] To reduce impacts on aggregate and mineral resources, Teck indicated that it will apply the following mitigations:

- Consult with mineral and aggregate rights holders regarding potential conflicts and focus on synergies between development activities.
- Consult with other industrial and commercial users during construction to consider shared infrastructure in attempt to minimize aggregate need.
- Conserve and stockpile surface material found during construction activities.
- Report to the regulator locations of surface material discovered.

[2629] The panel did not receive any submissions, statements of concern, or requests to participate in the hearing from holders of aggregate dispositions or metallic mineral rights.

Analysis and Findings

[2630] The panel is aware that there are no operating aggregate extraction pits or mineral development activities within the local study area. The panel also recognizes that there are existing aggregate exploration applications and existing metallic mineral rights within the local study area.

[2631] The panel understands that, regionally, the demand for aggregate is high but the supply is low. This demand is driven for the most part by oil sands development activity as well as urban expansion. Given the proximity of the areas of current surface material exploration interest within the local study area, it is likely that any material discovered would primarily serve oil-sands-related activities.

[2632] The panel is aware that provisions within the *Public Lands Act* dispositions for oil sands mines have been established to prevent the sterilization of surface material during mining development activities.

[2633] The panel requires Teck to implement the mitigation measures it has identified related to potential effects to aggregate and mineral resources. Some of these will be incorporated as conditions in *Public Lands Act* approvals, when they are issued.

[2634] Having regard for the mitigation measures proposed by Teck, the panel considers the impact to aggregate material and users in the local study area to be low.

Forest Management

Evidence

[2635] Teck said that the project area overlaps two forest management units and the north part of Alberta-Pacific Forest Industries Inc.'s forest management area. Northland Forest Products Ltd. is the only quota holder in both forest management units A10 and A15, where they have the rights to all coniferous volume (about 8500 m³ per year) and 65 per cent coniferous volume (about 168 000 m³ per year), respectively. Alberta-Pacific holds all deciduous rights (about 450 500 m³ per year) and 35 per cent of the coniferous rights (about 93 000 m³ per year) in the forest management unit A15 part of the forest management area.

[2636] In 2011, a large area of the local study area was impacted by the Richardson wildfire. As a result, Teck updated its timber assessment, which resulted in a merchantable timber estimate of approximately 3 094 038 m³ within the local study area.

[2637] Teck has provided the following mitigations to reduce the impact of the project to the forest resources:

- All merchantable timber on the project area will have to be removed before development proceeding, but the clearing of vegetation will occur progressively, over the life of the project. Teck will balance

the number of timber salvage events while maintaining vegetation and associated wildlife habitat in areas where clearing is not yet required.

- Teck will work to establish a collaborative relationship with Northland and Al-Pac to develop an integrated land management strategy that will facilitate the efficient planning of future salvage operations necessary to accommodate the project.
- Logging access will be maintained where it is not in conflict with mine development.
- It will ensure that deciduous timber in forest management unit A10 is addressed based on direction from the Government of Alberta.
- It will develop a plan to limit the effects to the environment from timber harvesting activities.
- Maintain a goal of closure planning to reclaim the land to equivalent land capability for forestry and meet reforestation standards.

Analysis and Findings

[2638] The panel understands that the project will result in the loss of landbase that is currently contributing to the calculated annual allowable cut levels. It also understands that when *Public Lands Act* dispositions are issued, holders are required to pay timber damage assessment to the forest management area holder and Alberta to compensate for the loss of standing timber and future growth. Based on this, the residual impact of the Frontier project for forest management is the loss of operable timber landbase, which would reduce the future annual allowable cut levels for both forest companies.

[2639] The panel did not receive any submissions, statements of concern, or requests to participate in the hearing from any forestry company.

[2640] The panel accepts that the project will remove operable forest landbase. However, with the mitigations proposed by Teck and its commitments to work with the two affected forestry companies, the impacts will be minimized.

[2641] The panel requires Teck to implement the mitigation measures it has identified related to effects to forest management. Some of these will be incorporated as conditions in *Public Lands Act* approvals, when they are issued.

Trapping

Evidence

[2642] Teck provides that the local study area overlaps several RFMA:

- RFMA 1275 – 77.8 per cent overlap
- RFMA 2016 – 0.2 per cent overlap

- RFMA 2892 – 13.8 per cent overlap
- RFMA 2939 – 7.9 per cent overlap

[2643] To support the trapping activity, there is one cabin located within and another seven located just outside the local study area.

[2644] Teck said that it will mitigate potential effects to trapping through reclamation and access management. During reclamation it will restore habitat for fur-bearing species of interest to trappers. It will also continue to consult with the local trappers and, where appropriate, may negotiate compensation for losses associated with the project. Teck stated that it has reached an agreement with the holder of RFMA 1275. Teck also plans to relocate the miscellaneous permit trapper cabin in NW24-099-10W4M held by the holder of RFMA 1275.

[2645] The panel heard concerns from representatives of the holders of RFMAs 2939, 2932, and 2346. The holder of RFMA 2939 said that the project overlaps approximately one-third of his RFMA. Although not opposed to the project, the holder expressed concerns relating to the lack of communication, theft and vandalism at his cabin, and the loss of hunting opportunities for bison.

[2646] The holders of RFMA 2932 and 2346 highlighted their history in the area and the observations they have made during their time as RFMA holders. They also presented concerns relating to the lack of communication on project activities, concerns with insufficient compensation, and impacts to their way of life with habitat disturbances and noise on their RFMAs. They presented concerns related to potential impacts to an artesian well located approximately 500 metres away from a cabin, impacts to grave sites distributed throughout the area, damage to trapping area trails, increased industrial noise, and lower water levels in the Athabasca River that would affect accessibility. In general, they are concerned that the project will further impact their ability to trap and therefore their way of life on the RFMA areas. The holder of RFMA 2346 suggested having both the RFMA 2932 and 2346 incorporated into a conservation area or a park.

[2647] Teck responded to the concerns of representatives of RFMA 2939 and 2346 with a listing of attempts to communicate with them, pointing out that their RFMAs are several kilometres north of the project area, and that no grave sites have been found within the project footprint.

Analysis and Findings

[2648] The panel understands that the rights granted under a RFMA are exclusive to the trapping of fur-bearers with no rights to the land except where a disposition has been approved for a trapping cabin. The province has policies in place that establish the allowances for cabins and their use. The panel understands that when activities occur within a RFMA, there is compensation paid to the trapper managed by the Trapper Compensation Association. The panel is also aware that the Fort McKay First Nation has established and maintains a trapper compensation matrix that focuses on cumulative losses to RFMA

holders. This matrix is often used regionally by industry, RFMA holders, and First Nation communities when discussing RFMA holder compensation.

[2649] The panel understands that RFMA 2932 and 2346 are located outside the local study area: RFMA 2346 borders the northern project area boundary but is located approximately 7 km north of the local study area; RFMA 2932 is located approximately 9 km northwest of the local study area. It is understood that the biodiversity stewardship area proposed by Mikisew and Athabasca Chipewyan (much of which has now been included in Kitaskino Nuwenëné Wildland Provincial Park, established following the close of the hearing) would cover all of RFMA 2346 and the majority of RFMA 2932.

[2650] The panel understands that direct impacts to RFMA areas will occur as part of the project. It is expected that Teck will minimize impacts where possible by continuing consultation with the RFMA holders while implementing mitigation. The panel requires that Teck comply with the notification requirements related to RFMA holders. It is also expected that Teck will contribute to the Alberta trapper compensation program as required under the *Public Lands Act* application process.

[2651] The panel recognizes that the holders of RFMA 2932 and 2346 have expressed concern with respect to the Frontier project. However in reviewing the evidence provided by the holders and the location of the RFMAs, the panel concludes that the evidence presented does not provide details of direct impacts. Nonetheless, the panel expects that Teck will maintain consultation with the holders of RFMA 2932 and 2346 where necessary, including potential impacts to access through the Teck project area as it may impact the RFMA holders.

Hunting and Outfitting Evidence

Evidence

[2652] Teck states that the local study area is located in the Birch Mountains WMU 531 and that the project's clearing activities will result in a temporary loss of wildlife habitat and hunting opportunities on approximately 1.6 per cent of the WMU lands. This loss is however not expected to adversely impact hunting opportunities in the larger wildlife management area.

[2653] Teck said that within the WMU there are several outfitters that conduct hunting activities, but due to its remoteness, this WMU is not heavily used by outfitters. However one outfitter, Double Diamond Wilderness Hunts, currently uses the local study area extensively.

[2654] The panel heard evidence from Charles Beauchamp, owner of Birch Mountain Outfitter Corp. Mr. Beauchamp spoke of being an outfitter for 30 years, having a camp on Diana Lake under TFA 183417, and his experiences and understandings of wildlife and wildlife habitat in this area. He said that since 2016, he has moved 300 km further north to pursue bison hunting opportunities due to bison hunting becoming regulated in the local study area. This impacts his costs and time.

[2655] To reduce effects on hunting and outfitting, Teck intends to do the following:

- Establish measures to reduce wildlife mortality in the local study area, including policies restricting project staff and contractors from hunting in the area.
- Develop an access management plan to identify the objectives for managing access and maintaining public safety. This plan will provide the options for access to areas within and through the project disturbance area.
- Restore habitat for species of hunting interest.
- Continue to engage with outfitters to understand impacts.

[2656] Teck said that following reclamation, there will be a temporary decrease in habitat availability for black bear, waterfowl, and fisher, and an increase in habitat availability for moose, wood bison, and beaver. Overall Teck predicts that project effects will be temporary and that wildlife will gradually return as reclamation occurs. Success of reclamation will be monitored as outlined in the biodiversity management plan and wildlife mitigation and monitoring plan with the goal of restoring habitat for key game and fur-bearing species of interest and concern to hunters. Teck further committed that the wildlife mitigation and monitoring plan will include targets and benchmarks for performance over time regarding habitat use and the successful recolonization of disturbed landscapes by wildlife.

Analysis and Findings

[2657] Based on the evidence provided by the trappers and Mr. Beauchamp, the panel accepts that the project may have some effects on hunting opportunities in the area of the Frontier project. However there was no evidence provided that hunting and guiding opportunities are not available elsewhere in WMU 531 and the project disturbance area occupies a small portion of the WMU. Based on the evidence provided and Teck's proposed mitigation, the panel is satisfied that the project's impacts on hunting and outfitting opportunities in WMU 531 will be low.

[2658] Information provided by indigenous communities regarding hunting in the project area and the effects on indigenous use, rights and culture are addressed in section [32](#).

[2659] The panel recommends that Teck, in preparing its access management plan, work with appropriate regulatory agencies and stakeholders to identify key concerns and considerations with respect to access management in the project area. The panel requires Teck to submit an updated access management plan six months before site construction activities start and every five years thereafter. These will be incorporated as conditions in *Public Lands Act* approvals when they are issued. Teck should contact the AER before commencing work on the plan to request a terms of reference for the plan.

Recommendation

[2660] The panel recommends that Teck, in preparing its access management plan, work with appropriate regulatory agencies and stakeholders to identify key concerns and considerations with respect to access management in the project area.

[2661] Teck should contact AER before commencing work on the plan to request a terms of reference for the plan.

Sport Fishing

Evidence

[2662] According to information provided by Teck, the local study area has no popular sport fishing locations. Teck also notes that although there is some sport fish habitat, the majority of fish communities are represented by forage fish species.

[2663] Teck said that the proposed fish habitat compensation lake construction is predicted to increase the fishing opportunities available within the area.

[2664] No other evidence regarding sport fishing in the project area was presented to the panel.

Analysis and Findings

[2665] The panel is satisfied, based on the evidence, that the project will have no adverse effects on sport fishing in the project area.

Recreation and Tourism

Evidence

[2666] Based on information provided by Teck, it is understood that the Frontier project local study area currently has low amounts of recreational use in the form of ATV use, snowmobile use, and boating, and no tourism activities.

[2667] With respect to boating, Teck provided evidence of concerns from aboriginal communities on the visibility of the river water intake to travellers on the river for a distance of approximately 2 km.

[2668] To address the recreation occurring within the local study area, Teck has proposed the following mitigations:

- That the closure, conservation, and reclamation plan will include an end land use goal to support recreation opportunities.

- Riparian habitat in the southeast part of the local study area will be preserved and maintained to the maximum extent possible. In addition, the embankments of the river water intake will be revegetated to reduce its visibility to river travellers.

[2669] No other evidence regarding recreational and tourism effects was presented to the panel.

Analysis and Findings

[2670] The panel is satisfied that the project with the planned mitigations will have minimal to no adverse effects on recreation and tourism.

27 Wood Buffalo National Park and the Frontier Oil Sands Project

[2671] Wood Buffalo National Park is located approximately 27 kilometres north of the northernmost boundary of the Frontier project. In December of 2014, Mikisew submitted a petition to the UNESCO World Heritage Committee requesting that it place Wood Buffalo National Park on the List of World Heritage Sites in Danger. The petition included a number of concerns related to impacts of current and planned hydroelectric dams, oil sands development, cumulative effects and climate change on the hydrology and ecology of the Peace-Athabasca Delta that could adversely affect the park's outstanding universal value. In July 2015, the UNESCO World Heritage Committee made a decision to send a reactive monitoring mission to visit Wood Buffalo National Park and to request Parks Canada to undertake a strategic environmental assessment to evaluate the potential cumulative impacts of all developments (hydroelectric dams, oil sands, and mining) on the park's outstanding universal value.

[2672] In the fall of 2015, Parks Canada hosted a visit by the joint reactive monitoring mission of the World Heritage Centre and the International Union for Conservation of Nature to Wood Buffalo National Park. The monitoring mission participants met with representatives of indigenous communities associated with Wood Buffalo National Park, members from non-government organizations, industry, scientists and all levels of government to better understand and discuss the impacts of upstream developments on the park's outstanding universal value. The reactive monitoring mission's report, including 17 recommendations, was released on March 10, 2017.

[2673] Upon consideration of the reactive monitoring mission report, the federal minister of Environment and Climate Change and the CEO of the AER amended the joint review panel agreement and terms of reference on August 24, 2017. The amendment required the panel to consider the effects of the Frontier project on the outstanding universal value of Wood Buffalo National Park, including the Peace-Athabasca Delta, in its environmental assessment of the Frontier oil sands mine project.

Wood Buffalo National Park

[2674] Wood Buffalo National Park is Canada's largest national park with a total area of 44 807 square kilometres. It straddles the border of Alberta and the Northwest Territories and is managed by the Parks Canada Agency. Wood Buffalo National Park was created in 1922 to protect the last free-roaming herds of wood bison in the nation. It contains some of the largest undisturbed and unfragmented grass and sedge meadows, forest and wetland ecosystems in North America. The area contains extensive salt plains and gypsum karst landscape features, as well as rare, large-scale ecosystem processes with limited human interference.

[2675] Wood Buffalo National Park sustains the largest herd of wild free-ranging wood bison (*Bison bison athabascae*) in Canada, which includes an uninterrupted predator-prey relationship with the grey wolf (*Canis lupus*). The endangered Whooping Crane (*Grus americana*) relies on habitat within the

park's boundaries for certain of its life stages, most importantly, breeding. At the western point of Lake Athabasca, the Peace, Athabasca and Birch Rivers meet to form one of the world's largest inland deltas, the Peace-Athabasca Delta. It is an internationally recognized site of biodiversity, a Wetland of International Importance under the Ramsar Convention. The Peace-Athabasca Delta is key to the spring and fall staging for significant populations of migratory birds from all four major North American flyways. It also serves as an integral area for many species of waterfowl for their nesting, breeding and moulting needs.

[2676] For indigenous peoples, the Peace-Athabasca Delta is a vital component of their traditional territory. It supports their indigenous ways of life and has strong spiritual and cultural significance. The Peace-Athabasca Delta is a place where indigenous peoples hunt and gather, travel, and undertake cultural and spiritual practices.

Designation of Wood Buffalo National Park as a World Heritage Site

[2677] In 1983, Wood Buffalo National Park was designated a World Heritage Site. The UNESCO World Heritage Committee use ten criteria to define a site's world heritage values, which are expressed in terms of its outstanding universal value. Outstanding universal value are the basis for a site's designation on the World Heritage List and a site must have a minimum two out of ten values in order to be considered. An outstanding universal value is defined by UNESCO as: "natural significance, which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole" (UNESCO, 2006). Wood Buffalo National Park was designated as a World Heritage Site under three outstanding universal value criteria. These criteria are outlined below along with the rationale for their selection, as defined by the World Heritage Committee.

[2678] Criterion (vii): superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance

[2679] The great concentrations of migratory wildlife are of world importance and the rare and superlative natural phenomena include a large inland delta, salt plains and gypsum karst that are internationally significant.

[2680] Criterion (ix): outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals

[2681] Wood Buffalo National Park is the most ecologically complete and largest example of the entire Great Plains-Boreal grassland ecosystem of North America. It is the only place where the predator-prey relationship between wolves and wood bison has continued unbroken over time.

[2682] Criterion (x): the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation

[2683] Wood Buffalo National Park contains the only breeding habitat in the world for the Whooping Crane. It is an endangered species which has been brought back from the brink of extinction through careful management of the small number of breeding pairs in the park. Maintaining the integrity of the ecosystems within Wood Buffalo National Park is important in ensuring the long-term survival of the Whooping Crane population.

[2684] Wood Buffalo National Park contains two Ramsar Wetlands of International Importance: the Whooping Crane Summer Range and the Peace-Athabasca Delta. As a signatory to the Ramsar Convention, Canada is committed to designating Wetlands of International Importance and to ensuring their effective management. The Whooping Crane Summer Range is the breeding ground of the only wild, self-sustaining migratory flock of the endangered Whooping Crane, also listed on the International Union for Conservation of Nature Red List of Threatened Species, and is one of only two Alliance for Zero Extinction sites in Canada. The Alliance for Zero Extinction was established to identify, conserve and safeguard the most important sites for preventing global species extinctions. It consists of international biodiversity conservation organizations that work to protect key areas which are the last remaining refuges of one or more Endangered or Critically Endangered species.

Assessment of the Effects of the Frontier Project on the Outstanding Value of Wood Buffalo National Park

[2685] The joint review panel agreement and terms of reference were amended to direct the panel to consider the effects of the project on the outstanding universal value of Wood Buffalo National Park. On August 24, 2017, the panel issued an information request to Teck to provide an assessment of the potential effects of the project on these key indicators:

- The Peace-Athabasca Delta, including but not limited to, potential effects of the project on water quality and water quantity, wildlife and human health within the area;
- Whooping Crane and Whooping Crane breeding habitat;
- Wood Buffalo National Park's Great Plains-Boreal grassland ecosystem, including the predator-prey relationship between wolves and wood bison, taking into account potential effects of the project on the Ronald Lake bison herd; and
- Wood Buffalo National Park's salt plains and gypsum karst features.

[2686] On March 1, 2018, Teck submitted its response to the panel's information request. It had reviewed the statement of outstanding universal value for the park and considered the project's potential effect on the key indicators that the panel identified in its information request. Teck undertook a linkage

analysis to determine if there were direct or indirect effects of the project on the key indicators. If there was no linkage to an indicator, Teck concluded there was no project effect on the outstanding universal value of the park and no further assessment of potential effects was carried out. Potential project effects on integrity, protection and management of Wood Buffalo National Park were carried through to the effects assessment regardless of linkage analysis results.

[2687] As a result of its linkage analysis Teck determined there were valid linkages between the Frontier project and the following key indicators: the Ronald Lake bison herd; waterfowl and water bird species and Whooping Crane; hydrology and surface water quality in the Peace-Athabasca Delta; human and wildlife health risk; the Great Plains-Boreal grassland ecosystem; and, the predator-prey relationship of wolves and the Ronald Lake bison herd.

[2688] Teck concluded there was not a valid linkage between the project and several of the indicators. Woodland (boreal) caribou was found not to have a linkage because they are not migratory and not considered part of an outstanding universal value of the park. There was no linkage between the Delta subunit of the Wood Buffalo National Park bison herd and the Frontier project because their entire range is within the boundaries of the park. For Whooping Crane breeding habitat, Teck determined no linkage because the project disturbance area is located outside of Wood Buffalo National Park and project activities will not directly disturb breeding habitat (breeding areas are located in the northern portions of the park and in the Northwest Territories). Teck found no linkage between the project and the park's salt plains and gypsum karst features because the project does not overlie hydraulically active karst zones and if project activities did disturb the Devonian bedrock, effects are not expected to extend over large regional distances (over 200 km). Any disturbance to groundwater flow patterns in the project disturbance area will not affect the features because they are located in the northern portion of the park.

[2689] Teck completed an assessment of project effects for each key indicator for which it found a valid linkage to the outstanding universal value of Wood Buffalo National Park. Teck concluded that since the effects of the Frontier project within the local study area are expected to be of low magnitude, for those key indicators where valid linkages exist, the project is not likely to result in adverse effects on the outstanding universal value of Wood Buffalo National Park and the Peace-Athabasca Delta.

[2690] An effects assessment for each key indicator related to an outstanding universal value of Wood Buffalo National Park with linkage to the project is presented in the following sections.

Potential Project Effects on Water Quality and Quantity in the Peace-Athabasca Delta

Project Effects on Peace-Athabasca Delta Water Quality

[2691] Project effects to water quality and Teck's proposed mitigation measures are discussed in section 18, "[Surface Water Quality](#)."

[2692] Water quality in the Peace-Athabasca Delta and Wood Buffalo National Park has the potential to be affected by project activities through three contaminant pathways: releases from the project area to the Athabasca River which would flow into the Peace-Athabasca Delta; releases from the project area to the Ronald Lake watershed which would flow via Buckton Creek into Lake Claire; and aerial deposition of metals, PAHs or acidifying compounds from the project which could affect water quality within the Peace-Athabasca Delta and Wood Buffalo National Park.

Evidence

[2693] Teck's assessment of potential effects of the Frontier project on the outstanding universal value of Wood Buffalo National Park identified the following activities as having potential to affect surface water quality:

- Diversion of watercourses and release of clean diversion water to the environment.
- Release of muskeg drainage and overburden dewatering waters of acceptable quality into Redclay and Big Creeks and the Athabasca River.
- Creation of three end-pit lakes with discharge to Ronald Lake (north pit lake), Redclay Creek (central pit lake) and Big Creek (south pit lake). Releases from Redclay and Big Creeks would eventually discharge to the Athabasca River.
- Construction and operation of the fish habitat compensation lake and the Unnamed Creek 2 off-stream storage pond.
- Surface runoff, seepage and flux water flow from the external tailings areas, in-pit tailings deposits, overburden dumps and reclaimed pit surfaces at closure.
- Atmospheric emissions of acidifying emissions (sulphur and nitrogen oxides), metals and PAHs.

[2694] Teck summarized historical trends for water quality parameters upstream of the Peace-Athabasca Delta, which found varying trends in individual parameters. Overall, current and historical monitoring in the Athabasca River and Lake Athabasca indicated no adverse change in sediment quality and biological endpoints and no long-term trends in water quality. Teck assessed the impacts of the project to the Peace-Athabasca Delta as negligible with all parameter concentrations predicted to be within 10% of baseline concentrations or below applicable aquatic health thresholds. Teck stated that mitigation measures applied within the project area would provide protection for the downstream Peace-Athabasca Delta area.

The Athabasca River

[2695] For the application case, Teck predicted that in the Athabasca River at Embarras upstream of the Peace-Athabasca Delta, levels of acute and chronic toxicity and fish tainting potential would remain below guideline values and the project was not expected to change the predicted levels of these parameters from the base case. Concentrations of total dissolved solids were predicted to remain within

the range of concentrations predicted under the base case and would remain below chronic-effects benchmarks. Labile and refractory naphthenic acids were also predicted to remain within range of concentrations predicted under base case. All other substances were predicted to be within the range of concentration under base case at Embarras and were not considered further in their assessment.

[2696] Teck stated that current and historical monitoring showed no evidence of adverse change in sediment quality or biological endpoints in the Athabasca River and Lake Athabasca. Teck referenced the RAMP 2010 report which indicated no long-term trends in sediment quality parameters or benthic invertebrate endpoints. Because Teck predicted no effects on water quality at Embarras based on model results, Teck concluded that adverse effects at points beyond Embarras, including the Peace-Athabasca Delta, would not occur.

[2697] Parks Canada submitted that the project would likely result in adverse effects on water quality in the Peace-Athabasca Delta. In conducting their assessment of potential impacts to the Peace-Athabasca Delta, Parks Canada applied the precautionary principle on the basis that there is uncertainty in modelled results. It assumed water quality changes expected within the Peace-Athabasca Delta would be similar to effects observed at the project. Teck stated this assumption was not correct based on multiple lines of evidence including previous research and monitoring results.

[2698] As part of their response to Parks Canada, Teck referenced previous studies by ECCC and the Mikisew community-based monitoring program indicating water quality indicators related to oil sands inputs are either below guidelines or at background levels by the time the river reaches Wood Buffalo National Park. While some water quality parameters of concern highlighted by Parks Canada may be above guidelines, they were within concentration ranges observed in areas upstream of the mineable oil sands area. Teck also summarized historical studies, some of which found increases in certain PAHs in the delta but attributed the sources to natural outcrops of bitumen along the Athabasca River.

[2699] ECCC and Parks Canada both submitted that the project was potentially a significant source of methylmercury effects and that Teck's assessment of these effects was not sufficient. ECCC recommended that Teck conduct additional modelling of mercury and methylmercury concentrations in the downstream environment from the fish habitat compensation lake, including the Athabasca River and Peace-Athabasca Delta. Teck indicated that while they would be willing to collect additional baseline mercury data, it believes the mitigation, monitoring and adaptive management plan included with the draft detailed fisheries offsetting plan would address potential mercury issues in the receiving environment. During the hearing, ECCC confirmed they had not observed increases in mercury concentrations within the Athabasca River.

[2700] In response to concerns related to potential tailings dam failures, Parks Canada recommended development of a spill and emergency response plan with project and site-specific mitigation and

response measures to minimize environment impacts to Wood Buffalo National Park. Teck agreed to the proposed recommendations.

[2701] The strategic environmental assessment completed by Parks Canada found the following with respect to water quality in the Peace-Athabasca Delta:

- Western science based monitoring over 6 years showed a stable trend in Peace-Athabasca Delta water quality. However, indigenous land users reported changes in surface water quality in the rivers and lakes of the Peace-Athabasca Delta over the last 5 to 6 decades, predominantly linked to a lack of springtime flushing combined with effluents from multiple sources (oil sands, pulp and paper, agricultural and municipal effluents)
- Water quality effects in the Peace-Athabasca Delta are difficult to quantify due to changing flow rates and sediment loading, changes in Peace-Athabasca Delta river flows, lack of predevelopment water quality measurements, and difficulties in consistent monitoring (geographically and consistent parameters)
- Community-based monitoring reported a CCME water quality index of “Fair” for all sites monitored in the Peace-Athabasca Delta meaning “Water quality is usually protected but occasionally threatened or impaired; conditions sometimes depart from natural or desirable levels”
- Athabasca River has shown increasing concentrations of several parameters resulting in reduced water quality. These included magnesium, sodium, dissolved aluminum, total selenium, dissolved iron, dissolved arsenic as well as PAHs and PACs, although not necessarily attributable solely to mineable oil sands inputs
- A general lack of monitoring within the Peace-Athabasca Delta and Wood Buffalo National Park and apparent lack of incorporating community-based monitoring in regulatory decision making
- Based on a precautionary approach, a recommendation of implementing water quality improvement plans for each watershed draining into the Peace-Athabasca Delta was made

[2702] Parks Canada summarized trends from other reports (Oil Sands Monitoring Program) which generally found no specific trends in parameters when adjusted for flow, but several parameters which exceeded relevant guidelines. Parks Canada also summarized Mikisew community-based monitoring results for PAHs in the Peace-Athabasca Delta which noted elevated PAHs with a petroleum-derived fingerprint was detected. Mikisew indicated that the derived fingerprint was likely a combination of both natural and anthropogenic input.

[2703] The strategic environmental assessment indicated an overall decreasing trend in water quality in the Athabasca River. Within the Peace-Athabasca Delta, the Parks Canada strategic environmental assessment indicated a decreasing trend in water quality based upon indigenous traditional knowledge, and a consistent “fair” trend over the six years of assessed data.

[2704] Teck, in general, agreed with Parks Canada recommendations for regional monitoring, but stated that this should be part of the Oil Sands Monitoring Program which Teck is required to fund. Parks Canada stated that while Teck would be required to fund the Oil Sands Monitoring Program, Teck would not have oversight on which sites would be monitored.

Ronald Lake and Buckton Creek

[2705] For Ronald Lake, Teck predicted that concentrations of most substances would remain within reference condition ranges. Teck stated that Ronald Lake is not expected to experience acute or chronic toxicity, tainting potential or labile naphthenic acid as process-affected water from the project would not reach it or its tributaries, including Buckton Creek. Concentrations of total dissolved solids, refractory and total naphthenic acids were predicted to remain within the range of concentrations predicted under reference conditions and were not considered further in the environmental assessment.

[2706] As a result of concerns about project development impacts on the Ronald Lake watershed, Athabasca Chipewyan and Mikisew requested further consultation and monitoring prior to developing the north pit. Specifically, the agreed-upon commitments between Teck and Mikisew include a commitment to achieve no greater than negligible effect on water quality within the Ronald Lake watershed and the southern end of Lake Claire. As part of achieving this commitment, Teck has committed to not placing any tailings or process-affected water within the north pit end-pit lake.

[2707] Parks Canada submitted that the project was likely to adversely affect surface water quality in Ronald Lake as Teck predicted increases in water quality parameters as a result of the project but acknowledged that there was high uncertainty about the predicted effects of the project due to limited data collection. Parks Canada recommended that water quality monitoring occur in Ronald Lake, Buckton Creek and Lake Claire at least 5 years prior to development. Parks Canada further recommended that Teck demonstrate water quality in the Ronald Lake watershed meets objectives set by Parks Canada in collaboration with indigenous groups, and demonstrate that development within the watershed would not exceed objectives. Parks Canada confirmed that the proposed objectives have not been set yet and there is currently no structure in place for doing so.

[2708] Parks Canada stated that historical regional monitoring has not included Buckton Creek or Lake Claire, the two monitoring sites Parks Canada recommended.

[2709] Teck stated that it would agree to a recommendation that Teck monitor the Ronald Lake watershed as part of its finalized hydrology and water quality mitigation monitoring, and adaptive management plan and that this include preconstruction baseline monitoring. Teck stated that monitoring at near-field sites for discharges, snowpack monitoring, and regional oil sands monitoring would confirm its conclusions of no effects in Lake Claire and the Peace-Athabasca Delta.

Aerial Emissions

[2710] The project application identifies potential increases in aerial emissions (NO_x, SO_x, metals and PAHs) as a result of project activities. However, Teck concluded that project-related effects would be low in the project area and negligible for Wood Buffalo National Park.

[2711] In its assessment, Teck indicated that air quality monitoring at Fort Chipewyan concluded that current air quality was representative of a rural remote location or regional background location. As project-related effects on water quality from aerial emissions was predicted to be negligible, Teck indicated that there would be no potential to have greater effects at greater distances (i.e., within the Peace-Athabasca Delta and Wood Buffalo National Park).

[2712] Parks Canada and ECCC submitted that water bodies in the Peace-Athabasca Delta and Wood Buffalo National Park were already experiencing acid deposition rates in excess of their buffering capacity causing ecosystem damage and believed that the project would accelerate this effect. In contrast, Teck's assessment found that under existing conditions, only 27 of 285 assessed water bodies have a net potential acid input which exceeds critical loads and would be susceptible to acidification under existing conditions. This number increased to 28 under base case and remained at 28 for the application case.

[2713] Teck stated that aerial deposition of PAHs in the Peace-Athabasca Delta is assumed to be low based on previous studies showing deposition of these substances occurs within 20–30 km of oil sands mines. Teck also noted that the project does not include upgrading or coke storage and handling facilities, significantly reducing potential PAH and metal emissions from the project.

[2714] Parks Canada and ECCC submitted that air deposition of PACs and metals were underestimated by Teck. While they acknowledged there were large uncertainties about the magnitude of the effect, they believed that the effect was potentially significant.

[2715] ECCC recommended implementing a follow-up monitoring program to validate metal and PAH deposition predictions based on the regional oil sands monitoring program monitored parameters. In response, Teck indicated that they would support regional monitoring of emissions and deposition to the surrounding environment, including the Peace-Athabasca Delta and Wood Buffalo National Park, through funding provided to the regional oil sands monitoring program.

Analysis and Findings

[2716] The project will result in water discharges and aerial emissions which will increase concentrations and loadings of some surface water quality parameters within the area immediately surrounding the project. Given predicted increases within the local study area, it is plausible that changes in water quality may be detected further downstream or downwind. However, the panel expects that these effects will be minimal given the low magnitude of changes predicted for the local study area level and the distance between the project and the Peace-Athabasca Delta and Wood Buffalo National Park which

will further reduce contaminant concentrations in air and water before they reach these areas. Notwithstanding that measurable changes to water quality are not expected to occur in the Peace-Athabasca Delta as a result of the project, the panel understands that contaminant loading in the Peace-Athabasca Delta remains a concern and the project could contribute to this loading. The panel also understands that the Peace-Athabasca Delta is a dynamic system with a high degree of inherent variability in water quality making it difficult to detect low-level effects.

Athabasca River

[2717] Teck asserted that water quality concentrations will only diminish as they flow downstream from the source. While correct, this does not consider the potential loading of sediment and associated contaminants within the Peace-Athabasca Delta. Given the association of metals, nutrients and PAHs with sediments is well-documented, downstream loading and deposition of contaminants may still be a concern, even if minimal changes to water quality are predicted. An important mitigation measure for sediments during operations is the use of polishing ponds. In the closure landscape wetlands and end-pit lakes will reduce sediment concentrations in receiving water bodies such as the Athabasca River and the Ronald Lake watershed. The panel accepts that these measures will significantly reduce sediment transport and contaminant loading from the project to the Athabasca River and the Peace-Athabasca Delta.

[2718] However, even with these mitigation measures in place, the project will contribute to cumulative loading of water quality constituents. Far downstream locations like Lake Athabasca and Lake Claire represent a potential repository for these constituents which may build up over time. Current monitoring and research such as that conducted by the Oil Sands Monitoring Program, ECCC, independent university researchers and community-based monitoring have not identified any consistent trends in water or sediment quality within the Peace-Athabasca Delta that are attributable to loadings from the oil sands mining industry. The panel recognizes however that the Peace-Athabasca Delta is a highly dynamic system and therefore subtle effects would likely be missed.

[2719] The panel agrees that project effects on water quality in the Peace-Athabasca Delta and Wood Buffalo National Park from the Athabasca River are likely to be negligible. However, the potential for effects of increased loadings in combination with other mine operators in the region was not well addressed in the application and research gaps remain. While water quality changes were determined to be negligible, Teck will be increasing loads to the Athabasca River, and in combination with other mine discharges, this would represent a net increase in constituents of concern in downstream environments.

[2720] Mitigation measures implemented for the project, along with required monitoring of project effects by Teck should serve as an early warning indicator for potential downstream adverse effects. Additional regional monitoring and research is required as the Peace-Athabasca Delta and Wood Buffalo National Park have been less studied relative to the inflowing Athabasca River but are of high importance

to the region. To better understand the regional contributions the proposed project may be having on water quality in the Peace-Athabasca Delta and Wood Buffalo National Park, Teck will be required to fund regional water quality monitoring programs. It is expected that results of the regional monitoring will be considered when further developing and refining the monitoring, mitigation and adaptive management plans.

[2721] The panel has recommended that Teck explore opportunities to incorporate monitoring being conducted under the community-based monitoring program which has relevance to local project-related effects. This monitoring represents useful data collected from the Peace-Athabasca Delta and upstream Athabasca River which has not been incorporated into assessment of results from other oil sands monitoring programs to date.

[2722] The Parks Canada recommendation that the project be subject to water quality objectives established for Buckton Creek and Lake Claire by Parks Canada cannot be supported at this time given that objectives have not been developed and no structure for doing so currently exists. It is anticipated that any water quality objectives would consider the influence of other oil sands mines, industrial activities, municipalities and other development within the region influencing water quality in the Peace-Athabasca Delta and Wood Buffalo National Park.

Buckton Creek Watershed and Lake Claire

[2723] Given the mitigation measures proposed by Teck, its commitments to Mikisew and Athabasca Chipewyan regarding protection of the Buckton Creek watershed and Ronald Lake, and the panel's conditions related to development of the north pit, the panel finds that the project is not likely to have an adverse effect on water quality in the Buckton Creek watershed, Ronald Lake or Lake Claire.

[2724] The panel recognizes that Teck has no oversight role with respect to regional monitoring decisions, including monitoring locations selected by the regional oil sands monitoring program. Therefore, the panel has included conditions that require Teck to monitor for potential project effects at Ronald Lake and Buckton Creek to confirm its prediction of negligible effects. The panel has also included a recommendation to Alberta and Canada that monitoring of Lake Claire be incorporated into the Oil Sands Monitoring Program to address the desire for additional monitoring data.

[2725] While Teck views monitoring in the Peace-Athabasca Delta and Wood Buffalo National Park as the responsibility of the provincial and federal governments, it does have a responsibility to monitor for downstream effects should local monitoring identify potential impacts. Monitoring conducted at near-site locations should be used to develop a tiered monitoring system where additional monitoring by Teck at sites such as Lake Claire is undertaken should observations at near-field sites exceed established triggers as a result of project activities. This principle should be incorporated in monitoring, mitigation and adaptive management plans.

Aerial Emissions

[2726] Teck's assessment of potential aerial deposition effects to the Peace-Athabasca Delta and Wood Buffalo National Park relied upon its assessment of project effects, which it found to be negligible.

[2727] The panel agrees with Teck that the predicted effects of acidifying emissions from the project are expected to be negligible. This is based on Teck's modelling which shows no increase in the number of lakes affected by acidification between the base case and the application case. The panel recognizes that ECCC used a different model and came up with different results. However, ECCC's model results do not appear to match observations of water quality trends. Further, ECCC acknowledged that the alternative methods and models used may require further evaluation and verification. The panel concludes that there is a need to continue regional monitoring of acidification effects to validate predictions from the different models and inform future modelling choices.

[2728] In section 18, "[Surface Water Quality](#)," the panel found that with implementation of Teck's proposed mitigation and monitoring measures, the project was not likely to result in adverse effects to surface water quality due to aerial deposition of metals or PAHs. While the panel generally agrees with Teck's findings, the panel acknowledges that there is a great deal of uncertainty with regards to modelling of snowmelt contributions of metals and PAHs from project activities.

[2729] Additional monitoring at a local scale is required to confirm Teck's conclusions of negligible effects of aerial emissions on surface water quality and this has been included as a condition of approval. If Teck's monitoring indicates adverse effects from aerial emissions, additional monitoring extending further would be required in addition to implementation of mitigation measures to address exceedances.

[2730] The panel has included a recommendation to Alberta and Canada that regional monitoring of PAHs and metals in soils, sediments and surface waters, including deposition to surrounding regions such as Wood Buffalo National Park and the Peace-Athabasca Delta, be conducted as part of the regional oil sands monitoring program. As a condition of approval, Teck is required to support regional monitoring programs such as the Oil Sands Monitoring Program.

[2731] The panel's full analysis and findings, conditions and recommendations related to potential project effects to surface water quality are found in section 18, "[Surface Water Quality](#)."

Significance of Project Effects

[2732] The panel's findings related to the significance of project effects to water quality are found in section 18, "[Surface Water Quality](#)."

[2733] The panel found that while project effects to surface water quality are likely to occur within the local study area, the effects would be of low magnitude as in most cases the increase is expected to be

within 10% of reference conditions and concentrations in receiving water bodies are expected to remain below the regulatory guidelines or chronic-effects benchmarks.

[2734] Exceedances of water quality criteria are expected to be limited to water bodies in the local study area. Potential direct loadings to the Athabasca River and to the Peace-Athabasca Delta via the Athabasca River or Buckton Creek and Ronald Lake are expected to be limited based on required mitigation measures applied at the project site. The panel recognized that ongoing loading of contaminants of concern at levels below guidelines, but above background, could accumulate within the Peace-Athabasca Delta. However given the distance to the Peace-Athabasca Delta, and significant dilution volumes, it is not expected that these loadings will contribute significantly to water quality effects in the Peace-Athabasca Delta.

[2735] The panel concluded that project effects to surface water quality in the surface water quality local study area are adverse, but not likely to be significant due to the low magnitude, local extent and reversibility of the predicted effects.

[2736] Based on the low magnitude and local extent of predicted effects, the panel concludes that project effects to water quality in the Peace-Athabasca Delta and Wood Buffalo National Park will be negligible.

Potential Project Effects on Peace-Athabasca Delta Water Quantity

[2737] Project effects to surface water quantity and flows and Teck's proposed mitigation measures are discussed in section 19, "[Surface Water Quantity](#)."

Evidence

The Athabasca River

[2738] The project will affect surface water hydrology in the project development area through the removal and diversion of existing watercourses, use of surface water during operations and the creation of new watercourses and water bodies such as end-pit lakes in the closure landscape. Teck will require a water licence to allow it to capture and use surface runoff that would have flowed downstream of the project to the Athabasca River but cannot be released because Government of Alberta policies do not currently permit the release of water that has potentially come into contact with bitumen.

[2739] Most of Teck's assessments of downstream impacts to the Athabasca River assumed a constant project withdrawal rate of 4.2 m³/s which is the pumping capacity of Teck's proposed Athabasca River intake and is equivalent to 132 million m³/year. Teck has applied for a *Water Act* licence to withdraw water from the Athabasca River: 98 million m³/year for the early phase of project development (2025–2036) and 60 million m³/year for the remainder of the operational phase (2037–2066) and for the end-pit lake filling (closure) phase (2066–2080). In most years during operations, but before end-pit lake filling, withdrawals are expected to be in the range of 10 to 40 million m³/year under average conditions, with

average annual diversion during mining operations of 21.3 million m³/year, or an average diversion rate of 0.68 m³/s. During the expected 15 year end-pit lake filling stage, Teck expects to withdraw at a sustained annual rate of 60 million m³/year, or an average rate of 1.9 m³/s.

[2740] Teck predicts that a sustained withdrawal of 4.2 m³/s from their Athabasca River intake would result in a 1.4 cm decrease in average water level in Lake Athabasca. This is based on their analysis of the relationship between historical inflows to Lake Athabasca and changes in Lake Athabasca water levels. These estimates were derived from observed daily changes in Lake Athabasca water levels in response to changes in total lake inflow and did not include the effect of lake outflows. Teck concluded that this was equivalent to assuming no lake outflow, which would result in high estimated changes in lake level due to withdrawals.

[2741] Athabasca Chipewyan and Mikisew both identified late summer and fall as a key time for navigational use of the Athabasca River, the Athabasca Delta, the broader Peace-Athabasca Delta, and tributaries of the lower Athabasca River.

[2742] Athabasca Chipewyan and Mikisew identified a safe navigation depth for a fully loaded, outboard motor boat, including start-up, as 1.2 m. This depth was initially associated in 2010 with an approximate flow rate in the Athabasca River of 400 m³/s, which was defined as the aboriginal extreme flow.

[2743] In the Athabasca River mainstem between Fort McMurray and the Athabasca Delta, Mikisew identified navigation hazards and lost access to side and back channels that become progressively more prominent as flows in the Athabasca River decline below 600 m³/s.

[2744] The Athabasca Chipewyan and Mikisew community-based monitoring program has been measuring water levels in the Athabasca River delta and have developed relationships between river flow at Fort McMurray and water depth. Community-based monitoring data shows that, although there is significant variation in water flow depth at given locations for the same river flow rates, depths at key tributary and distributary points in the delta are often less than 120 cm when flow at Fort McMurray is less than 500 m³/s and is usually more than 120 cm when flow is above 700 m³/s. Based on this data, Athabasca Chipewyan and Mikisew revised the aboriginal extreme flow from 400 m³/s to 500 m³/s.

[2745] Community-based monitoring data derived estimates of water level changes at key navigation points in the Athabasca River and its delta due to a sustained 4.2 m³/s withdrawal range from 0.6 (Jackfish Creek) to 2.5 cm (Richardson River). The average change in depth across the navigation points is 1.1 cm for a maximum project withdrawal of 4.2 m³/s.

[2746] Teck assessed the effect of maximum project withdrawals on water depth at the navigation pinch points identified in the Surface Water Quantity Management Framework under *LARP*. Under historical flow conditions, the project and Surface Water Quantity Management Framework impacts ranged from 0.3 to 1.0 cm. The average change in flow depth was 0.6 cm.

Analysis and Findings

[2747] The panel notes that Teck's analysis did not take into account that a decrease in the level of Lake Athabasca would also reduce outflow, which means that the actual change in water level due to upstream withdrawals is less than their estimate. Teck's analysis also assumed a constant withdrawal of 4.2 m³/s, which is the maximum instantaneous withdrawal rate of their intake and is equivalent to 132 million m³/year. Based on their projected year-to-year water demand, their maximum demand in any year will never exceed 98 million m³ from the Athabasca River, and average annual diversions during the mining operational phases of the project are 21.3 million m³/year. The panel therefore concludes that Teck's estimates of changes to water levels and flows in the Athabasca River, Lake Athabasca, and the Peace-Athabasca Delta are very conservative as they are at the upper limit of the short-term potential impact on downstream water levels. On average, the panel expects that water level changes during the operational mining phases of the project will be approximately 1/6 of the impacts predicted in their assessments because 21.3 million m³ is approximately 1/6 of 132 million m³.

[2748] The panel notes that the Athabasca Chipewyan and Mikisew community-based monitoring program water depth data shows a relatively clear relationship of a 2 mm drop in flow depth per 1 m³/s drop in flow rate, although there is considerable uncertainty in interpreting the change in flow depth at low flows due to the significant scatter in the community-based monitoring program data. Broadly, these results are consistent with Teck's assessment that the effect of a sustained withdrawal of 4.2 m³/s is a decrease in flow depth of approximately 1 cm across a wide range of flows, both in the lower Athabasca River and its delta.

[2749] The joint agreements between Teck and Athabasca Chipewyan and Mikisew call for Teck to minimize withdrawals when flows drop below 500 m³/s. The panel recognizes that it is not possible to write an enforceable approval condition requiring Teck to minimize withdrawals during low flows without a precise definition of "minimize." The panel has included a condition that requires Teck to develop a minimization strategy as part of their water management plan for the project. The condition requires that the plan discuss minimization strategies, including maximizing use of fresh water storage capacity, avoiding filling of fresh water storage during low flows, maximizing diversions to fill storage during higher flows, and avoiding non-essential water use during periods of low flow.

[2750] The panel has also included a condition requiring Teck to include a strategy for maintaining at least 90 days of fresh water storage, not including diversions for the purpose of end-pit lake filling.

[2751] Overall the panel finds that Teck's assessment is conservative and over predicts effects to flow and water levels in the Athabasca River and Peace-Athabasca Delta. With mitigation measures proposed by Teck and the panel's conditions, project effects on water levels in Lake Athabasca and the Peace-Athabasca Delta are expected to be negligible.

[2752] The panel's full analysis and findings, conditions and recommendations related to potential project effects to surface water levels and flows in the Athabasca River are found in section 19, "[Surface Water Quantity](#)."

Ronald Lake and Buckton Creek

Evidence

[2753] Teck proposes to collect upstream water from unnamed tributaries near the north pit into a single diversion channel that will run through the northern tip of the project footprint (south of north pit and north of central pit). Some of these tributaries naturally contribute to Unnamed Stream 17, which is a tributary to Ronald Lake in the Buckton Creek and Lake Claire watersheds, and some would flow to Redclay Creek, which is a direct tributary of the Athabasca River. Teck proposes to construct a flow splitter to partition this flow to Unnamed Stream 17 and Redclay Creek. The north flow splitter will be designed to convey sufficient flow to account for the north watershed area that will be closed-circuited. The north mine pit, the associated overburden dumps and water diversion channels, and the flow splitter are the only project activities in the Lake Claire, Buckton Creek, and Ronald Lake watersheds.

[2754] Because of limited baseline flow monitoring available at this time, Athabasca Chipewyan and Mikisew are concerned that the splitter may not partition flow appropriately. Athabasca Chipewyan and Mikisew are also concerned about long-term operations, maintenance and functionality of the splitter. Athabasca Chipewyan and Mikisew want to be involved and consulted in the final design process.

[2755] After final closure, the presence of an end-pit lake at the north mine pit will reduce peak flows in the Ronald Lake watershed. Teck estimated that 1:10 year and 1:100 year peak outflows from Ronald Lake will be reduced from predevelopment levels of 9.4 m³/s and 20.7 m³/s, respectively to 7.0 m³/s and 13.5 m³/s, respectively. The presence of the end-pit lake is expected to increase winter flows by 40% and decrease open-water flows by 4%, while annual average flows remain largely unchanged from the predevelopment state (-0.2%). At all states of project development and at closure, 10th percentile, median, and 90th percentile water levels in Ronald Lake are expected to be essentially unchanged from the predevelopment condition (within 1 cm).

[2756] Parks Canada recommended that five years prior to development of the watershed draining into Ronald Lake, Teck should be required to submit for approval an analysis that demonstrates that Lake Claire water levels meet regime objectives determined by Parks Canada in collaboration with indigenous groups and others and development of the watershed draining into Ronald Lake will not result in project impacts to flow in Buckton Creek of more than 5% of natural flows in perpetuity.

[2757] Parks Canada also recommended that Teck be required to monitor flows in Buckton Creek for 15 years prior to development in the watershed draining into Ronald Lake. It also stated the Frontier project would change water flows to Ronald Lake, which drains into the Peace-Athabasca Delta via

Buckton Creek and Lake Claire. Small changes in water levels (centimetres) remained a concern for Parks Canada Agency because they can have an effect on ecology and navigation in Wood Buffalo National Park. The three largest lakes in the Peace-Athabasca Delta (Lakes Claire, Mamawi and Baril) are generally shallow (1 to 3 metres deep) and have a topographic relief that rarely exceeds 1 to 2 metres above the lakes. As a result of these attributes, Parks Canada Agency stated that effects of low water levels on the extent of wetted areas and wetland connectivity is magnified over the large flat expanse of the Peace-Athabasca Delta. Parks Canada Agency relied on the research of Carver (2016) that asserts the assumption that “small amounts of change are negligible” is invalid because in a “stressed state,” small incremental changes are of greater concern.

[2758] Mikisew land users and elders determined that the protection of the watersheds that flow into Lake Claire, including the Buckton watershed, is an urgent priority. They stated that the health of the Buckton watershed is necessary for the integrity of the Peace-Athabasca Delta and their cultural and spiritual relationship to it. They raised concerns about the consequences of changes in water volumes in the Peace-Athabasca Delta on migratory waterfowl, muskrats and other wildlife. Their use and access of the Buckton Creek and downstream Lake Mamawi and Lake Claire has already been constrained because of lower water due to existing industrial development. Any future reductions of water into Buckton Creek has the potential to diminish the productivity of sloughs that support access to locations for hunting and trapping areas (like Frog Creek), muskrat trapping, moose hunting and bird hunting.

[2759] The mine pits will intercept groundwater-bearing strata, resulting in dewatering of the overburden as gravity drainage of the shallow groundwater into the pit occurs. This cannot be avoided during the mining process. Teck predicts that the extent of drawdown in the Quaternary sediments will be limited.

[2760] Teck confirmed that the Ronald Lake watershed is located within the northernmost extent of the groundwater local study area and that the area of the groundwater model covered the Ronald Lake watershed. Teck confirmed that during operations on the northern boundary of the project and in the direction of the sensitive watersheds of Ronald Lake and Lake Claire, the predicted extent of the drawdown within the surficial aquifers would not be more than 4 to 5 km from the project development area.

Analysis and Findings

[2761] Because the diverted water represents a relatively small fraction of the total drainage area of Ronald Lake and Redclay Creek, it should be sufficient to design the splitter based on available baseline flow data, additional data collected between now and when the splitter will be built, and the known relative contributing areas. The panel expects that the splitter will function passively and maintenance should be mostly limited to regular checks to ensure the splitter is functioning as designed.

[2762] Downstream impacts to surface water levels and flow volumes should be negligible as long as the splitter is designed to account for the closed-circuited mine area within the Ronald Lake watershed and

the splitter is properly maintained. Impact monitoring should focus on Ronald Lake because that lake would be the best indicator of change. As part of its water management plan, Teck will be required to develop a Ronald Lake monitoring plan prior to the development of the north mine pit.

[2763] The panel notes that at closure Teck's estimates of changes to peak Ronald Lake outflows are not consistent with the closure drainage area of the north mine end-pit lake. The 25.4 km² contributing area of the north mine lake is less than 8% of the 335 km² Ronald Lake watershed, while Teck predicts changes in peak Ronald Lake outflows of 25% to 35% which it attributes to attenuation from the north mine lake.

[2764] The panel is including a condition requiring Teck to re-evaluate its closure plan prior to development of the north mine pit to demonstrate to the AER that changes to Buckton Creek peak, average, and low flows are within 5% of natural conditions. The panel believes that meeting this condition would be sufficient to demonstrate negligible project impacts on Ronald Lake, Buckton Creek, and Lake Claire.

[2765] Due to the localized extent of groundwater drawdown effects, the panel finds that drawdown of the water table in the surficial deposits in the vicinity of the project is not likely to have a significant effect on groundwater or surface water levels in Lake Claire, Ronald Lake or the Buckton Creek watershed. However the panel agrees that the extent of drawdown in Quaternary sediments should be verified during the life of the project through monitoring and regular integration and analysis of the collected monitoring data. The panel is requiring that, as part of the groundwater monitoring plan required under the project's *EPEA* approval, Teck include water level monitoring in groundwater wells installed at locations that increase confidence in the predictions that the Lake Claire watershed, including the Buckton Creek watershed and Ronald Lake areas are located outside of the maximum extent of the project's impact on the groundwater levels in the Quaternary aquifer.

[2766] The panel's full analysis and findings, conditions and recommendations related to potential project effects to surface water flows and water levels in the Buckton Creek watershed, Ronald Lake and Lake Claire are found in section 17, "[Groundwater](#)," and section 19, "[Surface Water Quantity](#)."

Significance of Project Effects

[2767] The panel's findings related to the significance of project effects to water quantity and flows are found in section 19, "[Surface Water Quantity](#)."

[2768] The panel found that while project effects to surface water quantity are likely, the magnitude of effects would be low as in the predicted reduction in flow is a very small percentage of total flows in the Athabasca River and water levels changes to the Athabasca River and Lake Athabasca are less than 1 cm. Changes in flows and water levels in the Buckton Creek watershed, Ronald Lake and Lake Claire are expected to be negligible.

[2769] The panel concluded that project effects to surface water flow and quantity in the local study area are adverse, but not likely to be significant due to the low magnitude and reversibility of the predicted effects.

[2770] Based on the low magnitude of effects expected to occur in the local study area, the panel concluded that project effects to water quantity and water levels in the Peace-Athabasca Delta and Wood Buffalo National Park will be negligible.

Cumulative Effects

[2771] Although the project is expected to have a negligible effect on water levels in the Peace-Athabasca Delta, due to the significant concerns expressed by participants in the review process about current effects occurring within the Peace-Athabasca Delta, the panel included a discussion of cumulative effects for the Athabasca River, Peace-Athabasca Delta and Slave River and Slave River Delta in section 19, "[Surface Water Quantity](#)." The panel concluded that while adverse and significant effects are occurring in the Peace-Athabasca and Slave River Deltas as a result of changes to water quantities and flows, these effects are due predominantly to hydropower regulation and regional climate change. Industrial water withdrawals by the oil sands industry only play a minor role and the project is not expected to significantly add to existing impacts.

[2772] Based on its findings, the panel is including a recommendation that Parks Canada and ECCC work with First Nations and other indigenous groups; the governments of Alberta, British Columbia, Northwest Territories, and Saskatchewan; and industry and other interested parties to implement the Wood Buffalo National Park World Heritage Site Action Plan to address the cumulative impact of hydropower development, climate change, and water withdrawals on the Peace-Athabasca Delta.

[2773] The panel is also including a recommendation that Canada work with First Nations and other indigenous groups, provincial and territorial governments, and industry and other interested parties to develop and implement an action plan to address the cumulative impact of hydropower development, climate change, and water withdrawals on the Slave River Delta.

Project Effects on Air and Water Quality and Its Potential Impact on Wildlife and Human Health Within the Peace-Athabasca Delta

Changes in Air Quality

[2774] Project effects to air quality and Teck's proposed mitigation measures are discussed in section 14, "[Air Quality](#)."

Evidence

[2775] Teck evaluated the potential effects of the Frontier project on the Peace-Athabasca Delta and Wood Buffalo National Park. The local air quality study area used for the air quality assessment consists of a 110 km by 110 km area centred on the project and includes the southern boundary of Wood Buffalo National Park. The air quality regional study area is an area approximately 330 km by 240 km and includes the Peace-Athabasca Delta and a portion of Wood Buffalo National Park.

[2776] Teck used a location near Fort Chipewyan to collect ambient air quality data to represent potential air quality changes for the Peace-Athabasca Delta. Teck stated that air quality in the Peace-Athabasca Delta can be viewed as being representative of a rural remote location, or a regional background location. Teck predicted slight changes in air quality for the Peace-Athabasca Delta because of the project and future oil sands developments but said that air quality is expected to still be regarded as background and it will have negligible effect on water and sediment quality.

[2777] Teck's assessment also predicts that the Frontier project will only make a small contribution to aerial deposition of contaminants.

[2778] Teck stated that potential acid input predictions for the Peace-Athabasca Delta and Wood Buffalo National Park are less than the most stringent monitoring load for sensitive receptors (less than $0.17 \text{ keq H}^+ \text{ ha}^{-1} \text{ a}^{-1}$). Potential acid input in the Peace-Athabasca Delta was predicted to be 0.004 to $0.020 \text{ keq H}^+ \text{ ha}^{-1} \text{ a}^{-1}$ for the base case, 0.004 to $0.021 \text{ keq H}^+ \text{ ha}^{-1} \text{ a}^{-1}$ for the application case, and 0.007 to $0.026 \text{ keq H}^+ \text{ ha}^{-1} \text{ a}^{-1}$ for the planned development case.

[2779] Teck stated that nitrogen deposition values are predicted to be less than the lower (5 kg N/ha/a) and upper (10 kg N/ha/a) critical load limits for boreal forests. Nitrogen deposition in the Peace-Athabasca Delta was predicted to be 1.2 to 2.4 kg N/ha/a for the base case, 1.3 to 2.4 kg N/ha/a for the application case, and 1.4 to 2.4 kg N/ha/a for the planned development case.

[2780] Teck stated that although cumulative ambient air quality changes from oil sands emissions might be measureable in the Peace-Athabasca Delta and Wood Buffalo National Park area for some air quality parameters, the levels are much lower than ambient air quality criteria; therefore, adverse effects due to the Frontier project are not anticipated.

[2781] Teck stated that polycyclic aromatic compounds and metal deposition decreases with increasing distance from oil sands developments and air quality modelling indicates deposition in the Peace-Athabasca Delta is equivalent to background levels. Teck referenced a study that indicates no measurable evidence of related far-field airborne metal contamination in the Peace-Athabasca Delta located approximately 200 km to the north of existing major oil sands projects, where measureable deposition was influenced by early North American industrial activity. Another study was referenced which concludes that the Peace-Athabasca Delta can be considered representative of background polycyclic aromatic compound deposition from the oil sands region, based on the collection and analysis of snow

samples. Teck stated that these studies support the conclusion that no adverse effects due to the oil sands air emissions are currently occurring or anticipated in the Wood Buffalo National Park and Peace-Athabasca Delta.

[2782] The strategic environmental assessment submitted by Parks Canada identified a number of peer-reviewed studies that demonstrate that numerous toxic metals and polycyclic aromatic compounds are currently deposited within 50–75 km of major oil sands developments. These contaminants originate from bitumen upgrading and fugitive dust (from open pit mines, tailings ponds, and haul roads). These studies imply that new oil sands developments will generate metals and polycyclic aromatic compounds emissions that will also be deposited on the landscape within 50–75 km of these new developments.

[2783] The strategic environmental assessment noted that other studies have reported no evidence that oil sands emissions have resulted in trace element deposition beyond 50 km and that mercury deposition appears to reflect global atmospheric mercury emissions. Other authors point out that there is no measurable evidence of related far-field airborne metal contamination in the Peace-Athabasca Delta, which is located approximately 200 km north of industry.

[2784] The strategic environmental assessment states that air quality studies indicate oil sands developments have the potential to cause critical load exceedances. As discussed in section 18, “[Surface Water Quality](#),” and in the above discussion on surface water quality effects, ECCC used a model to predict ecosystem effects in northern Alberta and Saskatchewan, which included parts of the Wood Buffalo National Park. The model predictions indicate that sulphur and nitrogen compounds can be carried far downwind from the sources, be chemically transformed and deposited, and have the potential to cause ecosystem damage. The model predictions showed critical load exceedances for terrestrial and aquatic ecosystems within Wood Buffalo National Park.

[2785] The strategic environmental assessment discussed a recent report that indicated aerial deposition of fugitive dust particles and aerosols from oil sands mines, coke piles, and stacks can result in snowmelt that is toxic to larval fish, but the dilution of contaminants in snow as it melts in the spring and mixes with river water is currently sufficient to confer a protective effect for larval fish in local rivers.

Analysis and Findings

[2786] Given the proximity of the Frontier project to Wood Buffalo National Park and the Peace-Athabasca Delta, the panel accepts that the Frontier project may result in an increase in some air quality parameters in the Peace-Athabasca Delta and Wood Buffalo National Park, such as NO₂. However, based on the modelling completed by Teck, the panel expects any changes would be negligible to low in magnitude and that air quality within Wood Buffalo National Park will remain at near background levels. The panel finds that the mitigation measures proposed by Teck, along with the panel’s conditions will minimize the impacts to air quality in the Peace-Athabasca Delta and Wood Buffalo National Park.

[2787] The panel also finds that the project's contribution to aerial deposition of contaminants within the Peace-Athabasca Delta and Wood Buffalo National Park are likely to be negligible. The panel acknowledges that the project will be located closer to the Peace-Athabasca Delta and Wood Buffalo National Park than other oil sands mining operations, however the project does not include an upgrader or coke handling operations which can be large sources of metal and polycyclic aromatic compound emissions. The panel recognizes that dust and other fugitive emissions can also be a large source of metal and polycyclic aromatic compounds, however Teck's proposed mitigation measures and the panel's conditions related to the control of dust and fugitive emissions will ensure these sources of emissions are appropriately managed.

[2788] With respect to cumulative effects, the panel acknowledges that some studies indicate that aerial deposition of metals and polycyclic aromatic compounds is occurring in the Peace-Athabasca Delta. However, the panel finds the evidence to be contradictory and inconclusive. The strategic environmental assessment conducted for Wood Buffalo National Park by Parks Canada did not identify any clear trends with respect to the effects of aerial deposition within the Peace-Athabasca Delta or Wood Buffalo National Park. While some studies report that deposition is occurring, other studies do not. For those studies that do indicate deposition is occurring, the amount of deposition observed is well below any thresholds at which significant adverse effects would be expected. In some cases the source of the deposition is uncertain. The panel concludes that continued regional monitoring and further studies are required to address these uncertainties and determine whether aerial deposition of metals and polycyclic aromatic compounds is occurring in the Peace-Athabasca Delta as a result of emissions from oil sands operations and whether the levels of deposition is a concern. The panel has included recommendations to Alberta and Canada that such monitoring occur as part of regional monitoring programs to ensure any regional effects are identified as early as possible.

[2789] The panel agrees with the results of Teck's assessment that the predicted effects of acidifying emissions from the project are likely to be negligible. As discussed earlier, this is based on Teck's modelling which shows no increase in the number of lakes affected by acidification between the base case and the application case. The panel recognizes that ECCC used a different model and came up with different results. However, ECCC's model results do not appear to match observations of water quality trends. Further, ECCC acknowledged that the alternative methods and models used may require further evaluation and verification. The panel concludes that there is a need to continue regional monitoring of acidification effects to validate predictions from the different models and inform future modelling choices. The panel has included conditions that require Teck to support regional monitoring programs, including those related to acid deposition.

[2790] To ensure project effects to air quality are effectively mitigated and deposition of contaminants is minimized, the panel has included conditions requiring Teck to finalize and submit to the AER its air quality mitigation, monitoring, and adaptive management plan and that the plan incorporate the

management of all Frontier project emissions. The panel has also included a condition that Teck develop and implement a dust management plan, which clearly identifies potential sources of PM_{2.5}, total suspended particulates, polycyclic aromatic compounds and metal emissions and mitigation measures. The plan is required to include adaptive management measures in the event that soil and water COPCs exceed predicted levels.

[2791] The panel's full analysis and findings, conditions and recommendations related to potential project effects to air quality are found in section [14](#), "[Air Quality](#)."

Significance of Project Effects

[2792] The panel's significance determination for project effects to air quality is found in section [14](#), "[Air Quality](#)."

[2793] The panel found that project effects to air quality are likely as the project is expected to result in some changes to air quality in the region. The predicted effects are of low to moderate magnitude depending upon the air contaminants being considered. Similarly, the geographic extent may be local or regional depending upon the contaminant.

[2794] The panel found that project emissions for nitrogen oxides, hydrocarbons and reduced sulphur compounds would be moderate in magnitude and regional in extent. Project emissions of total suspended particulates, polycyclic aromatic compounds and metals would be moderate in magnitude but local in extent.

[2795] The panel found that project emissions for sulphur oxides, acid deposition and fine particulate and secondary organic aerosols would be low in magnitude and regional in extent.

[2796] Air quality parameters are generally expected to remain within Alberta's Ambient Air Quality Objectives. While some exceedances of Alberta's Ambient Air Quality Objectives have been recorded in the last five years, emissions from the Frontier project are not expected to result in incremental exceedances of Alberta's Ambient Air Quality Objectives or the *AQMF* level 4 triggers in the local study area, regional study area or Wood Buffalo National Park.

[2797] Based on the above the panel concluded that the project is not likely to result in significant adverse effects to air quality in the region. Furthermore, the project, in combination with other existing and approved projects is not expected to result in significant adverse effects to air quality in the region.

[2798] As air contaminant levels within Wood Buffalo National Park are predicted to be much lower than Alberta's Ambient Air Quality Objectives and remain near background levels the panel concludes that the project is not likely to result in significant adverse effects to air quality in the Peace-Athabasca Delta or Wood Buffalo National Park. Similarly, as acid deposition and deposition of polycyclic aromatic compounds and metals are not expected to change appreciably within Wood Buffalo National Park as a

result of the Frontier project, the project is not likely to result in significant adverse effects to surface water quality or terrestrial ecosystems within the Peace-Athabasca Delta or Wood Buffalo National Park.

Changes in Water Quality

[2799] Project effects to water quality in the Peace-Athabasca Delta are discussed above. The panel concluded that project effects to water quality in the local study area would be low and project effects to water quality in the Peace-Athabasca Delta and Wood Buffalo National Park would be negligible.

Effects to Wildlife Health

[2800] Project effects to wildlife health and Teck's wildlife health risk assessment are discussed in section 24, "[Wildlife Health](#)."

Evidence

[2801] Teck conducted a wildlife health risk assessment to assess the nature and extent of potential adverse population-level effects to wildlife that might be associated with chemical emissions to air and releases to water from the project. Teck engaged with indigenous communities in the design of the assessment. The assessment considered releases to air and the aquatic environment and considered all project phases.

[2802] Both the human health risk assessment and the wildlife health risk assessment primarily focused on potential health risks within the air quality local study area, which is an area of approximately 110 km × 110 km centred on the project. The local study area will be most affected by the project, and is located within the larger air quality regional study area (330 km × 240 km). The northernmost reach of the local study area includes the southern boundary of Wood Buffalo National Park and water bodies that empty into the park and the Peace-Athabasca Delta. Teck submitted that if the findings of the human health risk assessment and wildlife health risk assessment indicated that the risks related to the project were low, then the risks to human health and wildlife in the park and Peace-Athabasca Delta would be low as well. This is because the human health risk assessment and wildlife health risk assessment focused on the potential risks to human health and wildlife in an area wherein the risks are anticipated to be greatest (i.e., within the air quality local study area and aquatics local study area).

[2803] Teck's assessment examined short-term (acute) and long-term (chronic) health risks to wildlife populations that may be attributable to the project, combined with existing, approved, and planned developments in the area. It evaluated the potential risks to wildlife health associated with COPCs emitted from the project to air and water. To assess the potential risks to wildlife health, Teck compared predicted chemical exposures to toxicological reference values intended to be protective of the health of wildlife populations.

[2804] Teck assumed wildlife species that frequent the area, both resident and migratory populations, could potentially be exposed to the chemicals emitted to air and released to water from the project. Teck identified twenty-two indicator species as receptors of potential concern. Teck used surrogates for indicator species, for example, Whooping Crane was used as a receptor surrogate for omnivorous waterfowl in the aquatic environment and woodland caribou used as a receptor surrogate in the terrestrial environment for Ronald Lake bison, woodland caribou and large herbivorous mammals.

[2805] Teck found that predicted acute hazard quotients for air inhalation of COPCs do not exceed 1 under the existing condition or for any of the three assessment cases for any of the receptors of potential concern, indicating that short-term air concentrations are not anticipated to have an adverse impact on either mammalian or avian wildlife in the region.

[2806] Teck's estimates of chronic inhalation risk estimates, were based on exposure periods that last from a few months to a few years, to possibly a lifetime. With the lone exception of NO₂ for the mammalian receptor of potential concern, Teck found that chronic hazard quotient values do not exceed 1 under the existing condition or any of the assessment cases for mammalian and avian receptors of potential concern.

[2807] Teck noted that hazard quotients above 1 were predicted for NO₂ on a chronic basis under all assessment cases. In some instances hazard quotients in the range of 5 were predicted for the application case, and the planned development case. However, Teck noted that the project does not contribute substantially to an increase of NO₂. Teck also noted that interpretation of the chronic risks for NO₂ must consider not only the assessment uncertainties, but also the conservatism incorporated into the exposure estimate (i.e., predicted annual average air concentration of NO₂) as well as the toxicological reference value.

[2808] Teck stated that the predicted chronic multiple pathway hazard quotient values were below 1 for most of the COPCs, with the following exceptions for the avian receptors of potential concern: manganese, methylmercury, selenium, and thallium, which were above conservative risk-based levels but, for those instances where there was an increase above the existing condition or the base case, the increase was very small.

[2809] The predicted chronic multiple pathway hazard quotient values for mammalian receptors of potential concern were below 1 for most of the COPCs, with the following exceptions: antimony, cadmium, manganese, methylmercury, selenium, thallium, and zinc. Teck noted that the lack of regional monitoring data for metals in aquatic plants was a primary source of uncertainty in this regard and committed to a monitoring program to reduce these uncertainties. The predicted hazard quotient values for the base case and application case were similar for most of the COPCs, suggesting that the contributions of the project with respect to predicted changes in air and water quality (and subsequently other environmental media) in the local study area will have a low impact on wildlife health.

[2810] Teck noted that naphthenic acids are known to be naturally present in the area because they are present in petroleum sources such as oil sands; but they are also concentrated in tailings ponds as a result of the extraction process and thus are of concern as pollutants. Teck committed to maintaining water quality in the area with respect to naphthenic acids contamination by capturing runoff, using mitigation measures for seepage, and using collection wells. Based on their assessment, Teck concluded that the project would not result in increased risk from naphthenic acids, although there is currently no oral toxicological reference value available to quantify the risk in the multiple pathway analysis for the wildlife health risk assessment.

[2811] Teck considered the overall risk to wildlife to be low. In the few cases where elevated risks were predicted, Teck noted the elevations were modest and likely attributable to the conservative nature of the wildlife health risk assessment. The estimated risks for base case and application case were consistently similar, and Teck concluded that the project will not contribute to the overall risks to wildlife health.

[2812] The overall conclusion of Teck's wildlife health risk assessment is that any project-related changes in air, water, and soil quality were not expected to result in population-level effects to wildlife health in the local study area surrounding the project. Moreover, population-level effects on wildlife health as a result of the combined influence of the project with existing, approved, and planned developments in the study area were not expected.

[2813] Teck stated that because the project-related effects on surface water quality in the Peace-Athabasca Delta are predicted to be negligible, the project is not predicted to have an adverse effect on wildlife or human health in that area. Similarly, any air quality-related changes (in the form of predicted ground-level air concentrations and deposition rates) associated with the project are not expected to result in adverse effects on wildlife or human health in the park. In short, risks to wildlife and human health associated with changes in water quality and air quality are predicted to be low in the park and the Peace-Athabasca Delta.

Analysis and Findings

[2814] The panel is satisfied that Teck's wildlife health risk assessment was conducted in a reasoned and responsible manner consistent with regulatory guidelines.

[2815] The panel finds that the project would only contribute to minor increases in potential exposure of wildlife in the region to COPCs. The panel notes that for the few exceedances that occur (including for NO₂), most occur under existing conditions and base case scenarios and the project either makes no contribution or only a small incremental contribution to the predicted risk. The panel also accepts that wildlife and human health risk assessments generally, and Teck's wildlife health risk assessment in particular, are conservative by design and generally over predict risk levels. Overall, the panel therefore concludes that the project is not likely to result in adverse effects to wildlife health.

[2816] The panel notes that there is limited information on the possible health effects of naturally occurring naphthenic acids or on background levels in the local environment and that Teck was not able to quantify the risk due to lack of an accepted toxicological reference value. The panel has included a condition requiring Teck to include monitoring of concentrations of naphthenic acids in the aquatic environment as part of its surface water quality and aquatic effects monitoring programs. The panel has also included a recommendation to Canada that it complete the development of a water quality guideline for naphthenic acids as soon as possible as this has been a long-standing concern for communities and has been a recommendation in previous joint review panel reports.

[2817] The panel agrees with Teck's conclusion that the project is not expected to contribute to increased risk to wildlife health as a result of methylmercury. As discussed in the surface water quality section above, the panel finds that Teck's proposed mitigation measures, combined with the panel's conditions, should reduce the potential for methylmercury generation. In addition, the panel has included conditions for additional baseline mercury sampling and for monitoring of methylmercury in the fish habitat compensation lake and off-stream storage pond as part of a required aquatic effects monitoring program for the project to validate assessment predictions or identify the need for additional mitigation measures. The panel's analysis and findings, conditions and recommendations related to mercury and methylmercury are included in the sections "[Surface Water Quality](#)" and "[Fish and Fish Habitat](#)."

[2818] The panel notes that Teck's assessment included commitments to collect samples of aquatic plants in the local area to better characterize the existing concentrations of PAHs and metals in these plants and, subsequently, to the food chain that depends upon them. Given the concerns of indigenous communities about wildlife health, the panel believes this work is necessary and may improve community confidence in assessment predictions. The panel has therefore included a condition that Teck collect baseline data on heavy metal and PAH concentrations in aquatic plants in the project area and include monitoring of future heavy metal and PAH concentrations in aquatic plants as part of its environmental effects monitoring programs.

[2819] The panel's full analysis and findings, conditions and recommendations related to project effects to wildlife health are found in section [24](#), "[Wildlife Health](#)."

Significance of Project Effects

[2820] The panel's significance determination for project effects to wildlife health is found in section [24](#), "[Wildlife Health](#)."

[2821] The panel found that while some COPCs exceed the hazard quotients established for the key indicator species or receptors, these exceedances generally also exist for existing conditions and under the base case, prior to development of the Frontier project. Where the addition of the project does result in an increase in risk to wildlife health, the change in risk attributable to the project is generally minimal.

[2822] As most hazard quotients are predicted to remain below 1 and the change in risk attributable to the project is minimal, the panel found that the project is not likely to result in significant adverse effects to wildlife health.

[2823] Given that the project is not expected to result in an appreciable increase in risk to wildlife health in the wildlife health risk assessment study area which is the area closest to and most likely to be affected by the Frontier project, the panel concludes that the project will also not result in significant adverse effects to wildlife in the Peace-Athabasca Delta and Wood Buffalo National Park.

Effects to Human Health

[2824] Project effects to human health and Teck's human health risk assessment are discussed in section 29, "[Public \(Human\) Health](#)."

Evidence

[2825] Teck completed a human health risk assessment to assess the potential health impacts of air emissions and surface water releases from the project. It assessed air emissions and surface water releases of chemical contaminants that may adversely affect human health via multiple exposure pathways, including air, water, soils, and from local and traditional foods. The human health risk assessment incorporated regional data on contaminant levels where available, and Teck consulted with local indigenous groups in order to improve inputs to the estimation of current and predicted exposures to COPCs that were identified by Teck.

[2826] For the inhalation assessment, Teck considered several different subgroups of area residents including:

- Cabins – including known locations of cabins within the study area
- Communities – including all permanent community residents living in Fort McKay, Fort McMurray, Fort Chipewyan and other known communities within the human health risk assessment study area (the air quality local study area)
- Places of interest – including known sacred sites, traplines, or traditional habitat, harvesting or hunting sites, natural areas, parks, camp sites, fishing locations
- Worker group – including adult individuals who stay at housing complexes or lodges within the human health risk assessment study area, and work in the area for a duration that is less than a lifetime

[2827] In addition Teck modelled more than 900 locations around the project disturbance area boundary.

[2828] For the multiple pathway assessment, Teck considered three groups of individuals:

- Community resident – includes individuals who live in the established communities in the local study area (Fort McKay, reserves) as well as Fort McMurray and Fort Chipewyan (including reserves). It was conservatively assumed that these individuals harvest and consume game and fish from the local study area on a regular basis.
- Maximum resident local study area – this group of locations includes all cabin and places of interest within the project development area boundary, and the locations where the maximum predicted ground-level concentrations of the chemicals are predicted on an annual basis. This group represents individuals who practice a traditional lifestyle but do not live in the larger, established communities. It was assumed that these individuals harvest and consume game and fish from the local study area on a regular basis.
- Worker group – includes adult individuals who stay at housing complexes or lodges within the human health risk assessment study area, and work in the area for a duration that is less than a lifetime. For this group, a change that has been made in response to feedback from stakeholders is the addition of food consumption exposure pathways, as these were not assessed previously.

[2829] As discussed for wildlife health, Teck submitted that if the findings of the human health risk assessment and wildlife health risk assessment indicated that the risks related to the project were low, then the risks to human health and wildlife in the park and Peace-Athabasca Delta would be low as well. This is because the human health risk assessment and wildlife health risk assessment focused on the potential risks to human health and wildlife in an area wherein the risks are anticipated to be greatest (i.e., within the air quality local study area and aquatics local study area).

[2830] For emissions of COPCs to air, Teck predicted that acute health-based guidelines for the air contaminants NO₂ and, to a lesser extent, SO₂ and PM_{2.5} would be exceeded at some locations close to the facility. For example, there were exceedances at some cabins but not in any communities in the region. Except for NO₂, exceedances were few in number and generally were more prevalent under existing conditions and in the base case. There were generally less exceedances under the planned development case due to the assumption of industry-wide adoption of Tier IV emission standards for mine fleets. For NO₂, the magnitude of all exceedances over regulatory values was small. Teck stated that the major contributor to NO₂ exceedances under existing and base case conditions were air emissions from the fleets of diesel haulage trucks in the region. Teck's assessment assumed the mine fleets contributing to regional air emissions would all be upgraded to Tier IV truck engines by 2025 when the Frontier project comes into operation. This issue is discussed further in section 14, "[Air Quality](#)."

[2831] For chronic exposures to COPCs via the inhalation pathway, the assessment predicted a very small number of exceedances. No exceedances were noted for community locations, and the few exceedances noted in specific locations closer to the Frontier project are present in the base case.

[2832] Overall, Teck expected that the health risks associated with NO₂, PM_{2.5}, and SO₂ concentrations would be low. Its analysis concluded that the incremental change in health risk due to inhalation of air contaminants between the base case and application case are generally negligible. This suggests that the project will have a minimal impact on health risks in the region.

[2833] For possible exposure to COPCs through pathways other than direct inhalation, Teck conducted multiple exposure pathway assessments. Teck identified exceedances of health-based guidelines for ingestion of foods containing methylmercury and manganese in the multiple exposure pathway assessments, both for community residents and local groups in work camps or cabin occupants. Following more detailed assessment, Teck's conclusions were as follows:

- Predicted increases in manganese exposures were small and exposure levels were well within the range of typical Canadian exposures. Teck concluded no adverse effects would be expected.
- There is currently a regional fish consumption advisory on the Athabasca River in relation to methylmercury concentrations. Teck stated that the methylmercury in fish collected from various areas in Alberta is within similar ranges to fish sold commercially.
- Present levels of methylmercury observed in local fish, including those caught in the Athabasca River, at times exceed levels in Health Canada guidelines. Teck's assessment concluded the frequency and level of exceedances would remain unchanged across the base case, application case, and the planned development case; that is, exposures (and therefore risks) would not be significantly increased due to the project and would remain comparable to fish caught in other regions of Alberta.
- Using Health Canada's current (2007) health-based limit for methylmercury, which is less stringent than the U.S. Environmental Protection Agency's value used in Teck's assessment, would reduce predicted risk by 50%.

[2834] ECCC disagreed with Teck's assessment of potential methylmercury concentrations in the future fish habitat compensation lake and recommended additional data collection and modelling to assess this issue.

[2835] Concerns about possible health hazards associated with naphthenic acids were raised by CPAWS, the Original Fort McMurray First Nation, the Clearwater River Band, Stand Earth, and ECCC. It was noted that naphthenic acids are naturally occurring in parts of the region but that many of these acids are also concentrated in tailing ponds and may degrade only very slowly, and that the health hazards associated with naphthenic acids are not fully understood.

[2836] Teck noted although the human health risk assessment discussed the health hazards of naphthenic acids in a qualitative manner, the lack of health-based exposure limits for naphthenic acids prevented it from making a quantitative estimation of risk. Teck committed to maintaining water quality in the area

with respect to naphthenic acids contamination by capturing runoff, using mitigation measures for seepage, and using collection wells.

[2837] Teck's human health risk assessment included detailed evaluations of whether the Frontier project could increase cancer risks from lifetime exposures of local and area residents to potentially carcinogenic COPCs. It concluded that incremental risks following lifetime exposures were low (less than 1 in 100 000 increase in cancer based on a lifetime's exposure) for area communities and locations close to the project development area. The human health risk assessment identified slight increases in cancer risk from current risk levels in a few specific locations close to the project development area for three of the COPCs assessed: benzene, PAHs (as a group, and as represented by a typical PAH, benzo(a)pyrene), and hexavalent chromium. These locations were either worker camps or places where people would visit (e.g., cabins) but not occupy for long periods of time. Teck stated that the assumption of constant exposure over a lifetime (60 years for workers at camps or 80 years for people frequenting cabins and places of interest) used in the assessment is highly conservative, and Teck concluded there would be no increased risk of cancer as a result of the project.

[2838] During the multiple pathway assessment, a potential increased cancer risk was identified related to PAHs and benzo(a)pyrene. The increased risks were due mostly to vegetation uptake of dusts containing these chemicals by moose foraging on vegetation or by direct ingestion of plants such as berries by local residents. Detailed review of these results confirmed that the apparent increase in risk was due to the incorporation of multiple conservative assumptions within the methodology. Further detailed evaluation concluded that PAH/benzopyrene exposures to local inhabitants would be well within the normal range of exposures. Following the detailed review, Teck concluded the contribution from the project to cancer risk in the region would be negligible.

[2839] Health Canada recommended monitoring to ensure predictions made within the human health risk assessment are accurate or conservative, including a recommendation that levels of methylmercury and lead are monitored over the life of the project.

[2840] Health Canada confirmed its position that the levels of methylmercury in local fish, as predicted in Teck's human health risk assessment, would not pose a risk provided people are following consumption advice from authorities.

[2841] Teck submitted that considering the proposed mitigation activities for the project to manage chemical releases to air and surface water, any changes to air, surface water and soil quality would result in insignificant increases in exposure to COPCs. Their assessment concluded that changes in exposure to COPCs between the base case and application case health risks are small or nonexistent, which implies that the project is not expected to contribute appreciably to human health risks. Furthermore, Teck stated that emissions from the project in combination with other emission sources in the oil sands region are not expected to result in adverse health effects. Teck noted that changes in health risk between the base case

and the planned development case are also small. Overall, Teck concluded that no adverse health effects are expected as the result of the Frontier project combined with existing and additional projects and activities planned for the region.

Analysis and Findings

[2842] The panel finds that Teck's human health risk assessment was conducted in accordance with accepted regulatory practice, is consistent with guidance from Health Canada and Alberta Health for public health risk assessment, and that Teck consulted with potentially affected residents.

[2843] The assessment appropriately identified COPCs that could be released from the Frontier project throughout its various phases, used estimations of exposure that were deliberately conservative (precautionary) in their derivation to reflect reasonable worst-case conditions, and compared the results against conservative regulatory values for safe exposure limits.

[2844] The panel finds that the selection of receptors for exposure assessment was robust. It adequately considered the range of exposures that people in the area might receive, including those residing within indigenous communities and those practicing a traditional lifestyle.

[2845] The panel accepts that a human health risk assessment is based on models that involve numerous assumptions and that certain relevant data might not be available. The panel finds that the approach taken in this human health risk assessment was set up to be conservative (i.e., precautionary) in its conclusions. The panel notes a high degree of conservatism was included in the human health risk assessment, including in the air quality predictions, the use of maximum exposure levels from hundreds of potential receptor locations as the input for estimating long-term or lifetime human exposure, and the use of conservative regulatory exposure limits. The one area where the air quality assessment, and hence the results of the human health risk assessment, may not be conservative is with respect to NO₂.

[2846] The panel finds that the incremental health risk change due to inhalation of air contaminants between the base case and application case are generally negligible. However the human health risk assessment identified NO₂ as an air pollutant of concern in the region, and the adoption of Tier IV emissions technology for mine fleets by 2025 by all oil sands mine operators was assumed in the human health risk assessment. The panel agrees with Health Canada that if adoption does not occur by this date, the results of the health risk assessment for NO₂ may not be valid. While Teck can control what technology it uses for its mine fleet, it cannot control what equipment other operators use and there is currently no regulatory requirement that existing mine equipment achieve the new Tier IV emissions standards.

[2847] The panel has included approval conditions and made recommendations to Teck to ensure NO_x emissions from the project are minimized. The panel has also included a recommendation to Alberta concerning regional NO_x emissions from mine fleets. While the panel recognizes there is some

uncertainty about the validity of the assumptions used for NO₂ emissions in the health risk assessment, regional ambient air quality monitoring is conducted in the Lower Athabasca region. If air quality approaches or exceeds limits and thresholds identified in the *AQMF*, many of which are health based, Alberta is required to take management action. This will ensure health risks related to NO₂ exposure are appropriately managed in the region.

[2848] The panel understands that methylmercury levels in some country foods in the region currently exceed health-based levels, as evidenced by current advisories for fish and eggs. It also notes that Teck's predicted concentrations of methylmercury are comparable with levels currently collected from fish in other regions of Alberta. The panel acknowledges Health Canada's position that local fish should continue to be consumed as long as relevant guidance is followed.

[2849] The panel agrees with Teck's assessment that the project is not likely to contribute to increased risks from methylmercury. Teck's commitment to remove organic materials during construction of the fish habitat compensation lake and the off-stream storage pond located in Unnamed Creek 2 is an acceptable mitigation to address this risk, and the panel has made this a condition of approval. The panel has also imposed conditions related to additional baseline mercury sampling prior to construction of the fish habitat compensation lake and off-stream storage pond and future monitoring of mercury and methylmercury in these water bodies. The panel's analysis and findings, conditions and recommendations related to methylmercury in the fish habitat compensation lake and other water bodies in the vicinity of the Frontier project are found in section 18, "[Surface Water Quality](#)." Future monitoring will determine if methylmercury levels are elevated in the fish habitat compensation lake and if necessary, additional mitigation measures can be implemented.

[2850] The panel notes Health Canada's recommendation for Teck to monitor methylmercury concentrations in fish, in conjunction with the concerns about adverse health impacts expressed by various local groups, and agrees that an appropriate monitoring and surveillance program is required. The panel is requiring Teck to develop and submit an aquatic environmental effects monitoring plan as a condition of approval and expects that monitoring of methylmercury in fish tissue will be included in this plan. The panel also understands that this may be a condition of any approvals issued by DFO.

[2851] With respect to naphthenic acids, the panel notes Teck's commitment to maintaining water quality in the project area. The panel is aware that research on naphthenic acids is continuing under the Oil Sands Monitoring Program and that efforts are being made at the federal level to develop a water quality guideline for oil-sands-derived naphthenic acids. The panel recommends that ECCC complete the development of a water quality guideline for naphthenic acids as soon as possible as this has been a long-standing concern for communities and has been a recommendation in previous joint review panel reports.

[2852] With respect to the potential for increased cancer risk, the panel agrees with the results of Teck's assessment that the project is not likely to result in an increase in cancer risk. The health risk assessment

makes use of a number of conservative assumptions that when compounded can over predict risk. This is what makes the assessment conservative (i.e., precautionary). For the increased risk associated with PAH/benzopyrene identified in Teck's health risk assessment, the detailed calculation showed that the highest predicted estimated daily intake of all PAHs in the benzo(a)pyrene group was estimated to be about 0.7 µg/day. This considered all exposure pathways and was for a local study area user that received the maximum exposure. It is also for the planned development case, which includes emissions from projects that have not been approved or constructed. In comparison, the estimated daily dietary intake of PAHs for individuals from several countries ranges from 0.02 to 28 µg/day. The 0.7 µg/day falls within and towards the low end of the range. This supports Teck's conclusion that the project and the project together with other existing, planned and approved projects is not a significant source of PAH exposure and are not likely to result in an increase in cancer risk due to PAH exposure.

[2853] In summary, Teck's methodology and analysis in its human health risk assessment was appropriate, conservative and thorough, and the panel believes it can rely on the results. The panel finds that chemical emissions from the project are low and their contribution to health risks in the region is expected to be low to negligible. The panel notes that where hazard quotients above 1 occur, most occur under existing conditions and base case scenarios and the project either makes no contribution or only a small incremental contribution to the predicted risk. As a result, the project is not expected to result in adverse effects to human health in the project area or the region.

[2854] The panel's full analysis and findings, conditions and recommendations related to project effects to human health are found in section 29, "[Public \(Human\) Health](#)."

Significance of Project Effects

[2855] The panel's significance determination for project effects to human health is found in section 29, "[Public \(Human\) Health](#)."

[2856] The panel found that while some COPCs will be released by the Frontier project and hazard quotients of greater than 1 are predicted for some receptor locations, these exceedances generally also exist for existing conditions and under the base case, prior to development of the Frontier project. Where the addition of the project does result in an increase in risk to human health, the change in risk attributable to the project is generally minimal.

[2857] As most hazard quotients are predicted to remain below 1 and the change in risk attributable to the project is minimal, the panel found that the project is not likely to result in significant adverse effects to human health.

[2858] Given that the project is not expected to result in an appreciable increase in risk to human health in the human health risk assessment study area which is the area closest to and most likely to be affected

by the Frontier project, the panel concludes that the project will also not result in significant adverse effects to human health in the Peace-Athabasca Delta and Wood Buffalo National Park.

Project Effects on Migratory Waterfowl and Water Birds

[2859] Project effects to migratory waterfowl and water birds and Teck's proposed mitigation measures are discussed in section [23](#), "[Wildlife](#)."

[2860] Waterfowl (ducks, geese and swans) are an important component of biodiversity and are key species for indigenous and non-indigenous harvesting activities. The oil sands region provides a critical corridor for migrating waterfowl, particularly during the fall. Changes to bird populations migrating through this corridor due to birds landing on external tailings areas and other industrial water bodies could affect waterfowl populations in the Peace-Athabasca Delta and Wood Buffalo National Park.

Evidence

[2861] Teck conducted waterfowl aerial surveys during the 2012 breeding season. Teck documented the habitat use, diversity and abundance of ducks, geese, swans and other water birds, with a focus on species of management concern. These surveys were conducted to assess the status of the breeding population and their reproductive success. Although waterfowl surveys were not carried out during spring and fall migration, the high density of open water in the central portion of the terrestrial local study area, including several shallow lakes, indicates this area also provides important stopover and feeding habitat for waterfowl migrants travelling through the terrestrial local study area.

[2862] Both the regional study area and terrestrial local study area contain waterfowl habitat that will be negatively affected by the project. Ponds, lakes, marshes, rivers, creeks and other open-water environments are considered suitable foraging habitat for waterfowl. Preferred nesting habitat varies by species and includes areas of emergent vegetation in wetlands, uplands near wetlands and tree cavities.

[2863] Teck indicated that at application case, waterfowl breeding habitat decreases in the terrestrial local study area from base case due to the direct loss of breeding habitat and sensory disturbances associated with the project. A decrease of 6938.1 ha (67.9 per cent reduction) for high-suitability habitat and a decrease of 6336.6 ha (66.9 per cent reduction) for moderate-suitability habitat is predicted within the terrestrial local study area. High- and moderate-suitability waterfowl breeding habitat is expected to remain in small isolated patches where water bodies or watercourses remain, primarily along the eastern and northern boundary of the terrestrial local study area.

[2864] In the regional study area, under the best-case scenario there will be

- A reduction of 6740.4 ha (2.0 per cent) for high-suitability habitat at application case (maximum development) relative to the base case (328 804.8 ha).

- A reduction of 6475.2 ha (4.0 per cent) for moderate-suitability habitat at application case (maximum development) relative to the base case (161 081.7 ha).

[2865] In the regional study area, under the worst-case scenario there will be

- A reduction of 6943.4 ha (2.4 per cent) of high-suitability habitat at application case (maximum buildout) relative to the base case (283 413.1 ha).
- A reduction of 6331.4 ha (5.3 per cent) of moderate-suitability habitat at application case (maximum buildout) relative to the base case (118 589.1 ha).

[2866] Teck said that tailings areas are the main cause of mortality risk to migrating or breeding waterfowl in the mineable oil sands area. Tailings areas are an integral part of the bitumen mining and extraction process and contain a mixture of process-affected water, residual hydrocarbons and other substances. Migratory bird contact with process-affected water and residual hydrocarbons is a concern. Tailings areas are of particular concern because the oil sands region lies along the convergence zone of flyways for migratory waterfowl on their way to and from the Peace-Athabasca Delta. The risk to waterfowl associated with tailings areas interactions is difficult to quantify as the total numbers of birds migrating through the oil sands region is not known with any scientific rigour. Recent estimates suggest that the Peace-Athabasca Delta hosts as many as 1.5 million birds each spring and fall.

[2867] Industry self-reported mortality data puts the average yearly number of waterfowl deaths due to tailings areas at approximately 65 bird deaths per year. Other recent estimates put the mortality rate higher but still less than 200 birds per year. Also of concern are the birds which land on tailings ponds and fly away. It is not known what the results of contact with process-affect water and residual hydrocarbons may be. Oil or other chemical products in the pond might cause feather fouling, or the liquid might be harmful if ingested. Additionally, birds that might use the pond for a period of time, then leave, might be subject to harm in the future as they preen their feathers, or if oiled feathers rub against eggs in a bird's nest.

[2868] Teck considered the environmental consequence for waterfowl landing in tailings management areas as high but the likelihood of these accidents occurring to be low.

[2869] ECCC indicated that numerous migratory birds continue to land on process-affected water bodies (including tailings areas) despite the presence of best available bird deterrent technology.

[2870] Mikisew and Athabasca Chipewyan raised the concern that migration patterns are changing, resulting in a large decrease of waterfowl travelling along traditional corridors to and through the Peace-Athabasca Delta. Members attribute these changes to reductions in water levels within the Peace-Athabasca Delta; the quantity and quality of migratory waterfowl habitat along migration pathways; and migratory birds being disturbed by air, noise, water, and light pollution associated with industrial development.

[2871] Kátł'odeeche First Nation indicated that there is potential for effects to migratory birds due to changes in availability of food and habitat, contamination of water, food, and sediments, and alteration of migration routes because of the project. Kátł'odeeche was also concerned about bird exposures to contaminated tailing and non-tailings water bodies and airborne pollution.

[2872] CPAWS suggested that with the close proximity of the project's tailings ponds to Wood Buffalo National Park and the Peace-Athabasca Delta, the number of birds exposed to process-affected water will increase in the future. It said that process-affected water can negatively impact migratory birds through direct exposure, ingestion or inhalation, which can ultimately lead to decreased fitness and death. CPAWS described the migration corridor for waterfowl and water birds, including Whooping Crane, on their way to and from Wood Buffalo National Park as passing over the mineable oil sands area, including the project. CPAWS argued that despite the implementation of extensive bird deterrent programs, tailings areas within the region represent a mortality risk to migratory birds if direct exposure occurs.

[2873] Parks Canada Agency said that the project would contribute to cumulative changes in migratory bird habitat, including effects to quality and quantity of available regional stopover habitat in the mineable oil sands area. Parks Canada was concerned that project effects might impact the survival, health and breeding success for migratory waterfowl, and may contribute to the overall decline in migratory waterfowl in the Peace-Athabasca Delta and the Wood Buffalo National Park.

[2874] Parks Canada indicated that the project would increase the area required for the management of tailings areas and other oil sands process-affected waters sites which would lead to an increased exposure of migratory waterfowl to contaminants during spring and fall migration. Adverse environmental effects have been observed in waterfowl within the Peace-Athabasca Delta where increasing levels of mercury have been found in gull and tern eggs.

[2875] Athabasca Chipewyan stated that hundreds of migratory birds are landing in industrial water bodies in the oil sands and becoming oiled and flying away. The fate and long-term health of these birds is unknown and to date no studies have tracked where these birds go, whether they survive, nor whether there are impacts to individual fitness. This is of serious concern to the Athabasca Chipewyan land users who consume waterfowl and eggs in the Peace-Athabasca Delta and Wood Buffalo National Park.

Analysis and Findings

[2876] The panel notes that Teck conducted waterfowl surveys during only one season which may not be fully representative of waterfowl use of the area and may not have covered all waterfowl habitat that may be affected by the project. This results in some uncertainty about the robustness of the baseline information, mostly with respect to spring and fall migrations. While it may have been helpful to have additional survey information to improve confidence in Teck's assessment, the panel is satisfied that it has sufficient information to assess the project's effects on waterfowl and waterfowl habitat.

[2877] The panel accepts Teck's commitment to complete baseline studies on stopover habitat use by migratory waterfowl in the project development area prior to construction and has made this a condition of approval.

[2878] The project will result in the eventual removal of all waterfowl habitat within the project disturbance area, an area of 292 km². As this includes more than 60 per cent of the high-suitability habitat within the terrestrial local study area this represents a high-magnitude effect at the level of the local study area. The loss of this habitat may also have consequences for indigenous harvesting of waterfowl within the terrestrial local study area. The panel notes however that not all of this habitat loss occurs at once. The habitat loss will occur over the 41 year life of the mine as it advances, so some waterfowl habitat will remain within the project disturbance area for many years before it is disturbed.

[2879] Within the regional study area, for the best-case scenario the amount of waterfowl habitat removed as a result of the project is about 2 per cent for high-suitability habitat and 4 per cent for moderate-suitability habitat. For the worst-case scenario, the predicted losses are only marginally higher. The panel finds these to be low-magnitude effects at the regional level.

[2880] The panel acknowledges that migratory pathways and the preference of migratory birds for landing sites within the mineable oil sands region are not fully understood. Additional studies and research may be beneficial in better understanding these issues and may inform future assessment of effects and mitigation measures. The panel accepts Teck's commitments to contribute to studies and research on regional waterfowl and to participate in the oil sands bird technical team. The panel has made these commitments conditions of approval.

[2881] The panel requires Teck to finalize and submit its waterfowl protection plan (bird protection plan) to the AER for approval prior to construction of the project. The plan must include measures to prevent wildlife from coming into contact with industrial wastewater including but not limited reducing the attractiveness of ponds to birds through design, construction and operational measures; prevention of and elimination of floating or emergent vegetation from the ponds; minimizing the presence of floating bitumen from the ponds; and bird deterrent systems. The plan must also include measures for monitoring and documenting avian mortality or contact with industrial wastewater. The panel also recommends that the Minister require a similar plan as a condition in a decision statement under *CEAA 2012*.

[2882] The panel accepts that even with advanced bird deterrent systems and the other proposed mitigation measures, some avian landing will still occur and some mortality may result. Any mortality is regrettable however considering the large numbers of waterfowl and other migratory birds that fly over the oil sands region, the number of birds observed to land in tailings ponds is low and the amount of direct mortality lower still. The panel accepts however that not all landings and mortality may be observed or reported and that there are concerns about the potential for longer term or chronic as well as acute effects. Notwithstanding these uncertainties, the panel is satisfied that Teck's proposed mitigation

measures and the panel's conditions will minimize the potential for avian landings and mortality. As a result the panel considers the magnitude of effects associated with waterfowl mortality resulting from landing in tailings ponds to be low.

[2883] The panel's full analysis and findings, conditions and recommendations related to project effects to migratory waterfowl and water birds are found in section 23, "[Wildlife](#)."

Significance of Project Effects

[2884] The panel's significance determination for project effects to migratory waterfowl and water birds is found in section 23, "[Wildlife](#)."

[2885] The panel found that project effects to migratory waterfowl and water birds is likely as the project will remove all waterfowl habitat from the project disturbance area and this habitat will not be restored for a prolonged period of time. The magnitude of the effect is low – although thousands of hectares of high- and moderate-suitability habitat will be removed within the project disturbance area, this represents only 2 and 4 per cent of the habitat available in the region. Mortality effects to wildlife due to the project are also expected to be low.

[2886] Overall, the panel concluded that the project was not likely to result in significant adverse effects to migratory waterfowl or water birds due to the low magnitude of effects at the regional level.

[2887] The panel acknowledges that the loss of habitat due to the project will have an adverse effect on waterfowl nesting and rearing habitat in the terrestrial local study area and will reduce available waterfowl stopover habitat. However significant high- and moderate-suitability habitat remains available in the wildlife regional study area and the loss of habitat is not expected to result in changes to the abundance of migratory waterfowl or water birds. The panel therefore concludes that the project is not likely to result in significant adverse effects to migratory waterfowl or water bird abundance within the Peace-Athabasca Delta or Wood Buffalo National Park.

Potential Cumulative Effects to Migratory Waterfowl and Water Birds

[2888] As the project will result in a loss of habitat for migratory waterfowl and water birds the panel conducted an assessment of cumulative effects. The panel's assessment is found in section 23, "[Wildlife](#)."

Evidence

[2889] According to Teck's assessment within the regional study area for the best-case scenario

- There is 365 931.1 ha of high-suitability habitat and 146 344.6 ha of moderate-suitability habitat under predevelopment conditions.
- High-suitability habitat decreases by 37 126.3 ha (10.1 per cent) and moderate-suitability habitat increases by 14 737.1 ha (10.1 per cent) in the base case relative to predevelopment conditions.

- High-suitability habitat declines by 6740.4 ha (2.0 per cent) and moderate-suitability habitat declines by 6475.2 ha (4.0 per cent) in the application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 17 506.1 ha (5.3 per cent) and moderate-suitability habitat declines by 10 519.3 ha (6.5 per cent) in the planned development case at maximum buildout (2066) relative to the base case.

Analysis and Findings

[2890] Within the regional study area, under the best-case scenario, high- and moderate-suitability habitat for waterfowl decreases by less than 20 per cent at base, application and planned development cases relative to predevelopment conditions. The panel considers this to be a moderate-magnitude effect. While the decreases in high- and moderate-suitability habitat are slightly higher than 20 per cent under the worst-case scenario, the panel does not expect this scenario to occur. Reclamation is a regulatory requirement and progressive reclamation will occur.

[2891] Waterfowl mortality due to waterfowl landing on tailings ponds or interacting with other industrial infrastructure is also expected to be of low magnitude.

Significance of Cumulative Effects

[2892] The panel's significance determination for cumulative effects to migratory waterfowl and water birds is found in section 23, "[Wildlife](#)."

[2893] The panel found that cumulative effects to migratory waterfowl and water birds are likely. Some loss of habitat has already occurred and the project and other developments will contribute to this loss. However as the amount of high- and moderate-suitability habitat lost is less than 20 per cent for the application and planned development cases compared to predevelopment conditions and sufficient waterfowl habitat remains to sustain waterfowl populations, the panel found that the magnitude of cumulative effects was moderate.

[2894] The panel concluded that the project, in combination with other existing, approved and reasonably foreseeable projects is not likely to result in significant adverse cumulative effects to waterfowl due to the moderate magnitude of effects and the availability of remaining habitat within the regional study area.

[2895] The panel acknowledges that the cumulative effect of habitat loss will have an adverse effect on waterfowl nesting and rearing habitat within the wildlife regional study area and will reduce available waterfowl stopover habitat. However significant high- and moderate-suitability habitat remains available in the wildlife regional study area and the loss of habitat is not expected to result in significant changes to the abundance of migratory waterfowl or water birds. The panel therefore concludes that the project, in

combination with other existing, approved and planned projects is not likely to result in significant adverse effects to migratory waterfowl or water bird abundance within the Peace-Athabasca Delta or Wood Buffalo National Park.

Potential Project Effects on Whooping Crane and Whooping Crane Breeding Habitat

[2896] Project effects to Whooping Crane and Teck's proposed mitigation measures are discussed in section [23](#), "[Wildlife](#)."

Evidence

[2897] According to ECCC, Whooping Crane are one of the rarest bird species in North America and are listed as endangered in both Canada and the United States of America. International conservation efforts have successfully increased population levels from near extinction in the 1940s to approximately 757 individuals in 2017, with the majority of birds (431 individuals in 2017) occurring within the Aransas-Wood Buffalo population. The recovery goal for Whooping Crane is to protect, restore and manage the species to be self-sustaining in the wild, with a long-term goal of establishing 1000 individuals in at least one self-sustaining population in North America by 2035.

[2898] ECCC stated that the probability of species' extinctions over the next 100 years is considered to be low (less than 15 per cent), if current environmental conditions do not deteriorate.

[2899] Teck reported that potential effects to Whooping Crane habitat apply only to stopover habitat used during migration as this species is known not to breed within the regional study area. Whooping Crane use a variety of wetlands along their migration corridor, favouring temporary and seasonal wetlands in the spring, and semi-permanent or permanent wetlands in the fall. Ponds, lakes, marshes, rivers, creeks and other shallow open-water environments are considered suitable stopover habitat for Whooping Crane.

[2900] In the terrestrial local study area there is a 2894.5 ha (98.6 per cent reduction) of high-suitability habitat from base case to application case. A small amount of Whooping Crane stopover habitat is expected to remain along the eastern edge of the terrestrial local study area where small water bodies are present.

[2901] In the regional study area, under the best-case scenario there will be

- A reduction of 2747.1 ha (4.1 per cent) for high-suitability habitat at application case relative to base case (58 368.0 ha). No moderate-suitability habitat is identified for any of the assessment cases.

[2902] Under the worst-case scenario in the regional study area there will be

- A reduction of 3158.8 ha (7.6 per cent) of high-suitability habitat at application case relative to the base case (41 386.3 ha). No moderate-suitability habitat is identified for any of the assessment cases.

[2903] *The Recovery Strategy for the Whooping Crane (Grus americana) in Canada* identifies critical habitat within the Wood Buffalo National Park with no additional critical habitat identified outside of the park.

[2904] Teck predicts that the closure landscape will provide conditions conducive to the reestablishment of Whooping Crane stopover habitat. Wetland communities will be supported by the reestablishment of drainage courses and areas of open water. At closure, total Whooping Crane stopover habitat availability increases in the terrestrial local study area relative to base case. However habitat gain consists of low-suitability habitat. High-suitability Whooping Crane stopover habitat is expected to occur in shallow open water bodies mainly throughout the western portion of the terrestrial local study area habitat.

[2905] ECCC stated that the loss of migrating habitat and increase in development in the woodland forest, along the bird's migration route, represents a potential threat to the species.

[2906] Parks Canada indicated that the project will contribute directly to the loss of stopover habitat for Whooping Crane. Parks Canada stated the project would remove up to 2747 ha (best-case scenario) to 3159 ha (worst-case scenario) of high and moderate quality Whooping Crane stopover habitat, and contribute an approximately 5 per cent cumulative decline in high and moderate quality stopover habitat in the regional study area.

[2907] Mortality risk for Whooping Crane is associated with interactions with tailings ponds during spring and fall migration, however the risk of Whooping Crane interactions with tailings areas or other project-related infrastructure is largely unknown.

[2908] Since the project update was filed in 2015, ECCC, as part of the Whooping Crane tracking partnership, has collected additional data on Whooping Crane migration and stopovers in the mineable oil sands area. Collar data reported by ECCC from 2010 to 2016 shows that most cranes migrate over the mineable oil sands area: 76 per cent in the spring (50 per cent to 90 per cent) and 92 per cent in the fall (84 per cent to 100 per cent). Of the individual cranes flying over the mineable oil sands area, relatively few stopped over: 16 per cent in the spring (11 per cent to 25 per cent) and 14 per cent in the fall (8 per cent to 21 per cent). For cranes that did, the stopovers were generally short in duration (one to two nights) and far from tailings areas (a distance of 23.0 km with a variability of plus or minus 15.7 km). However, some individual cranes have been observed to land on or adjacent to tailings areas (e.g., at the Muskeg River and Mildred Lake mines).

[2909] Teck initially assessed mortality risk to Whooping Crane from potential project effects as low at application case. Teck stated, as part of their review and response to ECCC, under conservative scenarios and considering most recent data and deployment of bird deterrents that the low magnitude of mortality risk would likely be more of a moderate magnitude. Mortality risk is characterized by Teck as how likely it is that a fatality may occur based on the likelihood of an interaction occurring. Overall, Teck concluded

that mortality risk will not result in a change in abundance of Whooping Crane population and distribution, although the loss of stopover habitat might alter their distribution during migration. Teck also indicated that the project is not expected to threaten the sustainability of the regional population of Whooping Crane and the breeding population of Wood Buffalo National Park. Teck notes that numbers of crane breeding pairs and total population numbers have been increasing over the period of oil sands development.

[2910] Athabasca Chipewyan and Mikisew expressed concern that the proposed project could affect Whooping Crane through increased habitat fragmentation, reduced habitat connectivity, cumulative stopover habitat removals, and increased risk of mortality associated with contact with industrial wastewater and tailings management areas at the mine site.

[2911] CPAWS said that with the close proximity of the project's tailings ponds to Wood Buffalo National Park, the number of birds exposed to process-affected water will increase in the future. It stated that process-affected water can negatively impact migratory birds through direct exposure, ingestion or inhalation, which can ultimately lead to decreased fitness and death. CPAWS was concerned that the migration corridor for the Whooping Crane passes over the mineable oil sands area, including the project. CPAWS said that despite the implementation of extensive bird deterrent programs, tailings areas within the region provide a mortality risk to migratory birds if direct exposure occurs.

[2912] ECCC stated it was concerned about Whooping Crane mortality associated with contact with deleterious substances (e.g., oil, bitumen, heavy metals) in tailings ponds and other process-affected water bodies, as well as collisions with mine infrastructure and loss of migratory or stopover habitat.

[2913] Parks Canada said that inexperienced cranes, such as juveniles and sub-adults, may be at higher risk of being exposed to tailings management areas or other industrial sites during migration.

[2914] Teck referred to studies and research completed through the Research on Avian Protection Project and the Oil Sands Bird Contact Monitoring Program. The research completed under these programs is to monitor the effectiveness of various bird deterrents in the region. Continued efforts to deter migratory birds from tailings areas should help protect Whooping Crane from exposure. For any event involving a Whooping Crane, Teck committed to complying with directions from the Canadian Wildlife Service (ECCC).

[2915] Teck said that the draft waterfowl protection plan identifies monitoring, mitigation and adaptive management necessary to deter waterfowl, including Whooping Crane and the adaptive management program will identify alternate designs for external tailings areas. Teck proposed to finalize and implement the waterfowl protection plan for the Frontier project.

[2916] ECCC wanted Teck to monitor the occurrence, movements and habitat use of Whooping Crane on and adjacent to Teck's lease lands to determine the response of birds to project activities of the

Frontier mine, and to inform development of mitigation measures. ECCC also suggested information be collected on interactions of Whooping Crane with external tailings areas and other industrial water bodies and be used by Teck to evaluate the success of mitigation measures and to improve performance of these measures and adaptive management plans.

[2917] Teck agreed with this recommendation through the finalization and implementation of the waterfowl protection plan.

[2918] ECCC also indicated that Teck should contribute funding to a regional monitoring program for Whooping Crane in the oil sands region, to inform understanding of broader cumulative effects and risks posed by oil sands developments. Parks Canada Agency supported of ECCC's proposed mitigation measures.

[2919] Teck agreed in part with this recommendation. Teck said it will participate in the Oil Sands Monitoring Program and will support the regional monitoring of Whooping Crane if prioritized by program managers.

Analysis and Findings

[2920] The panel understands that there is no critical Whooping Crane habitat outside of Wood Buffalo National Park. However, the panel accepts that members of the Aransas-Wood Buffalo Whooping Crane population migrate over the mineable oil sands region, including the project area, and that stopover habitat exists in the area. The project will remove almost all (98.6 per cent) of the high-suitability habitat for Whooping Crane within the terrestrial local study area. Within the regional study area, the amount of high-suitability habitat removed by the project is less than 10 per cent relative to the base case for both the best and worst-case scenarios. Using the 10 per cent change threshold for species at risk, the panel considers this a moderate-magnitude effect.

[2921] Reclamation should restore stopover habitat in the long term, however reclaimed habitat is expected to be predominantly low-suitability habitat as the wetlands included in Teck's closure plan are larger than those preferred by Whooping Crane.

[2922] Based on the evidence provided by ECCC the panel accepts that Whooping Crane do use areas around oil sands mining operations and there is therefore some potential for them to come into contact with process-affected water or bitumen in tailings ponds. However the data indicates that relatively few cranes stopover in the mineable oil sands area and those that do seem to prefer areas far from tailings facilities. This appears to be consistent with the lack of observed mortality for Whooping Crane associated with landings in tailings ponds. The panel recognizes however that it is possible for some landings and mortality to go undetected. However, based on the available evidence, the panel concludes that the risk of Whooping Crane mortality resulting from contact with process-affected water or bitumen in tailings ponds is low to moderate.

[2923] Most of the mitigation measures and conditions implemented for migratory waterfowl will also mitigate effects to Whooping Crane. The panel is satisfied that the proposed mitigation measures and commitments made by Teck, together with the panel's conditions, will minimize the potential for mortality effects to Whooping Crane. As a result, the panel finds that project effects to Whooping Crane abundance and distribution are expected to be low and not likely to affect the sustainability of the Whooping Crane population.

[2924] As discussed for waterfowl, the panel acknowledges that bird deterrent systems are not 100 per cent effective at deterring birds from landing on tailings ponds. Ongoing research into deterrent systems will be necessary to further reduce the potential for avian contact with tailings ponds and other process-affected waters. The panel is satisfied with Teck's commitment to participate on ongoing research and adopt the most advanced bird deterrent systems available when the project goes into operation.

[2925] The panel accepts Teck's commitment to consider and identify alternative designs and mitigation measures for the project's tailings ponds as part of its waterfowl protection plan and requires that this be a component of the plan to be submitted to the AER. The panel has included submission of the completed waterfowl (bird) protection plan to the AER as a condition of approval.

[2926] The panel also accepts Teck's commitment to monitor the occurrence, movements and habitat use of Whooping Crane on and adjacent to Teck's lease including interactions with tailings areas and will require this as part of the final waterfowl (bird) protection plan.

[2927] The panel acknowledges Teck's commitment to support regional monitoring initiatives through participation in the Oil Sands Monitoring Program. This is a regulatory requirement and has been included as a condition of approval.

[2928] The panel's full analysis and findings, conditions and recommendations related to project effects to Whooping Crane are found in section [23](#), "[Wildlife](#)."

Significance of Project Effects

[2929] The panel's significance determination for project effects to Whooping Crane is found in section [23](#), "[Wildlife](#)."

[2930] The panel found that project effects are likely as the project will remove suitable stopover habitat that could be available to Whooping Crane. Given the amount of high-suitability habitat lost as a result of the project will be about 4 per cent of the high-suitability habitat available in the regional study area, the panel considers this to be a moderate-magnitude effect. Low to moderate-magnitude effects are predicted for mortality associated with contact with tailings ponds or other project infrastructure. The combined effect of habitat loss and mortality on Whooping Crane abundance and distribution is considered to be of low magnitude.

[2931] The panel concluded that the project is not likely to result in significant adverse effects to Whooping Crane given the low magnitude of effects predicted for Whooping Crane abundance and distribution.

[2932] Although the project will affect the availability of stopover habitat for Whooping Crane and this might alter the distribution of Whooping Crane during migration, the project does not affect critical habitat for the Whooping Crane and is not expected to impact Whooping Crane abundance or threaten recovery efforts. The panel therefore finds that the project is not likely to result in significant adverse effects to Whooping Crane abundance and distribution in the Peace-Athabasca Delta or Wood Buffalo National Park.

Potential Cumulative Effects to Whooping Crane and Whooping Crane Breeding Habitat

[2933] As the project will result in a loss of stopover habitat for Whooping Crane the panel conducted an assessment of cumulative effects. The panel's assessment is found in section [23](#), "[Wildlife](#)."

Evidence

[2934] According to Teck's assessment, within the regional study area for the best-case scenario

- There is 66 458.1 ha of high-suitability habitat under predevelopment conditions. No moderate-suitability habitat is identified for predevelopment conditions or for any of the assessment cases.
- High-suitability habitat declines by 8089.9 ha (12.2 per cent) at base case relative to predevelopment conditions.
- High-suitability habitat declines by 2747.1 ha (4.7 per cent) at application case at maximum buildout (2066) relative to the base case.
- High-suitability habitat declines by 4010.2 ha (6.9 per cent) at planned development case at maximum buildout (2066) relative to the base case.

[2935] Teck concluded that the loss of high-suitability stopover habitat for Whooping Crane would be of moderate environmental consequence for all assessment cases (base case through to planned development case). Teck said wetland cover classes such as marsh/wet meadow are typically included in reclamation planning for oil sands developments so effects on stopover habitat are considered reversible.

[2936] Teck predicted low-magnitude effects to Whooping Crane abundance and distribution in the regional study area for at base case, application case and planned development case. Teck concluded these were of low environmental consequence as effects can be considered reversible as reclamation planning for oil sands developments will include the creation of wetland cover classes such as marsh/wet meadow cover classes as well as open water that will provide potential stopover habitat. In addition, reclamation will eliminate active tailings areas in the oil sands region, thereby minimizing mortality risk.

Analysis and Findings

[2937] Using the 10 per cent change threshold for at-risk species, for the best-case scenario, there are high-magnitude effects to Whooping Crane stopover habitat availability in the base, application and planned development cases in the regional study area. The most significant reduction in high-suitability habitat occurs from predevelopment conditions to the base case.

[2938] Although the loss of stopover habitat exceeds the 10 per cent threshold, the population of Whooping Crane is increasing and existing disturbance and oil sands development does not appear to be limiting population recovery goals. Under existing conditions, the cumulative effect of development in the region does not appear to be resulting in an adverse effect on Whooping Crane abundance and distribution. This appears to support Teck's assessment that effects to Whooping Crane abundance and distribution are likely to be low for all assessment cases.

Significance of Cumulative Effects

[2939] The panel's significance determination for cumulative effects to Whooping Crane is found in section [23](#), "[Wildlife](#)."

[2940] The panel found that cumulative effects are likely. Stopover habitat for Whooping Crane has been removed in the regional study area and the project and other developments will remove additional habitat. The magnitude of effects is high for habitat availability in the application and planned development cases as the amount of habitat lost exceeds 10 per cent relative to predevelopment conditions. However, the magnitude of effects is considered low for Whooping Crane abundance and distribution as the loss of stopover habitat is not expected to result in changes to Whooping Crane abundance or threaten the sustainability of the population.

[2941] Overall, the panel found that the project, in combination with other existing, approved and reasonably foreseeable projects is not likely to result in significant adverse cumulative effects to Whooping Crane. While loss of stopover habitat exceeds the threshold for a high-magnitude effect for all assessment cases, population recovery is occurring indicating that the loss of stopover habitat is not adversely affecting Whooping Crane recovery or the abundance and distribution of Whooping Crane.

[2942] As cumulative effects are not expected to affect the abundance of Whooping Crane in the regional study area or adversely affect recovery efforts, the panel concludes that the project, together with other existing, approved and reasonably foreseeable projects is not likely to adversely affect the abundance and distribution of Whooping Crane in Wood Buffalo National Park.

Potential Project Effects on Wood Buffalo National Park's Great Plains-Boreal Grassland Ecosystem

Evidence

[2943] Teck acknowledged that Wood Buffalo National Park has been identified by UNESCO as the largest example of the Great Plains-Boreal grassland ecosystem. Teck said that in the park, graminoid-dominated communities (sometimes referred to as grasslands) generally fall into three categories: freshwater meadows and marshes; saline meadows; and dry grasslands and these communities are widespread in the park.

[2944] Teck maintained that changes in hydrology resulting from the project are considered to be negligible and as a result effects on vegetation community diversity within Wood Buffalo National Park are not anticipated.

[2945] Teck also maintained that air quality model predictions and ambient monitoring results indicate that while there is potential for small increases in some air quality parameters in the park with the addition of the project, the predicted levels remain within the range of background conditions or are much less than relevant ambient air quality criteria. On this basis, Teck concluded that adverse effects on vegetation in the park as a result of the project are not anticipated.

[2946] Parks Canada Agency stated its concerns regarding the ability of the Peace-Athabasca Delta's grasslands to provide important grazing and calving areas for wood bison because of changes to native vegetation and the introduction of invasive species. Park Canada reports that changes to the water regime are one underlying mechanism altering the Great Plains-Boreal grassland ecosystem. Drying of the Peace-Athabasca Delta has resulted in an increase in shrub coverage (willows) and a rise in invasive thistle coverage in grassland ecosystems in the area. Parks Canada Agency noted changes in air quality also have the potential to affect the Great Plains-Boreal Grasslands ecosystems.

[2947] Parks Canada Agency did not agree with Teck's conclusion that the Peace-Athabasca Delta is sufficiently distanced from oil sands emissions to be at no risk from metal, total suspended particles and polycyclic aromatic compounds aerial deposition. Park Canada Agency agreed with ECCC's conclusion that changes to air quality and resulting aerial depositions over Wood Buffalo National Park are expected. Metals and polycyclic aromatic compounds that are deposited in winter months will settle in the snowpack and enter terrestrial and aquatic ecosystems during snowmelt. Park Canada Agency noted that this could lead to a large pulse of contaminants entering terrestrial and aquatic ecosystems at once and therefore their effects may be amplified.

Analysis and Findings

[2948] In previous sections, the panel concluded that the Frontier project is likely to have a negligible effect on surface water quantity, flows and levels in the Peace-Athabasca Delta and Wood Buffalo

National Park. The panel also concluded that effects to air quality and deposition within Wood Buffalo National Park are expected to be negligible or low and are not likely to result in adverse effects to surface water quality or terrestrial ecosystems in the park.

[2949] With respect to the drying of the Peace-Athabasca Delta and the associated increase in willows and invasive thistle coverage, based on the panel's assessment of cumulative effects to surface water flows and levels in the Peace-Athabasca Delta, the panel concluded that flow regulation on the Peace River and climate change were the dominant causes of reduced water levels with cumulative oil sands water withdrawals and project withdrawals making only minor contributions to this effect.

Significance of Project Effects

[2950] As project effects to surface water flows and levels and aerial deposition of contaminants within Wood Buffalo National Park are expected to be negligible, the panel concludes that adverse effects to the Great Plains-Boreal grassland ecosystem within the park are not likely to occur as a result of the project.

Potential Project Effects on the Predator-Prey Relationship Between Wolves and Bison

[2951] Teck stated that wolves are a primary predator of bison in Wood Buffalo National Park and for the Ronald Lake bison herd. Because there is a strong relationship between prey, bison, and predators (wolves), the Frontier project has the potential to affect the predator-prey relationship between wolves and the Ronald Lake bison herd.

[2952] Teck concluded that the project will have no effect on wood bison herds in the park. The only potential effect of the project on bison which use the park is for the Ronald Lake bison. Teck reported that there is little information available about predation by wolves on Ronald Lake bison. In its assessment, Teck indicated that indirect mortality risk due to predation is expected to increase slightly in the southern portion of the Ronald Lake bison range and will remain unchanged in the northern portion in of their range. Teck reported that where other prey species occur in the same area (i.e., white-tail deer and moose), wolves are less likely to target bison which are more dangerous to hunt. Teck concluded that the predator-prey relationship between bison and wolves is not predicted to measurably change as a result of the Frontier project.

[2953] Teck acknowledges that higher wolf densities coupled with an increase in linear feature density could increase predation risk for Ronald Lake bison. However, Teck notes that reclamation of linear disturbances such as seismic lines might reduce predation risk for bison. In its draft Ronald Lake bison mitigation, monitoring, and adaptive management plan Teck has therefore committed (among other mitigation measures) to reduce predation risk by: constructing predator access blocks to reduce line of sight for predators on linear features in the project development area; deactivating roads no longer in use in the project development area; and, reducing linear features in the closure landscape.

[2954] Parks Canada disagreed with Teck's environmental assessment conclusion that the increase in white-tailed deer and corresponding increase in wolf densities on the landscape will not result in an increase in bison predation. Parks Canada indicated that there are insufficient studies that have investigated the role that linear disturbances and alternate prey species play in altering the wolf-bison predator-prey relationship.

[2955] Athabasca Chipewyan stated that Teck's assessment of project effects failed to assess the link between the project and predation of the Ronald Lake bison and the Delta bison population. They noted that anthropogenic linear features facilitate the movement of wolves and increase their hunting efficiency. Athabasca Chipewyan has seen an increase in the wolf population within the Alberta boreal forest in response to increasing linear feature density south and south west of Wood Buffalo National Park. Indigenous knowledge holders from Athabasca Chipewyan indicated that the number of wolves are increasing south of the park.

Analysis and Findings

[2956] Given the distance between the project and the Delta subunit of park wood bison, and lack of evidence that the project would lead to an increase in predation on this park bison herd, the panel is satisfied that project will have no such effect. The panel accepts that there may be some increase in predation by wolves on Ronald Lake bison in the southern part of its range within the project disturbance area. The panel is satisfied that implementation of Teck's draft Ronald Lake bison mitigation, monitoring and adaptive management plan will address any potential increase in wolf predation on Ronald Lake bison.

[2957] In the following section on the project's potential effects on the Ronald Lake bison as an outstanding universal value of Wood Buffalo National Park, the panel has taken account of the fact that this herd and its range were not part of the park when it was originally established and the majority of the herd's range is outside of the park. The panel has concluded that the Ronald Lake bison herd does not constitute an outstanding universal value of Wood Buffalo National Park and the panel does not consider the project's potential effects on the herd as such. Based on this conclusion the project's potential effects on the predator-prey relationship between wolves and bison will occur mainly in the southern part of the Ronald Lake bison range outside of the park. These effects will therefore not act upon the wolf and bison predator-prey relationship within the park and will have no effect upon this element of its outstanding universal value.

[2958] The panel's assessment of project and cumulative effects to the Ronald Lake bison herd is found in section [23](#), "[Wildlife](#)."

Significance of Project Effects

[2959] Because the panel finds no linkage between the project and the predator-prey relationship of wolves and bison in the park, the panel concludes that the project will not adversely affect the predator-prey relationship between wolves and bison in Wood Buffalo National Park.

Potential Project Effects on the Ronald Lake Bison Herd

[2960] The predator-prey relationship between wolves and wood bison in Wood Buffalo National Park corresponds to one of the outstanding universal value criterion. In its information request to Teck, the panel asked Teck to provide an assessment of potential project effects on the outstanding universal value of Wood Buffalo National Park, including Wood Buffalo National Park's Great Plains-Boreal grassland ecosystem and the predator-prey relationship between wolves and wood bison, taking into account potential effects of the project on the Ronald Lake bison herd.

[2961] Teck said that bison are found throughout the park and those using the park can be divided into two populations. The largest, the Wood Buffalo National Park herd consists of several thousand individuals and is made up of several subpopulations where all or the majority of the individuals spend their time within the park's boundaries. This herd carries brucellosis and bovine tuberculosis, which was introduced to the park in the 1920s when the Government of Canada moved Plains bison from Buffalo National Park near Wainwright. The Delta subunit of the Wood Buffalo National Park herd in the vicinity of Lake Claire is located closest to the project but is not predicted to be affected by the project. Therefore, no linkage was identified between the project and the Wood Buffalo National Park herd.

[2962] Until recently, provincial wildlife managers considered the Ronald Lake bison herd to be a provincial herd. However, recent radio telemetry studies have established that some members of the herd use land within Wood Buffalo National Park. Because the project will affect a portion of the southern part of the Ronald Lake bison herd range and some members of the herd use habitat in the park to the southeast of Lake Claire, Teck concluded there was a valid linkage with a park outstanding universal value.

[2963] The panel appreciates Teck's diligence in investigating valid linkages between the project and wood bison in Wood Buffalo National Park. However in the case of the Ronald Lake bison herd, the panel is not convinced there is a valid linkage to the outstanding universal value of Wood Buffalo National Park.

[2964] When the park was established in 1922 to protect the last free-roaming northern wood bison its southern boundary was north of the Peace River. It was extended southward in 1926 to include the Peace-Athabasca Delta because the hybridized plains-wood bison (resulting from the introduction of plains bison to the park in 1925 and 1926) had moved into the delta area. This southward extension of the park now includes the northernmost extent of Ronald Lake bison herd range. Evidence provided by indigenous

community members indicate that the Ronald Lake bison herd range extended well south of the project disturbance area and that recent industrial activity has caused northward movement of members of this herd. Critical habitat (i.e., core range) for the Ronald Lake bison herd has yet to be determined under the Wood Bison Recovery Strategy.

[2965] Teck reported that reference to the Ronald Lake bison herd was not found in a review of the UNESCO nomination documents, Mikisew Cree First Nation's petition to the World Heritage Committee, nor the 2010 management plan for the park. However, the Ronald Lake bison herd was discussed in the UNESCO reactive monitoring mission report, which also includes a recommendation about the herd as part of "a broader Species Recovery Strategy."

[2966] Because the Ronald Lake bison herd does not appear to have been considered nor its range included within the original boundaries of Wood Buffalo National Park, and because the herd appears to spend the majority of time outside the park and at least some of the evidence before the panel indicates that the northward movement of the Ronald Lake bison herd may be as a result of relatively recent industrial activity, the panel is of the view that the herd's connection to the park as an outstanding universal value is tenuous at best. The panel therefore concludes that the Ronald Lake bison herd does not constitute an outstanding universal value of Wood Buffalo National Park and does not consider the project's potential effects on the herd as such.

[2967] The panel's assessment of project and cumulative effects to the Ronald Lake bison herd is found in section [23](#), "[Wildlife](#)."

Potential Project Effects on Wood Buffalo National Park's Salt Plains and Gypsum Karst Features

Evidence

[2968] Teck concluded that there will be no effects from the Frontier project on the salt plains and gypsum karst features in Wood Buffalo National Park because the project does not overlie hydraulically active karst zones and if project activities were to encounter such features in the Devonian bedrock, effects are not expected to extend over large regional distances (over 200 km).

[2969] Teck stated that any disturbance to groundwater flow patterns in the project development area will not impact these features because they are located in the northern portion of the Wood Buffalo National Park.

Analysis and Findings

[2970] Panel agrees with Teck's assessment that there are no pathways by which the project would affect the salt plains or gypsum karst features within the park

Potential Project Effects on Integrity, Protection, and Management of Wood Buffalo National Park

Evidence

[2971] Teck submitted that the project is not expected to result in any changes to the integrity of Wood Buffalo National Park. The project would not physically disturb any areas within the park boundary and does not alter the size of the park or introduce resource extraction within the park. The population density within the park is not altered by the project as the project workforce will be housed on-site and will access the site via airplane or motor vehicle from the south. As the project is located 27 km south of the southern park boundary and with no additional roadways or access routes north towards the park, the project will not affect the park's remoteness. Teck noted that the park is surrounded on most sides by buffer areas comprised of approximately 627 000 ha of provincial and territorial protection areas.

[2972] Teck acknowledged that protection and management of the park is the mandate of Parks Canada. The latest management plan for the park was released in 2010. In this plan, Parks Canada identified seven focus areas for park management:

- Establish a management structure with local aboriginal groups.
- Position the park as a dynamic destination and increase visitation in a way that results in a high degree of visitor satisfaction.
- Increase the park's relevance to non-visiting Canadians to ensure public awareness and strong support for ongoing management of natural and cultural resources.
- Develop a program of monitoring, research and management actions to ensure the long-term viability of the park's wood bison population.
- Minimize the risk of transmission of bovine diseases to adjacent disease-free wood bison and cattle herds.
- Develop a program of monitoring, research and management actions to understand, protect and present the ecological integrity and cultural value of the Peace-Athabasca Delta.
- Establish an area management approach that promotes compatible land-use and development for reserve and park lands at Pine Lake.

[2973] Teck submitted that development of the project would not alter Parks Canada's ability to fulfil their mandate that includes the protection and management of the park.

[2974] Teck committed to develop a number of management and mitigation plans as part of the project and submitted draft plans in response to information request from the panel. Teck said that the plans relevant to the key indicators considered in this assessment are:

- draft air quality mitigation, monitoring and adaptive management plan

- draft Ronald Lake bison mitigation, monitoring and adaptive management plan
- draft waterfowl protection plan
- draft wildlife mitigation and monitoring plan
- draft biodiversity management plan
- draft hydrology and water quality mitigation, monitoring and adaptive management plan

[2975] In addition to project-specific monitoring, mitigation and adaptive management, Teck identified existing regional monitoring programs that monitor the environment within the park and Peace-Athabasca Delta as well as contribution of oil sands emissions to air, water and land downstream of the park and the Peace-Athabasca Delta. Teck indicated that regional monitoring initiatives such as the Peace-Athabasca Delta ecological monitoring program, Oil Sands Monitoring Program, the Mikisew community-based monitoring program and Parks Canada ecological integrity monitoring in the Peace-Athabasca Delta are tracking stressors including oils sands emissions to the environment within the Wood Buffalo National Park. Data resulting from these programs would inform Teck, regulators and stakeholders about the current conditions of the park and the Peace-Athabasca Delta. This information will aid in the future management of Wood Buffalo National Park and ensure its continued ecology integrity.

Analysis and Findings

[2976] The panel accepts that the Frontier project will not result in any physical disturbance to Wood Buffalo National Park or create any new access routes to its borders. The project does not involve extraction of resources within its boundaries and is not likely to cause adverse effects to ecosystems within the park. Based on the panel's review of the project, effects of the Frontier project on Wood Buffalo National Park are expected to be of negligible or low magnitude. Since the park's location or remoteness will not be altered, the Frontier project is not expected to result in any changes to the integrity, management or protection of the park, which support the outstanding universal value of Wood Buffalo National Park.

Panel Conclusions on Potential Effects of the Frontier Project on the Outstanding Universal Value of Wood Buffalo National Park

[2977] For criterion (vii), the panel finds valid linkages exist for project effects on migratory birds, Peace-Athabasca Delta hydrology, water quality and health risk. The panel agrees with Teck's assessment that no linkage exists for the Wood Buffalo National Park bison herd, the salt plains or gypsum karst. Additionally, the panel does not consider the Ronald Lake bison herd to be an element of the outstanding universal value of Wood Buffalo National Park. Until recently the Ronald Lake bison herd was considered a provincial herd and the majority of the herd's historic and current range is located outside of the park.

[2978] For criterion (vii), the panel finds the following:

- The project will not affect migratory bird breeding habitat in the park. While the loss of habitat in the vegetation and wildlife regional study area may affect the local distribution of migratory birds it is not expected to affect migratory bird populations in the park. Mortality risk from tailings ponds and other project infrastructure is expected to have a negligible effect on migratory bird populations that breed in the park. While the cumulative effect from all oil sands developments might have measurable effects they are not expected to threaten the sustainability of bird populations in the park.
- The project will not affect breeding habitat for Whooping Crane in the park. Mortality risk to Whooping Crane resulting from the project, and the project together with other existing and approved projects, is not expected to result in a change in abundance of the population, although changes to stopover habitat might alter their distribution during migration. Project factors influencing Whooping Crane abundance and distribution are not expected to threaten the sustainability of the regional population or recovery efforts.
- The project is expected to cause negligible changes to the flows and water levels in Ronald Lake, Lake Claire and the Athabasca River. As the flows and water levels in Lake Claire and the Athabasca River are directly linked to those in Peace-Athabasca Delta, it is also expected that the project will cause negligible changes to the flows and water levels in the Peace-Athabasca Delta.
- The project is expected to have a negligible effect on surface water and sediment quality in Ronald Lake, Lake Claire and the Athabasca River. As effects on water and sediment quality are expected to be negligible upstream of the Peace-Athabasca Delta, the effects are also expected to be negligible within the Peace-Athabasca Delta and further downstream.
- Risks to wildlife and human health associated with changes in water quality and air quality are expected to be low in the park and in the Peace-Athabasca Delta.

[2979] Based on these findings, the panel concludes that the Frontier project is likely to have a negligible effect on the key indicators identified for criterion (vii).

[2980] For criterion (ix), the panel finds that a valid linkage exists between the project and the Great Plains-Boreal grassland ecosystem related to potential changes in water levels or air emission effects. While a valid linkage exists between the project and predator-prey relationship between wolves and wood bison for the Ronald Lake herd, the panel does not consider the Ronald Lake herd to be an element of the outstanding universal value for Wood Buffalo National Park.

[2981] For criterion (ix), the panel finds the following:

- The project is not expected to result in adverse effects to Great Plains-Boreal grassland ecosystem as changes in water levels, air quality and aerial deposition of contaminants in the Peace-Athabasca Delta and Wood Buffalo National Park are expected to be negligible.

- Because the panel finds no linkage between the project and the predator-prey relationship of wolves and bison in the park, the panel concludes that the project will not adversely affect the predator-prey relationship between wolves and bison in Wood Buffalo National Park.

[2982] Based on these findings, the panel concludes that the Frontier project is likely to have a negligible effect on the key indicators identified for criterion (ix).

[2983] For criterion (x), the panel finds that no linkage exists for Whooping Crane breeding habitat as the only known breeding habitat is located within the park and will not be affected by the project. As discussed under criteria (vii) for migratory birds, a linkage does exist between the project and Whooping Crane migration. A valid linkage also exists for the Great Plains-Boreal grassland ecosystem related to potential changes in water levels or air emission effects.

[2984] For criterion (x), the panel finds the following:

- The project will not affect breeding habitat for Whooping Crane in the park. Mortality risk to Whooping Crane resulting from the project, and the project together with other existing and approved projects, is not expected to result in a change in abundance of the population, although changes to stopover habitat might alter their distribution during migration. Project factors influencing Whooping Crane abundance and distribution are not expected to threaten the sustainability of the regional population or recovery efforts.
- The project is not expected to result in adverse effects to Great Plains-Boreal grassland ecosystem as changes in water levels, air quality and aerial deposition of contaminants in the Peace-Athabasca Delta and Wood Buffalo National Park are expected to be negligible.

[2985] Based on these findings, the panel concludes that the project is likely to have a negligible effect on the key indicators identified for criterion (x).

[2986] The panel also finds that the project is not likely to affect the integrity and protection and management of the park.

[2987] As project effects on the key indicators representing criteria (vii), (ix), and (x) are expected to be negligible and the project is not expected to affect the integrity and protection and management of the park, the panel concludes that the Frontier project is likely to have a negligible effect on the outstanding universal value of Wood Buffalo National Park.

28 Paleontological, Archaeological, and Historic Resources

[2988] The project has the potential to affect paleontological, archaeological, and historic resources within its footprint. Paleontological resources could be disturbed during overburden removal in the mine pits and possibly during excavation of the drainage ditches. Vegetation clearing and project construction will affect any historical resources in the project disturbance area by disrupting the sediments that contain archaeological sites. Effects on archaeological and historical resources are most likely to occur during the construction and commissioning phase, when site clearing and preparation and construction of facilities and infrastructure takes place (integrated application, volume 8, pp 2-1 through 2-9, and volume 2, section 11: Historical Resources, p. 11-1).

[2989] Historic resources in Alberta are protected under the *Historical Resources Act* and are defined as “any work of nature or of humans that is primarily of value for its paleontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest including, but not limited to, a paleontological, archaeological, prehistoric, historic or natural site, structure or object.”

[2990] The Alberta *Historical Resources Act* is administered by the Historic Resources Management Branch of Alberta Culture and Tourism. Approval from the minister of Alberta Culture and Tourism is required before a paleontological site, or any historical resources site, can be disturbed. Under Alberta Culture and Tourism, the Royal Tyrrell Museum of Palaeontology issues permits, reviews permit reports, and determines any additional work or mitigation measures needed for a development. Final *Historical Resources Act* clearance and requirements for paleontology are issued through the Historic Resources Management Branch.

[2991] Also applicable are the *CEAA 2012* requirements specified in section 5(1):

effects taken into account in relation to [...a project...] (c) with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on (i) health and socio-economic conditions, (ii) physical and cultural heritage, (iii) the current use of lands and resources for traditional purposes, or (iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Paleontological Resources

Evidence

[2992] Teck considered whether the construction and operation phase of the Frontier project might result in loss of paleontological resources, loss of interpretive value, or both. It stated that project activities will disturb strata with high paleontological potential, which could result in the loss of contents or disrupt the interpretive context of paleontological sites.

[2993] Teck reported that the Waterways, Clearwater, Grand Rapids, Joli Fou, Pelican, and Shaftesbury formations, which occur in the paleontology survey area (land around the project disturbance area where bedrock exposures occur, up to 20 km away), are strata with high paleontological potential. Field surveys for the Frontier project found fossil sites of high heritage value containing ammonites and shark material. However, except for the Clearwater Formation, none of these sites are in the project disturbance area and they will not be affected by project activities. In Teck's view the paleontology field surveys completed in 2007 and 2008 provide adequate coverage to assess the project. Teck conducted no further studies with respect to paleontological resources. Teck provided no baseline or assessment update for paleontology, and paleontological resources were not discussed further as part of the project update.

[2994] Teck reported that the project will disturb the Clearwater Formation during overburden removal in the mine pits and possibly during excavation of the drainage ditches. The Clearwater Formation has high paleontological potential and has yielded marine reptiles and ammonites at other sites, which are fossils of high heritage value. Therefore there is a high likelihood that the project will affect paleontological resources of high heritage value.

[2995] As stated by Teck, paleontological resources are protected and regulated under the Alberta *Historical Resources Act*; any disturbances to paleontological sites must be approved by the minister of Alberta Culture and Tourism. The minister determines the significance of the effect and any required mitigation. The Royal Tyrrell Museum of Palaeontology and Alberta Culture and Tourism will determine what mitigation measures are necessary to address project effects on paleontology. Teck will protect paleontological resources, and will address any mitigation requirements. After any required mitigation is completed and the minister of Alberta Culture and Tourism gives approval for the project, no residual project effects are recognized.

Analysis and Findings

[2996] The panel is satisfied with the adequacy of the work that Teck has conducted with respect to paleontological resources. The panel notes that Teck must also adhere to any requirements and mitigation measures determined by the Royal Tyrrell Museum of Palaeontology and Alberta Culture and Tourism to be necessary.

Significance of Effects on Paleontological Resources

[2997] Once Teck has complied with the requirements and mitigation measures determined by the Royal Tyrrell Museum of Palaeontology and Alberta Culture and Tourism to be necessary, no residual project effects remain. Since there are no residual project effects, there are also no cumulative effects.

Other Historic Resources

Evidence

[2998] Teck assessed the potential effects on historic resources. Historic resources are residues of past cultures or societies and are non-renewable resources. Once a site is disturbed, context cannot be replaced, recreated, or restored. Teck acknowledged that project construction would disturb historical resources and will affect the interpretive value of historical resources sites.

[2999] Teck indicated that adverse effects on historical resources are most likely to occur during the construction and commissioning phase, when site clearing and preparation and construction of facilities and infrastructure takes place. This effect, if not controlled through mitigation (site documentation and investigation), results in the permanent loss of part of the non-renewable historical resources record. Depending on the heritage value of the specific historical resources site, a significant adverse effect could occur (integrated application, volume 2, section 11).

[3000] Teck has conducted five historical resources studies that apply to the updated project area. Archaeological permits for these studies were issued by Alberta Culture and Tourism between 2008 and 2014. Alberta Culture and Tourism also issued two *Historical Resources Act* requirements letters for the project. Based on these authorized studies, 197 archaeological (which includes “historic”) sites lie within the project disturbance area, including a substantial number that will likely require additional investigation. Additional historic resources impact assessment investigations in the project disturbance area will be completed as required by Alberta Culture and Tourism. Teck will complete this work in phases so that all necessary studies are completed in advance of vegetation clearing in each development area.

[3001] Teck acknowledged that the project disturbance area is located in an area rich in historical resources. Teck stated that Alberta Culture and Tourism regulates any effects to historical resources sites through the *Historical Resources Act*. Alberta Culture and Tourism reviews historic resources impact assessments submitted for proposed development areas and independently assesses the significance of individual sites and determines the need for, and the scope of, mitigation measures.

[3002] Teck reported that several First Nations and indigenous groups expressed concern about the project’s potential effects on the cultural importance of paleontological, archaeological, prehistoric, historic, natural, and aesthetic sites or places to First Nations and aboriginal peoples as well as concern about trails, burial, and spiritual sites.

[3003] Teck stated it plans to work collaboratively with aboriginal communities to understand and address their concerns regarding historical resources in culturally appropriate ways, while also meeting the requirements specified by Alberta Culture and Tourism. Teck’s and Athabasca Chipewyan’s joint letter includes an objective of avoiding or minimizing impacts of the project on heritage resources.

[3004] The trappers' panel reported that grave sites were located within the project development area. However, Teck reported that no burial or spiritual sites were recorded during the historical resources studies conducted in the project development. Teck also cited the Fort McKay traditional land-use study (2011) in this regard.

Analysis and Findings

[3005] Teck must develop and implement an historical resources management plan to track the status of studies and correspondence with Alberta Culture and Tourism, including *Historical Resources Act* clearance for project components and for historical resources sites. The management plan must include a discovery protocol so that sites identified during future construction phases of the project are properly managed. The management plan will provide the basis for ongoing review of changes to the project disturbance area (including expansion of vegetation clearing areas in Teck's control) and the potential effects of such changes on historical resources sites. The panel notes that Teck also committed to involving affected First Nations and indigenous groups in future historical resources assessments and in developing and implementing the historical resources management plan.

[3006] Teck must also continue to work with Alberta Culture and Tourism, which issues the necessary archaeological permits and requirements letters to enable the work to proceed. Teck committed to ensure that appropriate and acceptable scopes of work are undertaken relative to *Historical Resources Act* requirements and project scope and schedule. Teck stated it will work with indigenous communities to address local concerns and interests regarding historical resources.

[3007] The panel notes that the joint letter submitted by Athabasca Chipewyan and Teck includes a section related to heritage resources. It commits to avoiding or minimizing impacts to them. Teck will work to accomplish this by using reasonable efforts to avoid or minimize impacts through implementation of a "chance-find and cultural heritage management plan."

[3008] Alberta Culture and Tourism issues requirements for mitigation at identified historical resources sites and issues *Historical Resources Act* clearance for the projects to proceed relative to historical resources. Consequently, project-specific effects on archaeological (which includes "historic") resources are continually mitigated to the standards set by Alberta Culture and Tourism. After implementation of mitigation measures as required by Alberta Culture and Tourism, there will be no effects from the project on historical resources.

[3009] The panel is satisfied with the adequacy of the work that Teck has conducted and has committed to conduct with respect to archaeological and historical resources.

Significance of Effects on Other Historical Resources

[3010] Once Teck has complied with the requirements and mitigation measures determined by Alberta Culture and Tourism to be necessary, no project effects remain. Since there will be no project effects, there are considered to be no cumulative effects.

29 Public (Human) Health

[3011] Teck completed a human health risk assessment to assess the potential health impacts of air emissions and surface water releases from the project. It assessed air emissions and surface water releases of chemical contaminants that may adversely affect human health via multiple exposure pathways, including air, water, soils, and from local and traditional foods. The human health risk assessment incorporated regional data on contaminant levels where available, and Teck consulted with local indigenous groups in order to improve inputs to the estimation of current and predicted exposures to COPCs that were identified by Teck.

Methodology

Evidence

[3012] According to Teck, the human health risk assessment was conducted consistent with guidance provided by regulatory agencies such as Health Canada and Alberta Health. The assessment consisted of the following:

- the identification of COPCs through a detailed evaluation of air and water emission inventories (prepared as part of Teck's air emissions and surface water quality assessments), followed by estimation of potential acute and chronic exposures of human receptors potentially located throughout the local study area and beyond (including nearby cabins, traditional use areas, and worker lodges; plus locations around Fort McMurray and Fort Chipewyan, which are beyond the boundaries of the local study area) and included evaluations of potential contaminant exposures through multiple pathways (e.g., addition of exposures via inhalation, water, foods and soil). Exposures from country foods, including local plant and prey species, were included, with input from aboriginal communities. Estimation of potential exposure scenarios included the base case, application case and planned development case;
- the selection of acceptable exposure limits for all the COPCs based on published values prepared by regulatory and scientific agencies, where available;
- the ratio of maximum expected estimations of exposure against selected regulatory exposure limits was used to derive a risk quotient, both for individual COPCs, combinations of chemicals with similar health hazards, and for multiple exposure pathways; and,
- where a risk quotient >1 was calculated, a more detailed analysis of the potential risk was conducted, including determining whether the conservative assumptions incorporated into the analysis were too extreme, the degree to which the proposed project would contribute to any risk, and potential mitigation actions, including long-term monitoring and surveillance.

[3013] Teck stated that the initial conservative assumptions included overestimates of maximum exposures by assuming long-term exposure (either 80 years for a resident or 60 years for a worker) to the highest predicted concentration of that COPC within the local study area (over 900 locations were identified and modelled); additionally, the regulatory exposure limits are designed to be conservative.

[3014] For the inhalation assessment, Teck considered several different subgroups of area residents including:

- Cabins – including known locations of cabins within the study area
- Communities – including all permanent community residents living in Fort McKay, Fort McMurray, Fort Chipewyan and other known communities within the human health risk assessment study area (the air quality local study area)
- Places of interest – including known sacred sites, traplines, or traditional habitat, harvesting or hunting sites, natural areas, parks, camp sites, fishing locations
- Worker group – including adult individuals who stay at housing complexes or lodges within the human health risk assessment study area, and work in the area for a duration that is less than a lifetime.

[3015] In addition Teck modelled more than 900 locations around the project disturbance area boundary.

[3016] For the multiple pathway assessment, Teck considered three groups of individuals:

- Community resident – includes individuals who live in the established communities in the local study area (Fort McKay, reserves) as well as Fort McMurray and Fort Chipewyan (including reserves). It was conservatively assumed that these individuals harvest and consume game and fish from the local study area on a regular basis.
- Maximum resident local study area – this group of locations includes all cabin and places of interest within the project development area boundary, and the locations where the maximum predicted ground-level concentrations of the chemicals are predicted on an annual basis. This group represents individuals who practice a traditional lifestyle but do not live in the larger, established communities. It was assumed that these individuals harvest and consume game and fish from the local study area on a regular basis.
- Worker group – includes adult individuals who stay at housing complexes or lodges within the human health risk assessment study area, and work in the area for a duration that is less than a lifetime. For this group, a change that has been made in response to feedback from stakeholders is the addition of food consumption exposure pathways, as these were not assessed previously.

Analysis and Findings

[3017] The panel finds the human health risk assessment was conducted in accordance with accepted regulatory practice, is consistent with guidance from Health Canada and Alberta Health for public health risk assessment, and that Teck consulted with potentially affected residents.

[3018] It appropriately identified COPCs that could be released from the Frontier project throughout its various phases, used estimations of exposure that were deliberately conservative (precautionary) in their derivation to reflect reasonable worst-case conditions, and compared the results against conservative regulatory values for safe exposure limits.

[3019] The panel finds that the selection of receptors for exposure assessment was robust. It adequately considered the range of exposures that people in the area might receive, including those residing within indigenous communities and those practicing a traditional lifestyle.

Effects of the Project

Evidence

Air Emissions

[3020] For emissions of COPCs to air, Teck predicted that acute health-based guidelines for the air contaminants NO₂ and, to a lesser extent, SO₂ and PM_{2.5} would be exceeded at some locations close to the facility. For example, there were exceedances at some cabins but not in any communities in the region. Except for NO₂, exceedances were few in number and generally were more prevalent under existing conditions and in the base case. There were generally less exceedances under the planned development case due to the assumption of industry-wide adoption of Tier IV emission standards for mine fleets (see section 14, "[Air Quality](#)"). For NO₂, the magnitude of all exceedances over regulatory values was small. Teck conducted a relative frequency analysis of exceedances and concluded the likelihood of exposures over these values was also low. Teck stated that the major contributor to NO₂ exceedances under existing and base case conditions were air emissions from the fleets of diesel haulage trucks in the region. Teck's assessment assumed the mine fleets contributing to regional air emissions would all be upgraded to Tier IV truck engines by 2025 when the Frontier project comes into operation. This is discussed further in section 14, "[Air Quality](#)."

[3021] For chronic exposures to COPCs, the assessment predicted a very small number of exceedances. No exceedances were noted for community locations, and the few exceedances noted in specific locations closer to the Frontier project are present in the base case.

[3022] Overall, Teck expected that the health risks associated with NO₂, PM_{2.5}, and SO₂ concentrations would be low. Its analysis concluded that the incremental change in health risk due to inhalation of air

contaminants between the base case and application case are generally negligible. This suggests that the project will have a minimal impact on health risks in the region.

[3023] Mikisew presented an alternative human health risk assessment that indicated increased health risks in the Chenal des Quatre Fourches area of Wood Buffalo National Park due to air transport of pollutants from the proposed project. The Chenal des Quatre Fourches area is an area of particular importance to Mikisew for traditional use.

[3024] Teck questioned the appropriateness of Mikisew's approach, particularly the methodology used to estimate air emissions and the dispersion model used to predict transport of the pollutants. Teck argued that the model was not appropriate given the distance between project and the source of exposure, which is about 100 km.

Other Exposure Pathways

[3025] For possible exposure to COPCs through pathways other than direct inhalation, Teck conducted multiple exposure pathway assessments. Teck identified exceedances of health-based guidelines for ingestion of foods containing methylmercury and manganese in the multiple exposure pathway assessments, both for community residents and local groups in work camps or cabin occupants. Following more detailed assessment, Teck's conclusions were as follows:

- Predicted increases in manganese exposures were small and exposure levels were well within the range of typical Canadian exposures. Teck concluded no adverse effects would be expected.
- There is currently a regional fish consumption advisory on the Athabasca River in relation to methylmercury concentrations. Teck stated that the methylmercury in fish collected from various areas in Alberta is within similar ranges to fish sold commercially.
- Present levels of methylmercury observed in local fish, including those caught in the Athabasca River, at times exceed levels in Health Canada guidelines. Teck's assessment concluded the frequency and level of exceedances would remain unchanged across the base case, application case, and the planned development case; that is, exposures (and therefore risks) would not be significantly increased due to the project and would remain comparable to fish caught in other regions of Alberta.
- Using Health Canada's current (2007) health-based limit for methylmercury, which is less stringent than the United States Environmental Protection Agency's value used in Teck's assessment, would reduce predicted risk by 50%.

[3026] ECCC disagreed with Teck's assessment of potential methylmercury concentrations in the future fish habitat compensation lake and recommended additional data collection and modelling to assess this issue.

[3027] Concerns about possible health hazards associated with naphthenic acids were raised by CPAWS, the Original Fort McMurray First Nation, the Clearwater River Band, Stand Earth, and ECCC. It was noted that naphthenic acids are naturally occurring in parts of the region but that many of these acids are also concentrated in tailing ponds and may degrade only very slowly, and that the health hazards associated with naphthenic acids are not fully understood.

[3028] Teck noted although the human health risk assessment discussed the health hazards of naphthenic acids in a qualitative manner, the lack of health-based exposure limits for naphthenic acids prevented it from making a quantitative estimation of risk. Teck committed to maintaining water quality in the area with respect to naphthenic acids contamination by capturing runoff, using mitigation measures for seepage, and using collection wells.

Carcinogens

[3029] Teck acknowledged long-standing concerns about possible increases in cancers in the local community of Fort Chipewyan. Teck noted that an update to the ongoing surveillance program being conducted by Alberta Health Services had been shared with the community and now covers the period between 1997 and 2016. Teck stated they understood the community would make the decision on whether or not to share the results more widely.

[3030] Teck's human health risk assessment included detailed evaluations of whether the Frontier project could increase cancer risks from lifetime exposures of local and area residents to potentially carcinogenic COPCs. It concluded that incremental risks following lifetime exposures were low (less than 1 in 100 000 increase in cancer based on a lifetime's exposure) for area communities and locations close to the project development area. The human health risk assessment identified slight increases in cancer risk from current risk levels in a few specific locations close to the project development area for three of the COPCs assessed: benzene, PAHs (as a group, and as represented by a typical PAH, benzo(a)pyrene), and hexavalent chromium. These locations were either worker camps or places where people would visit (e.g., cabins) but not occupy for long periods of time. Teck stated that the assumption of constant exposure over a lifetime (60 years for workers at camps or 80 years for people frequenting cabins and places of interest) used in the assessment is highly conservative, and Teck concluded there would be no increased risk of cancer as a result of the project.

[3031] During the multiple pathway assessment, a potential increased cancer risk was identified related to PAHs and benzo(a)pyrene. The increased risks were due mostly to vegetation uptake of dusts containing these chemicals by moose foraging on vegetation or by direct ingestion of plants such as berries by local residents. Detailed review of these results confirmed that the apparent increase in risk was due to the incorporation of multiple conservative assumptions within the methodology. Further detailed evaluation concluded that PAH/benzopyrene exposures to local inhabitants would be well within the

normal range of exposures. Following the detailed review, Teck concluded the contribution from the project to cancer risk in the region would be negligible.

[3032] Keepers of the Athabasca described the community's perspective about the fears of excess cancers in the community and reaffirmed their frustration with the continuing lack of a focused health study on communities within the region. Submissions from Athabasca Chipewyan, Mikisew Cree, and Smith's Landing First Nations repeated and reinforced this long-standing concern.

Other Concerns

[3033] The joint Teck–Athabasca Chipewyan and Mikisew-Teck submissions to the panel include a number of commitments, recommendations, and proposed conditions related to mitigation, monitoring and adaptive management (see [Appendix 11](#)). Commitments included addressing exposures to numerous COPCs through the monitoring of air quality, water quality, wildlife and fish health, and management of tailings discharge to ensure chemical emissions from the facility would not impact human health. These commitments further included a community-based monitoring approach. Additionally, there were commitments by Teck to advocate for and support future research.

[3034] The Teck–Athabasca Chipewyan joint letter to the panel includes a recommendation that the Crown lead a ten-year community health baseline study starting upon project approval, with follow-up monitoring occurring every five years. The letter also commits Teck to work cooperatively with Athabasca Chipewyan, other indigenous communities, and with the Crown on the conduct of the study, and Teck confirmed that it would be willing to provide funding consistent with regional industry participation and funding. The Teck-Mikisew agreement similarly calls for a government-led study and commits Teck to support and participate in regional studies.

[3035] Health Canada stated it was in favour of the proposed community health baseline study.

[3036] Health Canada stated that its review of the proposed project focused on the potential health impact of four components: air quality, drinking water quality, noise, and chemical contamination of country foods. Health Canada had the following concerns:

- The human health risk assessment's predictions for air quality will be invalid if the entire mine fleet does not meet Tier IV standards from the start of mine operations.
- Because Teck will use polyacrylamide as a process chemical, there is a risk to users of downstream water treatment plants in the event of a spill.

[3037] Health Canada recommended monitoring to ensure predictions made within the human health risk assessment are accurate or conservative, including a recommendation that levels of methylmercury and lead are monitored over the life of the project.

[3038] Health Canada confirmed its position that the levels of methylmercury in local fish, as predicted in Teck's human health risk assessment, would not pose a risk provided people are following consumption advice from authorities.

[3039] Health Canada recommended lead analyses be included in future monitoring, despite evidence in the human health risk assessment, which it did not dispute, that the project will not increase environmental levels of lead in the region. Health Canada stated this recommendation was made for reasons of precaution and in recognition of the high hazard presented by lead exposures.

[3040] Many participants expressed concerns about emissions from the proposed facility increasing the incidence of adverse health effects, including cancers, among local communities—both directly and indirectly through consumption of contaminated country foods and natural food sources. The physiological and cultural importance of maintaining a traditional way of life, including the consumption of local foods such as buffalo, moose, fish, and birds and birds' eggs, was repeatedly emphasized as was frustration with ongoing guidance not to drink spring, river, and lake water.

[3041] Numerous witnesses and submissions, including local residents and trappers, Athabasca Chipewyan, Mikisew and Smith's Landing, expressed concern about drinking water quality and stated that local residents and visitors no longer drink surface water because of perceived contamination.

[3042] Many participants maintained that the cumulative effect of oil sands development is having a detrimental impact on water and air quality and, in turn, affecting the health of people who reside and travel in the region. Athabasca Chipewyan and Mikisew described how effects on air and water quality were affecting the health of the fish, wildlife, and plants they rely on for food. The deteriorating quality of meat and plants has contributed to concerns about deteriorating health among residents of the region.

[3043] Teck submitted that considering the proposed mitigation activities for the project to manage chemical releases to air and surface water, any changes to air, surface water and soil quality would result in insignificant increases in exposure to COPCs. Their assessment concluded that changes in exposure to COPCs between the base case and application case health risks are small or nonexistent, which implies that the project is not expected to contribute appreciably to human health risks. Furthermore, Teck stated that emissions from the project in combination with other emission sources in the oil sands region are not expected to result in adverse health effects. Teck noted that changes in health risk between the base case and the planned development case are also small. Overall, Teck concluded that no adverse health effects are expected as the result of the Frontier project combined with existing and additional projects and activities planned for the region.

Analysis and Findings

[3044] The panel accepts that a human health risk assessment is based on models that involve numerous assumptions and that certain relevant data might not be available. The panel finds that the approach taken

in this human health risk assessment was set up to be conservative (i.e., precautionary) in its conclusions. The panel notes a high degree of conservatism was included in the human health risk assessment, including in the air quality predictions, the use of maximum exposure levels from hundreds of potential receptor locations as the input for estimating long-term or lifetime human exposure, and the use of conservative regulatory exposure limits. The one area where the air quality assessment, and hence the results of the human health risk assessment, may not be conservative is with respect to NO₂.

[3045] The panel finds that the incremental health risk change due to inhalation of air contaminants between the base case and application case are generally negligible. However the human health risk assessment identified NO₂ as an air pollutant of concern in the region, and the adoption of Tier IV emissions technology for mine fleets by 2025 by all oil sands mine operators was assumed in the human health risk assessment. The panel agrees with Health Canada that if adoption does not occur by this date, the results of the health risk assessment for NO₂ may not be valid. While Teck can control what technology it uses for its mine fleet, it cannot control what equipment other operators use and there is currently no regulatory requirement that existing mine equipment achieve the new Tier IV emissions standards.

[3046] The panel has included approval conditions and made recommendations to Teck to ensure NO_x emissions from the project are minimized. The panel has also included a recommendation to Alberta concerning regional NO_x emissions from mine fleets. While the panel recognizes there is some uncertainty about the validity of the assumptions used for NO₂ emissions in the health risk assessment, regional ambient air quality monitoring is conducted in the Lower Athabasca region. If air quality approaches or exceeds limits and thresholds identified in the *AQMF*, many of which are health based, Alberta is required to take management action. This will ensure health risks related to NO₂ exposure are appropriately managed in the region.

[3047] As discussed in section 14, “[Air Quality](#),” the AERMOD EPA Regulatory Model used by Mikisew to support its health risk assessment was not appropriate because the distance between the project and receptors in the Chenal des Quatre Fourches area exceed the limitations of the model. The model was also not calibrated. For these reasons the panel finds it cannot rely on the exposure levels predicted by the model and therefore does not accept the results of Mikisew’s alternative human health risk assessment.

[3048] The panel understands that methylmercury levels in some country foods in the region currently exceed health-based levels, as evidenced by current advisories for fish and eggs. It also notes that Teck’s predicted concentrations of methylmercury are comparable with levels currently collected from fish in other regions of Alberta. The panel recognizes the challenges in balancing health concerns due to ingestion of fish containing methylmercury with the well-described health advantages of eating locally-sourced high-quality fish protein. The panel acknowledges Health Canada’s position that local fish should continue to be consumed as long as relevant guidance is followed.

[3049] The panel agrees with Teck's assessment that the project is not likely to contribute to increased risks from methylmercury. Teck's commitment to remove organic materials during construction of the fish habitat compensation lake and the off-stream storage pond located in Unnamed Creek 2 is an acceptable mitigation to address this risk, and the panel has made this a condition of approval. The panel has also imposed conditions related to additional baseline mercury sampling prior to construction of the fish habitat compensation lake and off-stream storage pond and future monitoring of mercury and methylmercury in these water bodies. The panel's findings, conditions and recommendations related to methylmercury in the fish habitat compensation lake and other water bodies in the vicinity of the Frontier project is found in section 18, "[Surface Water Quality](#)." Future monitoring will determine if methylmercury levels are elevated in the fish habitat compensation lake and if necessary, additional mitigation measures can be implemented.

[3050] The panel notes Health Canada's recommendation for Teck to monitor methylmercury concentrations in fish, in conjunction with the concerns about adverse health impacts expressed by various local groups, and agrees that an appropriate monitoring and surveillance program is required. The panel is requiring Teck to develop and submit an aquatic environmental effects monitoring plan as a condition of approval and expects that monitoring of methylmercury in fish tissue will be included in this plan. The panel also understands that this may be a condition of any approvals issued by DFO.

[3051] With respect to naphthenic acids, the panel notes Teck's commitment to maintaining water quality in the project area. Further, the joint commitments between Teck, Mikisew and Athabasca Chipewyan will allow and encourage the development of focused study on this matter. The panel is aware that research on naphthenic acids is continuing under the Oil Sands Monitoring Program and that efforts are being made at the federal level to develop a water quality guideline for oil-sands-derived naphthenic acids. The panel recommends that ECCC complete the development of a water quality guideline for naphthenic acids as soon as possible as this has been a long-standing concern for communities and has been a recommendation in previous joint review panel reports.

[3052] With respect to the potential for increased cancer risk, the panel agrees with the results of Teck's assessment that the project is not likely to result in an increase in cancer risk. The health risk assessment makes use of a number of conservative assumptions that when compounded can over predict risk. This is what makes the assessment conservative (i.e., precautionary). For the increased risk associated with PAH/benzopyrene identified in Teck's health risk assessment, the detailed calculation showed that the highest predicted estimated daily intake of all PAHs in the benzo(a)pyrene group was estimated to be about 0.7 µg/day. This considered all exposure pathways and was for a local study area user that received the maximum exposure. It is also for the planned development case, which includes emissions from projects that have not been approved or constructed. In comparison, the estimated daily dietary intake of PAHs for individuals from several countries ranges from 0.02 to 28 µg/day. The 0.7 µg/day falls within and towards the low end of the range. This supports Teck's conclusion that the project and the project

together with other existing, planned and approved projects is not a significant source of PAH exposure and are not likely to result in an increase in cancer risk due to PAH exposure.

[3053] Because the Frontier project is not expected to contribute to any additional lead exposure in the region, the panel does not feel it necessary or appropriate to impose a condition on Teck related to lead monitoring. If lead monitoring is required, it should be conducted as part of regional monitoring programs. The panel recommends that Alberta and Canada consider the need to include lead monitoring as part of regional monitoring programs.

[3054] With respect to Health Canada's concerns about the potential for a spill involving polyacrylamide, it is expected that Teck will store and handle any hazardous chemicals in accordance with relevant regulatory requirements and be able to contain and respond to any spills. Teck is required, as a condition of approval, to develop and submit to the AER an emergency response plan prior to construction of the project. Spill response procedures and notification of regulatory agencies and potentially affected individuals or communities will be elements of the emergency response plan. Based on these requirements, the panel is satisfied that the potential risks of chemical spills will be appropriately managed.

[3055] The panel recognizes that people in the communities of Fort McKay and Fort Chipewyan and people living or working on the land are those that will be living and working closest to the Frontier project. The panel also recognizes that the safety of traditional diets and country foods continues to be a concern for community members. The panel is satisfied that Teck has specifically assessed the potential health impacts resulting from the project on indigenous communities, traditional land users and workers in the area. The assessment includes consideration of effects resulting from project emissions to air and surface water and exposure to air, surface water, soils and country foods.

[3056] The human health risk assessment assumed cabin residents get all their drinking water from local surface water bodies, and no increased risk due to the possible presence of chemical contaminants was identified. However the panel notes Health Canada's general recommendation for the public not to drink untreated water and is aware this is a standard recommendation made across Canada, driven in large part by concerns about various pathogens and parasites such as *E. coli*, giardia, and cryptosporidium in addition to possible chemical contamination.

[3057] Based on the assessment, the panel concludes that the project is not likely to result in increased health risks for indigenous communities, traditional land users or workers in the area of the project or the region.

[3058] The panel is encouraged that Teck, Athabasca Chipewyan and Mikisew have jointly developed recommendations and proposed conditions that include focused monitoring, including community-based programs. The panel recommends that Teck support the Mikisew – Athabasca Chipewyan community-

based monitoring program and incorporate this this program into its monitoring and reporting programs for the Frontier project. Knowledge gained from such monitoring will provide the basis to confirm the predictions made in the human health risk assessment, or where necessary identify additional mitigation measures to ensure risks to human health are minimized. Information from community-based monitoring programs may also help improve community confidence in the predictions.

[3059] The panel recognizes that there continue to be concerns about increased cancer risks in local communities. While the panel understands that Alberta Health Services has been conducting a surveillance program and recently provided an update to the communities, this information has not been publicly released and was not available to the panel. In the absence of any further information on cancer incidence in the communities and in light of the ongoing and significant concerns expressed by community members about cancers risks, the panel supports the recommendations made by Teck, Mikisew and Athabasca Chipewyan for a community health baseline study. The panel believes that such a study could result in improved understanding of this issue and increase community confidence about the potential for health risks in the region. The panel recommends that Alberta and Canada conduct a Crown-led ten-year community health baseline study that includes representation from local communities and oil sands operators. The panel acknowledges Teck's commitment to support such a study, should it be conducted. The panel recommends that Teck support the community health baseline study for the oil sands region, should Alberta and Canada conduct such a study.

[3060] In summary, Teck's methodology and analysis in its human health risk assessment was appropriate, conservative and thorough, and the panel believes it can rely on the results. The panel finds that chemical emissions from the project are low and their contribution to health risks in the region is expected to be low to negligible. As a result, the project is not expected to result in significant adverse effects to human health in the project area or the region.

Recommendations for Teck

[3061] The panel recommends that Teck support the Mikisew – Athabasca Chipewyan community-based monitoring program and incorporate this program into Teck's monitoring and reporting programs for the Frontier project.

[3062] The panel recommends that Teck support the community health baseline study for the oil sands region, should Alberta and Canada conduct such a study.

Recommendations for Alberta

[3063] The panel recommends that Alberta consider the need to include lead monitoring as part of regional monitoring programs.

[3064] The panel recommends that Canada and Alberta initiate and implement a Crown-led ten-year community health baseline study and include representation from local communities and oil sands operators.

Recommendations for Canada

[3065] The panel recommends that ECCC complete the development of a water quality guideline for naphthenic acids as soon as possible as this has been a long-standing concern for communities and has been a recommendation in previous joint review panel reports.

[3066] The panel recommends that Canada consider the need to include lead monitoring as part of regional monitoring programs.

[3067] The panel recommends that Canada and Alberta initiate and implement a Crown-led ten-year community health baseline study and include representation from local communities and oil sands operators.

Significance of Project Effects

[3068] Based on the criteria provided in the Agency's guide *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of adverse project effects on human health in the local study area:

[3069] The project is located in the within the mineable oil sands area of the Lower Athabasca region which has experienced significant industrial development over the past 40 years. The project is located downstream of other oil sands mines in an area that has experienced less industrial development.

[3070] The effects of the Frontier project on air quality and surface water quality are likely – project activities are expected to result in an increase in concentrations of some COPCs in emissions to air and releases to surface waters, particularly within and close to the project disturbance area, resulting in some increases in both direct exposure (due to breathing and drinking untreated water) and indirect exposure (from deposition of dusts, and ingestion of plants and animals which were exposed to increased concentrations of COPCs).

[3071] The magnitude will be low – while concentrations of some COPCs are predicted to increase in air and surface water bodies, the increases are generally expected to be low and below regulatory guidelines or, absent guideline values, other values justified within the human health risk assessment. On the few occasions where regulatory guidelines are predicted to be exceeded, no significant increases over current concentrations are expected as a result of the project.

[3072] The geographic extent is local – exceedances of health-based criteria are limited to a few receptor sites and water bodies in the local study area.

[3073] The duration is medium – effects will occur over the operational life of the project and during the closure period.

[3074] The frequency is periodic – while effects will occur throughout the construction, operations, and closure phase, the location and nature of the effects are expected to change throughout the phases as mining progresses.

[3075] The effects are reversible – project emissions to air, water and soils will end after project operations cease and closure is complete.

[3076] Based upon the above, the panel finds that the project is not likely to result in significant adverse effects to human health.

30 Social Effects

[3077] The Fort McMurray region has undergone rapid social change since the 1960s, when oil sands development began. The regional economy expanded significantly from the mid-1990s to 2008 because of growth in the oil sands industry. It has gone through periods of rapid growth punctuated with periods of stagnation or downturns. Most recently, the Horse River fire of 2016 drastically affected the community and its infrastructure, including a reduction in the population of Fort McMurray.

[3078] Teck provided a socioeconomic impact assessment of the project in its application in 2011 and updated it in 2015. This assessment outlined the anticipated economic benefits of the Frontier project, as well as the effects of the project on employment, population, housing, social infrastructure, transportation and municipal infrastructure and services.

[3079] The economic effects of the Frontier project are significant. Teck estimated that construction of the project will increase Alberta's gross domestic product (GDP) and household income by \$18.3 billion and \$13.2 billion, respectively. Once fully operational, the project's operation and sustaining capital expenditure is estimated at \$2.1 billion annually or \$76.8 billion over the life of the project. Teck estimated that operation of the project will increase Alberta's annual GDP and household income by \$2.1 billion and \$2.2 billion, respectively.

[3080] The Frontier project will have economic and employment benefits elsewhere in Canada. Approximately \$4.4 billion of total construction spending and \$167 million annually in operation spending is expected to accrue to other provinces. The project will also have a number of economic and employment benefits on the study area. Approximately \$592 million of total construction spending, and \$219 million annually in operation spending, is expected to accrue to the local study area in the form of worker wages and contractor income.

[3081] In its 2015 project update, Teck identified a number of project milestones, including those in [Table 36](#). The panel recognizes that the project schedule has and will continue to change. For the purpose of this decision report, the panel is using the project milestone schedule as submitted by Teck.

Table 36. Project milestones

Milestone	Date
Teck board of directors project sanction decision	2019
Detailed engineering for phase 1	2019–2023
Phase 1 – Production train 1 – Site preparation	2019–2025
Phase 1 – First oil	2026
Phase 2 – Construction	2030–2036
Phase 2 – First oil	2037
Phase 1 and 2 – End of mine life	2066
Closure complete	2081

Employment Effects

Evidence

[3082] The project is expected to create a total of 278 190 person-years of direct, indirect (i.e., suppliers to the project), and induced employment (i.e., the general economy) across Alberta and Canada.

Construction Workforce

[3083] The construction workforce is expected to contribute 38 150 person-years of direct employment (27 675 on site; 4875 off site; 5600 engineering). During construction, the combined total direct, indirect, and induced employment in Alberta is estimated at 75 800 person-years. Other provinces (especially Ontario, Nova Scotia, and British Columbia) will accrue 18 500 person-years of indirect and induced employment. In total, the Frontier project will result in 94 300 person-years of direct, indirect, and induced employment across Canada related to construction activities between 2019 and 2038.

[3084] The on-site construction workforce is estimated to peak at about 6300 workers in 2024 (reflects workers on-site at any given time who require accommodation).

Operations Workforce

[3085] The operation workforce is expected to be 1470 workers (1430 on site) in 2026 when phase 1 begins, and will peak at 2500 workers (2435 on site) in 2038 when both phases of the Frontier project are in full operation. Beyond the 2038 assessment period through to 2066, on-site operations employment levels could fluctuate by between 15 per cent and 25 per cent above this level, potentially reaching between 2800 and 3100 persons on-site.

[3086] The total direct, indirect and induced employment in Alberta, related to project operations, is estimated at about 4100 person-years annually. Other provinces (especially Ontario, British Columbia, and Québec) will accrue 660 person-years of indirect and induced employment.

[3087] Social impacts from the project are largely related to the presence of rotational workers from outside the region and direct and indirect workers who permanently move to the region. The Frontier project has the potential to increase the permanent resident population and affect regional housing, infrastructure, and service providers.

Workforce Availability

[3088] Teck anticipates that the size and quality of the Alberta and Canada labour force with experience in the oil sands will continue to grow. It believes that there will be sufficient construction labour and services available to develop the Frontier project as scheduled, and that the phased development approach for the project will spread out the industry demand for construction skills. During the hearing, the

representative of the International Brotherhood of Electrical Workers Local 424 testified that there are currently 4000 journeymen and 9000 apprentices on their out-of-work list.

[3089] Don Scott, mayor of the Regional Municipality of Wood Buffalo, stated that the workforce in the municipality is currently underused. Mr. Scott stated that much has changed in this region since the use of the fly-in/fly-out workforce model that became common in recent years and the municipality strongly advocated for the use of local employment, stating that it would provide benefits to both the municipality and Teck. Local employment is the driving force of a region, and as such, the municipality wants Teck employees to reside in the region. Mr. Scott stated:

We believe those who extract resources from our region should live in our region, support our businesses, support our airport, support our social profit sector, and support our First Nation and Métis people in businesses.

[3090] Teck stated that it will develop policies and standards to guide local labour-force development and hiring initiatives to increase the potential number of qualified local residents.

Local and Indigenous Business and Training Opportunities

[3091] Teck provided baseline statistics and strategies for indigenous involvement in the labour force, including evidence that unemployment and labour-force participation rates for the indigenous population in Fort Chipewyan and Fort McKay are lower than the provincial average—though they still lag behind the non-indigenous population. Barriers to labour-market readiness in regional indigenous communities include lack of education (secondary and post-secondary), lack of transportation, lack of applicable skills and training (e.g., safety and driver training), and other social and cultural challenges (e.g., difficulties pairing cultural activities such as hunting/gathering seasons with standard work rotations).

[3092] Teck acknowledges that indigenous community members in rural communities such as Fort McKay and Fort Chipewyan have expressed interest in improved access to flexible and culturally sensitive employment and training opportunities in or near their communities. Teck stated that it will implement its corporate-wide indigenous peoples policy.

[3093] Teck stated that it has not established employment targets for indigenous participation in the project, nor does it plan to conduct workforce evaluations for indigenous communities. It will seek to develop employment objectives, metrics, and plans jointly with potentially affected communities through negotiated agreements.

[3094] Teck commits to implement the following measures regarding employment, business, and training opportunity needs:

- Specific contractual commitments to indigenous communities regarding employment, business, and training opportunities will be made within participation agreements negotiated between Teck and the indigenous community.
- Recruiting residents from the region will be first priority, recruiting from the rest of Alberta second, followed by the rest of Canada, North America, and overseas.
- It will draw on various sources of labour in Canada that are traditionally under-represented in the labour market, including indigenous people, immigrants, and women.
- It will develop policies and standards to guide local labour-force development and hiring initiatives to increase the potential number of qualified local residents, businesses, and contractors.
- It will consult with indigenous communities regarding procurement and employment initiatives such as:
 - establishing mechanisms to enhance employment prospects of local residents, including preferential consideration;
 - using procurement processes that regard local ownership and prevalence of workers residing locally as positive criteria in goods and services vendor selection competitions; and
 - establishing monitoring programs that measure local involvement, gather feedback, and work with interested parties on how to improve results.
- It will seek to develop lasting mutual benefits that respect indigenous communities' values and will implement its relevant charters, codes, and policies, including its indigenous peoples policy, when working with indigenous peoples.
- It will use what it has learned to date from local indigenous communities to overcome challenges specific to indigenous employment and procurement in the oil sands.
- It will consider work experience in lieu of a high school graduation for indigenous peoples.
- It will work with the Fort McMurray Chamber of Commerce, the northeastern Alberta Aboriginal Business Association, and others to maximize contracting and employment opportunities in the region.
- It will offer a choice of worker turnaround cycles and opportunities to earn premium pay through overtime.
- It will continue to work with the indigenous communities in the area and specifically with the communities of Fort McKay and Fort Chipewyan to develop indigenous employment and business development programs. It is committed to maximize opportunities for local indigenous businesses to

supply services and products in support of project construction and operations; hire qualified indigenous people from the communities surrounding the project; and support education, training, and investment initiatives in local indigenous communities, where appropriate.

- Beyond direct employment and contracting activities, Teck plans to continue providing direct support to community initiatives through its social investment programs in Fort McKay and Fort Chipewyan.
- Teck's indigenous community employment and business development programs, as well as community-specific participation agreements, will take into consideration input provided by local indigenous communities and will be guided by a commitment to develop substantial opportunities for local indigenous businesses to supply services and products in support of project construction and operations.
- It will continuously monitor local employment and procurement policies and programs, and report the results of this monitoring as part of ongoing community consultation.
- Continuing to support local labour-force skills development and working with communities, government, and other industrial proponents on programs that assist community members overcome labour-market barriers.

Monitoring

[3095] Teck has yet to determine the exact reporting and monitoring mechanisms for its local procurement and employment policies, but will engage with indigenous communities to develop appropriate mechanisms. It stated that it expects they will likely be similar to mechanisms used by Teck's other operations and might include:

- Total employment, attraction and retention rates, average salary levels and other general human resource data. Where possible, the data will be disaggregated at the local community level.
- Procurement activity, including examination of goods and services sourced from providers in local communities, value and length of contracts, types of goods and services provided and employment and enterprise effects associated with procurement.

Analysis and Findings

[3096] The panel finds that there should be sufficient capacity available in the regional, provincial, and Canadian workforce to meet the requirements of the Frontier project.

[3097] The panel is satisfied with Teck's commitment to facilitate and monitor employment, training, and procurement from regional indigenous communities through formal policies and participation agreements and with plans to develop a reporting mechanism.

[3098] Based on the above, the panel finds that the project's labour requirements will not result in unintended adverse workforce effects for other regional, provincial, or national employers.

Population Effects

Evidence

[3099] Long-range base case population forecasts in Teck's 2015 project update indicate that the population in Fort McMurray and the nearby community of Sapræ Creek (urban service area) will grow more slowly than projected in 2011, reflecting the revised outlook for approved and planned projects in the region. The revised projection indicates that the resident population will be approximately 103 000 by 2027.

[3100] The application case population effect includes new direct, indirect, and induced workforce participants that would migrate to the region, including their families. Teck estimates that at the application case, the population of the Regional Municipality of Wood Buffalo will increase by 2000 individuals over the project life, with a peak of 4700 additional residents in 2025.

[3101] Teck's planned development case projections indicate that the population in the urban service area will grow more slowly than projected in 2011. The revised projection indicates that by 2027, the resident population would be in the range of 117 000 under planned development case assumptions. This estimate is roughly 15 per cent lower than planned development case estimates presented in Teck's 2011 application, which reflects a general slowdown in oil sands development in the region.

[3102] In general, populations of rural communities within the Regional Municipality of Wood Buffalo grew between 2001 and 2016, with estimates ranging from 12 per cent in Conklin to 68 per cent in Fort McKay. Fort Chipewyan was the only community to not grow in this timeframe, experiencing an estimated net decrease of 20 persons (2 per cent). Indigenous groups in Fort McKay and Fort Chipewyan noted that, to the degree that Teck supports economic activity in these communities, the Frontier project might assist in retaining current residents or attracting former residents back to these communities from other locations. Teck identified that this might place increased demands on local infrastructure and services, including housing.

[3103] Teck stated that forecasting population in the Fort McMurray urban service area continues to be subject to uncertainty. It noted that a return to stronger oil prices and increased investment in the region could push the growth rate to earlier, higher estimates. In general, the consensus suggests a continued upward population growth trend in the region driven by future oil sands development. The pace at which this occurs is more challenging to determine.

[3104] The effect that construction and operation of the Frontier project will have on the Fort McMurray residential population is limited by the use of a lodge-based work camp approach.

[3105] During construction, the effect on the urban population stems primarily from indirect and induced employment effects.

[3106] During construction or operations, some workers may relocate permanently to the region or live in marshalling points outside the region based on personal preference.

[3107] Teck assumes that 90 per cent of operation workers will live outside the region and be flown in for work.

[3108] Teck stated that accommodating the workforce on site through a lodge-based approach has additional benefits:

- It reduces traffic volumes on Highway 63 and the Fort Chipewyan winter road.
- It reduces the effects of industrial development on the resident population of the Regional Municipality of Wood Buffalo.
- It reduces the effects of industrial development on regional service providers and infrastructure.
- It allows spouses and family members of lodge-based workers to remain in their communities and be active in the labour force in the community in which they permanently reside.
- It would spread the economic benefits of industrial development to other communities outside of the region. However, this approach creates less revenue for local businesses and the Regional Municipality of Wood Buffalo.

[3109] Regional Municipality of Wood Buffalo Mayor Scott raised concerns about the use of a “lodge-based approach” or “camps” for the Frontier project. The municipality would prefer that workers relocate and reside permanently in the municipality. He notes that the newly constructed Fort McMurray airport is currently well below capacity. He stated:

This idea that everybody should be flying in and flying out of remote worksites makes no sense. The circumstances that we faced some time ago were high housing prices. That is no longer the case. Our housing prices have dropped considerably. This is an affordable community, and we need to start making sure it is a community. People need to make this their home, not a community where people fly in and fly out. So we would like to see all the residents reside in the community, whether they are being bused to site and then back, depending on the shifts, but we can certainly help coordinate that, or utilize our airport if you need to fly employees to the remote site. We think that is absolutely critical.

[3110] Teck committed to monitor for project-related population and housing issues and to collaborate with appropriate authorities to resolve them if they arise.

Analysis and Findings

[3111] The panel acknowledges that estimated population growth in the mineable oil sands area has declined from the forecasts in Teck's 2011 application. It accepts that this is primarily the result of slower growth in oil sands development in the region.

[3112] Teck's plans to provide workforce accommodations for most of its employees (90 per cent of operations workforce) will minimize the effects of induced population growth in the region, especially within Fort McMurray.

[3113] The panel notes that potential project-related increases in populations in indigenous communities and the resulting demands for housing and services could result in adverse effects. The panel accepts Teck's commitment to monitor for project-related population and housing issues and to collaborate with appropriate authorities to resolve them.

[3114] The panel is satisfied with Teck's approach to mitigating population effects in the region by providing on-site, lodge-based accommodations during construction and operations.

[3115] The panel acknowledges Fort McMurray's efforts to encourage Teck employees to reside within the community. The panel expects that the region can accommodate the expected induced population growth from the Frontier project. The panel finds that project effects on population growth are likely and that the magnitude of effects will be low.

Housing & Workforce Accommodation

Evidence

[3116] Teck will use the existing 300-person winter drilling camp to enable construction of the Frontier project lodge and other early works from 2017 to 2019. By about 2022, Teck plans on having the first 1500 beds of its on-site construction lodge ready, with capacity growing to 4000 to 5000 beds by 2023. The on-site workforce is estimated to peak at about 6300 workers in 2024.

[3117] During the construction period, when the on-site construction workforce exceeds the capacity of the existing winter drilling camp and planned construction lodge, Teck will use existing work camps near the project to accommodate the extra demand.

[3118] Effects of the Frontier project on the urban housing market in Fort McMurray would result primarily from new residents from indirect or induced employment, and are expected to include the following:

- Annual demand of 240 units during phase 1 construction (roughly equivalent to 33 per cent of the average annual housing starts from 2010 to 2014).

- A peak in housing demand of 1680 units will occur around 2025.
- Long-term demand for about 715 units once the project reaches full buildout in 2037.

[3119] The Horse River fire of 2016 destroyed more than 2400 buildings in Fort McMurray, many of them homes. Teck stated that by the time Frontier project construction peaks in 2024, rebuilding of these homes is expected to be largely complete. Mayor Scott stated that “construction of replacement homes is on track with where the municipality anticipated that we would be at this time.” By 2024 he expects that reconstruction should be “well completed.”

[3120] Teck expects that the area housing market will be able to meet peak demands of 1680 units by 2025. Should rebuilding activities take longer than anticipated (i.e., beyond 2021) and limit the capacity of infrastructure and services in the region, Teck would consider increased use of its on-site lodge and other work camps.

[3121] Housing affordability in Fort McMurray was a concern at the time of filing the initial application (2011) and the project update (2015); however, Mayor Scott noted that there has been a recent and considerable drop in the cost of housing.

[3122] Teck examined the potential impact of the Frontier project on housing availability and affordability in indigenous communities (on reserve), as well as population and migration effects on reserve. Teck concluded that Frontier project-related population growth in rural communities is, to a large extent, influenced by the availability of housing in those communities. Indigenous groups in Fort McKay and Fort Chipewyan noted that the Frontier project might assist in retaining current residents or attracting former residents back to these communities. Teck stated that this may place increased demands on local housing.

[3123] The Council of Canadians raised concerns about the community impacts of fly-in/fly-out workforce accommodations in mining operations, particularly for indigenous women. Teck referenced several aspects of their employment programs designed to address potential cultural and gender issues associated with fly-in/fly-out workforce accommodations:

- An employee and family assistance program
- Clear policies regarding discrimination, harassment, and bullying in the workplace
- Cultural considerations available to employees such as a dedicated area to cook traditional foods
- Cross-cultural training for employees
- Approaches to ensure gender equality in the workplace such as appropriate sizing of personal protective equipment, etc.
- Additional camp-related policies to ensure that the workforce remains on the project site (personal vehicle restrictions, recreational amenities, drug and alcohol policy, etc.)

[3124] Teck examined constraints for gender representation in the industry and at Teck's operations, including available daycares in the region and the impacts of long-distance fly-in/fly-out work rotations.

[3125] Teck stated that it has experience operating remote on-site lodging of similar size and conditions in the Red Dog mining operation in Alaska, where it deals with comparable issues relating to indigenous workforce accommodations, culture and gender considerations, and effects on subsistence harvesting and livelihoods. It plans to build on this experience in managing workforce arrangements for the Frontier project's accommodations.

[3126] Teck commits to implement the following mitigation measures regarding cultural and gender-based concerns with fly-in/fly-out operations:

- Continue to expand Teck's knowledge of, and engagement with, local stakeholders and indigenous communities near the project to confirm their ongoing and growing participation in project-related benefits, as well as the design of appropriate and effective mitigation measures to reduce any adverse effect. These efforts are envisioned to include capacity-building support within participation agreements for indigenous communities.
- Provide cultural diversity awareness training to employees and contractors, focusing on respect for traditional land users as well as respect for indigenous world views, customs, and values.
- Consider supportive workplace practices as it develops workplace policies and seek local indigenous community input into cultural awareness training to be provided at the project site.
- Review its standard bereavement policy, including policies from other fly-in/fly-out operations in Alberta, as operation-specific policies are developed during future planning phases.
- Discuss with local communities the design of fly-in/fly-out shifts that best benefit employees and families while remaining logistically and financially feasible.

Analysis and Findings

[3127] The panel notes that the Frontier project's remote location and Teck's plan to accommodate most of its construction and operations workforce in the on-site lodge or in open lodges near the site will limit interaction with the region's housing, social, and municipal infrastructure.

[3128] The panel finds that potential demand for additional housing appears to be within the historical pace of new home construction. Evidence indicates that housing replacement from the recent fires in Fort McMurray should be largely completed by the time additional housing demand from induced population growth from the project would occur and that housing affordability in the region has improved in recent years. Wood Buffalo Regional Municipality Mayor Scott represented that it is looking to grow the permanent resident population in the municipality.

[3129] Based on the evidence above, the panel finds that there should be sufficient housing infrastructure available in the region to meet the needs of employees and induced workforce relocations.

Social and Municipal Infrastructure

Evidence

[3130] Demand on the region's social infrastructure has been affected in the short term by both the economic recession and 2016 Fort McMurray wildfire. Although the reduced population in 2016 served to decrease overall demands for social infrastructure, effects on both individuals and families related to the loss of jobs and homes has and will likely continue to place increased demands on social infrastructure providers, including mental health, food bank, and other social services. No health, police, or emergency facilities were destroyed by the fire.

[3131] Since 2006, the provincial government has announced plans for and moved forward with a number of infrastructure improvements in Fort McMurray.

[3132] Key municipal services have the capacity to service 130 000 residents. The planned development case in the 2015 project update anticipates an increase in the urban population of the region to 117 000 by 2027. The application case project population effect anticipates up to 4700 additional residents in 2025 at peak construction, and 2000 individuals over the long-term operations period.

[3133] Teck identified measures to mitigate the effects of the Frontier project on social and municipal infrastructure:

- Health Services:
 - Provide on-site health services, including an on-site medical facility staffed by qualified health professionals providing 24-hour on-site primary, emergency, occupational health services, first aid, stabilization of serious injuries, advanced life support, remote online consultation with a physician, and dispensing of common prescriptions.
 - Helicopter or fixed-wing aircraft via the on-site aerodrome to transport injured workers requiring rapid evacuation for off-site medical care.
 - Provide financial and in-kind contributions to the Northern Lights Health Foundation, where appropriate, to support the efforts of Alberta Health Services to meet the needs of Wood Buffalo residents.
 - Make health promotion and disease prevention initiatives a focus of their community investment policy.
 - Discuss options for coordinating on-site health facilities and resources with other industrial proponents near the project.

- Provide employees with access to the company’s confidential employee and family assistance plan, which provides support for families and individuals who might experience difficulty dealing with personal, family, or work-life issues that can affect one’s health and well-being.
- Security and Emergency Services
 - Maintain explicit and enforced lodge, workplace, and flight policies with regards to illegal activities and the use of alcohol and drugs.
 - Provide on-site security services, including controlled gates, check-in procedures, perimeter security fencing and lodge-based security officers on duty 24 hours.
 - Offer in-house security services to assist the Royal Canadian Mounted Police within, and sometimes outside, the project lease boundaries (e.g., securing accident scenes and assisting with highway closures).
 - Provide helicopter or fixed-wing aircraft access via the on-site aerodrome for injured workers requiring rapid evacuation for off-site medical care.
- Social, Recreation, and Education Services
 - Assess and support school events and education initiatives identified by rural schools in the study area, as appropriate.
 - Consider support for community-level initiatives, including social groups providing assistance to those in need.
 - Continue to provide direct support to community initiatives through its social investment programs.
 - Make on-site recreational opportunities and facilities available to workers.

[3134] Original Fort McMurray First Nation and Clearwater River Band raised concerns regarding the capacity of sewage storage for Fort McMurray.

[3135] Teck indicated that it plans to transport sewage to Fort McMurray facilities during construction and will build an on-site treatment facility when the mine is operating. Teck noted that the Fort McMurray sewage treatment facility has been designed for 137 000 people, and Teck’s assessment is that there is capacity to accommodate sewage generated during the construction of the project.

Analysis and Findings

[3136] Teck’s plans to rely on a lodge-based approach for housings and to provide health, security and recreations services for its construction and operations workforce in conjunction with its community support and investment plans, will mitigate most of the social and municipal infrastructure project effects.

[3137] The evidence presented by Teck and the Regional Municipality of Wood Buffalo confirms that there is existing capacity in municipal services to meet the needs of the population forecasts for both the application case and planned development case population forecasts.

Traffic Effects

Evidence

Transportation of Workforce

[3138] Teck stated that construction and operations workers will be transported in and out of the region by air, using the on-site aerodrome. Until the on-site aerodrome is ready, Teck will arrange to use an existing airstrip located north of Fort McKay. Teck stated that accommodating the workforce in on-site lodge base accommodations will reduce traffic volumes on Highway 63 and the Fort Chipewyan winter road. Open camps in the region will be used to accommodate the portion of the workforce that is not accommodated on site. These camps are within 71 km of the project site. Buses will provide daily transport to and from the project site for most of these workers. Buses will also transport most workers residing in Fort McMurray.

[3139] A minority of workers are expected to require personal and company light vehicles for these daily commutes.

[3140] Teck estimates that during construction, traffic associated with worker commutes (i.e., buses and light pickup trucks) will account for 30 to 100 movements daily.

Transport of Equipment

[3141] Teck estimates that the Frontier project will require \$4.717 billion in equipment and materials which require transportation to the site. The United States will likely be the largest supplier of mobile equipment, although equipment and materials may also be sourced from Asia and Europe. Teck states that this foreign content relates in large part to the procurement of specialized mining equipment such as heavy haulers and shovels, steam generators, and specialized vessels, pipes, and valves.

[3142] Trucks are the most likely mode of transport within Alberta. The North American railway network and Canadian National Railway's Lac La Biche Subdivision are other transportation options. Teck anticipates 270 average daily vehicle movements in 2024, the year of peak on-site construction, including 140 daily transport trucks at this time.

[3143] Transportation effects will be concentrated on Highway 63 and the Fort Chipewyan winter road north of Fort McKay. Specific plans and mitigation related to the transport of large mining equipment and oversized loads will be part of the detailed project execution plan. Teck is aware of challenges faced by

other operators in the region, and these will be considered during the execution planning phase of the project.

[3144] Teck will mitigate the effects of the Frontier project on traffic through a number of measures:

- constructing and operating an aerodrome near the project site
- using on-site as well as regional lodge accommodations during both construction and operations to reduce worker commutes
- transporting construction and operations workers by bus
- limiting private vehicles brought to the project site
- scheduling truck traffic, including oversized loads, to off-peak hours
- using an on-site concrete batch plant and attempting to source aggregates from pits near to site
- enforcing lodge, workplace, and flight policies with regards to illegal activities and the use of alcohol and drugs
- supporting the efforts of Regional Municipality of Wood Buffalo and Oil Sands Community Alliance to work with Alberta to improve highway infrastructure in a timely way
- keeping responsible regional and provincial planners informed of the development plans and timing
- consulting and cooperating with other operators regarding shift scheduling with a view to reduce overlap in commuter traffic
- providing funding to assist in the maintenance and safety of applicable segments of Highway 63 from Fort McKay to Fort Chipewyan that would be affected by the project

[3145] Teck indicated that Alberta Transportation has assessed Frontier project's traffic impacts to Highway 63, and determined that they are likely to be insignificant.

Analysis and Findings

[3146] The panel is satisfied that the existing transportation plans are sufficient to mitigate the effects of the Frontier project on traffic and transportation infrastructure. The panel expects that these will be reviewed with Alberta Transportation to ensure that they minimize unintended traffic issues which may arise during construction activities.

[3147] The panel recommends that Teck provide its detailed project executions plans to transport of large mining equipment and oversized loads to Alberta Transportation for review and feedback at least three months before starting construction.

Effects on Indigenous Communities

Evidence

[3148] Indigenous groups provided evidence of current social and economic effects of industrial development on their communities. These included:

- Concerns about confidence in the quality and quantity of resources including wildlife, vegetation and water which result in avoidance of harvesting. In addition to the effects on cultural practices, additional expenditures are incurred to purchase food to replace that which they would have traditionally harvested.
- Some indigenous groups indicated that increased involvement in the wage economy resulted in loss of traditional lifestyles and practices with resultant effects on history, culture and language retention. This also affects community cohesion, through reduced time to undertake traditional land-use practices together, as well as broader community food sharing opportunities. Loss of community sharing of resources can also result in additional costs to purchase food to replace that which they would have traditionally harvested.
- Restrictions on access resulting in loss of opportunities to practice traditional activities and additional travel time and costs to access new areas.

[3149] In its September 2011 integrated application, Teck concluded that oil sands development is a net benefit to the region, from a socioeconomic perspective. It recognized that social costs and benefits are not shared equally across all members of society. Indigenous residents in the region experience some benefits in becoming part of the oil sands economy but they also experience negative social effects from loss of use of traditional lands. Teck updated its socioeconomic assessment in its June 2015 project update and concluded that the project will contribute to cumulative industrial development that can affect traditional land-use practices and contribute to social change in predominantly aboriginal communities. It largely reaffirmed the conclusions from the 2011 assessment.

[3150] In May of 2017, at the request of the panel, Teck submitted a community-specific socioeconomic assessment for indigenous groups that it had engaged with and that may be affected by the project (CEAR 294, appendix 5.7). Based on traditional land use and cultural impact assessments, linkages were established to socioeconomic conditions. The assessment provided specific and measurable socioeconomic information about communities in the regional study area including Fort McKay, Fort Chipewyan and Fort McMurray.

[3151] Assessments were completed for the following indigenous groups:

- Athabasca Chipewyan First Nation
- Fort Chipewyan Métis Local 125

- Fort McKay First Nation
- Fort McKay Métis
- Fort McMurray Métis Local 1935
- Lac La Biche Métis Local 1909

[3152] Mikisew Cree First Nation was not included because Teck had agreed not to undertake a proponent-led traditional land-use assessment for that nation.

[3153] The assessments identified pathways through which negative and positive socioeconomic effects occur. These included:

- Negative economic effects from changes to traditional land use, including increased access costs, reduced harvest yields, increased need to purchase store-bought food and reduced incomes specific to trappers.
- Positive economic effects from project-related activity, including jobs, contracts, incomes, revenues to companies (including community-owned), considered within the context of likelihood of access for community members.
- Negative population effects associated with members moving away from the community because of industry-related economic considerations (cost of living, access to wage opportunities).
- Positive population effects associated with retaining or attracting back former community members, contributing to rural communities' long-term sustainability.
- Negative community effects from changes to traditional land use, including contributing to existing, reported social and health challenges, reduced activity levels, concerns regarding country food safety and overall health, feelings of stress, disconnectedness, frustration, isolation, changes in community values, loss of traditions, language and knowledge, effects on identity and autonomy among others.
- Positive community effects related to social, health, education, infrastructure, which influence quality of life for residents.

[3154] Within these socioeconomic pathway areas, key indicators were identified and data was quantified to characterize current economic, population and community conditions and determine project and cumulative effects.

[3155] Teck stated that the results of the Community-Specific Socioeconomic Assessment are conservative. All projects are included, even those that have withdrawn their applications (Joslyn North mine expansion and Pierre River mine). It assessed effects against a predevelopment scenario (pre-1965) rather than to an existing baseline case.

Effects of the Frontier Project on Socioeconomic Conditions

[3156] For economic conditions in all communities, except Lac La Biche Métis Local 1909, project-related effects were mixed in direction (both positive and negative) and moderate in terms of magnitude. Population and community effects were found to be mixed in direction (positive and negative) and low and moderate in magnitude respectively. For Lac La Biche Métis Local 1909, effects of the project were mixed in direction and low in magnitude for *economic, population and community*. For all communities, effects were local or regional in geographic extent, long term in duration, continuous, and reversible.

Table 37. Project effects classification

	Case	Direction of effects			Magnitude/consequence		
		Economic	Population	Community	Economic	Population	Community
Athabasca	Application	mixed	mixed	mixed	moderate	low	moderate
Chipewyan First Nation	PDC	mixed	mixed	mixed	moderate	low	moderate
Fort Chipewyan	Application	mixed	mixed	mixed	moderate	low	moderate
Métis Local 125	PDC	mixed	mixed	mixed	moderate	low	moderate
Fort McKay First Nation	Application	mixed	mixed	mixed	moderate	low	moderate
	PDC	mixed	mixed	mixed	moderate	low	moderate
Fort McKay Métis	Application	mixed	mixed	mixed	moderate	low	moderate
	PDC	mixed	mixed	mixed	moderate	low	moderate
Fort McMurray	Application	mixed	mixed	mixed	moderate	low	moderate
Métis Local 1935	PDC	mixed	mixed	mixed	moderate	low	moderate
Lac La Biche	Application	mixed	mixed	mixed	low	low	low
Métis Local 1909	PDC	mixed	mixed	mixed	low	low	low

Cumulative Effects on Socioeconomic Conditions

[3157] Cumulative socioeconomic effects were found to be mixed in direction (positive and negative) for economic, population and community areas for all communities. Magnitude was found to be low for base case, and moderate for economic and community for the application case and planned development case. Population was found to be low for all three cases. Consequence was determined to be moderate for *economic and community*, and low for *population*.

[3158] The assessment concluded that socioeconomic conditions in the indigenous communities in the regional study area as well as those in Fort McMurray are mixed. A number of indicators in Fort Chipewyan, Fort McKay and Fort McMurray reflect communities with a number of positive socioeconomic conditions. These are in part due to a number of new infrastructure investments funded through industry social investment in the region or by municipal, provincial or federal government programs.

[3159] Teck acknowledged that many of the negative economic effects from changes in traditional land-use practices might fall on elders and other community members who are less likely to participate directly in any positive economic opportunities associated with the Frontier project. It is possible that these adverse effects on vulnerable populations could be offset, to some extent, by mitigation measures focused on social supports to assist vulnerable community members in navigating the economic changes brought on by industrial development.

[3160] Teck sees participation agreements with indigenous groups as a key mechanism for ensuring that management and mitigation plans are appropriate and effective to each community's specific needs and interests. They state that these agreements provide mechanisms for continued engagement throughout the life of the Frontier project, which may result in the development of additional community-specific mitigation measures to manage specific effects.

[3161] Follow-up socioeconomic monitoring will be conducted by Teck through its participation agreements, as outlined in its draft socioeconomic monitoring plan. It notes that regional cumulative socioeconomic monitoring is ongoing by government and other public and industry organizations.

Analysis and Findings

[3162] Evidence presented by indigenous groups on economic, community and social factors was general and non-specific and often presented in the context of effects on culture and traditional practices. The panel has considered this evidence primarily in its assessment of the effects of the Frontier project on the use of lands and resources for traditional purposes, culture and asserted rights for each of the participating communities.

[3163] The evidence in Teck's community-specific assessments focused on measurable quantifiable metrics to characterize current community social and economic conditions and predict the effects of the project and cumulative effects. The panel found this evidence persuasive and relied on it to make its findings.

[3164] The panel finds that the Frontier project will result in both positive and adverse effects on community, population and economic conditions. From the evidence, it finds that the magnitude of these effects will be low or moderate. It agrees with Teck's determination that negative and positive project effects are not shared equally by all population groups in either primarily indigenous or non-indigenous communities.

[3165] Participation agreements between Teck and affected communities may assist in addressing unintended socio and economic effects of the Frontier project on vulnerable members of the communities.

Significance Determination for Project Effects

[3166] Based on the approach discussed in the determination of significance chapter in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project social effects.

- The effects of the Frontier project on workforce, population, housing, services, transportation and traffic effects of the Frontier project are likely and the magnitude is determined to be low in the local or regional study areas. Effects on culture and gender will be determined largely by Teck's implementation of programs as described and participation agreements with affected indigenous communities.
- The geographic extent is regional, although some workforce effects will be realized provincially and nationally.
- The duration is medium. Social effects will occur only during operations.
- The frequency will be continuous. Effects are expected to occur throughout the 40-year operational life of the project.
- The effects of the Frontier project are reversible. Measurable effects of the project are expected to cease at the end of operations.

[3167] The panel finds that adverse effects of the Frontier project, including those communities remote from the project, are likely, but will be negligible or low in magnitude and not significant.

Table 38. Summary – Significance of effects

Project effects Socioeconomic conditions	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Effects on workforce availability	low	regional	medium	continuous	reversible	not significant
Effects on population – Urban	low	regional	medium	continuous	reversible	not significant
Effects on housing – Urban	low	regional	medium	continuous	reversible	not significant
Effects on population and housing – Rural communities in Regional Municipality of Wood Buffalo	low/medium	regional	medium	continuous	reversible	not significant

Project effects Socioeconomic conditions	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Effects of workforce accommodations on culture and gender impacts	low	local	medium	continuous	reversible	not significant
Effects on social services	low	regional	medium	continuous	reversible	not significant
Effects on traffic and transportation	low	regional	medium	continuous	reversible	not significant
Cumulative effects	low	regional	medium	continuous	reversible	not significant
Community-specific effects analysis (project and cumulative effects)	low (positive and adverse)	local and regional	long term	continuous	reversible	not significant

Cumulative Effects

[3168] The panel finds that adverse effects of the project in combination with other planned developments for all communities, including indigenous communities and those communities remote from the project, are likely, but will be negligible or low in magnitude and not significant

- The amount of construction activity in the oil sands region, which would overlap with Frontier project construction activities, is subject to considerable uncertainty, though Teck anticipates there is adequate skilled workforce available to meet cumulative construction and operations capacity.
- The planned oil sands developments included in the planned development case, and the associated population growth, will lead to increased demand for municipal infrastructure and services, including water, sewer, emergency services, the regional road network, and municipal planning and development services. Municipal services of the Regional Municipality of Wood Buffalo have sufficient capacity to service the expected number of residents.
- The panel finds that cumulative effects are likely to occur and that the magnitude of those effects is low. Some effects may be adverse while some may be beneficial. The panel concludes that the Frontier project, in combination with other current or reasonably foreseeable future projects, is not likely to result in significant adverse cumulative effects to socioeconomic conditions for indigenous peoples.

31 Visual Aesthetics

[3169] While the final terms of reference for the Frontier project do not require an assessment of visual aesthetics, Teck completed one. Teck defined the term “visual aesthetics” to cover a broad range of visual, scenic, cultural, and spiritual aspects of the landscape. “Visibility of the Frontier project is a quantitative criterion referring to the geographic area from which the Frontier project will be visible ...” The panel has received other aesthetics-related concerns that include noise, light, and odours that will emanate from the Frontier project. However, this portion of the panel’s report focuses only on visual aesthetics. Other potential aesthetic effects such as noise and odour are dealt with in the appropriate sections.

Evidence

[3170] The Frontier project will be visible from many vantage points as well as from aircraft. The more prominent features of the project are the flare stacks, the internal disposal area, and the external tailings disposal areas with height projections of 150 m, 57 m and 60 m above grade, respectively.

[3171] Teck used viewshed model and spatial analysis to identify locations from which the Frontier project would be visible at maximum buildout (application case) and which project components would be visible. Using this model, Teck identified 11 receptor locations to determine from which of them some project components would be visible. The model demonstrated that project components taller than 30 m would be visible from some receptor locations in between the Birch Mountains Escarpment and the Athabasca River where the terrain is relatively flat, at higher elevations on the east side of the Athabasca River and the Birch Mountains, and along potential recreational access routes, including approximately 27 km along the Fort Chipewyan winter road and almost 11 km along the Canterra Road at higher elevations. The river water intake will be visible for a distance of almost two kilometres by travellers on the Athabasca River. Some of the western margin project components will be visible from the Ronald Lake Historic Cabin. Portions of the external tailings area and the flare stacks will be visible from the trapper’s cabin located approximately 10 km south southwest of the Frontier project. Flare stacks and the aerodrome as well as the river water intake and the permanent access road to the river water intake will be visible from the Old Tripe de Roche Place on the east side of the Athabasca River from the Frontier project. The project will not be directly visible from Fort McKay, Fort McMurray, or Fort Chipewyan.

[3172] Teck indicated that aboriginal communities expressed the following visual aesthetic concerns:

- visibility of the Frontier project, especially the river water intake, by people travelling along the Athabasca River
- lighting from the Frontier project
- visibility of the Frontier project from Fort McKay

- visibility of the Frontier project from nearby sacred sites
- visibility of the Frontier project from nearby trapper and historic cabins
- visibility of the Frontier project from the east side of the Athabasca River
- visibility of the Frontier project from traditional trails
- the ability of traditional land users to experience remoteness and solitude while undertaking traditional pursuits (this last point speaks to the noise, light, odour, and other sensory disturbances)

[3173] First Nations raised concerns in statements of concern and written submissions. However, these concerns were not raised at the hearing either through oral testimony or final argument. Fourteen First Nations advised the panel that they had entered into agreements with Teck and withdrew their objections to the Frontier project; however, the Mikisew Cree and Athabasca Chipewyan First Nations indicated their withdrawals were conditional on the federal and provincial governments carrying out certain recommendations put forward jointly with Mikisew Cree First Nation and Teck and Athabasca Chipewyan and Teck. Athabasca Chipewyan raised concerns related to the light from the Frontier project being visible at traplines and on reserve lands at night. Mikisew also filed evidence suggesting impacts from industrial sounds, smells, or light (from Our Land is Rich Mikisew Cree First Nation Culture and Rights Report for the Teck Frontier project update Firelight Group September 15, 2015).

The noise, light, odour and other sensory disturbances created by industrial activity diminishes the spiritual quality of the sacred sites and has a very negative impact on the Métis' ability to undertake Spiritual Activities. (From Fort McKay Métis Integrated Cultural Assessment prepared by The Human Environment Group Ltd (HEG) March 2016)

[3174] Teck will mitigate effects of the Frontier project on visual aesthetics by maintaining vegetated buffers between the Frontier project and the Athabasca River as well as along project transportation corridors to the extent feasible. Teck will implement mitigation measures to reduce potential effects on visual aesthetics where safety concerns are not an issue. In addition to buffers, reclamation techniques will be used that integrate the project site at closure with the surrounding landscape. Teck will develop closure plans that include integration and contouring of slopes to mimic natural topography, focus on establishing a variety of vegetation communities, and avoid unnatural-looking breaks at development boundaries. Teck proposes additional measures for the river water intake, intending to plant a narrow band of white spruce along the edge of the cofferdam and plant dogwood on the cofferdam, except in areas where tall vegetation would impede any maintenance or present safety concerns. Teck will also complete reclamation in the area in such a way as to minimize erosion and slope instability.

[3175] Teck has committed to using lighting that minimizes light pollution and will incorporate lighting consideration into future stages of engineering. Teck will consult with potentially affected aboriginal communities on lighting considerations. Teck has also committed, in its agreement with Athabasca

Chipewyan to “support ... Athabasca Chipewyan’s objectives regarding access and traditional use management” by developing “a light management plan with the objective of minimizing project-related light pollution and promptly [respond] to light pollution complaints of Athabasca Chipewyan First Nation members.” (CEAA #571)

[3176] Teck will record, investigate, and follow up on all concerns associated with the Frontier project’s visual aesthetics. At closure, Teck will remove project infrastructure, and the Frontier project area will be reclaimed using vegetation types similar, though not identical to, existing conditions, creating a continuous vegetated landscape. Teck states that prediction confidence in the visual aesthetics assessment is moderate, and model input is considered accurate and reliable at the scale presented.

[3177] Teck did not provide a visual effects consequence determination in either its integrated application or its project update.

Analysis and Findings

[3178] The panel notes that there are currently no Alberta regulations, guidelines, or policies in place to regulate the amount of light emitted by industrial facilities. The same applies to visual aesthetics. However, Teck addressed these topics in its impact assessment.

[3179] Given the conditional nature of the withdrawal of objections by Mikisew and Athabasca Chipewyan, their evidence contained in traditional land-use studies reference by Teck remains on the record of the proceeding. At the same time this evidence was not tested at the hearing by cross-examination and the panel can therefore give it limited weight.

[3180] The panel finds that Teck’s assessment of the Frontier project’s effects on visual aesthetics is sufficient to address those effects and the concerns raised. Teck’s visual aesthetics study area is of a size sufficient to assess the potential effects, being based on limits of visual acuity and light refraction studies. The use of the viewshed model and spatial analysis is provided sufficient information to assess the effects. The panel accepts Teck’s conclusion that prediction confidence in the visual aesthetics assessment is moderate and that model input is considered accurate and reliable at the scale presented. The panel finds that Teck’s proposed mitigation measures satisfactorily address the project’s impacts on visual aesthetics.

[3181] While the panel acknowledges that the Frontier project will have some effect on the visual aesthetics of the area, the panel concludes the Frontier project will not likely result in significant adverse visual aesthetic effects except for the people, including river travellers, who frequent the identified receptor locations from which project components will be visible.

Significance of Project Effects

[3182] Based on the evidence provided by Teck and the criteria provided in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018), the panel used the following approach to determine the significance of project visual aesthetic effects to the identified receptor locations:

- The aesthetic effects are likely to occur because some physical features of the project will be visible from a number of receptor locations.
- Magnitude of the effects are generally negligible or low because the project will be visible from only a few locations.
- Geographic extent of the effect is regional since while it will be visible from only a few ground and river locations, it will be visible from aircraft as well.
- Frequency of the effects is continuous.
- Duration of the effect is long with some features visible for the life of the project and following closure.
- Some of the effects are reversible upon reclamation of the project.

[3183] The panel concludes there will be a low residual effect after mitigation.

32 Effects on Indigenous Traditional Use of Lands and Resources, Culture, and Asserted Rights

[3184] The panel's terms of reference mandate the panel to accept as part of its record and review information from indigenous groups related to the nature and scope of asserted or established aboriginal or treaty rights in the area of the project. Further, the panel must accept and review information on the potential adverse effects that the project may have on asserted or established aboriginal or treaty rights, and information regarding any measures proposed to avoid or mitigate the potential adverse effects of the project on asserted or established aboriginal or treaty rights.

[3185] For any likely project effects to asserted or established aboriginal or treaty rights, the panel must consider:

- Any potential effects on current uses of lands and resources by aboriginal persons for traditional purposes.
- Any effects (including the effects related to increased access, fragmentation of habitat and displacement of the exercise of traditional activities) on hunting, fishing, trapping, cultural and other traditional uses of the land (e.g., collection of medicinal plants, use of sacred sites), as well as related effects on lifestyle, culture, health and quality of life of aboriginal persons.
- Any effects of alterations to access into areas used by aboriginal persons for traditional uses.
- Any adverse effects of the project on the ability of future generations to pursue traditional activities or lifestyle.
- Any effects of the project on heritage and archaeological resources in the project area that are of importance or concern to aboriginal groups.

[3186] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities, or their ability to exercise their asserted rights.

[3187] The panel's terms of reference require it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted or the strength of such claims. But, for the purposes of assessing the potential effects of the Frontier project, the panel accepts the rights being asserted.

[3188] Mikisew Cree First Nation and the Agency, in a collaborative effort, developed the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project* for use during the environmental assessment of the Frontier project. The objective of the methodology was to support the mandate of the panel with respect to the assessment of the

potential effects of the Frontier project on the exercise of Mikisew's rights. The methodology was submitted to the panel for its consideration with a suggestion that it might be helpful when considering effects to other indigenous groups involved in the environmental assessment process.

[3189] The panel has considered the Mikisew-Agency methodology and while the panel has not applied the methodology in its entirety, the panel has used certain aspects of the methodology where it has determined that it would assist the panel in the environmental assessment of the Frontier project as required by the joint review panel terms of reference.

[3190] Briefly, the methodology consists of three steps, including:

- Step 1: Determining the context in which potential impacts on rights will occur, through:
 - Identifying the conditions that support the community's exercise of rights;
 - Understanding how historic, existing and approved activities have affected the conditions that support the community's exercise of rights; and
 - Identifying the importance of the Frontier project's location in relation to the exercise of a community's rights.
- Step 2: Evaluating potential Frontier project impacts to rights through:
 - Identifying the pathways for potential impacts of the Frontier project (positive and negative) on the exercise of rights; and
 - Determining whether the Frontier project will have a low, medium or high level of impact on the exercise of rights based on:
 - nature of impacts,
 - regional/historic/cumulative impacts,
 - community thresholds,
 - cultural landscape,
 - preferred expression of rights,
 - distribution of benefits / impact equity, and
 - present and future generations.
- Step 3: Follow-up and validation of the implementation of the methodology.

[3191] As an integral component of the methodology, the following set of guiding principles for implementing the three steps are set out below.

- The assessor must consider the nature and scope of rights, as those rights are asserted, and how the rights might be impacted.
- Assessing impacts on aboriginal and treaty rights requires more than assessing environmental effects on the current use of lands and resources for traditional purposes or on physical and cultural heritage.
- Assessing impacts on the exercise of aboriginal and treaty rights requires understanding the context of historical and contemporary cumulative effects in which rights are exercised. This context needs to be evaluated before looking at project effects on those rights. The assessor must recognize that existing environmental conditions do not tell the full story about historical and current cumulative impacts on aboriginal and treaty rights.
- The assessment should not be limited to site-specific effects, but must consider all impacts on the exercise of rights.
- Using an indigenous perspective and indigenous knowledge is an imperative.
- The assessment must consider indigenous values, norms and laws, where provided by a community.
- The assessor must engage the rights-bearing community during an assessment. The selection of methods and indicators for assessing impacts to aboriginal and treaty rights is to be community driven, where a community has elected to participate.
- Thresholds and measures to understand the potential effects of a project on the exercise of aboriginal and treaty rights and culture are to be used where they have been defined by the community.
- Assessments of impact to the exercise of aboriginal and treaty rights should consider a project's contribution to reconciliation (not within the mandate of the panel).

Indigenous Groups That Participated

[3192] During the environmental assessment for the Frontier project, a number of indigenous groups actively participated in the process with written submissions, documented oral testimony, traditional land-use assessments, cultural impact assessments, and numerous studies and reports. Many of the indigenous groups also participated actively during the public hearing for the Frontier project.

[3193] Indigenous groups that participated in the environmental assessment process included the following:

- Treaty 8 First Nations:
 - Athabasca Chipewyan First Nation
 - Mikisew Cree First Nation
 - Fort McMurray First Nation #468

- Fort McKay First Nation
- Deninu K'ue First Nation
- Smith's Landing First Nation
- Kátl'odeeche First Nation
- Fond du Lac First Nation
- Non-status Indigenous Groups:
 - Original (First) Fort McMurray First Nation
 - Clearwater River Band
- Métis Indigenous Groups:
 - Fort Chipewyan Métis Local 125
 - Fort McMurray Métis Local 1935
 - Fort McKay Métis Local 63
 - Lakeland Métis Local 1909
 - Métis Nation of Alberta Region 1
 - Métis Local # 1949 Owl River
 - The Northwest Territory Métis Nation

Panel Assessment

[3194] The panel assessed the indigenous groups separately based on the information gathered during the review process. A separate section is included in this report for each indigenous group, with the exception of Fort McKay Métis and Fort McKay First Nation who made joint submissions for the most part and therefore are assessed in the same section.

[3195] As required by its terms of reference, the panel assessed each group, regardless of whether that group withdrew from participation, came to agreements with the Teck, or supported the project.

[3196] Each section in the report for each indigenous group has the following structure:

- Background
- The ACO's conclusion on the adequacy of consultation
- Asserted or established aboriginal and treaty rights
- Current context of historic and cumulative effects

- Current use of lands and resources for traditional purposes
- Health and socioeconomic conditions
- Physical and cultural heritage
- Project and cumulative effects
 - Effects on current use of lands and resources for traditional purposes
 - Effects on health and socioeconomic conditions
 - Effects on physical and cultural heritage
- Mitigation measures
- Conditions and recommendations
- Determination of significance
 - Significance determination for project effects
 - Significance determination for cumulative effects
 - Significance determination for effects to asserted rights

[3197] The panel has determined the significance of project effects and cumulative effects to current use of lands and resources, and physical and cultural heritage based on the approach discussed in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[3198] The panel has made separate determinations of significance for project effects and cumulative effects for each of

- current use of lands and resources for traditional purposes,
- health and socioeconomic conditions, and
- physical and cultural heritage.

[3199] Each of these three elements has been assessed for the following factors:

- the magnitude of the effects,
- the geographic extent of the effects,
- the duration of the effects,
- the frequency of the effects, and
- whether the effects would be irreversible.

[3200] Summary tables of the panel's significance determinations are provided at the end of each section.

The Aboriginal Consultation Office

[3201] Section 21 of *REDA* excludes the AER from determining the adequacy of Crown consultation associated with the rights of aboriginal peoples as recognized and affirmed under Part II of the *Constitution Act, 1982*. The ACO directs, monitors, and supports the consultation activities of Government of Alberta departments.

[3202] Under provincial ministerial order, the AER is required to request advice from the ACO prior to making a decision on an energy application for which First Nations or Métis Settlement consultation is required. The ministerial orders direct the AER to work with the ACO to establish and maintain joint operating procedures that set out how the AER and ACO will cooperate to administer and coordinate their work.

[3203] The joint operating procedures require that the AER panel request advice from the ACO as to whether the ACO has found consultation to have been adequate and to request advice on mitigation measures that may be required to address potential impacts on aboriginal rights.

[3204] The panel made the request for advice before closing the evidentiary portion of the hearing so that parties would have an opportunity to comment on the ACO advice.

[3205] The ACO submitted reports to the panel for the following:

- Athabasca Chipewyan First Nation
- Deninu K'ue First Nation
- Fort McMurray First Nation #468
- Fort McKay First Nation
- Kátl'odeeche First Nation
- Mikisew Cree First Nation
- Smith's Landing First Nation

[3206] The ACO did not submit reports for Métis or non-status indigenous groups, or First Nations located outside of Alberta.

Athabasca Chipewyan First Nation

Background

[3207] The Athabasca Chipewyan First Nation is an Athabaskan-speaking Dené people who call themselves *Dënesuḷiné*, meaning “people of the land.” They are also known as *K'ai Tailé Dené*, meaning “people of the land of the willow” in reference to the delta of the Peace and Athabasca Rivers and the *Etthen Eldeli Dené* meaning “caribou eaters” in reference to their reliance on caribou. Ancestors and present members have lived and sustained themselves, their families and their community in the traditional territory of Athabasca Chipewyan for thousands of years by hunting, trapping, fishing, and gathering, carrying out their distinctive way of life, and passing down their culture for countless generations. Athabasca Chipewyan’s traditional lands radiate from the Peace-Athabasca Delta, including the lower Athabasca River and lands to the south of Lake Athabasca, extending to the lands around Fort McMurray and Fort McKay. Athabasca Chipewyan is the successor to an aboriginal group that entered Treaty No. 8 with the Crown at Fort Chipewyan in 1899. As a “band” under the *Indian Act*, Athabasca Chipewyan has eight reserves set aside for the use and benefit of their members.

[3208] Athabasca Chipewyan has a population of over 1000 people and is growing rapidly. Most members reside in Fort Chipewyan, Fort McMurray, and Fort McKay, while some members live in Fort Smith and elsewhere.

[3209] Athabasca Chipewyan identified three homeland zones covering approximately 2 723 200 ha as places where Athabasca Chipewyan history, culture, and livelihood are most firmly rooted: the *k'es hochela nene* (Poplar Point homeland), *dzÔ tuwßze nene* (Jackfish Lake homeland) and *t'βnu nene* (Old Fort Point homeland). These areas were described as a living part of Athabasca Chipewyan identity.

[3210] Athabasca Chipewyan and its members have maintained their identity and culture, in part, by exercising the rights that define and sustain Athabasca Chipewyan as a distinct people. Their lands continue to provide food and other resources for them as well as areas to transmit place-specific indigenous knowledge and values between generations. Their members described the importance of living by Athabasca Chipewyan values and Dené Law, which includes sharing, respect, and stewardship—taking only what is needed, looking after the land, and using everything that is taken. They stated that their duty as *Dënesuḷiné* is to care for the earth and its inhabitants, and they take this responsibility seriously because their continued existence and way of life depends on it.

[3211] On September 17, 2018, Athabasca Chipewyan advised the panel that they had reached an agreement with Teck to address their project-specific concerns. The participation agreement included joint recommendations to Alberta and Canada; these recommendations appear in [Appendix 9](#). Although issues remain that are beyond Teck’s ability to address, such as those related to regional planning (including land-use planning for the exercise of aboriginal and treaty rights), water allocation, and

wildlife management, Athabasca Chipewyan removed its opposition to the project subject to the recommendations to Alberta and Canada being addressed.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[3212] On August 24, 2018, the ACO advised that consultation was complete and concluded that Athabasca Chipewyan's concerns did not constitute site-specific concerns. The ACO reviewed Athabasca Chipewyan's subsequent written submission of August 31, 2018, and attended the hearing. It advised that the hearing did not reveal new information or concerns regarding potential site-specific impacts of the project on the continued exercise of Athabasca Chipewyan's treaty rights and traditional uses.

[3213] The ACO provided its final advice to the panel on November 26, 2018. It noted that on August 27, 2018, Athabasca Chipewyan advised the panel that Athabasca Chipewyan and Teck have reached an agreement to address their project-specific concerns. It also identified that Athabasca Chipewyan's hearing submissions noted other broad concerns that are better addressed outside of project-specific consultation or that fall outside the scope of the Government of Alberta's *Policy on Consultation with First Nations on Land and Natural Resource Management* (2005) and the Government of Alberta's *Guidelines on Consultation with First Nations on Land and Natural Resource Management* (2007).

Asserted or Established Aboriginal and Treaty Rights

[3214] Athabasca Chipewyan stated that their members continue to hold and exercise rights under Treaty 8 and rights guaranteed by section 35 of the *Constitution Act, 1982*. Athabasca Chipewyan asserts rights to hunt, trap, fish, and gather, as well as the incidental rights essential to the continuation of those "traditional patterns of activity and occupation," including section 35 rights to sufficient:

- water quality and quantity sufficient to fish and to access Athabasca Chipewyan's lands for hunting, trapping and gathering
- quality and quantity of resources in preferred harvesting areas, including berry crops, traditional medicines, migratory birds, caribou, and bison
- routes of access, navigation, and transportation (within constraints of time and cost) to access Athabasca Chipewyan lands and resources
- experience of remoteness and solitude to maintain cultural and spiritual relationships with the land and instruct younger generations on the land
- use of timber to live on the land while hunting, trapping, gathering, and fishing (e.g., to build shelters and fires)

[3215] Athabasca Chipewyan stated their members have a right, now and in the future, to practice their rights in their preferred manner and locations with confidence, to sustain the health and well-being of themselves and their families, and to pass their culture on to their children. Their ability to do so requires

priority access to sufficient quality and quantity of the tangible and intangible resources (e.g., water, game, fish, berries, spiritual sites, cultural landscapes and homelands, and traditional knowledge) that underlie the meaningful practice of rights.

[3216] The panel's terms of reference require it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by or the strength of such claims. But, for the purposes of assessing the potential effects of the Frontier project, the panel accepts the rights being asserted.

Current Context of Use of Lands

[3217] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities, or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Canadian Environmental Assessment Agency (the Agency), effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished. The evidence heard by the panel about land use and resources for traditional purposes and practice of asserted rights is summarized below.

[3218] Athabasca Chipewyan participated throughout the environmental assessment review process by providing written submissions and comments and participated in the public hearing process through written submissions, presenting oral traditional knowledge and expert testimony, as well as final argument. Their submissions are available on the public record, including the *Athabasca Chipewyan Knowledge and Use Report*, appendix 17A of volume 3 of the project update (CEAR #163); *Athabasca Chipewyan First Nation Comments on the Project* (CEAR #242, #321, #323, #380); *Athabasca Chipewyan First Nation Hearing Submission Filing, August 31, 2018* (CEAR #498); *Athabasca Chipewyan First Nation Hearing Presentations* (CEAR #598-603); and *Athabasca Chipewyan First Nation Final Written Argument* (CEAR #693).

[3219] Athabasca Chipewyan defined the local study area as the area within 5 km of the project footprint to represent the distance easily travelled on a day trip through the bush and returning by foot. Athabasca Chipewyan's regional study area includes the areas where direct or indirect project-related effects may interact with Athabasca Chipewyan current use. The local study area and regional study area are shown in figure 3 of Athabasca Chipewyan's knowledge and use report.

[3220] Teck defined a variety of local and regional study areas and a Ronald Lake bison study area. For traditional land use, Teck selected study areas that corresponded with the underlying resource used in

traditional harvesting. For example, bison harvesting was assessed using the same study area used to assess effects to bison populations. Teck's study areas included a terrestrial local study area, an aquatics local study area, a traditional land-use regional study area, an aquatics regional study area, and a Ronald Lake bison study area. The terrestrial local study area was used to assess effects on the opportunity for hunting and trapping activities, plant harvesting, and effects on culturally important sites and areas. The aquatics local study area was used to assess effects on traditional fishing activities. Teck's traditional land-use regional study area is based on the vegetation and wildlife assessments to capture all direct project effects combined with cumulative effects from other developments.

[3221] Athabasca Chipewyan stated that the project is proposed within Treaty 8 territory and within lands they have historically relied on and currently rely on for the practice of knowledge, use, and rights under Treaty 8, including hunting trapping, gathering, fishing, and associated cultural and livelihood practices.

[3222] They have used these lands for generations and rely on them for travel to and from their reserve lands, communities, and harvesting areas; social, cultural, and spiritual purposes; economic development; cultural land use and occupation; the health and vibrancy of their communities; and maintenance of their distinctive way of life.

[3223] The project would be located immediately west of the confluence of the Athabasca and Firebag Rivers, east of the Birch Mountains, and adjacent to *tabil k'e* (place for setting nets), an Athabasca Chipewyan habitation, harvesting, and cultural area on the west side of the Athabasca River near the confluence of the Athabasca River and Redclay Creek. The proposed location is within lands designated as an Athabasca Chipewyan cultural protection area called *k'es hochela nene* (Poplar Point homeland), approximately 16 km from their Poplar Point reserve (Chipewyan 201G) and near historic and registered trap lines held and used by Athabasca Chipewyan members since before the institution of Crown trap lines.

[3224] The *k'es hochela nene* includes approximately 1 292 290 ha of lands and waters critical to historic, current, and future Athabasca Chipewyan practice of rights. It includes areas west of the Athabasca River to the Birch Mountains and east of the Athabasca River into Saskatchewan. East of the Athabasca River, the southern boundary of *k'es hochela nene* is defined by the Firebag River corridor (5 km on either side of the Firebag River). The Firebag River is a critical use corridor and demarcates what many Athabasca Chipewyan members see as the boundary between where they are still able to practice their rights safely and where industrial contamination and disturbance now makes it unsafe to subsist on the land. The importance of the Firebag area as a critical corridor of rights practice is highlighted by the density of Athabasca Chipewyan land-use values recorded along the river.

- One hundred thirty-five Athabasca Chipewyan land-use values, including critical hunting areas, camps, cultural/spiritual areas, trails, Athabasca Chipewyan trap lines, and key wildlife and endangered boreal caribou habitat have been recorded within 5 km of the Firebag River.
- Seven hundred forty-seven land-use values have been mapped within the *k'es hochela nene* homeland as a whole.

[3225] West of the Athabasca River, the southern and western boundaries of this homeland are defined by core wood bison range extending south and west from the area of Ronald Lakes, extending into the Birch Mountains. Bison from this area are relied upon heavily by Athabasca Chipewyan members and are especially critical to those families affiliated with the Poplar Point and Point Brule areas. Impacts to this area are being experienced as a result of recreational use of the area. As an area where Athabasca Chipewyan rights can still be meaningfully practiced, the importance of the *k'es hochela nene* homeland is likely to increase as industrial effects continue to accumulate upstream along the Athabasca River.

Current Use of Lands and Resources for Traditional Purposes

[3226] Athabasca Chipewyan described a progression of changes over the past 150 years by settlers, missionaries, governments, and industry.

- Mining in Treaty 8 territory occurring since 1899.
- The creation of provinces and territories to regulate lands and resource extraction.
- The creation of Wood Buffalo National Park in 1922 and its expansion in 1926 restricted land use in Athabasca Chipewyan territory.
- An influx of white trappers in the 1920s and 1930s and the creation of trap lines in the 1940s resulted in trap lines, including those on Athabasca Chipewyan territory, being given to non-indigenous trappers who restricted Athabasca Chipewyan trapping.
- Missionaries took and put indigenous children in residential schools, which negatively affected Athabasca Chipewyan language and culture, ruined the lives of many children, tore apart many families, and forced them to move off the land to Fort Chipewyan.
- In the late 1960s, the Bennett Dam was built and reduced the amount of water flowing in the Peace-Athabasca Delta, which negatively affected the trapping industry and made many parts of the delta inaccessible for hunting, trapping, fishing, and gathering.
- In the 1960s and 1970s, the oil sands industry began and disturbed Athabasca Chipewyan territory and wildlife habitat and increased the amount of contamination affecting wildlife and people.

Resources

[3227] Athabasca Chipewyan described the importance of their traditional use of lands, historically and currently, for hunting, trapping, fishing, and gathering for sustenance, medicinal, and spiritual purposes. They identified

- 1687 site-specific subsistence values,
- 309 habitation values,
- 245 cultural/spiritual values,
- 81 transportation values, and
- 79 environmental features within the Athabasca Chipewyan regional study area, including a large concentration of values in the Peace-Athabasca Delta.

[3228] Sixty-four of these sites are within the Athabasca Chipewyan local study area, and 18 are within 250 m of the project footprint. Those 18 sites include permanent cabins and camp areas, the Athabasca River transportation corridor and associated trails used to access bison hunting areas, a historic trapping area (not a registered fur management area) used by members of Athabasca Chipewyan's Tripe de Roche family, and cranberry harvesting and fishing areas along the Athabasca River. Other sites within the local study area include blueberry collection areas and preferred fishing areas for pickerel, walleye, and whitefish along the Athabasca River and near its confluence with the Firebag River.

[3229] Athabasca Chipewyan stated that many culturally important species were plentiful throughout the region but now are difficult to find. Athabasca Chipewyan elders link declines to poor water quality due to industrial projects and reduced water levels, leading to the loss of quality wetland habitat. Other declines were understood to be associated with increased development and increased human population, which resulted in hunting pressure.

[3230] Athabasca Chipewyan hunted and managed the Ronald Lake bison for thousands of years, and the Ronald Lake bison are currently the only accessible wood buffalo population that is disease-free that Athabasca Chipewyan can legally hunt. Bison were plentiful, but oil sands development has reduced the Ronald Lake bison's historic range, and the population has declined. As a result, Athabasca Chipewyan issued the Bison Declaration, which introduced a self-imposed hunting ban on Ronald Lake bison for Athabasca Chipewyan members until the herd recovered.

[3231] Although the livelihood and survival of Athabasca Chipewyan's ancestors was based on harvesting caribou, Athabasca Chipewyan members currently do not hunt woodland caribou because they are listed as threatened under *SARA*.

[3232] Moose were historically plentiful, and they are the most commonly harvested large animal.

[3233] Athabasca Chipewyan members hunt many species of waterfowl in many areas in the regional study area, including along the Athabasca River during migration through the oil sands region. Athabasca Chipewyan stated that 30 years ago thousands of birds would fly over the region and hunters could harvest as many birds as they needed in a couple of days. Knowledge holders have reported a decline in the number of migratory birds passing through the project area, including duck, geese, and cranes, and Athabasca Chipewyan stated that it is increasingly difficult to harvest birds and collect eggs.

[3234] Athabasca Chipewyan land users may trap or snare rabbit, beaver, and muskrat along the shores of the Athabasca River while travelling from Fort McMurray to Poplar Point.

[3235] They said that new forms of transportation have enabled many non-indigenous hunters and trappers to access the region, which has increased pressure on Athabasca Chipewyan use and resulted in a decline in harvests.

[3236] Athabasca Chipewyan described generations growing up, living, and setting nets to fish near the proposed project area along the Athabasca River and in the inland lakes within the Poplar Point homeland area. One location, called *tabil k'e* on the west side of the Athabasca River near the confluence of Redclay Creek, was especially important for fishing. The Athabasca River and its side channels were described as critical for traditional fishing activities. Athabasca Chipewyan use the *k'es hochela nene* for harvesting a variety of plants and medicines. Within the traditional land-use regional study area, they gather sweet grass, rat root, diamond and willow fungus, cat-tails, mint tea, and plants used for smudges, with many of these growing west of the Athabasca River to the Birch Mountains. Within 250 m of the project footprint, they harvest berries. They also harvest berries within 5 km of the project area, especially near where the project approaches the Athabasca River corridor, and on the east side of the Athabasca River, near Poplar Point. Other blueberry and cranberry harvesting locations are located within the traditional land-use regional study area.

Access

[3237] Athabasca Chipewyan members stated they rely on trails and water routes to access areas used to hunt, trap, fish, and gather. They said that trapping areas upstream of the project are located in an area near Kears Lake, which is already subject to extensive industrial impacts from oil sand mines, tailings, infrastructure, and other barriers to Athabasca Chipewyan access.

[3238] The Athabasca River is the lifeblood of their lands, and it provides a vital transportation corridor; access to their reserve lands; access to culturally important hunting, trapping, fishing and gathering areas; and supports the resources required for the continuity of Athabasca Chipewyan's distinctive culture.

[3239] At the public hearing, Elder Julie Mercredi described the importance of water:

The water is my highway, the water is how I get to my home. My home is out on the land. That's where my religion is, that's where my spirituality is, that's where my food is, that's where my ancestry is. So without water to get to my homeland, it might just make our culture disappear.

[3240] Athabasca Chipewyan described the critical importance of having sufficient water quantity in the Athabasca River and its side channels, adjacent streams, and in the Peace-Athabasca Delta. River-based transportation routes have been documented within Athabasca Chipewyan's local study area and regional study area, including the Athabasca River and transportation routes via Lake Mamawi to Lake Claire in Wood Buffalo National Park. The lower Athabasca River is an essential transportation link providing access to the Peace-Athabasca Delta, river shores, its tributaries, adjacent lands (including reserve lands), and associated resources. The Peace-Athabasca Delta is a key area for hunting and harvesting, and water levels in the southern portion of the Peace-Athabasca Delta, including Athabasca Chipewyan reserves, are particularly dependent on recharge from the Athabasca River. Athabasca Chipewyan harvesters have developed specialized boat-hunting skills that are essential to the practice of their rights across expansive portions of Athabasca Chipewyan lands.

[3241] Athabasca Chipewyan members have observed reduced flows in the Athabasca River and the Peace-Athabasca Delta over the last 40 years. Athabasca Chipewyan developed three thresholds indicative of indigenous navigability:

- a minimum water depth of 1.2 m to allow passage of a fully loaded boat
- aboriginal base flow (1600 m³/s), which allows Athabasca Chipewyan to navigate and access territories fully
- aboriginal extreme flow (500 m³/s), which is the minimum flow rate before widespread and extreme disruption of indigenous navigation occurs

[3242] Athabasca Chipewyan's community-based monitoring program has demonstrated that water levels are already frequently below the aboriginal extreme flow, the minimum water level required for the exercise of Athabasca Chipewyan rights, particularly during the fall hunting season. Passage through key pinch points across the territory is difficult and increasingly impossible in some locations.

[3243] They described situations where insufficient water in the Athabasca River does not permit safe navigation in the lower Athabasca River and associated waterways. Low water levels, mud flats, sand bars, and log jams prevent access to back channels used to reach preferred hunting and fishing locations, reserve lands, and culturally important areas.

[3244] Many places have been dry for so long that grasses and willows have grown over, preventing boat access when water returns for a season and skidoo travel when the delta freezes.

[3245] Many Athabasca Chipewyan families were born, raised, and engaged in hunting, trapping, fishing, and picking berries at Jackfish Lake, which is only accessible by boat for a few weeks in June and July when the water level is high. Low water levels have prevented many from accessing the area for as often or as long as they would like.

Experience of Remoteness and Solitude

[3246] Increased traffic, physical disturbance, observed contamination, and related effects and other impacts have resulted in an implied threshold of disturbance being reached, which has led to widespread loss of areas used by many Athabasca Chipewyan members.

Health and Socioeconomic Conditions

[3247] Athabasca Chipewyan stated that interviews with Athabasca Chipewyan and other aboriginal people in the 1980s found that one-third of meat, fish, and birds eaten were from wild sources on average. Some households consumed wild foods twice a day, with moose, bison, bear, and caribou consumed an average of 128 times per year, berries 63 times, fish 62 times, birds 32 times, and small game 27 times. Many elders recall being raised on buffalo, which had provided significant food for the community as well as income during the eighteenth-century fur trade.

[3248] Moose also provide a large portion of the preferred diet for many Athabasca Chipewyan families. Athabasca Chipewyan estimated that a household of five would need to harvest between five and ten moose per year to satisfy cultural and subsistence needs. Wild foods continue to be extremely important, and the quality of the resources is crucial for their health.

[3249] Athabasca Chipewyan members have observed adverse changes in the quality of water and wild foods on the Athabasca River system since the mid-1980s, including changes to taste, odour, and sheen on drinking water sources; abnormalities in fish, moose meat, bird eggs; and tainted aquatic medicines. These changes, in combination with the current levels of perceived waterborne contaminants, have resulted in fear and loss of confidence in water and wild foods, which has led to avoidance and widespread impairment or loss of use of large portions of Athabasca Chipewyan territory. Due to a decline in the number and quality of wild foods and the barriers to accessing them, some Athabasca Chipewyan members can no longer hunt, and the community is able to share fewer wild foods.

[3250] Despite concerns with contamination, traditional foods from the land are still the preferred, healthiest, and most affordable food available, particularly those living in remote communities like Fort Chipewyan.

[3251] Athabasca Chipewyan land users must now travel further to access “clean” areas where they can harvest confidently, which increases time and effort spent, as well as the increased costs of pursuing traditional activities. They also haul water with them due to the increasing presence of foam and scum on water sources, which limits the distances they can travel. As harvesting has become more costly and time consuming, some members have pursued wage-based positions, which has resulted in a shift to increased consumption of store-bought foods.

Physical and Cultural Heritage

[3252] The panel is required to take into account the physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[3253] Athabasca Chipewyan described a deep cultural connection with the land, which is maintained by practicing traditional activities on the land. Athabasca Chipewyan shared that their elders’ teachings only become real when practiced out on the land.

[3254] Within the Athabasca Chipewyan regional study area, 309 habitation values and 245 Athabasca Chipewyan site-specific cultural or spiritual values (including ceremonial places, medicine collection places, and major burial sites) have been documented.

[3255] Two cultural sites, including the historic trapping area used by the Tripe de Roche family, and six habitation values including permanent cabins and camps are within 250 m of the project footprint.

[3256] *Tabil k’e*, an important habitation area where Athabasca Chipewyan members historically trapped fish using a stone weir and willow trap system and nets, is within the Athabasca Chipewyan local study area along with additional camps and cabins concentrated along the Athabasca River and extending into the Birch Mountains.

[3257] For many Athabasca Chipewyan members, bison and bison hunting is a uniquely important cultural activity that reinforces deep ceremonial and spiritual relationships. Bison skulls play an integral ceremonial role as altars and places for making offerings.

[3258] Athabasca Chipewyan stated that bison became part of the Dené cultural fabric, engendering the Dené laws that are essential to Athabasca Chipewyan identity including stewardship and respect. Lisa Tssessaze, director of Athabasca Chipewyan’s Dené Lands and Resource Management Office, described the importance of the Ronald Lake bison to Athabasca Chipewyan and the reaction to seeing the animals hunted for sport:

It’s painful for me to see how the spirit of the buffalo is taken away from their ancestral land. They’ve been on that land for thousands of years and to have their head taken away and mounted on someone’s office, someone’s home, I don’t understand how we cannot love and respect an animal so majestic, so beautiful.

[3259] Athabasca Chipewyan members derive a sense of pride from harvesting because they can return to their families and feed them. They feel proud to be contributing to their community, so they continue to live the values they have been taught. Subsistence and related practices “on the land” remain integral to the cultural continuity of Athabasca Chipewyan tradition, but the transmission of Athabasca Chipewyan knowledge and the ability of their members to maintain their way of life and connection to lands and resources is under stress as multiple culturally important species and places are either lost to their use or become rare or hard to find. They stated that members are finding it increasingly difficult to harvest food with confidence and to carry out traditional activities due to decades of industrial activity in the region, which has interfered with their way of life.

[3260] Athabasca Chipewyan expressed concerns regarding the future of Athabasca Chipewyan knowledge, language, and sense of place, as these intangible cultural resources are vulnerable to industrial change.

[3261] Athabasca Chipewyan stated that the land, water, and air have been degraded by the cumulative impacts of oil sands development over the past forty years. As a result, their ability to live off the land and carry out practices essential to their culture and livelihood has been impaired in large areas, and they can no longer sustain themselves through traditional practices. Their culture and way of life is threatened, and they have struggled to retain their language, culture, way of life, identity, and economic self-sufficiency.

Analysis and Findings

[3262] Teck did not contest the evidence provided by Athabasca Chipewyan. Athabasca Chipewyan appeared at the hearing and had its evidence tested through questioning. The panel finds it is able to rely on the evidence presented by Athabasca Chipewyan as summarized above.

[3263] Athabasca Chipewyan presented specific evidence that some members use lands for harvesting and cultural practices in and within 5 km of the project development area that will be directly affected by the project.

[3264] The panel finds from the evidence that:

- Athabasca Chipewyan members use lands in and within 5 km of the project development area in the *k'es hochela nene* (the Poplar Point homeland) for hunting, fishing, trapping, gathering, and conducting cultural practices, and these lands will be directly affected by the project.
- Athabasca Chipewyan members use the local and regional study areas to hunt, trap, fish, and gather; use historic camping sites and trapping areas in the immediate area of the project development area; and use the location called *tabit k'e* (meaning “net setting place”) on the west side of the Athabasca River near the confluence of Redclay Creek as an important historic traditional fishing location.

- Athabasca River is a key transportation route that Athabasca Chipewyan relies on to access its hunting and trapping areas and to practice traditional activities and that low water levels can adversely affect these uses.
- Athabasca Chipewyan use of lands for traditional and cultural activities is integral to the maintenance of their culture and the transmission of knowledge and cultural practices to younger members of their community. The loss of use of harvesting areas has adversely affected their ability to practice and teach traditional knowledge to the youth.
- Difficulty practicing traditional activities due to the increased effort, time, and cost required; the inability to safely access culturally important areas; and reduced hunting success has interfered with their traditional way of life and eroded their culture.

Project and Cumulative Effects

[3265] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights. It must also assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources and practice of asserted rights.

[3266] Evidence dealing specifically with the effects of the Frontier project is summarized below.

Effects on Current Use of Lands and Resources for Traditional Purposes

Athabasca Chipewyan's View

Resources

[3267] Athabasca Chipewyan was concerned that the project would eliminate or prevent the use of preferred hunting, trapping, fishing, and gathering activities in the local and regional study areas. They described various project effect pathways that could result in reduced harvesting success.

[3268] The project would create open tailings ponds that could be hazardous to birds that land in them, and mining activities could affect waterfowl migratory patterns and increase mortality. Reduced habitat and hunting access and changes to migration patterns would reduce hunting success.

[3269] The project would increase industry and non-indigenous recreational land user access, which would increase competition for harvesting traditional resources and reduce the quality of the hunting and gathering experience for Athabasca Chipewyan members. The abundance of moose, bison, and caribou would be reduced. Overall, the area where Athabasca Chipewyan cannot practice, including the local study area, the Firebag confluence, and Poplar Point reserve, would be expanded.

Access

[3270] The project could affect their ability to access harvesting areas by removing existing trails; introducing road closures, access controls, and fencing; increasing traffic; and by reducing water levels and flows in the Athabasca River. Athabasca Chipewyan stated that the project would disturb or eliminate ten trails and water routes within the Athabasca Chipewyan local study area, including four trails within 250 m of the project footprint. These trails and water routes are used to access the Birch Mountains, Ronald Lake, Poplar Point Reserve, and other areas along the Athabasca River, including Red Clay Creek and Big Creek and Lake Claire hunting areas.

[3271] The project would destroy or disturb land in the project footprint, which include lands used for fishing, trapping, and important habitat and movement corridors for wildlife including caribou, wood bison, and moose. This may displace Ronald Lake bison into areas that might not be suitable for harvesting or where opportunities for harvesting are reduced due to the effort needed to access and harvest bison, which may affect some harvesters more than others. Displacement may increase the likelihood of interaction with bison herds in Wood Buffalo National Park, which could result in disease contraction and the loss of the Ronald Lake bison's genetic distinctiveness. This would result in the loss of Athabasca Chipewyan's ability to access and harvest bison for multiple generations.

[3272] The project would reduce water levels in the Athabasca River system and delta, which would increase impediments to navigation on water and land-based access. These impediments would reduce access to bird hunting areas in the Athabasca Chipewyan local study area and regional study area, preferred fishing areas in the Athabasca Chipewyan local study area and regional study area, preferred trapping areas, and portions of the Athabasca Chipewyan regional study area that are normally accessible by boat, including Lake Claire and Athabasca Chipewyan reserve areas in the Peace-Athabasca Delta.

[3273] Council Member Raymond Cardinal described the difficulties of accessing culturally important areas at the public hearing:

...there were gates, there were restrictions, there was private property, no hunting, security guards all over the place. So, you know, it made it difficult for me to practice my rights.

Experience of Remoteness and Solitude

[3274] Athabasca Chipewyan stated that the project would create sensory disturbances, including noise, light, visual effects, odour, and create smoke or air quality effects. These sensory disturbances would affect 14 high-quality or unique Athabasca Chipewyan habitation sites, including 4 in or within 250 m of the project footprint.

[3275] They said the project would increase physical disturbance (fencing, road controls, traffic) and increase noise, dust, odour, and perceived contamination of air, ground, and water. These disturbances

would adversely affect their members' experience of practicing traditional activities and reduce opportunities for peaceful enjoyment of the land and the experience of remoteness and solitude.

[3276] Athabasca Chipewyan explained that remoteness and solitude was needed to maintain cultural and spiritual relationships with the land and to instruct younger generations on the land. Their members with specific connections to the land near the project would not be able to transmit place-specific indigenous knowledge and place names to future generations, and such knowledge could be lost.

Applicant's View

Resources

[3277] Teck stated that the project is proposed within the 1 292 290 ha *k'es hochela nene* (Poplar Point homeland), and the traditional land-use regional study area overlaps with 385 968 ha of homeland zones.

[3278] The project, when including a 183 m buffer where the discharge of a firearm is prohibited by Alberta hunting regulations,

- would directly affect 32 513 ha (8.4 per cent) of the area overlapping with the traditional land-use regional study area and 75 per cent of the area overlapping with the terrestrial local study area, and
- would affect 3209 ha of critical waterway zones, which amounts to 1.1 per cent of the 280 140 ha that overlap with the traditional land-use regional study area and 33 per cent of the area that overlaps with the terrestrial local study area.

[3279] The project's direct disturbance of the *k'es hochela nene* homeland zone and critical waterway zones would reduce habitat availability for wildlife, fish and plants.

- The project would disturb 29 923 ha or 19 per cent of the area overlapping the Ronald Lake bison study area and *k'es hochela nene*, including a loss of 6258 ha of preferred bison habitat availability.
- It would reduce preferred habitat availability for traditionally important fur-bearing species, and 2 ha of RFMA 2016 would be disturbed (1 per cent of the trapline). The proposed river water intake could result in the loss or alteration of fish habitat in the Athabasca River.
- It would disturb 25 024 ha (8 per cent) of high and moderate traditional plant potential within the traditional land-use regional study area, and at planned development case, the cumulative loss would be 601 286 ha (50 per cent).

[3280] Teck predicted that there would be

- High-magnitude cumulative effects from the project in combination with other activities on the Ronald Lake bison herd, moose, woodland caribou, black bear, fisher, Canada lynx, muskrat, and waterfowl in the traditional land-use regional study area.

- Moderate-magnitude cumulative effects were predicted on beaver in the traditional land-use regional study area.

[3281] At planned development case,

- Disturbance affecting the traditional land-use regional study area overlapping the *k'es hochela nene* homeland zone would increase to 43 446 ha (11 per cent) or 49 917 ha (13 per cent) with a weapon buffer.
- Disturbance affecting the traditional land-use regional study area overlapping the Athabasca Chipewyan critical waterway zones would increase to 64 313 ha (23 per cent) or 74 783 ha (27 per cent) with a weapon buffer.
- Disturbance affecting the traditional land-use local study area overlapping the *k'es hochela nene* homeland zone would increase to 30 623 ha (71 per cent) or 35 056 ha (81 per cent) with a weapon buffer.
- Disturbance affecting the traditional land-use local study area overlapping the Athabasca Chipewyan critical waterway zones would increase to 2832 ha (29 per cent) or 4844 ha (50 per cent) with a weapon buffer.
- Disturbance affecting the Ronald Lake Ronald Lake bison study area overlapping the *k'es hochela nene* homeland zone would increase to 33 423 ha (21 per cent).
- Disturbance affecting the Ronald Lake Ronald Lake bison study area overlapping the Athabasca Chipewyan critical waterway zones would increase to 2534 ha (24 per cent).

Access

[3282] Teck stated that the project would affect Athabasca Chipewyan access by trails and water to hunting, fishing, trapping and gathering areas due to water withdrawals and the direct removal of lands from the project footprint and the presence of mining infrastructure and tailings ponds. The project would reduce flows in Redclay Creek and lower Big Creek downstream of the project. Teck's hydrology assessment did not predict a change in navigability of the Athabasca River.

Experience of Remoteness and Solitude

[3283] Teck stated that the project would affect the experience of remoteness and solitude needed to maintain cultural and spiritual relationships with the land and instruct younger generations on the land. Teck noted the following:

- Athabasca Chipewyan habitation values near the river water intake may experience noise, and *Tabil k'e* (place for setting nets) is located just east of the proposed aerodrome.
- Indigenous land users might be able to hear intermittent noise from the bird deterrent system.

- Odour might be detectable slightly north and south of the project disturbance area and within the Ronald Lake Ronald Lake bison study area.
- There would be a low probability that odour due to the project would be detectable on the Athabasca River.
- The project would be visible from multiple areas, including points along the Athabasca River.

Effects on Health and Socioeconomic Conditions

Athabasca Chipewyan's View

[3284] Athabasca Chipewyan stated that contamination is having a serious effect on Athabasca Chipewyan knowledge and use throughout the area along with other psychosocial impacts. Athabasca Chipewyan attributed these changes mainly to oil sands development. The project would contribute to already high perceived levels of industrial contaminants within their environment.

[3285] The project would reduce their confidence in water quality and wild foods. Increased emissions could reduce water quality and air quality, and the project would increase the risk of accidental contaminant release, which would increase the real or perceived contamination of traditional resources and foods, including wildlife, fish, and vegetation. This would exacerbate the contaminant load in migratory birds and other wildlife, which could affect the health of the species and the health of their members who consume these species.

[3286] A lack of confidence in wild foods would result in a further loss of use of preferred harvesting areas, especially downstream of the project, which could result in their members travelling further to access harvesting areas. This would increase the travel costs and time required for Athabasca Chipewyan members to practice traditional activities.

[3287] Canada's preliminary assessment identified health concerns related to potential impaired or diminished land and resource use due to perceived or observed contamination and reduced confidence in the subsistence resources due to impacts to local and regional air quality and water quality.

Applicant's View

[3288] Teck's human health risk assessment examined health risks associated with multiple routes of exposure, including those related to water, fish, wild game, plants, berries, and soil. The risk estimates, with a few exceptions, are currently, and will continue to be, below health-based guidelines. The overall health risks to Athabasca Chipewyan appear to be similar to those posed to communities that are outside of the oil sands region. Teck presented evidence that project emissions, in combination with other sources of COPCs, are not expected to result in a detectable increase in health risks or to have adverse effects on wildlife populations in the Athabasca Oil Sands Area. Additional detail on project effects can be found in

the sections “[Public \(Human\) Health](#),” “[Wildlife Health](#),” “[Surface Water Quality](#),” “[Air Quality](#),” and “[Vegetation](#).”

[3289] Teck stated that trails used to access harvesting areas may be disturbed, and the use of alternative and less-direct access routes would result in additional travel time or costs for Athabasca Chipewyan harvesters.

Effects on Physical and Cultural Heritage

[3290] The panel is required to take into account the effects on physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Athabasca Chipewyan’s View

[3291] The project would disturb the following:

- 3 site-specific Athabasca Chipewyan cultural/spiritual values
- 17 habitation values
- 20 subsistence values within 5 km of the project footprint

[3292] Within 250 m of the project footprint, some of these values include a teaching and ancestral trapping area associated with the Athabasca Chipewyan’s Tripe de Roche family as well as permanent cabins and camps used by Athabasca Chipewyan members as a base for hunting.

[3293] Additional camps and cabins and *tabil k’e*, the historic habitation area, are within 5 km of the project footprint.

[3294] The project would also affect 2 subsistence values within 250 m of the project footprint, and 20 within 5 km of the footprint. Athabasca Chipewyan explained that subsistence resources hold deep social and cultural value. Harvesting, processing, and sharing wild foods and medicines is a major focus of interaction between adults and children, elders and youth. Harvesting activities such as gathering rat root, setting and checking nets for fish, calling moose, hauling meat, or tanning or processing hides provide the context for learning, reinforcing, and transmitting traditional ecological knowledge and cultural values and provide opportunities for sharing and maintaining sacred connections between generations and between humans and animals.

[3295] Athabasca Chipewyan stated that reduced confidence in the quality of food and water would impair or reduce Athabasca Chipewyan use of these values and result in loss of use of preferred harvesting areas, especially downstream of the project. Athabasca Chipewyan stated that reduced use would result in reduced transmission of traditional knowledge in the local study area and regional study area.

[3296] Athabasca Chipewyan described a positive feedback cycle where a reduction in harvesting would result in reduced consumption of wild foods and water, which would lead to fewer opportunities to transmit traditional knowledge. The reduced ability to transmit traditional knowledge to younger community members would result in less successful hunting in the future and further reduce the consumption of wild foods.

[3297] They said the project would reduce or eliminate opportunities to transmit knowledge and language, including place-based knowledge specific to the local study area, for multiple generations, which could erode Athabasca Chipewyan knowledge and language. These effects might extend into the Athabasca Chipewyan regional study area. They are not certain that their children will be able to continue traditional practices.

Applicant's View

[3298] Teck agreed with Athabasca Chipewyan's view that project effects on Athabasca Chipewyan culture were best assessed by Athabasca Chipewyan.

Analysis and Findings

[3299] Teck did not contest the evidence provided by Athabasca Chipewyan regarding their assessment of the effects of the project and agreed that project effects on Athabasca Chipewyan were best assessed by Athabasca Chipewyan. Athabasca Chipewyan also appeared at the hearing and had their evidence tested through questioning. Athabasca Chipewyan's evidence was largely supported by evidence from other parties. The panel finds it is able to rely on the evidence of Athabasca Chipewyan as summarized above.

[3300] The panel finds from the evidence that:

- Access to sufficient quality and quantity of tangible and intangible resources (e.g., water, wildlife, fish, berries, spiritual sites, cultural landscapes and homelands, the ability to transmit traditional knowledge) is necessary for Athabasca Chipewyan to practice traditional and cultural activities, and the Frontier project will potentially adversely affect that access.
- Athabasca Chipewyan is currently experiencing adverse effects on their ability to access lands for these practices as a result of industrial activities in the region and that the project will likely further exacerbate these effects.
- The project will directly affect 32 513 ha (8.4 per cent of the traditional land-use regional study area) and disturb trails in the project development area, which would require harvesters to use less-direct routes, resulting in additional travel time and costs.
- The project footprint will result in the direct loss of lands where traditional and cultural activities are practiced. The project may also create further barriers to accessing areas which meet Athabasca

Chipewyan's requirements for sufficient quality and quantity of lands to meaningfully practice traditional and cultural activities.

- Harvesting bison is an important element of Athabasca Chipewyan culture, and Athabasca Chipewyan has introduced a self-imposed hunting ban on harvesting the Ronald Lake bison to protect that resource.
- Low water levels during certain periods of the year present challenges to the ability of Athabasca Chipewyan harvesters to access hunting and fishing areas along the Athabasca River, as well as in the Peace-Athabasca Delta and Wood Buffalo National Park.
- Harvesting and sharing wild foods holds deep social and cultural values for Athabasca Chipewyan community members, and this is fundamental to maintaining cultural values between generations.
- The project will affect their ability to access hunting, fishing, gathering, and trapping areas by directly removing lands and trails and creating barriers to accessing other areas that meet Athabasca Chipewyan's requirement for sufficient quality and quantity of lands to meaningfully practice traditional activities.

Mitigation Measures

Mitigation Measures Proposed by the Applicant to Address Project Effects

[3301] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[3302] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. A number of the issues and concerns identified by Athabasca Chipewyan are addressed by these commitments. Teck committed to measures specific to Athabasca Chipewyan, and these are described in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

[3303] Teck committed to a number of mitigation measures intended to reduce project effects on Athabasca Chipewyan's current use of lands and resources for traditional purposes and physical and cultural heritage. Some mitigation measures were intended to reduce adverse project effects to access, the experience felt while practicing traditional activities, and the quality of wild foods and water.

Participation Agreement

[3304] On September 17, 2018, Teck and Athabasca Chipewyan announced the signing of a participation agreement with respect to the Frontier project. The agreement is a substantial and critical mitigation for the effects described in this updated assessment while also providing mechanisms for continued

engagement throughout the life of the Frontier project, which might result in the development of additional community-specific mitigation measures to manage specific effects.

[3305] The agreement sets out

- objectives for environmental management and comprehensive environmental impact mitigation,
- management commitments from Teck in support of these objectives, and
- areas for requested Crown action and support in furtherance of these objectives.

[3306] Teck and Athabasca Chipewyan requested that the panel consider the objectives, commitments, and requested recommendations in preparing its report.

[3307] Athabasca Chipewyan asserted that Crown action is either necessary to facilitate Teck's mitigation and management commitments (for example, the biodiversity stewardship area or a framework for caribou restoration and wildlife habitat offsets) or to mitigate regional and cumulative effects of oil sands development that Teck alone cannot address (for example, human health and migratory bird studies, or amending the *Surface Water Quantity Management Framework*). They requested that, if the project is approved, the panel clearly outline what is required from the Crown to minimize the impacts of project-specific and cumulative impacts of oil sands development on Athabasca Chipewyan's rights.

[3308] Athabasca Chipewyan stated that their jointly submitted conditions and recommendations would still be insufficient to fully address their regional and cumulative concerns regarding water quantity management. Athabasca Chipewyan also independently recommended that Teck be required to completely shut off their river water intake when the river flow reaches 500 m³/s during the open-water season. Teck stated that it would not be feasible to do so, but Athabasca Chipewyan urged that all operators should be required to adhere to this threshold.

Analysis and Findings

[3309] The panel finds that the Frontier project is likely to cause an adverse effect on Athabasca Chipewyan's ability to access lands for traditional purposes. Existing adverse cumulative effects of development on the practice of traditional and cultural activities and the exercise of Athabasca Chipewyan rights will be exacerbated by the project. The panel has recommended mitigation that should be included in the Minister's decision statement under *CEAA 2012*.

[3310] In the section of this report dealing with wildlife, the panel has concluded that the Frontier project will result in significant, adverse effects to the Ronald Lake bison herd, increasing the likelihood of disease being transmitted from the diseased animals in Wood Buffalo National Park to the healthy animals in the Ronald Lake herd. This means that the Frontier project will likely adversely affect to Athabasca Chipewyan's traditional use of the Ronald Lake bison herd.

[3311] While the panel concluded that none of the proposed mitigation measures was likely to be effective in reducing the risk of disease transmission, it did make several recommendations to the governments of Canada and Alberta regarding the Ronald Lake bison herd (see [Appendix 6](#)).

[3312] In the section of this report dealing with wildlife, the panel concluded the Frontier project will displace moose as a result of loss of habitat in the local study area. This change in abundance of moose in preferred harvesting areas will reduce harvesting success of indigenous hunters, which will adversely affect Athabasca Chipewyan's traditional use of this resource. The panel has made recommendations to the governments of Canada and Alberta concerning the management of moose.

[3313] In section [23](#), "[Wildlife](#)," the panel reached the conclusion that the Frontier project, in combination with other developments, will likely result in significant adverse cumulative effects on caribou.

[3314] In section [23](#), "[Wildlife](#)," the decline in fur-bearer abundance as a result of the project will vary with the species, with effects ranging from high magnitude for lynx and fisher to moderate for black bear, beaver, and muskrat. The panel notes that indigenous concerns are mainly related to the availability of fur-bearers for harvesting and that these concerns are closely linked to water levels in the rivers and the Peace-Athabasca Delta and other access issues.

[3315] In the sections "[Wildlife Health](#)" and "[Vegetation](#)," the panel concluded that air and water quality effects from the Frontier project are not expected to significantly affect wildlife and vegetation health. However, reduced confidence in the quality of foods and water quality may adversely affect Athabasca Chipewyan's use of these resources and result in loss of use of preferred harvesting areas, especially downstream of the project.

[3316] In section [29](#), "[Public \(Human\) Health](#)," the panel determined that the project is not likely to result in adverse effects to the health of indigenous land users in the region. The panel has also made recommendations to the governments of Canada and Alberta regarding the protection of human health (see [Appendix 6](#)).

[3317] In section [19](#), "[Surface Water Quantity](#)," the panel found that significant adverse cumulative effects to surface water quantity, flows, and water levels in the Athabasca River, Peace-Athabasca Delta, and Slave River Delta are occurring but are due predominantly to hydropower regulation and regional climate change, with industrial water withdrawals playing a minor role. These changes in surface water quantity appear to be adversely affecting Athabasca Chipewyan's ability to access lands and resources for traditional purposes. The panel does not believe that the Frontier project is likely to exacerbate those existing effects. The panel has made recommendations to the governments of Canada and Alberta with regards to surface water quantity and indigenous navigation.

[3318] The participation agreement and the commitments made by Teck are intended to mitigate the effects of the project on current use of land and resources for traditional purposes, physical and cultural heritage, and impacts to aboriginal and treaty rights. The agreement will establish a cooperative implementation committee to implement the agreement. The panel supports the establishment of such processes to manage mitigation measures and adapt to circumstances that may not be anticipated at this time. It expects the parties to comply with the various commitments that they have made in this agreement.

[3319] A consolidated version of Teck's commitments is in [Appendix 11](#). The panel has required a number of these proposed measures as conditions of the project approval. A number of these measures are outside the authority of the panel but are reasonable given the context of the region, the issues and concerns, and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of valued environmental components, which will serve to also reduce effects on indigenous use of lands and resources. In conjunction with a number of adaptive management plans that Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Athabasca Chipewyan.

[3320] Athabasca Chipewyan removed its objections to the Frontier project following the submission of the agreement. The mitigation measures that are known within these agreements are expected to contribute to the mitigation of the effects of the project on current use of lands and resources, physical and cultural heritage, and asserted indigenous rights.

[3321] Athabasca Chipewyan participated in the oral portion of the hearing, presented evidence, and were available for cross-examination.

Conditions and Recommendations

[3322] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Athabasca Chipewyan.

Conditions

[3323] The panel requires that Teck finalize a traditional land-use mitigation, monitoring, and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of construction of the project.¹⁶⁰ The plan will be required as a condition of an *EPEA* approval for the project.

¹⁶⁰ Draft *EPEA* Approval – Condition 3.1.7

Recommendations for the Governments of Alberta and Canada

[3324] The panel recommends that Canada and Alberta consider the environmental management objectives, commitments, and recommendations identified in the September 17, 2018, joint letter from Athabasca Chipewyan and Teck. [Appendix 9](#) lists the joint recommendations.

Determination of Significance

[3325] The panel determined the significance of project effects to current use of lands and resources, and physical and cultural heritage based on the approach discussed in the Agency's guide *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[3326] The panel also assessed the potential for the Frontier project to impact the rights asserted by Athabasca Chipewyan in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Parties' Views on Significance

[3327] Athabasca Chipewyan stated that residual project effects on bison, moose, fish, migratory birds, and access to preferred areas are likely to be very high magnitude due to the likelihood of changes, the importance and uniqueness of these resources, and their vulnerability to change as a result of existing effects from industrial activity. Athabasca Chipewyan determined that the frequency of the effects would be continuous, last for more than twenty years, and would be irreversible because the existing cultural landscape would be destroyed or practices of knowledge and use in the area would be impaired or interrupted for more than one generation. Athabasca Chipewyan stated that the project would affect the experience of remoteness and solitude needed to maintain cultural and spiritual relationships with the land and instruct younger generations on the land.

[3328] Athabasca Chipewyan determined that the project alone would likely have significant adverse residual effects on Athabasca Chipewyan knowledge and use in multiple areas, with some of the most critical impacts to important site-specific values. These values relate to habitation, subsistence, transportation and environmental features, impacts on hunting wood bison and moose, interruption or disturbance of access to and enjoyment of Athabasca Chipewyan lands and waters, loss of use of areas due to perception of contamination, and effects to the Athabasca River and adjacent streams during ice-free low-flow periods. Athabasca Chipewyan anticipated that the project's residual effects would meet or exceed the threshold of significance within the local study area and regional study area and threaten the ability of Athabasca Chipewyan members to practice knowledge and traditional use activities in preferred ways at preferred locations within the local study area, regional study area, and beyond.

[3329] Teck stated that the project would affect Athabasca Chipewyan access by trails and water to hunting, fishing, trapping and gathering areas due to water withdrawals and the direct removal of lands. Teck determined that the effects of the project on the opportunity for Athabasca Chipewyan to hunt the Ronald Lake bison herd and other traditionally important species, harvest traditionally important vegetation, and use culturally important sites would be adverse and high in magnitude. The magnitude of effects on the opportunity to trap on two Athabasca Chipewyan trap lines in the traditional land-use regional study area would be adverse and high magnitude. Adverse and low to moderate-magnitude effects were determined for fishing. Teck determined that all of these effects would be long term because they would affect multiple generations of Athabasca Chipewyan land users.

Panel Determination

Current Use of Land and Resources for Traditional Purposes

[3330] The geographic extent of project effects would be regional. The effects to Athabasca Chipewyan's ability to access and harvest species of cultural importance are expected to occur within the local study area and regional study area.

[3331] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape.

[3332] Frequency of effects would be continuous.

[3333] The project effects would be irreversible. Uncertainty exists regarding the timing and success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife, and waterfowl populations which Athabasca Chipewyan members harvest. Further, it is uncertain whether indigenous groups would reestablish traditional use activities on reclaimed lands following a multigenerational absence and therefore a loss of cultural connection to those lands.

[3334] The magnitude of project effects would be high. Project effects, including the direct loss of lands in the project disturbance area, represent an important portion of the *k'es hochela nene* homeland zone.

[3335] Due to the high magnitude, regional geographic extent, long-term duration, and continuous frequency, the project effects to Athabasca Chipewyan's current use of lands and resources for traditional purposes in the local and regional study areas would be adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

Health and Socioeconomic Conditions

[3336] As determined in section 29, “[Public \(Human\) Health](#),” the panel finds that the human health effects from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Athabasca Chipewyan members.

[3337] As determined in section 30, “[Social Effects](#),” the panel finds that the socioeconomic effects from the project are expected to be low in magnitude. The panel believes that this finding applies for Athabasca Chipewyan.

[3338] The panel believes that effects would be continuous and regional in extent, but the effects would be medium term in duration and reversible as they would decrease at the end of operations.

[3339] As a result, the panel deems that the project effects to the health and socioeconomic conditions of Athabasca Chipewyan would be adverse but not significant.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[3340] The geographic extent of project effects would be regional. The effects to Athabasca Chipewyan’s ability to continue to participate in culturally important activities are expected to occur within the local study area and regional study area.

[3341] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities.

[3342] The frequency of effects would be continuous.

[3343] The project effects to the transfer of cultural values and knowledge, which require connections to the land from one generation to the next, would be irreversible given the likely loss of connection to traditional activities and the cultural values that take place on lands directly affected by the project. This loss of connection would severely affect the ability of land users, especially elders, to transfer knowledge to younger generations.

[3344] The magnitude of project effects would be high. The project would affect culturally important areas, cabins, wildlife species, and the ability to access them.

[3345] As a result, the panel deems the project effects to Athabasca Chipewyan’s physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance in the local and regional study areas would be adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

Summary

[3346] The panel finds that the project effects to Athabasca Chipewyan's physical and cultural heritage are adverse, significant, and likely to occur even in consideration of the key mitigation measures proposed.

Significance Determination for Cumulative Effects

[3347] Athabasca Chipewyan provided extensive oral and written evidence demonstrating how lands where its members practice traditional activities, including areas along the Athabasca River north of Fort McMurray, have undergone intense changes in recent decades. The effects of industrial development have adversely affected their ability to hunt, trap, fish, gather plants, and use culturally important areas within and near the project area.

[3348] Teck predicted that there would be high-magnitude cumulative effects from the project, in combination with other activities, on the Ronald Lake bison herd, moose, woodland caribou, black bear, fisher, Canada lynx, muskrat, and waterfowl in the traditional use regional study area. Teck acknowledged that, compared to predevelopment conditions, Athabasca Chipewyan is currently experiencing substantial changes to their ability to undertake traditional activities. Teck assessed the cumulative effects on Athabasca Chipewyan's opportunity to continue practicing traditional land-use activities in the traditional land-use regional study area to be high.

Panel Determination

Current Use of Land and Resources for Traditional Purposes

[3349] The geographic extent of cumulative effects would be at a provincial scale because cumulative effects are occurring over much of the traditional lands used by Athabasca Chipewyan members. The hydrological changes and effects to water quality extend beyond the project regional study area and into the Peace-Athabasca Delta and Wood Buffalo National Park. Changes in water levels have affected habitat for species of importance to Athabasca Chipewyan for hunting and trapping, and low water levels create a major barrier to Athabasca Chipewyan members' ability to access lands that are crucial to practicing traditional activities.

[3350] The panel finds that the duration of cumulative effects would be long. Cumulative effects will extend beyond the cessations of industrial activities in the region. Cumulative effects are likely to be experienced for an extremely long time similar to the effects that are being felt as a result of the hydroelectric dams on the Peace River.

[3351] The frequency of cumulative effects would be continuous.

[3352] The cumulative effects on some measures will be irreversible. It is uncertain whether indigenous groups will reestablish traditional use activities on effected lands following a multigenerational absence and therefore a loss of cultural connection to those lands.

[3353] The magnitude of cumulative effects would be high. Much of the area that Athabasca Chipewyan considers homelands have been adversely affected by oil sands mining and development. Some of the most harmful cumulative effects are occurring in the Peace-Athabasca Delta and Wood Buffalo National Park, where changing hydrological conditions appear to have resulted in the drying of some areas. This drying, and resulting lower water levels, prevent Athabasca Chipewyan members from accessing areas important for trapping, hunting, fishing, gathering, and heritage sites and areas important for conducting cultural practices.

Health and Socioeconomic Conditions

[3354] As determined in section 29, “Public (Human) Health,” the panel finds that the cumulative effects to human health from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Athabasca Chipewyan members.

[3355] As determined in section 30, “Social Effects,” the panel finds that the cumulative socioeconomic effects are expected to be low in magnitude. The panel believes that this finding applies for Athabasca Chipewyan.

[3356] The panel believes that cumulative effects would be continuous and regional in extent, but the effects would be medium term in duration and reversible as they would decrease at the end of operations.

[3357] The panel finds the cumulative effects to the health and socioeconomic conditions of Athabasca Chipewyan would be adverse but not significant.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[3358] The geographic extent of cumulative effects would be provincial. The cumulative effects to Athabasca Chipewyan’s ability to continue to participate in culturally important activities are expected to occur within the provincial boundary, extending beyond the regional study area.

[3359] The duration of cumulative effects would be long term, and the frequency of cumulative effects would be continuous. Cumulative effects would extend beyond the end of project operations and reclamation and closure activities.

[3360] The cumulative effects on the transfer of cultural values and knowledge, which require connections to the land from one generation to the next, would be irreversible given the likely loss of connection to traditional activities and the cultural values.

[3361] The magnitude of cumulative effects would be high. The cumulative effects would affect culturally important areas, cabins, wildlife species, and the ability to access them.

[3362] The panel finds that the effect of the project in combination with the effects of past activities on Athabasca Chipewyan's physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance in the local and regional study areas would be adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

Summary

[3363] The panel finds that the cumulative effects on Athabasca Chipewyan's current use of lands and resources for traditional purposes and physical and cultural heritage are adverse, significant, and likely to occur even in consideration of the mitigation measures conditioned by the panel.

Significance Determination for Asserted Rights

[3364] The panel assessed potential effects of the Frontier project on Athabasca Chipewyan's asserted rights as required by its terms of reference. In conducting its assessment, the panel took into consideration the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*.

[3365] The panel finds that the residual effects to current use of land and resources, physical and cultural heritage, and effects to Athabasca Chipewyan's asserted rights are not likely to be fully mitigated by the measures required by the panel or the known measures within the agreement between Athabasca Chipewyan and Teck. In consideration of the scale of the project and the evidence presented by the parties, the panel finds that the residual project effects on Athabasca Chipewyan's ability to exercise asserted rights will be adverse and significant and likely to occur. These effects on asserted rights will be most prominent for those Athabasca Chipewyan members that access lands within the project development area and the local study area.

[3366] The project in combination with current effects of industrial development will further exacerbate cumulative effects on Athabasca Chipewyan's ability to exercise asserted rights. The panel finds that cumulative effects on these asserted rights will be adverse, significant and likely to occur.

Table 39. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	regional	long	continuous	irreversible	significant
Cultural and physical heritage	high	regional	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	regional	long	continuous	irreversible	significant

Table 40. Summary – Significance determination for cumulative effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	provincial	long	continuous	irreversible	significant
Cultural and physical heritage	high	provincial	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	provincial	long	continuous	irreversible	significant

Deninu K'ue First Nation

Background

[3367] The Deninu K'ue First Nation is primarily based on the south shore of the Great Slave Lake in Fort Resolution in the Northwest Territories and has approximately 915 members. The Deninu K'ue First Nation stated that their traditional territory does not include the Frontier project area but includes, among other areas, portions of the Slave River and Slave River Delta. The Deninu K'ue First Nation's traditional territory, as part of the Akaitcho Dené First Nations, encompasses an area to the north, east, and south of Great Slave Lake greater than that covered by Treaty 8.

[3368] The Deninu K'ue First Nation participated in Parks Canada's strategic environmental assessment of Wood Buffalo National Park.

[3369] The Deninu K'ue First Nation submitted the following:

- June 15, 2018: Statement of concern
- August 31, 2018: Hearing submission
- November 14, 2018: Scheduling of final arguments
- December 5, 2018: Final written argument

[3370] The Deninu K'ue First Nation participated in the hearing, providing direct evidence to the panel on October 3, 2018.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[3371] The *Joint Operating Procedures for First Nations Consultation on Energy Resource Activities* requires that the AER panel request advice from the ACO as to whether the ACO has found consultation to have been adequate and request advice on mitigation measures that may be required to address potential impacts on aboriginal rights. The panel made the request for advice before closing the evidentiary portion of the hearing so that parties would have an opportunity to comment on the advice.

[3372] The ACO attended the hearing and heard the evidence of Deninu K'ue First Nation. The ACO found that the Deninu K'ue First Nation provided no evidence of adverse impacts attributable to land and resource management decisions by Alberta in connection with the Frontier project. Further to the ACO's letter to the panel of September 19, 2018, it advised the AER that consultation is not currently required with Deninu K'ue First Nation.

Asserted or Established Aboriginal and Treaty Rights

[3373] The Deninu K'ue First Nation is a signatory of Treaty 8. The Deninu K'ue First Nation stated that Treaty 8 guarantees the rights to hunt, fish, trap, and gather. Furthermore, they indicated that it was promised at the time of the signing of the treaty that the mode of life of the Akaitcho Dené First Nations (which includes the Deninu K'ue First Nation as well as three other First Nations) would not be interfered with, that they would be able to continue to exercise their harvesting rights to hunt, fish, trap, and gather as they had always done, and that they would be entitled to maintain their traditional lifestyle and live as before. They also claim additional rights, which do not only exist on paper, but are in active use, and are an integral part of their tradition and existence.

[3374] The Deninu K'ue First Nation assert outstanding aboriginal rights and title in and to their traditional territory because their treaty was merely a peace and friendship treaty rather than a land surrender treaty. The Deninu K'ue First Nation also noted that they believe the signing of the treaty brought about a duty on their part to speak on behalf of their people and for things that do not have the ability to speak.

[3375] The panel's terms of reference require it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent the panel receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted or the strength of such claims. For the purposes of assessing the potential effects of the Frontier project the panel accepts the rights being asserted.

Context of Historical and Current Cumulative Effects

[3376] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities, or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Canadian Environmental Assessment Agency (the Agency), effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

Current Use of Lands and Resources for Traditional Purposes

[3377] The Deninu K'ue First Nation indicated that industrial activity upstream of the Slave River is extensive, and Northerners have raised concerns for many years about the cumulative impacts of these upstream activities on the land, water, air, culture, and traditional lifestyle. The Deninu K'ue stated that there are a large number of mines, and they feel surrounded by them. They raised concerns that oil sands mines are disturbing large areas and effects are likely to be observed large distances downstream. The Deninu K'ue noted that, given the lack of long-term monitoring, it is difficult to measure the full extent that these effects have had on the downstream environment. They maintained that it is difficult to align

specific effects to specific developments; however, local and traditional knowledge provides key insights into what the long-term changes have been and the gravity of these effects. The Deninu K'ue stated that many projects, including pulp mills, the Bennett Dam, pesticides, farming activities, municipalities, and mines, could be contributing to the cumulative effects.

[3378] The Deninu K'ue said they practice their rights in the Slave River and Slave River Delta, the Taltson River, the Jean River, the Little Buffalo River, the Big Buffalo River, and parts of the "Big Lake" north, east, and south. They indicated that they practice traditional uses on the northwestern part of Wood Buffalo National Park. The Big Buffalo River, Little Buffalo River, and some of the tributaries leading to the Little Buffalo River are located in the Wood Buffalo National Park.

[3379] The Deninu K'ue First Nation hunt, fish, and trap on a regular basis, which provides fur to sell and meat to subsist on. Their traditional lands are also used for the gathering of berries for food and plants for medicinal purposes. They stated that fish abound in and around the areas of the Slave River, the Slave River Delta, and the waters into which the Slave River flows.

[3380] The Deninu K'ue First Nation indicated that in areas where they practice their rights, including in Wood Buffalo National Park, water flow has decreased and water levels are much lower today compared to the past. Members provided examples of areas where water flowed in the past but no longer flows today. One member gave the example that the lake used to be 30 yards away from his house but is now 200 yards away. Members also mentioned that there used to be 20 to 30 channels in the delta, but now there are only three. Members said the water level is going down every year by 2 to 4 feet. The Deninu K'ue First Nation stated that due to low water levels, access to important harvesting areas is not possible by boat, specifically in the delta and the Jean River. They explained that low water levels have also resulted in ecosystem changes. Low currents result in more deposition of sediment, and when sediment builds up, vegetation establishes itself, and the boreal forest ecosystem changes to include new species like willows. They said these ecological changes are affecting their traditional way of life.

[3381] The Deninu K'ue First Nation explained that oil sands developments have affected the quality of the water in their community. The Deninu K'ue First Nation members stated that the way the water looks and tastes has changed, and they have observed oil sheens on top of the river. None of their members drink the water from rivers anymore; they carry drinking water with them when they are out on the land.

[3382] The Deninu K'ue said they are experiencing climate change and are concerned about oil sands development contribution to climate change. The Deninu K'ue described the changes they are experiencing, including increasing temperatures resulting in reduced water levels, changes in the cycle of seasons, weather and precipitation, and changes in animal behaviour and migration. They stated that these changes affect the timing of their hunting and gathering activities. Members explained that in the past, they knew when environmental processes occurred. Today, the timing is changing and migrations or mating could occur a week earlier or a week later than it used to. Similarly, medicines are harvested and

used at specific times to maximize health benefits, and the change in timing is affecting the confidence members have in their past timing predictions. They noted that more severe forest fires affect the ecosystem and animals in the area and the ability of the region to regenerate itself. They explained that with climate change, the ice is freezing less than it did in the past. This has affected their members' safety and confidence when travelling in their territory.

[3383] They are concerned that the wildlife species in the Athabasca, Peace, and Slave basins, including species at risk, waterfowl, ducks, and moose, are declining, and cited this as evidence that the ecological integrity of the area is declining.

Physical and Cultural Heritage

[3384] The panel is required to take into account the physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[3385] The Deninu K'ue First Nation members described the sadness they feel when they go in the bush and observe the changes in the condition of the land and the water levels resulting in the loss of rivers.

Health and Socioeconomic Conditions

[3386] The Deninu K'ue First Nation raised concerns regarding the increased deposition of contaminants and the declining health of the environment. They are concerned that the acute and chronic exposure to air and aquatic contaminants is leading to changes in the health and quality of the natural resources (e.g., fish and wildlife) as well as the health of their people who rely on resources downstream of oil sands members stated that they suspect that diseases and cancers in their communities are caused by the contamination of the water.

Analysis and Findings

[3387] Teck did not contest the evidence provided by Deninu K'ue First Nation. Deninu K'ue First Nation also appeared at the hearing and had their evidence tested through questioning. The panel finds it is able to rely on the evidence presented by Deninu K'ue First Nation. The panel finds from the evidence that:

- Deninu K'ue First Nation continues to use their traditional lands as described.
- They use lands in the northwestern part of Wood Buffalo National Park.
- Their land-use activities are focused downstream of the project and on the areas in and around the Slave River and Slave River Delta.
- Their members practice their asserted rights to hunt, trap, fish, and gather, and these activities can include spiritual practices.
- These activities do not regularly occur within the disturbance area of the Frontier project.

- They did not describe any specific use of lands or resources within the project disturbance area or the local or regional study areas.
- They did not identify any specific sites or culturally important areas that would be directly affected by the project.

[3388] Deninu K'ue First Nation did not present specific evidence that members use lands for harvesting and cultural practices in the project development area or the local and regional study areas that will be directly affected by the project. The panel finds that Deninu K'ue First Nation has not demonstrated that they currently use these lands or resources for traditional purposes.

Project and Cumulative Effects

[3389] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources and practice of asserted rights.

Effects on Use of Lands and Resources for Traditional Purposes

Deninu K'ue First Nation's View

[3390] The Deninu K'ue First Nation stated that if the project is approved, they expect the livelihood of their members would be affected for years to come. They are concerned that the project would affect their aboriginal and treaty rights. They disagree with Teck's assessment that the project would not affect them. They explain that the Deninu K'ue First Nation community in Fort Resolution is located downstream from the Frontier project, and studies have shown that the upstream development of oil sands has downstream effects on the waters within the southern Northwest Territories, including declines in water levels and water currents.

[3391] The Deninu K'ue stated that water is directly and indirectly essential to the exercise of their aboriginal and treaty rights, and they are concerned that the Frontier project would further affect water flow.

[3392] The Deninu K'ue said they are concerned that the Frontier project would further affect water quality and could contaminate the aquatic environment. They have concerns about the effects of contaminants from tailing ponds leaks and seepage, bitumen, oil and wastewater spills, refinery effluent, sewage from camps, removal of muskeg and overburden drainage, mine runoff through sedimentation ponds, airborne particulates from refineries and upgrading facilities, emissions from stacks and heavy equipment, coke and tailings dust, the use of large quantities of water for bitumen extraction, processing and land disturbance, and subsequent releases of naturally occurring metals and PAHs. They stated that it is not possible to guarantee that the Frontier project would be safe. The Deninu K'ue First Nation

members stated that “even one bad day could be the end of the Deninu K’ue First Nation and their way of life.”

[3393] The Deninu K’ue raised concerns that with climate change, parasites and insects could become more prevalent and affect large animals.

[3394] The Deninu K’ue First Nation are concerned about what will be left for their kids and grandkids. They worry that their future generations may not be able to practice their asserted rights to hunt, fish, trap, and gather in their traditional territory.

Teck’s View

[3395] Teck stated that the Deninu K’ue First Nation does not claim that the project is located within their traditional territory. The Deninu K’ue is primarily located in Fort Resolution, which is approximately 385 km from the Frontier project—a significant distance according to Teck. Teck stated that the Frontier project is predicted to have negligible effects on the park, including the Peace-Athabasca Delta, and therefore Deninu K’ue First Nation’s traditional use of the park and the Peace-Athabasca Delta would not be affected by the project. Teck stated that many of the concerns expressed regarding the Peace-Athabasca Delta exist whether or not the Frontier project proceeds.

Effects on Health and Socioeconomic Conditions

Deninu K’ue First Nation’s view

[3396] Deninu K’ue First Nation members raised concerns that the Frontier project could contaminate wildlife. They stated that they were told not to eat rabbit and chickens living around the Pine Point mine and are worried that similar contamination could occur as a result of the Frontier project.

[3397] The Deninu K’ue First Nation stated that carrying water instead of drinking it on the land costs money and it adds weight to carry when going out on the land.

Findings and Analysis

[3398] As a downstream community, The Deninu K’ue First Nation described their concern about the effects of oil sands development on water quality in the Peace-Athabasca Delta and downstream in the Slave River. The panel has determined that the project is not expected to result in measurable effects to water quality in the Peace-Athabasca Delta (and by extension the Slave River).

[3399] Deninu K’ue First Nation do not use lands or resources within the project disturbance area or the local or regional study areas. They did not identify any specific sites or culturally important areas that would be directly affected by the project. The Deninu K’ue First Nation has not demonstrated that they will be affected by the project.

Mitigation Measures

[3400] Teck's view is that the Frontier project will not affect Deninu K'ue First Nation, and therefore Teck has not entered into any type of agreement with them.

[3401] The Deninu K'ue First Nation stated that they want to be involved in monitoring and management of project-related effects.

[3402] Transport Canada stated that it can include terms and conditions within project approvals to address impacts and cumulative impacts to navigation. Transport Canada confirmed that it continues to support a regional approach to water management, which can more effectively consider all of the cumulative impacts of water withdrawal for oil sands operations. To support this regional approach and to further its own understanding of the impacts of water withdrawals on navigation, Transport Canada advised that it is working to complete a navigation study in spring 2019. Transport Canada also confirmed that it is committed to working with the Government of Alberta. It committed to sharing the results of the study not only with Alberta, but also with other partners, including indigenous groups, Parks Canada, and ECCC.

Analysis and Findings

[3403] In section 18, "[Surface Water Quality](#)," the panel determined that the Frontier project will result in water discharges and aerial emissions that will increase concentrations and loadings of some surface water quality parameters within the local study area. Given predicted increases within the local study area, it is plausible that changes in water quality may be detected further downstream or downwind. However, the panel expects that these effects will be minimal and the project is not likely to result in adverse effects to water quantity in the Peace-Athabasca Delta and Wood Buffalo National Park.

[3404] In section 19, "[Surface Water Quantity](#)," the panel found that significant adverse cumulative effects to surface water quantity, flows, and levels in the Athabasca River, Peace-Athabasca Delta, and Slave River Delta are occurring but are due predominantly to hydropower regulation and regional climate change, with industrial water withdrawals playing a minor role. These changes in surface water quantity appear to be adversely affecting Deninu K'ue First Nation's ability to access lands and resources for traditional purposes. The panel does not believe that the Frontier is likely to exacerbate those existing effects. The panel has made recommendations to the governments of Canada and Alberta with regards to surface water quantity and indigenous navigation.

[3405] In section 14, "[Air Quality](#)," the panel concluded that there is some potential for measurable air emissions from the project in the Peace-Athabasca Delta and Wood Buffalo National Park, but the effects will be minimal.

[3406] In section 29, "[Public \(Human\) Health](#)," the panel determined that the project is not likely to result in adverse effects to the health of indigenous land users in the region. The panel has made

recommendations to the governments of Canada and Alberta regarding the protection of human health (see [Appendix 6](#)).

[3407] The panel agrees with Teck that the project will not affect Deninu K'ue First Nation's traditional territory.

[3408] The panel notes that Teck has committed to a number of environmental mitigation measures and made commitments designed to mitigate effects of the project on indigenous communities

[3409] A consolidated version of Teck's commitments is in [Appendix 11](#). The panel has required a number of these proposed mitigations as conditions of the project approval. A number of these measures are outside the authority of the panel. However, many of these mitigations are reasonable given the context of the region, the issues and concerns, and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of valued environmental components, which will serve to also reduce effects on indigenous use of lands. In conjunction with a number of adaptive management plans that Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Deninu K'ue First Nation.

Conditions and Recommendations

[3410] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Deninu K'ue First Nation.

Conditions

[3411] The panel requires that Teck finalize a traditional land-use mitigation, monitoring and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of construction of the project.¹⁶¹ The plan will be required as a condition of an *EPEA* approval for the project.

Recommendations

[3412] To reduce effects to navigation, the panel recommends that Transport Canada include terms and conditions within project approvals to address project impacts and cumulative impacts to navigation. The panel recommends that Transport Canada continue its work on a navigation study and share the results of the study with the Deninu K'ue First Nation.

¹⁶¹ Draft *EPEA* Approval – Condition 3.1.7

Determination of Significance

[3413] The panel determined the significance of project effects to current use of lands and resources and physical and cultural heritage based on the approach discussed in the Agency's guide *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[3414] The panel also assessed the potential for the Frontier project to impact the rights asserted by Deninu K'ue First Nation in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Significance Determination for Project Effects

Current Use of Lands and Resources for Traditional Purposes

[3415] The magnitude of effects would be low or negligible. There is some potential for measurable air emissions from the project in the Peace-Athabasca Delta and Wood Buffalo National Park, but those effects will not be significant. While some contaminants will be released into surface waters from the project, the water quality assessment determined that the effects will be limited primarily to the local study area and that these loadings are not expected to contribute significantly to water quality effects in the Peace-Athabasca Delta or Wood Buffalo National Park. It is not plausible that water withdrawals from the project will have any meaningful impact on the Slave River and its delta. The panel determined that the project will have minimal effects on air quality, water quality, and water quantity, and that while unlikely, if any residual effects from the project occur, they will not be significant.

[3416] The evidence presented does not demonstrate that Deninu K'ue First Nation's current use of lands or resources overlap with the project disturbance area or the local or regional study areas. While the panel does not dispute that Deninu K'ue First Nation's ability to practice their asserted aboriginal and treaty rights has been affected by various developments to the south, the panel has determined that Deninu K'ue First Nation's current use of land and resources for traditional purposes will not be affected by the project.

[3417] The geographic extent of effects would be provincial. There may be small measurable changes in some air quality, water quality, or water quantity parameters in the Peace-Athabasca Delta and Wood Buffalo National Park.

[3418] The duration of effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape.

[3419] The frequency of effects would be continuous.

[3420] Project effects would be reversible.

Health and Socioeconomic Conditions

[3421] As determined in section 29, “Public (Human) Health,” the panel finds the human health effects from the project will be low in magnitude. The panel believes that this finding particularly applies to the health of Deninu K’ue First Nation members given that their main location is in Fort Resolution, approximately 385 km from the Frontier project.

[3422] Deninu K’ue First Nation’s participation occurred late in the review process after the panel had issued notice on June 6, 2018, that it had determined there was sufficient information to proceed to hearing. Deninu K’ue First Nation did not provide sufficient evidence for the panel to make a well-founded determination on the effects on their socioeconomic conditions.

Physical and Cultural Heritage and Any Structure, Site, or Thing That Is of Historical, Archaeological, Paleontological, or Architectural Significance

[3423] Deninu K’ue First Nation did not provide sufficient evidence for the panel to determine effects on their physical or cultural heritage.

Summary

[3424] The panel finds that the project effects on Deninu K’ue First Nation’s current use of lands and resources and physical and cultural heritage will be low to negligible in magnitude. While unlikely, if any residual effects from the project do occur, they will not be significant.

Significance Determination for Cumulative Effects

Current Use of Land and Resources for Traditional Purposes and Physical and Cultural Heritage and Any Structure, Site, or Thing That Is of Historical, Archaeological, Paleontological, or Architectural Significance

[3425] Deninu K’ue First Nation provided some evidence of cumulative effects of industrial development on their use of lands and resources for traditional purposes. However, the panel is not persuaded that the Frontier project will adversely affect Deninu K’ue First Nation. The panel believes that if there are any incremental effects of the Frontier project that contribute to cumulative effects to Deninu K’ue First Nation, they will be negligible.

Significance Determination for Asserted Rights

[3426] For the reasons identified above, the Frontier project is not likely to affect the rights asserted by Deninu K’ue First Nation.

Table 41. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources for traditional purposes	low/negligible	provincial	long term	continuous	reversible	not significant
Health	low	NA	NA	NA	NA	not significant

Fond du Lac First Nation

Background

[3427] The Fond du Lac First Nation has 2080 members and is located on Lake Athabasca in Saskatchewan, approximately 180 kilometres east of Fort Chipewyan.

[3428] Fond du Lac First Nation filed one submission, a request to participate filed June 12, 2018.

[3429] Fond du Lac First Nation participated in the hearing, appearing before the panel on October 16, 2018, in Fort Chipewyan.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[3430] The ACO did not require consultation with Fond du Lac First Nation.

Asserted or Established Aboriginal and Treaty Rights

[3431] Fond du Lac First Nation asserted Treaty 8 rights, which include the right to areas to practice fishing, hunting, trapping and cultural activities and have they burial grounds within the entire Treaty 8 territory. They stated that Treaty 8 members are not restricted to practicing within their home province.

[3432] The panel's terms of reference require it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by or the strength of such claims. But, for the purposes of assessing the potential effects of the Frontier project the panel accepts the rights being asserted.

Context of Historical and Current Cumulative Effects

[3433] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities, or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Canadian Environmental Assessment Agency (the Agency), effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

Use of Lands and Resources for Traditional Purposes

[3434] Fond du Lac First Nation stated that their people have been using their lands for thousands of years. They said they use the same resources and drink the same water as the Athabasca Chipewyan First Nation even though they are located in a separate province.

[3435] Fond du Lac First Nation stated that they are facing cumulative environmental effects from oil sands mines and uranium mines in their territory. Elders have also noticed changes in fish species in their traditional territory, including an abundance of lake trout and very few other fish species. They explained that according to oral histories, lake trout has never been caught in their territory before. They raised concerns that cumulative effects to fish are causing them to change their migration routes.

Physical and Cultural Heritage

[3436] The panel is required to take into account the physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[3437] Fond du Lac First Nation stated that maintaining contact with the land is essential because therein lies their identity. They explained that it is only by understanding where they come from that they know where we are going. They added that hunting and trapping are integral components of their history, culture, and traditional way of life. They said, “when flora and fauna disappear, so does a part of us.”

[3438] Fond du Lac First Nation stated that they are losing the history of their indigenous culture and that that hunting and trapping are slowly vanishing as well.

Health and Socioeconomic Conditions

[3439] Fond du Lac First Nation raised concerns that oil sands projects result in sediment in the river and contaminate the lands where they hunt, fish, trap, camp, swim, and drink. They explained that the environment must be pristine for animals to be healthy. Contaminants affect the environment and animals, which in turn affects humans that consume the contaminated plants, fish, birds or animals. They are particularly concerned about the contamination of aquatic life, stating that that commercial fishing in Lake Athabasca was closed in 1985 due to contamination. In addition, their members have noticed deformities in aquatic species, especially those that are close to mine sites in the Athabasca Basin.

[3440] They said their members are struggling because of unemployment in part due to the closing of the uranium mines and commercial fishing.

Analysis and Findings

[3441] Teck did not contest the evidence provided by Fond du Lac First Nation. Fond du Lac First Nation appeared at the hearing and had their evidence tested through questioning. The panel finds it is able to rely on the evidence presented by Fond du Lac First Nation and summarized above. The evidence shows the following:

- Members of Fond du Lac First Nation community continue to use their traditional lands as described.
- Their land-use activities are focused “downstream” of the project and on the areas in and around Lake Athabasca, the Peace-Athabasca Delta, and Wood Buffalo National Park.

- Their members practice their asserted rights to hunt, trap, fish, and gather, and these activities can include spiritual practices.
- These activities do not occur regularly within the disturbance area for the Frontier project.
- They did not describe any specific use of lands or resources within the project disturbance area or the local or regional study areas.
- They did not identify any specific sites or culturally important areas that would be directly affected by the project.

Project and Cumulative Effects

[3442] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights, and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources and practice of asserted rights.

Fond Du Lac First Nation's View

[3443] Fond du Lac First Nation raised concerns that the Frontier project may affect the plants they gather for ceremonial consumption and avian life within their traditional territory.

[3444] Fond du Lac First Nation said they are concerned that the Frontier project could affect their community hunters and trappers and the animals they hunt, fish, catch, and eat.

Applicant's View

[3445] Teck predicted that the Frontier project will have negligible effects on Wood Buffalo National Park, including the Peace-Athabasca Delta, and therefore Fond du Lac First Nation's traditional use of the park and the Peace-Athabasca Delta would not be affected by the project. Teck stated that many of the concerns expressed regarding the Peace-Athabasca Delta exist whether or not the Frontier project proceeds.

Analysis and Findings

[3446] Fond du Lac First Nation's participation occurred late in the review process, after the panel issued notice on June 6, 2019, that it had determined it had sufficient information to proceed to hearing.

[3447] Fond du Lac's use of lands and resources and the concerns they describe focus mainly in the Peace-Athabasca Delta and Wood Buffalo National Park and not in the project area.

[3448] Fond du Lac First Nation do not use lands or resources within the project disturbance area or the local or regional study areas. They did not identify any specific sites or culturally important areas that

would be directly affected by the project. The Fond du Lac First Nation has not demonstrated that they will be affected by the project.

Mitigation Measures

[3449] Fond du Lac First Nation requested that they be included in early stages of planning for projects to allow them the opportunity to share their traditional knowledge and identify important areas. They want to be included in impact management processes and employment opportunities.

[3450] Teck's view is that the project will not affect Fond du Lac First Nation, and consequently Teck has not entered into any type of agreements with them.

[3451] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

Analysis and Findings

[3452] In section [18](#), "[Surface Water Quality](#)," the panel determined that the Frontier project will result in water discharges and aerial emissions that will increase concentrations and loadings of some surface water quality parameters within the local study area. Given predicted increases within the local study area, it is plausible that changes in water quality may be detected further downstream or downwind. However, the panel expects that these effects will be minimal, and the project is not likely to result in adverse effects to water quantity in the Peace-Athabasca Delta and Wood Buffalo National Park.

[3453] In section [19](#), "[Surface Water Quantity](#)," the panel found that significant adverse cumulative effects to surface water quantity, flows, and water levels in the Athabasca River, Peace-Athabasca Delta, and Slave River Delta are occurring but are due predominantly to hydropower regulation and regional climate change, with industrial water withdrawals playing a minor role. These changes in surface water quantity appear to be adversely affecting Fond du Lac First Nation's ability to access lands and resources for traditional purposes. The panel does not believe that the Frontier project is likely to exacerbate those existing effects. The panel has made recommendations to the governments of Canada and Alberta with regards to surface water quantity and indigenous navigation.

[3454] In section [14](#), "[Air Quality](#)," the panel concluded that there is some potential for measurable air emissions from the project in the Peace-Athabasca Delta and Wood Buffalo National Park, but the effects will be minimal.

[3455] In section [29](#), "[Public \(Human\) Health](#)," the panel determined that the project is not likely to result in adverse effects to the health of indigenous land users in the region. The panel has made

recommendations to the governments of Canada and Alberta regarding the protection of human health (see [Appendix 6](#)).

[3456] Teck's proposed mitigation measures and commitments outlined in CEAR #361 (appendix 10.12) are intended to address general concerns of indigenous parties, including many of the concerns identified by Fond du Lac First Nation, including effects to hunting, trapping, fishing, gathering, and resources, including plants and birds. The panel has required a number of these proposed mitigations as conditions of the project approval.

[3457] A consolidated version of Teck's commitments is in [Appendix 11](#). If implemented, these commitments may reduce the effects of the project on a number of valued environmental components which will serve to also reduce effects on indigenous use of lands. The panel has identified some of these and made them conditions of the project approval. A number of these measures are outside the authority of the panel. In conjunction with a number of adaptive management plans that Teck will be required to develop, and conditions imposed by the panel, these commitments can play an important role in mitigating project effects on many issues and concerns identified by Fond du Lac First Nation.

Conditions and Recommendations

[3458] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Fond du Lac First Nation.

[3459] The panel requires that Teck finalize a traditional land-use mitigation, monitoring and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of construction of the project.¹⁶² The plan will be required as a condition of an *EPEA* approval for the project

Determination of Significance

[3460] The panel determined the significance of project effects to current use of lands and resources, and physical and cultural heritage based on the approach discussed in the Agency's guide *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[3461] The panel also assessed the potential for the Frontier project to impact the rights asserted by Fond du Lac First Nation in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

¹⁶² Draft *EPEA* Approval – Condition 3.1.7

Significance Determination for Project Effects

Current Use of Land and Resources for Traditional Purposes

[3462] The magnitude of project effects would be low or negligible. There is some potential for measurable air emissions from the project in the Peace-Athabasca Delta and Wood Buffalo National Park but those effects will not be significant. While some contaminants will be released into surface waters from the project, the water quality assessment determined that the effects will be limited primarily to the local study area and that these loadings are not expected to contribute significantly to water quality effects in the Peace-Athabasca Delta or Wood Buffalo National Park. The panel determined that the project will have minimal effects on air quality, water quality, and water quantity and that, while unlikely, if any residual effects from the project do occur, they will not be significant.

[3463] The evidence presented on current use does not demonstrate that Fond du Lac First Nation's current use of lands or resources overlap with the project disturbance area or the local study area. While the panel does not dispute that Fond du Lac First Nation's ability to practice their asserted aboriginal and treaty rights has been affected by various developments to the south, the panel has determined that Fond du Lac First Nation's current use of land and resources for traditional purposes will not be affected by the project.

[3464] The geographic extent of project effects would be provincial. There may be small measurable changes in some air quality, water quality, or water quantity parameters in the Peace-Athabasca Delta and Wood Buffalo National Park.

[3465] The duration of the project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape.

[3466] The frequency of effects would be continuous.

[3467] The project effects would be reversible.

[3468] The panel finds that the effects of the project are adverse but not significant and unlikely to occur given the project mitigation measures and conditions imposed by the panel.

Health and Socioeconomic Conditions

[3469] As determined in section 29, "[Public \(Human\) Health](#)," the panel finds that the human health effects from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Fond du Lac First Nation members.

[3470] Fond du Lac First Nation's participation occurred late in the review process, after the panel issued notice on June 6, 2019, that it had determined it had sufficient information to proceed to hearing. Fond du

Lac First Nation did not provide sufficient evidence for the panel to make a well-reasoned determination on the effects on their socioeconomic conditions.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[3471] Fond du Lac First Nation did not provide sufficient evidence for the panel to determine effects on their physical or cultural heritage.

Summary

[3472] The panel finds that the project effects on current use of lands and resources for traditional purposes the local and regional study areas are adverse, not significant, and unlikely given the mitigation measures proposed. The panel determines that effects from the project will not be significant.

Significance Determination for Cumulative Effects

Current Use of Land and Resources for Traditional Purposes and Physical and Cultural Heritage

[3473] Fond du Lac provided some evidence of cumulative effects of industrial development on their use of lands and resources for traditional purposes. However, the panel found that its evidence was insufficient for the panel to make a well-founded determination on the magnitude of such effects.

Significance Determination for Asserted Rights

[3474] For the reasons identified above, the Frontier project is not likely to adversely impact the rights asserted by Fond du Lac First Nation.

Table 42. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources for traditional purposes	low/negligible	provincial	long	continuous	reversible	not significant
Health	low	NA	NA	NA	NA	not significant

Fort McMurray Métis Local 1935

Background

[3475] Fort McMurray Métis Local 1935 (Métis Local 1935) is the association that represents the interests of approximately 300 active Métis members living in Fort McMurray and its surroundings. Métis Local 1935 is a member of the Métis Nation of Alberta, Region 1.

[3476] Métis Local 1935 submitted the following key submissions:

- April 10, 2013: Statement of Concern
- December 16, 2013: Comments on Information Request Round 2
- October 1, 2014: Traditional land-use study
- August 10, 2015: Cultural Impact Assessment
- October 17, 2016: Comments on Sufficiency
- July 21, 2017: Review of Information Request #1 through #9
- August 22, 2017: Withdrawal of statement of concern

[3477] On August 22, 2017, Fort McMurray Métis Local 1935 notified the panel that they had entered into an agreement with Teck and withdrew their statement of concern. They advised the panel that they did not object to the granting of approvals, that they supported the project, and that they would not participate in the hearing.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[3478] The ACO did not submit a report regarding consultation adequacy and whether actions may be required to address potential adverse impacts to the existing rights of the Fort McMurray Métis Local 1935.

Asserted or Established Aboriginal and Treaty Rights

[3479] The panel's terms of reference requires it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by or the strength of such claims. But, for the purposes of assessing the potential effects of the Frontier project the panel accepts the rights being asserted.

[3480] Métis Local 1935 asserted the following rights:

- Access to the land to hunt, trap, fish and harvest resources.

- Use of the Athabasca River and surrounding lands.
- Harvesting rights that depend on wildlife.

Context of Historical and Current Cumulative Effects

[3481] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous group's ability to access and use lands and resources, their ability to practice culturally important activities or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Agency, effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished. The evidence heard by the panel about land use and resources for traditional purposes and practice of asserted rights is summarized below.

[3482] Métis Local 1935 stated that they have a deep historic connection to the trapping area around the Frontier project. It is considered to be a place of cultural importance and a site of intergenerational knowledge transfer. They noted that traplines and traditional land use serve as one of the principal mechanisms for transmission of traditional knowledge and traditional values because they connect families and communities. Métis Local 1935 stated that they have a strong sense of forbearance and concern over the future sustainability of trapping in the region.

Use of Lands and Resources for Traditional Purposes

Hunting, Trapping, Fishing, and Gathering

[3483] Métis Local 1935 indicated that the project is located in an area that they highly value and frequently use, is largely inaccessible and unaffected by oil sands development. The Métis Local 1935 stated that the area where the Frontier project is proposed is of even higher value considering the loss of land in the area, the rapid decrease in berries, big game, particularly moose, and fur-bearers in the region and the fact that big game and fur-bearers still reside there.

[3484] Members identified 23 hunting and trapping sites that would be affected by the Frontier project, where they hunt moose, bison and elk. Métis Local 1935 described nine important habitats in and near the project development area that would be affected by the Frontier project. These habitats are used by moose, bison, caribou, deer, black bear, elk, beaver, wolf, muskrat, squirrels, rabbit, wolverine, marten, mink, and lynx.

[3485] Métis Local 1935 noted three berry harvesting sites that would be affected by the Frontier project. They indicated that Frontier project's local study area is known as a good place to harvest blueberries, raspberries, Saskatoon berries, hazelnuts, strawberries, and rosehips.

[3486] Métis Local 1935 stated that they use traplines year round for all traditional activities and use the registered fur management areas 1275 and 2939. These two registered fur management areas overlap the project development area.

[3487] Métis Local 1935 stated that the portion of the Athabasca River that is adjacent to the project disturbance area provides habitat for species that they fish including: arctic grayling, walleye, northern pike, cod (lingcod and burbot), white sucker and jackfish, pickerel, whitefish, and goldeye. They also said that their members fish along the Athabasca River and adjacent creeks around the proposed river water intake. They said they use the Athabasca River for navigation as a means to access harvesting areas, traplines, cabins and culturally important sites along the river including sites within the local study area.

[3488] Métis Local 1935 stated that another significant cumulative effect to their ability to conduct traditional land-use activities has been the decline in places available due to the loss of land and access to land as a result of industry, the city of Fort McMurray growing, and the hunting and trapping regulations on harvesting. Members stated that the outskirts of Fort McMurray were used for traditional land use but today they are developed. They said that the number of traplines registered to Métis Local 1935 members has fallen by more than 70 per cent since the 1950s. Members noted that they practice all of their traditional land-use activities on traplines; therefore losing those areas affects their traditional land-use generally. They stated that regulations on traplines have also significantly contributed to the erosion of traditional land use because they limit the amount of time trappers can live on their trapline and limit the use of traplines to a narrow commercial model of trapping prescribing how many furs must be caught. This has impeded their use of traplines as spaces where the community can conduct other subsistence activities including gardening or spaces where the community can come together.

Access

[3489] Several of their members use trails from Bitumount and Clausen's Landing that lead to Ronald and Diana Lakes. Some of these trails pass through the Frontier project disturbance area. Community members and trappers on registered fur management area 2901 use trails from the Athabasca River through the local study area to gain access to their harvesting area and cabins. These members also use trails from their traplines through the local study area to gain access to their harvesting areas around Ronald, Diana, Legend, Lynn and Namur Lakes.

[3490] Métis Local 1935 stated that access to the Athabasca River and adjacent tributaries has been greatly restricted due to oil sands development. The river used to be the transportation route and access point for members. There are only small pockets of land and points of access left to access community traditional lands from the Athabasca River. Métis Local 1935 noted that maintaining open access to their harvesting areas is one of their key concerns. Métis Local 1935 stated that access restrictions are detrimental to harvesting rights. Loss of access and fewer resources force members to go further away to different areas to harvest and this requires more time and effort.

Health and Socioeconomic Conditions

[3491] Métis Local 1935 members trap for commercial purposes and some work as hunting guides and as outfitters in and north of the project disturbance area and along the Athabasca River.

[3492] Métis Local 1935 are concerned about the quality and safety of resources particularly based on reports that oil sands mine activities lead to health problems. They raised concerns that contamination of fish and fish habitat could pose risks to people who feed on Athabasca River fish. They said that oil sands industrial activity have resulted in the community's perception of low-quality and unsafe local food resources which has resulted in members reducing harvesting practices and no longer consuming water, hunting or fishing in traditional areas.

[3493] Métis Local 1935 stated that the perception of contamination results in psychosocial effects ranging from fear and frustration to isolation and guilt which in turn impedes traditional land use. Métis Local 1935 stated that they have experienced 50 years of dramatic and cumulative socioeconomic effects as a result of oil sands development. They stated that to this day, the 1960s stand as a traumatic watershed in the collective memory of the community, when the comfortable cocoon of Fort McMurray was ripped open and they were subjected to an extraordinarily rapid and powerful political, socioeconomic, and cultural shock. They stressed that one can certainly argue that of all the indigenous communities in the region, Métis Local 1935 has experienced the most acute and severe cumulative socioeconomic effects.

[3494] Métis Local 1935 hybrid commercial and subsistence economy existed through 1960s, where the commercial economy supported rather than undermined the subsistence economy. Today, members noted that the high cost of living feeds into the need to work full-time in the commercial economy furthering the imbalance with the subsistence economy. They said that they wish they could live off the land and not have a wage job. As they have moved further into a market economy, they have had to rely upon, to a greater extent, money to purchase goods (food) that were once primarily in the bush which in turn reinforces the need for money and wage labour.

[3495] Métis Local 1935 stated that the increase in temporary workers has created security risks, vandalism, theft, and trash at their traditional cabins. The inappropriate use of the cabins and harvesting sites by the non-indigenous population has reduced the sense of privacy and security of Métis Local 1935 land users. Members have felt a rise in frustration at the non-indigenous population's lack of respect.

Physical and Cultural Heritage

[3496] The panel is required to take into account the physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[3497] Métis Local 1935 stated that 40 traditional trails, cabins and cultural/spiritual sites overlap the local study area. Other cabins that they use along the Athabasca River are located in the regional study area. Two burial sites are located within the project disturbance area and more burial sites are located

along the Athabasca River. They said the Athabasca River has profound historical and contemporary cultural significance for them.

[3498] They identified that Sled Island, which is adjacent to the terrestrial local study area on the Athabasca River, as a culturally important location.

[3499] They explained that over the past fifty years, the loss of spaces to conduct traditional activities, the rapid rise in the non-indigenous population and the rising cost of living has reduced the physical proximity of the community to traditional use sites. In addition, shift work has drawn workers away from the community. Taken together, these cumulative effects resulted in a significant and long-term decline in their ability to construct and maintain strong family and community spaces.

[3500] They stated that the decline in familiar harvesting places and opportunities to go out on the land has dramatically weakened the transmission and reproduction of culture. They stated that while industry creates opportunities for youth employment, it results in a loss of space and time to devote to traditional harvesting which disrupts the transfer of knowledge. Since knowledge holders are most likely to not have worked in the oil sands, the high cost of living forces them to move out of Fort McMurray and impedes the transfer of knowledge. The loss of old-growth forests in the regional study area also affects knowledge transfer regarding traditional resources only found in old-growth forests.

[3501] Métis Local 1935 stated that traditional land use is integral to Métis culture and identity. It nourishes the minds, bodies and spirits of Métis families. The loss of areas for traditional use represents a threat to cultural norms, spiritual values, sense of self, place, purpose, and knowledge that are embedded within the physical act of land use and connections between Métis Local 1935 and their traditional territory.

[3502] In their cultural impact assessment, they introduced the concept of Métis environmental cultural components that makes the existence, adaptation, and transmission of Métis Local 1935 culture possible. The five Métis environmental cultural components are: traditional land use, family and community, values and spirituality, identity, and autonomy, and self-determination. Métis Local 1935 stated that cumulative effects including loss of land and access, greater non-indigenous access, fewer resources, reduced the safety of harvested resources, wage labour, cost of living, and government regulations have affected Métis environmental cultural components.

[3503] According to their cultural impact assessment, cumulative effects to Métis environmental cultural components are also causing feedback loops. For example, Métis Local 1935 members identified feedback effects to traditional land use from three Métis environmental cultural components: family and community relations, identity, and values and spirituality. Another example of a feedback loop is that the loss of family and cultural bonds would affect values and spirituality, which in turn, affects family and community bonds.

Analysis and Findings

[3504] Teck did not contest the evidence provided by Métis Local 1935. Métis Local 1935's written evidence was submitted before Teck's submission of a June 2015 project update. These provided specific and detailed evidence about cabin locations and their use of lands and resources for traditional purposes and evidence about their physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[3505] As Métis Local 1935 did not appear at the hearing, the panel was unable to test their evidence nor was it able to clarify applicability of their traditional land use and cultural impact assessment studies. However, Métis Local 1935's specificity of evidence regarding use of lands in the project area was sufficient to demonstrate their current and historic use of lands and resources in the project area to the panel.

[3506] The evidence demonstrated to the panel that:

- Members use specific registered fur management areas in the area of the project.
- Members use specific lands in the local or regional study areas to hunt, trap, fish, and gather.
- Members use multiple cabins, camp sites and other cultural locations near or in the disturbance area for harvesting and cultural practices or accessing culturally important sites.

[3507] The panel finds that Métis Local 1935 currently use lands and cultural sites in the project development area, local study area and regional study area which will be affected by the project.

Project and Cumulative Effects

[3508] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights, and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources, and practice of asserted rights.

Effects on Use of Lands and Resources for Traditional Purposes

Fort McMurray Métis Local 1905 View

[3509] Métis Local 1935 stated that they are concerned about potential conflicts between Métis use of registered fur management areas 1275, 2939, 1743, 1661, 2331, 2890, 2901, 2908, and 2555 for hunting, trapping, fishing and harvesting resources and the Frontier project. Members identified 23 hunting and trapping sites that would be affected by the Frontier project, where they hunt moose, bison and elk. They explained that this potential conflict is of high importance due to the centrality of these traplines to historic and actual Métis community intergenerational and cultural knowledge transfer. Specifically, they

raised concerns that a Métis Local 1935 member's registered fur management areas is located directly across the proposed river water intake and could be affected by it and road access.

[3510] Métis Local 1935 described important habitats in the project disturbance area that would be affected by the Frontier project. These habitats are used by moose, bison, caribou, deer, black bear, elk, beaver, wolf, muskrat, squirrels, rabbit, wolverine, marten, mink, and lynx. They raised concerns about the Frontier project's disturbance to wildlife and wildlife habitat including from noise and increased in traffic resulting in wildlife collisions. They also raised concerns about the Frontier project's destruction of lakes, fish habitat, and riparian habitats. Members noted that effects to wildlife would interfere with subsistence and harvesting activities. They are particularly concerned about the Frontier project's effects on moose, bison, fur-bearers, and caribou. They described the long-term sustainability of the Ronald Lake bison is a priority for them. They identified two fishing sites that would be affected by the Frontier project.

[3511] Métis Local 1935 noted three berry harvesting sites that would be affected by the Frontier project. They stated that Frontier project's local study area is known as a good place to harvest blueberries, raspberries, Saskatoon berries, hazelnuts, strawberries, and rosehips.

[3512] Métis Local 1935 raised concerns that the Frontier project could contaminate soil, air and water upon which traditional activities depend. They also said that project pollution, groundwater contamination, and watershed disturbances could affect the flow and quality of water in the Athabasca River which could cause contamination of fish and fish habitat especially considering the Frontier project's proximity to the river.

[3513] Métis Local 1935 stated that the area where the Frontier project is proposed is of even higher value considering the loss of land in the area, the rapid decrease in berries, big game, particularly moose, and fur-bearers in the region and the fact that big game and fur-bearers still reside there.

[3514] They explained that access through the local study area to registered fur management areas 2890, 2908, and 2901, which are all held by Métis Local 1935 members, will be disturbed by the Frontier project. In addition, they raised concerns that the project would make access more difficult to Sled Island, points north (Lake Athabasca, Ronald Lake, Poplar Point and Brule Point), west (Birch Mountains) and east (Firebag River, Margaret River) of the local study area. Métis Local 1935 said that the Frontier project would enable a greater ease of access for non-aboriginal people increasing competition for scarce resources; a problem they are already facing due to industries currently in operation.

[3515] Métis Local 1935 raised concerns that the Frontier project would contribute to decreasing water levels and impede navigation. Members also expressed concerns about impacts to navigation with respect to the proposed Athabasca River bridge and the fact that the bridge could be permanent.

[3516] Métis Local 1935 said they believe the land will never be reclaimed to what it was before it was disturbed. They question the optimistic portrayal of reclamation efforts and the characterization of impacts as temporary. They raised concerns that with the present pace of development, commitment to reclamation is neglected by proponents and due to the lack of oversight, limited reclamation continues.

Teck's View

[3517] Teck stated that multiple Métis Local 1935 wildlife habitat values, hunting, trapping and fishing areas overlap the terrestrial and aquatics local study areas. Fish habitat might be lost in the Athabasca River because of the river water intake, but will be compensated for in the fish habitat compensation facility.

[3518] Teck stated that the Frontier project would not affect registered fur management area 1743, held by a Métis Local 1935 member, as it is located immediately across the Athabasca River from the Frontier project. Access to it in winter is expected to be facilitated by the Fort Chipewyan winter road and therefore access to this trapline is expected to be available throughout the construction and operation of the project. Registered fur management area 2016 was unassigned and therefore assumed to be potentially available to all indigenous communities for trapping. It overlaps a small portion of the local study area and is in the traditional land-use regional study area.

[3519] Teck stated that the registered fur management areas 2890, 2901, and 2908 held by Métis Local 1935 members, are located west of the terrestrial local study area and would not experience any direct disturbance from the Frontier project.

[3520] Teck stated that Métis Local 1935 plant harvesting areas that overlap the local study area are expected to be lost. Teck said that the availability of plants would be decreased while the project is in operation but would be reestablished at closure.

[3521] Teck stated that trails used by Métis Local 1935 community members to access harvesting areas and cabins would be disturbed by the Frontier project. Teck predicted that the Frontier project would disturb trails within the project disturbance area, trails that parallel the Athabasca River on the west shore, trails that connect areas within the project disturbance area to areas both north and south, and trails that connect the Athabasca River to areas east of the terrestrial local study area. Teck stated alternative access routes to these areas would remain from both areas south and north of the Frontier project. However, Teck stated that alternative access strategies or implementation of access controls on existing access routes could result in additional travel time or costs.

[3522] Teck noted that while access to some areas is provided by industry access roads, this may also result in increased use of areas by non-aboriginal harvesters and a corresponding increase in competition for traditionally important land areas or resources. Teck stated that construction and operation of the

bridge and east side access road are expected to have an incremental effect on the use of culturally important sites and resources due to an increase in non-aboriginal human presence.

[3523] Teck's navigability assessment predicted that the Frontier project is not expected to affect navigation on the Athabasca River. However, indigenous communities have stated that they are experiencing loss of access because of current low water levels. Teck stated that the Athabasca River bridge would be constructed to leave enough space between the bridge piers for navigation of the Athabasca River. Teck predicted that changes in water levels of less than 1 cm in the Athabasca River would be expected near the bridge. Teck identified these risks as negligible and said the bridge is not expected to affect navigation.

[3524] Teck stated it would work with regulators, potentially affected aboriginal communities, and stakeholders over the life of the Frontier project to identify the optimal post-project use for the bridge. If there is no interest in or use for the bridge at the end of the project, Teck would decommission and remove it.

Effects on Health and Socioeconomic Conditions

[3525] Métis Local 1935 stated that they are particularly concerned about the Frontier project's potential socioeconomic effects, given the community's geographic concentration in Fort McMurray. They said that aboriginal workers are under-represented in oil sands jobs and are not provided the same employment incentives and salary benefits such as living allowances and travel expenses that outside migrant workers are offered. In addition, their members have faced the same inflated costs of housing, food and commodity prices as migrant workers in Fort McMurray.

[3526] Métis Local 1935 said that wage economy and shift work results in disconnected families: kids taking on parenting when parents are absent and men away from families in high-stress environments are conducive to alcohol and drug usage, struggle to re-integrate into family and community life and are prone to infidelity and separation.

[3527] Métis Local 1935 raised concerns that non-aboriginal workers moving to Fort McMurray for the Frontier project would result additional stress on the local real estate and rental markets, which results in emigration of community members due to living costs and lack of ability to stay in Fort McMurray. A key concern expressed by members was the cumulative effects of living costs on the ability of elders to stay in Fort McMurray, especially after retirement.

[3528] Teck's human health risk assessment predicted that the Frontier project would not significantly affect health risks in the region. Teck stated that the elevated health risks are predominantly because of existing conditions and approved projects, with the Frontier project having a negligible to low effect on those risks.

[3529] Teck concluded that, on the whole, a positive direction is achievable for indigenous communities in the regional study area, whereby the benefits from the Frontier project outweigh negative effects considered in the socioeconomic assessment, particularly in the economic area (employment, training and income), should key outcomes be achieved over time.

Effects on Physical and Cultural Heritage

[3530] The panel is required to take into account the effects on physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[3531] Métis Local 1935 said that cabins that are used but not held by Métis Local 1935, located in the regional study area associated with registered fur management areas 1275, 1661, 2331, and 2939 could be disturbed by the project. Considering that they are located between Fort McMurray and the Frontier project, Métis Local 1935 stated that the transportation corridors used for transporting equipment and personnel could cause safety concerns for the cabin owners and therefore constitutes a major concern for them. In addition, they said the river water intake could disturb a cabin that is located approximately 1.5 km away from it.

[3532] Métis Local 1935 raised concerns that Unnamed Lake 2 (Small Sandy Lake) and numerous other unnamed water bodies that would be affected by the Frontier project are important traditional use locations.

[3533] Métis Local 1935 stated that the Frontier project would cause incremental effects on Métis environmental cultural components by increasing in the non-indigenous population, cost of living, shift work, workplace discrimination, disturbing the land, and access to harvesting areas, reducing the availability of resources, affecting aesthetics and safety and causing environmental contamination.

[3534] Teck stated that multiple cabins identified by the Métis Local 1935 are in close proximity to the project disturbance area but would not be directly disturbed by the Frontier project. One cabin location that is reported to be located within the project disturbance area and cabins associated with registered fur management area 1275 located at Unnamed Lake 1 would be directly disturbed by the Frontier project. In addition, Teck stated that two cultural sites are expected to be located close to the access road and bridge. One burial site would not be directly disturbed by the Frontier project and the second's location is believed to be within the local study area however archaeological investigations in this area identified no burial location.

[3535] Teck stated that concerns have been expressed regarding cumulative development in the Athabasca oil sands region to date including difficulties transmitting traditional knowledge to youth because of ongoing development within traditional lands. Teck recognized that these concerns have the potential to extend to the Frontier project.

[3536] Teck stated that it is not appropriate to take issue with an indigenous group's cultural impact assessment conclusions, as this would invariably require Teck to opine on the quality, strength or accuracy of the information collected or traditional knowledge holders perspectives regarding impacts to their indigenous culture and rights. Teck said that it is of the opinion that the results and recommendations in the various cultural impact assessments are best used as vehicles for engagement and consultation between Teck and Indigenous communities. Teck's preferred approach to developing mitigation and other commitments identified in cultural impact assessments or traditional land use is to seek to negotiate long term benefits agreements directly with indigenous groups.

Summary

[3537] Teck's assessment of incremental effects of the project for Métis Local 1935 traditional land-use key indicators found the magnitude to be moderate or high for opportunities to harvest bison and to use culturally important sites and areas. Opportunities to hunt traditionally important wildlife species, trap fur-bearers, fish for traditionally important species and harvest important vegetation were low to moderate. Teck's planned development case cumulative effects classification and determination of consequence for Métis Local 1935 found that the magnitude was high for all of the above key land-use indicators except fishing which was determined to be low to moderate.

Analysis and Findings

[3538] Teck did not contest Métis Local 1935's assessment of the effects of the project on their asserted rights. Métis Local 1935's evidence was largely supported by evidence from other parties, including Teck. Its evidence was sufficiently detailed and specific that the panel is able to assess the effects of the project on Métis Local 1935's use of lands.

[3539] From the evidence the panel finds that:

- The project disturbance area will result in the direct loss of lands where traditional activities are practiced.
- Registered fur management area 2890, 2901, and 2908 held by Métis Local 1935 members, are located west of the terrestrial local study area and would not experience any direct disturbance from the Frontier project. One cabin associated with registered fur management area 1275 located at Unnamed Lake 1 would be directly disturbed.
- Cumulative effects on the practice of traditional activities will be exacerbated by the project.
- The project will result in high-magnitude effects on some key traditional land-use indicators.
- The panel notes Teck's analysis which also determined that the effects of the project were high in magnitude for several key traditional land-use factors.

[3540] The panel finds that in the absence of mitigation measures, the Frontier project will adversely affect current use of lands and resources for traditional purposes and affect physical and cultural heritage values of the Métis Local 1935 and further exacerbate existing cumulative effects.

Mitigation Measures

[3541] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[3542] At the request of the panel, Teck summarized its commitments to indigenous communities in the region. These are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

Participation Agreement or Sustainability Agreement

[3543] On August 22, 2017, Teck and Métis Local 1935 announced the signing of a participation agreement with respect to the Frontier project. The agreement identifies a number of economic benefits for Métis Local 1935 connected with the Frontier project, as well as creating opportunities for meaningful engagement and communication. It also sets out a framework for items such as traditional land use and environmental stewardship related to the Frontier project. Teck considers the agreement to be substantial and critical mitigation for the effects described in its updated assessment while also providing mechanisms for continued engagement throughout the life of the Frontier project, which might result in the development of additional community-specific mitigation measures to manage specific effects. The agreement includes “ongoing mitigation, monitoring and management of project impacts to the environment and Métis Local 1935’s traditional use, identification of contracting and employment opportunities, and provision of direct financial benefits to them.”

Métis Local 1935 Proposed Mitigation

[3544] Métis Local 1935 requested that Teck include them in fish rescues, wildlife reclamation planning, hydrology, documenting and preserving native plant species, forest/tree types, rare plant research and monitoring, weed management effectiveness monitoring and monitoring of the closure drainage systems. Teck committed to engaging with indigenous groups in all plans. Teck also stated that where an indigenous group has entered into a long-term sustainability agreement (participation agreement) regarding the Frontier project, it would uphold ongoing commitments for engagement that have been established in the agreement. The long-term sustainability agreements include mechanisms for ongoing community input and consultation of environmental and impact management and monitoring throughout the Frontier project life cycle.

[3545] Métis Local 1935 recommended that access be kept open to regional fur management areas 1275, 1661, 2331, and 2939. Teck stated that one of the specific objectives of the access management plan would be to optimize hunting opportunities for aboriginal users and ensure continued access through the local study area to regional fur management areas located west of the terrestrial local study area and lease land and land beyond the Frontier project for traditional use. At the hearing, Teck stated that plans for development of access to registered fur management areas located west of the terrestrial local study area and land beyond the Frontier project for traditional use would be developed in the finalization of the access management plans in collaboration with indigenous communities.

[3546] Métis Local 1935 requested that Teck make efforts to avoid disruption to specific sites. At the hearing, Teck stated that it would continue to work the Métis Local 1935 through participation agreements. However, regarding the protection of cultural sites within the project disturbance area, these sites would be lost as a result of the Frontier project.

[3547] Métis Local 1935 recommended that Teck consult with community members to identify the exact location of the burial sites and perform field verification to ensure the integrity of these sites is protected. At the hearings, Teck stated that there are no known burial sites within the project disturbance area that need to be avoided. Further archaeological investigations would be conducted and Teck would work with Métis Local 1935.

[3548] Métis Local 1935 requested that measures be taken to limit non-indigenous hunting in the areas around Fort McMurray and the Frontier project. Teck stated it would prohibit Frontier project personnel from fishing, hunting and trapping within the project disturbance area during work rotations, which is when Teck's policies' can be enforced and prohibit Frontier project personnel from using personal recreation vehicles within the project disturbance area. Teck committed to monitor site personnel compliance with site rules regarding fishing, hunting, trapping and personal recreation vehicles. The threshold or target is zero.

[3549] Métis Local 1935 recommended that a more active and aggressive caribou habitat protection plan that includes caribou population recovery efforts be adopted immediately and that they be included. Teck stated that range plans for Red Earth, Richardson and West Side of Athabasca River ranges have not yet been released by Alberta Energy and Parks. When these plans become available, Teck, in collaboration with regulators and indigenous communities, would assess their recommendations and determine whether (or to what extent) they are appropriate to include in the Frontier project's mitigation and monitoring plans and as part of Teck's adaptive management process.

[3550] Métis Local 1935 requested that a trapline reclamation program be implemented to ensure that traplines that are currently held by them stay within the community and that they have access to future traplines as they become available.

[3551] Métis Local 1935 recommended that Alberta develop a Métis consultation policy. They stated that this recommendation was made by the Shell Jackpine panel. Métis communities in Alberta have been largely excluded from the regulatory consultation process or proponents have not contributed to Métis consultation in the same way they have provided resources to First Nations. The Government of Alberta has not required consultation by a proponent with Métis Local 1935, nor has Alberta itself consulted with Métis Local 1935. The lack of a Métis consultation policy also limits Métis meaningful participation in regional planning, cumulative effects management, and monitoring. Métis Local 1935 requested that Alberta establish a multistakeholder committee that includes Métis Local 1935 to develop policy recommendations for involving Métis communities in decision-making regarding biodiversity conservation and management including work on the draft biodiversity policy and Lower Athabasca draft biodiversity management framework. Métis Local 1935 also requested that Alberta move forward with implementing the Indigenous Traditional Knowledge Framework.

[3552] Métis Local 1935 stated that they considered CEMA to be the only independent multistakeholder group focused on cumulative effects management. The monitoring and research work CEMA undertook was both relevant and crucial to regional environmental management. COSIA is not a multistakeholder organization and does not give communities like Métis Local 1935 a collaborative or partnership role. Métis Local 1935 recommends that unfinished CEMA work be completed; specifically research and monitoring to reestablish species diversity on reclaimed land, including developing reclamation guidance to plan for species diversity on reclaimed lands and criteria and indicators for oil sands mine reclamation to evaluate the capability of reclaimed lands to support traditional end land uses. Teck stated that CEMA and the Alberta Environmental Monitoring Evaluation Reporting Agency have recently ceased their activities. Teck committed to participate in the following regional committees and research organizations: COSIA including the Wildlife Habitat Effectiveness Connectivity project, Alberta Biodiversity Monitoring Institute, Oil Sands Monitoring Program.

Canada

[3553] Transport Canada stated that it has the ability, within its regulatory processes, to include terms and conditions within project approvals to address impacts and cumulative impacts to navigation. To support this regional approach and to further its own understanding of the impacts of water withdrawal on navigation, Transport Canada advised that it is working to complete a navigation study in spring 2019. Transport Canada also confirmed that it is committed to working with Alberta. It committed to sharing the results of the study not only with Alberta, but also with other partners, including indigenous groups, Parks Canada, and ECCC.

Analysis and Findings

[3554] The panel recognizes the participation agreement and the commitments which are intended to mitigate the effects of the project on current use of land and resources for traditional purposes; physical

and cultural heritage; and impacts to asserted aboriginal rights. The agreement is considered to be substantial as it appears to have resolved or accommodated Métis Local 1935 opposition to the project and includes mechanisms for continued engagement throughout the life of the project which may result in the development of additional community-specific mitigation measures to manage specific effects.

[3555] The panel supports the establishment of such processes to manage mitigation measures and adapt to circumstances that may not be anticipated at this time. It expects the parties to comply with the various commitments which they have made in this agreement.

[3556] A consolidated version of Teck's commitments is in [Appendix 11](#). The panel has required a number of these proposed mitigations as conditions of the project approval. A number of these measures are outside the authority of the panel. However, many of these mitigations are reasonable given the context of the region, the issues and concerns and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of environmental valued components, which will serve to also reduce effects on indigenous use of lands. In conjunction with a number of adaptive management plans which Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Métis Local 1935.

[3557] Métis Local 1935 removed their objections to the Frontier project following the submission of the agreement. Métis Local 1935 states that the agreement includes measures including ongoing mitigation, monitoring and management of project impacts to their traditional use. As the full details of this agreement remain private, the panel must assume that the measures agreed upon would meet their needs and interests with respect to the Frontier project.

Conditions and Recommendations

[3558] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Métis Local 1935. The panel makes the following condition for Métis Local 1935.

[3559] The panel requires that Teck finalize a traditional land-use mitigation, monitoring, and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of construction of the project.¹⁶³ The plan will be required as a condition of an *EPEA* approval for the project.

¹⁶³ Draft *EPEA* Approval – Condition 3.1.7

Determination of Significance

[3560] The panel determined the significance of project effects to current use of lands and resources, and physical and cultural heritage based on the approach discussed in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[3561] The panel also assessed the potential for the Frontier project to impact the rights asserted in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

[3562] As noted Métis Local 1935 did not participate in the oral portion of the hearing and therefore they, and their experts, were unavailable for questions, cross-examination and otherwise testing of their evidence by either Teck or the AER. Teck did not contest Métis Local 1935 evidence in their written submissions. Teck's own conclusions regarding significance or consequence of effects of the project on Métis Local 1935 traditional land-use key indicators largely aligned with Métis Local 1935 assessment. As a result, the panel assigns a moderate measure of weight to Métis Local 1935 submissions and evidence even in the absence of the opportunity to test it through the oral hearing process.

Significance Determination for Project Effects

[3563] Teck stated that while land may be reclaimed after project closure, knowledge of, familiarity with, or preferred use of that portion of the landscape may be lost due to the interruption in the continued use of that area. Therefore, Teck stated that while aboriginal land users may return to that portion of the landscape after reclamation, the relationship with the area may be permanently altered. As a result, Teck determined that for the purposes of the traditional land-use assessment, any potential effect that is long term in duration would be considered irreversible.

[3564] According to their incremental effects assessment of significance to Métis Local 1935 traditional land-use key indicators which considers only the incremental effects of the Frontier project prior to reclamation:

- Teck predicted that the incremental effect of the project on Métis Local 1935 opportunities to harvest bison would be regional in geographic extent, long term, continuous, irreversible, and of moderate to high magnitude.
- Teck predicted that the incremental effect of the project on Métis Local 1935 opportunities to hunt traditionally important wildlife species would be regional in geographic extent, long term, continuous, irreversible, and of low to moderate magnitude.

- Teck predicted that the incremental effect of the project on Métis Local 1935 opportunities to trap fur-bearers would be regional in geographic extent, long term, continuous, irreversible, and of low magnitude.
- Teck predicted that the incremental effect of the project on Métis Local 1935 opportunities to harvest traditionally important vegetation would be regional in geographic extent, long term, continuous, irreversible, and of low magnitude.
- Teck predicted that the incremental effect of the project on Métis Local 1935 opportunities to fish for traditionally important species would be regional in geographic extent, long term, continuous, irreversible, and of low magnitude.
- Teck predicted that the incremental effect of the project on Métis Local 1935 opportunities to use culturally important sites would be regional in geographic extent, long term, continuous, irreversible, and of moderate to high magnitude.

Panel Determination

Current Use of Land and Resources for Traditional Purposes

[3565] The magnitude of project effects would be high. The evidence was persuasive that Métis Local 1935 are using lands in the project disturbance area and local study area for hunting, trapping, fishing, gathering and important cultural activities. The project effects and direct loss of lands in the project disturbance area represents an important portion of the area relatively near Fort McMurray which is being used by Métis Local 1935 members for these purposes. This is especially relevant for those families that have historically used lands within the project disturbance area which will no longer be available to them.

[3566] The geographic extent of project effects would be regional. The effects to Métis Local 1935's ability to access and hunt wildlife species of importance and to participate in culturally important activities are expected to occur within the local study area and regional study area.

[3567] The duration of effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape that will support traditional land-use activities.

[3568] The frequency of effects would be continuous.

[3569] The project effects would be irreversible. Uncertainty exists regarding the timing and success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife, and waterfowl populations which their members harvest. Further, it is uncertain whether indigenous groups would reestablish traditional use activities on reclaimed lands following a multigenerational absence and therefore a loss of cultural connection to those lands.

[3570] Due to the high magnitude, regional geographic extent, long term duration, continuous frequency, and irreversibility, the effects are adverse, significant and likely to occur even in consideration of project mitigation measures and conditions imposed by the panel.

Health and Socioeconomic Conditions

[3571] As determined in section 29, “Public (Human) Health,” the panel finds that the human health effects from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Métis Local 1935 members.

[3572] As determined in section 30, “Social Effects,” the panel finds that the socioeconomic effects from the project are expected to be low in magnitude. The panel believes that this finding applies for Métis Local 1935.

[3573] The panel finds that health and socioeconomic effects would be continuous and regional in extent. The effects would be medium term in duration and reversible as they would decrease at the end of operations. Due to the low magnitude, continuous, regional, medium term, and reversibility, the project effects to the health and socioeconomic conditions would be adverse but not significant.

Physical and Cultural Heritage and any Structure, Site, or Thing That Is of Historical, Archaeological, Paleontological, or Architectural Significance

[3574] Métis Local 1935 identified specific use of areas, cultural sites and cabins in the project disturbance area and local study area that would be directly affected by the project. The panel has determined that the magnitude of effects is high related to physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[3575] The geographic extent of project effects would be regional. The effects on Métis Local 1935 ability to continue to participate in culturally important activities are expected to occur within the local study area and regional study area.

[3576] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities.

[3577] The frequency of effects would be continuous.

[3578] The project effects would be irreversible given the likely multigenerational loss of connection to traditional activities and cultural values that take place on lands directly affected by the project.

Summary

[3579] The panel finds the project effects would be adverse, significant and likely to occur even in consideration of the key mitigation measures proposed.

Significance Determination for Cumulative Effects

[3580] Much of the evidence from Métis Local 1935 referenced currently occurring adverse effects to their ability to access and use lands and resources, their ability to practice culturally important activities and their ability to exercise their asserted rights. Métis Local 1935 stated that cumulative effects caused by existing developments affect them greatly now and they are concerned that future developments would affect them to a larger degree. Métis Local 1935 stated that the community is at a critical juncture; the present trajectory is not sustainable, and if something is not done now, the impairment of the mechanism of cultural continuity could end in irreversible damage. Métis Local 1935 stressed that the sustainability threshold for cultural viability and propagation has been surpassed and cumulative project-related effects of the Frontier project on the traditional land-use values and culture are of high magnitude.

[3581] Teck predicted that the cumulative effects of the project effects prior to reclamation, in combination with existing and future effects on Métis Local 1935 opportunities to hunt traditionally important wildlife species would be regional in geographic extent, long term, continuous, irreversible, and of high magnitude. Teck predicted that the project's contribution to this effect would be of low to moderate magnitude.

Panel Determination

Current Use of Land and Resources for Traditional Purposes

[3582] The magnitude of cumulative effects would be high. The panel accepts evidence from Métis Local 1935 and Teck that areas used for traditional activities by Métis Local 1935 have been adversely affected by oil sands mining and development and other industrial activities.

[3583] The geographic extent of cumulative effects would be provincial as cumulative effects described by Métis Local 1935 are occurring beyond the regional study area and over much of the area which they describe as traditional lands.

[3584] The duration of cumulative effects would be long. Cumulative effects will extend beyond the cessations of industrial activities in the region.

[3585] The frequency of cumulative effects would be continuous.

[3586] The project effects would be irreversible. Uncertainty exists regarding the timing and success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife, and waterfowl populations which their members harvest. Further, it is uncertain whether indigenous groups would reestablish traditional use activities on reclaimed lands following a multigenerational absence and therefore a loss of cultural connection to those lands.

Health and Socioeconomic Conditions

[3587] As determined in section 29, “[Public \(Human\) Health](#),” the panel finds that the cumulative effects to human health from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Métis Local 1935 members.

[3588] As determined in section 30, “[Social Effects](#),” the panel finds that the cumulative socioeconomic effects are expected to be low in magnitude. The panel believes that this finding applies for Métis Local 1935 members.

[3589] The panel finds that cumulative effects would be continuous and regional in extent, but would be medium term in duration and reversible as they would decrease at the end of operations. Due to the low magnitude, the cumulative effects to the health and socioeconomic conditions would be adverse but not significant.

Physical and Cultural Heritage and any Structure, Site, Or Thing That Is of Historical, Archaeological, Paleontological, or Architectural Significance

[3590] The magnitude of cumulative effects would be high. The cumulative effects would affect culturally important areas, cabins, wildlife species, and the ability to access them.

[3591] The geographic extent of cumulative effects would be provincial. The cumulative effects to Métis Local 1935 ability to participate in culturally important activities are expected to occur beyond the local study area and regional study area.

[3592] The duration of cumulative effects would be long term. Cumulative effects would extend beyond the end of project operations and reclamation and closure activities.

[3593] Frequency of cumulative effects would be continuous.

[3594] The cumulative effects would be irreversible. There is some uncertainty depending on the success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife and waterfowl populations which Métis Local 1935 members hunt, gather and trap. Other cumulative effects, such as those that affect the ability of Métis Local 1935 to transfer cultural values and knowledge that are based on connections to the land, from one generation to the next, may be impossible to reverse.

Summary

[3595] The panel finds the cumulative effects to Métis Local 1935 would be adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

[3596] The panel believes that significant effects are currently occurring and will occur regardless of whether or not the project proceeds. It finds that residual effects of the project will be an incremental contribution to cumulative effects as they are currently being experienced by Métis Local 1935.

Significance Determination for Asserted Rights

[3597] The panel assessed potential effects of the Frontier project on Fort McMurray Métis Local 1935's asserted rights as required by its terms of reference. In conducting its assessment, the panel took into consideration the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*.

[3598] The ability of Métis Local 1935 members to practice certain asserted rights has already been diminished. The panel finds that the residual effects to Métis Local 1935 asserted rights would not be fully mitigated. Some adverse incremental effects from the project on asserted rights may occur but they are not likely to be significant. Effects on asserted rights would be most prominent for those members who access lands within the project disturbance area and the local study area.

[3599] The panel finds that due to the high magnitude, provincial geographic extent, long-term duration, continuous frequency, and irreversibility of project effects to Métis Local 1935 current use of lands and resources for traditional purposes and physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance, the cumulative effects on Métis Local 1935 asserted rights would be significant.

Table 43. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	regional	long	continuous	irreversible	significant
Cultural and physical heritage	high	regional	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	regional	long	continuous	irreversible	significant

Table 44. Summary – Significance determination for cumulative effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	provincial	long	continuous	irreversible	significant
Cultural and physical heritage	high	provincial	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	provincial	long	continuous	irreversible	significant

Fort Chipewyan Métis Local 125

Background

[3600] The Fort Chipewyan Métis are located in Fort Chipewyan on the northwest side of Lake Athabasca and have an estimated 1080 members. The Fort Chipewyan Métis have occupied this oldest historical settlement in Alberta since before its establishment in 1788. The Government of Alberta acknowledges the Fort Chipewyan Métis as both a historic and contemporary community, and applies constitutionally protected harvesting rights to demonstrated Métis harvesters. The Fort Chipewyan Métis Local 125 is the nonprofit Métis organization affiliated with the Métis Nation of Alberta, who represents the interests of the Fort Chipewyan Métis in relations with industrial project proponents, government, civil society organizations, and business partners. Fort Chipewyan Métis 125 works to preserve Métis lifestyles and culture and to provide services for the Métis people of Fort Chipewyan.

[3601] Fort Chipewyan Métis Local 125 filed the following submissions:

- May 28, 2012: Statement of Concern.
- November 8, 2013: Barb Hermansen – Her Story, the Last Woman to Raise Children on the Athabasca River.
- June 15, 2015: Fort Chipewyan Métis Local 125 Métis Land Use & Ecological Knowledge Study.
- August 28, 2015: Fort Chipewyan Métis Local 125 Métis Land Use & Ecological Knowledge Study Final Report: Teck Resources Ltd Frontier Mine (TLU).
- October 11, 2016: Withdrawal of concerns regarding the project.
- May 29, 2017: Fort Chipewyan Métis Local 125 Cultural Impact Assessment for the Proposed Frontier Oil Sands Mine project.

[3602] On October 11, 2016, Fort Chipewyan Métis withdrew their statement of concern and advised the panel that they did not object to the granting of approvals and that they supported the project. On December 7, 2016, Teck and Fort Chipewyan Métis announced the signing of a participation agreement. The agreement identifies a number of economic benefits, opportunities for meaningful engagement and communication, and critical mitigation for the effects of the project. (CEAR #291, package 4, page 4-19)

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[3603] The ACO did not submit a report regarding consultation adequacy and whether actions may be required to address potential adverse impacts to the existing rights of Fort Chipewyan Métis Local 125.

Asserted or Established Aboriginal and Treaty Rights

[3604] Fort Chipewyan Métis asserted the following rights:

- Practicing traditional livelihoods
- Intergenerational knowledge transfer of cultural and spiritual practices
- Hunting, fishing, trapping, gathering, and gardening and ancillary practices
- Continued use of traditional lands and locations for harvesting purposes
- Food and water security
- Ability to travel and use of traditional waterways
- Access to a clean, safe, and healthy environment for sustainable traditional harvesting and community well-being
- Affordable local economy
- Ability for continued gathering, visiting, providing, and sharing

[3605] The panel's terms of reference require it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by or the strength of such claims. But, for the purposes of assessing the potential effects of the Frontier project, the panel accepts the rights being asserted.

Context of Historical and Current Cumulative Effects

[3606] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities, or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Canadian Environmental Assessment Agency (the Agency), effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

Use of Lands and Resources for Traditional Purposes

[3607] Fort Chipewyan Métis stated that over recent decades, the ongoing and cumulative uptake of land for oil sands and related industrial expansion has had an impact on the landscape of northeastern Alberta and the lifestyles of those who live there. They said that as large-scale bitumen extraction in northern Alberta has expanded, the cumulative impacts of development to the region's First Nation and Métis peoples and their communities have been significant. They repeatedly expressed concerns over broad shifts in the way they live, including shifts in harvesting activities, migration of animals, and disturbance from noise, odour, and infrastructure development.

[3608] Fort Chipewyan Métis shared that traditional harvesting practices form the backbone of Métis way of life, culture, pride, and knowledge transfer. They said that harvesting encompasses snaring, trapping, hunting of big game and birds, fishing, and gathering berries, medicinal plants, and water. They stated that hunting provides highly valued meat for the community, which they consider more nutritious than meat sold in the local stores. Some members' knowledge of hunting also allows them to generate income by providing outfitting and guiding services.

Gathering and Harvesting

[3609] Fort Chipewyan Métis explained that there are many wildlife and plant species of cultural and ecological value and the local study area holds critical wildlife habitat for large animals and small fur-bearers. They are concerned that the local study area is one of the last remaining areas upstream (south) of the Firebag River that is suitable for traditional uses and that once the Frontier project goes in there will be nothing left there. They explained that Métis harvesting is more than a form of economic subsistence. Hunting, fishing, and being on the land are integral to Métis culture and identity. They actively hunt, trap, fish, and harvest within and around the proposed Frontier project footprint, the local study area, the project development area, and within 10 km of the Frontier project footprint.

[3610] Species of interest include moose, bear, caribou, buffalo (bison), deer, chicken (spruce hen), mud hen, geese, ptarmigan, grouse, duck, swan, and Sandhill crane. Moose are singled out for their significance as a staple food. They have observed moose seasonal migration patterns and habitat preferences within the project footprint and local study area along the Athabasca River banks and through to the base of the Birch Mountains. Duck, geese, and swan are largely hunted around the lakes in the Frontier project footprint near the main cabin on the shore of the Athabasca River adjacent to the project development area and on Athabasca River islands in the local study area. Grouse and spruce hen are known to be found along every cutline and trail within the local study area and the project footprint.

[3611] Fort Chipewyan Métis explained the importance of plant harvesting as a component of their traditional diet and the foundation of their traditional medicines. Medicinal plants are harvested in five places within the local study area, one within the project footprint, another with proposed road infrastructure running through it, and two on the east bank directly adjacent to the river intake.

[3612] Fort Chipewyan Métis stated that the quality of water in the river and delta is not trusted for drinking. Land users must carry water on the land, which can be prohibitive.

[3613] Fort Chipewyan Métis stated that its members are concerned with the effects of industrial emissions and the effects it has on the quality of country foods including meat, fish, and plants harvested in the area.

[3614] Fort Chipewyan Métis explained that a reduction in gardening is attributed to industrial development. Specifically, wage-based employment in Fort McMurray makes gardening less convenient, and concerns about air and water contamination cause feelings that it is no longer safe to grow vegetables.

Trapping

[3615] Fort Chipewyan Métis explained that commercial trapping is a long established activity for the Métis since the fur trade. Knowledge of wildlife habitat, locations, seasonality, and techniques are passed down to next generations. Trapping maintains connections to Métis culture and heritage while providing meat and hide for subsistence and production of cultural items for ceremonies, personal use, clothing, economic income, or trade.

[3616] They explained that trapping and snaring of fur-bearing species occurs in the project development area and surrounding areas, including the Frontier project footprint and the local study area. Species of interest include lynx, fisher, beaver, squirrel, martin, mink, fox, coyote, wolverine, rabbit, weasel, otter, muskrat, and wolf.

[3617] They said that many Métis families hold Alberta RFMAs/traplines and pass them down from generation to generation.

Fishing

[3618] Fort Chipewyan Métis stated that fish are harvested in the Athabasca River along the local study area. Species of interest include pickerel, whitefish, goldeye, suckerfish, northern pike (jackfish), lake whitefish, lingcod/mariah, and freshwater clam. They told the panel about hook fishing just below Firebag River for jackfish, whitefish, goldeye, sucker, and some mariah. They harvest freshwater clams outside of winter freeze up months in a couple of places along the river in the local study area.

[3619] Fort Chipewyan Métis described a number of changes to fish and fishing that they attribute to the effects of industrial development and associated contamination—specifically, effects on habitat, physical changes to fish (especially pickerel) such as changes in colour and texture in the skin and meat, declining fish health, and a growing number of deformed fish. They have observed declines in fish and clam populations, thus reducing that part of the traditional Métis diet. This reduction is believed to be attributed to pollution from industrial activities. Their members also said that changes in water levels may be driving the reduced fish populations, where effects to pickerel spawning locations have been observed.

[3620] They believe the changes in the quality and quantity of fish and clams results in significant impacts on fishing and consumption, especially in terms of their traditional diet.

[3621] They believe contributions to cumulative effects coming from upstream oil sands development and operations are affecting water quality, water quantity, and fish north of existing development areas along the Athabasca River corridor and the Peace-Athabasca Delta and Lake Athabasca.

Access and Trails

[3622] Fort Chipewyan Métis stated that access to the land is one of the most important elements of land use and highlighted the importance of the lands along the Athabasca River from north to south as a traditional use corridor since the fur trade. They said that the waters of the Peace-Athabasca Delta and its rivers and lakes have long served as transportation corridors while supporting and sustaining land-based cultural and economic activities. Industry expansion and disturbance of southern harvesting areas along the Athabasca River corridor have reduced access and use of resources in preferred use areas.

[3623] They explained that industrial facilities affect the water level in the Athabasca River. Travelling to traplines can be difficult with access restricted by low water and additional vegetation in now shallower areas in the delta. Further, changes in ice characteristics impact their ability to travel for land-based activities in the winter season.

[3624] Some of their members do not harvest south of the Firebag River anymore because of the development. Industry expansion has reduced available land and resource use in preferred areas. Finding other equally viable areas may be further away or difficult to access. This results in intensified competition for resource harvesting in remaining areas and reduces harvesting opportunities. Additional travel results in increased costs and time, making it less economical to rely on harvesting resources to support individuals and their families.

[3625] They stated that interference by non-aboriginal land users or preapproval activities on the Frontier lease has already impeded land user access with a cut log blockage across River Road, which had to be partially removed to pass.

Health and Socioeconomic Conditions

[3626] Fort Chipewyan Métis stated that dust from exposed soil, vehicular traffic, and other air particulates from industry-related activities are known by land users to affect the health, size, and taste of plant foods.

[3627] They said that when heading south (upstream), members can see, smell, and hear industry.

[3628] They stated that the physical condition of wildlife and fish has changed due to industrial contamination. Fort Chipewyan Métis have observed disturbance of areas within the regional study area downstream of the Frontier project (e.g., black film on snow) and link physical health effects to industrial odours present in the regional study area. Further, Fort Chipewyan Métis are concerned that air pollutants can affect vegetation and soil quality, the health and quality of wildlife species, and resources for harvesters.

[3629] Fort Chipewyan Métis stated that water quality, water quantity, and air quality have affected traditional commercial activities such as trapping, fishing, barging, and guiding businesses. Fort

Chipewyan Métis feel that industrial pollution has contaminated northern lakes, creeks, and the Athabasca River and that it could reduce water quality and harm fish and wildlife that Métis harvesters rely on.

[3630] Members stated that they gather certain foods from areas further away from the Peace-Athabasca Delta because they are more reliably available and trusted.

[3631] Fort Chipewyan Métis stated that, with the drop in fur prices, closure of the fisheries, higher costs of living, and loss of productive trapping areas, members' ability to make a living at trapping and fishing has decreased. They explained that many members earn a living by working in the wage-based economy, which results in increased stress associated with higher cost of living, working out of town, pace of life, and less time to visit, gather, and share with friends and family. The local aboriginal livelihood was typically a mixture of subsistence activity, sale of commodities produced from the resources of the bush (furs, fish, and handicrafts), wage labour, and government transfers. It is increasingly difficult for members to go to the bush due to costs and lack of time because of the wage-based labour force.

Physical and Cultural Heritage

[3632] The panel is required to take into account the effects the physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[3633] Fort Chipewyan Métis identified the following:

- Land-use patterns, plants and animals harvested, traditional activities, indigenous place names, and cultural, spiritual, and historical places within the regional study area. They identified that permanent occupation of the local study area has been recorded since the early 1900s.
- Cabins, campsites, trails, hunting areas, trapping areas, berry picking areas, medicinal plant gathering areas, animal habitat areas, and areas connected to traditional stories, oral history, and transmission of cultural knowledge within the project footprint. They said that traditional land-use values are connected to current and future cultural identity, land use, and consumption of traditional foods.
- 10 sites relating to cultural, historical, and spiritual sites in the local study area composed of burial sites, an old fur trade store, a place where tar was collected to paint boats, a groundwater spring, and preferred sites on the river.
- 26 place names used by members within 10 km of the project footprint where 7 were reported in the project footprint.
- 28 historic or contemporary habitation sites within 10 km of the project footprint important to gathering, visiting, and sharing.

[3634] Fort Chipewyan Métis stated that the changing landscapes threaten to reduce the connection they have with the stories, experiences, and skills in certain locations, making it difficult to recognize once familiar locations.

Analysis and Findings

[3635] The Fort Chipewyan Métis advised the panel in its October 11, 2016, correspondence that if a public hearing was held, it would not oppose the application.

[3636] Teck did not contest evidence provided by Fort Chipewyan Métis regarding current use of lands.

[3637] Fort Chipewyan Métis did not seat a panel during the oral portion of the hearing or provide an opportunity for cross-examination of their evidence, which was submitted before signing an agreement with Teck. As such, the panel is able to place limited weight on the evidence presented by Fort Chipewyan Métis.

[3638] Fort Chipewyan Métis presented specific evidence that some members use lands for harvesting and cultural practices in and within 5 km of the project development area that will be directly affected by the project. Specifically, the panel finds that:

- Members of Fort Chipewyan Métis currently use lands and resources for traditional purposes within areas that will be affected by the Frontier project. There are sites that hold cultural or historical value that currently exist within the project disturbance area or within 10 kilometres of the project disturbance area.
- Fort Chipewyan Métis use trapping areas in the immediate vicinity of the project development area.
- Fort Chipewyan Métis use of lands for traditional and cultural activities is integral to the maintenance of their culture and the transmission of knowledge and cultural practices to younger members of their community.
- Harvesting and sharing subsistence resources holds deep social and cultural values for Fort Chipewyan Métis.
- Difficulty practicing traditional activities due to the increased effort, time, and cost required; the inability to safely access culturally important areas; and reduced hunting success has interfered with their traditional way of life and eroded their culture.

Project and Cumulative Effects

[3639] The panel must consider the current context of use of lands and resources for traditional purposes and exercise of asserted rights and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources and practice of asserted rights.

Effects on Use of Lands and Resources for Traditional Purposes

Fort Chipewyan Métis View

Resource

[3640] Fort Chipewyan Métis stated that the Frontier project footprint will remove 29 217 ha or 292.17 km² of lands use area. They said that cabins, campsites, trails, hunting areas, trapping areas, berry picking areas, medicinal plant gathering areas, animal habitat areas, and areas connected to traditional stories, oral history, and transmission of cultural knowledge are located in the Frontier project footprint and would be destroyed. The Frontier project will also render any remaining resources challenging and burdensome to access and largely unusable or undesirable to them.

Harvesting and Gathering

[3641] Fort Chipewyan Métis stated that on the west bank of the local study area there are one hundred kilometres of main harvesting trails continuously used by the holder of RFMA 1275 and his Métis family. Two other main trails are on the east bank in the local study area, which collectively provide access to some of the more intensely used areas on the trapline for subsistence and commercial trapping purposes. Another member uses the two main trails through the northernmost and east portion of the project footprint and local study area to hunt and camp, sometimes with family members.

[3642] They stated that four of the nine major trapping areas within the project footprint would be destroyed by the project, and the remaining adjacent trapping areas would not be viable because of habitat fragmentation and proximity to project activity disturbance. They explained that the loss of trapping habitat due to industrialization undermines the economic foundation of the traditional mixed economy and commercial trapping activities. Additionally, knowledge transmission of trapping in the local study area to future generations will cease if the project commences.

[3643] As several fur-bearing species in the project area rely on aquatic environments for habitat and food sources, members are concerned that the drawdown of water sources will affect the sustainability of the aquatic environment, species, and the fur-bearers who rely on them.

[3644] They expressed great concern that the Ronald Lake bison are at risk of destruction and that the birds are altering their migration patterns. They explained that the project footprint and associated roads and infrastructure would destroy a large portion of critical habitat and displace wildlife and plants that are intrinsic for them to continue harvesting, hunting, and snaring in the remaining local study area.

[3645] They stated that the berry harvesting areas in the project footprint will be destroyed. Within the local study area, they will not be able to harvest traditional foods and medicines at specific harvesting locations. They explained the necessity of following specific cultural and spiritual protocols when harvesting medicines. They will not harvest near an area experiencing sensory as well as physical disturbance since it is the purity or undisturbed nature of the harvesting areas that is required for the

protocol of giving tobacco and prayer before harvesting and for the effectiveness of the medicine collected. One medicinal plant harvesting location was reported in the project disturbance area, and another in close proximity to the project disturbance area. Three additional medicinal plant harvesting locations were reported within 10 km of the Frontier project footprint. One participant noted that there are at least two, rarer, medicinal plants, which were not identified, in the local study area and project footprint that will be difficult to find elsewhere.

[3646] Effects from the Frontier project on remaining habitats will include dust and airborne particulates from traffic, truck fleets, heavy equipment, and exposed soil on vegetation; airborne and site surface water particulates entering water bodies and affecting water quality, aquatic habitat, and species for consumption; noise; odour; light pollution; increased traffic; and recreational users accessing and competing in the area.

Access

[3647] Fort Chipewyan Métis are concerned about water withdrawal from surface water creeks, which reduces fresh water tributaries replenishing the quality and quantity of the Athabasca River. Water being taken for the Frontier project from the Athabasca River is seen as another contribution to already low water levels. Currently, the area upstream of the project area and up to Fort McMurray can only be used for a reduced season of transportation.

[3648] Fort Chipewyan Métis stated that not only would the project footprint physically destroy trails, those trails that lie along or cross the footprint, such as access roads and river intake routes, would be directly affected as well. The integrity of the remaining fragments of trails would be lost and so would the value and viable use of the area for subsistence practices. They identified 33 direct and potential impacts to transportation routes (including trails, on land and over water) in the local study area, 20 of these are in the project footprint.

[3649] Fort Chipewyan Métis stated that the competition for resources will increase as more people gain access to the area. They state that interference by non-aboriginal land users or preapproval activities on the lease has already impeded their access with a cut log blockage across River Road, which had to be partially removed to pass. They feel that the Frontier project in combination with the CNRL and Shell projects will severely reduce the available hunting area and increase non-aboriginal hunting activities in the area, with a combined effect of diminished moose hunting returns in the area and an increase in avoidance behaviour to such an extent that it is no longer a viable hunting area.

[3650] Fort Chipewyan Métis explained that each new project not only disturbs existing access routes but can also restrict access routes to other areas that pass through or by the project and lease areas. Access restrictions through lease areas are onerous, time consuming, and unpredictable, furthering feelings of alienation from the land and altering land-use patterns by influencing harvesting decisions.

Disturbance

[3651] Fort Chipewyan Métis are concerned that increases in non-aboriginal land users will result in the potential misuse and degradation of Métis cultural and spiritual places. Generally, they fear increasing instances of theft, trash, vandalism, fire hazards in the area, poaching in the traplines, and a threat to traditional resource use.

[3652] They are concerned that the influx of outside workers who are unfamiliar with local aboriginal identity and culture pose a threat of potential conflicts over traditional resource use, access issues to harvesting areas, and impacts to wildlife. Members are increasingly concerned about crime and safety on the land.

[3653] Fort Chipewyan Métis explained that the lights, odours, and noise from project-related activities and the river intake structure will disturb wildlife, especially in fall and winter when many of the trees are bare and sound barriers are reduced.

Teck's View

Hunting and Gathering

[3654] Teck stated that bison harvesting areas located in the project disturbance area will no longer be available to Fort Chipewyan Métis harvesters because of project development at maximum buildout; however, more northerly areas will not be directly disturbed by the Frontier project.

[3655] Any waterfowl hunting that occurs on lakes in the project disturbance area is expected to be lost because of project development. Specifically, any waterfowl hunting occurring at Unnamed Lake 1 and Unnamed Lake 2 will be unavailable at the start of project construction in 2021 when these water bodies will be dewatered.

[3656] High-magnitude effects are predicted to occur for moose compared with the predevelopment case and before reclamation. High-magnitude effects are also predicted before reclamation for other key traditional use wildlife species including woodland caribou, black bear, and waterfowl.

[3657] Teck stated that it expected all plant and berry harvesting sites located in the project disturbance area will no longer be available for use by Fort Chipewyan Métis members. Teck stated that availability of plants will decrease but will be reestablished at closure.

[3658] Teck stated that 4 of 9 major trapping areas in RFMA 1275 are within the project footprint and will be disturbed. An additional trapline, RFMA 2016, is unassigned and therefore assumed to be available to indigenous trappers.

Fishing

[3659] The effects on fish and fish habitat at the alternate application case showed that residual effects range from negligible to low in magnitude. The draft fisheries offsetting plan is intended to result in no reduction of fish habitat productivity and no overall reduction in fish abundance, but it might change where the fish are located on the project footprint landscape.

Access

[3660] An existing north-south road, intersected by the project disturbance area will be disturbed because of the Frontier project and will result in the interruption of north-south travel along the project footprint by Fort Chipewyan Métis land users. Teck intends to allow access to or through its mineral surface lease described in the draft access management plan to assist in the mitigation of this effect on land users. Teck recognized that the use of alternative access strategies or the implementation of access controls on existing access routes will potentially result in additional travel time or costs to indigenous land users. Teck also stated that while access to some areas is provided by industry access roads, this may also result in increased use of areas by non-aboriginal harvesters and a corresponding increase in competition for traditionally important land areas or resources.

[3661] Teck stated that multiple overland trails located in the project footprint are expected to be disturbed by development of the Frontier project, including RFMA 1275. Two main trails used for hunting and camping in the north and east portions of the project footprint and the use of portions of these trails is expected to be lost as project development progresses. Teck stated that east-west trails reported on the east bank of the Athabasca River are not expected to experience direct disturbance at any assessment case.

[3662] Teck stated that the Frontier project, in conjunction with other oil sands developments, is not expected to affect navigation on the Athabasca River. Teck predicted that changes in the Athabasca River water levels because of water withdrawals to be negligible (i.e., less than 5 cm). It stated that the loss of access because of low water levels has been considered in all cumulative effects cases. There would be moderate increase in costs and time to travel on waterways.

Disturbance

[3663] Teck stated that sensory disturbances are changes in noise, odour, and visual aesthetics. The furthest extent where the continuous sounds of the Frontier project might be perceptible to land users is 2.3 km. Continuous noise will not be perceptible outside the traditional land-use regional study area. Noise from the Fort Hills project at planned development case will be expected in areas southeast of the Frontier project on the east side of the Athabasca River.

[3664] Teck stated that it expects odour to be perceptible in the Ronald Lake bison study area in regions surrounding the Frontier project. Odours because of existing conditions are predicted to be perceptible in areas south of the region.

[3665] Teck stated that project components taller than 30 m will be visible from several locations throughout the Ronald Lake bison study area and the traditional land-use regional study area. Because of the proximity of the Frontier project to RFMA 1275, the Frontier project is expected to be visible on the undisturbed portions of this trapline.

[3666] Teck stated that cumulative effects of development will contribute to regional haze and associated visibility impairment.

Effects on Health and Socioeconomic Conditions

Fort Chipewyan Métis View

[3667] Fort Chipewyan Métis expressed concerns with traffic volume, including truck and over-dimensional trips, particularly from Fort McKay north of Highway 63 and on the Fort Chipewyan winter road. This concern is especially important to indigenous community members living in Fort Chipewyan.

[3668] They are concerned that air pollutants from the Frontier project may affect vegetation and soil quality, the health and quality of wildlife species, and resources for harvesters.

[3669] They are concerned that toxic elements from the Frontier project will leech into the river and lake and impact fish species, water quality, human health, and Métis practice and harvesting around those areas.

[3670] Fort Chipewyan Métis stated that dust from exposed soil, vehicular traffic, and other air particulates from industry-related activities will potentially affect remaining berry areas in the local study area and its surroundings. One collection area has proposed road infrastructure running through it.

Teck's View

[3671] Teck states that effects on well-being due to traditional land use, including feelings of stress, isolation, and disjointedness, will continue to be exacerbated under cumulative growth. Fort Chipewyan Métis will have an opportunity to offset these challenges linked to cumulative development through economic, social, and cultural programs funded by governments, participation agreements with industry, and revenues generated from community-owned companies. Teck considers that, on the whole, a positive direction is achievable for indigenous communities in the regional study area, meaning the benefits from the project outweigh negative effects, particularly in the economic area, should key outcomes be achieved over time.

[3672] Teck recognized many of the economic effects from changes in traditional land-use practices might fall on elders and other community members unlikely to participate directly in economic opportunities associated with the project. It is possible that effects on vulnerable populations can, to some extent, be offset by mitigation efforts focused through social supports.

[3673] In general, positive economic effects from cumulative development in the region, including employment, household incomes, contracting and businesses revenues, and revenues to community-owned companies, are expected to continue under base case and planned development case assumptions. Positive economic benefits are expected to accrue to the community and its members. These will be offset to some degree, by supports required by vulnerable community members to navigate economic changes brought on by industrial development.

Effects on Physical and Cultural Heritage

[3674] The panel is required to take into account the effects on physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

Fort Chipewyan Métis View

[3675] Fort Chipewyan Métis stated that within the local study area, 26 place names, 7 of which in the project footprint, that are linked to Métis sense of place and identity will be directly or potentially affected by the Frontier project.

[3676] They are concerned that increased access to the area enabled by road infrastructure and river intake construction could potentially affect the three burial sites nearest to the project footprint. They explained that destruction of historic cabins and indigenous places in the cultural landscape will erase Métis legacy on the land and create anomie for current and future generations, alienation, and psychosocial stress for community members with ties to the areas, while erasing part of Alberta and Canada's historic landscape and heritage.

[3677] They identified 10 sites (e.g., cemetery, future envisioned burial sites, old fur trade store) that may be affected by odour, noise, and visual disturbances within the local study area. Sensory disturbances coupled with fear of contaminants are linked to an increase in stress, psychological and cultural impacts on individuals and the community, and a decrease in sense of peace and spiritual rejuvenation that comes with being on the land.

[3678] They identified 26 places used for sharing knowledge in the local study area that are likely to experience direct impacts resulting in potential losses in knowledge, stories, and connections members have associated with the places.

[3679] Fort Chipewyan Métis identified four specific places in the local study area where members' ability to gather, visit, and share will be reduced due to odour, noise, and visual disturbances. They stated

that reduced access, changes on the landscape, and increased costs to harvest resources have led to lost or limited opportunities for Fort Chipewyan Métis members to access familiar landmark places used for gathering, visiting, and sharing. Gathering, visiting, and sharing with and between members are important aspects of Métis culture.

[3680] They said that the Frontier project will affect habitat, limit access to important resources, and increase contamination concerns in the project footprint and local study area, resulting in a potential decrease of harvesting and fewer opportunities to maintain the values associated with providing.

Teck's View

[3681] Teck stated that three cabins between Oakley (Big) Lake (Unnamed Lake 1) and Small Sandy Lake (Unnamed Lake 2), moose cabin, squirrel cabin, and the cabin on Redclay Creek will be directly disturbed because of the Frontier project. Other cabin locations will be located in close proximity to the project disturbance area.

[3682] Teck stated that because of the location of multiple cabins along the Athabasca River, it is expected that these locations are reached by boat access on the river. The Frontier project in conjunction with other oil sands developments is not expected to affect navigation on the Athabasca River.

[3683] Teck stated that sensory disturbances are expected to affect cultural practices where noise, odour, and visible features will be experienced in areas immediately surrounding the Frontier project. Continuous sounds might be perceptible to land users up to 2.3 km southwest of the project disturbance area, which might include the area where the Crooked Lake cabin is situated. Continuous noise will not be perceptible outside the traditional land-use regional study area.

[3684] Odour effects may be perceptible at the Crooked Lake cabin and other habitation or cultural and or historical and spiritual values. Visibility of the Frontier project is expected for multiple areas throughout and beyond the traditional land-use regional study area.

[3685] Teck stated that a decrease in traditional land use can result in a weakening of family and community bonds; this in turn can lead to reduced traditional land-use practice and a reduced experience through lowered participation.

[3686] Teck recognizes that concerns have been expressed regarding cumulative development in the Athabasca oil sands region to date, including difficulties transmitting traditional knowledge to youth because of ongoing development within traditional lands. These concerns have the potential to extend to the Frontier project.

Analysis and Findings

[3687] Teck did not contest evidence provided by Fort Chipewyan Métis regarding project effects on use of lands and resources for traditional purposes, socioeconomic and health conditions, and effects on physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[3688] Fort Chipewyan Métis did not seat a panel during the oral portion of the hearing or provide an opportunity for cross-examination of their evidence, which was submitted before signing an agreement with Teck. As such the panel is able to place limited weight on the evidence presented by Fort Chipewyan Métis and summarized above.

[3689] The panel finds from the evidence that:

- The project footprint will result in the direct loss of lands where Fort Chipewyan Métis land-use activities are conducted.
- The project will disturb trials in the project development area, which will require harvesters to use less-direct routes to remaining undisturbed areas, resulting in additional travel time and costs.
- Fort Chipewyan Métis is currently experiencing adverse effects on their ability to access lands for these practices as a result of industrial activities in the region, and the project will further exacerbate these effects.
- The project will affect Fort Chipewyan Métis physical heritage sites and affect opportunities to use these areas for important cultural practices.
- The project may have negative socioeconomic effects on Fort Chipewyan Métis members, but these may be offset by economic, employment, and community benefits.
- The project footprint will result in the direct loss of lands where traditional and cultural activities are practiced.
- Cumulative effects on the practice of traditional and cultural activities will be exacerbated by the project, which will eliminate or prevent the use of preferred hunting, trapping, fishing, and gathering activities in the local study area and regional study area.

[3690] The panel finds that, in the absence of mitigation measures, the Frontier project will adversely affect current use of lands and resources for traditional purposes, result in health and socioeconomic effects, and affect physical and cultural heritage values of the Fort Chipewyan Métis and further exacerbate existing cumulative effects.

Mitigation Measures

[3691] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[3692] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

[3693] After the close of the hearing, ECCC's Canadian Wildlife Service, together with Alberta and the Mikisew, established the Kitaskino Nuwenënë Wildland Provincial Park, which was announced on March 11, 2019. Canada stated that ECCC will work with the Mikisew and the Alberta to support the development of a tripartite biodiversity stewardship area co-management agreement on management of the area.

Participation Agreement

[3694] On December 7, 2016, Teck and Fort Chipewyan Métis announced the signing of a participation agreement with respect to the Frontier project. The agreement identifies a number of economic benefits for Fort Chipewyan Métis, as well as creating opportunities for meaningful engagement and communication. It also sets out a framework for items such as traditional land use and environmental stewardship related to the Frontier project.

[3695] The agreement will be implemented through a joint cooperative implementation committee, which will work collaboratively to support and implement the following:

- Economic benefits to support the community's interests and rights
- Contracting opportunities for Fort Chipewyan Métis businesses
- Education, training, and employment opportunities for Fort Chipewyan Métis members
- Consideration of traditional knowledge and traditional land use
- Environmental stewardship planning and implementation

[3696] Teck states that it considers these agreements to be substantial and critical mitigation for the effects described in this updated assessment and they also provide mechanisms for continued engagement throughout the life of the project, which might result in the development of additional community-specific mitigation measures to manage specific effects.

[3697] Teck and Fort Chipewyan Métis will work together through the cooperative implementation committee to develop the Frontier project in an environmentally and socially responsible manner that

creates meaningful, sustainable benefits and is based on a fundamental respect for Fort Chipewyan Métis heritage, culture, and long-standing connection to the region.

[3698] Fort Chipewyan Métis suggested several recommendations to support ongoing consultation and to help in discussions to address, avoid, mitigate, or compensate for project-specific, downstream, and cumulative impacts:

- Existing Athabasca River watershed monitoring and ongoing river water quality testing must be rigorous and the results must be shared with the Fort Chipewyan Métis and community advisory group. Opportunities and support should be provided for Fort Chipewyan Métis participation in regional monitoring initiatives.
- Collaborative project-specific environmental impact monitoring planning with Fort Chipewyan Métis harvesters regarding, but not limited to, caribou habitat range delineation, Ronald Lake bison range delineation and population management, and moose migration monitoring.
- Fort Chipewyan Métis monitoring programs in the Peace-Athabasca Delta should be established.
- A Fort Chipewyan Métis water monitoring program for Lake Claire, Athabasca River, and Athabasca Lake should be established.
- A Fort Chipewyan Métis aquatic species monitoring program should be established.
- Funding should be provided for Fort Chipewyan Métis participation in regional air monitoring organization.

[3699] Teck stated that all project personnel will receive cultural diversity awareness training focusing on respect for aboriginal land users, traplines, cabins, trails, and equipment, as well as respect for aboriginal world views, customs, and values.

[3700] All project personnel will be prohibited from fishing in watercourses or water bodies in the project disturbance area and those that are accessible to project workers but not the general public. Project personnel will not be allowed during work rotations to hunt, fish, trap, or possess a firearm.

Analysis and Findings

[3701] The panel finds that the Frontier project is likely to cause an adverse effect on Fort Chipewyan Métis' ability to access lands for traditional purposes. Existing adverse cumulative adverse effects of development on the practice of traditional and cultural activities will be exacerbated by the project. The panel has recommended mitigation that should be included in the Minister's decision statement under *CEAA 2012*.

[3702] In section [23](#), "[Wildlife](#)," the panel concluded that the Frontier project will result in significant adverse effects to the Ronald Lake bison herd by increasing the likelihood that disease will be transmitted

from the diseased animals in Wood Buffalo National Park to the healthy animals in the Ronald Lake herd. This means that the Frontier project will likely adversely affect Fort Chipewyan Métis' traditional use of the Ronald Lake bison herd.

[3703] While the panel concluded that none of the proposed mitigation measures was likely to be effective in reducing the risk of disease transmission, it did make several recommendations to the governments of Canada and Alberta regarding the Ronald Lake bison herd (see [Appendix 6](#)).

[3704] In section [23](#), "[Wildlife](#)," the panel concluded the Frontier project will displace moose as a result of loss of habitat in the local study area. This change in abundance of moose in preferred harvesting areas will reduce harvesting success of indigenous hunters, which will adversely affect Fort Chipewyan Métis' traditional use of this resource. The panel has made recommendations to the governments of Canada and Alberta concerning the management of moose.

[3705] In section [23](#), "[Wildlife](#)," the panel found that the Frontier project in combination with other developments are likely to result in significant adverse cumulative effects on caribou.

[3706] Further, the panel found that the decline in fur-bearer abundance as a result of the project will vary with the species, with effects ranging from high magnitude for lynx and fisher to moderate for black bear, beaver, and muskrat.

[3707] In the sections "[Wildlife Health](#)" and "[Vegetation](#)," the panel found that air and water quality effects from the Frontier project are not expected to significantly affect wildlife and vegetation health. However, reduced confidence in the quality of foods and water quality may adversely affect Fort Chipewyan Métis' use of these resources and result in loss of use of preferred harvesting areas, especially downstream of the project.

[3708] In section [29](#), "[Public \(Human\) Health](#)," the panel has found that the project is not likely to result in adverse effects to the health of indigenous land users in the region. The panel has made recommendations to the governments of Canada and Alberta regarding the protection of human health (see [Appendix 6](#)).

[3709] In section [19](#), "[Surface Water Quantity](#)," the panel found that significant adverse cumulative effects to surface water quantity, flows, and water levels in the Athabasca River, Peace-Athabasca Delta, and Slave River Delta are occurring but are due predominantly to hydropower regulation and regional climate change, with industrial water withdrawals playing a minor role. These changes in surface water quantity appear to be adversely affecting Fort Chipewyan Métis' ability to access lands and resources for traditional purposes. The panel does not believe that the Frontier project is likely to exacerbate those existing effects. The panel has made recommendations to the governments of Canada and Alberta with regards to surface water quantity and indigenous navigation.

[3710] The participation agreement between Fort Chipewyan Métis and Teck contains commitments that are intended to mitigate the effects of the project on Fort Chipewyan Métis' current use of land and resources for traditional purposes; socioeconomic conditions, physical and cultural heritage, and asserted rights. The panel notes that the agreement will establish a cooperative implementation committee through which implementation of the agreement will be executed.

[3711] The panel supports the establishment of such processes to manage mitigation measures and adapt to circumstances that may not be anticipated at this time. It expects the parties to comply with the various commitments that they have made in this agreement.

[3712] Teck made commitments intended to mitigate issues and concerns identified by indigenous groups in the region. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12), and a consolidated version of these is in [Appendix 11](#). The panel has required a number of these proposed measures as conditions of the project approval. A number of these measures are outside the authority of the panel. However, the panel finds that many of these mitigations are reasonable given the context of the region, the issues and concerns raised by Fort Chipewyan Métis, and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of valued environmental components, which will serve to also reduce effects on indigenous use of lands. In conjunction with a number of adaptive management plans that Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Fort Chipewyan Métis.

[3713] Fort Chipewyan Métis removed their objections and expressed support for the Frontier project following the submission of the participation agreement. Because the full details of this agreement remain private, the panel must assume that the measures agreed upon would meet their respective needs and interests with respect to the Frontier project. The panel finds the mitigation measures that are known within these agreements will be essential to reducing the effect of the project on Fort Chipewyan Métis' current use of lands and resources, physical and cultural heritage, and asserted rights.

Conditions and Recommendations

[3714] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by on Fort Chipewyan Métis.

[3715] The panel requires that Teck finalize a traditional land-use mitigation, monitoring and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of

construction of the project.¹⁶⁴ The plan will be required as a condition of an *EPEA* approval for the project

Determination of Significance

[3716] The panel determined the significance of project effects to current use of lands and resources, and physical and cultural heritage based on the approach discussed in the Agency's guide *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[3717] The panel also assessed the potential for the Frontier project to impact the rights asserted by Fort Chipewyan Métis in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Significance Determination for Project Effects

[3718] Fort Chipewyan Métis did not participate in the oral portion of the hearing; it and its experts were unavailable for questions and cross-examination, so their evidence could not be tested by either Teck or the AER. Teck did not contest Fort Chipewyan Métis' evidence in any of its written submissions. Teck's own conclusions regarding significance or consequence of effects of the project on Fort Chipewyan Métis traditional land-use key indicators largely aligned with Fort Chipewyan Métis' assessment. As a result, the panel assigns a moderate measure of weight to Fort Chipewyan Métis submissions and evidence even in the absence of the opportunity to test it through the oral hearing process.

[3719] Fort Chipewyan Métis members continue to live and practice rights within and around the project area, the local study area, regional study area, the Peace-Athabasca Delta, and Wood Buffalo National Park. The dramatic increase in industrial activities has created a number of challenges to Fort Chipewyan Métis members who continue to hunt, fish, trap, gather plants, and conduct cultural and spiritual activities on these lands. In their assessment of effects of the project, they determined that effects of the project are negative, that the duration would be long term or permanent, that geographical extent of effects would be local or regional and the magnitude of effects would be high. Fort Chipewyan Métis stated that without the ability for fulsome mitigation and accommodation measures, the results of its assessment of the project on its asserted rights are considered significant.

[3720] Fort Chipewyan Métis stated that the Frontier project effects identified will be negative, regional, long term, irreversible and of high magnitude.

¹⁶⁴ Draft *EPEA* Approval – Condition 3.1.7

[3721] According to Teck's incremental effects assessment of significance to Fort Chipewyan Métis traditional land-use key indicators for the Frontier project before reclamation, the effects would be as follows:

- regional, long term, continuous, irreversible, and moderate to high magnitude to harvesting bison
- high to trapping fur-bearers
- low to fishing
- low to harvesting important vegetation
- moderate to high to opportunities to use culturally important sites and areas

[3722] Teck stated that while land may be reclaimed after the Frontier project closure, knowledge of, familiarity with, or preferred use of that portion of the landscape may be lost due to the interruption in the continued use of that area. Therefore, Teck stated that while aboriginal land users may return to that portion of the landscape after reclamation, the relationship with the area may be permanently altered. As a result, Teck determined that for the purposes of the traditional land-use assessment, any potential effect that is long-term in duration would be considered irreversible.

Panel Determination

Current Use of Land and Resources for Traditional Purposes

[3723] The magnitude of project effects would be high. The project effects and direct loss of lands in the project disturbance area and effects on the local study area and regional study area represent an important area for Fort Chipewyan Métis. The effects are especially significant to those individuals and families who have traditionally used this area.

[3724] The geographic extent of project effects would be regional. The effects to Fort Chipewyan Métis ability to access and hunt wildlife species of importance and to participate in culturally important activities are expected to be effected directly by removal of the project development area and within the local study area and regional study area.

[3725] The duration of project effects would be long term. They will extend beyond the end of project operations and reclamation and closure activities (2081). Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape that supports traditional land-use activities.

[3726] The frequency of project effects would be continuous.

[3727] The project effects would be irreversible. Uncertainty exists regarding the timing and success of reclamation and closure activities and the extent to which future landscapes will be able to support

vegetation, wildlife, and waterfowl populations which their members harvest. Further, it is uncertain whether indigenous groups would reestablish traditional use activities on reclaimed lands following a multigenerational absence and therefore a loss of cultural connection to those lands.

Health and Socioeconomic Conditions

[3728] As determined in section 29, “Public (Human) Health,” the panel finds that the human health effects from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Fort Chipewyan Métis members.

[3729] As determined in section 30, “Social Effects,” the panel finds that the socioeconomic effects from the project are expected to be low in magnitude. The panel believes that this finding applies for Fort Chipewyan Métis members.

[3730] The panel finds that effects would be continuous and regional in extent, but the effects would be medium term in duration and reversible because they would decrease at the end of operations.

[3731] As a result, the panel finds that the project effects to the health and socioeconomic conditions would be adverse but not significant.

Physical and Cultural Heritage and Any Structure, Site, or Thing That Is of Historical, Archaeological, Paleontological, or Architectural Significance

[3732] The magnitude of project effects would be high. The project would affect culturally important areas, cabins, wildlife species, and the ability to access them. It includes adverse effects on the ability to transfer knowledge to younger members of Fort Chipewyan Métis.

[3733] The project effects would be regional. The effects on Fort Chipewyan Métis’ ability to continue to participate in culturally important activities are expected to occur within the local study area and regional study area.

[3734] The duration of project effects would be long term. The project effects would extend beyond the end of project operations and reclamation and closure activities.

[3735] The frequency of effects would be continuous.

[3736] The project would be irreversible given the likely loss of connection to traditional activities and the cultural values that take place on lands directly affected by the project.

Summary

[3737] The panel finds that the effects of the project on Fort Chipewyan Métis’ current use of lands and resources for traditional purposes and physical and cultural heritage would be adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

Significance Determination for Cumulative Effects

[3738] Fort Chipewyan Métis provided extensive written evidence demonstrating how the effects of industrial development had adversely affected their ability to hunt, trap, fish, gather plants, and use culturally important areas within and near the project area.

[3739] Teck predicted that there would be high-magnitude cumulative effects from the project, in combination with other activities, on the Ronald Lake bison herd, moose, woodland caribou, fisher, Canada lynx, muskrat, and waterfowl in the traditional use regional study area. Teck acknowledged that, compared to predevelopment conditions, Fort Chipewyan Métis is currently experiencing substantial changes to their ability to undertake traditional land-use activities. Teck assessed the cumulative effects on Fort Chipewyan Métis' opportunity to continue practicing traditional land-use activities in the traditional land-use regional study area to be high.

Panel Determination

Current use of Land and Resources for Traditional Purposes

[3740] The magnitude of cumulative effects would be high. Much of the area that Fort Chipewyan Métis considers homelands have been adversely affected by oil sands mining and development. Some of the most harmful cumulative effects are occurring in the Peace-Athabasca Delta and Wood Buffalo National Park, where changing hydrological conditions appear to have resulted in the drying of some areas. This drying and resulting lower water levels prevent their members from accessing heritage sites and areas important for trapping, hunting, fishing, gathering, and conducting cultural practices.

[3741] The geographic extent of cumulative effects would be provincial because cumulative effects are occurring over much of the traditional lands used by Fort Chipewyan Métis members. The hydrological changes and effects to water quality extend beyond the project regional study area and into the Peace-Athabasca Delta and Wood Buffalo National Park. Changes in water levels have affected habitat for species of importance for hunting and trapping. Low water levels create a major barrier to their members' ability to access lands that are crucial to practicing traditional activities and the transmission of cultural knowledge.

[3742] The duration of cumulative effects would be long term. The duration of cumulative effects will extend beyond the cessations of industrial activities in the region. Cumulative effects are likely to be experienced for an extremely long time similar to the effects that are being felt as a result of the hydroelectric dams on the Peace River.

[3743] The frequency of cumulative effects would be continuous.

[3744] The cumulative effects would be irreversible. Without changes in regulation of water flows on the Peace River, restrictions in access due to drying conditions in the Peace-Athabasca Delta and Wood

Buffalo National Park will continue to affect the ability of Fort Chipewyan Métis harvesters to transfer cultural values and knowledge from one generation to the next.

[3745] The ability of Fort Chipewyan Métis to practice certain rights has already been impacted to a significant degree, especially in the Peace-Athabasca Delta and Wood Buffalo National Park where hydrological conditions resulting in drying of the landscapes has occurred primarily from regulation of water in the Peace River and the effects of climate change. Industrial water withdrawals from the Athabasca River have played a less important role in this drying of the landscape. The effects of the project on hydrological conditions on the Peace-Athabasca Delta and Wood Buffalo National Park were determined to be negligible. However, for Fort Chipewyan Métis harvesters, further impacts, regardless of how small, are considered significant.

Health and Socioeconomic Conditions

[3746] As determined in section 29, “[Public \(Human\) Health](#),” the panel finds that the cumulative effects to human health from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Fort Chipewyan Métis members.

[3747] As determined section 30, “[Social Effects](#),” the panel finds that the cumulative socioeconomic effects are expected to be low in magnitude. The panel believes that this finding applies for Fort Chipewyan Métis members.

[3748] The panel finds that cumulative effects would be continuous and regional in extent but would be medium term in duration and reversible because they would decrease at the end of operations. As a result, the panel finds that the cumulative effects to the health and socioeconomic conditions would be adverse but not significant.

Summary

[3749] The panel finds that the cumulative effects to Fort Chipewyan Métis’ current use of lands and resources for traditional purposes and physical and cultural heritage are adverse, significant, and likely to occur even in consideration of the mitigation measures conditioned by the panel.

Significance Determination for Asserted Rights

[3750] The panel assessed potential effects of the Frontier project on Fort Chipewyan Métis’ asserted rights in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*.

[3751] The panel finds that the residual effects to current use of land and resources, physical and cultural heritage, and effects to Fort Chipewyan Métis’ asserted rights would not be fully mitigated by the known measures within the agreement between Fort Chipewyan Métis and Teck. In consideration of the scale of the project and the evidence presented by the parties, the panel finds that the residual project effects on

Fort Chipewyan Métis' ability to exercise rights will be adverse and significant and likely to occur. These effects on rights will be most prominent for those Fort Chipewyan Métis members that access lands within the project development area and the local study area.

[3752] The project in combination with current effects of industrial development will further exacerbate cumulative effects on Fort Chipewyan Métis' ability to exercise asserted rights. The panel finds that cumulative effects on these asserted rights will be adverse, significant and likely to occur.

Table 45. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	regional	long	continuous	irreversible	significant
Cultural and physical heritage	high	regional	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	regional	long	continuous	irreversible	significant

Table 46. Summary – Significance determination for cumulative effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	provincial	long	continuous	irreversible	significant
Cultural and physical heritage	high	provincial	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	provincial	long	continuous	irreversible	significant

Fort McKay First Nation and Métis

Background

[3753] The community of Fort McKay includes Cree, Dené, and Métis peoples and is situated on the Athabasca River in the Regional Municipality of Wood Buffalo, approximately 65 kilometres north of Fort McMurray. The main community of Fort McKay has a population of 521 people. The Fort McKay community is the closest community to the Frontier project.

[3754] In addition to the main community, on Indian reserve #174, the Fort McKay First Nation holds several other seasonally occupied reserves totalling over 14 886 hectares.

[3755] The Fort McKay Métis community is led by a president and board of directors. They have a membership of approximately 80 people with about half living in Fort McKay. The Métis also hold a long-term lease to 800 acres of land in Fort McKay.

[3756] Fort McKay First Nation and Fort McKay Métis Community (collectively referred to as Fort McKay) submitted a large number of joint submissions, including their traditional land-use study. Given that the Fort McKay First Nation and Fort McKay Métis have a history of working together on the review of the Frontier project, the fact that there is significant overlap between the rights each group has asserted, and the similarities in the ways that each group uses the land and resources, for the purposes of this assessment, the panel has chosen to include both groups in this section. Where “Fort McKay” is referred to, it means submissions presented collectively by Fort McKay First Nation and Fort McKay Métis. Otherwise, submissions are referenced individually to the specific group.

[3757] Fort McKay First Nation and Fort McKay Métis made the following key joint submissions to the panel:

- November 24, 2011: Traditional Land-Use study
- September 8, 2014: A community approach for landscape planning

[3758] Fort McKay First Nation provided individual submissions:

- October 26, 2016: Cultural Impact Study
- December 21, 2016: Notice of entering into a long-term sustainability agreement
- August 31, 2018: Hearing submission

[3759] Fort McKay First Nation entered into a long-term sustainability agreement with Teck for the Frontier project. Fort McKay First Nation submitted a letter of non-objection and stated that they did not object to the Frontier’s applications on the basis that Teck has adequately addressed their project-specific

concerns. However, Fort McKay First Nation stated that they would participate in the hearings to raise regional issues, including cumulative effects.

[3760] The Fort McKay First Nation provided direct evidence to the panel during the oral hearing on October 1, 2018.

[3761] Fort McKay Métis provided individual submissions:

- March 4, 2016: Cultural Impact Assessment
- December 13, 2016: Notice of entering into a long-term sustainability agreement

[3762] Fort McKay Métis entered into a long-term sustainability agreement with Teck for the Frontier project and withdrew their statement of concern, advising that they no longer objected to the granting of approvals for the Frontier project. Fort McKay Métis stated that the long-term sustainability agreement includes ongoing mitigation, monitoring, and management of the effects of the Frontier project on the environment and impacts to rights, identification of contracting and employment opportunities, and provision of direct financial benefits. Fort McKay Métis expressed their support for the Frontier project and stated that it will result in positive effects. Fort McKay Métis did not participate in the oral portion of the hearing.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[3763] The ACO did not submit a report regarding consultation adequacy and whether actions may be required to address potential adverse impacts to the existing rights of the Fort McKay Métis.

[3764] The ACO stated that Fort McKay First Nation's concerns were either not site-specific, or the ones that were suggestive of site-specific concerns were not spatially specific enough. The ACO stated that, in any event, it appears that Fort McKay First Nation's concerns have been heard, considered, and addressed by the project proponent as the Fort McKay First Nation stated that they do not object to the project.

Asserted or Established Aboriginal and Treaty Rights

[3765] Fort McKay asserted the following rights:

- hunting
- fishing
- trapping
- plant harvesting
- commercial harvest for registered fur management area holders
- pursuit of way of life

- livelihood from traditional lands
- sufficient lands and access to them of a quality and nature sufficient to support meaningful experience
- site-specific cultural features and cultural practices

[3766] Fort McKay First Nation asserted that they have the meaningful right to hunt, trap, and harvest natural resources within their traditional territory for food, social, spiritual, and cultural purposes. They assert the right to the continuity and non-interference of their way of life, to teach their traditions to younger generations, and to the use, enjoyment, and control of lands reserved for them including reserve lands. They asserted the right to self-govern and participate in the co-management of their traditional territory.

[3767] The Fort McKay Métis asserted that they have unextinguished aboriginal rights to hunt, fish, trap, and gather, as well as exercise activities necessarily incidental to these activities. They asserted the right to the use and enjoyment of the lands they occupy in the community free from noxious odours, pollution, noise, and other nuisances.

[3768] The panel's terms of reference require it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights to the extent the panel receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by Fort McKay First Nation or Fort McKay Métis, or the strength of such claims. However, for the purposes of assessing the potential effects of the Frontier project on aboriginal and treaty rights, the panel accepts the rights as asserted.

Context of Historical and Current Cumulative Effects

[3769] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities, or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Canadian Environmental Assessment Agency (the Agency), effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished. The evidence heard by the panel about land use and resources for traditional purposes and practice of asserted rights is summarized below.

Use of Lands and Resources for Traditional Purposes

[3770] Fort McKay views its traditional lands west and north of Fort McKay, encompassing the Birch Hills, Namur, and Gardiner Lakes areas, as the last bastion of pristine cultural lands. The project is within the 160 km Métis harvesting policy radius and within the *Moose Lake Access Management Plan* area.

[3771] Fort McKay stated that lands within and surrounding the Frontier project have been used by people from Fort McKay to practice their aboriginal way of life since time immemorial and are within Fort McKay's traditional territory.

[3772] The community of Fort McKay is the closest community to the project. Fort McKay First Nation and Fort McKay Métis members living in the community have experienced effects from oil sands development in the region since the 1960s, when development initially began. They view that industrial development is limiting their ability to carry out cultural activities within their traditional territory and that this is significantly affecting their collective and individual identity. Fort McKay added that community stressors coupled with a perception of high risk and low trust levels are having a considerable negative effect upon the well-being of community members. They said that their fragile community is in danger of losing its cultural identity.

[3773] Fort McKay stated that the local study area is relatively unaffected by industrial activity and is important wildlife habitat—especially considering how much of Fort McKay's traditional territory has been lost to date. Members refer to this area as their “food bank.”

Hunting, Trapping, Fishing, and Gathering

[3774] Fort McKay stated that they practice several traditional activities within and near the Frontier project local study area and along the Athabasca river from Fort McMurray to Fort McKay, including hunting, fishing, drying meat, gathering eggs, harvesting wood, picking berries, and gathering medicinal plants.

[3775] Fort McKay stated that their members hunt for moose, caribou, bison, deer, grouse, ptarmigan, and waterfowl. The species the most frequently consumed are moose, ruffed grouse, spruce grouse, and mallards. They also trap bear, beaver, lynx, fisher, marten, wolf, muskrat, wolverine, weasel, otter, squirrel, fox, mink, porcupine, and rabbit.

[3776] Wildlife and plants present within the local study area, such as moose, bison, beaver, rat root, bog cranberry, low-bush cranberry, and blueberries, are of particular cultural importance.

[3777] Fort McKay First Nation stated that tenured leases for oil sands mines occupy 80 per cent of its territory. The combined loss of traplines, effects to wildlife, access restrictions, presence of non-aboriginal people, and pollution has led to a lack of quality harvesting areas and decreased harvesting success.

[3778] The Athabasca River and its tributaries (such as the Firebag River) were a primary fishing area before industry. Today, pollution of surface waters is a major deterrent to fishing in those areas. Many waterways, including aquatic ecosystems, have been directly affected by oil sands development; fishing

camps have been destroyed and members have fewer places they can fish. Fort McKay Métis are concerned that regionally, fisheries are of poor quality and are on the verge of collapse.

[3779] Fort McKay stated that there has been a significant loss of plant collection areas and they are often disappointed to find sites destroyed by development.

[3780] Where habitat appears to be intact, the dust, noise, odours, sight, and other effects associated with nearby industry drives away animals and affects vegetation, thus reducing the suitability of an area for harvesting.

Wildlife

[3781] Fort McKay stated that wildlife abundance indicators for fisher, caribou, moose, and black bear are already below or at the lower limit of their natural range of variation. They have observed deterioration in the condition of animal and plant species, including declines in wildlife health. They said that they have observed the moose population declining.

[3782] Fort McKay First Nation raised concerns that climate change is exacerbating the cumulative effects on wildlife. For example, they feel that with decreased snow pack, more moose are hunted by wolves, warmer winters have led to more ticks, and reduced precipitation has resulted in poor berry growing conditions, resulting in less available food for wildlife.

Access and Trails

[3783] Fort McKay explained that industrial disturbance and access for new land users has resulted in the loss or loss of access to, much of its intensely used traditional lands in reasonable proximity to its community, significantly affecting members' ability to exercise their treaty and aboriginal rights, livelihood, culture and traditional economy.

[3784] Industrial activity has made access easier for non-aboriginal users to access previously remote or largely inaccessible areas. They stated that public access often degrades the condition of sites due to overuse and inappropriate use, which reduces their appeal for members. They also said that the increase in number of roads has resulted in members getting confused when accessing trails.

Health and Socioeconomic Conditions

Health

[3785] Fort McKay raised the following current health concerns:

- Lifestyle choices in a boom wage economy significantly affect health and well-being of community members, including substance use and abuse, poor diet, mental illness, depression and suicide.

- The Fort McKay First Nation feel that they have lost control over aspects of their lives, including their self-sufficiency, food security, and health, which has led to increased anxiety, worry, and hopelessness about their health and the future as result of cumulative impacts of industrial development.
- Fort McKay members believe that many long-standing health and community well-being problems are associated with industrial development. They stated that there are serious concerns about the exposure of the community to air contaminants and odours and resulting effects to human health, including cancer and asthma. Members are concerned about the increased rate of occurrence of rare cancers.
- Pollution has caused overall concern about the safety of the air they breathe, the water they drink, and the food they consume, including the quality of wild meat. It has also changed the way community members interact with the land.
- Their members are reluctant to drink water while conducting traditional activities because of concerns that the water is contaminated.
- Fort McKay stated that there is real fear in the community and among elders in particular about human health and contaminated wildlife; the stress associated with concerns about pollution negatively affects members' health.

[3786] Fort McKay First Nation added the following:

- They already have concerns about the small number of places left where they believe moose and plants are safe to consume; one of which is near the Frontier project.
- Air quality data from an air monitoring station at its Moose Lake reserve showed that air emissions are affecting the air quality in this area.
- Dust is affecting its use and enjoyment of its traditional territory and reserve lands.

Socioeconomic

[3787] Fort McKay stated that the loss of land near their community has led them to having no choice but to shift from a mixed economy (traditional activities and wage work) to a predominantly wage-based economy. It has also reduced opportunities for commercial trapping and therefore resulted in a loss of revenue to Fort McKay members.

[3788] They stated that oil sands projects have brought in more cash, land use changes that have affected well-being, reduced time in the bush, and there has been little time and few support programs to adjust. These effects have brought about negative lifestyle choices, including substance use and abuse, addictive behaviours such as gambling, abusive relationships, and sedentary lifestyles. They stated that alcohol, drugs, and addiction issues are often related to a sense of powerlessness.

[3789] There is a sense of segregation and racism experienced when in Fort McMurray, especially when accessing services. They said that increased population leads to higher number of strangers in Fort McKay, which contributes to an atmosphere of fear among residents.

[3790] Fort McKay First Nation stated that they have experienced a decline in the existence of, access to, and condition of physical cultural sites and cultural landscapes due to industry. These declines resulted in reduced land-use opportunities as well as a members feeling a growing sense of loss and disconnection from their history, culture, spirituality, and family, as well as decreased knowledge transfer to younger generations.

[3791] Fort McKay stated that industrial development has had serious and negative impacts on traditional knowledge, and this has limited the transfer of knowledge to younger generations. Youth have reduced opportunities to conduct traditional activities and learn about the land, spend time together, tell stories, and generate and transfer traditional knowledge.

[3792] Fort McKay Métis stated that due to the loss of land, loss of traplines, and access restrictions, fewer of their members practice traditional activities or practice them less frequently. Also, that fewer community members have the skills to survive and provide for themselves in the bush.

Physical and Cultural Heritage

[3793] The panel is required to take into account the physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[3794] Fort McKay identified cabins, gathering places, trails, six sites that include burial sites, a historic site, and a site of importance to a traditional story within or near the Frontier local study area.

[3795] Fort McKay stated that their culture is already under stress due to industrial development, the taking up of lands, access restrictions, the influx of non-aboriginal peoples, and the rapid and significant shifts in environmental, social, and economic conditions that have occurred since the 1960s.

[3796] Fort McKay Métis stated that the most significant effect on their culture has come from the immense use of land and water for oil sands development, with the associated air and water pollution, influx of non-aboriginal people into the region, and changes in access to clean, healthy land since the 1960s.

[3797] The sights, sounds, and smells of oil sands mining permeate the community of Fort McKay and significantly affect their enjoyment and quality of life.

Analysis and Findings

[3798] Teck did not contest information provided by Fort McKay. The panel finds it is able to rely on the evidence presented by Fort McKay and summarized above.

[3799] The panel finds from the evidence that:

- Fort McKay First Nation and Fort McKay Métis demonstrated they use lands within the project disturbance area for hunting, harvesting, and cultural practices. The local study area contains important moose and buffalo hunting areas and is valued by Fort McKay for gathering plants, berries, and medicinal plants such as blueberries, cranberries, and rat root.
- The local study area contains historic traplines and valued trapping areas. The local and regional study areas also contain trails, cabins, and cultural sites such as gathering places and burial sites.

Project and Cumulative Effects

Effects on Use of Lands and Resources for Traditional Purposes

[3800] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights. It must also assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources and practice of asserted rights.

[3801] Evidence dealing specifically with the effects of the Frontier project is summarized below.

Fort McKay View

Resources

[3802] Fort McKay expressed concern that the Frontier project effects on wildlife may include changes in the composition of wildlife species, the loss of habitat, and changes in wildlife movement, resulting in reduced harvesting success and members having to go elsewhere to practice harvesting activities. They expressed particular concern about potential effects to species that are of key cultural importance or are known to be diminishing within traditional lands including moose, caribou, bison, and fur-bearers.

[3803] They said the Frontier project would cause a further decline in the moose populations and loss of beaver habitat.

[3804] They also raised concerns that seepage from the Frontier project's tailings ponds, deposition and drainage of contaminants, dust in water and snow, and the use of wetlands and lakes as polishing ponds would exacerbate pollution concerns and affect wildlife.

Vegetation/gathering

[3805] Fort McKay stated that the Frontier project is likely to affect plant abundance and biodiversity, partially due to the establishment of non-native invasive species, resulting in effects to ecological integrity.

Fishing

[3806] Fort McKay First Nation stated that the Athabasca River bridge would affect the aquatic environment and their harvesting activities (CIA p. 6). They are concerned that the Frontier project in combination with the proposed Pierre River mine will cause the loss of aboriginal fisheries.

Hunting and Trapping

[3807] Fort McKay stated that even though no Fort McKay registered fur management areas are directly affected by the Frontier project, the local study area contains historic traplines and highly valued trapping areas. The Frontier project is located near Fort McKay registered fur management areas 850, 1661, 879, 94, and 2457, and registered fur management areas 1661, 879, and 94 are particularly important traditional land-use areas.

Access

[3808] Fort McKay stated that the Athabasca River bridge and the east side access road would add to the existing cumulative effects of site access by non-aboriginal users.

[3809] The Frontier project would result in access restrictions that would affect travel and access to areas, including due to security protocols like waiting for an escort (TLU, p. 53, 60, 61 and 150). This would result in longer travel times to a reduced number of areas. Not all their members are able to travel long distances, so changes in access would reduce the number of people able to pursue traditional activities (CIA p. 76).

[3810] By losing access, they also lose high-quality natural resources, inexpensive food, culture, language, stories, history, and traditional skills and knowledge.

Water Quantity

[3811] Fort McKay stated that the Frontier project's elimination of watercourses and water bodies, tributary removals, diversions, withdrawals, closed-circuiting, and process-water seepage could cause losses of water.

[3812] They are concerned about the cumulative effects of the Frontier project on water quantity, including decreasing muskegs, lower creek water levels, increased drying of the land, and lower quantity of water in rivers and lakes for fish populations.

[3813] Fort McKay Métis stated that the Frontier project, including the Athabasca River bridge and water withdrawals, could further affect low flows and navigability of the Athabasca River, further discouraging people from using it for transport in the summer months. The decreased navigability affects access to traditional sites and the ability to visit friends and family in Fort Chipewyan and Poplar Point.

Water Quality

[3814] The Fort McKay Métis raised concerns that the project could cause accidents, such as tailing pond breaches and pipeline breaches, and oil could affect local waterways.

Reclamation and Closure

[3815] Fort McKay is concerned with the rapid reclamation and restoration of ecological integrity within the project disturbance area. They are skeptical of the potential success of oil sands reclamation and whether reclaimed land would be able to support wildlife species and the exercise of rights.

[3816] They have been disappointed with reclamation efforts in the region to date and feel that the land will never be restored to the way it was. While recently reclaimed sites might be on a trajectory towards recovering biological diversity and function at the time that the reclamation certification is granted, the sites will likely not be suitable for a predisturbance range of traditional activities. Due to the lack of demonstrated reclamation of peat-based ecosystems, disturbance to deep peat areas is a significant, permanent net loss to the traditional land-use capability of the project disturbance area.

[3817] They stated that the Frontier project development will have a significant and long-standing negative effect on the presence of traditional-use plants and biodiversity in the project disturbance area.

[3818] Fort McKay stated that the Frontier project effects cannot be completely mitigated by Teck, and residual effects will add to significant cumulative regional effects of development. The absence of any effort by government or industry to address the cumulative effects of each additional project, and in this case another mine, on the land ignores their rights and interests as residents.

[3819] They are concerned that pit lakes will cause negative changes to the traditional use of the landscape and will not become healthy viable aquatic ecosystems.

Teck's View

Wildlife

[3820] Teck stated that the Frontier project will affect important Fort McKay land-use areas, predicting that the project would result in high-magnitude effects to moose, caribou, black bear, and waterfowl before reclamation.

[3821] It predicted that the incremental effect of the project on Fort McKay opportunities to hunt traditionally important wildlife species would be regional in geographic extent, long term, continuous, irreversible, and of low to moderate magnitude.

Fur-bearers/trapping

[3822] Teck stated that none of the Fort McKay owned registered fur management areas overlap the terrestrial local study area.

- Registered fur management area 850 is located to the west of the Frontier project. Teck stated that there is the potential for the Frontier project to produce noise that could be heard from this trapline and interrupt trails that may be used for access.
- Registered fur management area 1661, held by Fort McKay, is located directly east of the project disturbance area on the eastern side of the Athabasca River and that access to it would be relatively unaffected and it would continue to be accessible from points along the Athabasca River.

[3823] Teck predicted that the incremental effect of the project on Fort McKay opportunities to trap fur-bearers would be regional in geographic extent, long term, continuous, irreversible, and of low magnitude.

Fish

[3824] According to Teck, construction of the Frontier project, including the Athabasca River bridge, would result in the loss or alteration of productive fish habitat. Additional changes in habitat and fish availability may occur at the planned development case due to Pierre River project.

[3825] Teck predicted that the incremental effect of the project on Fort McKay opportunities to fish for traditionally important species would be regional in geographic extent, long term, continuous, irreversible, and of low magnitude.

Vegetation/gathering

[3826] Teck stated that Fort McKay traditional plant harvesting areas that overlap the local study area are expected to be lost; however, outside the traditional land-use regional study area, plant harvesting areas are located immediately north of the regional study area near Poplar Point and in the region of the Namur and Gardiner Lakes.

[3827] The availability of plants would be decreased while the project is in operation but will be reestablished at closure. At the planned development case, disturbance to the Fort McKay plant harvesting area would increase.

[3828] Teck predicted that the incremental effect of the project on Fort McKay opportunities to harvest traditionally important vegetation would be regional in geographic extent, long term, continuous, irreversible, and of low magnitude.

Access

[3829] Teck stated that the Frontier project would disturb trails within the project disturbance area, trails that parallel the Athabasca River on the west shore, trails that connect areas within the project disturbance area to areas both north and south, and trails that connect the Athabasca River to areas east of the terrestrial local study area. Alternative access routes to these areas would remain from areas both south and north of the Frontier project, but alternative access strategies or implementation of access controls on existing access routes could result in additional travel time or costs for Fort McKay. Additional trails would be affected in the planned development case, including trails connecting the Athabasca River to the Birch Mountains.

[3830] Teck stated that access to some areas by industry access roads may result in increased use of areas by non-aboriginal harvesters and a corresponding increase in competition for traditionally important land areas or resources. Teck stated that construction and operation of the bridge and east side access road are expected to have an incremental effect on the use of culturally important sites and resources due to an increase in non-aboriginal presence.

[3831] The Athabasca River bridge would be constructed to leave enough space between the bridge piers for navigation of the Athabasca River, and Teck stated that the bridge is not expected to affect navigation.

[3832] Teck acknowledged that some communities have expressed concerns regarding the *Surface Water Quality Management Framework*; however, it argued that the panel is nevertheless required to act in accordance with *LARP* as it exists today and that the Frontier project complies with *LARP*. Teck predicted that neither the Frontier project, nor the project in conjunction with other oil sands developments, would affect navigation on the Athabasca River.

Reclamation and Closure

[3833] Teck stated that while land may be reclaimed after the Frontier project closure, knowledge of, familiarity with, or preferred use of that portion of the landscape may be lost due to the interruption in the continued use of that area. Therefore, while aboriginal land users may return to that portion of the landscape after reclamation, the relationship with the area may be permanently altered. As a result, for the purposes of the traditional land-use assessment, any potential effect that is long term in duration would be considered irreversible.

Effects on Health and Socioeconomic Conditions

Fort McKay View

Health

[3834] Fort McKay raised the following health concerns about the Frontier project:

- Cumulative effects on water, air, and soil quality will affect the quality of country foods and reduce community health.
- Emissions from the project will reduce confidence in water quality and wild foods.
- Increased emissions could affect fish, migratory birds, and other wildlife, which could in turn affect the health of Fort McKay members who consume wildlife.
- Their families are not confident in their current or future water supply and believe the Frontier project will make this situation worse.
- The project's contribution to odours.
- The project will increase stress due to socioeconomic and environmental changes brought on by oil sands development.

Socioeconomic

[3835] Fort McKay Métis stated that the demand for workers if the Frontier project were to proceed would result in a rapid increase in the number of people moving to the region. They added that increased regional population has resulted in increased demand on health and social services in Fort McMurray, including education services that youth in Fort McKay depend on.

[3836] Fort McKay are concerned that Frontier, like other projects in the region, will hire already-qualified aboriginal people when the bigger challenge is supporting community members to become qualified.

Teck's View

[3837] Teck's human health risk assessment examined health risks associated with multiple routes of exposure, including those related to water, fish, wild game, plants, berries, and soil. It predicted that the Frontier project would not significantly affect health risks in the region. Teck stated that the elevated health risks are predominantly because of existing conditions and approved projects, with the Frontier project having a negligible to low effect on those risks.

[3838] Teck presented evidence that project emissions, in combination with other sources of COPCs, are not expected to result in a detectable increase in health risks or to have adverse effects on wildlife populations in the Athabasca Oil Sands Area. With few exceptions, the risk estimates are currently, and will continue to be, below health-based guidelines.

Effects on Physical and Cultural Heritage

[3839] The panel is required to take into account the effects on physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Fort McKay View

Disturbance

[3840] Fort McKay stated that the Frontier project would contribute to visual effects like light pollution and regional haze and that project components would be visible from various places, including in registered fur management area 850.

Cultural Sites

[3841] Fort McKay stated that the loss of cabins, gathering places, water collection sites, burial sites, and 850 km of trails due to the Frontier project would affect culture. The Frontier project would remove cultural landscapes and culturally significant sites that represent an accumulation of place-specific traditional knowledge.

[3842] They are concerned about the number of high-value archaeological sites that would be affected by the Frontier project. Fort McKay First Nation stated that cultural landscapes are core cultural components. They carry a particularly strong sense of place, home, and belonging and are important to facilitate the transfer of knowledge and cultural values through generations. They are unique and cannot be replaced by other locations. Fort McKay First Nation stated that disturbing burial grounds is disrespectful and has serious cultural implications.

Knowledge Transfer

[3843] Fort McKay stated that effects that last longer than one generation (20 years) irreparably changes cultural knowledge transmission and the connection to the land, and this effect is permanent and irreversible.

[3844] The magnitude of the effects of the Frontier project is high, due to lack of alternative nearby locations, current stress on land uses, and the importance of the land uses that are found in the local study area. Fort McKay stated that the Frontier project's effects are significant because they are clearly distinguishable and are likely to result in strong concern in the community and substantial changes in the overall use of lands or resources. Fort McKay stated that the Frontier project would have an irreversible effect because the traditional sites in the local study area will be destroyed and never reestablished. They stated that the Frontier project would result in significant, unacceptable change to cultural practice, cultural landscapes, well-being, and cultural values.

[3845] Fort McKay Métis stated that the Frontier project would result in a highly significant effect on the links between

- trapping and self-determination and leadership, faith, understanding nature, and respect;
- hunting and identity, self-reliance, self-determination and leadership, cooperation, caring, cohesion, faith, pride, happiness, adaptability, understanding nature and respect;
- fishing and water use and identity, self-reliance, self-determination and leadership, caring, cohesion, faith, pride, happiness, adaptability and understanding nature;
- plant gathering and identity, self-determination and leadership, caring, cohesion, faith, pride, happiness, adaptability and understanding nature; and
- getting together with friends and family.

Teck's View

Disturbance

[3846] Teck predicted that the continuous sounds of the Frontier project might be perceptible to land users up to 2.3 km southwest of the project disturbance area. Noise may overlap with hunting areas, the edge of registered fur management area 850, and Fort McKay sites around Crooked Lake. Teck stated that noise from the river water intake may be perceptible while travelling on the Athabasca River. Aboriginal land users in areas outside of the project disturbance area may be able to hear intermittent noise from the bird deterrent system. At the planned development case, Fort Hills is expected to increase the range of perceptible noise on the Athabasca River.

[3847] Teck stated that odours from the Frontier project are expected to be perceptible beyond the borders of the terrestrial local study area, particularly to the north and south of the west side of the project. Those odours could affect Fort McKay sites at Crooked Lake but should not affect any registered fur management areas held by Fort McKay members. Odour effects at the planned development case might be experienced continuously on the west side of the Athabasca River from south of Fort McKay through the project disturbance area.

[3848] Teck predicted that Frontier project components taller than 30 m would be visible from several locations including on Fort McKay traplines.

[3849] The Frontier project would be a source of emissions that could lead to regional haze. Teck predicted that visual disturbance would increase due to the construction of additional developments and that, cumulatively, developments would contribute to regional haze and associated visibility impairment.

Sites

[3850] Teck stated that a total of 197 known precontact archaeological sites are on record in the project disturbance area and are expected to be disturbed during clearing, construction, and mining.

[3851] Multiple Fort McKay cabins and gathering places will be disturbed by project development and would no longer be available.

[3852] The road to the river water intake may directly affect a site which Fort McKay identified as “a burial site, a historic site or a site of importance to a traditional story.”

[3853] To date, no confirmed burial locations have been recorded in the project disturbance area, and Teck stated that it will continue to consult with Fort McKay regarding the potential for the project to affect burial sites. Disturbance to culturally important sites will increase at the planned development case.

[3854] Teck predicted that the incremental effect of the project on Fort McKay opportunities to use culturally important sites would be regional in geographic extent, long term, continuous, irreversible, and of moderate to high magnitude for Fort McKay First Nation and of moderate magnitude for Fort McKay Métis.

Analysis and Findings

[3855] Teck did not contest information provided by Fort McKay. The panel finds it is able to rely on the evidence presented by Fort McKay and summarized above.

[3856] The panel finds from the evidence that:

- Fort McKay is the closest community to the proposed Frontier project and is near several other oil sands mining operations.
- The area contains habitat for wildlife species and contains plants that are culturally important to the community.
- Reduced confidence in the quality of foods and water quality impair Fort McKay’s use of resources.
- A loss of traditional trails as a result of the Frontier project would affect Fort McKay’s ability to access hunting, fishing, gathering, and trapping areas. Harvesters will be required to use less-direct routes, resulting in additional travel time and costs.
- Low water levels during certain periods of the year present challenges to the ability of Fort McKay harvesters to travel and access hunting and fishing areas along the Athabasca River.
- Fort McKay are currently experiencing adverse effects of industrial activities on their current use of lands and resources for traditional purposes and physical and cultural heritage.
- The existing cumulative effects on Fort McKay’s current use of lands and resources for traditional purposes and physical and cultural heritage and practice of traditional and cultural activities will be exacerbated by the Frontier project.

Mitigation Measures

[3857] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[3858] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361, (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

[3859] On December 13, 2016, the Fort McKay Métis Community Association advised the AER and CEAA that they had entered into a long-term sustainability agreement with Teck regarding the project. They noted that the agreement included ongoing mitigation, monitoring, and management of project impacts to the environment, their traditional use and rights, identification of contracting and employment opportunities, and direct financial benefits to the Fort McKay Métis Community Association. On the basis of commitments made by Teck to work with Fort McKay Métis Community Association, they expressed support for the project and stated their view that there will be positive effects of the project.

[3860] On December 21, 2016, Fort McKay First Nation advised the AER and CEAA that they had entered into a long term sustainability agreement with Teck regarding the project. They stated that they do not object to the application on the basis that Teck has adequately addressed their project-specific concerns.

Analysis and Findings

[3861] The panel finds that the Frontier project will result in the direct loss of lands relatively close to the community where traditional and cultural activities are practiced. The Frontier project will likely affect Fort McKay's ability to access hunting, fishing, gathering, and trapping areas due to the direct removal of lands and trails. As a result, harvesters will be required to use less-direct routes, resulting in additional travel time and costs. The Frontier project will create barriers to accessing other areas important to Fort McKay. As such, the Frontier project is likely to cause an adverse effect on Fort McKay's ability to access and use lands and resources for traditional purposes. Existing adverse cumulative adverse effects of development on the practice of traditional and cultural activities will be exacerbated by the project. The panel has recommended mitigation that should be included in the Minister's decision statement under *CEAA 2012*.

[3862] In section [23](#), "[Wildlife](#)," the panel has concluded that the Frontier project will result in significant, adverse effects to the Ronald Lake bison herd, increasing the likelihood of disease being transmitted from the diseased animals in Wood Buffalo National Park to the healthy animals in the Ronald Lake herd. This means that the Frontier project will likely adversely affect Fort McKay's traditional use of the Ronald Lake bison.

[3863] While the panel concluded that none of the proposed mitigation measures were likely to be effective in reducing the risk of disease transmission, it did make several recommendations to the governments of Canada and Alberta regarding the Ronald Lake bison (see [Appendix 6](#)).

[3864] In section [23](#), “[Wildlife](#),” the panel concluded that the Frontier project will displace moose as a result of loss of habitat in the local study area. This will reduce harvesting success of indigenous hunters, which will adversely affect Fort McKay’s traditional use of this resource. The panel has made recommendations to the governments of Canada and Alberta with concerning the management of moose.

[3865] In section [23](#), “[Wildlife](#),” the panel reached the conclusion that the Frontier project in combination with other developments are likely to result in significant adverse cumulative effects on caribou.

[3866] Further, the decline in fur-bearer abundance as a result of the project will vary with the species, with effects ranging from high magnitude for lynx and fisher to moderate for black bear, beaver, and muskrat. The panel notes that indigenous concerns are mainly related to the availability of fur-bearers for harvesting and that these concerns are closely linked to water levels in the rivers and the Peace-Athabasca Delta and other access issues.

[3867] In the sections “[Wildlife Health](#)” and “[Vegetation](#),” the panel concluded that air and water quality effects from the Frontier project are not expected to significantly affect wildlife and vegetation health. However, reduced confidence in the quality of foods and water quality may adversely affect Fort McKay’s use of these resources and result in loss of use of preferred harvesting areas, especially downstream of the project.

[3868] In section [29](#), “[Public \(Human\) Health](#),” the panel has determined that the project is not likely to result in adverse effects to the health of indigenous land users in the region. The panel has made recommendations to the governments of Canada and Alberta regarding the protection of human health (see [Appendix 6](#)).

[3869] In section [19](#), “[Surface Water Quantity](#),” the panel found that significant adverse cumulative effects to surface water quantity, flows, and water levels in the Athabasca River, Peace-Athabasca Delta, and Slave River Delta are occurring but are due predominantly to hydropower regulation and regional climate change, with industrial water withdrawals playing a minor role. These changes in surface water quantity appear to be adversely affecting Fort McKay’s ability to access lands and resources for traditional proposes. The panel does not believe that the Frontier project is likely to exacerbate those existing effects. The panel has made recommendations to the governments of Canada and Alberta with regards to surface water quantity and indigenous navigation.

[3870] Fort McKay presented an extensive list of recommendations (see [Appendix 9](#)). Fort McKay First Nation’s recommendations addressed a broad scope of topics, including engaging Fort McKay in

establishing air quality objectives, enhancing environmental impact assessment terms of reference, monitoring initiatives, species at risk, regional wildlife monitoring, conservation offsets, fisheries offset planning, wetlands policy, tailings, end-pit lake reclamation and closure landscape, including aboriginal peoples in land-use planning, etc. It requested that the panel make these recommendations to the governments of Alberta and Canada.

[3871] The panel has identified a number of conditions that it will require of Teck to further mitigate the effects of the project. The panel's conditions for Teck address various areas including air quality, water quality, water quantity, reclamation and closure, various wildlife species, tailings, etc. Many of these required conditions relate specifically to concerns that Fort McKay First Nation and Fort McKay Métis have identified.

Conditions and Recommendations

[3872] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Fort McKay.

Conditions

[3873] The panel requires that Teck finalize a traditional land-use mitigation, monitoring, and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of construction of the project. The plan will be required as a condition of an *EPEA* approval for the project.¹⁶⁵

Recommendations for the Governments of Alberta and Canada

[3874] The panel recommends that the governments of Alberta and Canada review and consider the recommendations made by Fort McKay First Nation and included in [Appendix 9](#). The panel supports ongoing engagement between Fort McKay First Nation, Canada, and Alberta.

Determination of Significance

[3875] The panel determined the significance of project effects to current use of lands and resources, and physical and cultural heritage based on the approach discussed in the Agency's guide *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[3876] The panel also determined the significance of impacts to Fort McKay's aboriginal and treaty rights in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal*

¹⁶⁵ Draft *EPEA* Approval – Condition 3.1.7

and Treaty Rights of the Proposed Frontier Oil Sands Mine Project, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Significance Determination for Project Effects

Parties' Views on Significance

[3877] Fort McKay determined that the project-related effects identified in its traditional land-use study are adverse, regional, permanent, and of high magnitude.

[3878] Teck's assessment showed that from base case to application case, the effects would be adverse and high in magnitude on

- hunting the Ronald Lake bison,
- hunting and trapping other traditionally important species, and
- harvesting traditionally important vegetation.

[3879] Its assessment showed the effects to the ability to harvest traditionally important fish species were adverse and low to moderate in magnitude.

[3880] These effects on hunting and harvesting were considered by Teck to be long term, as they will extend throughout the life of the project (through 2081) and affect multiple generations of Fort McKay land users.

Panel Determination

Current use of Lands and Resources for Traditional Purposes and Physical and Cultural Heritage and any Structure, Site, or Thing That Is of Historical, Archaeological, Paleontological, or Architectural Significance

[3881] The magnitude of project effects would be high. The direct loss of lands prevents Fort McKay members from accessing heritage sites and areas important for trapping, hunting, fishing, gathering, and conducting cultural practices. Fort McKay demonstrated extensive use of the project development area, local study area, and regional study areas for hunting, trapping, gathering, and important cultural activities. The project effects and direct loss of lands in the project development area represent an important portion of the area relatively near the hamlet of Fort McKay, which is being used by Fort McKay members for these purposes. This is especially relevant for those families that have historically used lands within the project disturbance area, which will no longer be available to them.

[3882] The geographic extent of project effects would be regional. The effects on Fort McKay's ability to access and hunt wildlife species of importance and to participate in culturally important activities are expected to occur within the local study area and regional study area.

[3883] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape that will support traditional land-use activities.

[3884] The frequency of project effects would be continuous.

[3885] The project effects would be irreversible. Uncertainty exists regarding the timing and success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife, and waterfowl populations which their members harvest. Further, it is uncertain whether indigenous groups would reestablish traditional use activities on reclaimed lands following a multigenerational absence and therefore a loss of cultural connection to those lands.

Health and Socioeconomic Conditions

[3886] As determined in section 29, “Public (Human) Health,” the panel finds that the human health effects from the project are expected to be low in magnitude. This finding applies to the health of Fort McKay members.

[3887] As determined in section 30, “Social Effects,” the panel finds that the socioeconomic effects from the project are expected to be low in magnitude. This finding applies to the social-economic effects to Fort McKay members.

Summary

[3888] The panel finds that the Frontier project is likely to cause significant adverse effects to Fort McKay’s current use of lands and resources for traditional purposes and physical and cultural heritage. These effects are likely to occur even in consideration of the mitigation measures conditioned by the panel.

Significance Determination for Cumulative Effects

Parties’ Views on Significance

[3889] Fort McKay stated that, due to industrial development in their traditional territory, resources are no longer sufficient, accessible, or sufficiently productive to meet their needs. Fort McKay First Nation stated that impacts of oil sands development to their traditional lands and culture have been significant and have reshaped the landscape. In their view, thresholds of acceptable change are already breached due to existing cumulative impacts from industrial development. They stated that regional cumulative effects on their culture are significant, adverse, and long term.

[3890] Fort McKay First Nation and the Fort McKay Métis jointly provided extensive written evidence that demonstrated current land uses and how the effects of industrial development have adversely affected

their ability to hunt, trap, fish, gather plants, and use culturally important areas within and near the project area. Fort McKay First Nation also presented oral testimony that focused on broader cumulative effects and land-use concerns associated with Alberta policies and programs in the mineable oil sands area. Fort McKay Métis did not participate in the oral portion of the hearing. Fort McKay determined that the magnitude of project and cumulative effects are adverse and significant.

[3891] Fort McKay determined that the post-mitigation residual effects of the project will add to the current significant and adverse cumulative effects of development. Fort McKay considers the cumulative project effects on traditional land-use values and treaty and aboriginal rights to be significant and adverse.

[3892] Teck's assessment determined that, from the base case to both application case and planned development case, the effects on the opportunity to hunt the Ronald Lake bison and hunt and trap other traditionally important species and harvest traditionally important vegetation were adverse and high in magnitude, the effects to harvest traditionally important fish species were adverse and low to moderate in magnitude, and the consequence of the effects of cumulative development on Fort McKay traditional land use in the traditional land-use regional study area is high.

[3893] Teck predicted that there would be high-magnitude cumulative effects from the project, in combination with other activities, on the Ronald Lake bison herd, moose, woodland caribou, fisher, Canada lynx, muskrat, and waterfowl in the traditional use regional study area. Teck acknowledged that, compared to predevelopment conditions, Fort McKay is currently experiencing substantial changes to their ability to undertake traditional land-use activities. Teck determined that the cumulative effects on Fort McKay's ability to continue practicing traditional land-use activities in the traditional land-use regional study area to be high.

Panel Determination

[3894] The panel notes that Teck predicted that prior to reclamation, the cumulative effects of the project, in combination with existing and future effects on Fort McKay's opportunities to use culturally important sites would be regional in geographic extent, long term, continuous, irreversible, and of high magnitude. The panel accepts Teck's determination that the cumulative effects of development would have high consequence for the base case, application case, and the planned development case.

Current use of Lands and Resources for Traditional Purposes and Physical and Cultural Heritage and Any Structure, Site, or Thing That Is of Historical, Archaeological, Paleontological, or Architectural Significance

[3895] The magnitude of cumulative effects would be high. Much of the area that Fort McKay traditionally used is affected by oil sands mining and development. The panel accepts the evidence presented by the Fort McKay community that the cumulative effects are currently high, and that the Frontier project, even with the implementation of mitigation measures and conditions imposed by the panel, will incrementally add to current effects on Fort McKay.

[3896] The geographic extent of cumulative effects on Fort McKay current use of lands and resources for traditional purposes and physical and cultural heritage is provincial because cumulative effects are occurring over much of the traditional lands used by Fort McKay members.

[3897] The duration of cumulative effects would be long term. Cumulative effects will extend beyond the cessations of industrial activities in the region. The extended time frames associated with reclamation and closure and the uncertainties regarding Teck's ability to fully restore landscapes that will support traditional use activities and cultural values result in multigenerational effects to Fort McKay.

[3898] The frequency of cumulative effects would be continuous.

[3899] The cumulative effects would be irreversible. There is some uncertainty regarding the success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife, and waterfowl populations that Fort McKay members hunt, gather, and trap. Other cumulative effects, such as those that affect the ability of Fort McKay to transfer cultural values and knowledge from one generation to the next, which is based on connections to the land, may be impossible to reverse.

Health and Socioeconomic Conditions

[3900] As determined in section 29, "[Public \(Human\) Health](#)," the panel finds that the effects of the Frontier project on human health are expected to be low in magnitude, and therefore the panel finds that the cumulative effects of the project in combination with other existing, approved, or reasonably foreseeable projects on human health are not likely to be significant. The panel believes that this finding applies to the health of Fort McKay members.

[3901] As determined section 30, "[Social Effects](#)," the panel finds that the effects of the Frontier project on socioeconomic conditions are expected to be low in magnitude. The panel believes that this finding applies to Fort McKay members. Consequently the panel determines that the cumulative effects of the Frontier project in combination with other existing, approved, or reasonably foreseeable projects socioeconomic conditions are not likely to be significant.

Summary

[3902] The panel finds that the cumulative effects to Fort McKay's current use of lands and resources for traditional purposes and physical and cultural heritage in the local and regional study areas are adverse and significant and likely to occur even in consideration of the mitigation measures conditioned by the panel.

Significance Determination for Asserted Rights

[3903] The panel assessed the effects of the Frontier project on the rights asserted by Fort McKay First Nation and Fort McKay Métis in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*.

[3904] The panel determined that the Frontier project is likely to result in significant adverse cumulative effects to the current use of lands and resources for traditional purposes and physical and cultural heritage of the Fort McKay First Nation and Fort McKay Métis. These effects often overlap with their ability to practice rights, but the effects to those rights extend beyond the biophysical effects. Where Fort McKay members are required to travel further to avoid these effects, this represents an additional effect to their rights beyond the direct effects of the project itself.

[3905] The project would be added to a landscape where a number of existing and proposed developments also effect Fort McKay's use of lands, traditional cultural practices, and ability to access aboriginal and treaty rights.

[3906] The panel finds that the residual effects to current use of land and resources, physical and cultural heritage, and effects to rights asserted by Fort McKay First Nation and Fort McKay Métis will not be fully mitigated by the mitigation measures proposed by Teck or by measures in the participation agreements that are known to the panel. The panel notes that other measures in the agreements with Teck, Fort McKay First Nation, and Fort McKay Métis may provide additional mitigating effects of the project, but the private nature of the agreements does not enable the panel to reach any conclusions in that regard.

[3907] On the basis of the evidence in front of the panel, and in consideration of the scale of the project, the panel finds that the Frontier project will likely result in effects to Fort McKay First Nation's and Fort McKay Métis's ability to exercise the rights as asserted. The panel finds that these effects will be adverse, significant, and likely to occur. Effects on asserted rights will be most prominent for those Fort McKay members that currently access lands within the project disturbance area and the local study area.

[3908] The project in combination with current effects of industrial development will further exacerbate cumulative effects on Fort McKay First Nation's and Fort McKay Métis's ability to exercise asserted rights. The panel finds that cumulative effects on these asserted rights will be adverse, significant and likely to occur.

Table 47. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	regional	long	continuous	irreversible	significant
Cultural and physical heritage	high	regional	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	regional	long	continuous	irreversible	significant

Table 48. Summary – Significance determination for cumulative effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	provincial	long	continuous	irreversible	significant
Cultural and physical heritage	high	provincial	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	provincial	long	continuous	irreversible	significant

Fort McMurray 468 First Nation

Background

[3909] Fort McMurray 468 First Nation stated that their traditional territory extends as far north as the Northwest Territories, east and southeast into Saskatchewan, south to the North Saskatchewan River, and as far west as the Wabasca River. They said the determination and mapping of their traditional territory is a work in progress.

[3910] Fort McMurray 468 filed the following submissions:

- June 7, 2013: Statement of concern
- July 31, 2015: Comments on information request round 2
- May 31, 2017: Withdrawal of statement of concern

[3911] Fort McMurray 468 entered into a long-term sustainability agreement with Teck regarding the Frontier project and withdrew their statement of concern.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[3912] *The Joint Operating Procedures for First Nations Consultation on Energy Resource Activities* requires that the AER panel request advice from the ACO as to whether the ACO has found consultation to have been adequate and request advice on mitigation measures that may be required to address potential impacts on aboriginal rights. The panel made the request for advice from the ACO before closing the evidentiary portion of the hearing so that parties would have an opportunity to comment on the ACO advice.

[3913] The ACO attended the hearing. Fort McMurray 468 did not participate in the hearing. Following the hearing, the ACO advised the AER that consultation is not currently required with Fort McMurray 468.

Asserted or Established Aboriginal and Treaty Rights

[3914] Fort McMurray 468 asserted rights under Treaty 8.

[3915] The panel's terms of reference requires it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent the panel receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by Fort McMurray 468 or the strength of such claims. But for the purposes of assessing the potential effects of the Frontier project on Fort McMurray 468's asserted aboriginal and treaty rights, the panel accepts that the Fort McMurray 468 has the rights being asserted.

Context of Historical and Current Cumulative Effects

[3916] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities, or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Canadian Environmental Assessment Agency (the Agency), effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

Use of Lands and Resources for Traditional Purposes, Health and Socioeconomic Conditions, and Physical and Cultural Heritage

[3917] Fort McMurray 468 stated that the Frontier project is located within Treaty 8 lands and their traditional territory. They stated that they do not have specific traditional land-use occupancy or traditional environmental knowledge information regarding their current use of the Frontier project's location because they are undertaking the mapping of their traditional territory.

[3918] Fort McMurray 468 stated that the Frontier project location is largely undisturbed by industrial development and it is known to be sensitive and a key wildlife and biodiversity zone that features numerous watercourses, muskeg to the north, and is located near the Athabasca River.

[3919] Teck did not provide an assessment of the effects of the Frontier project to the Fort McMurray 468's current use of lands and resources for traditional purposes, health and socioeconomic conditions, and physical and cultural heritage.

Analysis and Findings

[3920] Fort McMurray 468 provided limited, non-specific, and very general evidence of use of lands in the project and study areas. They withdrew their opposition to the project and did not appear at the hearing to present any specific evidence. In the panel's view, Fort McMurray 468 did not demonstrate that

- members currently use the lands and resources in the local or regional study areas to hunt, trap, fish, and gather or that
- members currently use lands near or in the project disturbance area for cultural practices or accessing culturally important sites.

Project and Cumulative Effects

Effects on Current Use of Lands and Resources for Traditional Purposes, Health and Socioeconomic Conditions, and Physical and Cultural Heritage

[3921] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources and practice of asserted rights.

[3922] Fort McMurray 468 expressed concerns regarding the amount of water that the Frontier project would withdraw from the Athabasca River.

[3923] Fort McMurray 468 indicated that cumulative effects caused by existing developments affect them greatly now and they are concerned that future developments would affect them to a larger degree.

[3924] In its response to the Fort McMurray 468's statement of concern, Teck stated that Fort McMurray 468's concerns have been considered in both the Frontier project's integrated application and the Frontier project update environmental assessments.

[3925] Teck did not provide an assessment of the effects of the Frontier project to the Fort McMurray 468's current use of lands and resources, physical and cultural heritage, and health and socioeconomic conditions.

Analysis and Findings

[3926] Fort McMurray 468 provided limited, non-specific, and very general evidence on effects of the project. They did not appear at the hearing and did not present information on how the Frontier project may affect specific current uses of lands and resources for traditional purposes, health and socioeconomic conditions, or physical and cultural heritage, or any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[3927] Based on the information provided by Fort McMurray 468 and Teck, the panel finds the following:

- The project could result in the direct loss of lands where traditional activities are practiced, but the panel was unable to determine this with certainty.
- Cumulative effects on the practice of traditional activities may be exacerbated by the project, but the panel was unable to determine this with certainty.

- Fort McMurray 468 has not demonstrated that the project will affect uses of lands and resources for traditional purposes, health and socioeconomic conditions, or physical and cultural heritage or any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

Mitigation Measures

[3928] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[3929] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

[3930] General issues and concerns identified by Fort McMurray 468 are addressed by these commitments.

[3931] Teck stated that Fort McMurray 468 expressed that they would like to remain involved in broader engagement activities with respect to the Frontier project (e.g., fisheries offsetting and wildlife mitigation planning). Teck agreed to keep them involved in these types of engagements.

Analysis and Findings

[3932] Teck's proposed mitigation measures and commitments are intended to address general concerns of indigenous parties. The panel has required a number of these proposed measures as conditions of the project approval.

[3933] A consolidated version of Teck's commitments is in [Appendix 11](#). If implemented, these commitments may reduce the effects of the project on a number of environmental valued components, which will serve to also reduce effects on indigenous use of lands. The panel has identified some of these and made them conditions of the project approval. A number of these measures are outside the authority of the panel. In conjunction with a number of adaptive management plans that Teck will be required to develop, and conditions imposed by the panel, these commitments can play an important role in mitigating project effects to general concerns identified by Fort McMurray 468.

Conditions and Recommendations

[3934] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Fort McMurray 468.

[3935] The panel requires that Teck finalize a traditional land-use mitigation, monitoring, and adaptive management plan for the project and submit it to the AER for approval 6 months before starting construction of the project.¹⁶⁶ The plan will be required as a condition of an *EPEA* approval for the project.

Determination of Significance

[3936] The panel determined the significance of project effects to current use of lands and resources and physical and cultural heritage based on the approach discussed in the Agency's guide *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[3937] The panel also assessed the potential for the Frontier project to impact the rights asserted by Fort McMurray 468 in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Significance Determination for Project Effects and Cumulative Effects

[3938] Fort McMurray 468 did not provide specific evidence describing if or how it currently uses lands in and within the project disturbance area, local study area or regional study area. Nor did Fort McMurray 468 provide specific evidence as to how the effects of the project would adversely affect their ability to hunt, trap, fish, or gather plants or affect culturally important areas within or near the project development area.

[3939] Fort McMurray 468 filed a statement of concern about the project in 2013 (before the 2015 project update). They subsequently withdrew their statement of concern in 2017. They did not attend the hearing, and so the limited, non-specific evidence they provided was not tested through the hearing process and could not be fully relied on.

[3940] The panel finds that it cannot make a reasoned determination of significance on the effects of the project and its contribution to any cumulative effects on Fort McMurray 468.

Significance Determination for Asserted Rights

[3941] For the reasons identified above, the panel cannot conclude that the Frontier project will affect rights asserted by Fort McMurray 468.

¹⁶⁶ Draft *EPEA* Approval – Condition 3.1.7

Kátl'odeeche First Nation

Background

[3942] The Kátl'odeeche First Nation is located in the Hay River reserve, Northwest Territories. They stated that their primary traditional territory extends into the Wood Buffalo National Park. The Kátl'odeeche First Nation is a member of the Cooperative Management Committee for the Wood Buffalo National Park.

[3943] The Kátl'odeeche First Nation filed the following submissions:

- June 19, 2018: Request to participate at the hearing
- August 24, 2018: Hearing submission
- September 11, 2018: Hearing participant submission
- November 13, 2018: Scheduling of Final arguments
- November 27, 2018: Final written argument

[3944] The Kátl'odeeche First Nation participated in the hearing, cross-examining the applicant on September 27, 2018. They did not provide direct evidence to the panel.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[3945] The ACO did not require consultation with Kátl'odeeche First Nation. The ACO did not submit a report regarding consultation adequacy and whether actions may be required to address potential adverse impacts on their existing rights.

[3946] On November 26, 2018, the ACO informed the AER that Kátl'odeeche First Nation provided no evidence of adverse impacts attributable to land and resource management decisions by Alberta in connection with the project. Further to the Aboriginal Consultation Office's letter to the panel of September 19, 2018, the ACO advised the AER that consultation is not currently required with Kátl'odeeche First Nation.

Asserted or Established Aboriginal and Treaty Rights

[3947] The Kátl'odeeche First Nation asserted that they have rights and interests in the Wood Buffalo National Park.

[3948] The panel's terms of reference requires it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by or

the strength of such claims. But, for the purposes of assessing the potential effects of the Frontier project, the panel accepts the rights being asserted.

Context of Historical and Current Cumulative Effects

[3949] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities, or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Agency, effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

[3950] Kátl'odeeche First Nation appeared at the hearing but did not provide any specific evidence about how their members use lands for harvesting and cultural practices in the project disturbance area.

Analysis and Findings

[3951] Kátl'odeeche First Nation provided a written hearing submission, cross-examined Teck in Fort McMurray, and provided written final argument. They did not provide direct evidence to the panel during the hearing.

[3952] Kátl'odeeche First Nation did not describe any specific use of lands or resources within the project disturbance area or the local or regional study areas. They did not identify any specific sites or culturally important areas that would be directly affected by the project.

Project and Cumulative Effects

[3953] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources, and practice of asserted rights.

Effects on Use of Lands and Resources for Traditional Purposes

Kátl'odeeche First Nation's View

[3954] Kátl'odeeche First Nation raised concerns about the Frontier project's proximity to Wood Buffalo National Park and the risk that the project would affect air quality in the park. They also expressed concerns that the project would produce greenhouse gas emissions that contribute to climate change. They raised concerns about the overall integrity of Wood Buffalo National Park, including existing effects of development on water quality, quantity, and flow; migratory birds; and the effects of climate change.

[3955] They are concerned by the findings in the Parks Canada's strategic environmental assessment regarding potential current and future cumulative effects on Wood Buffalo National Park from bitumen extraction, dams, other industries, and climate change. They said the effects on Wood Buffalo National Park's migratory birds, water quality and quantity, and, consequently, fish habitat are of particular urgency. They are concerned that effects on water quantity and quality in the Peace-Athabasca Delta are likely to be exacerbated by climate change as flows and water levels are expected to drop. Future reductions in river flows and water levels in the Peace-Athabasca Delta could affect their aboriginal and treaty rights.

[3956] Kátl'odeeche First Nation said the Frontier project poses unacceptable risks to the ecological integrity and outstanding universal value of Wood Buffalo National Park and unacceptable risks to species at risk.

[3957] Kátl'odeeche First Nation said that air quality guidelines near the Wood Buffalo National Park's border may not be adequate to prevent degradation of the Wood Buffalo National Park's world heritage values. They raised concerns that certain contaminants and stressors may not be included in the guidelines.

[3958] They said that the panel should be proactive in applying the *United Nations Declaration on the Rights of Indigenous Peoples* and ensure that affected indigenous nations provide their free, prior, and informed consent before the project is approved.

[3959] The Kátl'odeeche First Nation stated that the precautionary principle advises decision makers to err on the side of caution when there is a lack of full scientific certainty, including a lack of baseline information or gaps in information.

[3960] "...uncertainty remained about the scope and magnitude of the project on the Ecological Integrity and outstanding universal value of Wood Buffalo National Park. Given the value of the park to the indigenous peoples, and to current and future generations of Canadians, the Kátl'odeeche First Nation submits that proper application of the precautionary principle militates in favour of denying approvals for the Frontier project at this time. Eschewing the precautionary principle and proceeding with approvals in the absence of proper information on the potential cumulative impacts of the project, other existing and proposed developments, and climate change on the park is irresponsible and in violation of Canada's statutory obligations."

[3961] They said that approval of the project should be contingent on the imposition of all of the recommended conditions proposed by the Government of Canada.

Teck's View

[3962] Teck stated that Kátł'odeeche First Nation does not claim that the project is located within their traditional territory. Kátł'odeeche First Nation is based in Hay River Dené Reserve, which is approximately 405 kilometres from the Frontier project; a significant distance according to Teck. Teck stated that the Frontier project is predicted to have negligible effects on the park and Peace-Athabasca Delta, and therefore the Kátł'odeeche First Nation's traditional use of the park and the Peace-Athabasca Delta would not be affected by the project. Teck stated that many of the concerns expressed regarding the Peace-Athabasca Delta would exist whether or not Frontier proceeds.

Effects on Health and Socioeconomic Conditions

[3963] Kátł'odeeche First Nation raised concerns that the Frontier project could contribute to mercury loadings that have already been found in high levels in minnows and waterfowl eggs downstream of oil sand activities. In addition, they are concerned that the project's contribution to climate change could increase the methylation rate of mercury in the environment and consequently the rate at which mercury bio-accumulates in predators.

[3964] Kátł'odeeche First Nation expressed concerns that reduced water levels and flow rates could result in an increase in the concentration of contaminants in the Peace-Athabasca Delta. They are also concerned about contamination of fish that migrate in the Slave River and through the Great Slave Lake, where they harvest fish.

Effects on Physical and Cultural Heritage

[3965] The panel is required to take into account the effects on physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[3966] The Kátł'odeeche First Nation did not provide information about any physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

Analysis and Findings

[3967] Kátł'odeeche First Nation provided a written hearing submission, cross-examined Teck in Fort McMurray, and provided written final argument. They did not present witnesses for cross-examination. Kátł'odeeche First Nation evidence was largely supported by evidence from other parties. As Kátł'odeeche First Nation's evidence was not tested, the panel can only apply very limited weight to the evidence of Kátł'odeeche First Nation as summarized above.

[3968] As their concerns are focused on the Peace-Athabasca Delta and Wood Buffalo National Park and not in the project area, the Frontier project would not likely cause effects to their current use, if any, of lands and resources for traditional purposes.

[3969] Kátl'odeeche First Nation's participation occurred late in the review process after the panel had issued notice on June 6, 2019, that it had determined there was sufficient information to proceed to hearing. They did not provide sufficient evidence for the panel to determine specific effects on their physical or cultural heritage, or on their health or socioeconomic conditions.

Mitigation Measures

[3970] Kátl'odeeche First Nation suggested that long-term studies on oil sands contamination effects on migratory waterfowl are needed. They stated a comprehensive, independent analysis of wetland loss in the oil sands region is needed. Due to the lack of long-term baseline data to show changes to migration routes, staging/stopover sites, and breeding sites, it is unknown if oil sands activities may be causing waterfowl to avoid the Athabasca River flyway.

[3971] Kátl'odeeche First Nation raised concerns about the inadequacy of existing Alberta environmental guidelines and frameworks—specifically the *Surface Water Quality Management Framework*—in protecting the world heritage values in the Peace-Athabasca Delta. They said that it is unknown if current water withdrawal limits on the Athabasca River are strict enough.

[3972] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[3973] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

[3974] Transport Canada stated that it has the ability to include terms and conditions within project approvals to address impacts and cumulative impacts to navigation. Transport Canada confirmed that it continues to support a regional approach to water management, which can more effectively consider all of the cumulative impacts of water withdrawal for oil sands operations. To support this regional approach and to further its own understanding of the impacts of water withdrawals on navigation, Transport Canada advised that it is working to complete a navigation study in spring 2019. Transport Canada also confirmed that it is committed to working with the Government of Alberta. It committed to sharing the results of the study not only with Alberta, but also with other partners, including indigenous groups, Parks Canada, and the ECCC.

Analysis and Findings

[3975] In section 18, "[Surface Water Quality](#)," the panel determined that the Frontier project will result in water discharges and aerial emissions that will increase concentrations and loadings of some surface

water quality parameters within the local study area. Given predicted increases within the local study area, it is plausible that changes in water quality may be detected further downstream or downwind. However, the panel expects that these effects will be minimal, and the project is not likely to result in adverse effects to water quality in the Peace-Athabasca Delta and Wood Buffalo National Park.

[3976] In section [19](#), “[Surface Water Quantity](#),” the panel found that significant, adverse cumulative effects to surface water quantity, flows, and levels in the Athabasca River, Peace-Athabasca Delta, and Slave River Delta are occurring but are due predominantly to hydropower regulation and regional climate change, with industrial water withdrawals playing a minor role. These changes in surface water quantity appear to be adversely affecting Kátl’odeeche First Nation’s ability to access lands and resources for traditional purposes. The panel does not believe that the Frontier project is likely to exacerbate those existing effects. The panel does not believe that the Frontier project would adversely affect Kátl’odeeche First Nation’s ability to pursue eco-tourism opportunities. The panel has made recommendations to the governments of Canada and Alberta regarding surface water quantity and indigenous navigation.

[3977] In section [14](#), “[Air Quality](#),” the panel concluded that there is some potential for measurable air emissions from the project in the Peace-Athabasca Delta and Wood Buffalo National Park, but the effects will be minimal.

[3978] In section [29](#), “[Public \(Human\) Health](#),” the panel has determined that the project is not likely to result in adverse effects to the health of indigenous land users in the region. The panel has made recommendations to the governments of Canada and Alberta regarding the protection of human health (see [Appendix 6](#)).

[3979] The panel notes Teck’s view that the project will not affect Kátl’odeeche First Nation traditional territory, and consequently they have not entered into any type of agreements with Kátl’odeeche First Nation. The panel also notes that Teck has committed to a number of environmental mitigation measures and made commitments designed to mitigate effects of the project on indigenous communities.

[3980] A consolidated version of Teck’s commitments is in [Appendix 11](#). The panel has required a number of these proposed mitigations as conditions of the project approval. A number of these measures are outside the authority of the panel. However, many of these mitigations are reasonable given the context of the region, the issues and concerns, and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of valued environmental components, which will serve to also reduce effects on indigenous use of lands. In conjunction with a number of adaptive management plans which Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Kátl’odeeche First Nation.

Conditions and Recommendations

[3981] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Kátl'odeeche First Nation.

Conditions

[3982] The panel requires that Teck finalize a traditional land-use mitigation, monitoring, and adaptive management plan for the project and submit it to the AER for approval 6 months before starting construction of the project.¹⁶⁷ The plan will be required as a condition of an *EPEA* approval for the project.

Recommendations

[3983] To reduce effects to navigation, the panel recommends that Transport Canada use its ability to include terms and conditions within project approvals to address project impacts and cumulative impacts to navigation. The panel recommends that Transport Canada continue its work on a navigation study and share the results of the study with Kátl'odeeche First Nation.

Determination of Significance

[3984] The panel determined the significance of project effects to current use of lands and resources and physical and cultural heritage based on the approach discussed in the Agency's guide *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[3985] The panel also assessed the potential for the Frontier project to impact the rights asserted by Kátl'odeeche First Nation in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Significance Determination for Project Effects

Current Use of Lands and Resources for Traditional Purposes

[3986] The magnitude of effects is low or negligible. There is some potential for measurable air emissions from the project in the Peace-Athabasca Delta and Wood Buffalo National Park, but those effects will not be significant. While some contaminants will be released into surface waters from the project, the water quality assessment determined that the effects will be limited primarily to the local study area and that these loadings are not expected to contribute significantly to water quality effects in the Peace-Athabasca Delta or Wood Buffalo National Park. It is not plausible that water withdrawals from

¹⁶⁷ Draft *EPEA* Approval – Condition 3.1.7

the project will have any meaningful impact on the Slave River and its delta. The panel determined that the project will have minimal effects on air quality, water quality, and water quantity and that, while unlikely, if any residual effects from the project occur, they will not be significant.

[3987] The geographic extent of effects would be provincial. There may be small measurable changes in some air quality, water quality, or water quantity parameters in the Peace-Athabasca Delta and Wood Buffalo National Park.

[3988] The duration of effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape.

[3989] The frequency of effects would be continuous.

[3990] The project effects would be reversible.

[3991] The panel finds that the effects of the project would be adverse but not significant and unlikely to occur in consideration of project mitigation measures and conditions imposed by the panel.

Health and Socioeconomic Conditions

[3992] As determined in section 29, "[Public \(Human\) Health](#)," the panel finds that the human health effects from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Kátł'odeeche First Nation members.

[3993] Kátł'odeeche First Nation's participation occurred late in the review process after the panel had issued notice on June 6, 2019, that it had determined there was sufficient information to proceed to hearing. They did not provide sufficient evidence for the panel to make a well-founded determination on the effects to their socioeconomic conditions.

Physical and Cultural Heritage and Any Structure, Site, or Thing That Is of Historical, Archaeological, Paleontological, or Architectural Significance

[3994] Kátł'odeeche First Nation did not provide sufficient evidence for the panel to make a well-founded determination on the effects to their physical or cultural heritage conditions.

Summary

[3995] The panel finds that the project effects to current use of lands and resources for traditional purposes in the local and regional study areas are adverse, not significant, and unlikely in consideration of the key mitigation measures proposed.

Significance Determination for Cumulative Effects

Current Use of Land and Resources for Traditional Purposes and Physical and Cultural Heritage

[3996] Kátl'odeeche First Nation did not provide evidence of cumulative effects of industrial development on their use of lands and resources for traditional purposes to allow the panel to make a well-reasoned determination on the magnitude of such effects.

Significance Determination for Asserted Rights

[3997] For the reasons identified above, the Frontier project will not impact the rights asserted by Kátl'odeeche First Nation.

Table 49. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources for traditional purposes	low/negligible	provincial	long	continuous	reversible	not significant
Health	low	NA	NA	NA	NA	not significant

Métis Nation of Alberta, Lakeland Local Council 1909

Background

[3998] Métis Nation of Alberta, Lakeland Local Council 1909 is the political entity representing some Métis harvesters from the Athabasca River Community who maintain traditional harvesting activities on ancestral traplines between Fort McKay and Fort Chipewyan. Local 1909 formed in response to the effects of regional and cumulative industrial development on the Métis community. Several harvesters move seasonally between Lac La Biche, Fort McMurray, and the Athabasca River Community to balance traditional harvesting with the pressures of the modern industrial economy.

[3999] The information that Local 1909 presented came from a small sample of their members and references only a specific geographic area and time, so it may not reflect the views of all members.

[4000] During the environmental assessment review process, Local 1909 submitted written comments that included a statement of concern, a traditional knowledge and use baseline study, and comments on Teck's information. Local 1909 recommended that the knowledge and use study inform a future effects assessment study to examine potential project effects in more detail. On June 30, 2017, Local 1909 notified the panel that they had entered into a long-term participation agreement with Teck and withdrew their statement of concern and their objection to the proposed project.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[4001] The ACO did not submit a report regarding consultation adequacy and whether actions may be required to address potential adverse impacts to the existing rights of the Lakeland Local Council 1909.

Asserted or Established Aboriginal or Treaty Rights

[4002] Local 1909 identified the following values to be integral to their rights, traditional use practices, and way of life: trapping, hunting, culturally important plants, water, fishing, trails, cabins and camps. Local 1909 stated that these values are highly interconnected and many activities would not be practiced if the availability or quality of a resource was not present.

[4003] The panel's terms of reference requires it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent the panel receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by Local 1909 or the strength of such claims. But for the purposes of assessing the potential effects of the Frontier project on Local 1909 aboriginal and treaty rights, the panel accepts that Local 1909 has the rights being asserted.

Current Context

[4004] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Agency, effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished. The evidence heard by the panel about land use and resources for traditional purposes and practice of asserted rights is summarized below.

Current Use of Lands and Resources for Traditional Purposes

[4005] Local 1909 stated that they hunt a variety of wildlife species, including moose, bison, moose, bear, wolf, deer, fisher, beaver, muskrat, lynx, wolverine, and migratory waterfowl. Harvestable fish species in the area include: goldeye, grayling, jackfish, mariah, pickerel, whitefish, and yellow perch. Local 1909 members also harvest berries and medicinal plants close to cabins and on traplines within 25 km of the project disturbance area.

[4006] Local 1909 stated that Buckton Creek is an important place for bison in the winter, and bison is the preferred alternative to moose for fulfilling subsistence needs. Their members hunt moose and bison five or six times per year, in multiple seasons, historically and currently. They hunt for subsistence and commercial purposes within the terrestrial regional study area and bison study area. Local 1909 identified over twenty values within the terrestrial local study area associated with moose and bison hunting, including three recorded kill sites. Local 1909 members have a high level of concern for the ability to continue hunting the Ronald Lake bison and moose.

[4007] Their members identified two critical fishing locations within the aquatic resources local study area where subsistence purposes are concentrated in the winter and summer. Unnamed Lake 1, referred to as Net Lake by Local 1909, is used for jackfish and pickerel, and Unnamed Lake 2, are both within the project disturbance area and heavily fished. Ronald Lake, Dianne Lake and Island Lake are also fished heavily in the winter and summer seasons for subsistence. Silver and yellow perch have also been caught by Local 1909 members in several small unnamed lakes in the aquatic resources local study area.

[4008] Local 1909 stated that industrial activity has already displaced important wildlife populations and habitat. Members stated that the migratory patterns of the Ronald Lake bison have changed, and winter drilling activities associated with the project have contributed to this change.

[4009] They explained that traditional knowledge and traditional use activities have already been adversely affected by a variety of pressures, which have displaced members from harvesting areas, reduced the quantity and quality of traditional resources, and reduced the frequency of engaging in traditional activities. Pressures include industrial expansion, especially from oil sands development;

residential school; competition from recreational hunters; changing water levels in the Athabasca River; and pollution affecting the quality and quantity of resources available for Local 1909 members to harvest.

Access

[4010] Local 1909 stated that mobility is a part of Métis rights, culture, and way of life. A Métis family may reside in one location and harvest and practice their rights in another, and mobility is a historical practice that continues today. Local 1909 members use the Athabasca Basin as a main water route for navigation within 25 km of the project disturbance area to access hunting, fishing, trapping, and camping grounds for subsistence purposes and commercially to guide hunters. The river is of high concern to Local 1909 as it also serves as the principal conduit between Fort McMurray and Fort Chipewyan.

[4011] They said that historic and contemporary trails used for hunting and trapping are found within the terrestrial local study area, bison study area and within 25 km of the project disturbance area including a frequently used trail that intersects with the terrestrial local study area and follows a historic Métis wagon trail. Local 1909 identified a long cut line from the southern boundary of Wood Buffalo National Park to Fort McKay, passing through the terrestrial traditional land-use local study area, which follows the route of a traditional road between Fort Chipewyan and Fort McKay. Known as the Keyano Road, the route provides access to many of the trappers' cabins and settlements, and it remains important for historical, cultural and practical reasons.

Experience

[4012] Local 1909 stated that traditional users perceive bad air quality, odours, noise, perceived water contamination, water taste, and other sensory environmental changes that may cause Local 1909 members to avoid traditional activities.

Physical and Cultural Heritage

[4013] The panel is required to take into account the effects of the project on physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological, or architectural significance.

[4014] Local 1909 members use cabins and camping areas to spend time on the land in the Athabasca Basin in support of harvesting activities and practicing traditional activities. Local 1909 members frequently use 12 cabins within 25 km of the project disturbance area, seven of which are located along the Athabasca River. Cabins along the Athabasca River are important bases and "landmarks" for accessing areas west of the river for hunting, trapping, and fishing. Cabins are also found along the river north of Clausen's Landing and further north at Point Brule, Poplar Point, and Embarras Portage. Local 1909 members consider the Athabasca River to have practical, social and cultural importance for the Métis community.

[4015] Local 1909 identified the following places as historic settlements along the Athabasca River: Pine Creek, Poplar Point, Point Brule, and Embarras Portage. Local 1909 highlighted the importance of cabins and camps to their way of life and culture.

[4016] Local 1909 members stated that they also maintain trapline cabins and camps at various strategic places throughout their territory, including seasonal camps and cabins within the bison study area, at the mouth of the Firebag River, at Ronald Lake, and at Dianne Lake. Local 1909 stated that, historically, trapping families lived and worked in many small settlements along the Athabasca River including at Pine Creek, Poplar Point, Point Brule, and Embarras Portage. Local 1909 stated that members currently do not report trapping in the terrestrial traditional land-use local study area. However, two members are licensees for RFMAs and they use cabins and trapline infrastructure in the winter months, which requires trail access year round to allow for repairs and maintenance to these cabins.

[4017] They said that woodland caribou is considered a heritage species of cultural importance, but community members no longer harvest woodland caribou in order to aid species conservation efforts. Other species that were hunted in the 1960s, such as deer and bear are rarely harvested today. Local 1909 stated that transmission of knowledge across generations requires communication but also practice. Local 1909 stated that hunters are wary about consuming meat from animals who spend too much time close to the mines and tailings ponds, and the presence of an additional mine, should the project be approved, could further dissuade harvesters from hunting in the area.

[4018] Local 1909 stated that the area affected by the project is used to transmit cultural knowledge related to hunting and other practices, with members teaching youth to process and skin animals in this area. Local 1909 stated that seasonal hunting and fishing camps located near the Firebag River, Ronald Lake, Dianne Lake, and along the Athabasca River have been used less frequently for travel, camping, fishing, and hunting since the 1990s.

Health and Socioeconomic Conditions

[4019] Local 1909 stated that boreal forest fragmentation, perceived dangers from the consumption of wild meat and fish, noxious odours, potentially contaminated water, disruptions to the landscape, and the influx of outsiders have taken a toll on the well-being of long-time residents of the region.

[4020] Trappers who operate downstream of the project are concerned about regional water and air quality as a result of forty years of oil sands industrialization.

[4021] Local 1909 members reported concerns about contamination of fish, signaling alienation and loss already experienced by members. Subsistence fishing occurred in the Athabasca River and Firebag River in the aquatics resources local study area in the summer and fall, but fishing has since ceased at these locations.

[4022] Local 1909 members consume water from the Athabasca Basin, and cleanliness is a concern for those who drink water downstream of the project. Buckton Creek is an important drinking water source and one of the only trusted water bodies due to fears over water contamination in the area.

[4023] Local 1909 members stated that reduced water quality has negatively affected their perception of the safety of drinking water and traditionally harvested foods. Members transport bottled water on harvesting expeditions due to fears of consuming contaminated water. Some harvesters have been deterred from consuming traditionally harvested resources, including blueberries, from areas downstream of the oil sands due to concerns of contamination. Local 1909 stated that the cumulative alienation and loss due to oil sands and related industrialization has already seriously affected traditional fishing.

[4024] Local 1909 said they would generally use traditional resources (meat, fur, wood, fish, water and trails) for culturally important harvesting purposes, but some members occasionally supplemented fur trapping and trading with seasonal wage labour in various sectors including construction, forestry, mining or transportation. Local 1909 members guide hunters into the traditional land-use local study area and adjacent areas as professional outfitters.

[4025] They described rapid urbanization around Fort McMurray as the population increased from around 1000 people in 1961 to almost 30 000 in 1982 due to commercial production in the oil sands. Jobs in the oil sands brought people out of the trapping settlements and into town, and some Local 1909 members abandoned former Métis village sites along the Athabasca River such as Pine Creek, Poplar Point, Point Brule, and Embarras Portage. Although once home to extended families of trappers, some sites became neglected due to lack of use.

[4026] Local 1909 members have reported a general cessation of subsistence water use while on the land, avoidance of fish from certain water bodies, and increased observation of tainted animals. Also that enhanced use of motor vehicles to overcome distances is required to travel to viable hunting and trapping areas.

[4027] Trappers must move further inland, away from the river, to find viable trapping areas due to increased competition from hunters. Many indigenous people and hunters have adopted new technologies like satellite phones, cellular phones, speedboats, and quads to access remote areas, which makes hunting and trapping more expensive.

[4028] Industrial expansion of the oil sands forced Local 1909 members to seek more affordable places to live and raise their families. This requires members to travel greater distances between viable harvesting locations and affordable housing, which reduced traditional knowledge and harvesting in the area.

[4029] Local 1909 also stated that in the late 1950s and early 1960s, indigenous children in the Fort McMurray area were rounded up from traplines and cabins, taken from their parents and grandparents, and shipped on box cars to Lac La Biche Mission or Blue Quills Residential School.

Analysis and Findings

[4030] Much of Local 1909 evidence is not contested by Teck or any other party to the proceeding. On June 30, 2017, they advised the panel that they had entered into a participation agreement with Teck and did not object to the project. Local 1909 did not attend the hearing or seat a panel of witnesses so its evidence was not subject to direct cross-examination.

[4031] The panel finds it is able to place a moderate weight on the evidence presented by Local 1909 and summarized above. The evidence shows that:

- Local 1909 members practice traditional activities, such as hunting, trapping, fishing, and gathering, within 25 km of the project disturbance area in the project's relevant local study areas, which would be directly affected by the project.
- Many of the traditional activities practiced by Local 1909 have been reduced due to a variety of pressures.
- The Athabasca River is a key transportation route that allows Local 1909 members to access important hunting and trapping areas and practice traditional activities.
- A historic trail through the terrestrial local study area remains important for Local 1909 to access culturally important cabins and settlements.
- Local 1909 use of lands for traditional and cultural activities is integral to the maintenance of their culture and the transmission of knowledge and cultural practices to younger members of their community. The loss of use of harvesting areas has adversely affected their ability to practice and teach traditional knowledge to the youth.
- Industrial activity has made it more difficult for Local 1909 to access safe food sources to harvest, and practicing traditional activities now requires increased effort, time, and costs. This has interfered with Local 1909's traditional way of life.

Project and Cumulative Effects

[4032] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights, and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources, and practice of asserted rights.

[4033] Evidence dealing specifically with the effects of the Frontier project is summarized below.

Current Use of Lands and Resources for Traditional Purposes

Métis Nation of Alberta, Lakeland Local Council 1909's View

Resource

[4034] Local 1909 stated that the project could result in diminished abundance of important wildlife populations in preferred harvesting areas; habitat reduction, degradation, and fragmentation; disruption to wildlife movement and predator dynamics; and contamination of preferred harvested species, including berries and medicine plants. Removal of Unnamed Lake 1 and 2 and contamination could degrade or destroy fish habitat in preferred locations.

[4035] Local 1909 stated that project-related activities would disrupt seasonal bison movements, reduce the viable habitat available to the bison, and bring in outside hunters (and predators), which would add pressure on Local 1909 hunters and reduce the bison population.

[4036] They said that winter road construction related to the project could affect the local hydrological conditions and subsequently affect wildlife such as muskrats and beavers.

[4037] They expressed concerns that the project would create access barriers to the movement of hunters, particularly relevant for those who use trails including the traditional trail going north-south through the terrestrial/traditional land-use local study area. Local 1909 predicted a high potential for the project to interact with river access routes and the historically and currently used traditional trail, assumed to be Keyano Road.

[4038] Local 1909 stated that, in consideration of the current cumulative effects context, the loss of one remaining preferred harvesting areas might have significant adverse effects on Local 1909 traditional land and resource use, cultural values, including intergenerational knowledge transfer, and aboriginal rights.

Applicant's View

Resource

[4039] Teck stated that no Local 1909 traplines are located in the traditional land-use regional study area, but RFMA 2016 is unassigned and could be used by Local 1909 members.

[4040] Teck stated that Unnamed Lake 1 and 2 would become unavailable at project construction in 2021. Fishing areas at Ronald Lake and Diana Lake would not be disturbed because of project development. Fish habitat might be lost in the Athabasca River because of the river water intake, and the bridge might have an incremental effect on traditional fishing because of changes in access to the Athabasca River.

[4041] Teck predicted that the incremental effect of the project on Local 1909 opportunities to harvest bison would be of moderate to high magnitude; opportunities to harvest traditionally important wildlife

species would be of low to moderate magnitude; opportunities to trap fur-bearers would be of negligible to low magnitude; opportunities to fish for traditionally important species would be of low to moderate magnitude; and, opportunities to harvest traditionally important vegetation would be of low magnitude. Details of Teck's wildlife, fish, and vegetation assessment can be found in those sections of this report.

[4042] Teck predicted that the cumulative effects of the project, in combination with existing and future effects on Local 1909 opportunities to harvest bison, opportunities to hunt traditionally important wildlife species, opportunities to fish for traditionally important species, and opportunities to trap fur-bearers, and opportunities to harvest traditionally important vegetation would be regional in extent, long term, continuous, irreversible, and of high magnitude except for opportunities to fish which was predicted to be moderate in magnitude.

Access

[4043] Teck identified multiple trails and transportation values that traverse the terrestrial local study area. Southern areas of the traditional land-use regional study area have already experienced changes to traditional land-based travel patterns because of existing developments in the area and this disturbance would expand at planned development case. Keyano River Road, which connects the project disturbance area to traplines to the north and areas south, would be directly disturbed by the project. Teck predicted the project, in conjunction with other oil sands developments, would not affect navigation on the Athabasca River. However, Teck recognized that indigenous communities are currently experiencing loss of access because of low water levels.

Experience

[4044] Teck predicted that the furthest extent where the continuous sounds of the project might be perceptible to land users is 2.3 km, which might affect members using trails or hunters in close proximity to the project disturbance area and portions of the Athabasca River due to the river water intake.

[4045] Odour is expected to be perceptible in the Ronald Lake bison study area, in regions surrounding the project to the north and south of the west side of the project, which might affect traditional trails used in accessing the cabin west of the project disturbance area, and odour might overlap with higher concentration hunting and trapping values near the project disturbance area.

[4046] The project is expected to be visible for multiple areas throughout and outside the Ronald Lake bison study area and traditional land-use regional study area including the two RFMAs, in high concentration hunting and trapping areas, and portions of the Athabasca River.

[4047] The project is expected to contribute noise, odour, and visual disturbance, as discussed in those sections of this report. Cumulatively, noise from the Fort Hills project could be expected in areas southeast of the project on the east side of the Athabasca River. Odour could increase in the traditional land-use regional study area, the southernmost area of the Ronald Lake bison study area and the range of

detectible odours along the Athabasca River could increase. Odours might be perceptible to trappers continuously along the west side of the Athabasca River from south of Fort McKay through the project disturbance area. The project could be visible at camp and cabin locations.

Physical and Cultural Heritage

[4048] The panel is required to take into account the cumulative effects on physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[4049] Local 1909 stated that industrial development, environmental transformation, social change and related impacts could have implications for the culture, way of life and identity of indigenous peoples. Some of these cultural impacts of industrialization were referred to as cumulative alienation and loss.

[4050] Teck stated that the project would disturb one cabin or camp site within the project disturbance area at Unnamed Lake 2. Cabins or camps along the Athabasca River, adjacent to the project and in areas downstream of the project would not be directly affected, including one cabin west of the project disturbance area, two at Ronald Lake, one at Diana Lake and areas at the mouth of the Firebag River, Poplar Point, Point Brule.

[4051] Teck stated that construction and operation of the bridge and east side access road associated with the project would have an incremental effect on the use of culturally important sites and areas because of changes to access and concerns regarding an incremental increase in human presence.

[4052] Teck stated that the project could result in decreased time for the practice of traditional land use due to work demands, which could affect community cohesion as there would be reduced time to practice traditional land-use activities together and less community sharing opportunities. There could also be effects on indigenous identity, at an individual and community level, including challenges to self-sufficiency, the ability to exercise autonomy and self-determination.

[4053] Teck predicted that the incremental effect of the project on Local 1909 opportunities to use culturally important sites and areas would be of low magnitude. Teck assessed the cumulative effects on the opportunity for Local 1909 members to use culturally important sites and areas as long-term in duration, continuous, irreversible and of high magnitude at planned development case.

Health and Socioeconomic Conditions

[4054] Local 1909 said that harvesters with direct experience living and harvesting downstream from oil sands mines have experienced environmental contamination, which makes them concerned about the project.

[4055] They said that the project would reduce access to harvesting areas and the traditional trail from Fort McKay to Poplar Point, which could result in psychological repercussions for those who maintain

RFMAs, the related cabins, and traditional infrastructure in the remaining wilderness areas between the project and Wood Buffalo National Park.

[4056] Local 1909 predicted that the project would have a moderate to high potential for interaction with existing guiding activities.

[4057] Teck stated that the project might result in additional travel time and costs for indigenous harvesters due to barriers to access that would require the use alternate and less-direct travel routes.

[4058] Teck predicted that the project could decrease access to harvesting areas due to physical or time constraints, which could accelerate members entering the formal wage economy resulting in decreased yields. Lower yields could result in a decline in the consumption of country foods and a need to substitute with store-bought foods and medicines.

[4059] Teck's human health risk assessment suggested that the project would not significantly affect health risks in the region. Elevated risks are predominantly due to existing conditions and approved projects, and the project would have a negligible to low effect on those risks. For additional details on Teck's human health risk assessment, see section 29, "[Public \(Human\) Health](#)."

Analysis and Findings

[4060] Much of Local 1909 evidence is not contested by Teck or any other party to the proceeding. On June 30, 2017, they advised the panel that they had entered into a participation agreement and did not object to the project. Local 1909 did not attend the hearing or seat a panel of witnesses so its evidence was not subject to direct cross-examination.

[4061] The panel finds it is able to place a moderate weight on the evidence presented by Local 1909 and summarized above. The evidence shows that:

- The project footprint will result in the direct loss of lands where Local 1909 traditional land-use activities are conducted.
- The project will disturb trails in the project development area, which will require harvesters to use less-direct routes to remaining undisturbed areas, resulting in additional travel time and costs.
- Local 1909 is currently experiencing adverse effects on their ability to access lands for these practices as a result of industrial activities in the region and that the project will further exacerbate these effects.
- The project will affect Local 1909 physical heritage sites and affect opportunities to use these areas for cultural practices.
- The project footprint will result in the direct loss of lands where traditional and cultural activities are practiced.

- Cumulative effects on the practice of traditional and cultural activities will be exacerbated by the project, which will eliminate or prevent the use of preferred hunting, trapping, fishing and gathering activities in the local study area and regional study area.
- While the panel finds that air and water quality effects are not expected to significantly affect human, wildlife and vegetation health, reduced confidence in the quality of foods and water quality may impair Local 1909's use of these resources and result in loss of use of preferred harvesting areas, especially downstream of the project.

Mitigation Measures

[4062] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[4063] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

Participation Agreement

[4064] Teck and Local 1909 entered into a participation agreement in 2017.

[4065] The agreement identifies a number of economic benefits for Local 1909 connected with the Frontier project, as well as creating opportunities for meaningful engagement and communication. It also sets out a framework for items such as traditional land use and environmental stewardship related to the Frontier project. The agreement is considered to be substantial and critical mitigation for the effects described in this updated assessment while also providing mechanisms for continued engagement throughout the life of the Frontier project, which might result in the development of additional community-specific mitigation measures to manage specific effects.

Analysis and Findings

[4066] The participation agreement and the commitments made by Teck are intended to mitigate the effects of the project on current use of land and resources for traditional purposes; physical and cultural heritage; and impacts to aboriginal rights. The agreement will establish a cooperative implementation committee to implement the agreement.

[4067] The panel supports the establishment of such processes to manage mitigation measures and adapt to circumstances that may not be anticipated at this time. It expects the parties to comply with the various commitments which they have made in this agreement.

[4068] A consolidated version of Teck's commitments is in [Appendix 11](#). The panel has required a number of these proposed mitigations as conditions of the project approval. A number of these measures are outside the authority of the panel. However, many of these mitigations are reasonable given the context of the region, the issues and concerns and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of environmental valued components, which will serve to also reduce effects on indigenous use of lands. In conjunction with a number of adaptive management plans which Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Local 1909.

[4069] Local 1909 removed its objections to the Frontier project following the submission of its agreement with Teck. As the full details of this agreement remain private, the panel assumes that the measures agreed upon would meet their respective needs and interests with respect to the Frontier project.

[4070] Local 1909 has expressed support for the project and did not participate in the hearing.

Conditions and Recommendations

[4071] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Local 1909. The panel also makes the following conditions and recommendations for Local 1909.

Conditions

[4072] The panel requires that Teck finalize a traditional land-use mitigation, monitoring, and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of construction of the project.¹⁶⁸ The plan will be required as a condition of an *EPEA* approval for the project

Recommendations

[4073] To reduce effects to navigation, the panel recommends that Transport Canada use its ability to include terms and conditions within project approvals to address project impacts and cumulative impacts to navigation. The panel recommends that Transport Canada continue its work on a navigation study and shares the results of the study with Local 1909.

Determination of Significance

[4074] The panel determined the significance of project effects and cumulative effects to the current use of lands and resources for traditional purposes; health and socioeconomic conditions; and physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or

¹⁶⁸ Draft *EPEA* Approval – Condition 3.1.7

architectural significance based on the approach discussed in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[4075] The panel also assessed the impacts to Local 1909's aboriginal and treaty rights in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*.

[4076] Local 1909 participated in the environmental assessment review process until they signed their agreement with Teck. They did not participate in the hearing so their evidence could not be tested. Teck did not contest Local 1909 evidence in any of its written submissions. Teck's own conclusions regarding significance or consequence of effects of the project on Local 1909 traditional land use key indicators largely aligned with Local 1909's assessment. As a result, the panel assigns a moderate weight to Local 1909 submissions and evidence even in the absence of the opportunity to test it through the oral hearing process.

Significance Determination for Project Effects

Current Use of Land and Resources for Traditional Purposes

[4077] The magnitude of project would be high. Local 1909 demonstrated that its members use the local study area and regional study area areas for hunting, trapping, fishing, and gathering. The project effects and direct loss of lands in the project disturbance area would affect lands being used by Local 1909 members.

[4078] The geographic extent of project effects would be regional. Project effects to Local 1909's ability to access and harvest species of importance are expected to occur within the local study area and regional study area.

[4079] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape that will support traditional land-use activities.

[4080] The frequency of project effects would be continuous.

[4081] The project effects would be irreversible. The potential for reversibility depends on the success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife and waterfowl populations which Local 1909 members hunt, gather and trap.

[4082] Due to the high magnitude, regional geographic extent, long-term duration, continuous frequency, and irreversibility of some effects, the project effects to Local 1909's current use of lands and resources

for traditional purposes in the local and regional study areas are adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[4083] The magnitude of project effects would be high. Local 1909 demonstrated that its members use the local study area and regional study area areas for conducting important cultural activities.

[4084] The geographic extent of project effects would be regional. Project effects to Local 1909's ability to access culturally important areas, to hunt wildlife species of importance, and to participate in culturally important activities are expected to occur within the local study area and regional study area.

[4085] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape that will support cultural activities.

[4086] The frequency of project effects would be continuous.

[4087] The project effects would be irreversible, given the likely loss of connection to traditional activities and the cultural values that take place on lands directly affected by the project, and the potential that future landscapes may no longer retain the unique characteristics to support cultural practices or reestablish traditional heritage connections.

[4088] Due to the high magnitude, regional geographic extent, long-term duration, continuous frequency, and irreversibility of effects, project effects to Local 1909's physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance in the local and regional study areas are adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

Health and Socioeconomic Conditions

[4089] As determined in the human health risk assessment, the panel finds that the health effects from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Local 1909 members.

[4090] As determined in section 30, "[Social Effects](#)," the panel finds that the socioeconomic effects from the project are expected to be low in magnitude. The panel believes that this finding applies for Local 1909 members.

[4091] The project effects would be continuous and regional in extent, but the effects would be medium term in duration and reversible as they would decrease at the end of operations. Due to the low

magnitude, continuous, regional, medium term, and reversibility, the project effects to the health and socioeconomic conditions would be adverse but not significant.

Summary

[4092] The panel finds that due to the high magnitude, regional geographic extent, long-term duration, continuous frequency, and irreversibility of some effects, project effects are adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

Significance Determination Cumulative Effects

Current Use of Land and Resources for Traditional Purposes

[4093] The magnitude of cumulative effects would be high. Much of the area that Local 1909 members traditionally used has been affected by industrial development. The panel accepts that the magnitude of the cumulative effects are currently high, and that the project, with implementation of mitigation measures and conditions, would incrementally add to the effects on Local 1909 current use of lands and resources for traditional purposes.

[4094] The geographic extent of cumulative effects would be provincial in scale as cumulative effects are occurring over much of the traditional lands used by Local 1909 members.

[4095] The duration of cumulative effects would be long term. Cumulative effects would extend beyond the cessations of industrial activities in the region. The extended time frames associated with reclamation and closure and the uncertainties regarding the Teck's ability to fully restore landscapes that will support traditional use activities and cultural values result in multigenerational effects to Local 1909.

[4096] The frequency of cumulative effects would be continuous.

[4097] The cumulative effects on some measures will likely be irreversible. There is some uncertainty depending on the success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife and waterfowl populations which Local 1909 members hunt, gather and trap.

[4098] Due to the high magnitude, provincial geographic extent, long-term duration, continuous frequency, and irreversibility of some effects, the cumulative effects to Local 1909's current use of lands and resources for traditional purposes in the local and regional study areas are adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[4099] The magnitude of cumulative effects would be high. Much of the area that Local 1909 for conducting cultural activities has been affected by development. The panel accepts that the evidence presented by the Local 1909 community that the cumulative effects are currently high, and that the project, with implementation of mitigation measures and conditions, will incrementally contribute to the effects to Local 1909.

[4100] The geographic extent of cumulative effects would be provincial as cumulative effects are occurring over much of the traditional lands used by Local 1909 members.

[4101] The duration of cumulative effects would be long term. Cumulative effects will extend beyond the cessations of industrial activities in the region. The extended time frames associated with reclamation and closure and the uncertainties regarding the Teck's ability to fully restore landscapes that will support cultural activities result in multigenerational effects to Local 1909.

[4102] The frequency of cumulative effects would be continuous.

[4103] The cumulative effects would be irreversible, given the uncertainty regarding reclamation landscapes and the disturbance of intergenerational patterns of knowledge transfer, which the panel considers to be the most important factor in making its determination. The cumulative effects that affect the ability of Local 1909 to transfer cultural values and knowledge, which are based on connections to the land, from one generation to the next, may be impossible to reverse.

[4104] Due to the high magnitude, provincial geographic extent, long-term duration, continuous frequency, and irreversibility of effects, the cumulative effects to Local 1909's physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance in the local and regional study areas are adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

Health and Socioeconomic Conditions

[4105] As determined in section 29, "Public (Human) Health," the panel finds that the cumulative effects to human health from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Local 1909 members.

[4106] As determined in section 30, "Social Effects," the panel finds that the cumulative socioeconomic effects are expected to be low in magnitude. The panel believes that this finding applies for Local 1909 members.

[4107] The cumulative effects would be continuous and regional in extent, but would be medium term in duration and reversible as they would decrease at the end of operations. Due to the low magnitude,

continuous, regional, medium term, and reversibility, the cumulative effects to the health and socioeconomic conditions would be adverse but not significant.

Summary

[4108] Due to the high magnitude, regional geographic extent, long-term duration, continuous frequency, and irreversibility of some effects, the cumulative effects to Métis Nation of Alberta, Lakeland Local Council 1909's current use of lands and resources for traditional purposes and physical and cultural heritage in the local and regional study are adverse and likely to be significant.

Significance Determination for Asserted Rights

[4109] The panel has assessed the significance of project effects to asserted rights in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*.

[4110] The panel finds that the residual effects to current use of land and resources; physical and cultural heritage; and effects to asserted rights would not be fully mitigated. In consideration of the scale of the project and the evidence presented by the parties, the panel finds that the residual project impacts to exercise of rights will be adverse and significant and likely to occur. These impacts on rights will be most prominent for those members that access lands within the project development area and the local study area.

[4111] The project in combination with current effects of industrial development will further exacerbate cumulative effects on Métis Nation of Alberta, Lakeland Local Council 1909's ability to exercise asserted rights. The panel finds that cumulative effects on these asserted rights will be adverse, significant and likely to occur.

Table 50. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	regional	long	continuous	irreversible	significant
Cultural and physical heritage	high	regional	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	regional	long	continuous	irreversible	significant

Table 51. Summary – Significance determination for cumulative effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	provincial	long	continuous	irreversible	significant
Cultural and physical heritage	high	provincial	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	provincial	long	continuous	irreversible	significant

Owl River Métis Local #1949

Background

[4112] The Owl River Métis Local #1949 is a member of the Métis Nation of Alberta Region 1 Council. Owl River Métis stated that they are recognized as a historic and contemporary Métis community in Alberta. There are approximately 100 members living in Lac La Biche and the surrounding area. The Métis Nation of Alberta Region 1 represented the Owl River Métis in the Frontier review until January 1, 2017, when Owl River Métis's Sustainability Resource Department assumed this role.

[4113] During the review process, Owl River Métis filed the following:

- July 14, 2017: Comments on Sufficiency of Information Frontier Oil Sands Mine Project Review;
- July 26, 2017: Notice of change of representation and Request for Supplemental Information for the Frontier Oil Sands Mine Project;
- June 15, 2018: Notice of Long-term Participation Agreement between Teck and Métis Nation of Alberta Region 1 Office and Local 1949 Owl River Métis, Local # 193 Conklin, Métis Local # 780 Willow Lake (Anzac), Métis Local # 2002 Buffalo Lake, Métis Local # 2010 Athabasca Landing and notice of withdrawing their statement of concern and objection to the proposed project.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[4114] The ACO did not submit a report regarding consultation adequacy or whether actions may be required to address potential adverse impacts to the existing rights of the Owl River Métis Local #1949.

Asserted or Established Aboriginal or Treaty Rights

[4115] Owl River stated that its members actively hunt, fish, trap, gather, and engage in other related activities. Owl River Métis stated that the exercise of their rights depends upon having access to habitat suitable to support the species being harvested. They stated that they have statutory rights to hunt, fish, and trap on Crown lands pursuant to the *Hunting, Fishing and Trapping Heritage Act*, and the right to commercial fur harvesting for holders of trapping areas pursuant to Alberta's *Wildlife Regulation*. Owl River Métis also stated that they have a common law right to use and enjoy the lands they occupy in the community free from noxious odours, pollution, noise, and other nuisances.

[4116] The panel's terms of reference requires it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by or the strength of such claims. But, for the purposes of assessing the potential effects of the Frontier project, the panel accepts the rights being asserted.

Context of Historical and Current Cumulative Effects

[4117] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities, or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Canadian Environmental Assessment Agency (the Agency), effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

[4118] The panel is required to take into account the effects of the project on the current use of lands and resources for traditional purposes, health and socioeconomic conditions, physical and cultural heritage, and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[4119] Owl River Métis said they actively use the project area to trap, fish, harvest plants, and hunt. They said the area contains 56 documented land-use values, and it would be close to camping sites at the Athabasca River.

[4120] Teck did not provide an assessment of the effects of the Frontier project on the Owl River Métis's current use of lands and resources, physical and cultural heritage, and health and socioeconomic conditions.

Analysis and Findings

[4121] Owl River Métis Local submitted comments on the Frontier project to the panel during the sufficiency review phase. They withdrew their opposition to the project and did not appear at the hearing.

[4122] They did not demonstrate current or historic use of specific

- lands and resources in the local or regional study areas to hunt, trap, fish, and gather, or
- lands near or in the project disturbance area for cultural practices or accessing culturally important sites.

Project and Cumulative Effects

[4123] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources and practice of asserted rights.

[4124] Owl River Métis expressed concerns that the Frontier project might affect their ability to exercise their aboriginal rights. They expressed concerns about the increased population and human traffic,

maintaining access through the area, and effects on air, water, and key wildlife populations such as moose, caribou, and bison.

Analysis and Findings

[4125] Owl River Métis did not appear at the hearing and did not present specific evidence showing their current use of lands and resources for traditional purposes, about health and socioeconomic conditions, about their physical and cultural heritage, or about any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[4126] Based on the information provided by Owl River Métis and Teck, the panel finds the following:

- The project could result in the direct loss of lands where traditional activities are practiced, but the panel was unable to determine this with certainty.
- Cumulative effects on the practice of traditional activities may be exacerbated by the project, but the panel was unable to determine this with certainty.

Mitigation Measures

[4127] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[4128] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

Analysis and Findings

[4129] Teck's proposed mitigation measures and commitments are intended to address general concerns of indigenous parties. The panel has required a number of these proposed measures as conditions of the project approval. General issues and concerns identified by Owl River Métis are addressed by these commitments.

[4130] A consolidated version of Teck's commitments is in [Appendix 11](#). If implemented, these commitments may reduce the effects of the project on a number of valued environmental components, which will also serve to reduce effects on indigenous use of lands. The panel has identified some of these and made them conditions of the project approval. A number of these measures are outside the authority of the panel. In conjunction with a number of adaptive management plans that Teck will be required to develop, and conditions imposed by the panel, these commitments can play an important role in mitigating project effects to general concerns identified by Owl River Métis.

Conditions and Recommendations

[4131] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Owl River Métis.

[4132] Teck must finalize a traditional land-use mitigation, monitoring, and adaptive management plan for the project and submit it to the AER for approval 6 months before starting construction of the project.¹⁶⁹ The plan will be required as a condition of an *EPEA* approval for the project.

Determination of Significance

[4133] The panel determined the significance of project effects to current use of lands and resources and physical and cultural heritage based on the approach discussed in the Agency's guide *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[4134] The panel also assessed the potential for the Frontier project to affect the rights asserted by Owl River Métis in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Significance Determination for Project Effects and Cumulative Effects

[4135] Owl River Métis did not provide specific evidence describing if or how it currently uses lands within the project disturbance area, local study area, or regional study area. Nor did Owl River Métis provide specific evidence as to how the effects of the project would adversely affect their ability to hunt, trap, fish, gather plants, or affect culturally important areas within or near the project area.

[4136] Owl River Métis filed a statement of concern about the project before the 2015 project update. They subsequently withdrew their statement of concern in 2018. They did not attend the hearing. The limited, non-specific evidence they provided was not tested through the hearing process. The panel found that Owl River Métis evidence could not be fully relied on.

[4137] The panel finds that it cannot make a reasoned determination of significance on the effects of the project, and its contribution to any cumulative effects, on Owl River Métis.

Significance Determination for Asserted Rights

[4138] Due to this lack of evidence, the panel has not made a determination as to whether the Frontier project will affect rights asserted by Owl River Métis.

¹⁶⁹ Draft *EPEA* Approval – Condition 3.1.7

Métis Nation of Alberta Region 1

Background

[4139] The Métis Nation of Alberta Region 1 is the association that represents the interests of Métis people living in northeastern Alberta. The Métis Nation Region 1 is part of the Métis Nation of Alberta Association that was established in 1928 and represents the interests of 35 000 Métis members.

[4140] Métis Nation Region 1 local councils are located in Fort Chipewyan (Métis Local 125), Fort McKay (Métis Local 63), Fort McMurray (Métis Local 1935 and Métis Local 2020), Willow Lake/Anzac (Métis Local 780), Conklin (Métis Local 193), Owl River (Métis Local 1949), Lac La Biche (#Métis Local 097), Lakeland/Lac La Biche area (Métis Local 1909), Athabasca Landing (Métis Local 2010), and Buffalo Lake (Métis Local 2002).

[4141] Métis Nation Region 1 submitted the following submissions:

- June 4, 2012: Statement of concern
- February 27, 2013: Sufficiency review round 1
- December 16, 2013: Review of responses to round 2
- October 18, 2016: Comments on sufficiency to proceed to public hearing
- June 15, 2018: Long-term participation agreement

[4142] Métis Nation Region 1 and each local council it represents entered into long-term sustainability agreements with Teck for the Frontier project. Those that had filed statements of concern withdrew them advising that they no longer objected to the granting of approvals for the Frontier project. Métis Nation Region 1 stated that the agreements include ongoing mitigation, monitoring, and management of project impacts to the environment and Métis traditional use and Métis rights, identification of contracting and employment opportunities, and provision of direct financial benefits. Métis Nation Region 1 did not participate in the hearing.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[4143] The ACO did not submit a report regarding consultation adequacy and whether actions may be required to address potential adverse impacts to the existing rights of the Métis Nation of Alberta Region 1.

Asserted or Established Aboriginal and Treaty Rights

[4144] On behalf of the members it represents, Métis Nation Region 1 asserted the following rights:

- Hunting
- Fishing
- Trapping
- Gathering
- Riverbed harvesting
- Traditional Métis harvesting
- Access to preferred areas to hunt, fish, and gather by water

[4145] The panel's terms of reference require it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by or the strength of such claims. But, for the purposes of assessing the potential effects of the Frontier project, the panel accepts the rights being asserted.

Context of Historical and Current Cumulative Effects

[4146] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities, or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Canadian Environmental Assessment Agency (the Agency), effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

Use of Lands and Resources for Traditional Purposes

[4147] Métis Nation Region 1 stated that its members used the lands along the Athabasca River and within the local and regional Frontier study areas for traditional purposes. They stated that its members have traditional land-use interests in the project area, including using the land in and around the project area for hunting, fishing, trapping, berry and plant harvesting, and natural and traditional resource conservation, including participation in caribou recovery activities.

[4148] Métis Nation Region 1 stated that their members are concerned with the magnitude and pace of development in the Regional Municipality of Wood Buffalo area and the cumulative effects of existing and proposed development on their communities. They said that there are already serious cumulative

effects on navigation and explained that, currently, reduced navigability limits access to traditional use locations and traditional use activities overall.

Health and Socioeconomic Conditions

[4149] Métis Nation Region 1 stated that its members use lands in and around the project area for social gatherings, recreation, and eco-tourism.

Physical and Cultural Heritage

[4150] The panel is required to take into account the physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[4151] Métis Nation Region 1 stated that its members use lands in and around the project area for cultural gatherings.

Analysis and Findings

[4152] Several Métis Nation Region 1 locals participated in the environmental assessment review process until the time that they signed agreements with Teck. These included Fort Chipewyan Métis Local 125, Fort McKay Métis Local 63, Fort McMurray Métis Local 1935, Owl River Métis Local 1949, and Lakeland/Lac La Biche area Métis Local 1909. None of these groups participated in the hearing so their evidence could not be tested. These groups are considered in other sections of this report.

[4153] Members of Métis Nation Region 1 stated that they use lands within the project disturbance area, the regional study area, and along the Athabasca for hunting, fishing, trapping, harvesting, and cultural practices.

[4154] The evidence presented by Métis Nation Region 1 was general and not specific to current use of lands by its members.

[4155] Much of Métis Nation Region 1's evidence was submitted before Teck's project update, which was submitted in June of 2015.

[4156] Métis Nation Region 1 did not attend the hearing or seat a panel of witnesses. Their evidence was not subject to direct cross-examination.

[4157] The panel finds that it is unable to fully rely on Métis Nation Region 1 evidence regarding use of lands for hunting, harvesting, and cultural practices by members which it represents.

[4158] Métis Nation Region 1 has not demonstrated that they currently use the lands or resources for traditional purposes.

Project and Cumulative Effects

[4159] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights. It must also assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources and practice of asserted rights.

Effects on Use of Lands and Resources for Traditional Purposes

[4160] Métis Nation Region 1 raised concerns that the Frontier project would limit access and cause further adverse effects on already serious cumulative effects on navigation.

[4161] Métis Nation Region 1 said they are concerned the Frontier project would have detrimental effects on their members' ability to practice traditional fishing practices and riverbed harvesting in the project areas and downstream. They said the river water intake structures could affect fish habitat by causing changes to local hydrodynamics and oxygen levels.

[4162] Métis Nation Region 1 said they are concerned the Frontier project would cause further wildlife and riparian habitat fragmentation. Métis Nation Region 1 raised specific concerns regarding caribou habitat fragmentation and population declines. They have observed caribou more regularly in subprime habitat. They have noticed that nocturnal amphibians in the Athabasca River Basin are not as abundant as they once were.

[4163] Métis Nation Region 1 stated that they are concerned about future potential environment incidents related to oil sands projects.

[4164] Teck did not provide an assessment of the effects of the Frontier project to the Métis Nation Region 1's current use of lands and resources, physical and cultural heritage, or health and socioeconomic conditions. Teck assessed the effects of the Frontier project on the following Métis Nation Region 1 Métis local councils: Fort Chipewyan Métis Local 125, Fort McKay Métis Local 63, Fort McMurray Métis Local 1935, and Lakeland/Lac La Biche area Métis Local 1909.

Effects on Health and Socioeconomic Conditions

[4165] Métis Nation Region 1 raised concerns that effluent from the Frontier project's industrial processes and runoff from tailings ponds could affect river ecosystems and aquatic life and pose threats to the health of their members who harvest fish and game in the area. They stated that they are concerned about the health of the Athabasca River.

[4166] They said that the Frontier project would increase vehicle traffic and reduce the sense of safety members feel when travelling due to increased traffic loads and large mining equipment.

[4167] They said they are concerned about the Frontier project causing an increase in population and related socioeconomic effects to housing, transportation, social health infrastructure, educational facilities, and quality of life, especially in Fort McKay and Fort Chipewyan.

[4168] They said they are concerned about the social impact of mining and work camp operations on women, children, and families.

Effects on Physical and Cultural Heritage

[4169] The panel is required to take into account the effects on physical and cultural heritage and any structure, site, or thing that is of historical, archaeological, paleontological, or architectural significance.

[4170] Métis Nation Region 1 said that its members include people who are represented by Fort Chipewyan Métis Local 125 and Fort McKay Métis Local 63 and also members who are not represented by either of these locals but who nevertheless have traditional land-use interests in the project area. These interests include use of land in and around the project area for hunting, trapping, berry and plant harvesting, cultural and social gatherings, recreation, eco-tourism activity, and natural and traditional resource conservation.

Analysis and Findings

[4171] The panel finds that it is unable to fully rely on Métis Nation Region 1's evidence regarding use of lands for hunting, harvesting, and cultural practices by its members. Métis Nation Region 1's evidence was too general and non-specific regarding the effects of the project on use of lands by its members.

[4172] Métis Nation Region 1 has not demonstrated that the project will adversely affect their members' use of lands and resources for traditional purposes, health and socioeconomic conditions, or physical and cultural heritage.

Mitigation Measures

[4173] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[4174] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

Participation Agreement

[4175] On June 15, 2018, the Métis Nation of Alberta Region 1 advised the AER and the Agency that it, as well as each of the local councils it represents, had entered into long-term sustainability agreements

with Teck regarding the project. Métis Nation Region 1 stated that the agreements include ongoing mitigation, monitoring, and management of project impacts to the environment and Métis traditional use and Métis rights, identification of contracting and employment opportunities, and provision of direct financial benefits. On the basis of commitments made by Teck to work with Métis Nation of Alberta Region 1, they do not object to the granting of approval for the project.

[4176] Métis Nation Region 1 stated that they would like to be involved in access management and monitoring or mitigation design in relation to water or traditional use activities. Teck committed to engaging with indigenous groups in the access management plan, the hydrology and water quality mitigation, monitoring and adaptive management plan, and the traditional land-use mitigation, monitoring, and adaptive management plan. Teck also stated that where an indigenous group has entered into an agreement regarding the Frontier project, Teck will uphold ongoing commitments for engagement that have been established in the agreement. The agreements include mechanisms for ongoing community input and consultation of environmental and impact management and monitoring throughout the Frontier project life cycle.

Analysis and Findings

[4177] The participation agreement and the commitments made by Teck are intended to mitigate the effects of the project on current use of land and resources for traditional purposes, physical and cultural heritage, and impacts to aboriginal rights.

[4178] The panel supports the establishment of such processes to manage mitigation measures and adapt to circumstances that may not be anticipated at this time. It expects the parties to comply with the various commitments they have made in the agreements.

[4179] A consolidated version of Teck's commitments is in [Appendix 11](#). The panel has required a number of these as conditions of the project approval. A number of these measures are outside the authority of the panel. If implemented, these commitments may reduce the effects of the project on a number of valued environmental components, which will serve to also reduce effects on indigenous use of lands. In conjunction with a number of adaptive management plans that Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Métis Nation Region 1.

[4180] Métis Nation Region 1 removed its objections to the Frontier project after entering a participation agreement with Teck. As the full details of this agreement remain private, the panel assumes that the measures agreed upon address their respective needs and interests with respect to the Frontier project. The mitigation measures that are known within these agreements will reduce the effects of the project on current use of lands and resources, physical and cultural heritage, and asserted aboriginal rights.

[4181] Métis Nation Region 1 has expressed support for the project.

[4182] Métis Nation Region 1 did not participate in the hearing. Their evidence was not subject to direct cross-examination, and most of it was submitted before signing an agreement with Teck and before Teck's project update. It is unclear to the panel how relevant the concerns about project effects identified by Métis Nation Region 1 may have changed following updates to the project.

Conditions and Recommendations

[4183] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Métis Nation Region 1. The panel also makes the following conditions and recommendations for Métis Nation Region 1.

[4184] The panel requires that Teck finalize a traditional land-use mitigation, monitoring, and adaptive management plan for the project and submit it to the AER for approval 6 months before starting construction of the project.¹⁷⁰ The plan will be required as a condition of an *EPEA* approval for the project.

Determination of Significance

[4185] The panel has not made a determination of significance for Métis Nation of Alberta Region 1 as they did not demonstrate current use of lands or that the project will affect them. Determinations have been made for some of the local councils they represent in other sections of this report.

¹⁷⁰ Draft *EPEA* Approval – Condition 3.1.7

Mikisew Cree First Nation

Background

[4186] Mikisew is a “legal band” that was created under the framework of the Indian Act in 1899, when the Cree and Chipewyan at Fort Chipewyan negotiated their entry into Treaty 8, first signed on the shores of Lake Athabasca. Mikisew members and elders consider Treaty 8 to be the foundation of a relationship between aboriginal and non-aboriginal peoples based on reconciliation, sharing, and protection of Mikisew culture, economic livelihood, and rights. At the signing of the treaty, Mikisew’s ancestors were given assurances they would be able to maintain their way of life and livelihood within their traditional lands.

[4187] With almost three thousand members, the Mikisew Cree First Nation is one of the largest First Nations in Treaty 8 and is the largest in the lower Athabasca oil sands region with a population that is young and rapidly growing. At current growth rates, the population of Mikisew rights holders will grow approximately 400 per cent over the next fifty years, with corresponding need for the healthy environments and resources on which Mikisew culture and rights depend.

[4188] Mikisew culture and way of life is grounded in the lands and waters of Mikisew traditional territory in northeastern Alberta in the area of the lower Peace River, lower Athabasca River, and the Peace-Athabasca Delta where it joins Lake Athabasca. The Mikisew practice a distinct way of life linked to travelling along waterways and maintaining a mixed economy based on trapping, fishing, and harvesting game. Culturally and linguistically the Mikisew are part of the larger Western Woods Cree cultural group, which spans the subarctic region from Hudson Bay west to the Rocky Mountains. The rich environment of the Peace-Athabasca Delta and surrounding areas has supported the development of Mikisew relationships with the environment and a unique Mikisew way of life.

[4189] The cultural heartlands of the Mikisew include large portions of what is now Wood Buffalo National Park, extending into the Birch Mountains, east along the Peace River, North along the Slave, and south along the Athabasca River. The Fort Chipewyan area has been Mikisew’s economic and administrative centre for generations, and continues to be the administrative base. The majority of members live off reserve near Fort Chipewyan, or in Fort McKay, Fort McMurray or other more southern areas.

[4190] The Mikisew submitted the following submissions:

- August 16, 2010: As Long As The Rivers Flow: Athabasca River Use, Knowledge and Change, Mikisew Cree First Nation Community Report
- November 25, 2013: Mikisew Cree First Nation Indigenous Knowledge and Use Report and Assessment for Teck Resources Limited’s Proposed Frontier Oil Sands Mine Project

- May 28, 2015: Addendum to The Mikisew Cree First Nation Indigenous Knowledge and Use Report and Assessment for Teck Resources Limited's Proposed Frontier Oil Sands Mine Project
- September 24, 2015: Wiyôw'tan'kitaskino (Our Land is Rich) A MIKISEW CREE CULTURE AND RIGHTS ASSESSMENT for the Proposed Teck Frontier Project Update
- June 15, 2015: Sakâw Mostos (Wood Bison) Mikisew Cree First Nation Indigenous Knowledge Study (Appendix 17A, pp. 305-369)
- May 25, 2018: *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*
- August 31, 2018: Mikisew Cree First Nation Hearing Submission Filing
- September 21, 2018: Mikisew Cree First Nation Evidence

[4191] The Mikisew participated in the hearing, providing submissions and direct evidence to the panel on the following dates:

- October 16, 2018: Hearing Presentation Panel
- October 17, 2018: Hearing Presentation Community Studies
- October 17, 2018: Hearing Presentation Ronald Lake Bison Herd
- October 17, 2018: Hearing Presentation Navigability
- October 17, 2018: Hearing Presentation Water Quantity, Indigenous Access and Traditional Use
- October 17, 2018: Hearing Presentation Polycyclic Aromatic Hydrocarbons
- October 17, 2018: Hearing Presentation Toxicology and Risk Assessment
- October 17, 2018: Hearing Presentation Migratory Birds
- October 18, 2018: Hearing Presentation Recommendations
- October 18, 2018: Hearing Presentation Ethical Space
- October 23, 2018: Aid to Questioning
- December 12, 2018: Handouts in Support of Mikisew Cree First Nation's Oral Final Argument
- December 12, 2018: Final Argument of the Mikisew Cree First Nation for the Hearing regarding the proposed Frontier project

[4192] On September 25, 2018, Teck announced that it had a participation agreement with the Mikisew Cree First Nation. Mikisew maintained the right to withdraw their support for the Frontier project pending Canada and Alberta committing, prior to issuing final authorizations for the project, to resolve the

outstanding issues outlined in Mikisew's August 31st, 2018, hearing submission and discharging their respective duties to consult Mikisew about the project.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[4193] The ACO advised the AER on August 24, 2018, that consultation with Mikisew for the *EPEA* and *Water Act* applications was adequate pending the outcome of the hearing process.

[4194] The ACO attended the hearing. The ACO stated that it reviewed Mikisew hearing submissions and Mikisew evidence at the oral hearing and determined that Mikisew did not identify any specific sites requiring avoidance and/or mitigation. The ACO also advised the AER that the oral hearing did not reveal new information or concerns regarding potential site-specific impacts of the Frontier project on the continued exercise of Mikisew's treaty rights and traditional uses.

Asserted or Established Aboriginal and Treaty Rights

[4195] During the hearing, Mikisew explained that Mikisew culture and rights are defined by three core components:

- Harvesting Rights: Mikisew subsistence practices in the project area;
- Way of Life: Mikisew culture, identity, language, sense of place and knowledge transfer; and
- Governance and Stewardship: Mikisew decision-making.

[4196] Mikisew knowledge holders understand Mikisew culture and rights to be protected for future generations as established by Treaty 8, specifically:

- Mikisew members have the right to be out on the land, to hunt, trap, fish, and practice their way of life fully.
- Mikisew rights do not erode or become less over time.
- Mikisew rights are held collectively to be practiced by all members in their preferred and culturally known places.
- Mikisew members should be able to maintain relationships with lands and waters free from disturbance or outside interference, and with confidence.
- Mikisew members should be able to maintain access a full cultural landscape and a right for Mikisew's stewardship norms, values and laws to be demonstrably incorporated and respected in Crown decision-making.
- Mikisew members have an inherent right to hunt bison.

[4197] Mikisew identify a number of conditions that are necessary to exercise Mikisew's asserted aboriginal and treaty rights, including:

- *Sakaw pimacihwin* (Bush Way of Life): Maintaining a healthy land-based way of life.
- *Wiyow'tan kitaskino* (Our Land is Rich): access to sufficient quantity of traditional resources, such as bison, moose, migratory birds, fish, in culturally relevant areas.
- *Sakaw Mostos* – Wood Bison (Keystone Species): With the Ronald Lake bison as the only herd accessible to Mikisew, its value is greatly increased as a cultural keystone species.
- Access to Areas for traditional uses.
- *Kistinawi* (Confidence): experiencing environmental health, including being able to trust the quality of water and traditional resources.
- *Ayapaskaw* (Cultural Landscape): The Peace-Athabasca Delta, which is the centre of Mikisew's traditional lands that has sustained the Mikisew for generations.
- Buckton Creek watershed: the watershed flows directly northward into Lake Claire to the Peace-Athabasca Delta both culturally important areas.
- *Nipi tapitum* (Water is Boss): Mikisew are dependent on a deltaic environment to practice their rights, therefore, clean and abundant water is needed for travel and a healthy ecosystem.
- *Kitaskino* (Experience): maintaining sense of place through ongoing relationships and connections with lands and waters.
- Future Generations: being able to experience all of the above without intergenerational interruptions is necessary for the transfer of indigenous knowledge and to maintain Mikisew social structures and family connections that enable the exercise of Mikisew's rights to be continued into the future.
- *Kitaskinaw owicita* (Governance and Stewardship): the obligation to live responsibly and prudently manage the ecosystems that support Mikisew's way of life.

[4198] The panel's terms of reference requires it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by or the strength of such claims. But, for the purposes of assessing the potential effects of the Frontier project the panel accepts the rights being asserted.

Context of Historical and Current Cumulative Effects

[4199] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous group's ability to access and use lands and resources, their ability to practice culturally important activities or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew and the Agency, effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability

to exercise their asserted aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

Use of Lands and Resources for Traditional Purposes

[4200] Mikisew's traditional land-use assessment and cultural impact assessment examined anticipated effects of the project within the project footprint and the local and regional study areas. The local study area defined by the Mikisew is equivalent to the project footprint plus a 5 km buffer. The regional study area represents an area where Mikisew anticipate they may experience direct, indirect, or induced effects of the project and is equivalent to the project footprint plus a 25 km buffer around the project and extending downstream to receiving waters of Lake Claire and the Athabasca Delta.

[4201] Mikisew explained that the Frontier project's local and regional study areas exemplify the Mikisew phrase *Wîyôw'tan kitaskino* or "our land is rich" where confidence and diversity of resources required for the Mikisew seasonal round is available.

[4202] Moose are currently the most commonly hunted large mammal for its members. Mikisew stated that the absence of permanent roads in large portions of their territory means that many preferred moose hunting areas, including areas nearest the Frontier project, are only accessible from Fort Chipewyan and the Athabasca Delta by boat, especially in the spring, summer and fall. In winter, rivers and creeks remain important for access and moose harvest as they are used alongside inland trails and bush roads, and as travel corridors for snow machines. Although moose are still relatively abundant, Mikisew members report declines in their numbers in the past fifteen years in the southern portions of Mikisew territory.

[4203] Mikisew stated that *Sakaw Mostos* or wood bison are a keystone species integral to their cultural, spiritual, and ceremonial practices with the skulls used in ceremonies and in sweat lodges as altars. Their members prefer the Ronald Lake bison as they feel that the herd is 'clean' and safe from disease and industrial contamination. Members are free to hunt bison and practice rights in the area of Ronald Lake and west of the Athabasca River in ways that are not possible within Wood Buffalo National Park. Mikisew stated that the project area, including Ronald and Diana Lakes, north of the Frontier project, remains the most important bison harvesting area available to Mikisew members.

[4204] Mikisew stated that although bison is one of the most preferred Mikisew foods, they have been largely removed from the seasonal round as a result of industrial and ecological changes and compounded by government policy. As a result, bison populations in Mikisew's territory fall far below the threshold Mikisew has established for harvesting levels needed for the full expression of Mikisew's rights.

[4205] Mikisew stated that they hunt migratory birds in the regional study area including various species of ducks and geese, and less commonly cranes, swans, and other large birds. Duck and goose eggs are collected in spring during nesting and summer moulting. Mikisew stated that bird camps provide an important social focus for the Mikisew seasonal round and offer unique annual opportunities for large

community wide harvesting and sharing of knowledge. Mikisew knowledge holders have observed changes in the patterns of migratory birds, including ducks and geese, with fewer birds travelling the Athabasca River corridor, and more travelling east and west around oil sand mine areas. This has resulted in an overall decline in the availability of migratory birds for Mikisew harvest. In periods of low water flow, Mikisew members also have difficulty accessing preferred bird hunting areas in the local study area and regional study area.

[4206] Mikisew fish harvesting areas include the confluence of the Firebag and Athabasca Rivers, the Peace-Athabasca Delta and areas further downstream near a traditional settlement called Snowbird's Settlement, located on the Embarras River. The absence of easily accessible roads into these important harvesting areas limit demands on the fish species by non-indigenous land users and favours Mikisew fishers.

[4207] Mikisew members have widespread concerns regarding the health of fish, and the safety of eating them resulting in limiting or avoiding harvest or consumption of fish from the Athabasca River and many becoming distrustful of fish caught in the wider Peace-Athabasca Delta. Mikisew's use of aquatic resources, including fishing, has been heavily impacted by existing development along the Athabasca River and into the Athabasca portion of the Peace-Athabasca Delta. This is due to of the extension of oil sands mining effects downstream, and Mikisew observation of contaminants, fish deformities, and changes in fish quality and taste. Mikisew reported large-scale fish kills in Lake Claire in the last decade. Small inland lakes that are upstream of the Athabasca River, including Ronald Lake, are increasingly important for Mikisew fishers as there is now a general preference to harvest fish in smaller inland lakes and streams that are away from industrial contaminants. Canada's preliminary assessment on potential impacts on the exercise of Mikisew rights related to resource use stated a potential reduced ability to fish due to loss of confidence in downstream aquatic environments, including in culturally important fishing areas at the confluence of Firebag and Athabasca Rivers and Snowbird's camp.

[4208] In the regional study area, water levels and water quality, as well as concerns regarding fish and other aquatic resources, have become major challenges to Mikisew confidence. While many knowledge holders commented on having confidence in much of the regional study area (especially the Birch Mountains and areas around Diana and Ronald Lakes and Lake Claire), loss of confidence in water quality and other subsistence resources south of the Firebag River is already widespread because of upstream mines.

[4209] Important trapping species for the Mikisew include muskrat, lynx, marten, rabbit, beaver, otter, red fox, silver fox, cross fox, weasels, fisher, coyote, wolves, wolverine, skunk, squirrel and mink. Beaver and muskrat are the most commonly trapped species in the local study area and regional study area. According to information provided by the Mikisew, the productivity of fur harvesting in the regional study area is closely associated with the availability of wetlands along creeks and rivers flowing from the Birch Mountains and along the shores of Lake Mamawi and Lake Claire coupled with healthy populations

and relatively undisturbed mature boreal forest habitats. Mikisew trap both inside and outside Wood Buffalo National Park and inside and outside of provincially designated registered fur management areas.

[4210] Currently there are four RFMAs held in whole or in part by Mikisew members, including RFMAs 1570, 2892, 2215, and 2453. Mikisew explained that RFMA 2892, which intersects the project footprint and spans the local and regional study areas, contains a network of camps, cabins, and trapping trails. Areas associated with RFMA 2892 are heavily used for fur harvesting. A second Mikisew trapline (RFMA #1570) is located north of the local study area but within the regional study area. Both traplines are located on the west side of the Athabasca River and north of the Firebag River. Teck stated that RFMA 2892, as it is held by a Mikisew trapper; it is not discussed in its assessment. Teck has not made any statements regarding potential impacts to RFMA 1570, RFMA 2215, or RFMA 2453. In the current situation, many Mikisew use and rely on family traplines mainly for cultural reasons, though trapping and trading of fur is still also an important economic activity for some.

[4211] Mikisew stated that their ability to harvest muskrat, lynx, marten, and mink is declining. Mikisew knowledge holders link these declines to declining water quantity and quality caused by industrial projects, leading to the loss of quality wetland habitat. Additionally, as lynx and martin prefer mature forest habitats [as per Mikisew knowledge holder] declines are attributed to industrial development, deforestation, and habitat destruction.

[4212] Mikisew stated that many critical and preferred use areas for plant gathering are located in the local and regional study areas, including the Athabasca River corridor, the Buckton Creek drainage basin and areas around the shores of Lake Mamawi and Lake Claire. Successful gathering of medicinal plants depends on the presence of wetlands or lake and river shores. Medicinal plant harvest is particularly sensitive to environmental contaminants where harvesting medicines in 'clean' areas removed from industrial contaminants, roads, or other disturbances is essential.

[4213] Berries are by far the most commonly harvested plant foods by the Mikisew. Much of the harvesting takes place in the local and regional study areas. Cultural and spiritual areas including medicinal plant collection areas are located in the area of the proposed bridge crossing. *Apsakiwoskos*, a heart medicine for the Mikisew, and *eyikatasiki*, which are harvested in the foothills of Birch Mountains and around Lake Claire, are difficult to locate elsewhere.

[4214] Mikisew knowledge holders reported declines in the occurrence of harvestable berries and plants throughout the local study area and regional study area since the late 1990s. Reduced water levels in the Peace-Athabasca Delta and along the Athabasca River have resulted in berry patches 'drying out' with smaller and less abundant fruit. Other customary plant food and medicine harvesting areas, especially those that rely on riparian areas and seasonal flooding, including rat root and mature birch, are also declining because of drying and invasive plants that Mikisew elders associate with oil sand mine construction along the banks of the Athabasca. Mikisew stated that concerns regarding oil sands

contaminants are also increasing and affect harvesting in a wide area surrounding existing mines and extending along the Athabasca River to the Peace-Athabasca Delta.

Mikisew Use of Waterways

[4215] A common theme in the land and resource use described by the Mikisew is the importance of sufficient water quantity and quality in the territory. The Mikisew phrase *Nipi tapitum*, meaning water is boss, is a summation of generations of accumulated indigenous knowledge about how the waters that create the Peace-Athabasca Delta are important for the ecosystem and continued practice of Mikisew rights. Clean and abundant water provides for safe drinking, healthy resources in the Peace-Athabasca Delta, and access throughout Mikisew territory.

[4216] The Athabasca River and its tributaries are an essential transportation corridor required for continued access to the Mikisew traditional territory. The Athabasca River is also used as a travel corridor between Fort McMurray and Fort Chipewyan and to places in between. Buckton Creek, Lake Claire, and Lake Mamawi are historically and currently important transportation routes vulnerable to low water levels. When water levels are low, and access by boat is lost, Mikisew are not able to harvest resources, and thus Mikisew members are effectively alienated from meaningful practice of Treaty 8 rights.

[4217] Mikisew travel primarily by boat within the regional study area in ice-free conditions along the Athabasca River and into Lake Claire. It has become difficult in recent years because of unreliable (low) water levels, especially along the Athabasca River south of Poplar Point in the area of the Firebag River (adjacent the project), through Lake Mamawi and at the south end of Lake Claire. They stated that reduced stream flows entering the Athabasca River, and flowing into Lake Claire, are resulting in increased impediments to navigation and reduced access to lands and resources by Mikisew members during low-water ice-free conditions.

[4218] Mikisew explained that in the area of Lake Claire and Wood Buffalo National Park, changes resulting from industrial activities are already being experienced, including lower water levels, perceived changes in water quality and disturbance from light visible at night, and industrial odours, especially during winter. Effects of reduced water levels at the south end of Lake Claire, and in the area of Lake Mamawi are currently affecting the ability of Mikisew members to access migratory bird harvesting areas around Buckton Creek and elsewhere in the regional study area.

[4219] The Mikisew described the Peace-Athabasca Delta (or *Ayapaskaw* in Cree) as a keystone cultural landscape and a primary location for harvesting, social networking, economic prosperity, and political and cultural activities that are vital to the continuity of the Mikisew. The Mikisew refer to the delta as their home, grocery store, classroom, medicine cabinet, church, highway, photo album, and the place where their happiest memories live. *Ayapaskaw* also informs the Mikisew worldview:

[4220] “For us, *Ayapaskaw* is everything. Our way of life is grounded in a generations-old relationship between Mikisew people and the superlative network of wetlands, reed banks, lakes, and waterways that form *Ayapaskaw*. ”

[4221] Mikisew stated that the Peace-Athabasca Delta is no longer meeting ecological integrity criteria or the conditions Mikisew members require to exercise their asserted aboriginal and treaty rights. Mikisew elaborated that while the Peace-Athabasca Delta was once a source of spiritual and cultural health, the delta is now increasingly identified as a place that can no longer provide Mikisew with food and cultural security. Mikisew presented evidence to show ongoing negative trends in water quantity, water quality, native vegetation, wildlife populations and health, migratory bird habitat and indigenous access across the delta. Mikisew stated that they believe that upstream oil sands projects contribute to these negative trends.

Health and Socioeconomic Conditions

[4222] During the hearing, the Mikisew described the idea of confidence (*Kistinawi*) in the quality and quantity of surrounding resources, and in one’s ability to rely on lands and waters as integral to Mikisew sense of place and identity and a requirement for a healthy community. Confidence suggests trust or security in a relationship to lands and waters that is not only physical, but also spiritual in nature. Confidence is maintained through personal experience and through comparing experience with knowledge passed on by other respected knowledge holders. It is increased where places and conditions, like water levels, are reliable and familiar and reduced where problems are perceived, or where ordinarily reliable conditions, like water level, become unpredictable. Confidence in traditional resources is based on indigenous knowledge indicators, such as the smell and taste of water, the spirit of the water, behaviour of wildlife, the prevalence of invasive species, and the quality of ice. Mikisew state that experiencing environmental health, including being able to trust the quality of water and traditional resources, is of fundamental importance to the ability of Mikisew members to exercise their asserted aboriginal and treaty rights.

[4223] Mikisew members have expressed the importance of continuing to consume wild meat and as part of their diet; meanwhile the decline of traditional foods has had detrimental impacts on their hunting and livelihoods. Transportation challenges and habitat destruction resulting from declining water levels have affected the ability of Mikisew harvesters to maintain their livelihoods.

[4224] Firsthand experience and observation of industrial processes by Mikisew elders and land users is resulting in avoidance of harvesting near oil sands operations. Mikisew explained that members have observed changes in the quality of water, wild foods (including fish, moose, and berries), and aquatic resources (including fish and medicinal plants) on the Athabasca River system since at least the mid-1980s. These changes in quality are mainly attributed by Mikisew members to oil sands development and have led to fear, avoidance of wild foods, impaired use of large portions of territory, and other

psychosocial impacts associated with contaminants. Mikisew explained that the resulting and widespread loss of confidence in the quality of fish, water and other aquatic resources near and downstream of existing oil sands facilities is having a serious effect on Mikisew knowledge and use practices and traditional livelihoods throughout the Athabasca River system. Mikisew members report that portions of the local study area and regional study area have already become affected to the point where Mikisew use is impaired.

[4225] The availability of traditional resources in Mikisew's territory is insufficient to meet the harvesting levels that were supportable prior to industrial development. Declining quality of resources is widespread in Mikisew's territory, including the Peace-Athabasca Delta, and is eroding Mikisew confidence in the safety of water and the health of traditional resources. Mikisew evidence shows that trust in traditional resources have been impacted by repeated observations of deformed fish, deformed rabbits, sick moose, deformed eggs and other abnormalities in traditional resources, beginning in the mid-1980s and thus having a probable links to oil sands activities. For at least some Mikisew members, residual effects from existing oil sands and related development have already resulted in impaired or lost use of preferred areas within southern portions of the local study area and regional study area. Mikisew consistently indicate an area of general impaired use near existing oil sands activity south of the Firebag River, including a portion of the updated Frontier project local study area.

[4226] Mikisew knowledge holders indicate there has been a negative trend in the quality of the water in harvesting areas, attributed primarily to upstream pollution from oil sands on the Athabasca River, and flow regulation on the Peace River, resulting in less frequent recharge and flushing of wetlands. Mikisew land users have observed an increase in scums and films in water bodies, decreased quality and taste or texture of fish, changes in taste and smell of water, changes in fish and animal health, including deformities, and changes in aquatic invertebrate presence. Taken together, these changes have led to an overall perception of risk and loss of confidence in the use of water and wildlife, resulting in serious impact to the way of life for many Mikisew families.

[4227] Mikisew stated that knowledge holders trace numerous human health impacts to existing industrial pollution and expect the project would worsen this situation. Mikisew stated that project effects on the physical and mental health of wildlife and members is a significant concern that has become heightened in recent years with growing numbers of cancers in the community. Mikisew explained that Mikisew families have experienced or lost loved ones to cancers, respiratory problems and other health issues attributed by Mikisew members to oil sands developments.

[4228] Mikisew cited that Health Canada (2005) identified several psychosocial factors associated with contamination, at least some of which are clearly affecting Mikisew use of lands and waters, including distrust, grief, guilt, sense of depersonalization, frustration, isolation, and depression. Mikisew stated that the well-being of the entire Mikisew community has been affected by changes south of the regional study area as some families have lost access to customary areas and have been forced to either stop practicing

their way of life or rely more heavily on other families and less familiar areas, sometimes resulting in conflict between displaced Mikisew members and other communities.

[4229] Mikisew stated that current challenges to maintaining preferred livelihoods and sharing relationships include industrial contaminants, loss of traditional water and food sources, decreasing availability of culturally important species, decreased trust in environmental quality, and reduced return on effort due to increasing costs of equipment and fuel. Social networks have also become impaired as fewer families are able to access lands or maintain seasonal cabins and camps. Fewer people on the land means that travel becomes more difficult and risky.

[4230] Industrial development along the Athabasca River is having far-reaching and multigenerational effects on Mikisew knowledge and use. Several Mikisew knowledge holders reported that their children, grandchildren, parents or grandparents have moved away from Fort Chipewyan and ancestral lands in recent decades to live in areas upstream of the oil sands where health is considered less at risk from oil sands related water and environmental contamination. Concerns regarding wild foods and environmental contaminants have influenced health decisions and out-migration decisions, ultimately creating a barrier to enduring transmission of cultural knowledge and *sakaw pimacihwin* to younger generations. Mikisew oral history evidence suggests that concerns regarding contamination of the Athabasca River and adjacent resources by oil sands development was one of the main reasons why many Mikisew members stopped living year round in the area of Snowbird's Settlement (Embarras Portage) on the Athabasca River. Effects of environmental contamination of wild foods create a barrier, even within families, for the transmission of cultural knowledge to younger generations

[4231] Industrial changes associated with oil sands mining have reduced opportunities for living on the land and resulted in impairment of social roles, reducing the amount of time parents and grandparents have with their children, and impairing the role of elders and expert Cree knowledge holders in decision-making and stewardship of particular territories and lands.

Physical and Cultural Heritage

[4232] The panel is required to take into account physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[4233] The Mikisew continued practice of their Treaty 8 rights is directly connected to the concept of *sakaw pimacihwin*, meaning a healthy land-based way of life. *Sakaw pimacihwin* exemplifies a continuity of knowledge, relationships, and practice passed on from past generations to present and future generations. Required characteristics for Mikisew to continue their practice of *sakaw pimacihwin* include;

- freedom of cultural practice without fear or interference associated with industrial contaminants, sensory disturbance, regulatory restriction or other external influence,

- maintaining confidence in the lands and resources in familiar areas,
- freedom to return to preferred, familiar and cultural sites over time,
- living on the land in places where ancestors lived previously, including at cabins and camps along the Athabasca River and around Lake Claire,
- experiencing environmental health and confidence in the quality of resources in accordance with Mikisew's seasonal round,
- experiencing individual and community health,
- maintaining place-specific knowledge, sense of place, and continuation of Mikisew language and identity,
- maintaining access to culturally important places using customary trails and water routes,
- encouraging intergenerational transmission of knowledge and continuity of practice,
- maintaining social networks, roles, and respecting family group areas,
- upholding Mikisew's stewardship values, and
- instilling the Mikisew way of life in future generations.

[4234] Mikisew explained that sense of place is an important experiential element that is intrinsic to their practice of rights, where maintaining ongoing relationships and connections with familiar and preferred lands, resources and waters is a necessary requirement. Mikisew indicators of a supportive sense of place include solitude, lack of sensory disturbances, safety, and cultural connections to an area. Mikisew explained the importance experiencing and enjoying the beauty of lands and waters without human structures or the worries of hearing, seeing or smelling industrial activities.

[4235] Mikisew assert that their sense of place in the regional study area is currently challenged by perceivable light pollution from existing oil sand mines visible at night, and air pollution, including industrial smells, perceivable as far as Fort Chipewyan and Lake Claire depending on wind, temperature and other conditions. These are particularly evident in fall and winter when hunting for moose, migratory birds, and bison, and along the Athabasca corridor. Based on Mikisew experience with large-scale oil sands mines, the continuity of relationships between place and culture maintained through harvesting and living on the land, is regularly and predictably severed or impaired by industrial effects. They indicate that once a relationship of this kind is severed for multiple decades by an oil sand mine, there is no evidence that reclamation can successfully achieve a level of cultural acceptability or confidence similar to predisturbance conditions.

[4236] Mikisew explained that cabins and camps used while harvesting and living on the land provide an important physical, social and cultural refuge for the Mikisew. When harvesting is not actively practiced, family cabins and camps provide a critical cultural resource relied on at different points in a Mikisew

member's life to reconnect with extended families or renew culturally important relationships with land and water. Mikisew members use the cabins and camps near Lobstick Point and along the Athabasca River regularly. Mikisew identified a number of culturally important habitation sites in the project footprint where the majority of them overlap with proposed project infrastructure planned near the Athabasca River.

[4237] The local study area contains several cultural and spiritual sites, including one burial site, two ceremonial sites, and locations for gathering medicinal plants, teaching areas, and two place names, including a place name for *Otabinask Minstik* ("Sled Island"). One Mikisew Indian Reserve (Old Fort #217) is located within the regional study area on the east side of the Athabasca River near Embarras Portage and Snowbird's camp.

[4238] Mikisew members with cabins near Fort Chipewyan and on Lake Claire said that existing levels of oil sand development are already visible at night as a result of a low glow of industrial light visible in the south, and unpleasant smells associated with oil sand production carried on the wind. Mikisew members with cabins further south along the Athabasca River are familiar with other impacts of noise, disturbance, vandalism, pollution, and lost sense of place as a result of industrial change. Effects of reduced water levels at the south end of Lake Claire, and in the area of the Athabasca River and Lake Mamawi are already impacting the ability of their members to access ancestral cabin and camp areas around Buckton Creek and elsewhere in the regional study area.

[4239] Mikisew stated that unmitigated effects from existing oil sands projects are widespread, acute, and have already caused serious declines in Mikisew use and occupancy in portions of the local study area and regional study area since at least the mid-1980s, and particularly in the past decade. Mikisew elaborated that environmental effects resulting from industrial disturbance, habitat loss, and contamination are acting cumulatively and are having cascading effects on the Mikisew, their intergenerational transmission of cultural knowledge, and on their ability to meaningfully practice *sakaw pimacihwin*, or a bush way of life, within the local study area, regional study area, and beyond. Since approximately 2000, accumulated industrial impacts in the regional study area have resulted in lost or impaired use by multiple Mikisew members due to road controls, traffic, noise, dust, smell, ground disturbance, perceived contamination, and disturbance by recreational users.

[4240] Mikisew stated that the well-being of the entire Mikisew community has been affected by changes south of the regional study area as some families have lost access to customary areas and have been forced to either stop practicing their way of life, or rely more heavily on other families and less familiar areas, sometimes resulting in conflict between displaced Mikisew members and other communities.

Analysis and Findings

[4241] Teck did not contest the evidence provided by Mikisew. Mikisew appeared at the hearing and had its evidence tested through questioning. The panel finds it is able to rely on the evidence presented by Mikisew and summarized above.

[4242] Mikisew presented specific evidence that some members use lands for harvesting and cultural practices in and within 5 km of the project development area that will be directly affected by the project. Specifically, the panel finds from the evidence:

- Mikisew use the local and regional study areas to exercise their rights to hunt, trap, fish and gather.
- The local study area is of particular importance to the Mikisew because of the critical habitat relied on by the last remaining herd of harvestable wood bison available within the Mikisew territory.
- Mikisew use of historic camping and trapping sites in the area of Snowbird's Settlement (Embarras Portage).
- Mikisew reserve lands and traplines are located along the Athabasca River and in southern Wood Buffalo National Park including Buckton Creek and Lake Claire.
- Mikisew trapline RFMA #2892 intersects with the proposed project footprint on the west side of the Athabasca River and north of the Firebag River.
- Mikisew Indian Reserve (Old Fort #217) is located within the regional study area, on the east side of the Athabasca River near Embarras Portage and Snowbird's camp.
- Within the local study area, the confluence of the Firebag and Athabasca rivers is an important historical fish harvesting area for the Mikisew.
- The Frontier project is proposed on the west bank of the Athabasca River, in an area with a long history of Mikisew habitation important to the Mikisew for fishing, hunting moose, wood bison and other animals, and other uses.
- There are regularly used cabins, village sites (Snowbird's camp), and habitation areas associated with Mikisew Indian Reserve lands within the regional study area.
- Mikisew use of lands and waterways for harvesting is integral to Mikisew cultural continuity providing enduring intergenerational transfer of Mikisew knowledge, language, and place names.

[4243] The evidence also demonstrates the importance to the Mikisew of transportation routes to fishing, hunting and trapping in the Peace-Athabasca Delta, the Athabasca River, Buckton Creek, Redclay Creek, and Lake Mamawi to Lake Claire in Wood Buffalo National Park, and the relationship to water level recharge from the Athabasca River.

[4244] The panel finds that Mikisew currently use lands including uses associated with exercising its asserted Treaty 8 rights to hunt fish and trap and for the practice of culturally important activities in specific areas within and adjacent to the project disturbance area.

Project and Cumulative Effects

[4245] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights, and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources, and practice of asserted rights.

[4246] Mikisew submitted *The Mikisew Cree First Nation Indigenous Knowledge and Use Report and Assessment for Teck Resources Limited's Proposed Frontier Oil Sands Mine Project* submission, the *Wiyôw'tan'kitaskino (Our Land is Rich) A MIKISEW CREE CULTURE AND RIGHTS ASSESSMENT for the Proposed Teck Frontier Project Update* submissions. They also provided a number of other written submissions and oral submissions from Mikisew members to the panel describing the potential effects of the project on their use of lands and resources, health and socioeconomic conditions, and physical and cultural effects of the project.

[4247] Canada submitted a *Government of Canada Preliminary Assessment of Potential Impacts on Asserted or Established Aboriginal or Treaty Rights* to the panel. Canada's submission is intended to "1) elaborate on the co-developed methodology that Mikisew and the Agency provided to the panel on May 25, 2018; (2) provide the Government of Canada's preliminary assessment that applies the methodology with respect to potential impacts of the proposed project on aboriginal or treaty rights, and recommendations for mitigation measures that arise from the application of the methodology; and (3) provide the panel with an explanation of proposed accommodation measures that are currently being contemplated at this early stage by the Canada and Mikisew, that may address identified potential impacts on aboriginal or treaty rights, and that the panel may wish to consider in the development of any of its recommendations."

[4248] In consultation with Mikisew, Teck agreed not to undertake a proponent-led traditional land-use assessment for Mikisew and no discussion of the effects on their traditional land use was included in its traditional land-use analysis project update analysis. Teck relied on the Mikisew rights and culture impact assessment which Teck and Mikisew were developing cooperatively. In its update, Teck stated that it expected to continue cooperatively working with Mikisew on the review of the rights and culture impact assessment, and the resolution of Mikisew issues and concerns.

Effects on Use of Lands and Resources for Traditional Purposes

Mikisew's View**Habitat**

[4249] The project is located in an area recognized by Mikisew members as having important habitat for cultural keystone species including wood bison, woodland caribou, and moose. In the local study area Mikisew site-specific environmental features include important moose and bison habitat areas, as well as drinking water sources, and boreal caribou range. Beyond the local study area, but within the regional study area, the values most at risk of project effects are areas of wood bison habitat and downstream environmental features as a result of increased perceived contamination of traditional resources and foods.

[4250] Mikisew are concerned about the destruction of habitat within the footprint, including dewatering of muskeg, removal of upland lakes, and habitat impacts resulting from reduced water levels downstream of the project including Diana and Ronald Lakes and in the Athabasca Delta.

[4251] Inside the updated project footprint there are 28 documented Mikisew site-specific subsistence values that will be destroyed or rendered unusable by the project due to its proximity to the Athabasca River. In the local study area up to 213 documented Mikisew site-specific subsistence values will be adversely impacted by direct disturbance and destruction of habitat, reduced Mikisew access, increased industry and recreational access, and fear associated with increased contamination of traditional resources or foods, leading to an increased scope and intensity of avoidance or reduced use. In the regional study area 5482 Mikisew site-specific subsistence values have been documented, including large concentrations of values along the Athabasca River and in the Athabasca Delta. In the regional study area, the values most at risk of project effects are downstream of the Frontier project along the Athabasca River and in the area of Ronald and Diana Lakes and Buckton Creek flowing into Lake Claire, including some of the most important and preferred Mikisew harvesting areas for bison.

[4252] Mikisew stated that the Frontier project will directly impact preferred bison harvesting areas around Ronald and Diana Lakes with effects extending well beyond 5 km of the project footprint. It would result in the elimination of all or almost all Mikisew harvesting for multiple Mikisew generations in an area that currently includes 91 per cent of recorded bison harvest sites south of Wood Buffalo National Park. They also anticipate the Frontier project will affect caribou and moose hunting, migratory bird harvesting, fishing, and terrestrial and aquatic plant gathering in the regional study area. Mikisew explained that protection measures such as access management, limits on non-aboriginal hunting, and limits on industrial development are critical for the future viability of the Ronald Lake bison and the practice of their right to hunt bison in preferred areas and using preferred means.

[4253] Mikisew stated that the Frontier project habitat destruction will reduce moose movement and numbers between the Athabasca River and the Birch Mountains, which would affect their ability to harvest the species.

[4254] Mikisew stated that downstream drying of habitats as a result of the Frontier project may reduce quantity of plants in preferred harvesting areas, especially riparian and wetland-dependent plants (e.g., ratroot) and berries (e.g., high and low-bush cranberries). They anticipate that effects on the ability to gather important aquatic plants, such as ratroot, will extend to Lake Claire and beyond. Effects on rare and hard to find plants, such as *Apsakiwoskos* ("heart medicine"), are likely to be negative and require further investigation. They said that current plant harvesting areas and culturally important plants, especially berries and medicines, are likely to be considered unsuitable for subsistence use based on their perceived quality.

Access

[4255] In the local study area, 36 documented Mikisew transportation values associated with the Athabasca River water route, as well as non-site-specific transportation values along portions of Buckton Creek and Redclay Creek, will be impacted or rendered unusable by the Frontier project.

[4256] Mikisew knowledge holders stated that increased access into the area because of Teck's exploration work has already created a situation in which the Ronald Lake bison is being hunted unsustainably by guide outfitters and other non-aboriginal hunters whose access is facilitated by Teck activities.

[4257] Mikisew expressed deep concern that the Frontier project will have similar effects on areas around and downstream of the project as have been experienced by Mikisew members living in the vicinity of existing oil sand mines.

Wildlife

[4258] Mikisew identified potential outcomes for the Ronald Lake bison if the Frontier project proceeds:

- Extirpation or near extirpation: Through a combination of stress, habitat loss, predation pressure, and increased hunting access by non-aboriginal sport hunters and outfitters as a result of project bridges and other infrastructure. Mikisew knowledge holders consider complete extirpation of the herd to be a very real possibility.
- Contamination: The herd is considered less suitable, or unsuitable for harvest because of Mikisew concerns of contamination due to proximity of industrial development.
- Displacement to Wood Buffalo National Park and disease transmission: The herd, or portions of the herd moves north into Wood Buffalo National Park. Mikisew members lose the ability to hunt them because of park restrictions and the herd comes into regular contact with park bison populations and the contagious diseases they carry.
- Displacement to Birch Mountains and inaccessibility: The herd, or portions of the herd, leaves its current range and moves further west into the Birch Mountains. Mikisew members lose the ability to

hunt them because of limited access and because the herd's movement patterns, with winter range near the Athabasca River, no longer correspond with Mikisew winter bison hunting periods and preferred hunting areas.

[4259] They assert that the Frontier project is likely to have impacts to the perceived health of moose in the local study area and extending downstream to the preferred moose harvesting areas of Lake Claire and the Peace-Athabasca Delta.

[4260] Mikisew members consider migratory birds to be vulnerable to large-scale, regional effects on water quantity and quality, because of migratory bird's reliance on aquatic resources and because of large-scale migration patterns that interact with oil sands developments. Mikisew stated that the project will directly impact preferred migratory bird harvesting as a result of impacts to habitat and migratory bird fly ways, drying of habitat as a result of changes in water flow, impacts to air quality, and increased levels of sensory disturbance affecting bird migration.

[4261] The Whole of Government submission noted that the Mikisew are self-imposing hunting bans and restrictions based on concerns about extirpation or near extirpation of the herd due to current development in the area with concerns that this situation may become compounded with the approval of the Frontier project.

Fishing

[4262] The project would affect preferred fishing areas in the Athabasca River, including the confluence of the Athabasca and Firebag, as well as in the area of Ronald and Diana Lakes, as a result of changes in water flow, construction of in-stream infrastructure (the Athabasca River bridge and water intake facilities), and increased levels of air and water based contaminants released into the environment. They indicate the project is likely to contribute to existing vulnerability of fish populations in Lake Claire and the Peace-Athabasca Delta as a result of reduced water levels and increased deposition of nitrogen and other contaminants. They stated that the effectiveness of the fish compensation lake is highly uncertain as Mikisew members are unlikely to find industry created fish habitat to be culturally acceptable.

Trapping

[4263] Project effects are likely to be most severe for Mikisew members practicing a bush way of life in areas closest to the project, Mikisew trapline, and cabin areas within the project footprint and along the Athabasca River. Impacts will extend beyond affected Mikisew individuals to all Mikisew members as a result of resulting erosion of knowledge held by active land users. The project is anticipated to impact the ability of future Mikisew generations to experience and learn from a continuity of Mikisew way of life knowledge and practice within the local study area and regional study area.

[4264] Mikisew asserts that the project will directly impact and destroy large portions of culturally important fur trapping areas along the Athabasca River due to drying of habitat, reduced water levels, and impacts of contaminants.

- Clearing and habitat destruction will remove portions of RFMA 2892 including mature timber habitat for lynx, marten, and mink.
- Mikisew trapline area (RFMA #2892) and a network of camps, cabins, and trapping trails associated with it are located within the project footprint and spanning the local study area and regional study area.
- The project will also interrupt trails connecting the Poplar Point area to areas further south.

[4265] The Whole of Government's preliminary assessment on potential impacts on the exercise of Mikisew harvesting rights related to traditional resources including food, medicinal plants, migratory birds, fur-bearers, and large mammals (i.e., bison, moose and caribou) indicated potential changes in harvesting success including;

- a loss of preferred areas and timing of harvest thereby disrupting the Mikisew seasonal round,
- a decrease in the quantity of wildlife available due to decreased reproductive success, increased predator-prey interactions and increased competition from non-aboriginal hunters,
- a reduction of quantity of resources (vegetation, wildlife, and fish) due to habitat destruction,
- a decrease in the ability to harvest due to perceived quality of the resources (vegetation, wildlife, and fish) leading to loss of confidence and avoidance behaviour,
- movement of the wildlife from familiar harvesting sites due to sensory disturbance, and
- clearing and habitat destruction may destroy portions of RFMA 2892.

Water

[4266] Mikisew explained that the northern part of the Frontier project crosses into what Mikisew refers to as the Buckton watershed, which flows directly northward into Lake Claire in the Peace-Athabasca Delta. Mikisew's land users and elders stated that the protection of the watersheds that flow into Lake Claire, including the Buckton watershed, is an urgent priority as the health of the Buckton watershed is necessary for the integrity of the Peace-Athabasca Delta and Mikisew's enduring cultural and spiritual relationship to it. Mikisew members expressed great concern regarding the intensification of effects on the Athabasca and the expansion of the effects of industrial development into watersheds that flow into what are currently un-impacted and pristine areas of Wood Buffalo National Park and Lake Claire.

[4267] Mikisew asserted that changes to the environment during construction and operation of the Frontier project will affect land- and river-based access and navigation by Mikisew members using the Athabasca River and Peace-Athabasca Delta. Mikisew stated that road closures, access controls,

destruction of trails and other transportation routes, and increased traffic within the local study area and regional study area will affect Mikisew way of life.

[4268] Mikisew asserted that the presence of the bridge on the Athabasca River will effect wildlife resources, movement corridors, disrupt riparian habitats, and increase the risk of accidents and spills and potential contamination on or near the bridge and access roads. Mikisew stated that they expect the construction of the Athabasca River bridge to lead to changes in the riverbed and channels and increase the risk of hazards on the river, including sandbars and bridge structures, and fencing and access control in important riparian areas near the bridge. Combined with existing and proposed water withdrawals, the bridge and associated risks would make this already difficult to navigate section of river more difficult for Mikisew users.

[4269] Mikisew expressed concerns that all-weather road access would increase hunting pressure on wildlife resources. They asserted that the Frontier project is likely to result in increased competition and conflict between Mikisew and other users, as well as a loss of privacy and seclusion along the Athabasca River and on adjacent road networks.

[4270] The Whole of Government submission's preliminary assessment on potential impacts on the exercise of Mikisew rights related to water use identified:

- a loss of Mikisew trust in water quality;
- a reduction in harvesting success due to access restrictions to preferred harvesting areas;
- an increased navigational safety concerns due to unpredictable water levels; and
- a reduction in opportunities for harvesting methods and timing due to reduced confidence in water resources.

[4271] The Whole of Government's preliminary assessment on potential impacts on the exercise of Mikisew rights related to resource and water use concurred with Mikisew's assessment.

Effects on Health and Socioeconomic Conditions

[4272] Mikisew stated that existing information suggests that the Frontier project is likely to affect areas of importance to Mikisew, including Mikisew diet, health and well-being, language and culture, socioeconomic conditions, indigenous and Treaty 8 rights, cumulative effects, and governance, policy, and planning.

[4273] Mikisew explained that changes in the environment due to the project are predicted to result in further increases in observed and perceived contamination in the local study area and regional study area. Mikisew stated that existing impacts along the Athabasca River corridor will extend along the Buckton Creek watershed into portions of Lake Claire and Wood Buffalo National Park that currently serve as a refuge for Mikisew use.

[4274] Canada's preliminary assessment identified health concerns related to potential impaired or diminished land and resource use due to perceived or observed contamination and reduced confidence in the subsistence resources due to impacts to local and regional air quality and water quality.

[4275] Mikisew stated that a loss of confidence in their territories will create an economic and social burden for families as they will need to travel into new regions to practice their rights.

[4276] Mikisew stated that respect, expertise, and age and gender-based social roles may be disrupted as a result of industrial changes; especially employment requiring long periods of time away from home or away from cultural roles such as hunting and teaching children.

Effects on Physical and Cultural Heritage

[4277] The panel is required to take into account the effects on physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Mikisew Way of Life: *Sakaw pimacihwin*

[4278] Mikisew elders and members are concerned about the unique cultural and ecological richness of the regional study area and the associated Mikisew *sakaw pimacihwin* (bush way of life) they feel is already impacted by existing oil sand developments in the region and is put further at risk by the Frontier project.

[4279] Mikisew expects the Frontier project will disrupt the ability of future generations to maintain Mikisew harvesting rights over the regional study area. The time lag (which may be up to 50-60 years in some instances) between disturbance and reclamation to suitable habitat has a compounding effect on this culturally important value.

[4280] They are concerned that the adverse effects of the Frontier project on Mikisew's way of life are likely to be far greater than past oil sand projects because of the Frontier project's size, extent of influence, and location. The watershed areas that would be impacted by the Frontier project are of special importance for Mikisew harvesting and way of life and are critical to the continuation and future practice of Mikisew culture, food security, rights, and way of life for many Mikisew members and families.

[4281] Mikisew knowledge holders stated that adverse effects of the project are likely to extend well beyond the project footprint and into large portions of Lake Claire and Wood Buffalo National Park. If built, significant residual adverse project effects are anticipated in the local and regional study areas for Mikisew intergenerational transmission of knowledge, language, culture, sense of place, identity and way of life; and ability to maintain Mikisew governance and stewardship of lands and resources.

[4282] With English as the dominant project language, absent substantial additional mitigation efforts, the trend of English place names replacing Cree place names and language in the project area is likely to continue and accelerate. Transformation of landscapes within the project footprint, as well as loss of use

beyond it, is likely to result in reduced use and potential loss of location-specific language terms and place names. Mikisew feel that increased alienation of Mikisew way of life and harvesting rights may have a cascading effect on transmission of place-based language and knowledge in the larger regional area. Mikisew explained that the persistence of land-based language is dependent on an enduring cultural landscape where elders and youth maintain access to preferred cultural sites. Mikisew stated that reduced opportunities for harvesting in the local study area and regional study area will further limit the transmission of knowledge.

Sites

[4283] Mikisew First Nation identified;

- one reported burial,
- one place name,
- a cultural area associated with the Athabasca River and the commemoration of the treaty by Fort McKay and Mikisew members, are located within the project footprint, and
- up to 18 additional reported Mikisew site-specific cultural/spiritual values within the local study area are likely to be impacted by direct disturbance from noise and light, reduced Mikisew access, increased industry and recreational access, or other disturbances. In the regional study area (and including the local study area).

[4284] In addition, 739 Mikisew site-specific cultural/spiritual values are documented in the regional study area. These include ceremonial places, medicinal plant collection sites, burial sites, and cultural teaching areas sensitive to a variety of effects, including water level and water quality changes. At least some of these cultural/spiritual values are likely to be impacted by the project as a result of anticipated effects on Athabasca River levels, especially during low flow, and the increased perceived or observed contamination of traditional resources including medicine plants, leading to avoidance or reduced use.

[4285] Mikisew stated that sensory disturbances coupled with increased traffic, reduced access and reduced confidence in water and resources as a result of impacts extending into Wood Buffalo National Park and Lake Claire will decrease opportunities to enjoy culturally preferred areas used for camps, cabins, teaching and cultural practice within the regional study area. The bridge across the Athabasca River would introduce numerous sensory disturbances, including loss of privacy, increased noise, increased traffic, and decreased sense of place due to a more pronounced industrial presence. Some of their camps and cabins may be destroyed or rendered unusable due to disturbance and destruction of critical habitats.

Habitation

[4286] Inside the Frontier footprint, 16 documented Mikisew site-specific habitation values associated with current and historic cabins and camp locations may be destroyed or rendered unusable by the project.

In the local study area, up to 86 documented Mikisew site-specific habitation values are likely to be impacted. In the regional study area 1744 Mikisew site-specific habitation values have been documented. Within the regional study area, the habitation values most at risk are those downstream of the project along the Athabasca River and Buckton Creek into Lake Claire. These include regularly used cabins, village sites (Snowbird's camp), and habitation areas associated with Mikisew Indian Reserve lands.

Culture

[4287] Mikisew knowledge holders expressed deep concern that increased industrialization will result in fewer opportunities for future Mikisew generations to live and learn Mikisew way of life. Mikisew expect that the Frontier project will mean losing the ability to freely practice a culture and way of life that has endured and flourished around Lake Claire, along the Athabasca River and into the Birch Mountains, and the Wood Buffalo National Park since time immemorial. Mikisew stated that the Frontier project would affect the ability of future Mikisew generations to experience and learn from Mikisew knowledge holders active in the local study area and regional study area. Mikisew elaborated that this will lead to lost opportunities for future generations to practice harvest rights in ways consistent with past generations leading to an erosion of critical elements of a Mikisew way of life within the local study area and regional study area. Mikisew knowledge holders expressed concern over lost opportunities for future generations to maintain cultural and harvesting relationships with the Ronald Lake bison.

[4288] The Whole of Government submission's preliminary assessment on potential impacts on the exercise of Mikisew way of life related to resource and water use identified;

- a reduction in Mikisew's ability to transmit Mikisew way of life to future generations including culture, language, and spirituality related to harvesting in preferred areas. These limitations are compounded by younger generations' concerns about contamination,
- a loss of language tied to particular places,
- a reduction in time available to teach land-based skills due to increased travel requirements to sites further away, and
- a loss of sense of place and peaceful enjoyment of the land, particularly at cabins along the Athabasca River used as a base for bird, moose, bison, berry and medicine harvesting.

Mikisew Governance and Stewardship: *Kitaskinaw owicita*

[4289] Mikisew stated that if the Frontier project is to proceed, there is particular concern around how the project might affect Mikisew governance and stewardship priorities. Specifically, Mikisew's ability to maintain the lands, waters, and resources for current and future generation harvesting success, to uphold the treaty, and to maintain the vital relationship of land, animals and people will be permanently undermined as a result of direct impacts and industrial contaminants. Mikisew stated that the existing level of impacts to Mikisew's governance and stewardship values increases the value and sensitivity of

remaining places where Mikisew culture and rights, including way of life, harvest rights, and stewardship, can be freely practiced.

[4290] If the Frontier project proceeds, they are concerned with a loss of control for leaders over the critical decisions that allow them to maintain *kitaskino* in the regional study area. Mikisew explained that effects from the Frontier project would cause Mikisew to feel a responsibility for the incremental loss of their territory and the long-term inability to protect their land base for future generations.

[4291] Mikisew explained that the Frontier project will force families to practice their rights in regions and core areas that are not their designated family lands causing conflict within and between families and increasing pressure on Wood Buffalo National Park due to encroaching families.

[4292] If the Frontier project proceeds, the failure for the Mikisew will be in the loss of traditional knowledge and associated decrease in respect and influence of senior elders in the maintenance of traditional governance and Mikisew way of life. Further, Mikisew have stated that if they lose their trust in the health of the environment, and if the animals are unable to thrive in the area, then the Mikisew will not be able to maintain *Kistinawi* or the core stewardship practices, which will undermine the Mikisew worldview.

[4293] Canada's preliminary assessment on potential impacts on the exercise of Mikisew rights related to resource and water use indicated that Mikisew might face potential reduced ability to govern and steward the land, to implement the family-based governance system and the allocation of lands, and may experience undermining of Mikisew governance principles.

Analysis and Findings

[4294] Teck did not contest the evidence provided by Mikisew regarding their assessment of the effects of the Frontier project on their asserted rights. Rather, Teck relied on the Mikisew rights and culture impact assessment. Mikisew appeared at the hearing and had their evidence tested through questioning. Mikisew's evidence was largely supported by evidence from other parties, such as the Whole of Government submission's preliminary assessment. The panel finds it is able to rely on the Mikisew assessment and other evidence of Mikisew as summarized above.

[4295] The assessment provided by Mikisew shows that the loss of lands in the project development area and affected lands in the local study area will adversely affect the following:

- Mikisew's access to sufficient quality and quantity of tangible and intangible resources (e.g., water, game, fish, berries, spiritual sites, cultural landscapes and homelands, traditional knowledge, and others) for the meaningful practice of their rights.
- Mikisew's ability to harvest bison, caribou, moose, migratory birds, fish and the gathering of terrestrial and aquatic plants.

- Mikisew's perceptions of the health of country foods and affect Mikisew continuity of cultural practices, knowledge transmission, and language for future generations as a result of increased access, disturbance, and perceptions of diminishing air and water quantity and quality.

[4296] The panel finds the evidence also shows that;

- Mikisew is currently experiencing adverse effects from industrial development on their requirements for priority access to sufficient quality and quantity of tangible and intangible resources (e.g., water, game, fish, berries, spiritual sites, cultural landscapes and homelands, traditional knowledge, and others) necessary for the practice of their asserted rights. The project will directly affect more than 29 000 ha and exacerbate these effects.
- Harvesting bison is an important element of Mikisew culture and that the project will disturb an area where more than 90 per cent of recorded bison harvest sites occur.
- The project will affect moose hunting, migratory bird harvesting, fishing, and terrestrial and aquatic plant gathering in the regional study area. Mikisew described cumulative effects of industrial development on these activities which will be exacerbated by the project which will eliminate or prevent the use of preferred hunting, trapping, fishing and gathering activities in the project development area, local study area, and regional study area.

[4297] The panel finds that in the absence of mitigation measures, the Frontier project will adversely affect current use of lands and resources for traditional purposes and affect physical and cultural heritage values of the Mikisew and further exacerbate existing cumulative effects.

Mitigation Measures

[4298] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[4299] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

[4300] After the close of the hearing, Alberta established the Kitaskino Nuwenëné Wildland Provincial Park, which was announced on March 11, 2019. Canada stated that ECCC will work with Mikisew and Alberta to support the development of a tripartite biodiversity stewardship area co-management agreement for management of this area.

Participation Agreement

[4301] The participation agreement and the commitments made by Teck are intended to mitigate the effects of the project on current use of land and resources for traditional purposes; physical and cultural heritage; and impacts to aboriginal rights. The agreement will establish a cooperative implementation committee to implement the agreement. The panel supports the establishment of such processes to manage mitigation measures and adapt to circumstances that may not be anticipated at this time. It expects the parties to comply with the various commitments which they have made in this agreement.

[4302] A consolidated version of Teck's commitments is in [Appendix 11](#). The panel has required a number of these proposed measures as conditions of the project approval. A number of these measures are outside the authority of the panel but are reasonable given the context of the region, the issues and concerns and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of environmental valued components, which will serve to also reduce effects on indigenous use of lands and resources. In conjunction with a number of adaptive management plans which Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Athabasca Chipewyan.

[4303] On September 25, 2018, Teck and Mikisew announced the signing of a participation agreement with respect to the Frontier project. The agreement identifies a number of economic benefits for Mikisew connected with the Frontier project, as well as creating opportunities for meaningful engagement and communication. It also sets out a framework for items such as traditional land use and environmental stewardship related to the Frontier project. The agreement is considered to be substantial and critical mitigation for the effects described in this updated assessment while also providing mechanisms for continued engagement throughout the life of the Frontier project, which might result in the development of additional community-specific mitigation measures to manage specific effects.

[4304] Mikisew maintained the right to withdraw their support for the Frontier project pending Canada and Alberta committing, prior to issuing final authorizations for the project, to resolve the outstanding issues outlined in Mikisew's August 31st, 2018, hearing submission and discharging their respective duties to consult Mikisew about the project.

[4305] Canada and Mikisew are contemplating accommodation measures that the panel may wish to consider as measures that could address potential adverse impacts on asserted aboriginal and treaty rights. They state that accommodation measures contemplated by the federal government and indigenous groups will continue to evolve and be informed by this decision and ongoing consultations directly with indigenous parties. Measures identified to accommodate Mikisew rights issues include;

- bison protection,
- a project-specific Teck Frontier monitoring and oversight committee,

- delta protection and Peace-Athabasca Delta monitoring and research,
- cultural programming, and
- caribou protection.

[4306] Teck and Mikisew have worked together towards developing measures to mitigate and monitor project effects on Mikisew current use of lands and resources for traditional purposes and physical and cultural heritage. Teck and Mikisew have agreed upon and proposed project conditions that resolve Mikisew's project-specific requests of Teck. Teck understands that Mikisew has no further requests of Teck and that all Mikisew's remaining concerns and requested management actions rest with Canada and Alberta. Teck is committed to working constructively with the Crown and Mikisew, where appropriate, to support resolution of these matters consistent with Teck's support for regional environmental monitoring and management.

[4307] Mikisew has proposed that a project oversight committee be formed, which would include government authorities and indigenous groups. The committee would include indigenous peoples meaningfully in the monitoring and regulatory oversight of the Frontier project and in the design of adaptive management measures. Teck expressed support for this proposal, contingent on committee having an efficient design, which does not duplicate efforts, increase costs above and beyond those contemplated in its permit applications and agreements with indigenous communities, and which includes clear lines of accountability and transparency.

[4308] Based on this larger framework, Mikisew is not objecting to the panel's decision on project applications under its authority as the AER, provided that the panel's decision reflects project conditions jointly developed by Teck and Mikisew.

Analysis and Findings

[4309] The panel finds that the Frontier project is likely to cause an adverse effect on Mikisew's ability to access and use lands and resources for traditional purposes. Existing adverse cumulative adverse effects of development on the practice of traditional and cultural activities will be exacerbated by the project. The panel has recommended mitigation that should be included in the Minister's decision statement under *CEAA 2012*.

[4310] In section 23, "[Wildlife](#)," the panel has concluded that the Frontier project will result in significant, adverse effects to the Ronald Lake bison increasing the likelihood of disease transmission to the healthy animals in the Ronald Lake herd from the diseased animals in Wood Buffalo National Park. This means that the Frontier project will likely adversely affect to Mikisew's traditional use of the Ronald Lake bison.

[4311] While the panel concluded that none of the proposed mitigation measures were likely to be effective in reducing the risk of disease transmission, it did make several recommendations to the governments of Canada and Alberta regarding the Ronald Lake bison (see [Appendix 6](#)).

[4312] In section [23](#), “[Wildlife](#),” the panel concluded the Frontier project will cause a displacement of moose as a result of loss of habitat in the local study area. This change in abundance of moose in preferred harvesting areas will reduce harvesting success of indigenous hunters, which will adversely affect Mikisew’s traditional use of this resource. The panel has made recommendations to the governments of Canada and Alberta with concerning the management of moose.

[4313] In section [23](#), “[Wildlife](#),” the panel reached the conclusion “that the Frontier project in combination with other developments are likely to result in significant, adverse cumulative effects on caribou.

[4314] Further, the decline in fur-bearer abundance as a result of the project will vary with the species, with effects ranging from high magnitude for lynx and fisher to moderate for black bear, beaver and muskrat. The panel notes that indigenous concerns are mainly related to the availability of fur-bearers for harvesting and that these concerns are closely linked to water levels in the rivers and the Peace-Athabasca Delta and other access issues.

[4315] In the sections “[Wildlife Health](#)” and “[Vegetation](#),” the panel concluded that air and water quality effects from the Frontier project are not expected to significantly affect wildlife and vegetation health. However, reduced confidence in the quality of foods and water quality may adversely affect Mikisew’s use of these resources and result in loss of use of preferred harvesting areas, especially downstream of the project.

[4316] In section [29](#), “[Public \(Human\) Health](#),” the panel has determined that the project is not likely to result in adverse effects to the health of indigenous land users in the region. The panel has made recommendations to the governments of Canada and Alberta regarding the protection of human health (see [Appendix 6](#)).

[4317] In section [19](#), “[Surface Water Quantity](#),” the panel found that significant, adverse cumulative effects to surface water quantity, flows, and water levels in the Athabasca River, Peace-Athabasca Delta, and Slave River Delta are occurring, but are due predominantly to hydropower regulation and regional climate change, with industrial water withdrawals playing a minor role. These changes in surface water quantity appear to be adversely affecting Mikisew’s ability to access lands and resources for traditional purposes. The panel does not believe that the Frontier is likely to exacerbate those existing effects. The panel has made recommendations to the governments of Canada and Alberta with regards to surface water quantity and indigenous navigation.

[4318] The agreement between Mikisew and Teck and the commitments are intended to mitigate the effects of the project on Mikisew's current use of land and resources for traditional purposes, physical and cultural heritage, social, economic, and health effects, and impacts to Mikisew's asserted rights. The panel expects the parties to comply with the various conditions in the agreement.

[4319] A consolidated version of Teck's commitments is in [Appendix 11](#). The panel has required a number of these proposed mitigations as conditions of the project approval. A number of these measures are outside the authority of the panel. However, many of these mitigations are reasonable given the context of the region, the issues and concerns and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of environmental valued components, which will serve to also reduce effects on indigenous use of lands. In conjunction with a number of adaptive management plans which Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Mikisew.

[4320] Mikisew said they are not objecting to the panel's decision on project applications under the panel's authority as the AER, provided that the decision reflects the project conditions jointly developed by Teck and Mikisew. Mikisew's position on further decisions by Alberta and Canada for the project is dependent on those governments committing to resolve the outstanding issues and discharging their respective duties to consult Mikisew about the project prior to issuing final authorizations for the project. The agreement also included jointly recommended measures for governments pertaining to outstanding issues.

[4321] While a number of the recommendations are outside the mandate of the AER, the panel recommends that Canada and Alberta consider these recommendations. The panel strongly supports ongoing engagement with indigenous groups, including Mikisew, affected by the project.

Conditions and Recommendations

[4322] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Mikisew.

Conditions

[4323] The panel requires that Teck finalize a traditional land-use mitigation, monitoring and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of construction of the project.¹⁷¹ The plan will be required as a condition of an *EPEA* approval for the project

¹⁷¹ Draft *EPEA* Approval – Condition 3.1.7

Recommendations for the Governments of Alberta and Canada

[4324] The panel recommends that Canada and Alberta consider the project conditions jointly proposed by the Mikisew and Teck in the August 31, 2018, Mikisew hearing submission to the panel (see [Appendix 9](#)).

[4325] The panel recommends that the governments of Canada and Alberta consider establishing a project oversight committee, as described by the Mikisew. Indigenous membership on the committee should not be limited to the Mikisew, and may include any group that is affected by the Frontier project, as appropriate.

[4326]

Determination of Significance

[4327] The panel determined the significance of project effects to current use of lands and resources, and physical and cultural heritage based on the approach discussed in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[4328] The panel also assessed the potential for the Frontier project to impact the rights asserted consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew and the Agency.

Significance Determination for Project Effects

Mikisew's View

[4329] Based on the pre-industrial and current Mikisew way of life, the residual effects of the Frontier project, after mitigation, are likely to be adverse and will substantially worsen the condition of Mikisew's ability to practice a bush way of life over multiple generations during project construction, operation, and reclamation. These effects are anticipated as a result of destruction of a large area of lands and waters within multiple watersheds, and the importance of areas within the local study area, and surrounding and downstream within the regional study area, to Mikisew way of life.

[4330] Significant adverse residual effects from the project are expected on Mikisew's;

- way of life, including language, identity and sense of place,
- harvesting rights, including harvest of bison, moose, fish, plants, fur and migratory birds,
- subsistence values,
- cultural and spiritual values,

- habitation values,
- transportation values,
- environmental values (within the footprint, including unique areas of bison habitat, a movement corridor for moose and other animals, and associated muskeg and water conditions), and
- stewardship and governance values.

[4331] *Way of life* – Residual effects of the project on the ability of future Mikisew generations are considered significant, adverse and likely including on language, identity and sense of place, especially in relation to the project footprint, local study area, and watersheds downstream of the project.

[4332] *Harvest Rights* – The project is considered to have significant adverse residual effects on the ability of future Mikisew generations to harvest bison, moose, fish, plants, fur and migratory birds, particularly in relation to the project footprint, local study area and watersheds downstream of the project.

[4333] *Subsistence* – Residual project effects on site-specific subsistence values would be high magnitude, continuous during construction and operations, extend to subsistence values in the regional study area, last longer than 20 years, and would be irreversible (unlikely to return to a predevelopment condition). This effect is anticipated with a high degree of confidence.

[4334] *Habitation* – Residual project effects on site-specific habitation values would be high in magnitude, continuous and extend into the regional study area, last longer than 20 years, and would be irreversible (unlikely to return to a predevelopment condition). This effect is anticipated with a high degree of confidence.

[4335] *Cultural/Spiritual* – Residual project effects on site-specific cultural and spiritual values would be high in magnitude, continuous through construction and operations and would extend to similar values in the regional study area, last longer than 20 years and considered irreversible (values will not return to a pre-impact condition). This effect is anticipated with a high degree of confidence.

[4336] *Transportation* – The sensitivity to change of site-specific transportation values within the local study area (especially to water level changes) is considered high as a result of existing impacts in the local study area and regional study area. As such, the magnitude of effect is considered high. The most important residual effects on water based transportation values would be intermittent and occur during low-flow ice-free periods, but effects on trail networks west of the Athabasca River would be continuous through construction and operations. Due to interruption of transportation routes, effects would extend to the regional study area. Duration of effect on use and knowledge of site-specific transportation values would be greater than 20 years and considered irreversible. This effect is anticipated with a high degree of confidence.

[4337] The magnitude of effect on reported environmental feature values is considered high. Effects would be continuous through construction and operations and may extend to the regional study area. Duration of effect on use and knowledge of site-specific values would be greater than 20 years and considered irreversible. This effect is anticipated with a high degree of confidence.

Table 52. Mikisew Cree First Nation characterization of residual project effects on Mikisew way of life

	Direction	Magnitude	Extent	Duration	Reversibility	Frequency	Context /confidence
Language, identity and sense of place	neg	high	local and regional	>50 yrs (permanent)	No	High (continuous)	Extremely sensitive (at risk and already past threshold) / moderate confidence
Knowledge transmission and continuity of practice and experience	neg	high	local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) / moderate confidence

Table 53. Characterization of residual project effects on Mikisew harvesting rights

	Direction	Magnitude	Extent	Duration	Reversibility	Frequency	Context /confidence
Bison hunting	neg	high	local and regional	>50 yrs (permanent)	No	High (continuous)	Extremely sensitive (rare and already past threshold) / moderate confidence

	Direction	Magnitude	Extent	Duration	Reversibility	Frequency	Context /confidence
Moose hunting	neg	high	local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) / moderate confidence
Migratory bird hunting	neg	high	local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) / moderate confidence
Fishing	neg	high	local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) / moderate confidence
Plant Gathering	neg	high	local and regional	>50 yrs (permanent)	No	High (continuous)	Somewhat sensitive (already impacted) / moderate confidence
Trapping (food and cultural use)	neg	high	local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) / moderate confidence

Table 54. Characterization of residual project effects on the ability of Mikisew to maintain a set of eight primary Mikisew governance and stewardship values

	Direction	Magnitude	Extent	Duration	Reversibility	Frequency	Context /confidence
Interdependence of land, animals, Mikisew; Ability to protect land base	Neg	High	local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) / high confidence
Balancing individual autonomy with collective	Neg	High	local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) / moderate confidence
Respect for family and traditional knowledge	Neg	Mod	local and regional	>50 yrs (permanent)	No	High (continuous)	Somewhat sensitive / low to moderate confidence
Uphold the treaty	Neg	High	local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) / high confidence
Access rules	Neg	High	local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) / moderate confidence

	Direction	Magnitude	Extent	Duration	Reversibility	Frequency	Context /confidence
Sharing rules and reciprocity	Neg	High	local and regional	>50 yrs (permanent)	Yes	High (continuous)	Sensitive (already past threshold) / moderate confidence
Maintenance of family hunting territories	Neg	High	Local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) “this is the last place left”/ High confidence
Practice of relationships with animals	Neg	High	Local and regional	>50 yrs (permanent)	No	High (continuous)	Sensitive (already past threshold) / moderate confidence

Government of Canada View

[4338] Canada considered the submissions of Mikisew, mitigation measures proposed by Teck, and jointly agreed to conditions between Teck and Mikisew to address potential impacts on aboriginal or treaty rights. Canada also considered the draft traditional land-use mitigation, monitoring, and adaptive management plan developed by Teck. Canada’s preliminary assessment is that the Frontier project may result in a potentially serious impact on the exercise of aboriginal or treaty rights resulting from;

- effects to the Ronald Lake bison and the linkages to Mikisew harvest rights,
- water levels in the Peace-Athabasca Delta unless adaptive management measures are implemented,
- effects on migratory birds and small wildlife, related to Mikisew’s ability to exercise rights related to traditional resources, and
- the ability of Mikisew to exercise hunting rights related to caribou.

Teck's View

[4339] Teck, in consultation with Mikisew, agreed not to undertake a proponent-led traditional land use assessment with respect to Mikisew. Teck did not contest the evidence provided by Mikisew regarding the adverse effects of the project to the use of lands in the project area.

Panel Determination

The Current Use of Lands and Resources for Traditional Purposes

[4340] The magnitude of project effects would be high. Mikisew members demonstrated use of the lands in the project development area, local study area and regional study area for hunting, trapping, gathering and fishing. The significant footprint of project effects, including the direct loss of lands in the project disturbance area, and effects on traditional uses in the local study area and regional study area will result in high magnitude of effects especially to those members that have traditionally used this area.

[4341] The geographic extent of project effects would be regional. The effects to Mikisew's ability to access and harvest species of cultural importance are expected to occur within the project disturbance area, local study area, and regional study area.

[4342] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape.

[4343] The frequency of project effects would be continuous.

[4344] The project effects would be irreversible. Uncertainty exists regarding the timing and success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife, and waterfowl populations which their members harvest. Further, it is uncertain whether indigenous groups would reestablish traditional use activities on reclaimed lands following a multigenerational absence and therefore a loss of cultural connection to those lands.

[4345] The panel finds that the project effects to Mikisew's current use of lands and resources for traditional purposes in the local and regional study areas are adverse and significant and likely to occur even in consideration of the conditions imposed by the panel and key mitigation measures proposed.

Health and Socioeconomic Conditions

[4346] As determined in section 29, "[Public \(Human\) Health](#)," the panel finds that the human health effects from the project are low magnitude. The panel believes that this finding applies to the health of Mikisew members.

[4347] As determined in section 30, "[Social Effects](#)," the panel finds that the socioeconomic effects from the project are low magnitude. The panel believes that this finding applies for Mikisew.

[4348] The panel finds that the project effects to the health and socioeconomic conditions of Mikisew would be adverse but not significant.

Physical and Cultural Heritage and any Structure, Site, or Thing That Is of Historical, Archaeological, Paleontological, or Architectural Significance

[4349] The magnitude of project effects would be high. The project would affect culturally important areas, cabins, wildlife species, and the ability to access them. For those members who have conducted traditional practices on the lands in the project disturbance area and local study area, it will result in a disconnection from culture and an inability to pass on stories, place names and practices unique to the specific landscapes of these areas.

[4350] The geographic extent of project effects would be regional. The effects to Mikisew's ability to continue to participate in culturally important activities are expected to occur within the local study area and regional study area.

[4351] The magnitude of project effects would be high. Project effects, including the direct loss of lands in the project disturbance area represent an important portion of the *k'es hochela nene* homeland zone.

[4352] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities.

[4353] The frequency of project effects would be continuous.

[4354] The project effects would be irreversible given the likely loss of connection to traditional activities and the cultural values that take place on lands directly affected by the project.

Summary

[4355] The panel finds that due to the high magnitude, regional geographic extent, long-term duration, continuous frequency, and irreversibility, the project effects to Mikisew's physical and cultural heritage are adverse, significant and likely to occur even in consideration of the mitigation measures proposed.

Significance Determination for Cumulative Effects

Current Use of Lands and Resources for Traditional Purposes

[4356] The magnitude of cumulative effects would be high. Much of the area that Mikisew considers homelands have been adversely affected by industrial development and oil sands operations. Some of the most harmful cumulative effects are occurring in the Peace-Athabasca Delta and Wood Buffalo National Park where changing hydrological conditions appear to have resulted in the drying of some areas. This drying, and lower water levels, prevent Mikisew members from accessing areas important for trapping, hunting, fishing, gathering, and heritage sites and areas important for conducting cultural practices.

[4357] The geographic extent of cumulative effects would be provincial as cumulative effects are occurring over much of the traditional lands used by Mikisew members. The hydrological changes and effects to water quality extend beyond the project regional study area and into the Peace-Athabasca Delta and Wood Buffalo National Park. Changes in water levels have affected habitat for species of importance to Mikisew for hunting and trapping, and low water levels create a major barrier to Mikisew members' ability to access lands that are crucial to practicing traditional activities.

[4358] The duration of cumulative effects would be long. The duration of cumulative effects will extend beyond the cessations of industrial activities in the region. Cumulative effects are likely to be experienced for an extremely long time similar to the effects that are being felt as a result of the hydroelectric dams on the Peace River.

[4359] The frequency of cumulative effects would be continuous and irreversible. The projects contribution to these effects will depend on the success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife and waterfowl populations which Mikisew members hunt, gather and trap.

Health and Socioeconomic Conditions

[4360] As determined in section 29, "[Public \(Human\) Health](#)," the cumulative effects to human health from the project are low magnitude. The panel believes that this finding applies to the health of Mikisew members.

[4361] As determined in section 30, "[Social Effects](#)," the cumulative socioeconomic effects from the project are low magnitude. The panel believes that this finding applies for Mikisew.

[4362] The cumulative effects would be continuous and regional in extent, but the effects would be medium term in duration and reversible as they would decrease at the end of operations.

[4363] The panel finds that due to the low magnitude, continuous, regional, medium term, and reversibility, the cumulative effects to the health and socioeconomic conditions of Mikisew would be adverse but not significant.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[4364] The magnitude of cumulative effects would be high. The cumulative effects would affect culturally important areas, cabins, wildlife species, and the ability to access them.

[4365] The geographic extent of cumulative effects would be provincial. The cumulative effects to Mikisew's ability to continue to participate in culturally important activities are expected to occur beyond the local and regional study areas.

[4366] The duration of cumulative effects would be long term. Cumulative effects would extend beyond the end of project operations and reclamation and closure activities.

[4367] The frequency of cumulative effects would be continuous.

[4368] The cumulative effects would be irreversible given the likely loss of connection to traditional activities and the cultural values.

Summary

[4369] The panel finds the project effects, in combination with the effects of past activities, to Mikisew's physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance in the local and regional study areas are adverse and significant and likely to occur even in consideration of the conditions and proposed mitigation measures. The residual effects of the project will make a significant contribution to the current cumulative effects of industrial development in the area, especially for those Mikisew members who are currently using lands and resources in the project development area, the local study area and the regional study area.

Significance Determination for Asserted Rights

[4370] The panel assessed potential effects of the Frontier project on Mikisew's asserted rights in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*.

[4371] The panel finds that the residual effects to current use of land and resources; physical and cultural heritage; and effects to Mikisew's asserted rights are not likely to be fully mitigated by the measures required by the panel or the known measures within the agreement between Mikisew and Teck. In consideration of the scale of the project and the evidence presented by the parties, the panel finds that the residual project effects on Mikisew's ability to exercise asserted rights will be adverse and significant and likely to occur. These effects on asserted rights will be most prominent for those Mikisew members that access lands within the project development area and the local study area.

[4372] The panel also notes that Canada's preliminary assessment and Mikisew's assessment of project effects on rights also conclude that the effects will be likely, adverse and significant.

[4373] The project in combination with current effects of industrial development will further exacerbate cumulative effects on Mikisew's ability to exercise asserted rights. The panel finds that cumulative effects on these asserted rights will be adverse, significant and likely to occur.

Table 55. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	regional	long	continuous	irreversible	significant
Cultural and physical heritage	high	regional	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Effects on asserted rights	high	regional	long	continuous	irreversible	significant

Table 56. Summary – Significance determination for cumulative effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	provincial	long	continuous	irreversible	significant
Cultural and physical heritage	high	provincial	long	continuous	irreversible	significant
Health	low	regional	medium	continuous	reversible	not significant
Social effects	low	regional	medium	continuous	reversible	not significant
Asserted rights	high	provincial	long	continuous	irreversible	significant

Northwest Territory Métis Nation

Background

[4374] The Northwest Territory Métis Nation represents Indigenous Métis of the South Slave region. Representing its three member Councils of Hay River, Fort Smith and Fort Resolution, it includes approximately 3000 people. Members of the Northwest Territory Métis Nation have traditionally used, occupied and managed the land and resources throughout their traditional territory, which encompasses the whole of the Northwest Territories, and the northern parts of the provinces bordering the Northwest Territories including northern Alberta.

[4375] The Northwest Territory Métis Nation submitted the following:

- August 30, 2018: Hearing submission filing
- October 4, 2018: Participated in the hearing providing direct evidence and a presentation to the panel

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[4376] The ACO did not submit a report regarding consultation adequacy and whether actions may be required to address potential adverse impacts to the existing rights of North West Territories Métis.

Asserted or Established Aboriginal and Treaty Rights

[4377] The Northwest Territory Métis Nation stated that its members have aboriginal rights to hunt, fish and harvest throughout their traditional territory, which are linked to traditional and cultural activities that are integral to the distinctive culture of the Northwest Territory Métis Nation. Portions of Northwest Territory Métis Nation traditional territory include the Peace-Athabasca Delta and Wood Buffalo National Park.

[4378] The panel's terms of reference requires it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted or the strength of such claims. For the purposes of assessing the potential effects of the Frontier project, the panel accepts the rights being asserted.

Context of Historical and Current Cumulative Effects

[4379] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous groups' ability to access and use lands and resources, their ability to practice culturally important activities or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Agency, effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a

community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

Use of Lands and Resources for Traditional Purposes

[4380] Northwest Territory Métis Nation members have historically relied upon the resources within Wood Buffalo National Park for community and trading purposes prior to 1923. Northwest Territory Métis Nation lived and harvested in Wood Buffalo National Park with their families and practiced traditional activities, including harvesting, trapping, and hunting activities; salt harvesting; harvesting medical plants; and harvesting timber.

[4381] The Northwest Territory Métis Nation expressed concerns regarding potential downstream project effects and cumulative effects on Wood Buffalo National Park, their community, and their aboriginal rights. Northwest Territory Métis Nation also expressed concerns regarding the proximity of the project to Wood Buffalo National Park, the potential risk of leaks and spills from tailings ponds, additional water withdrawal, and atmospheric deposition of contaminants.

[4382] The Northwest Territory Métis Nation expressed concerns that the cumulative effects of past, present, and future resource development on the outstanding universal value of Wood Buffalo National Park could be exacerbated by the totality of all the negligible effects that Teck had predicted. The Northwest Territory Métis Nation believed that cumulative impacts of water withdrawals have not been adequately addressed in conjunction with the impact of climate change projections on the Peace-Athabasca Delta, and by extension, on the outstanding universal value of Wood Buffalo National Park.

[4383] The Northwest Territory Métis Nation stated that they have observed drastic adverse impacts in the Peace-Athabasca Delta from previous projects, including hydroelectric projects, decades of industrial development, and the effects of climate change. They explained that there are gaps in knowledge related to water flow and impacts to the Peace-Athabasca Delta and the Peace-Athabasca Delta is vulnerable to climate change due to its unique topography and wetland-dominated landscape. The hydrology and ecology of the Peace-Athabasca Delta has degraded due to climate change, and these cumulative effects will be exacerbated by future projects including the Site C Dam.

[4384] Northwest Territory Métis Nation described seeing thousands of geese at Lake Claire and harvesting a year's supply in a few hours, but now there are mud flats where there used to be water. They stated that there used to be islands in the Peace-Athabasca Delta with many moose, but the islands are now part of the mainland and the moose are no longer there. After the dam went in, the delta dried up and willows have grown twenty feet high where there used to be water for boating. Northwest Territory Métis Nation described not being able to access areas in the Peace-Athabasca Delta because the willows are too thick and the water is too low, adding that the animals are not there.

Health and Socioeconomic Conditions

[4385] Elder Evans of Northwest Territory Métis Nation stated that wild foods used to be their livelihood, but now members go to the store and buy processed foods and bottled water. Northwest Territory Métis Nation noted that they must travel with large quantities of water when boating because they do not trust the quality of the water due to observations of scum. They also indicated that they are scared to eat ducks, moose, and fish due to fears of contamination. Northwest Territory Métis Nation noted that they could smell odours from the oil sands if the winds blew from Fort McMurray.

[4386] When Northwest Territory Métis Nation were out trapping actively in the 1970s and 1980s, they were in good physical shape from running, cutting wood and setting traps. Youth do not do that as often now, and many spend more time indoors at home. In the 1970s Northwest Territory Métis Nation stated that trapping for one year could produce 8000 to 10 000 muskrat worth about \$6 each. Now there is very little trapping except by those that can afford skidoos and equipment, and this is reducing the opportunity to pass on this way of teaching to youth.

[4387] The Northwest Territory Métis Nation submitted that the precautionary principle should be applied and the Frontier project should not be approved while uncertainties regarding adverse environmental effects to the Peace-Athabasca Delta continue to exist, and the potential for adverse project effects on their aboriginal rights and the outstanding universal value of Wood Buffalo National Park is still unknown.

Physical and Cultural Heritage

[4388] The panel is required to take into account the physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[4389] Northwest Territory Métis Nation said their families engaged in a variety of cultural practices, including cabin construction. They have exercised cultural practices since before the establishment of government in the area and the designation of Wood Buffalo National Park, and their ancestors held a spiritual relationship with their traditional territory.

[4390] In 1923, Northwest Territory Métis Nation were excluded from most areas of Wood Buffalo National Park, which resulted in a loss of traplines and cabins, and ultimately a loss of livelihood for many hunters, trappers and their families. This exclusion and subsequent loss of livelihood resulted in future generations losing their connection to the land where their grandparents hunted and trapped. This connection is slowly being restored, and they are actively trying to continue the culture by taking young people out on the land.

Analysis and Findings

[4391] Northwest Territory Métis Nation appeared at the hearing and had their evidence tested through questioning. The panel finds it is able to rely on the evidence presented by Northwest Territory Métis Nation and summarized above. The panel finds from the evidence that:

- Members of Northwest Territory Métis Nation continue to use their traditional lands as described.
- Their land-use activities are focused downstream of the project and on the areas in and around the Slave River, Wood Buffalo National Park and the Peace-Athabasca Delta.
- Their members practice their asserted rights to hunt, trap, fish and gather, and these activities can include spiritual practices.
- These activities do not occur regularly within the disturbance area for the Frontier project.
- They did not describe any specific use of lands or resources within the project disturbance area or the local or regional study areas.
- They did not identify any specific sites or culturally important areas that would be directly affected by the project.

[4392] The Northwest Territory Métis Nation has not demonstrated that they currently use the lands or resource for traditional purposes within the project development area, the local study area or the regional study area for the project's assessment.

Project and Cumulative Effects

[4393] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights. It must also assess how the Frontier project, or the project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources and practice of asserted rights.

Effects on Use of Lands and Resources for Traditional Purposes

Northwest Territory Métis Nation's View

[4394] The Northwest Territory Métis Nation expressed concerns that the project would affect species within Wood Buffalo National Park and subsequently affect Northwest Territory Métis Nation members.

[4395] The Northwest Territory Métis Nation stated that there is high potential for adverse effects of the project on the aboriginal rights of the Northwest Territory Métis Nation. They did not agree with Teck's assessment that the Frontier project would have a negligible effect on the outstanding universal value of Wood Buffalo National Park. They asserted that the project would affect wildlife species, the environment, and natural phenomena within Wood Buffalo National Park that contribute to its outstanding universal value.

Effects on Health and Socioeconomic Conditions

[4396] The Northwest Territory Métis Nation did not provide specific evidence of project or cumulative effects regarding health or socioeconomic effects of the project.

Effects on Physical and Cultural Heritage

[4397] The panel is required to take into account the effects on physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[4398] The Northwest Territory Métis Nation did not provide specific evidence of project or cumulative effects on physical and cultural impacts within the project development area, local study area or regional study area.

Teck's View

[4399] Teck did not explicitly assess project effects on Northwest Territory Métis Nation, but Teck assessed project effects to Wood Buffalo National Park as being negligible. Teck predicted the project would have a negligible effect on the outstanding universal value of the park.

[4400] Teck stated that the project could result in decreased time for the practice of traditional land use due to work demands, which could affect community cohesion, as there would be reduced time to practice traditional land-use activities together and less community sharing opportunities. There could also be effects on indigenous identity, at an individual and community level, including challenges to self-sufficiency, the ability to exercise autonomy and self-determination.

Analysis and Findings

[4401] Northwest Territory Métis Nation appeared at the hearing and had their evidence tested through questioning. Their evidence on conditions in Wood Buffalo National Park was largely supported by evidence from other parties. The panel finds it is able to rely on the evidence of Northwest Territory Métis Nation as summarized above.

[4402] The panel finds that their use is in the Peace-Athabasca Delta and Wood Buffalo National Park and Slave River and not in the project area. The project will have minimal effects on air quality, water quality and water quantity in these areas. They did not demonstrate that they use lands in the project development area, local study area or regional study area. As such, the Frontier project would not likely cause adverse effects to their current use of lands and resources for traditional purposes.

[4403] The Northwest Territory Métis Nation has not demonstrated specific project effects on their use of lands and resources, physical or cultural heritage, or on their health or socioeconomic conditions.

Mitigation Measures

[4404] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[4405] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

[4406] Teck's view is that the project will not affect Northwest Territory Métis Nation and consequently they have not entered into any type of agreements with them.

[4407] Transport Canada stated that it has the ability, within its regulatory processes, to include terms and conditions within project approvals to address impacts and cumulative impacts to navigation. Transport Canada confirmed that it continues to support a regional approach to water management, which can more effectively consider all of the cumulative impacts of water withdrawal for oil sands operations. To support this regional approach and to further its own understanding of the impacts of water withdrawals on navigation, Transport Canada advised that it is working to complete a navigation study in spring 2019. Transport Canada also confirmed that it is committed to working with the Province of Alberta. It committed to sharing the results of the study not only with Alberta, but also with other partners, including indigenous groups, Parks Canada, and ECCC.

Analysis and Findings

[4408] In section [18](#), "[Surface Water Quality](#)," the panel determined that the Frontier project will result in water discharges and aerial emissions which will increase concentrations and loadings of some surface water quality parameters within the local study area. Given predicted increases within the local study area, it is plausible that changes in water quality may be detected further downstream or downwind. However, the panel expects that these effects will be minimal and the project is not likely to result in adverse effects to water quality in the Peace-Athabasca Delta and Wood Buffalo National Park.

[4409] In section [19](#), "[Surface Water Quantity](#)," the panel found that significant, adverse cumulative effects to surface water quantity, flows, and water levels in the Athabasca River, Peace-Athabasca Delta, and Slave River Delta are occurring. It determined that these effects are predominantly the result of hydropower regulation and regional climate change, with industrial water withdrawals playing a minor role. These changes in surface water quantity appear to be adversely affecting Northwest Territory Métis ability to access lands and resources for traditional proposes. The panel does not believe that the Frontier is likely to exacerbate those existing effects. The panel has made recommendations to the governments of Canada and Alberta with regards to surface water quantity and indigenous navigation.

[4410] In section 14, “[Air Quality](#),” the panel concluded that there is some potential for measurable air emissions from the project in the Peace-Athabasca Delta and Wood Buffalo National Park but the effects will be minimal.

[4411] In section 29, “[Public \(Human\) Health](#),” the panel has determined that the project is not likely to result in adverse effects to the health of indigenous land users in the region. The panel has also made recommendations to the governments of Canada and Alberta regarding the protection of human health (see [Appendix 6](#)).

[4412] The panel notes Teck's view that the project will not affect Northwest Territory Métis Nation's traditional territory and consequently they have not entered into any type of agreement with Northwest Territory Métis Nation. The panel also notes that Teck has committed to a number of environmental mitigation measures and made commitments designed to mitigate effects of the project on indigenous communities

[4413] A consolidated version of Teck's commitments is in [Appendix 11](#). The panel has required a number of these proposed mitigations as conditions of the project approval. A number of these measures are outside the authority of the panel. However, many of these mitigations are reasonable given the context of the region, the issues and concerns and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of environmental valued components, which will serve to also reduce effects on indigenous use of lands. In conjunction with a number of adaptive management plans which Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Northwest Territory Métis Nation.

Conditions and Recommendations

[4414] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Northwest Territory Métis Nation.

Conditions

[4415] The panel requires that Teck finalize a traditional land-use mitigation, monitoring and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of construction of the project.¹⁷² The plan will be required as a condition of an *EPEA* approval for the project.

¹⁷² Draft *EPEA* Approval – Condition 3.1.7

Recommendations

[4416] To reduce effects to navigation, the panel recommends that Transport Canada use its ability to include terms and conditions within project approvals to address project impacts and cumulative impacts to navigation. The panel recommends that Transport Canada continue its work on a navigation study and shares the results of the study with the Northwest Territory Métis Nation.

Determination of Significance

[4417] The panel determined the significance of project effects to current use of lands and resources, and physical and cultural heritage based on the approach discussed in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[4418] The panel also assessed the potential for the Frontier project to impact the rights asserted by Northwest Territory Métis Nation in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Significance Determination for Project Effects

Current Use of Land and Resources for Traditional Purposes

[4419] The magnitude of project effects would be low or negligible. The Northwest Territory Métis Nation has not demonstrated that they use lands likely affected by the project. There is some potential for measurable air emissions from the project in the Peace-Athabasca Delta and Wood Buffalo National Park but those effects will not be significant. While some contaminants will be released into surface waters from the project, the water quality assessment determined that the effects will be limited primarily to the local study area and that these loadings are not expected to contribute significantly to water quality effects in the Peace-Athabasca Delta or Wood Buffalo National Park. It is not plausible that water withdrawals from the project will have any meaningful impact on the Slave River and its delta. The panel determined that the project will have minimal effects on air quality, water quality and water quantity and that while unlikely, if any residual effects from the project occur, they will not be significant.

[4420] The evidence presented on current use does not demonstrate that Northwest Territory Métis Nation's current use of lands or resources overlap with the project disturbance area or the local study area. While the panel does not dispute that Northwest Territory Métis Nation's ability to practice their asserted aboriginal and treaty rights has been affected by various developments to the south, the panel has determined that Northwest Territory Métis Nation's current use of land and resources for traditional purposes will not be affected by the project.

[4421] The geographic extent of project effects would be provincial. There may be small measurable changes in some air quality, water quality, or quantity parameters in the Peace-Athabasca Delta and Wood Buffalo National Park.

[4422] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected period for reclamation and the likelihood of establishing a functioning landscape.

[4423] The frequency of project effects would be continuous.

[4424] The project effects would be irreversible. Uncertainty exists regarding the timing and success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife, and waterfowl populations, which their members harvest. Further, it is uncertain whether indigenous groups would reestablish traditional use activities on reclaimed lands following a multigenerational absence and therefore a loss of cultural connection to those lands.

[4425] The panel finds that the effects of the project are adverse but not significant and unlikely to occur in consideration of project mitigation measures and conditions imposed by the panel.

Health and Socioeconomic Conditions

[4426] As determined in section 29, "[Public \(Human\) Health](#)," the panel finds that the human health effects from the project are expected to be low in magnitude. The panel believes that this finding particularly applies to the health of Northwest Territory Métis Nation members given that their 3000 members mainly reside in the Northwest Territories and mainly use the Peace-Athabasca Delta and Wood Buffalo National Park for traditional uses.

[4427] Northwest Territory Métis Nation's participation occurred late in the review process after the panel had issued notice on June 6, 2019, that it had determined there was sufficient information to proceed to hearing. They did not provide sufficient evidence for the panel to make a well-reasoned determination on the effects to their socioeconomic conditions.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[4428] Northwest Territory Métis Nation did not provide sufficient evidence for the panel to determine effects on their physical or cultural heritage.

Summary

[4429] The panel finds that the effects of the Frontier project on Northwest Territory Métis Nation's current use of lands and resources will be low/negligible in magnitude. While unlikely, if any residual effects from the project do occur, they will not be significant.

Significance Determination for Cumulative Effects

[4430] Northwest Territory Métis Nation provided limited evidence of cumulative effects of industrial development on their use of lands and resources for traditional purposes. However, the panel is not persuaded that the Frontier project will adversely affect Northwest Territory Métis. The panel believes that if there are any incremental effects of the Frontier project on any current cumulative effects to Northwest Territory Métis Nation, they will be negligible.

Assessment of Impacts to Asserted Rights

[4431] For the reasons identified above, the Frontier project is not likely to affect the rights asserted by Northwest Territory Métis Nation.

Table 57. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources for traditional purposes	low/negligible	provincial	long	continuous	reversible	not significant
Health	low	NA	NA	NA	NA	not significant
Asserted rights	low/negligible	provincial	long	continuous	irreversible	Not significant

Original Fort McMurray First Nation and Clearwater River Band

Background

[4432] The Original Fort McMurray First Nation and Clearwater River Band stated that they have 840 members. They described their traditional lands as approximately bounded to the north by the provincial boundary of Alberta with the Northwest Territories, to the west by the House River, on the east by the approximate location of the Alberta-Saskatchewan boundary, and on the south by a line extending through Philomena.

[4433] The Original Fort McMurray First Nation (also called the Wood Buffalo First Nation) are descendants of Indians who lived in Alberta, the Northwest Territories and on the plains since time immemorial. They said they have inhabited the Fort McMurray area since before the signing of Treaty 8 in 1899. They lived on lands held by Canada until the mid-1970s, when they lost their homes in Waterways, Cree Flats and Moccasin Flats.

[4434] The Clearwater River Band No. 175 (also called Paul Cree's Band of Indians) are descendants of Indians who lived in Alberta, the Northwest Territories, and on the plains since time immemorial and prior to the establishment of Treaty 8. They stated that a reserve was set aside for them in 1921, in Township 88, east of Fort McMurray at the junction of the Clearwater and Christina Rivers. They said that those reserve lands were taken from them.

[4435] The Original Fort McMurray and Clearwater River Band filed the following joint submissions:

- April 30, 2018: Comments on additional information submitted by the proponent
- April 30, 2018: Request for extension of time
- June 20, 2018: Request to participate at the hearing
- August 31, 2018: Notice of question of constitutional law
- August 31, 2018: Hearing submission
- September 12, 2018: Hearing submission
- September 17, 2018: Request for extension
- September 18, 2018: Letter to the ACO
- September 17, 2018: Hearing material for Charles Beauchamp
- September 20, 2018: Response to the replies to the notice of constitutional law
- October 20, 2018: Clearwater hearing submission
- October 20, 2018: Hearing materials

- November 26, 2018: Scheduling of final arguments

[4436] The Original Fort McMurray and Clearwater River Band participated in the hearing. They cross-examined the applicant on October 28, 2018, and the Government of Canada on October 23, 2018, provided direct evidence on October 20, 2018, and their final argument was on December 11, 2018.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[4437] On September 19, 2018 the ACO advised that Alberta did not require consultation with the Original Fort McMurray First Nation and Clearwater River Band under Alberta's First Nations consultation policies.

Asserted Aboriginal and Treaty Rights

[4438] The Original Fort McMurray First Nation and Clearwater River Band asserted that they have the right to hunt, fish, trap, gather, harvest, collect traditional medicines and other indigenous cultural activities, and live and use their traditional lands as they have done for centuries.

[4439] They asserted the following rights to

- use the rivers and other water bodies for transportation, access and sustenance and use mineral resources including oil seeps, tar sands, or pitch near these water bodies to aid their travel on these water bodies and for other purposes including cultural and medicinal uses;
- use natural gas seams as fuel and for other purposes;
- possess, control, and manage the traditional lands and identify places and names therein;
- enjoy, use, and benefit from the wildlife, waters, forests, vegetation, plants, and mineral resources;
- build cabins and structures and trails throughout the traditional lands;
- subsist and develop as a society and as a people in and from the traditional lands;
- exercise a particular way of life and carry on traditional aboriginal activities in the traditional lands including cultural, religious, spiritual, ceremonial, cultural, trading, educational, and medicinal practices and activities;
- maintain burial sites throughout the traditional lands;
- develop and maintain unique land relationships including specific extended family trapping areas;
- act as protectors and stewards of the land, the wildlife resources, the natural resources, and environment of the traditional lands;
- exist as an aboriginal society, carry on their own particular way of life, exercise their own culture, earn a livelihood in harmony with the land and preserve the lands and the resources of the traditional lands; and

- continue to be a distinct aboriginal people and society with their own social organization, distinct culture and particular language, institutions, laws, practices, customs and traditions.

[4440] The panel's terms of reference requires it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted by or the strength of such claims. But, for the purposes of assessing the potential effects of the Frontier project the panel accepts the rights being asserted.

Context of Historical and Current Cumulative Effects

[4441] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous group's ability to access and use lands and resources, their ability to practice culturally important activities or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Agency, effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

Use of Lands and Resources for Traditional Purposes

[4442] The Original Fort McMurray First Nation and Clearwater River Band stated that they have lived, hunted, fished and gathered traditional foods from time immemorial on lands surrounding Lake Athabasca, Ronald Lake, south along the Birch Mountains and on both sides of the Athabasca River. These lands include the site of the Frontier project and Wood Buffalo National Park. They said they have hunted the Ronald Lake bison since before the signing of Treaty 8.

[4443] The Original Fort McMurray First Nation said its members have lived in Fort McMurray including: Macdonald Island, Anzac, Fort Chipewyan, and old Fort McKay. Members said that they hunted, trapped, and fished along the Athabasca and Clearwater Rivers, in Mud Flats and up the Athabasca River in the Thickwood heights. They also hunted and trapped on traplines along the Athabasca River and where Thickwood Heights is today. They trapped north of Fort Chipewyan on the Slave River, across Poplar Point and the Birch mountains and have hunted and trapped on the project site before traplines were established. Members remember hunting for caribou, catching many muskrats and picking berries in the project area and stated that they currently hunt near the Christina River and near Wood Buffalo National Park.

[4444] Members of the Clearwater River Band said they lived on the Clearwater reserve, Moccasin flats and in Fort McMurray. They have trapped, hunted and fished in Fort McKay, Fort Chipewyan, and Uranium City for over 200 years. Members of the Clearwater River Band have also owned traplines, one of which was located west of Fort McKay between Albion sands and Firebag.

[4445] The Original Fort McMurray First Nation and Clearwater River Band stated that when they are out on the land, air cannons from the oils sand mines constantly disturb them and there is no place to hunt to feed their families in their traditional lands. They talked about how much the town of Fort McMurray has grown in size and the loss of the areas where they used to pick berries.

[4446] They explained that the wildlife is currently stressed and populations are declining as a result of continued industrial development, the increased pressure of human intrusion in the area, light pollution, the destruction of habitat, the alteration of wetlands, the clearing of old-growth and other forests and vegetation areas. Muskrats, fish, mosquitos were also abundant in the past around their traditional lands. Also, Chub (Lake Athabasca Dace) is disappearing and that it is the main food source that the walleye and jackfish to feed on.

[4447] They said that old-growth forests have already been lost due to climate change, lack of provincial protection, industry and forest fires and that reduced old-growth forest ecosystems affects wildlife that depend on old-growth forests – namely fur-bearers and birds.

[4448] Their members said that water levels are currently low in the Athabasca River and in Lake Athabasca. They believe that this is a cumulative effect from the Peace River dam, the Charlotte River dam and water withdrawals from oil sands development in the region. They said that the low water level is severely affecting the river and its tributaries.

Health and Socioeconomic Conditions

[4449] The Original Fort McMurray First Nation and the Clearwater River Band stated that their traditional land north of Fort McMurray to Poplar Point has been degraded as a result of existing industrial activity. They stated that they are unable to use that land anymore because “it is polluted, it is bare and it is full of industry.” Berries around Fort McKay are covered in dust from the oil sand mines and members are concerned that they are contaminated because they are grown in contaminated soil from the mine dust. Members living in Fort Chipewyan currently live off the land and eat some of the country foods.

[4450] The Original Fort McMurray First Nation and the Clearwater River Band expressed fear of contamination of foods and that they no longer trust resources that they rely on. They do not drink the local water, eat the local meat, fish, or berries there because they believe they are polluted and contaminated. Members stated that fish they have caught smelled like oil or had sores on them. They are concerned that the pollution from the stacks is saturating their lands with algae blooms that are toxic, dangerous to humans and animals, and the damage is irreversible.

[4451] They said caribou used to be abundant and was the main meat they relied on every winter to feed their families. Muskrats, fish, mosquitos were abundant in the past around their traditional lands. Also,

that chub (Lake Athabasca Dace) is disappearing and that it is the main food source that the walleye and jackfish to feed on. They said the stressors on wildlife and fish leads to food insecurity for their families.

[4452] The Original Fort McMurray First Nation and the Clearwater River Band stated that homelessness is an issue in their communities and people die on the streets. They also talked about employees of other oil sands operators vandalizing, stealing, and harassing their members and their concerns about personal safety.

Physical and Cultural Heritage

[4453] The panel is required to take into account physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance

[4454] The Original Fort McMurray First Nation and the Clearwater River Band identified

- non-specific (no specific locations were identified) sacred spiritual, burial, and other ceremonial sites,
- pipestone from sacred quarries in Calumet creek area (about 10 kilometres south of the Teck Frontier mine lease),
- a battlefield somewhere between the Fort Hills and Frontier sites where a battle took place in the 1800s and many men died,
- non-specific unclaimed grave sites that could be of the Original Fort McMurray First Nation and Clearwater Band ancestors, and
- non-specific family cabins.

Analysis and Findings

[4455] Teck did not contest the evidence provided by the Original Fort McMurray First Nation and the Clearwater River Band.

[4456] The Original Fort McMurray First Nation and the Clearwater River Band appeared at the hearing and had their evidence tested through questioning. The panel finds it is able to rely on the evidence presented by the Original Fort McMurray First Nation and the Clearwater River Band as summarized above.

[4457] The Original Fort McMurray First Nation and the Clearwater River Band presented non-specific evidence that some members use lands for harvesting and cultural practices on the project disturbance area and through the Birch Mountains and Richardson River area. Their evidence did not reference the use of specific areas, lands, or place names of areas used for hunting, gathering or trapping, or important cultural sites or cabins within the project disturbance area or the local study area.

[4458] The panel finds that non-specific nature of the Original Fort McMurray First Nation and the Clearwater River Band's evidence did not demonstrate that:

- Members use specific lands in the local or regional study areas to hunt, trap, fish, and gather.
- Members use specific lands near or in the project disturbance area for cultural practices or accessing culturally important sites.

[4459] The panel finds that Original Fort McMurray First Nation and the Clearwater River Band have not demonstrated that they currently use lands specifically in the project disturbance area, the local study area or the regional study area that will be directly affected by the project.

Project and Cumulative Effects

[4460] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights, and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources, and practice of asserted rights.

Effects on Use of Lands and Resources for Traditional Purposes

Original Fort McMurray First Nation and Clearwater River Band's View

[4461] The Original Fort McMurray First Nation and the Clearwater River Band stated that the project would disrupt their current and future ability to exercise their asserted aboriginal and treaty rights within their traditional territory for more than 40 years.

[4462] Specifically, they stated general concerns about the effects of the Frontier project and the effects of general oil sands development on the following:

- Their ability to hunt for food, fish and harvest – They explained that the project would have a detrimental effect on their traditional lands, and that the footprint of the project would destroy an extensive area of their traditional lands,
- Their traditional ties to Wood Buffalo National Park – They are concerned about how the project will affect the park.
- Wildlife habitat – The destruction of habitat for fish, aquatic species, beaver, muskrat, fisher, otter, fox, cougars, lynx, black bear, martin, moose, woodland caribou, waterfowl, water shrew, peregrine falcon, squirrel, rabbit and other wildlife populations.
- Effects on wildlife and birds – Including from tailings ponds, fugitive dust from oils sands operations, aerodrome activity, industrial disturbance and the destruction of wetland habitat.

- Timelines for reclaiming fish habitat – They explained that current members and subsequent generations will be affected by the loss of fish habitat before those habitats are available to be fished. They expressed concern that the end-pit lakes will not be able to provide fish habitat and instead will contaminate aquatic systems. They have concerns about the project’s effects on surface water and groundwater quantity, including the project’s interruption of water flows from the Birch Mountains flowing through the project disturbance area into the Athabasca River.
- The Ronald Lake bison herd – The project will reduce the herd’s habitat, which could affect the herd’s sustainability. They are particularly concerned with the exposure of bison to tailings ponds. They explained that the project footprint disturbs muskeg-rich habitat that bison rely on and use as a migration route. They are also concerned about potential for commingling of the Ronald Lake bison with the diseased Wood Buffalo National Park bison.
- Wildlife population – Increases to the population of wolves and coyotes may affect the populations of other species.
- Increased human presence – They explained that the project would make land more easily accessible to the public and non-indigenous hunters, which will affect both wildlife and traditional land users.
- Accidents and malfunctions – They questioned how they would be warned before it reached them in the event of an oil spill or flaring incident while they are on the land.
- Reclamation outcomes – They explained that reclaimed areas do not include the species indigenous to the area such as blueberries, cranberries, boysenberries, cowberries, pin cherries, Saskatoon berries, chokecherries, and indigenous plants that are needed to feed the birds, animals and their members. Also, reclaimed areas do not resemble forest indigenous to the area. Members stated that muskegs are not restored in oil sands project reclamation, and this loss affects wildlife because bison and other animals rely on the grasses and the plants that grow in muskegs. Muskegs are key to their way of life. They stated that the loss of this ecosystem causes effects to wildlife which in turn affects trapping and traditional uses. Also, the project would clear old-growth forests resulting in a period of over 60 to 100 years after reclamation before old-growth will begin again.
- Climate change – They believe the project is a step in the wrong direction because oil sands contribute to climate change. They are concerned about severe weather events and increased frequency of intense floods and forest fires. Members stated that warmer climates can also affect the ticks and bugs that in turn affect humans and animals; for example, mule deer and woodland caribou can die from ticks that are spread by the white-tailed deer.

[4463] The Frontier project is located in the same broad area where members of the Clearwater River Band hunted, trapped and fished when they were younger.

Applicant's View

[4464] Teck did not specifically assess the effect of the Frontier project on the Original Fort McMurray First Nation and the Clearwater River Band's current use of lands and resources for traditional purposes.

Effects on Health and Socioeconomic Conditions

Original Fort McMurray First Nation and Clearwater River Band's View

[4465] The Original Fort McMurray First Nation and Clearwater River Band said they are concerned about the loss of muskeg. It is contributing to a decrease in the quality of the water because muskeg is a water purifier.

[4466] They raised specific concerns regarding fugitive dust toxicity and effects to human health including when ingesting country foods that were exposed to it. They also raised concerns about Teck's underestimation of particulate matter; namely, that their air quality assessment did not consider the particulate matter that was produced by the forest fire in 2015.

[4467] They said that oil sands mining camps bring social problems like pests, diseases including sexually transmitted diseases, loss of employment, drugs, suicides, overdoses and killings. These social problems are brought from the outside to the project's community and affect the Original Fort McMurray First Nation and the Clearwater River Band's families and children.

[4468] They raised concerns about Fort McMurray infrastructure and the municipality's ability to handle and dispose of garbage and sewage accumulated through industrial activity.

[4469] They said that the effects of the Frontier project on traditional lands and on their rights will be significant and that the project would result in serious and permanent damage to the wildlife they rely on.

[4470] The Original Fort McMurray First Nation also said that Charles Beauchamp's outfitting business would be severely impacted by the Frontier mine due to the project's effects to bison and moose.

Effects on Physical and Cultural Heritage

[4471] The panel is required to take into account the effects on physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Original Fort McMurray First Nation and Clearwater River Band's View

[4472] The Original Fort McMurray First Nation and the Clearwater River Band stated that the Frontier project lands include sacred spiritual, burial and other ceremonial sites that they continue to use today. They raised concerns that there could be pipestone on the Frontier site as it is found nearby in Fort Hills and Calumet Creek. They stated that pipestone is sacred and needs to be protected. They are concerned that the proposed bridge or water intake could disturb a battlefield between the Fort Hills and Frontier

sites where a battle took place in the 1800s and many men died. They also said that the grave sites that have been identified through this process and that are not claimed by Fort McKay could be grave sites of the Original Fort McMurray First Nation and Clearwater Band ancestors. They said that there could be family cabins near the Frontier project.

Analysis and Findings

[4473] Teck did not contest the evidence provided by the Original Fort McMurray First Nation and the Clearwater River Band. The Original Fort McMurray First Nation and the Clearwater River Band appeared at the hearing and had its evidence tested through questioning. Their evidence was similar in nature to other parties, though less specific with respect to details about their current use of lands and resources, and how they practice asserted rights and how those would be affected by the project.

[4474] The panel finds it is able to rely on the evidence of the Original Fort McMurray First Nation and the Clearwater River Band as summarized above. However the non-specific nature of the evidence provided few links to possible effects of the project.

[4475] From the evidence the panel finds that:

- The Original Fort McMurray First Nation and the Clearwater River Band are currently experiencing adverse effects on their ability to hunt, fish, trap and gather food. Due to the non-specific nature of the evidence the panel was unable to determine with certainty that the project will contribute to these effects.
- The Original Fort McMurray First Nation and the Clearwater River Band appear to avoid hunting, fishing and gathering in the oil sands area because of perceptions that the meat and berries are contaminated from pollution and are unsafe to consume.
- The project footprint could result in the direct loss of lands where traditional activities are practiced but the panel was unable to determine this with certainty due to the non-specific nature of the evidence.
- Harvesting bison is important to the Original Fort McMurray First Nation and the Clearwater River members and their ability to hunt them in the future may be affected by the project but the panel was unable to determine this with certainty due to the non-specific nature of the evidence.
- Cumulative effects on the practice of traditional activities may be exacerbated by the project, which may eliminate or prevent hunting, trapping, fishing, and gathering activities in the local study area and regional study area but the panel was unable to determine this with certainty due to the non-specific nature of the evidence.

- The project may affect their ability to access hunting, fishing, gathering and trapping areas from the direct removal of lands but the panel was unable to determine this with certainty due to the non-specific nature of the evidence.

[4476] The panel finds that Original Fort McMurray First Nation and the Clearwater River Band have not demonstrated that the project is likely to result in significant effects to current use of lands and resources for traditional purposes, health and socioeconomic conditions or for physical or cultural heritage activities.

Mitigation Measures

[4477] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[4478] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

[4479] The Original Fort McMurray First Nation and Clearwater River Band stated that there is a need for effective mitigation measures to prevent animals from becoming oiled as well as facilities with equipment to better respond to flocks of birds that come into contact with oil spills or land on tailings ponds.

[4480] They recommended that

- The Ronald Lake bison be preserved and enough land be protected for them to flourish on. They recommend extending the Wood Buffalo National Park boundary down to engulf the habitat that the Ronald Lake bison herd uses. They also recommended more thought and planning and a herd management plan for the Ronald Lake bison herd to ensure their habitat is preserved, to ensure a buffer zone is maintained and the herd does not come in contact with the diseased bison in Wood Buffalo National Park. They said fences would need to be strong enough to withstand bison to keep bison out of the site. In addition, bison feces and noise cannons should be used to deter bison from coming in proximity to tailings ponds. They would like to be included in project-specific studies on the environment and bison and the group of indigenous groups that could be affected by effects to Wood Buffalo National Park.
- Shipping bitumen in the form of dry bitumen or pellets to reduce the potential effects of spills.

- Tailing ponds be eliminated or at least that a liner be installed to prevent seepage. Also, a better recovery of hydrocarbons on tailings ponds should be required and no end-pit lakes should be approved until at least one is proven as viable.
- Areas with pipestone be protected and the battles of the fur trade site be protected.

Analysis and Findings

[4481] In section 23, “[Wildlife](#),” the panel has concluded that the Frontier project will result in significant, adverse effects to the Ronald Lake bison increasing the likelihood of disease transmission to the healthy animals in the Ronald Lake bison from the diseased animals in Wood Buffalo National Park. As Mr. Beauchamp, does not currently harvest from the Ronald Lake bison, this is unlikely to adversely affect his use of this resource or his outfitting operation.

[4482] While the panel concluded that none of the proposed mitigation measures was likely to be effective in reducing the risk of disease transmission, it did make several recommendations to the governments of Canada and Alberta regarding the Ronald Lake bison (see [Appendix 6](#)).

[4483] In section 23, “[Wildlife](#),” the panel concluded the Frontier project will cause a displacement of moose as a result of loss of habitat in the local study area. This change in abundance of moose in preferred harvesting areas will reduce harvesting success of indigenous hunters, which may adversely affect the Original Fort McMurray First Nation and Clearwater River Band’s abilities to access this resource and Mr. Beauchamp’s outfitting business. The panel has made recommendations to the governments of Canada and Alberta with concerning the management of moose.

[4484] Further, the panel reached the conclusion that the Frontier project in combination with other developments are likely to result in significant, adverse cumulative effects on caribou.

[4485] The panel also concluded that the decline in fur-bearer abundance as a result of the project will vary with the species, with effects ranging from high magnitude for lynx and fisher to moderate for black bear, beaver and muskrat.

[4486] In the sections “[Wildlife Health](#)” and “[Vegetation](#),” the panel concluded that air and water quality effects from the Frontier project are not expected to significantly affect wildlife and vegetation health. However, reduced confidence in the quality of foods and water quality may adversely affect Original Fort McMurray First Nation and Clearwater River Band’s use of these resources and result in loss of use of preferred harvesting areas, especially downstream of the project.

[4487] In section 29, “[Public \(Human\) Health](#),” the panel has determined that the project is not likely to result in adverse effects to the health of indigenous land users in the region. The panel has made recommendations to the governments of Canada and Alberta regarding the protection of human health (see [Appendix 6](#)).

[4488] A consolidated version of Teck's commitments is in [Appendix 11](#). A number of the issues and concerns identified by Original Fort McMurray First Nation and the Clearwater River Band are addressed by these commitments.

[4489] The panel has required a number of these proposed mitigations as conditions of the project approval. A number of these measures are outside the authority of the panel. However, the panel finds that many of these measures are reasonable given the context of the region, the issues and concerns and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of environmental valued components, which will serve to also reduce effects on indigenous use of lands. In conjunction with a number of adaptive management plans which Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by the Original Fort McMurray First Nation and Clearwater River Band.

[4490] The panel acknowledges that the Original Fort McMurray First Nation and Clearwater River Band objected to the Frontier project and have maintained their opposition to the project. They have not signed a participation agreement with Teck, and as such, mitigation measures that arise from those agreements between Teck and other indigenous groups may be less likely to reduce the effect of the project on the current use of lands and resources, physical and cultural heritage, of the Original Fort McMurray First Nation and Clearwater River Band.

Conditions and Recommendations

[4491] The panel has established a number of conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by the Original Fort McMurray First Nation and Clearwater River Band.

Conditions

[4492] The panel requires that Teck finalize a traditional land-use mitigation, monitoring and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of construction of the project.¹⁷³ The plan will be required as a condition of an *EPEA* approval for the project.

Recommendations for Teck

[4493] Work collaboratively with the Original Fort McMurray First Nation and Clearwater River Band and include them in the traditional land-use mitigation, monitoring and adaptive management plan for the project.

¹⁷³ Draft *EPEA* Approval – Condition 3.1.7

Determination of Significance

[4494] The panel determined the significance of project effects to current use of lands and resources, and physical and cultural heritage based on the approach discussed in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[4495] The panel also assessed the potential for the Frontier project to impact the rights asserted in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Significance Determination for Project Effects

[4496] The Original Fort McMurray First Nation and Clearwater River Band provided general non-specific evidence describing how the effects of the project will adversely affect their ability to hunt, trap, fish, gather plants and some non-specific evidence of culturally important areas. The panel was unable to determine that the Original Fort McMurray First Nation and the Clearwater River Band currently use lands in the project disturbance area, the local study area or the regional study area that will be directly affected by the project.

Current Use of Lands and Resources for Traditional Purposes

[4497] The geographic extent of project effects would be regional. Any effects to the Original Fort McMurray First Nation's and Clearwater River Band's ability to access and harvest species of cultural importance are expected to occur within the regional study area.

[4498] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities. Uncertainties exist regarding the expected timeframe for reclamation and the likelihood of establishing a functioning landscape.

[4499] The frequency of project effects would be continuous.

[4500] The project effects would be irreversible. Uncertainty exists regarding the timing and success of reclamation and closure activities and the extent to which future landscapes will be able to support vegetation, wildlife, and waterfowl populations which their members harvest. Further, it is uncertain whether indigenous groups would reestablish traditional use activities on reclaimed lands following a multigenerational absence and therefore a loss of cultural connection to those lands.

[4501] Due to the non-specific nature of evidence from Original Fort McMurray First Nation and Clearwater River Band regarding current use of lands in the project disturbance area, local study area and regional study area, the panel finds that the magnitude of project effects will be low or moderate. Their evidence suggests that they avoid hunting, gathering and fishing in the mineable oil sands region

(including the project disturbance area and local study area) as the result of perceived effects of oil sands pollution on animals and plants which they normally harvest. The panel does not believe that the project will result in widespread significant adverse effects to the use of lands by Original Fort McMurray First Nation and Clearwater River Band.

[4502] In consideration of project mitigation measures and conditions imposed by the panel the magnitude of effects on the Original Fort McMurray First Nation and Clearwater River Band will be low or moderate in magnitude and not significant.

Health and Socioeconomic Conditions

[4503] As determined in section 29, "[Public \(Human\) Health](#)," the panel finds that the human health effects from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Original Fort McMurray First Nation and Clearwater River Band members.

[4504] As determined in section 30, "[Social Effects](#)," the panel finds that the socioeconomic effects from the project are expected to be low in magnitude. The panel believes that this finding applies for Original Fort McMurray First Nation and Clearwater River Band members.

[4505] The panel notes that due to the current prohibition on hunting bison from the Ronald Lake bison, Mr. Beauchamp has relocated his outfitting business to north of Wood Buffalo National Park. As a result, the project will not affect his current outfitting business with respect to bison or moose hunting.

[4506] The panel finds that the project effects to the Original Fort McMurray First Nation's and Clearwater River Band's health and socioeconomic conditions would be adverse, but are not likely to occur and not significant.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[4507] The panel has determined that the magnitude of effects would be low. The Original Fort McMurray First Nation's and Clearwater River Band's evidence did not identify specific use of areas or sites in the project disturbance area and local study area that would be directly affected by the project.

[4508] The geographic extent of project effects would be regional. The effects to the Original Fort McMurray First Nation's and Clearwater River Band's ability to continue to participate in culturally important activities are expected to occur within the local study area and regional study area.

[4509] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities.

[4510] The frequency of the project effects would be continuous.

[4511] The project effects to the transfer of cultural values and knowledge, which require connections to the land from one generation to the next, would be irreversible given the likely loss of connection to traditional activities and the cultural values that take place on lands directly affected by the project.

Summary

[4512] The panel finds that the project effects to the Original Fort McMurray First Nation's and Clearwater River Band's current use of lands and resources for traditional purposes and physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance in the local and regional study areas would be low or moderate in magnitude, adverse, but not significant.

Significance Determination for Cumulative Effects

[4513] The Original Fort McMurray First Nation and Clearwater River Band stated that the cumulative effects of development in their traditional lands has impacted their way of life, has been responsible for their displacement and threatens the sustainability of their aboriginal and treaty rights. They explained that any more development will extirpate them from the area. They noted that thresholds for effects to traditional land use and particularly pollution thresholds in this regard have been already superseded due to cumulative effects.

[4514] Teck stated that it had made good faith efforts to meet with the Original Fort McMurray First Nation and Clearwater River Band to discuss their interests. Teck stated that it approached indigenous consultation and engagement in a manner consistent with its approved aboriginal consultation plan, which contemplates a spectrum of consultative efforts.

The Current Use of Lands and Resources for Traditional Purposes

[4515] The magnitude of cumulative effects would be high. Areas that the Original Fort McMurray First Nation and Clearwater River Band use for traditional activities have been adversely affected by oil sands mining and development. They report avoidance of a large part of their traditional use areas where they perceive that species which they hunt and foods which they gather have been contaminated by pollution from oil sands and therefore not fit for consumption. Cumulative effects of development are preventing the Original Fort McMurray First Nation and Clearwater River Band members from accessing areas for trapping, hunting, fishing, and gathering.

[4516] The geographic extent of cumulative effects would be provincial as cumulative effects are occurring over much of the traditional lands used by the Original Fort McMurray First Nation and Clearwater River Band members and beyond the regional study area.

[4517] The duration of cumulative effects would be long. Cumulative effects will extend beyond the cessations of industrial activities in the region. Cumulative effects are likely to be experienced for an extremely long time.

[4518] The frequency of cumulative effects would be continuous.

[4519] The cumulative effects may be irreversible. It is uncertain whether Original Fort McMurray First Nation and Clearwater River Band members would reestablish traditional use activities on lands following a multigenerational absence and therefore a loss of cultural connection to those lands.

[4520] The panel finds that due to the high magnitude, provincial geographic extent, long-term duration, continuous frequency, the cumulative effects to the Original Fort McMurray First Nation's and Clearwater River Band's current use of lands and resources for traditional purposes and physical and cultural heritage in the local and regional study areas and Wood Buffalo National Park would be adverse and significant and likely to occur even in consideration of the key mitigation measures proposed.

Health and Socioeconomic Conditions

[4521] As determined in section 29, "Public (Human) Health," the panel finds that the cumulative effects to human health from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Original Fort McMurray First Nation and Clearwater River Band members.

[4522] As determined in section 30, "Social Effects," the panel finds that the cumulative socioeconomic effects are expected to be low in magnitude. The panel believes that this finding applies for Original Fort McMurray First Nation and Clearwater River Band members.

[4523] The panel finds that the cumulative effects to the health and socioeconomic conditions of the Original Fort McMurray First Nation and Clearwater River Band would be adverse but not significant.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[4524] The Original Fort McMurray First Nation and Clearwater River Band report avoiding harvesting in large areas of the mineable oil sand area due to perceptions of the effects of pollution on wildlife and vegetation. The geographic extent of cumulative effects would extend beyond the regional study area and therefore be provincial. The cumulative effects to the Original Fort McMurray First Nation's and Clearwater River Band's ability to continue to participate in culturally important activities are expected to occur beyond the local study area and regional study area.

[4525] The duration of cumulative effects would be long term. Cumulative effects would extend beyond the end of project operations and reclamation and closure activities.

[4526] Frequency of cumulative effects would be continuous.

[4527] The cumulative effects to the transfer of cultural values and knowledge, which require connections to the land from one generation to the next, would be irreversible given the likely loss of connection to traditional activities.

[4528] The magnitude of cumulative effects would be high. The cumulative effects would affect culturally important areas, cabins, wildlife species, and the ability to access them.

Summary

[4529] The panel finds that the project effects, in combination with the effects of past activities, to the Original Fort McMurray First Nation's and Clearwater River Band's current use of lands and resources for traditional purposes and physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance would be adverse and significant and likely to occur even in consideration of the key mitigation measures proposed. Residual effects of the project will not result in a significant incremental contribution to cumulative effects as they are currently being experienced by the Original Fort McMurray First Nation and Clearwater River Band.

Significance Determination for Asserted Rights

[4530] The panel has assessed project impacts to the Original Fort McMurray First Nation's and Clearwater River Band's asserted aboriginal and treaty rights in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*.

[4531] The panel determined that some adverse incremental effects from the project on asserted rights may occur but that they are not likely to be significant. The panel recognizes that the ability of the Original Fort McMurray First Nation and Clearwater River Band members to practice certain asserted rights has already been diminished. The panel determined that cumulative effects of existing industrial activity including any additional incremental effects of the project will result in ongoing significant adverse cumulative effects to Original Fort McMurray First Nation and Clearwater River Band members practice of asserted rights.

Table 58. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	low/moderate	regional	long	continuous	irreversible	not significant
Cultural and physical heritage	low	regional	long	continuous	irreversible	not significant
Health	low	regional	long	continuous	reversible	not significant
Social effects	low	regional	long	continuous	reversible	not significant
Asserted aboriginal and treaty rights	low					not significant

Table 59. Summary – Significance determination for cumulative effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Use of lands and resources	high	provincial	long	continuous	irreversible	significant
Cultural and physical heritage	high	provincial	long	continuous	irreversible	significant
Health	low	regional	long	continuous	reversible	not significant
Social effects	low	regional	long	continuous	reversible	not significant
Contribution of the project to cumulative effects	low/moderate	regional	long	continuous	reversible	not significant
Asserted rights	high					significant

Smith's Landing First Nation

Background

[4532] Smith's Landing First Nation stated that they have a registered population of approximately 353 members. They estimated that 120 members live in Alberta; 28 on reserves in Fort Fitzgerald and Thebacha Nare; and 161 members live in the Northwest Territories. The remaining members reside outside of Alberta and the Northwest Territories.

[4533] Smith's Landing's traditional territory spans northern Alberta, northern Saskatchewan, northern Manitoba, the Northwest Territories, and southern Nunavut. It includes Wood Buffalo National Park and the Frontier project. Smith's Landing has ten reserves located within northeastern Alberta. Two of which—*Ejere K'elni Kue* 196I and *Tsu Nedehe Tue* 196H—are located in Wood Buffalo National Park. The eight other reserves are located along the Slave River and east of the Slave River.

[4534] Smith's Landing filed the following submissions:

- June 20, 2018: Request to participate at the hearing
- August 31, 2018: Hearing submission
- October 3, 2018: Direct evidence
- October 23, 2018: Undertaking 7
- December 5, 2018: Final argument

[4535] Smith's Landing participated in the hearing, providing direct evidence to the panel on October 3, 2018.

The Aboriginal Consultation Office's Conclusion on the Adequacy of Consultation

[4536] On August 24, 2018, the ACO informed the AER that Smith's Landing did not identify any specific sites requiring mitigation and/or avoidance with reference to the project and that no consultation was required with Smith's Landing or if it was required, the consultation was adequate. On September 19, 2018, the ACO informed the panel that it currently does not require consultation with Smith's Landing but that it would attend the hearing to consider their evidence.

[4537] The ACO attended the hearing, heard the Smith's Landing evidence and noted that during the hearing Smith's Landing identified downstream cumulative impacts in Wood Buffalo National Park and the Slave River area as a concern but that Smith's Landing did not identify any specific sites requiring mitigation and/or avoidance with reference to the project.

Asserted or Established Aboriginal and Treaty Rights

[4538] Smith's Landing is a signatory of Treaty 8. They asserted that they hold the following rights:

- To maintain a distinctive way of life in relation to the lands, waters and resources in its traditional territory;
- Harvesting rights, including hunting, fishing and trapping;
- Ancillary and incidental rights, including the right to access Treaty 8 lands for the purpose of exercising treaty rights; and
- Procedural right to consultation, and potentially accommodation when the Crown contemplates an action or decision that may adversely affect an aboriginal or treaty right.

[4539] Smith's Landing stated that the following are requirements to meaningfully exercise their treaty rights:

- a healthy, clean and sustainable environment (i.e., land, water and resources);
- access to preferred harvesting areas;
- access to areas of cultural and spiritual significance;
- the ability to harvest culturally important species;
- access to traditional transportation routes;
- the ability to share resources with community members;
- access to safe transportation routes; and
- the ability to pass on culture, knowledge and language to younger generations.

[4540] The panel's terms of reference requires it to consider the effects of the Frontier project on asserted or established aboriginal and treaty rights, to the extent it receives such information. The panel has not made any determinations as to the validity of the aboriginal or treaty rights being asserted or the strength of such claims. For the purposes of assessing the potential effects of the Frontier project the panel accepts the rights being asserted.

Context of Historical and Current Cumulative Effects

[4541] Much of the evidence heard by the panel spoke to currently occurring adverse effects to indigenous group's ability to access and use lands and resources, their ability to practice culturally important activities or their ability to exercise their asserted rights. According to the joint methodology submitted by Mikisew Cree First Nation and the Agency, effects of the Frontier project should be considered in the context of the historic and contemporary cumulative effects that have a bearing on a

community's existing ability to exercise their aboriginal and treaty rights, as well as the extent to which the exercise has already been diminished.

Use of Lands and Resources for Traditional Purposes

[4542] Smith's Landing described themselves as the stewards of the northern waters flowing out of Alberta on the Slave River. They described a duty to ensure that these resources are protected for the Slave River. They noted that the Athabasca River drains north into the Slave River and consequently, any change to the Athabasca River directly affects the Slave River. They stated that their stewardship role and *Dene Ch'anié*—"the path we walk"—have been significantly impacted by downstream cumulative impacts of development.

[4543] Smith's Landing described that they have 10 reserves within northeastern Alberta and Wood Buffalo National Park. They also stated that their traditional territory includes Wood Buffalo National Park and the Frontier project area.

[4544] Smith's Landing stated that they practice their rights to hunt, fish, trap, and gather in and near Wood Buffalo National Park including Lake Claire, Birch River, the Slave River area, Fort Fitzgerald, Peace River, Athabasca River, Pine Lake, McNeil Lake, Helen Lake, Leland Lake, Charles Lakes, Dog River, Murdock Creek, La Butte, and Hornaday Creek.

[4545] Smith's Landing stated that they rely on areas in Wood Buffalo National Park and along the Slave River to hunt large game including moose, buffalo and bear, migratory birds, including ducks, geese, swans and cranes, fish, trap fur-bearing animals, including wolves, wolverine, lynx, martin, fisher, beaver and muskrat and gather medicine such as rat root and spruce gum.

[4546] Smith's Landing stated that they use various traditional transportation routes in Wood Buffalo National Park, up the Slave River past Fort Fitzgerald and into the Dog River.

[4547] Smith's Landing maintains that they are experiencing significant adverse cumulative impacts on their rights, culture and interests resulting from development within their territory. They note cumulative effects from upstream developments have changed the air quality, water quality, water quantity, ice quality and quantity and seasonal flows and sediment deposits on the Slave River. Once abundant populations of wildlife and fish have been significantly reduced which has affected their ability to exercise their treaty rights and continue to live off the land.

[4548] Smith's Landing stated that they have experienced cumulative effects for a long time; starting with the signing of Treaty 8. Cumulative effects continued when Wood Buffalo National Park was created and traditional activities were curtailed, when the prairie bison were introduced in the park, when the natural resources transfer acts were passed, residential schools, and the relocation of their people from Fort Fitzgerald to Fort Smith in the 1960s where they faced significant hardship. The construction of the

Bennett Dam in the 1960s, the pulp mills and recently, the oil sands have led to degradation of traditional lands and resources. They explained that all of these events have affected their community and their way of life.

[4549] Since the building of the Bennett Dam in the 1960s and increasing oil and gas activities south of Wood Buffalo National Park, Smith's Landing has experienced significant changes to the land, waters and resources that are integral to their way of life.

[4550] They stated that they can no longer access locations by water as they could in the past. The building of the Bennett Dam and increasing oil and gas activities south of Wood Buffalo National Park have resulted in significant changes to the land, waters and resources that are integral to their way of life.

[4551] Smith's Landing stated that they have experienced a noticeable decline in water levels in Wood Buffalo National Park, Slave River and tributaries including the Dog River. Members stated the decline in water levels in Wood Buffalo National Park and Slave River is about 2 or 3 feet per year. Members said they have never seen water levels as low as they currently are. They explained that in the past, the creeks didn't freeze but today those creeks are dry, lakes have dried up and are overgrown with willows. Members have observed decreased water flows in the summer, increased flows in the winter, and reduced seasonal flows in the Athabasca River.

[4552] Smith's Landing stated that on the Dog and Slave Rivers, boat docks no longer reach the water's edge during low-water events. Since the introduction of upstream development, their members have experienced more difficulties navigating water bodies in Wood Buffalo National Park, the Slave River and tributaries than in the past.

[4553] Smith's Landing has been faced with new navigational challenges as low water levels have exposed hazards such as sandbars, reefs, and rocks making it difficult and dangerous to travel by boat on the Slave River and its tributaries. They identified several areas as being difficult or impossible to travel or access as result of low water levels including: Slave River, La Butte Creek, Hornaday Creek, Dog River, Murdock Creek, Scow Channel, Ryan Creek, and Pine Lake. In some places, the water is so low that it is not possible to go there with a canoe. Smith's Landing cannot access its reserve (Hokedhe Tue 169E) located near Myers Lake by boat because of low water on the Dog River.

[4554] Smith's Landing stated that it has witnessed downstream cumulative effects from low water on the Slave River and associated waterways including changes to plants and vegetation. Specifically, grasslands are turning into prairies and declining in extent and quality. In addition, because of the lowering of the water tables, members say it is a greater challenge than in the past to find medicines like rat root and spruce gum.

[4555] Smith's Landing explained that fish and wildlife populations began to decline in the 1970s. The decline in wildlife in Wood Buffalo National Park and the Slave River area includes moose, buffalo,

woodland caribou, beaver, fox, muskrat, ducks, geese, swans, and migratory birds. They stated that bison, at their current population and distribution, do not adequately support their indigenous way of life. Their members said that due to wildlife population declines, they are forced to travel further from their preferred harvesting areas. They raised concerns that low water levels have resulted in a decline in habitat for fish and wildlife.

[4556] Their members have experienced perceived and actual changes in the quality of the water in Wood Buffalo National Park and the Slave River and it has affected their ability to exercise their rights and rely on water resources. Members believe the water in the Slave River has been contaminated because of oil sands developments. They stated that they have also experienced airborne pollution that has affected the quality of the rain as far north as Fort Fitzgerald and Fort Smith. A member explained that some fish's flesh, including whitefish, is softer than and not as good to eat as it was in the past. Members are careful to check the fish before they eat them to make sure there are no lesions on the skin, strange growths or anything in its intestines.

[4557] The group has observed murky, brown-coloured water that tastes strange and has oily film on its surface. They no longer trust the quality of the water and no longer drink water from the Slave River and surrounding lakes due to a fear of disease. Their members testified that when they were young, they used to hunt and fish on the Slave River without any concerns related to the health of the wildlife. In the 1970s, this started to change. Members are concerned that air and water pollution from the oil sands is affecting the wildlife and the food chain.

Physical and Cultural Heritage

[4558] The panel is required to take into account the physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[4559] Smith's Landing stated that they rely on the lands, waters and resources in the areas described in the current use section above for ceremonial and spiritual purposes.

[4560] Smith's Landing stated that their members are unable to properly use their lands and resources, access cultural spiritual sites and conduct stewardship over their resources due to effects to woodland caribou and cumulative downstream impacts. Since members are unable to properly use their lands, it prevents them from passing on traditional knowledge and skills.

[4561] Their members provided evidence that their traditional life and language seem to be fading away.

[4562] They explained that as treaty rights holders, they hold a stewardship role to protect the land, resources and northern waters to ensure the continuation of their *Dene Ch'anie*—"the path we walk"—the culture, beliefs and values of Smith's Landing, which embodies a code of conduct according to natural laws. They said that this duty to protect mother earth is interwoven into the fabric of their being. Their

stewardship role and *Dene Ch'anié* have been affected by downstream cumulative impacts of development.

[4563] Smith's Landing stated that oppressive colonialism, capitalism, greed, and money have persistently degraded their cultural values, their spiritual relationships to the land, and their relationships to their ancestors that they uphold by continuing their cultural values and their way of life. They compared it to a disease that is eating away at their culture.

Health and Socioeconomic Conditions

[4564] Smith's Landing stated that with the introduction of oil sands development, they are concerned about eating fish and wildlife from Wood Buffalo National Park and the Slave River due to pollutants being discharged from the oil sands into the Athabasca River. They specifically noted concerns about eating birds that could have been contaminated by tailings ponds before arriving north. They also expressed concerns about high mercury levels in the water.

[4565] Their members no longer trust the quality of the water and no longer drink water due to a fear of disease. They correlated high cancer rates in their traditional territory with contaminated water.

[4566] Smith's Landing stated that *LARP* has resulted in their community being surrounded by protected areas. On one side is Wood Buffalo National Park and on the other side are lands protected by Alberta. They stated that this has had economic consequences on their community. The cost of living is high in their community and this is resulting in members having to rely on welfare.

[4567] Smith's Landing stated that social and environmental conditions, and the changes to those conditions over time, have created limitations on the exercise of their treaty rights and affected their cultural way of life. Members have been forced to travel by plane in order to access preferred harvesting areas that can no longer be accessed by boat. This is costly and creates further hardship for individuals who have limited resources to feed their family. Their members are forced to travel further from their preferred harvesting areas to hunt causing additional financial pressure.

[4568] They stated that following the decline in fur-bearing animal populations, it has become nearly impossible for members to trap for a living. Their members testified that they can no longer rely on the land to make a wage living.

Analysis and Findings

[4569] Teck did not contest the evidence provided by Smith's Landing. Smith's Landing appeared at the hearing and had its evidence tested through questioning. The panel finds it is able to rely on the evidence presented by Smith's Landing and summarized above.

[4570] The panel finds from the evidence that:

- Smith's Landing stated that they practice their rights to hunt, fish, trap, and gather in and near Wood Buffalo National Park including Lake Claire, Birch River, the Slave River area and areas generally downstream from the project disturbance area.
- Waterways are key transportation routes that they on to access hunting and trapping areas and to practice traditional activities and that low water levels has adversely affect these uses and their ability to access reserve lands.
- Smith's Landing use of lands for traditional and cultural activities is integral to the maintenance of their culture. The loss of use of harvesting areas has adversely affected their ability to practice and teach traditional knowledge to the youth.
- Smith's Landing is currently experiencing adverse effects on their ability to access lands for traditional uses because of low water levels in the region.
- Smith's Landing is experiencing difficulty practicing traditional activities due to the increased effort, time, and cost required; the inability to safely access culturally important areas; and reduced hunting success, which has interfered with their traditional way of life and eroded their culture.
- Smith's landing did not demonstrate that they likely use lands or resources within the project disturbance area or the local or regional study areas for the project. Nor did they identify any specific sites or culturally important areas that would be directly affected by the project.

Project and Cumulative Effects

[4571] The panel must consider the current context of land use and resources for traditional purposes and exercise of asserted rights, and assess how the Frontier project, or the Frontier project in combination with other approved or reasonably foreseeable projects, will affect that current use of lands and resources, and practice of asserted rights.

Effects on Use of Lands and Resources for Traditional Purposes

Smith Landing First Nation's View

[4572] Smith's Landing stated that although its current use of lands and resources is not located directly within the Frontier project footprint, it would still be affected by the project. They raised concerns that the Frontier project's effects to water quality, air quality and water quantity has the potential to directly, indirectly, adversely and cumulatively impact their and interest by further affecting the lands and resources they rely on including fish, wildlife, plants, and medicines. They explained that since the Athabasca River drains north into the Slave River, any change to the Athabasca River affects the Slave River. Smith's Landing explained that the Frontier project would cause downstream effects in their traditional territory and on Wood Buffalo National Park resulting in further deterioration of the outstanding universal value of the park.

[4573] Smith's Landing raised concerns about the Frontier project's effects on habitat for the boreal population of woodland caribou in the region. They are concerned that caribou could currently be birthing in the Frontier project footprint.

[4574] They raised concerns regarding the potential effects of the Frontier project on the water quantity in the Peace-Athabasca Delta and on the Slave River.

[4575] They spoke about the Frontier project depositing air pollution onto the snow and contaminating the water.

[4576] They explained the potential effects of the Frontier project on the water quality in the Peace-Athabasca Delta and on the Slave River. They are concerned that the Frontier project would further degrade the water resources their members rely on to maintain their cultural way of life. They also raised concerns about water contamination due to leaking tailing ponds. They said that they have great moral difficulty with industry using good clean water and returning polluted water into their environment.

Applicant's View

[4577] Smith's Landing is based in Fort Smith which is approximately 240 kilometres from the Frontier project; a significant distance according to Teck. Teck stated that the Frontier project is predicted to have negligible effects on the park including the Peace-Athabasca Delta and therefore Smith's Landing's traditional use of the park and the Peace-Athabasca Delta would not be affected by the project. Teck stated that many of the concerns expressed regarding the Peace-Athabasca Delta would exist whether or not Frontier proceeds.

[4578] Teck stated that the Frontier project does not fall within the currently designated woodland caribou ranges as defined by Canada and Alberta. Teck's assessment determined that project-related effects on caribou are negligible.

[4579] Teck's navigability assessment determined that the Frontier project, in conjunction with other oil sands developments, is not expected to affect navigation on the Athabasca River.

Effects on Health and Socioeconomic Conditions

[4580] Smith's Landing spoke about the effects of the Frontier project on the health of their members as a result of water and air pollution.

[4581] They explained that eco-tourism is being considered as a potential activity that would create economic benefits and employment for members without causing harm to the environment. They are concerned that the Frontier project, by causing pollution and reducing water levels, could affect this eco-tourism opportunity.

Effects on Physical and Cultural Heritage

[4582] The panel is required to take into account the cumulative effects on physical and cultural heritage and any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

[4583] Smith's Landing explained that in *Haudenosaunee* teachings, they live by the Great Law. One of those teachings, require members to think of the effect that a decision will have on members seven generations down the line. They expressed concerns that younger generations are going to face extreme difficulties living off the land and continuing their cultural way of life in the face of the Frontier project.

[4584] They explained that the Frontier project would further affect their cultural practices and traditions in and around the Slave River. These include their ability to share resources with community members, the ability to maintain cultural values that make them who they are, the ability to continue to act as stewards of their traditional territory, and the ability to maintain a spiritual connection to their land and a relationship to their ancestors.

[4585] Smith's Landing is concerned that permanent changes could put the world heritage values and ecological integrity of the Peace-Athabasca Delta at risk and would make that area undesirable for indigenous people who depend on it to transfer cultural knowledge and skills to the next generation. They explained that because their culture and language are land-based to practice their language and culture they must have access to the land. They are concerned that the Frontier project will further affect their traditional way of life and their ability to pass on their traditional knowledge to future generations. They said that this creates the risk that they may lose their culture and connection to the land.

Findings and Analysis

[4586] Teck did not contest the evidence provided by Smith's Landing regarding their assessment of the effects of the project on their asserted rights. Smith's Landing's evidence was largely supported by evidence from other parties downstream from the project development area. The panel finds it is able to rely on the evidence of Smith's Landing as summarized above.

[4587] The panel finds from the evidence that reduced water levels affect Smith's Landing's ability to access traditional lands and reserve lands in the Peace-Athabasca Delta and Wood Buffalo National Park and may adversely affect their ability to create economic benefits through eco-tourism.

Mitigation Measures

[4588] Teck submitted a draft traditional land-use mitigation, monitoring, and adaptive management plan for the project. It anticipates that the plan would be finalized with regulators and indigenous communities before submitting it to the AER as an anticipated condition of an *EPEA* approval.

[4589] At the request of the panel, Teck summarized its commitments to indigenous communities in the region that are intended to mitigate issues and concerns identified through their engagement processes. Teck's commitments to indigenous communities are outlined in CEAR #361 (appendix 10.12). A consolidated version of these is in [Appendix 11](#).

[4590] Transport Canada stated that it has the ability, within its regulatory processes, to include terms and conditions within project approvals to address impacts and cumulative impacts to navigation. Transport Canada confirmed that it continues to support a regional approach to water management, which can more effectively consider all of the cumulative impacts of water withdrawal for oil sands operations. To support this regional approach and to further its own understanding of the impacts of water withdrawal on navigation, Transport Canada advised that it is working to complete a navigation study in spring 2019. Transport Canada also confirmed that it is committed to working with the Province of Alberta. It committed to sharing the results of the study not only with Alberta, but also with other partners, including indigenous groups, Parks Canada, and ECCC.

Analysis and Findings

[4591] In section [18](#), "[Surface Water Quality](#)," the panel determined that the Frontier project will result in water discharges and aerial emissions which will increase concentrations and loadings of some surface water quality parameters within the local study area. Given predicted increases within the local study area, it is plausible that changes in water quality may be detected further downstream or downwind. However, the panel expects that these effects will be minimal and the project is not likely to result in adverse effects to water quality in the Peace-Athabasca Delta and Wood Buffalo National Park.

[4592] In section [19](#), "[Surface Water Quantity](#)," the panel found that significant, adverse cumulative effects to surface water quantity, flows, and water levels in the Athabasca River, Peace-Athabasca Delta, and Slave River Delta are occurring, but are due predominantly to hydropower regulation and regional climate change, with industrial water withdrawals playing a minor role. These changes in surface water quantity appear to be adversely affecting Smith's Landing's ability to access lands and resources for traditional purposes. The panel does not believe that the Frontier project is likely to exacerbate those existing effects. The panel does not believe that the Frontier project would adversely affect Smith's Landing's ability to pursue eco-tourism opportunities. The panel has made recommendations to the governments of Canada and Alberta with regards to surface water quantity and indigenous navigation.

[4593] In section [14](#), "[Air Quality](#)," the panel concluded that there is some potential for measurable air emissions from the project in the Peace-Athabasca Delta and Wood Buffalo National Park but the effects will be minimal.

[4594] In section [29](#), "[Public \(Human\) Health](#)," the panel has determined that the project is not likely to result in adverse effects to the health of indigenous land users in the region. The panel has made

recommendations to the governments of Canada and Alberta regarding the protection of human health (see [Appendix 6](#)).

[4595] The panel notes Teck's view that the project will not affect Smith's Landing traditional territory and consequently they have not entered into any type of agreements with Smith's Landing. The panel also notes that Teck has committed to a number of environmental mitigation measures and made commitments designed to mitigate effects of the project on indigenous communities.

[4596] A consolidated version of Teck's commitments is in [Appendix 11](#). The panel has required a number of these proposed mitigations as conditions of the project approval. A number of these measures are outside the authority of the panel. However, many of these mitigations are reasonable given the context of the region, the issues and concerns and the nature of the project. If implemented, these commitments may reduce the effects of the project on a number of valued environmental components which will serve to also reduce effects on indigenous use of lands. In conjunction with a number of adaptive management plans which Teck will be required to develop, conditions imposed by the panel will play an important role in mitigating project effects to many issues and concerns identified by Smith's Landing.

Conditions and Recommendations

[4597] The panel has established conditions that Teck will be required to implement in the development, operation, and reclamation of the project. Many of these conditions address general concerns of indigenous parties and many of the concerns identified by Smith's Landing.

Conditions

[4598] The panel requires that Teck finalize a traditional land-use mitigation, monitoring and adaptive management plan for the project and submit it to the AER for approval 6 months prior to the start of construction of the project.¹⁷⁴ The plan will be required as a condition of an *EPEA* approval for the project.

Recommendations

[4599] To reduce effects to navigation, the panel recommends that Transport Canada use its ability to include terms and conditions within project approvals to address project impacts and cumulative impacts to navigation. The panel recommends that Transport Canada continue its work on a navigation study and shares the results of the study with Smith's Landing.

¹⁷⁴ Draft *EPEA* Approval – Condition 3.1.7

Determination of Significance

[4600] The panel determined the significance of project effects to current use of lands and resources, and physical and cultural heritage based on the approach discussed in the Agency's guide, *Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012* (March 2018).

[4601] The panel also assessed the potential for the Frontier project to impact the rights asserted by Smith's Landing in consideration of the *Methodology for Assessing Potential Impacts on the Exercise of Aboriginal and Treaty Rights of the Proposed Frontier Oil Sands Mine Project*, jointly submitted to the panel by the Mikisew Cree First Nation and the Agency.

Significance Determination for Project Effects

Current Use of Lands and Resources for Traditional Purposes

[4602] The magnitude of project effects would be low to negligible. There is some potential for measurable air emissions from the project in the Peace-Athabasca Delta and Wood Buffalo National Park but the effects will not be significant. While some contaminants will be released into surface waters from the project, the water quality assessment determined that the effects will be limited primarily to the local study area and that these loadings are not expected to contribute significantly to water quality effects in the Peace-Athabasca Delta or Wood Buffalo National Park. It is not plausible that water withdrawals from the project will have any meaningful impact on the Slave River and its delta. The project will have minimal effects on air quality, water quality and water quantity and that while unlikely, if any residual effects from the project occur, they will not be significant.

[4603] The evidence presented on current use does not demonstrate that Smith's Landing's current use of lands or resources overlap with the project disturbance area or the local study area. While the panel does not dispute that Smith's Landings ability to practice asserted aboriginal and treaty rights has been affected by various developments to the south, their current use of land and resources for traditional purposes will not be affected by the project.

[4604] The geographic extent of project effects would be provincial. There may be small measurable changes in some air quality, water quality or quantity parameters in the Peace-Athabasca Delta and Wood Buffalo National Park.

[4605] The duration of project effects would be long term. Project effects would extend beyond the end of project operations and reclamation and closure activities.

[4606] The frequency of project effects would be continuous.

[4607] Project effects would be reversible, given the limited effects to Smith's Landing members' current use of lands and resources.

Health and Socioeconomic Conditions

[4608] As determined in section 29, “Public (Human) Health,” the panel finds that the human health effects from the project are expected to be low in magnitude. The panel believes that this finding particularly applies to the health of Smith’s Landing members given that their main location is in Fort Smith, approximately 240 km from the project.

[4609] As determined in section 30, “Social Effects,” the panel finds that the socioeconomic effects from the project are expected to be low in magnitude. The panel believes that this finding is especially applicable to Smith’s Landing given that Fort Smith is 240 km from the project.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[4610] Smith’s Landing’s evidence did not demonstrate to the panel that it is actively using lands, including for cultural and spiritual activities, or has sites of importance, in the project disturbance area or the local or regional study areas. Therefore, the panel determines that the magnitude of project effects would be negligible.

Summary

[4611] The panel finds that the project effects on Smith’s Landing’s current use of lands and resources and physical and cultural heritage will be low to negligible in magnitude. While unlikely, if any residual effects from the project occur, they will not be significant.

Significance Determination for Cumulative Effects

Current Use of Lands and Resources for Traditional Purposes

[4612] The magnitude of cumulative effects would be high. The cumulative effects to surface water quantity, flows and water levels in the Athabasca River, Peace-Athabasca Delta and Slave River Delta are already adverse and significant. These effects are due predominantly to hydropower regulation and regional climate change. Industrial water withdrawals play a minor role. The project is not expected to significantly add to existing impacts on Smith’s Landing, which will continue whether or not the project proceeds.

[4613] The geographic extent of cumulative effects would be provincial. The hydrological changes and effects to water quantity extend beyond the regional study area and into the Peace-Athabasca Delta and Wood Buffalo National Park. Cumulative effects are occurring over much of the traditional lands used by Smith’s Landing members.

[4614] The duration of cumulative effects would be long term. Cumulative effects will extend beyond the cessations of industrial activities in the region. Many of the cumulative effects are likely to be experienced for an extremely long time as a result of the hydroelectric dams on the Peace River.

[4615] The frequency of cumulative effects would be continuous.

[4616] The cumulative effects would be irreversible. It is uncertain whether the cumulative effects to water quantity currently experienced in Wood Buffalo National Park and the Peace-Athabasca Delta could be reversed.

Health and Socioeconomic Conditions

[4617] As determined in section 29, “Public (Human) Health,” the panel finds that the cumulative effects to human health from the project are expected to be low in magnitude. The panel believes that this finding applies to the health of Smith’s Landing members.

[4618] As determined in section 30, “Social Effects,” the panel finds that the cumulative socioeconomic effects are expected to be low in magnitude. The panel believes that this finding applies for Smith’s Landing members.

[4619] The panel finds that cumulative effects would be continuous and regional in extent, but would be medium term in duration and reversible as they would decrease at the end of operations. Due to the low magnitude, continuous, regional, medium term, and reversibility, the cumulative effects to the health and socioeconomic conditions would be adverse but not significant.

Physical and Cultural Heritage and Any Structure, Site or Thing That Is of Historical, Archaeological, Paleontological or Architectural Significance

[4620] The magnitude of cumulative effects is high. Ecological changes in the Peace-Athabasca Delta and Wood Buffalo National Park could make that area undesirable for indigenous people who depend on it to transfer cultural knowledge and skills to the next generation.

[4621] The geographic extent of cumulative effects is provincial. The duration is long and the frequency continuous due to the extent of upstream development, in particular hydro flow regulation on the Peace River, affecting water levels in the Peace-Athabasca Delta.

[4622] The cumulative effects are determined to be irreversible given the likely loss of connection to the land from one generation to the next necessary for traditional activities and the cultural values.

Summary

[4623] Smith’s Landing is experiencing high-magnitude cumulative effects on their current use of lands and resources and physical and cultural heritage in the Peace-Athabasca Delta, Wood Buffalo National

Park and Slave River areas. The project is not expected to significantly add to existing impacts on Smith's Landing, which will continue whether or not the project proceeds.

Significance Determination for Asserted Rights

[4624] The panel has determined that Smith's Landing is experiencing cumulative effects from industrial development on their use of lands in the Peace-Athabasca Delta, Wood Buffalo National Park, and Slave River areas. Changes in water levels have affected their ability to access areas of importance for hunting and trapping and create a major barrier to their members to access lands that are crucial to the practice of asserted rights and the transmission of cultural knowledge. The panel has determined that these existing effects on asserted rights are significant. The project, however, is not expected to significantly add to existing effects on Smith's Landing and it will not result in incremental effects to Smith's Landing exercise of asserted aboriginal and indigenous rights.

Table 60. Summary – Significance determination for project effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Current use of lands and resources	low/negligible	provincial	long	continuous	reversible	not significant
Physical and cultural heritage	negligible	provincial	long	continuous	irreversible	not significant
Health	low	local	medium	continuous	reversible	not significant
Social effects	low	local	medium	continuous	reversible	not significant
Asserted aboriginal and treaty rights	low/negligible	provincial	long	continuous	irreversible	Not significant

Table 61. Summary – Significance determination for cumulative effects

Valued environmental component	Magnitude	Geographic extent	Duration	Frequency	Reversibility	Significance
Current use of lands and resources	high	provincial	long	continuous	irreversible	significant
Physical and cultural heritage	high	provincial	long	continuous	irreversible	significant
Health	low	local	medium	continuous	reversible	not significant
Social effects	low	local	medium	continuous	reversible	not significant
Contribution of the project to cumulative effects	negligible	provincial	long	continuous	irreversible	not significant
Asserted aboriginal and treaty rights	high	provincial	long	continuous	irreversible	significant

33 Economic Effects

[4625] The capital cost is estimated at \$20.6 billion (2014 dollars) to complete phases 1 and 2 of the Frontier project. The total operating costs, including sustaining capital but excluding energy purchases, is around \$67 billion.

[4626] The Frontier project would create 7000 direct jobs during construction. Total direct, indirect, and induced construction employment in Alberta is estimated to be 75 800 person-years, with an additional direct and indirect employment in other provinces of 8500 person-years. It will create 2500 operation jobs during the 41-year life of the mine.

[4627] Two different analytical tools were used to assess the economic effects of the Frontier project:

- an economic impact assessment prepared by Teck; and
- a cost-benefit analysis prepared by OSEC.

[4628] Teck's economic impact assessment used an input-output model to determine project effects. An input-output model "quantifies the ripple effects of project-related spending (direct, indirect and induced effects) as expressed in terms of widely accepted measures of anticipated economic activity (GDP, labour income, jobs, government revenue)."

[4629] Teck stated that the input-output analysis has been the standard approach used in the assessments of all large-scale Alberta oil sands projects over the last 15 years.

[4630] Using this analysis, Teck determined that the Frontier project is expected to contribute more than \$70 billion directly to federal, provincial, and municipal government revenues. This includes approximately \$12 billion in taxes to the federal government, \$55 billion to Alberta in royalties and taxes, and a further \$3.5 billion to the municipal government through property taxes.

[4631] OSEC maintained that Teck's assessment of project benefits is incorrect or incomplete because it used an input-output model. They criticized Teck's economic impact assessment and Teck's use of an input-output analysis because it ignores economic constraints such as limits to investment capital and labour supply. It also ignores economic effects such as incremental government burdens or social costs from pollution.

[4632] OSEC maintained that the method of economic impact assessment used by Teck is not designed to estimate net benefits except under very limited circumstances. It is a method for understanding the gross economic impacts linked to a "shock" to an economy such as a major investment. While the economic impact assessment can identify some of the economic effects from a project, it does not identify the net social benefit or cost of a project. OSEC suggested a cost-benefit analysis would be the proper method for determining the economic effects.

[4633] Teck noted that Statistics Canada and Alberta Finance build and maintain independent input-output models. The Alberta Finance input-output model was used by Teck to determine benefits in its economic impact assessment for the Frontier project.

[4634] OSEC used a cost-benefit analysis to assess the economic effects of the Frontier project. They submitted that a cost-benefit analysis entails identifying benefits and costs and then summing these impacts to arrive at an estimate of net benefits. They acknowledged that the method of cost-benefit analysis is not required under current Alberta and federal environmental assessment guidelines. They stated that cost-benefit analysis is a standard method for project evaluations in many other countries.

[4635] Dr. Chris Joseph, for OSEC, provided a base case analysis and 16 other scenarios. The base case relied on a “dual-discounting approach” where “market impacts (e.g., oil revenue, capital expenditures, etc.) are discounted at 10 per cent to be more consistent with private opportunity costs of capital and oil sands supply cost studies, and environmental impacts at 3 per cent reflecting sustainability concerns.”

[4636] OSEC’s cost-benefit base case analysis included the following:

- revenues from oil production
- construction, operations, and reclamation costs
- potential employment benefits
- costs to government
- impacts on other commercial activities
- air pollution
- greenhouse gas emissions
- impacts on water resources
- impacts on ecosystem services

[4637] OSEC base case analysis found that few or no employment benefits should be expected due to current and expected labour-market conditions and that the Frontier project has little if any public interest value from the perspective of jobs.

[4638] The OSEC base case analysis concluded that there will be a net loss to society of \$4.6 billion (net present value) and an internal rate of return to Teck of 8.1 per cent, suggesting that the Frontier project is not in the public interest and is not a good investment prospect for Teck.

[4639] OSEC’s 16 other scenarios account for different emissions costs, prices, costs, and testing the application of consistent discount rates. In four scenarios, where a 3 per cent or 8 per cent uniform discount rate was applied to all impacts, and oil prices from the International Energy Agency’s New

Policies Scenario oil price forecast were assumed, net benefits to society were positive. OSEC contends that none of these scenarios that result in a positive net benefit are likely. They note conclusions of the National Energy Board and International Energy Agency that new bitumen mines are unlikely to be built due to their poor financial outlook.

[4640] OSEC stated that the results of its cost-benefit analysis are highly sensitive to assumptions about discount rates, the future price of oil, and assumptions about how future greenhouse gas emission damages are valued.

[4641] OSEC submitted a range of societal costs for the Frontier project's greenhouse gas emissions independent of the carbon tax. These costs were derived by multiplying a range of estimates for the social cost of carbon with emissions.

[4642] Dr. Joseph estimated the social cost of carbon intended to reflect the monetary impact of greenhouse gas emissions on global society. He used the Government of Canada's "updated central" damage cost factors to produce a net cost of \$317 million and a total project greenhouse gas damage cost over the life of operations of \$5.5 billion (net present value).

[4643] OSEC contends that Teck has underestimated the costs of carbon in its environmental impact assessment and input-output model. They note that the output-based allocation under the Alberta's *CCIR* will continue to become more stringent every year for the next 50 years and that carbon costs will increase accordingly.

[4644] Teck stated that the \$635 million total cost of carbon for is based on compliance under the *Specified Gas Emitter Regulation*. Teck maintains that under the new *CCIR*, the carbon cost is not materially different than that assessed using the *Specified Gas Emitter Regulation*.

[4645] Teck contends that Canada and Alberta recognize the practical need to maintain the competitiveness of Canada's trade-exposed sectors to prevent carbon leakage to less-progressive jurisdictions. Teck contends that its estimates of the costs of carbon emissions are reasonable.

[4646] Teck was critical of the OSEC cost-benefit analysis for its use of differential discount rates applied to benefits and costs. It used an 8 per cent discount rate for determining benefits while using a 3 per cent discount rate for determining costs associated with environmental effects such as the impacts of pollution, ecosystem services, and greenhouse gas damages.

[4647] Teck noted that the Treasury Board of Canada Secretariat guidance document on conducting cost-benefit analyses states that regardless of which discount rate is used, "the costs and benefits should be discounted using the same rate."

[4648] Using the OSEC cost-benefit analysis model, Teck used consistent 8 per cent and 3 per cent discount rates for both costs and benefits. It found that

- at a uniform 8 per cent discount rate, the net present value increased to a positive \$3.3 billion from a negative \$4 billion using differential rates, and
- at a uniform 3 per cent discount rate, the net present value increased to \$30.5 billion from a negative \$4 billion using differential rates.

[4649] At the AER's request, OSEC undertook an analysis using its cost-benefit analysis model using uniform discount rates. This resulted in a majority of the OSEC's cost-benefit analysis scenarios converting to a net positive benefit for the Frontier project. OSEC found that:

- with consistent rates at 8 per cent, the base case produced a \$4.6 billion positive net present value, and
- with consistent rates at 3 per cent, the base case produced a \$33.4 billion positive net present value.

[4650] Keepers of the Athabasca (Keepers) were also critical of the Teck input-output approach to its economic impact assessment. They noted that while Teck estimated private costs (construction, operation, and reclamation costs), its economic impact assessment did not monetize social costs (climate change, environmental damages, or human health).

[4651] Keepers criticized Teck for not providing an estimate of total revenues over the life of the Frontier project, which would be used to determine benefits.

[4652] In an effort to avoid duplication, Keepers did not conduct their own cost-benefit analysis. They suggested that the cost-benefit analysis approach used by OSEC is the "appropriate method to determine whether a project will yield net benefits to society" as it "sums both the total private and social benefits ... and costs."

[4653] OSEC raised concerns about adequacy of the Mine Financial Security Program to secure mine closure and reclamation costs due the programs asset-to-liability approach.

[4654] Keepers raised concerns about Teck's financial capability to fully fund environmental liabilities associated with reclamation and closure costs and ensure that these do not fall to Albertans.

[4655] Dr. Joseph estimated a base scenario for reclamation and closure costs to be \$429 million (2017 undiscounted dollars). This cost estimate was based on the assumption that these costs would be 2 per cent of the capital expenditures.

[4656] Alternative reclamation and closure costs were based on cost estimates per hectare multiplied across the project area, which produced a cost of \$4.1 billion.

[4657] Teck noted that its plan for progressive reclamation results in the completion of a portion of the reclamation before the end of mining operations. It stated that it will fully comply with the Mine Financial

Security Program and that the larger Teck organization and its cash flow would provide an extra measure of security regarding funding the remaining closure costs.

[4658] After mine operations are scheduled to cease in 2066, Teck estimated that remaining reclamation, closure, and post-closure activities will cost about \$2.9 billion to complete following the cessation of mining activities.

[4659] OSEC, Keepers, Stand Earth, and the Council of Canadians raised concerns about the effects of oil prices on the economics of the Frontier project.

[4660] Keepers noted that oil price forecasts from the National Energy Board (NEB) for Brent benchmark prices were “significantly lower” than those used by Teck in its price projections for West Texas Intermediate (WTI).

[4661] OSEC raised similar concerns about Teck’s oil price forecasts and presented specific comparisons showing the lower prices from the NEB’s 2016 price forecasts for the Brent price benchmark for crude oil in contrast to the International Energy Agency’s 2016 World Energy Outlook for WTI forecasts.

[4662] OSEC noted that Teck’s future oil price forecasts are based on the International Energy Agency’s estimates that global demand will increase to 110 million barrels a day by 2040. They argue that this forecast is inconsistent with the Paris Agreement and the goal of limiting warming to 2 degrees of preindustrial levels, and therefore the associated price forecasts should not be relied on in Teck’s estimate of benefits from the Frontier project.

[4663] The Council of Canadians challenged Teck’s forecast for global demand growth for petroleum products and transportation fuels and the North American pipeline and rail distribution expansions to provide sufficient capacity to move production from the project to market. They noted that long-term project operations are dependent on the following:

- “Scarcity of oil with lower supply costs than oil sands”
- “Little serious international action to limit greenhouse gases”
- “Little serious domestic policy or civil society action to curtail oil sands development”

[4664] Referencing an Institute for Energy Economics and Financial Analysis report from 2015, the Council of Canadians details further project-specific risks:

- Analysis from Oil Change International suggests phase 1 would require WTI prices of at least US\$140 per barrel and “would not achieve a positive free cash flow anytime in the next 50 years.”
- The same study suggests phase 2 would require US\$118 per barrel and phase 3 would require US\$150 per barrel, as the resource becomes harder to access.

- The Institute for Energy Economics and Financial Analysis raised concerns that although oil sands are a small part of Teck's portfolio, they "absorb a large and growing portion of the company's shrinking resources," suggesting the company would be financially vulnerable to take on oil sands ventures in addition to its other mining projects, including the Fort Hills oil sands mine.
- The Council of Canadians challenged forecast of global demand growth for petroleum products and transportation fuels and the North American pipeline and rail distribution expansions to provide sufficient capacity to move production to market.

[4665] The Council of Canadians cite two other independent analyses of break-even prices:

- Wood Mackenzie stated "oil prices will need to rise to between US\$70 and US\$80 per barrel before large oil sands mines like the Frontier project can be economically viable."
- Stockholm Environmental Institute stated the project's break-even was at least US\$80.

[4666] Stand Earth was also critical of Teck's economic analysis and focused on the commercial viability of the Frontier project. Similar to the Council of Canadians, Stand Earth's concerns relied on analysis provided by Institute for Energy Economics and Financial Analysis in a 2018 report.

- Much of the analysis in the August 2018 report was carried over in the October 2018 presentation but reported lower break-even estimates for 2018 than the initial 2015 report, showing that changes in the market can positively influence the economic viability of the project.
- Compared to the 2015 report, Institute for Energy Economics and Financial Analysis' s updated August 2018 model shows the following:
 - Phase 1 now needs a US\$84 per barrel break-even (compared to US\$140 per barrel).
 - Phase 2 now needs a US\$86 per barrel break-even (compared to US\$118 per barrel).
 - The 2018 report model relied on a price of US\$71 per barrel, declining to US\$67 per barrel over the life of the project.
- The decrease in break-even costs potentially suggests that the threshold for profitability has also decreased, improving the viability compared to the initial estimate.

[4667] The updated October 2018 Institute for Energy Economics and Financial Analysis presentation lists a number of economic risk factors associated with the Frontier project:

- It questions Teck's ability to lower production costs from \$30 per barrel to \$20 per barrel.
- It asserts that the WTI and Western Canada Select (WCS) differential is set to widen to over \$30 per barrel between 2020 and 2025 with changing International Maritime Organization sulphur fuel standards that would lower prices and revenues for the project.

- International Maritime Organization implementation expects to lower the price of high-sulphur fuel oil and questions export capacity to Asia, which would negatively affect the project's economics.
- Pipeline capacity shortfalls that would limit the production sent to market and revenues received by the project.
- Teck's market capitalization (shares multiplied by price) was used as a proxy for its financial capability, and the report questions Teck's capacity to afford the Frontier project. This information is not overly useful in determining the viability of a project.
- Macro-forces, such as the Trans Mountain delays and competition in the Permian Basin, could adversely affect Canadian oil sands operations.

[4668] In response to Stand Earth's Institute for Energy Economics and Financial Analysis presentation, Teck questioned the independence of the Institute for Energy Economics and Financial Analysis. Teck noted that the mission of the institute is to "accelerate the transition to a diverse, sustainable and profitable energy economy and to reduce dependence on coal and other non-renewable energy resources."

[4669] Teck acknowledged that conducting an economic evaluation using lower oil prices, higher costs, higher WTI and WCS differentials, and lower production rates will negatively impact project economics.

[4670] Teck stated that it relied on a credible third-party global crude oil supply and demand models and forecasts to derive its project economics. Teck noted that the International Energy Agency base case forecast and its New Policies Scenario show that global energy demand (defined by the International Energy Agency as world liquids demand) will increase from 95 to about 110 million barrels per day by 2040 and that long-term oil price values will be in excess of US\$95 per barrel during that vast majority of the operational period (2026–2066).

[4671] Teck estimated total carbon taxes at \$635 million and reclamation and closure costs to be about \$2.9 billion. At a 50 dollars per tonne (\$/t) carbon tax representative of both federal and provincial policies, compared to the original \$30/t, Teck acknowledged the total carbon tax costs would rise to between \$700 million and \$750 million.

[4672] Teck provided an assessment of two leading factors in widening the differential between WTI and WCS prices: pipeline takeaway capacity and the International Maritime Organization's sulphur standards.

[4673] In response to concerns regarding a shortfall of export pipeline capacity, Teck listed a number of pipeline expansion projects in progress that would add up to 1.79 million barrels per day of takeaway capacity, in addition to about 750 000 barrels per day of existing rail capacity.

[4674] In response to concerns regarding the International Maritime Organization's sulphur regulations set to come in to effect January 1, 2020, Teck agreed that there will be a "substantial change" in

differentials in the short term. They assert that market impacts from this change will be short term and would be expected to rebalance by the early 2020s with the following scenario:

- High prices will reduce demand for ultra-low-sulphur diesel and low-sulphur-compliant fuels as consumers reduce consumption and use alternatives.
- Wide price differentials between low-sulphur-compliant fuels and high-sulphur fuel oil will lead to increased scrubber uptake as ships are incentivized to switch to lower-priced high-sulphur fuel oil. This will increase demand for high-sulphur fuel oil and decrease demand for low-sulphur-compliant fuels.
- “More residue upgrading and desulphurization capacity will be built as depressed [high-sulphur fuel oil] prices improve project investment economics; this will decrease the supply of [high-sulphur fuel oil]. [Western Canada Select] differentials are then expected to narrow by 2023 as the market rebalances the supply and demand for ultra-low-sulphur diesel and [high-sulphur fuel oil].”

Analysis and Findings

[4675] The panel notes that an input-output analysis is one standard approach for projects of this type in Alberta and that input-output models are independently maintained by Alberta and Canada. The panel understands that the input-output methodology has been used in the assessment of all prior oil sands mining projects. This type of modelling objectively measures the gross economic effects generated by investments and expenditures. The panel recognizes the limitations of such modelling in that it provides a snapshot using dated data. However, data used by Teck is the best available maintained by an independent and credible third-party to measure effects on the economy and is not intended to reflect project-specific economics. The panel finds that Teck’s use of the input-output model is an acceptable approach to examining the magnitude of project effects and to estimate the economic benefits of the Frontier project.

[4676] In considering the cost-benefit methodology and analysis suggested by OSEC, the panel notes that this is a tool that is used to assess net benefits. The panel noted the robust considerations of inputs and factors in the analysis and recognizes that it has some advantages in that it can capture costs and benefits not normally included in the input-output analysis. However, cost-benefit analyses are sensitive to the assumptions and factors built into the analysis and results. A cost-benefits analysis provides a tool to assess the impacts of various inputs and factors, but requires general consensus on the assumptions if it is used to reflect the analysis of economic costs and benefits. The panel notes that to date, the cost-benefit analysis approach has not been widely used to determine the magnitude of economic benefits of oil sands developments.

[4677] The cost-benefit analysis conducted by OSEC was criticized for its selection of key assumptions, including the use of two different discount rates for selected costs and benefits referred to as dual

discounting. Teck maintained that this practice did not adhere to best practices for conducting a cost-benefit analysis.

[4678] The panel also notes guidance from the Treasury Board of Canada that consistent discount rates should be used for both benefits and costs. While it is reasonable to provide scenarios with a range of discount rates to assess impacts under different assumptions and time-value preferences (e.g., market or environmental impacts), rates should be uniform for each scenario.

[4679] The panel finds that a consistent discount rate should be used. Using a “dual-discounting approach” runs the risk of subjectively skewing the results, either positively or negatively. When uniform discount rates were applied by Teck and OSEC, it showed that a majority of scenarios, and the base case, convert to a net positive benefit, especially depending on which discount rates are selected.

[4680] The panel accepts Teck’s estimated reclamation and closure liability of \$2.9 billion following the completion of mining operations. It understands that these costs are included in the Teck’s project budget. Further discussion regarding the Mine Financial Security Program (MFSP) uncertainties and management can be found in section [34](#).

[4681] The economic benefits of the Frontier project will be affected by potential changes in factors such as the future price of oil, unexpected increases in closure and liability costs, the market for high-sulphur fuels, shipping regulations, pipeline capacity, and the future costs of carbon emissions.

[4682] The panel understands that there are great uncertainties in predicting the future price of oil and that there will be variations in forecasts from different agencies that specialize in this area.

[4683] In reviewing the future oil price forecasts evidence provided, the panel notes that there are merits and limits to each of the two primary price forecasts used:

- The International Energy Agency forecasts provide a comprehensive international outlook for production, policies, and prices.
- The NEB has its own scenarios that overlap with the International Energy Agency’s but are typically more conservative in their outlook.

[4684] The independent International Energy Agency’s forecasts are a reasonable basis for the economic analysis. The forecasts suggest that demand is expected to remain robust for decades to come even if the switch to alternative energy sources continues or accelerates.

[4685] The panel accepts the findings of the NEB and the International Energy Agency which conclude that demand for hydrocarbons, including crude oil liquids, will continue for decades to come. The panel finds that the nature of mining oil sands reserves is such that they will continue to provide a long, steady stream of oil production. This production will have a role in meeting growing global energy demand into

the future, with evidence supporting significant opportunities to supply developing economies and increasing energy needs.

[4686] The panel finds that factors that may place downward pressure on bitumen prices are primarily short term in nature:

- Bitumen market access is set to improve with Enbridge's Line 3 Replacement completion and increased rail capacity investments into the early 2020s.
- Canada's Trans Mountain Expansion and TransCanada's Keystone XL pipelines are still before regulatory proceedings but could present additional capacity early into the 2020s.
- The International Maritime Organization sulphur standards pose short-term risk to higher-sulphur oil, although refiners capable of processing heavy oil will likely continue to source it as a relatively less expensive feedstock.
- The impact of the sulphur standards to West Texas Intermediate and Western Canada Select differentials is likely to narrow through the mid-2020s as refineries adapt and install equipment to capitalize on the spread between feedstock and higher priced low-sulphur distillate products (e.g., diesel).
- Ships subject to the International Maritime Organization standards are likely to install scrubbers to allow them to run on high-sulphur fuel oil while complying with the sulphur emission limit.

[4687] The panel notes that Teck has negotiated impact benefit agreements with fourteen First Nations in the region. Teck asserted that these agreements create the framework for ongoing cooperation and collaboration and for environmental stewardship, economic benefits, and dispute resolution. While these agreements are not available for review by the panel, the panel recognizes that some measure of beneficial financial or employment measures may be included, although it is unable to make a finding on their significance.

[4688] Teck has estimated there will be \$635 million in carbon costs under Alberta's Specified Gas Emitter Regulations at \$30 per tonne, which is similar to the current *CCIR*. Although there are some differences between these two regulations, they are consistent in their application of carbon pricing to high emitters.

[4689] At higher carbon costs of \$50 per tonne, reflective of federal policy, the total carbon costs to Teck could rise to between \$700 million and \$750 million. This cost would be separate from the capital expenditures used to estimate the economic effects, such as jobs and taxes.

[4690] The social cost of carbon, presented by Dr. Joseph is an estimate derived by ECCC. He used ECCC's "updated central" damage cost factors. Dr. Joseph estimated it would lead to discounted damages of \$317 million during operations and \$5.5 billion for the total project.

[4691] The panel finds that the estimate of more than \$70 billion in royalty and taxes paid to municipal, provincial, and federal governments is a significant beneficial economic impact. These benefits are found to support all levels of regional, provincial, and national economies.

[4692] When a uniform discount rate is applied to the model used by OSEC in its cost-benefit analysis, the panel found the outcomes of several scenarios changed to produce positive net benefits. Depending on value of the discount rate assumed (3, 8, or 10 per cent), some of the scenarios continued to produce net costs under the highest discount rate. These scenarios included: capturing costs of upstream and downstream emissions, including the social cost of carbon, lower price assumptions, and higher capital and operating costs.

[4693] In determining the economic effects of the Frontier project, the panel finds that they are beneficial and likely, and will be

- national in their geographic extent – the royalties, taxes, and employment benefits are expected to affect all of Canada to some degree;
- medium term in duration – economic benefits from the project will largely cease at the end of bitumen production; and
- continuous and of high magnitude – levels of employment, royalties, and taxes to the various levels of governments for the operational life of the Frontier project will increase.

[4694] For the reasons above, the panel finds that the Frontier project will result in significant direct and indirect economic benefits, including employment, royalties, and tax benefits to the region, Alberta, and Canada.

34 Reclamation and Closure Liability

[4695] Alberta's MFSP is designed to ensure that sufficient resources are available to complete reclamation and closure activities and to provide liability coverage for oil sands and coal mines in Alberta. The fundamental principle of the program is that the approval holder is responsible to carry out suspension, abandonment, remediation, and surface reclamation to the standards established by the Province of Alberta until a reclamation certificate has been issued.

[4696] AEP is responsible for policy design of the MFSP while the AER administers it.

Evidence

[4697] Teck's reclamation and closure plans for the Frontier project has mining activities completed by 2066 and the majority of reclamation and closure activities occurring by 2081. Teck estimated that closure monitoring and management would need to occur for an additional 40 to 65 years after closure (after 2081).

[4698] Teck estimates the total reclamation and closure costs for the Frontier project to be \$11.8 billion. Approximately \$201 million of this is incurred during the construction phase and an additional \$8.7 billion is incurred during the operations phase. The reclamation and closure liability remaining at the end of mining in 2066 is estimated to be \$2.9 billion.

[4699] Teck stated that costs occurring before end of mine life were considered operating costs, and any costs incurred after end of mine life are considered reclamation and closure cost.

[4700] Teck stated that Frontier mine operations are scheduled to cease in 2066, at which time 43% of the project disturbance area will have been progressively reclaimed.

[4701] Teck stated that it will comply with the current MFSP as established by the Government of Alberta.

[4702] Teck identified two security options available under the MFSP: oil sands mines may elect to pay full financial security or use a combination of financial security and the value of their assets to secure their liability.

[4703] When assets are used to secure liability, financial security is collected through four types of security deposits: base security deposit, operating life deposit, asset safety factor deposit, and outstanding reclamation deposit.

[4704] Teck stated that the base security deposit for the Frontier project under the MFSP is \$30 million. Based on Teck's economic assumptions and evaluation, Teck anticipates that posting additional security beyond the base security of \$30 million will not be required until 2051, when the reserve life index falls below 15.00. Once the reserve life index falls below 15.00, Teck will post the operating life deposit,

which is 10% of the liability annually until six years from the end of reserves. At this time Teck's MFSP liability will be equal to their MFSP security.

[4705] Teck's total resource estimate for the project is 3220.5 million barrels of recovered bitumen. Teck's independent resource assessor estimated the unrisks resource to be 3184 million barrels of recovered bitumen.

[4706] OSEC submitted that the Mine Financial Security Program methodologies used to calculate assets and liability further compound the likelihood that the AER's total reported MFSP liability is lower than the actual liability.

[4707] OSEC believes that the MFSP fails to incentivize progressive reclamation. Under the current program, operators set their own targets for reclamation, and if the targets are missed, the operator must pay \$75 000/ha. This system encourages operators to set the target low in order to avoid the risk of being in noncompliance.

[4708] Teck stated that it was important to note that not all development and disturbance associated with the Frontier project will occur at the same time. The maximum reclamation liability for the Frontier project is expected to be at its highest at the end of year 2037, when there is almost 30 years of resource left to mine. Areas disturbed by the project will be progressively reclaimed as soon as it is practical to do so. Starting in 2046, 20 years before end of mining, there will be as much or more land reclaimed each year than disturbed. Teck states that progressive reclamation will begin in 2035 and that by the end of mining operations in 2066, they will have progressively reclaimed about 43% of the project disturbance area.

[4709] Teck stated that \$500 million of the \$2.9 billion estimated closure costs were budgeted to address issues such as seepage, monitoring, and mitigation of end-pit lakes. Closure costs include the construction of a physical hydraulic barrier to act as a passive seepage interception system to capture seepage from the external tailings areas. Teck estimates it will take 10 to 13 years and cost \$200 million to \$500 million to construct the hydraulic barrier.

[4710] Teck stated that if it chooses or is required to provide full security payment based on the MFSP calculation, a maximum security of approximately \$4.3 billion would be required throughout the life of the project.

[4711] OSEC indicated that Teck has not provided supporting evidence that would allow the panel to determine if their post-closure monitoring and mitigation costs are sufficient.

[4712] OSEC questioned Teck about its corporate structure and what entity would construct and operate the Frontier project. OSEC also questioned Teck's ability to use cash flow from other Teck operations to meet its reclamation and closure obligations for the Frontier project or to post security against project

resources or other Alberta resources owned by Teck. OSEC suggested that as a condition of approval, Teck Resources Ltd should be financially responsible for reclamation obligations.

[4713] Teck confirmed that the Frontier project is a partnership that's wholly owned by Teck Resources Ltd. As a partner within that structure, Teck Resources Ltd. is liable for all partnership liabilities.

[4714] OSEC noted that in the 2015 report of the Auditor General of Alberta, the Auditor General found that the MFSP allows the economic value of mining assets to be overstated, which may result in less than sufficient security being posted. The Auditor General recommended that AEP review the program and determine whether changes were required to the asset calculation. Given the Auditor General's findings, OSEC submitted that full security is the only option that protects Albertans from oil sands liability.

[4715] Keepers of the Athabasca submitted a paper titled *Alberta over a Barrel: Environmental Liabilities and Royalties in the Oil Sands*, which questioned Teck's accounting estimates for reclamation and closure liabilities and their use of discounting for environmental liability estimates.

[4716] Teck confirmed that it believed its financial accounting and reporting procedures are appropriate. As a Canadian public company, Teck is required to follow international financial reporting standards. Teck's financial statements are also audited by independent auditors.

[4717] Teck stated that it is a diversified resource company with stable cash flows and the ability to endure through challenging economic times. Teck believes this will allow the necessary financial security, if required by the MFSP at the time. Cash flows from Teck's portfolio of assets can be used to provide all or some of the security as opposed to only revenue from the Frontier project.

Analysis and Findings

[4718] The panel recognizes that the MFSP has been established by AEP, who are responsible for the overall policy and program design. The AER's role is to administer the program established by AEP.

[4719] The panel also acknowledges that the Auditor General of Alberta has raised concerns about the MFSP and its effectiveness. Specifically, the Auditor General found that improvements were needed to how security is calculated and how security amounts are monitored. The Auditor General concluded that without these improvements, if a mine operator cannot fulfil its reclamation obligations, and no other private operator assumes the liability, the province is at risk of having to pay substantial amounts of public money.

[4720] The asset calculation under the MFSP allows for the use of both proven and probable reserves. The panel acknowledges that Teck has not extended their mine reserve life by including probable (risked) reserves.

[4721] The panel notes that Teck has underestimated their \$2.9M closure liability by classifying environmental obligations as operating expenses and decreasing MFSP liability with progressive reclamation that has not been completed.

[4722] The panel accepts that Teck is required to and will comply with the requirements of the MFSP as it currently exists.

[4723] The panel recommends that Alberta complete its review of the MFSP and implement any changes required to address the Auditor General's recommendation to ensure that Albertans are protected from assuming reclamation and closure liabilities such as those associated with the Frontier project. If changes are made to the MFSP in the future, they would apply to the Frontier project.

[4724] There is significant uncertainty associated with forecasting conditions and estimating costs so many years into the future. The panel recommends that the AER, in its roles as the administrator of the MFSP, consider potential triggers which could be implemented to ensure that Teck's long-term post-2066 closure and reclamation liabilities are securely funded and do not fall to Albertans to address.

[4725] Notwithstanding Teck's compliance with the requirements of the MFSP, the panel finds that the areal extent of the Frontier project (292 km²), the magnitude of the post-mining closure liability (\$2.9 billion), and the long period of post-closure care and monitoring required (40 to 65 years or more) contribute to unique challenges and risks for effective oversight and regulation of reclamation and closure obligations.

Recommendation to Alberta

[4726] The panel recommends that Alberta complete its review of the MFSP and implement any changes required to address the Auditor General's recommendation to ensure that Albertans are protected from assuming reclamation and closure liabilities such as those associated with the Frontier project.

35 OSCA Application

[4727] Teck applied under sections 10 and 11 of the *OSCA* to construct, operate and reclaim the Frontier project. The Frontier project will have 2 mine pits and a processing plant for the recovery of deasphalted bitumen from oil sands ore, first oil is expected in 2026.

[4728] In support of its *OSCA* application 1709793, Teck provided its mine plan, tailings plan, and preliminary design for the processing plant and associated infrastructure for the Frontier project. A socioeconomic assessment and environmental assessment was also provided, in accordance with *Directive 023*.

[4729] The mine plan was consistent with the requirements of AER *Directive 082*. The technology selected by Teck for mining, extraction and recovery of bitumen is commercially proven and has been used successfully in the oil sands mining industry.

[4730] Teck also provided preliminary geotechnical design of earth structures, including mine face, pit walls, storage and disposal structures. Detailed engineering design will be submitted to the AER for approval prior to construction in accordance with the *OSCR*.

[4731] Teck also submitted a tailings management plan that meets the requirements of *Directive 085* for this stage of the project and is consistent with the *TMF*. The selected fluid tailings centrifuge technology is commercially proven. Teck will not deposit treated or untreated tailings in its proposed end-pit lakes.

[4732] In order to ensure Teck is able to achieve the *TMF* outcomes and its proposed tailings management plan objectives, the panel requires Teck to submit research plans and additional information prior to operations. An updated tailings management plan application is also required, once the Frontier project is operational. The updated tailings management plan shall be consistent with the most recent government policy and regulatory requirements at the time of application.

[4733] Teck also provided a noise impact assessment indicating the Frontier project will meet the requirements in AER *Directive 038*. Teck will submit a post-construction sound survey and noise monitoring reports to the AER.

[4734] Teck submitted supporting information to ensure the safe and efficient operation of the mine, processing plant, tailings management and associated project infrastructure. Teck will submit an emergency response plan to the AER, prepared in accordance with *Directive 071* prior to beginning operations. Teck committed to collaborate with stakeholders on the development of the emergency response plan.

[4735] To ensure safe tailings operations, Teck has taken into account dam safety considerations and regulatory requirements that will be followed for safe and responsible tailings management practices. Teck is required to comply with the federal and the new Alberta dam safety regulatory requirements.

Teck will reduce the volume of tailings during operations and deposit centrifuge cake in-pit so that containment dams are minimized in the closure landscape.

Public Interest Determination

[4736] The mandate of the AER under *REDA* is to provide for the efficient, safe, orderly, and environmentally responsible development of energy resources in Alberta. To ensure this occurs, the AER has set out requirements in its directives, bulletins, orders, and other regulatory instruments. Meeting those requirements does not by itself ensure that proposed development is in the public interest. The panel must further consider section 3 of *OSCA* which provides for the economic, orderly and efficient development in the public interest of the oil sands resources and section 3 of the *Responsible Energy Development Act General Regulation* which requires that the panel consider the environmental, social and economic effects of the Frontier project.

[4737] The regulatory framework for the oil sands under *OSCA* (and all energy resource activities under *REDA*) is based on the general premise that development of Alberta's hydrocarbon resources is in the public interest. However, when a project may cause significant environmental or social effects or effects to aboriginal and treaty rights the panel must balance the potential benefits of the project against project effects to consider whether the project is in the public interest.

[4738] The Frontier project is the largest and most northerly oil sands mine project to date in Alberta. It is unique in many respects. It has a large physical footprint with a disturbance area of 29 217 ha. It is technically complex and it will operate for 41 years, followed by a prolonged closure period. There will be a loss of some habitat types within the project disturbance area for up to 100 years following closure in 2081. Some effects of the project will be irreversible.

[4739] The proposed project is within a region that has seen significant and intense levels of oil sands development, but in an area which is relatively less affected by industrial development. The *LARP* vision for the area speaks to supporting development of the region and its oil sands reserves. One of the outcomes for the region is to optimize the economic potential of the oil sands resource. Other outcomes include managing landscapes to maintain biodiversity, managing air and water quality, enhancing the quality of life for residents, and including indigenous people in land-use planning.

[4740] In making our public interest determination, the panel has considered the social, economic and environmental effects of the project and the effects of the project on the asserted rights of indigenous peoples. The panel has determined that for a number of environmental and socioeconomic factors, the project is likely to result in adverse effects which range from low to high in magnitude. Some of these effects are considered to be significant. The panel has also determined that the project is likely to result in significant positive economic effects for Alberta and Canada.

[4741] In considering whether the Frontier project is in the public interest, project-specific and cumulative effects to important environmental attributes and effects on indigenous rights use and culture have weighed heavily in the panel's determination.

[4742] Those expressing an interest in the project are diverse and have unique interests and needs which are sometimes conflicting. These include indigenous groups and their members, labour groups, non-governmental organizations, industry, municipal, provincial and federal governments, and citizens of Alberta and Canada.

Indigenous Groups

[4743] The panel has an obligation to consider impacts to constitutionally protected aboriginal and treaty rights which are a unique component of the public interest. Indigenous groups in the region will bear most of the adverse effects of the project. They are the closest neighbours to the project and they have the most at stake in terms of effects on the use of lands for traditional hunting, gathering, and cultural practices.

[4744] Fourteen indigenous groups who are the most affected by the project have signed participation agreements with Teck and have withdrawn their objections to the project. This includes all of the indigenous groups for which the panel has found that the project will likely result in adverse and significant project effects.

[4745] Participation agreements between Teck and Indigenous groups are described by the parties as containing measures to further mitigate the effects of the project. Some of these groups have expressed outright support for the project and indicated that the implementation of the agreements will lead to measurable positive effects in their communities. Others have indicated that through the agreements they have resolved their project-specific concerns but that their support for the project is conditional on a number of actions being taken by governments through which the effects of the project and other development can be further mitigated. As stated by Mikisew Cree First Nation in its written submission to the panel:

This Joint Review Panel is one part of a larger decision-making and approval process for the Project that will continue after the Panel discharges its responsibilities. This means that there remain opportunities after the Panel releases its report for the Governments of Alberta and Canada to resolve outstanding issues relating to effects on Mikisew's Aboriginal and treaty rights, and to discharge their still incomplete obligations to consult, prior to issuing final approvals for the Project.

Based on this larger framework, Mikisew is not objecting to the Panel's decision on Project applications under its authority as the AER, provided that the Panel's decision reflects the Project conditions jointly developed by Teck and Mikisew. Mikisew and Teck have worked together in good faith towards developing measures to better mitigate and

monitor certain project effects. The proposed regulatory conditions set out in Appendix 2 are the product of genuine efforts to mitigate certain Project effects.

[4746] In the panel's experience, the extent of agreement between Teck and Indigenous groups is unprecedented for an oil sands development of this type.

[4747] There are likely social and economic benefits to the 14 indigenous groups that have signed participation agreements with Teck resources. In considering the significance of the participation agreements, the following considerations are relevant:

- The participation agreements are private.
- The parties are sophisticated organizations able to negotiate agreements that serve their mutual interests.
- The local indigenous communities are most directly exposed to the effects of the project and have most at stake in its development.
- The panel accepts Teck's view that the agreements appear to be consistent with Canada's support for the principles of the *United Nations Declaration on the Rights of Indigenous Peoples*.
- It is reasonable to assume there are benefits to the indigenous groups flowing from the agreements which are consistent with principles of economic reconciliation with Canada's indigenous groups.

[4748] The panel assumes that participation agreements negotiated by indigenous groups include measures to address aspects of their social, environmental, and economic interests.

[4749] If Teck meets its commitments as the panel expects it will, and governments are able to work with specific indigenous groups to determine if and how to address actions which they have requested, the project would meet many of the interests identified by those most directly affected by the project.

[4750] In considering evidence from indigenous groups and Teck, the panel finds that positive social and economic benefits are anticipated from participation agreements. Based on the jointly proposed conditions provided to the panel and the evidence of the groups these agreements also incorporate engagement and collaboration in planning, monitoring of project effects and adaptive management which provide parties a means to address future unanticipated effects related to traditional land use and social and environmental effects as they may occur. This has resulted in demonstrated support for the project from the most affected indigenous groups in the region albeit conditional on government action in some cases. It appears the Frontier project will provide some benefit to the most affected First Nation and Métis groups from the region.

Nongovernmental Organizations

[4751] Non-governmental organizations generally argued that development of the Frontier project would not be in the public interest. Sierra Club BC stated that the project is not in the public interest when considering its greenhouse gas emissions and their impacts on the global climate. Keepers of the Athabasca expressed concerns about the financial risk of environmental liabilities falling to Albertans and royalty risk if the project is unsuccessful. OSEC presented a cost-benefit analysis that indicated the project would not result in net economic benefits. These concerns are addressed in the sections [“Economic Effects,”](#) [“Purpose or Need of the Project,”](#) [“Reclamation and Closure Liability,”](#) and [“Greenhouse Gas Emissions.”](#) Findings in these sections did not support the assertions made by Sierra Club BC, Keepers, or OSEC.

[4752] Teck disagreed with the views expressed by the non-governmental organizations. It stated that Canada should not stop developing its oil sands resources and leave the resource in the ground. Assertions to do so ignore the fact that Canada and the rest of the world continue to demand oil. Teck argued it would not be in Canada’s interests to acquire its oil from foreign sources and stop developing its oil resources and simply allow other jurisdictions to supply global and Canadian oil demand.

[4753] The panel agrees that importing oil from other countries while forgoing the economic benefits of developing Alberta’s resources does not appear to be in the public interest.

[4754] The panel finds that:

- Teck is required to comply with the MFSP which is established by the Government of Alberta to secure reclamation liabilities.
- Teck provided evidence that its progressive reclamation plans and its corporate resources will allow the necessary financial security, if required by the MFSP, to mitigate liability risks to Albertans.
- There are credible forecasts that indicate increasing hydrocarbon use globally over the next several decades. Evidence was not provided which demonstrated that oil produced—or not produced—in Canada would reduce domestic or global consumption or the associated carbon emissions.
- The project is consistent with Alberta’s Climate Leadership Plan and provincial and federal regulatory requirements related to greenhouse gas emissions in effect at the time of the hearing.
- The project would result in oil production to meet Canadian and global demand.
- The project is expected to have emissions that are equivalent to or lower than oil produced in some other jurisdictions. Not permitting oil production from the Frontier project may result in exporting emissions to other jurisdictions with higher emission intensity than the project and increase overall global greenhouse gas emissions on a per barrel basis.

- The project may make it more challenging for Canada to meet its international greenhouse gas emission commitments. However, the federal government has not yet established or implemented the regulatory mechanisms needed to achieve the emissions reductions required to achieve those commitments. It is not in the panel's terms of reference or within the panel's authority to determine if or how Canada will meet these commitments in the context of this project assessment.
- Climate change is a global issue and it would be difficult and outside the panel's mandate to assess the project's contribution to global climate change relative to other global projects or jurisdictions. The panel's responsibility is to assess whether the project meets current regulatory requirements related to greenhouse gas emissions and production efficiency, not global climate change effects. We can and have done the former, but not the latter.

[4755] The panel finds that the project satisfies current policy and regulatory requirements related to financial security and greenhouse gas emissions.

Labour Groups

[4756] The project is expected to result in 7000 direct jobs during construction and create up to 2500 operations jobs during the life of the mine (41 yrs.). It is projected to create a total of 278 190 person-years of direct, indirect, and induced employment across Alberta and Canada. It would have a positive effect on regional, provincial and national employment. Labour representatives at the hearing stated that unemployment levels for oil sands workers are high in the Regional Municipality of Wood Buffalo and in Alberta. A representative of the International Brotherhood of Electrical Workers, Local 424 stated that they are heavily dependent on oil sands construction. The economic downturn has left 4000 journeymen and 9000 apprentices or 70 per cent of their membership unemployed. They and a number of other labour representatives who attended the hearing expressed their strong support for the project.

[4757] The panel finds that the project would have a significant positive effect on employment within the Regional Municipality of Wood Buffalo, Alberta and Canada. This is aligned with the interests of labour groups.

Municipal, Provincial, and Federal Governments

[4758] Mayor Scott from the Regional Municipality of Wood Buffalo stated that the municipality supports the project as it presents a significant potential benefit to the region, its people and businesses. It is expected to bring additional employment and business opportunities to the municipality. Teck estimates that the project will contribute \$3.5 billion in taxes to the municipality.

[4759] The panel finds that there are likely to be significant economic benefits of the project to regional, provincial and Canadian governments over the life of the project. The panel finds that:

- The project is expected to contribute more than \$70 billion directly to federal, provincial and municipal government revenues. These revenues could support existing provincial and federal services or support initiatives to assist Canada in moving to a less carbon intensive future and achieving its targets under the Paris Climate Accord.
- The project will have a beneficial effect on the Regional Municipality of Wood Buffalo.
 - It will provide employment opportunities to oil sands workers currently under employed in the region and province.
 - It will provide an estimated \$3.5 billion in taxes to the municipality over its operating life.
 - Spare capacity exists in Fort McMurray to accommodate workers.
 - The analysis of housing, transportation and social services did not identify any significant negative effects.
 - The Frontier project could assist in furthering the recovery in the community from the oil and gas downturn and from the recent fires.
 - There is capacity and desire in Fort McMurray to support potential workers and their families.

[4760] In considering the economic benefits of the project, the panel finds that development of the Frontier project is consistent with the aspirations of the Regional Municipality of Wood Buffalo.

[4761] The governments of Alberta and Canada have an economic interest in the development of natural resources. Benefits from resource development, such as royalties and taxes, are used to fund government programs and provide services to citizens and businesses.

[4762] Governments also have an interest in responsible resource development and environmental protection. Several of the federal agencies that participated in the environmental review process and hearing for the Frontier project, have environmental protection mandates. While those federal agencies expressed concerns and provided recommendations relating to the project, the panel has concluded that taking these into account, the project satisfies Alberta and Canada's current policy and regulatory requirements.

Citizens of Alberta and Canada

[4763] The citizens of Alberta and Canada have diverse interests. They are interested in jobs and economic opportunities. They buy and use petroleum products. They are concerned about the environment and climate change. The panel received form letters signed by citizens of Alberta and Canada expressing concerns about greenhouse gas emissions and climate change, about the loss of caribou and bison habitat, and about effects to other wildlife and species at risk, biodiversity, water quality and human health.

[4764] The panel has considered all of these issues as part of its review. The project will result in significant employment and economic opportunities for Albertans and Canadians. While the project is likely to result in significant adverse effects to some environmental receptors, the panel has imposed conditions on Teck and made recommendations for action by Alberta and Canada to address issues that cannot be fully mitigated or addressed by Teck.

Panel Determination

[4765] On the basis of the evidence, the panel finds that the Frontier project will result in significant direct and indirect economic benefits for Alberta and Canada. It is also expected to result in social and economic benefits for those indigenous communities most directly affected by the project who have agreements with Teck. While the panel has determined that the Frontier project is also likely to result in significant adverse effects to some habitat types and the wildlife that rely on them, some of which are species at risk, these effects are not expected to threaten the sustainability of regional ecosystems or wildlife populations. With respect to the Ronald Lake bison herd, the threat of disease transmission from contact with diseased bison in Wood Buffalo National Park exists today, even without the project.

[4766] In weighing the social, economic and environmental evidence the panel considered that the project is located within the mineable oil sands area where the only way to recover the resource is through mining. It recognizes that there are limited opportunities to mitigate some of these adverse effects. It has paid special attention to the interests of indigenous groups in its deliberations as they are most directly affected by the adverse environmental effects and loss of lands. The participation agreements which they have developed with Teck and the support for the project expressed by some of the parties has informed the panel's public interest determination.

[4767] Overall, the panel concludes that the economic benefits for Alberta and Canada and the expected social and economic benefits for indigenous communities outweigh the adverse environmental effects. The panel therefore finds that on balance approval of the Frontier project is in the public interest.

Approval Decision

[4768] The panel has considered the environmental, economic and social effects of the project. The panel also considered the effects on the aboriginal and treaty rights of indigenous peoples. Having considered those matters, the panel considers it to be in the public interest to grant the approval sought under *OSCA*.

[4769] Pending the authorization of the Lieutenant Governor in Council, the panel, exercising its authority as the AER, approves Teck's *OSCA* application 1709793. The new Frontier oil sands mining commercial scheme is approved subject to the *OSCA*, the *OSCR* and the conditions contained in the draft *OSCA* approval found in [Appendix 5](#).

[4770] Should the schedule of the project change significantly, Teck is required to inform the AER and any other regulatory agencies so that changes associated with project milestones schedule are appropriately changed.

36 *Water Act*

Evidence

[4771] Teck requested an approval and licence under the *Water Act* to construct and operate water management facilities and to divert water for the Frontier project. The request included the following activities:

- muskeg drainage and overburden dewatering
- McMurray basal water sands depressurization and Quaternary deposits dewatering
- withdrawing, diverting, and impounding surface and groundwater
- constructing, operating, and reclaiming external and internal tailings and overburden disposal areas, including dam structures
- constructing water handling and containment structures, including dam structures
- constructing watercourse crossings such as pipelines, transmission lines, and bridges
- diverting surface waters and streams around the project disturbance area

[4772] Teck submitted an application under the *Water Act* to divert water from the Athabasca River, surface runoff water in the closed-circuit areas, seepage to the mine pit, basal water sands depressurization, and seepage from the perimeter of the external tailings area. The requested maximum annual water diversion volume from all water sources during phase 1 was 105.2 million cubic metres (Mm^3) per year; during phase 2, the maximum volume was 81.1 Mm^3 per year. The requested maximum annual volume of water withdrawal specifically from the Athabasca River during phase 1 was 98.0 Mm^3 per year and during phase 2, it was 60.0 Mm^3 per year. The maximum rate of withdrawal from the river during both phases is proposed to be 4.2 cubic metres per second. Teck stated that the project will involve closed-circuit drainage and applied under the *Water Act* for a maximum annual surface runoff water allocation of 14.9 Mm^3 and a maximum annual groundwater diversion volume of 14.7 Mm^3 .

[4773] Teck included a proposed project fenceline within the *Water Act* application. Teck stated the proposed fenceline considered the proposed mine and water management plans, appropriate offset from natural streams and water bodies and inclusion of all areas to be affected by the project activities.

[4774] Teck stated that the off-stream storage pond and river water intake system have been sized to comply with the *Lower Athabasca Region: Surface Water Quantity Management Framework for the Lower Athabasca River*. Teck indicated that it reviewed and evaluated the framework and determined that the project's updated water management plan aligns with its requirement to halt river withdrawals during low-flow periods. Teck committed that the project will be designed to have adequate off-stream storage capacity in consideration of the frameworks water sharing provisions.

[4775] Teck proposes to send water collected in the closed-circuit area to the external tailings areas where the water will mix with tailings and become part of the bitumen processing recycled water system. The external tailings areas and the bitumen processing plant are in the Athabasca River major river basin, as defined in the *Water Act* (Ministerial) Regulation.

[4776] The northern 27 km² of the closed-circuit area drains to Ronald Lake and is within the Lake Claire watershed, which is part of the Peace/Slave River major river basin as defined in the *Water Act* (Ministerial) Regulation. The remaining 199.9 km² is within the Athabasca River major river basin as defined by the *Water Act* (Ministerial) Regulation.

[4777] The portion of the closed-circuit area that is within the Peace/Slave River major basin includes the north mine area, internal and external disposal areas and northern portion of the Main Pit.

[4778] Teck proposes to fill end-pit lakes with water from the Athabasca River. The proposed north pit lake, and the northern portion of the main pit lake are in the Peace/Slave River major river basin.

Analysis and Findings

[4779] The *Water Act* is Alberta legislation that allocates and manages Crown owned water. Section 49 of the *Water Act* requires Teck Frontier to have a licence prior to diverting water for use for any purpose. In addition, under section 36 of the *Water Act*, Teck may not commence or continue an activity except pursuant to an approval, unless it is otherwise authorized under the *Water Act*. Teck requested both an approval and licence under the *Water Act* to construct and operate water management facilities and to divert water for the Frontier oil sands mine project.

[4780] As stated in section 19, “[Surface Water Quantity](#),” and section 17, “[Groundwater](#),” the panel notes that section 47 of the *Water Act* states that “A licence shall not be issued that authorizes the transfer of water between major river basins in the province unless the licence is specifically authorized by a special Act of the Legislature.” The panel therefore cannot issue a surface water runoff and groundwater seepage collection licence for the portion of the project closed-circuit area that is within the Peace/Slave River major river basin for use in the Athabasca River major river basin. In addition, because the proposed north pit lake and the northern portion of the central pit lake are in the Peace/Slave River major river basin, and the Athabasca River is in the Athabasca River major river basin, the panel cannot issue a licence that allows Teck to use water from the Athabasca River to fill the north pit lake and the northern portion of the central pit lake.

[4781] The panel does approve a *Water Act* licence for the diversion of water from sources in the Athabasca River Basin, including the Athabasca River, groundwater and surface runoff contributing to Redclay Creek, Big Creek, First Creek and Athabasca River. The licence will not allow for the diversion of water from any water sources within the Peace/Slave River major basin. The fenceline identified within

the licence will be described by project legal land locations within the Athabasca River major river basin only and will not include any project lands located within the Peace/Slave major river basin.

[4782] The panel will include a condition stating that Teck shall not divert any water from the Athabasca River major river basin for use in the Peace/Slave major river basin. In addition, a condition will be included stating that Teck shall not divert any water from the Peace/Slave major river basin for use in the Athabasca River major river basin.¹⁷⁵

[4783] The panel recognizes that Teck requested a phased *Water Act* licence and is satisfied with the requested allocations from surface water and groundwater, river water intake location, rate of diversion from the Athabasca River and overall phased approach. With the licence fenceline excluding the project area proposed to be located within the Peace/Slave major river basin, the panel recognizes that the approved fenceline is different than the original proposal and therefore will include a condition that will require Teck to provide an analysis of future diversion volume needs.¹⁷⁶ In addition, a condition will be included allowing the licence to be amended to reduce the maximum allowable diversion volume, if the analysis has not demonstrated a need for the licensed maximum diversion volume.¹⁷⁷

[4784] The panel is only issuing a licence for the Athabasca River Basin portion of the project because the *Water Act* does not allow a licence to be issued for the interbasin transfer of water without a special Act of the Legislature of the Government of Alberta. The panel notes that should Teck proceed with development of the project, it will have ample time to seek the necessary special act from the legislature as development of the portion of the project located in the Peace/Slave river basin, that requires a licence, would not be expected to occur for more than 25 years after the start of mining.

[4785] The panel recommends that the Government of Alberta consider passing a special act authorizing licences and amendments to licences, which meet specific criteria defined in the act, to be issued for the transfer of water between the Peace/Slave River basin and the Athabasca River Basin.

[4786] The panel recognizes that Teck committed to complying with the *Surface Water Quantity Management Framework for the Lower Athabasca River* and will include a condition in the *Water Act* licence requiring Teck to comply with the *Surface Water Quantity Management Framework for the Lower Athabasca River*, as amended.¹⁷⁸

[4787] The panel understands the current designs for the proposed major works with the potential to impact or alter the flow of water within the project fenceline will require detailed engineering plans and analysis reports to be submitted. Major works include, but are not limited to dams, dikes, settling and

¹⁷⁵ Draft *Water Act* Licence – Conditions 3.33 and 3.34

¹⁷⁶ Draft *Water Act* Licence – Condition 3.25(b)

¹⁷⁷ Draft *Water Act* Licence – Condition 3.9

¹⁷⁸ Draft *Water Act* Licence – Condition 3.15

water storage ponds, tailings ponds, end-pit lakes, compensation lakes, flow splitters, fisheries enhancement structures and realignments to streams or creeks. The panel will include a condition within the *Water Act* approval that will require Teck to provide detailed engineering plans and analysis reports prior to construction of the individual works.¹⁷⁹

[4788] Teck proposes to construct a flow splitter on Big Creek in 2037, when off-stream storage pond 2 is built. However, as explained in section 19, “[Surface Water Quantity](#),” Teck has not provided sufficient justification to demonstrate the need for the proposed flow splitter on Big Creek and therefore the panel does not approve its construction. The panel requires Teck to develop and implement a geomorphic monitoring program for Big Creek as part of its water management plan. Should monitoring results indicate the need for the splitter, Teck can apply for its construction at a later date based on information gathered from the geomorphic monitoring program.

[4789] The panel understands the current design for the river water intake on the Athabasca River is conceptual and will require the detailed engineering plans and analysis reports to be submitted for authorization before beginning construction. The panel will include a condition within the *Water Act* approval to require the submission.¹⁸⁰

[4790] The panel recognizes that Teck submitted a project fenceline covering all areas of the Teck Frontier project where *Water Act* related approval activities will take place. The panel is satisfied with the fenceline approach and the *Water Act* approval will reference the entire fenceline that was requested by Teck, including the north mine area.

[4791] Based on the evidence provided within the filed applications and through the proceeding, the panel has determined that Teck’s *Water Act* application for the Frontier oil sands mining project, subject to conditions within the *Water Act* approval and licence, is consistent with the purpose of the *Water Act* to support and promote the conservation and management of water, including the wise allocation and use of water. As a result, the panel approves the Teck Frontier project (*Water Act* approval application No. 001-00303079 and licence application No. 001-00303091), subject to the conditions contained in the draft *Water Act* approval and licence included in [Appendix 5](#). The panel requires Teck to comply with the associated *Water Act* licence and approval during the life cycle of the Teck Frontier project.

Recommendation to Alberta

[4792] The panel recommends that the Government of Alberta consider passing a special act authorizing licences and amendments to licences, which meet specific criteria defined in the act, to be issued for the transfer of water between the Peace/Slave River basin and the Athabasca River Basin.

¹⁷⁹ Draft *Water Act* Approval – Conditions 3.12, 3.13 and 3.17

¹⁸⁰ Draft *Water Act* Approval – Condition 3.3

37 Environmental Protection & Enhancement Act (*EPEA*)

Evidence

[4793] In its 2015 project update, Teck indicated that it is seeking approval from the AER under *EPEA* for the construction, operation, and reclamation of the project as described below:

- Mine:
 - Development of the main and north mine pits
 - External and in-pit disposal areas for overburden and interburden
- Extraction:
 - Ore preparation, bitumen extraction, froth treatment, and tailings preparation facilities
- Tailings Management:
 - External and in-pit tailing areas
 - Tailings pipeline to transport tailings from extraction and froth treatment to the various tailings facilities
 - Tailings management facilities, including centrifuge plant
- Water Management:
 - Muskeg drainage and overburden dewatering
 - Diversion of unaffected surface water around or away from the mine development
 - Operational and closure mine drainage system
 - Diversion of water from the Athabasca River
 - Diversion of water from Big Creek
 - River Water Intake and water pipeline
 - Off-stream storage pond (OSSP)
 - Depressurization of basal water sands
 - Reinjection of basal water sands depressurization water into an adjacent basal water sands unit
 - Seepage control from the ETAs
 - Containment ponds for recycle water, river water, fish habitat compensation lake
 - Potable water treatment and distribution
 - Domestic wastewater collection treatment and disposal

- Development of pit lakes
- Groundwater monitoring program
- Utilities:
 - Cogeneration and heat integration facility
 - Steam and hot water generation facilities
 - Hot process water tank
 - Electric power and natural gas connections
- Offsites:
 - Tankage for process solvent, diluent, and diluted bitumen product
 - Product custody transfer facilities
 - Vapour recovery unit
 - Emergency blowdown and flare system
 - Containment ponds for wastewater, site stormwater, and emergency discharge of process-affected water
 - Process control centre
 - Fire protection system, including firewater containment and distribution
- Infrastructure:
 - Access roads to the project
 - Aerodrome and associated facilities
 - Administration and support buildings
 - Lodges for construction and operations
 - Athabasca River bridge
- Environmental control:
 - Waste management plan
 - External tailings area seepage interception wells and hydraulic barrier
 - Class II and Class III landfill
 - Hazardous waste storage
 - Chemical storage

- Closure, conservation, and reclamation plan for an initial 10-year approval period
- Emergency response and oil spill contingency plans and facilities
- Environmental monitoring plans

[4794] When Teck originally filed its application, *LARP* (Government of Alberta, 2012) was in draft form. The updated assessments within the 2015 project update reflect the goals and objectives that remain consistent with both the draft and finalized version of *LARP*.

Analysis and Findings

[4795] *EPEA* is Alberta's legislation that manages the effects of industrial activities on the environment over the life span of the activity (construction, operation, and reclamation). Pursuant to the *Activities Designation Regulation* (Alberta Regulation 276/2003) under *EPEA*, the following activities are applicable to the Teck Frontier oil sands mining operation, for which an *EPEA* approval is required:

- Schedule 1, Division 2 (Substance Release), Part 8 (Oil and Gas), (h) (ii): the construction, operation or reclamation of an oil sands processing plant, in which the plant is for the recovery from oil sands of crude bitumen, sand and other substances; and
- Schedule 1, Division 3 (Conservation and Reclamation), (a): the construction, operation or reclamation of a mine.

[4796] The panel recognizes that all of the specified activities Teck has applied for are associated with the main activity of oil sands mining. The majority of these specified activities would be captured under the activities listed in Division 2 and 3 of Schedule 1, and thus, would need an *EPEA* approval. See the introduction to this report for additional detail regarding approval of the Frontier project components.

[4797] Alberta's *LARP*, finalized in September 2012, outlines the province's strategy to achieve a balance between economic development and maintaining the environmental landscape within the Lower Athabasca region. By using *LARP*'s specific environmental frameworks – *AQMF*, *Surface Water Quality Management Framework*, *Groundwater Management Framework*, and the *TMF*, this approach assists regulatory organizations in managing cumulative air, water, and biodiversity effects from all industrial and non-industrial activities. In order for the Teck Frontier project to operate in the region, *LARP* and its associated frameworks must be complied with.

[4798] *EPEA* approvals for industrial activities manage a set of subject areas. These subject areas are air quality emissions, surface water quality for releases into the environment (which may include domestic wastewater), waste management, potable water and waterworks, groundwater quality, wildlife and wildlife habitat (including fisheries and fish habitat), and reclamation.

[4799] In addition to the abovementioned subject areas, *EPEA* oil sands mining approvals have a section involving research and development of tailings, end-pit lakes, and wetlands.

[4800] The report on tailings research is required every three years and provides the AER updates about ongoing and planned research and development activities. In addition to getting a better scientific understanding of tailings deposits and its potential effects to human health, another purpose is to assess how tailings deposits could be reclaimed back into terrestrial and wetland ecosystems.

[4801] The end-pit lakes' research and development report is expected to be submitted to the AER every two years, with the overall objective of developing self-sustaining end-pit lakes on the closure landscape.

[4802] A wetland research plan is also expected to be submitted to the AER. Within it, Teck is to build at least one site-specific pilot wetland and to measure its performance. In order to provide updates on the monitoring of the pilot wetland and any other wetland research conducted, the AER expects a wetland monitoring report to be submitted. Both the wetland research plan and the wetland monitoring report will allow the AER to be informed on the progress of wetland development and will provide Teck with the necessary data to successfully reclaim additional self-sustaining wetlands in their final closure landscape.

[4803] Based on the evidence provided within the filed applications and through the proceeding, the panel has determined that Teck's *EPEA* application to construct, operate, and reclaim the Frontier oil sands mining project is consistent with the general provisions of *EPEA* to protect the environment while promoting responsible resource development. As a result, the panel approves the Teck Frontier project (*EPEA* Application No. 001-00247548), subject to the conditions contained in the draft *EPEA* approval included in [Appendix 5](#). The panel requires Teck to comply with the associated *EPEA* approval during the life cycle of the Teck Frontier project.

38 CEAA 2012 Recommendations

[4804] According to the terms of reference in the joint review panel agreement between the federal minister of Environment and Climate Change, the joint review panel is required to conduct an assessment of the environmental effects of the Frontier project in a manner consistent with the requirements of *CEAA 2012*, *REDA*, *EPEA*, and *OSCA*.

[4805] In the preceding sections of this report, the panel assessed the various components of the Frontier project, considered evidence from the parties regarding the potential environmental effects of the Frontier project identified measures that it considered necessary to mitigate the effects of the Frontier project, and taking those measures into account, determined the significance of those effects. In addition to placing binding conditions on Teck in its capacity as the AER, the panel has identified mitigation measures that are required to mitigate the effects of the Frontier project as set out under section 5 of *CEAA 2012*.

[4806] The panel recommends that the Minister include the mitigation measures, monitoring requirements and follow-up programs listed below in the decision statement under section 53 of *CEAA 2012*.

Conservation, Reclamation and Closure

- 1) In order to mitigate the effects of the Frontier project and reestablish biodiversity and wildlife habitat in the reclaimed landscape, Teck should submit a plan, which includes a program to achieve continuous improvement on biodiversity. Objectives of the plan should include both an increase in the number of species planted and on the number of habitats (ecosite phases and wetland classes) on reclaimed sites with a target to increase the number of wildlife habitat types. Teck should report its results in achieving continuous improvement of biodiversity every ten years.
- 2) In order to avoid adverse effects of the project resulting from the spread of non-native invasive species and noxious weeds, Teck should develop and implement a program for the effective control of non-native invasive species and noxious weeds throughout the construction, operations, and closure phases of the project.
- 3) To confirm the predictions made in the assessment, Teck should undertake a reclamation follow-up program that includes methods to track and report on cumulative increases in vegetation species, ecosite phases, and wetland classes as reclamation proceeds throughout the life of the mine. The reclamation monitoring program should also include the monitoring of settlement on revegetated upland areas. Teck should address continuous improvement in biodiversity potential at the species and community level during progressive reclamation that targets the capability for long-term biodiversity.

Accidents and Malfunctions

- 4) In order to mitigate the potential adverse effects of accidents and malfunctions, including effects on the health of indigenous peoples, Teck should maintain a site-specific emergency response plan that demonstrates:
 - a) Systems are in place for timely notification and updates regarding any noncompliance, accident or malfunction that may pose an immediate threat to human health or the environment;
 - b) plans for testing and responding to any unplanned release of water or other releases from the Frontier project; and,
 - c) mechanisms for receiving and incorporating concerns of indigenous groups.

Air Quality

- 1) In order to mitigate potential adverse effects of the Frontier project on air quality and human health due to NO_x emissions to air, the Frontier project cogeneration NO_x emission limit should be set to 0.44 t/d per unit. Teck should also operate Tier IV compliant, or equivalent in emissions stringency, mine fleet haul trucks. Teck should also be required to repair and maintain its mine fleet to remain compliant with Tier IV standards, or equivalent.
- 2) In order to reduce acidifying emissions from the Frontier project and mitigate potential adverse environmental effects to air quality, Teck should use low-sulphur natural gas and diesel fuels in haul trucks and other equipment.

Surface Water Quality

- 1) In order to avoid adverse effects to surface water quality during operations, Teck should be required to manage industrial runoff on site. All industrial wastewater should be contained in the industrial wastewater control system for use as recycle water. Runoff including plant site drainage, drainage and seepage control at the External Tailings Areas and External Disposal Areas containing tailings fines, drainage at mine pits and in-pit tailings storage areas should all be contained in the industrial wastewater control system for use as recycle water.
- 2) In order to reduce the potential for mercury methylation and avoid adverse effects to surface water quality, aquatic life and human health, Teck should:
 - a) remove all vegetation and organic soils from the footprints of the off-stream storage ponds and the fish habitat compensation lake during their construction;
 - b) provide a plan to monitor the concentrations of mercury, methylmercury, and any parameters known to influence their concentration on a seasonal basis from surface water sources that would be used to fill the off-stream storage ponds and fish habitat compensation lakes;

- c) Teck should not use source waters with elevated mercury concentrations to fill off-stream storage ponds and the fish habitat compensation lake;
- 3) To confirm the predictions in the assessment regarding concentrations of mercury and methylmercury, Teck should monitor mercury and methylmercury concentrations in water and in fish tissues in the fish habitat compensation lake, once completed.

Surface Water Quantity

- 1) In order to avoid adverse effects to surface water flows and surface water quantity as a result of the Frontier project and to mitigate adverse effects to use of lands and resources for traditional purposes by indigenous peoples as a result of reduced ability to access lands by water, Teck should:
 - a) develop a water management plan with the objectives of maximizing use of fresh water storage capacity, avoiding filling of fresh water storage during low flows, maximizing diversions to fill storage during higher flows, and avoiding non-essential water use during periods of low flow;
 - b) maintain at least 90 days of fresh water storage, not including diversions for the purpose of end-pit lake filling;
 - c) not divert water from the Athabasca River for end-pit lake filling when Athabasca River flows at the Fort McMurray station are below 600 m³/s; and
 - d) re-evaluate its closure plan before developing the north mine pit to demonstrate that changes to Buckton Creek peak, average, and low flows are within 5% of natural conditions.

Groundwater Quality and Quantity

- 1) In order to confirm the predictions in the assessment regarding the effects of dewatering on surface water levels in the Lake Clair watershed and Wood Buffalo National Park, prior to the beginning of project construction, Teck should establish groundwater monitoring wells in the Quaternary, Cretaceous and Devonian aquifers. These wells should be used to set a baseline and then monitored to verify the absence of groundwater drawdown effects on receptors outside of the project development area resulting from Frontier project activities. Receptors should include, at minimum, the Lake Claire watershed, which includes the Buckton Creek watershed and Ronald Lake.

Wildlife

- 1) In order to mitigate adverse effects on the Ronald Lake bison herd, Teck should finalize a Ronald Lake bison mitigation, monitoring, and adaptive management plan. The plan should clearly demonstrate how input from indigenous communities and relevant provincial and federal authorities has been sought and incorporated.

- 2) In order to confirm the predictions in the assessment regarding range shift and contact between the Ronald Lake bison herd and the diseased Delta bison herd in Wood Buffalo National Park, Teck should fund an independent evaluation of its proposed mitigation measures. The results of this evaluation should be used by Teck to inform mitigation and adaptive management planning. Teck should also continue to fund studies, as part of a follow-up monitoring program, on the Ronald Lake bison herd movements, habitat use, and behaviour of the herd prior to, during and following project construction.
- 3) In order to mitigate adverse effects on caribou, Teck should develop a mitigation, monitoring and adaptive management plan for the Frontier project, which describes how it will monitor effects of the Frontier project on caribou, such as incidental predation, and how it will determine whether additional mitigation measures related to caribou are required.
- 4) In order to mitigate potential adverse effects of the Frontier project on migratory birds, including Whooping Crane, Teck should finalize and implement a waterfowl protection plan for the Frontier project. The plan should include techniques and procedures to prevent bird contact with industrial wastewater and to prevent bird mortalities associated with industrial wastewater, including but not limited to:
 - a) reducing the attractiveness of ponds to birds through design, construction and operational measures;
 - b) prevention of and elimination of floating or emergent vegetation from the ponds;
 - c) minimizing the presence of floating bitumen from the ponds;
 - d) minimizing the bird nesting habitat around the ponds;
 - e) minimizing habituation of birds to the ponds;
 - f) a description of the bird deterrent technology;
 - g) a description of bird deterrent locations, including a map;
 - h) a schedule for implementation of the bird deterrent program including initial start-up and annual deployment; and
 - i) a description of how adaptive management principles will be used to foster continuous improvement of the bird deterrent program.

The plan should incorporate the use of “best available technology economically available” and research and monitoring results.

- 5) In order to confirm the predictions in the assessment regarding the potential effects of the Frontier project on migratory birds, including Whooping Crane, Teck should implement a follow-up program which, at minimum documents:

- a) avian mortality;
 - b) avian contacts;
 - c) timing of incidents;
 - d) bird species affected; and
 - e) with respect to Whooping Crane, occurrence, movements and habitat use of Whooping Crane on and adjacent to Teck's lease including interactions with tailings areas.
- 6) Based on the findings of the monitoring above, Teck should submit a report to the Responsible Authority on an annual basis, which includes:
- a) a summary of activities related to the implementation of the waterfowl protection plan for the previous year;
 - b) summary of the results of monitoring and research conducted;
 - c) proposed adjustments to the bird protection plan for the upcoming year; and
 - d) maps and figures as needed to illustrate (a) to (c) above.

Indigenous Use, Culture and Rights

- 1) In order to mitigate the effects of the Frontier project on indigenous use of land and resources for traditional purposes, health and socioeconomic conditions and physical and cultural heritage, Teck should develop a traditional land-use mitigation, monitoring and adaptive management plan for the Frontier project. The plan should demonstrate how Teck will monitor the effects of the project, engage with indigenous groups and what actions will be taken, if necessary, if it is determined that the project is causing unanticipated adverse effects.
- 2) In order to mitigate the effects of the Frontier project on indigenous use of land and resources for traditional purposes, Teck should develop and implement an access management plan which maintains the ability of indigenous peoples to access lands and resources.

Conclusion

[4807] The panel has conducted its review in a manner that discharges the responsibilities of the AER under *REDA*, *OSCA*, *EPEA*, the *Water Act*, the requirements of *CEAA 2012*, and the panel's terms of reference. The panel finds that the Frontier project is in the public interest and approves the applications subject to the conditions in this report. Project effects and cumulative effects have weighed heavily in the panel's assessment. The panel has set numerous approval conditions and made recommendations to the federal minister of Environment and Climate Change, and to the governments of Canada and Alberta. These are summarized in [Appendix 5](#) and [Appendix 6](#).

Dated in Calgary, Alberta, on July 25, 2019.

Alberta Energy Regulator

Mr. A. Bolton
Presiding Hearing Commissioner

Mr. R. C. McManus
Hearing Commissioner

Mr. W. Klassen
Hearing Commissioner

Appendix 1 Hearing Participants

Joint Review Panel / Secretariat

(Abbreviations used in report)

Joint Review Panel

Alex Bolton (panel chair)
Robert McManus
William Klassen

Counsel

Meighan LaCasse (AER)
Alison Doebele (AER)
Charles Birchall (CEAA)

Panel managers

Tara Wheaton (AER)
David Haddon (CEAA)

CEAA analysts

Jason Patchell
Elyse Maisonneuve
Claudette Bois
Robyn-Lynne Virtue

AER technical experts

Renato Chiarella
Kenneth Yap
Adriana Ledi
Africa Geremew
Yetimgeta Mihiretu
Charly Wang
Rod Drummond
Wally Qiu
Steven Stryde
Dan Slavik
Leanne Erickson
Margaret Magai
Agnes Wajda-Plytta
Ernst Kerkhoven
Chris Teichreb
Elena Zimmerman
Eva Kilinska
Geoff Granville
Blair Bailey
Shamus Hardie

Teck Resources Limited

Counsel

Martin Ignasiak
Danielle Chu
Justin Fontaine
Scott McKenzie

Witnesses

Kieron McFadyen
Lyndon Chiasson
Robin Johnstone
Neil Sandstrom
Yvonne Walsh

(continued)

Janais Turuk
Michael Di Marco
Kristen Sibbel
Steven Hilts
Wayne Speller
Scott Donald
Jerry Vandenberg
Chris Bjornson
Getu Biftu
Dejiang Long
Anna Brace
Martin Jalkotzy
Jonathan Chui
Ivan Whitson
Reid Person
Dave Brescia
Derek Ebner
Bart Koppe
Ian Gray
Richard Sisson
Pearce Shewchuk

Athabasca Chipewyan First Nation

Counsel

Matt Hulse
Eamon Murphy
Caily DiPuma

Witnesses

Chief Allan Adam
Elder Alice Rigney (translator for the elders)
Elder Rene Bruno
Morgan Voyageur
Councillor Raymond Cardinal
Elder Julie Mercredi
Councillor Jonathan Bruno
Bruce Maclean
Lisa Tssessaze
Martin Carver

Canadian Parks and Wilderness Society Northern Alberta (CPAWS)

Counsel

Drew Yewchuk
Shaun Fluker

Witness

Dr. Colleen Cassady St. Clair

Deninu K'ue First Nation

Counsel

Witnesses

Marc d'Entremont
Councillor Patrick Simon
Elder Henry McKay

Fond du Lac First Nation

Counsel

Witnesses

Chief Louie Mercredi
Councillor Willie John Laurent
Councillor Ronnie Augier

Fort McKay First Nation

Counsel

Tarlan Razzaghi

Witnesses

Alvaro Pinto
Bori Arrobo
Ryan Abel

Government of Canada (GOC)

Counsel

James Elford
Robert Drummond

Witnesses

Lukas Mundy
Katelyn Wells
Paul Makar

(continued)

Joanne Parrott
Daniel Lee Peters
Alexandra Steffen
Susanne Forbrich
Richard Wiacek
Teresa LaForest
Melissa Gorman
Barry Jessiman
Luc Pelletier
Anita Gudmundson
Raphael Israel
Gregory Black
Karmen Klarenbach
Shelley Ball
Nicolas Benoit
Kim Kasperski
Tod Ramsfield
Dan Thompson
Katherine Cumming
Stuart Macmillan
Jonah Mitchell
Todd Shury
Laurie Wein
Beverley J. Ross
Stephanie Martens
Brandi Mogge
Doris Aubin
Candace Anderson

International Brotherhood of Electrical Workers, Local 424

Counsel

Presentation by
Scott Crichton

Kátl'odeeche First Nation

Counsel

Daniel T'seleie

Witnesses

Keepers of the Athabasca

Counsel

Witnesses

Jule Asterisk
Paul Belanger
Gerda Kits
Regan Boychuk
John O'Connor
Jean L'Hommecourt

Local Lodge 146 of the International Brotherhood of Boilermakers

Counsel

Presentation by

Luc Bérubé

Mikisew Cree First Nation

Counsel

Mark Gustafson
Karey Brooks

Witnesses

Chief Archie Waquan
Jocelyn Marten
Councillor Calvin Waquan
Melody Lepine
Elder Terry Marten
Elder Alice Marten
Elder George Marten
Elder Sloan Whiteknife
Elder Rita Marten
Elder Alec Whiteknife
Elder Larry Marten

(continued)

Carl Braun
Craig Candler
Martin Carver
Bruce Maclean
Mandy Olsgard
Petr Komers
Brian Kopach
Sarah Hechtenthal
Dan Stuckless
Carla Davidson
Ginger Gibson

Oil Sands Environmental Coalition (OSEC)

Counsel

Kurt W. Stilwell
Barry K. Robinson
Olivia French

Niki Way (analyst with Pembina Institute)

Witnesses

Jan Gorski
Jodi McNeill
Nina Lothian
Simon Dyer
Chris Joseph

Original Fort McMurray First Nation and Clearwater River Band 175

Counsel

Darlene Gladieu-Quinn

Witnesses

Elder Evelyn Jones
Elder Maureen Cardinal
Elder Pete Malcolm
Charles Beauchamp
Robert Gilbert
Acting Chief John Malcolm
Chief Maryann Powder
Elder Allan Powder
Councillor Flora Powder
Elder Jean Powder

Regional Municipality of Wood Buffalo

Counsel

Presentation by
Mayor Don Scott

Sierra Club BC

Counsel

Witness
Mark Worthing

Smith's Landing First Nation

Counsel

Megan McConnell

Witnesses

Becky Kostka
Sadele Paulette
Elder Maglorie Paulette
Elder Gerry Cheezie
Councillor Thaidene Paulette
Elder Lawrence Cheezie
Councillor Fred Daniels
Chief John Tourangeau

Stand Earth

Counsel

Witness
Tom Sanzillo

The Council of Canadians

Counsel

Witness
Bronwen Tucker

The Northwest Territory Métis Nation

Counsel

Witnesses

Ron Yoworsky

Elder Earl Evans

Trappers

Represented by

Daniel McCargar

Witnesses

Darryl Shevolup

Charles Shevolup

Peter Hoffmann

Presentation by

George Clark

Wilderness Committee

Counsel

Witness

Peter McCartney

Appendix 2 Agreements to Establish a Joint Review Panel

AGREEMENT
To Establish a Joint Review Panel
for the Frontier Oil Sands Mine Project
Between

The Minister of the Environment, Canada
- and -
The Alberta Energy Regulator, Alberta

PREAMBLE

WHEREAS the Alberta Energy Regulator (the AER) has statutory responsibilities pursuant to the *Responsible Energy Development Act* (REDA); and

WHEREAS the Minister of the Environment, Canada (the Federal Minister of the Environment) has statutory responsibilities pursuant to the *Canadian Environmental Assessment Act, 2012* (CEAA 2012); and

WHEREAS the proposed Frontier Oil Sands Mine Project (the project) requires a public hearing and approvals from the AER pursuant to REDA the *Oil Sands Conservation Act*, the *Environmental Protection and Enhancement Act* (EPEA) and the *Water Act*, and is subject to an assessment under CEAA 2012; and

WHEREAS the Federal Minister of the Environment has referred the project to a review panel in accordance with section 29 of the former *Canadian Environmental Assessment Act* and has determined that pursuant to section 40(1) of CEAA 2012 a joint review panel should be established to consider the project; and

WHEREAS the Government of the Province of Alberta and the Government of Canada established a framework for conducting joint review panels through the *Canada-Alberta Agreement on Environmental Assessment Cooperation (2005)* signed on May 17, 2005; and

WHEREAS the AER and the Federal Minister of the Environment have determined that a joint review of the project will ensure that the project is evaluated according to the spirit and requirements of their respective authorities while avoiding unnecessary duplication, delays and confusion that could arise from individual reviews by the Government of Canada or the AER; and

WHEREAS the AER and the Federal Minister of the Environment have determined that a joint review of the project should be conducted in a manner consistent with the provisions of Appendix 2 of the *Canada-Alberta Agreement on Environmental Assessment Cooperation (2005)*; and

WHEREAS pursuant to section 126 of CEAA 2012, the assessment by the joint review panel is continued under the process established under the former *Canadian Environmental Assessment Act* as if it had been referred to a review panel under section 38 of CEAA 2012; and

WHEREAS the AER has determined that pursuant to section 18 of *REDA* a joint review panel cooperative proceeding should be established and that the project should be considered in a cooperative proceeding by the AER and the Canadian Environmental Assessment Agency (the Agency).

THEREFORE, the AER and the Federal Minister of the Environment hereby establish a joint review panel for the project in accordance with the provisions of this Agreement and the Terms of Reference attached as an Appendix to this Agreement.

1. Definitions

For the purpose of this Agreement and of the Appendix attached to it,

"Aboriginal" describes those Aboriginal peoples of Canada as defined in the *Constitution Act, 1982*, subsection 35(2) including the Indian, Inuit and Métis peoples of Canada;

"Agency" means the Canadian Environmental Assessment Agency established under CEAA 2012;

"environment" means the components of the Earth, and includes

- a. land, water and air, including all layers of the atmosphere,
- b. all organic and inorganic matter and living organisms, and
- c. the interacting natural systems that include components referred to in a. and b;

"environmental effect" means, for the purposes of the Federal Minister of the Environment, those effects described in section 5 of CEAA 2012;

"federal authority" means a Minister, agency or department of the Government of Canada;

"follow-up program" means a program for

- a. verifying the accuracy of the environmental assessment of the project, and
- b. determining the effectiveness of any mitigation measures;

"interested party" means any person who the Joint Review Panel determines, with respect to the project, may be directly affected by the carrying out of the project or has relevant information or expertise;

"Joint Review Panel" refers to the Joint Review Panel established by the AER and the Federal Minister of the Environment through this Agreement;

"mitigation" means, in respect of the project, the elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means;

"parties" means the signatories to this Agreement;

"project" means the proposed Frontier Oil Sands Mine Project described in Part 1 of the Terms of Reference;

“**proponent**” has the meaning provided in section 2 of CEEA 2012;

“**public registry**” means the Canadian Environmental Assessment Registry established under section 78 of CEEA 2012;

“**report**” means the document produced by the Joint Review Panel, which contains decisions pursuant to REDA, EPEA, the *Water Act* and the *Oil Sands Conservation Act*, and the Joint Review Panel's rationale, conclusions and recommendations relating to the environmental assessment of the project including any mitigation measures and follow-up program pursuant to CEEA 2012 and a summary of comments received from the public, including Aboriginal persons and groups.

2. Establishment of the Joint Review Panel

- 2.1** A process is hereby established to create a co-operative proceeding pursuant to section 18 of REDA, and a Joint Review Panel pursuant to sections 38, 39, 40 and 42 of CEEA 2012, for the purposes of the joint review of the project.
- 2.2** The AER and the Agency will make arrangements to coordinate the announcements of a joint review of the project by both the AER and Canada.

3. Constitution of the Joint Review Panel

- 3.1** The Joint Review Panel will consist of three members. The chief hearing commissioner of the AER shall appoint the chairperson and shall appoint one other member of the Joint Review Panel, with the approval of the Federal Minister of the Environment. The third Joint Review Panel member will be appointed by the Federal Minister of the Environment in accordance with article 3.2 of this Agreement.
- 3.2** The Federal Minister of the Environment will select the third Joint Review Panel member and recommend the selected candidate as an individual who may serve as a potential hearing commissioner of the AER. If acceptable to the Lieutenant Governor in Council of Alberta and the Chief Hearing Commissioner of the AER, the Lieutenant Governor in Council of Alberta will nominate this candidate to serve as a hearing commissioner of the AER and the Chief Hearing Commissioner of the AER will appoint this candidate as a member of the Joint Review Panel. The selected candidate will also be appointed by the Federal Minister of the Environment as a member of the Joint Review Panel.
- 3.3** The Joint Review Panel members shall be unbiased and free from any conflict of interest relative to the project and are to have knowledge or experience relevant to the anticipated environmental effects of the project. In the event that a Joint Review Panel member resigns or is unable to continue to work, the remaining members shall constitute the Joint Review Panel unless the federal Minister of the Environment and the AER determine otherwise. In such circumstances, the federal Minister of the Environment and the AER may choose to replace the member.

4. Secretariat

- 4.1 Administrative, technical, and procedural support requested by the Joint Review Panel shall be provided by a Secretariat, which shall be the joint responsibility of the AER and the Agency.
- 4.2 The Secretariat will report to the Joint Review Panel and will be structured so as to allow the Joint Review Panel to conduct its review in an efficient and cost-effective manner.
- 4.3 The AER will provide its offices for the conduct of the activities of the Joint Review Panel and the Secretariat.
- 4.4 Costs for conducting the joint review will be shared between the Agency and AER in accordance with Appendix 2 attached to this Agreement.

5. Record of Joint Review and Report

- 5.1 A public registry will be maintained by the Agency during the course of the joint review in a manner that provides for convenient public access and for the purposes of compliance with sections 79 to 81 of CEEA 2012.
- 5.2 Subject to sections 45(3), (4), and (5) and 79(3) of CEEA 2012, the public registry will include all records relating to the review, including submissions, correspondence, hearing transcripts, exhibits and other information, received by the Joint Review Panel and all public information produced by the Joint Review Panel relating to the review of the project.
- 5.3 On completion of the assessment of the project, the Joint Review Panel shall prepare a report. The report shall include an executive summary in both official languages of Canada. The report will set out the rationale, conclusions and recommendations of the Joint Review Panel relating to the environmental assessment of the project, including any mitigation measures and follow-up program, and a summary of comments received from the public, including Aboriginal persons and groups. The report will be conveyed to the Federal Minister of the Environment within the overall time limit for the review established by the Federal Minister of the Environment.
- 5.4 After the report is submitted, the Agency will maintain the public registry. The AER will continue to maintain records of the proceedings and the report in accordance with its normal practices and procedures.
- 5.5 The Agency will be responsible for the translation of public notifications and releases and the report prepared by the Joint Review Panel, into both of the official languages of Canada. The Agency will use all reasonable efforts to expedite the translation of the report.

6. Other Government Departments

- 6.1 The Joint Review Panel may request federal and provincial authorities having specialized information or knowledge with respect to the project to make that information or knowledge available to the Joint Review Panel in an acceptable manner. The Joint Review Panel may also retain the services of independent non-

government experts to provide advice on certain subjects within the Joint Review Panel's Terms of Reference.

- 6.2 Nothing in this Agreement will restrict the participation by way of submission to the Joint Review Panel by federal or provincial government departments or bodies, subject to article 6.1 above, under section 20 of CEEA 2012 and section 49 of REDA.
- 6.3 The names of the experts retained by the Joint Review Panel and any documents obtained or created by the experts and that are submitted to the Joint Review Panel will be placed on the public registry. This shall exclude any information subject to solicitor-client privilege where the expert is a lawyer.
- 6.4 The Joint Review Panel may, in its sole discretion, require any expert referred to in articles 6.1 and 6.3 to appear before the Joint Review Panel at the public hearing and testify in regard to the documents they have created or obtained and that were submitted to the Joint Review Panel and made public in accordance with the preceding paragraph.

7. Participant Funding

- 7.1 Decisions regarding participant funding by the Agency under the federal Participant Funding Program, and decisions on participant funding by the AER as provided for in REDA, the AER *Rules of Practice* and the AER's *Directive 031: REDA Energy Cost Claims* will, to the extent practicable, take into account decisions of the other party.

8. Amending this Agreement

- 8.1 The terms and provisions of this Agreement may be amended by written memorandum executed by both the Federal Minister of the Environment and the Chief Executive Officer of the AER.
- 8.2 Subject to section 49 and 62 of CEEA 2012, this Agreement may be terminated at any time by an exchange of letters signed by both parties.

9. Signatures

WHEREAS the parties hereto have put their signatures



The Honourable Catherine McKenna
Minister of the Environment



Jim Ellis
CEO
Alberta Energy Regulator

Date FEB 19 2016

Date May 11/2016

Appendix 1

Terms of Reference

Part I - Scope of Project

Teck Resources Limited (the Proponent) proposes to develop and operate a new oil sands mine and processing plant (the project), located 110 kilometres north of Fort McMurray, Alberta. As modified by the Asset Exchange Agreement announced by the Proponent on June 7, 2013 and described in the July 29, 2013 letter to Alberta Environment and Sustainable Resource Development, the Canadian Environmental Assessment Agency and the Alberta Energy Regulator, the proposed project would produce 38 156 cubic metres per calendar day (240 000 barrels pcd) of partially deasphalted bitumen.

The project would use truck and shovel to mine two open pits. The project would also include an ore preparation plant, bitumen extraction plant, tailings facilities, cogeneration facilities, support utilities, disposal and storage areas, river water intake, fish habitat compensation lake, roads, an airfield, and camp facilities.

The project would have a disturbance area of 24 139 hectares, resulting from three development phases. The Proponent proposes to start producing partially deasphalted bitumen in 2021. Mining operations would cease in 2054 with decommissioning and reclamation to be completed by 2068.

Part II - Scope of the Environmental Assessment of the Project

The Joint Review Panel shall conduct an assessment of the environmental effects of the project referred to in the Scope of the Project (Part 1) in a manner consistent with the requirements of CEAA 2012, REDA, EPEA, the *Oil Sands Conservation Act* and these Terms of Reference.

As per section 19(1) of CEAA 2012, the assessment shall include a consideration of the following factors:

- a) the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;
- b) the significance of the effects referred to in paragraph a;
- c) comments from the public, including Aboriginal persons and groups, that are received during the joint review;
- d) mitigation measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;
- e) the requirements of the follow-up program in respect of the project;
- f) the purpose of the project;
- g) alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means; and
- h) any change to the project that may be caused by the environment.

As provided in paragraph 19(1)(j) and subsection 19(3) of CEEA 2012, the assessment by the Joint Review Panel shall also include a consideration of the additional following matters:

- a) effects of the project on asserted or established Aboriginal or treaty rights, to the extent the Joint Review Panel receives such information as provided in Part III hereof; and
- b) community knowledge and aboriginal traditional knowledge (such as, but not limited to, traditional use studies) received during the joint review.

Part III – Scope of the factors

The scope of the factors includes those specified in the “Final Terms of Reference” for the preparation of the Environmental Impact Assessment Report for the UTS Energy Corporation/Teck Cominco Ltd. (now Teck Resources Ltd.) Frontier Oil Sands Mine issued by Alberta Environment (now Alberta Environment and Sustainable Resource Development) on February 11, 2009. The document is available on the public registry (document # 9).

In considering the factors outlined in Part II, the Joint Review Panel shall have regard for the following:

Aboriginal Rights and Interests

The Joint Review Panel shall accept as part of its record and review information from Aboriginal groups related to the nature and scope of asserted or established Aboriginal or treaty rights in the area of the project, as well as information on the potential adverse environmental effects that the project may have on asserted or established Aboriginal or treaty rights, and information regarding any measures proposed to avoid or mitigate the potential adverse effects of the project on asserted or established Aboriginal or Treaty rights. The Joint Review Panel may also receive information provided in this regard by the Proponent, interested parties, federal authorities or government, and provincial departments or government.

The Joint Review Panel shall consider:

- Evidence presented concerning any likely project effects to asserted or established Aboriginal or treaty rights, such as:
 - Any potential effects on current uses of lands and resources by Aboriginal persons for traditional purposes;
 - Any effects (including the effects related to increased access, fragmentation of habitat and displacement of the exercise of traditional activities) on hunting, fishing, trapping, cultural and other traditional uses of the land (e.g. collection of medicinal plants, use of sacred sites), as well as related effects on lifestyle, culture, health and quality of life of Aboriginal persons;
 - Any effects of alterations to access into areas used by Aboriginal persons for traditional uses;
 - Any adverse effects of the project on the ability of future generations to pursue traditional activities or lifestyle; and

- Any effects of the project on heritage and archaeological resources in the project area that are of importance or concern to Aboriginal groups.
- Evidence presented concerning the measures proposed to manage, mitigate and compensate any identified effects on asserted or established Aboriginal rights and interests.

For the purposes of its report, the Joint Review Panel shall summarize claims of Aboriginal or treaty rights as presented and consider the effects of the project on the Aboriginal or treaty rights. The Joint Review Panel may use this information to make recommendations that relate to the manner in which the project may adversely affect the Aboriginal or treaty rights.

The Joint Review Panel shall reference in its report:

- the information provided regarding the manner in which the project may adversely affect asserted or established Aboriginal or treaty rights; and
- the information provided regarding the strength of claim in respect of Aboriginal or treaty rights that were asserted by an Aboriginal group, including information about the location, extent, bases and exercise of those asserted Aboriginal or treaty rights in the area of the project.

The Joint Review Panel, based on its assessment of the environmental effects of the project, may recommend measures to mitigate any adverse environmental effects caused by the project that could adversely affect those asserted or established Aboriginal or treaty rights that were identified.

The Joint Review Panel is not required by these Terms of Reference to make any determinations as to:

- the validity of asserted Aboriginal or treaty rights or the strength of such claims;
- the scope of the Crown's duty to consult an Aboriginal group; or
- whether the Crown has met its respective duties to consult or accommodate in respect of rights recognized and affirmed by section 35 of the *Constitution Act, 1982*.

Nothing in these Terms of Reference limits the application of section 21 of REDA or Part 2 of the *Administrative Procedures and Jurisdiction Act* to the AER, and the Joint Review Panel (in its capacity as a panel of AER hearing commissioners) remains at all times subject to the requirements of those provisions, and is entitled to exercise the powers under Part 2 of the *Administrative Procedures and Jurisdiction Act*, including but not limited to section 13 thereof.

Cumulative Effects Assessment

The cumulative effects assessment should take into consideration the approach described in the Agency's draft "Technical Guidance for Assessing Cumulative Environmental Effects under CEAA 2012" (December 2014) and in the Operational Policy Statement "Assessing Cumulative Environmental Effects under CEAA 2012" (December 2014). The Joint Review Panel should focus its consideration of cumulative

effects on key valued components. Without limiting itself thereto, the following components should be considered:

- water quality and quantity;
- air quality and greenhouse gas emissions;
- asserted or established Aboriginal or treaty rights and interests;
- wildlife and wildlife habitat for valued species including: federally and provincially listed species at risk, and migratory birds; and
- valued vegetation communities and wetlands.

The cumulative effects assessment should provide a justification and description of the spatial and temporal boundaries and include, but not be limited to, the following:

- a pre-industrial case to allow the Joint Review Panel to take into account the effects that may have already been experienced prior to the project; and
- future foreseeable projects or activities as of the issuance of the Joint Review Panel's Terms of Reference.

Accidents & Malfunctions

In considering the environmental effects of malfunctions or accidents that may occur in connection with the project, the Joint Review Panel should include potential malfunctions or accidents associated with the following components:

- tailings management;
- waste management and disposal;
- use, handling or spills of chemicals and hazardous materials on-site;
- the increase in road traffic, and the risk of road accidents; and
- any other project components or systems that have the potential, through accident or malfunction, to adversely affect the natural environment.

The Joint Review Panel should consider the likelihood of occurrence of a malfunction or an accident and the sensitive elements of the environment (*e.g.* communities, homes, natural sites of interest, areas of major use) that may be affected in the event of any such malfunction or accident.

Plans, measures and systems to reduce the potential occurrence of a malfunction or accident should be considered in the assessment and should indicate how they will reduce the effects or consequences of any such malfunction or accident.

Effects of Changes to the Environment

The Joint Review Panel shall consider the effects of any changes caused by the project to the components of the environment described in section 5(1) of CEAA 2012.

Change to the Project Caused by the Environment

The Joint Review Panel will also consider any change to the project that may be caused by the environment.

The Joint Review Panel will consider environmental changes and hazards that may occur and may affect the project. The Joint Review Panel should also take into account the potential influence of climate change scenarios presented by the Proponent and other interested parties on climate parameters (e.g. precipitation, temperature), and physical environmental processes.

The Joint Review Panel shall consider the influence that these environmental changes and hazards may have on the project as predicted and described by the Proponent and interested parties.

Part IV – Review Process Mandate

The Joint Review Panel shall conduct its review in a manner that discharges the responsibilities of the AER under the REDA, the requirements set out in CEAA 2012, and the requirements set out in the Terms of Reference that were fixed and approved by the Federal Minister of the Environment and the AER.

The Joint Review Panel shall have all the powers and duties of a panel described in section 45 of CEAA 2012 and of a panel of hearing commissioners described in REDA and the rules and regulations thereunder.

A majority of the Joint Review Panel members constitutes a quorum for the purposes of the proceeding to be conducted by the Joint Review Panel. When a hearing, public meeting, or other activity is conducted by the Joint Review Panel and a member of the Joint Review Panel for any reason does not attend on any day or part of a day, the other members who are sitting at the hearing, public meeting or other activity may continue as fully and effectively as though the absent member was present.

Part V – Review Process

The environmental assessment for the project consists of three stages. These stages are referred to as the Pre-Panel Stage, the Joint Review Panel Stage and the Post-Panel Stage. This description of the review process is limited to the Joint Review Panel stage.

The main steps of the joint review during the Joint Review Panel stage of the environmental assessment will be as follows:

Review of the documentation

1. As soon as possible following its appointment, the Joint Review Panel will initiate a public comment period on whether the information available on the public registry is sufficient to allow a review that complies with the Joint Review Panel's Terms of Reference and to proceed to the public hearing phase of the process. The public, Aboriginal groups and government departments and agencies will be provided with a minimum of 30 days to provide comments.
2. Comments received during the comment period will be made available to the

public through the public registry as soon as possible.

Determination of sufficiency of information

3. After the public comment period has closed, the Joint Review Panel will decide if it has sufficient information to proceed to hearing. In so doing, the Joint Review Panel will consider its own review of the information, any written comments from the public, including Aboriginal persons and groups, government departments or agencies, other governments or technical experts, and any written exchanges between the public and the Proponent.
4. Should the Joint Review Panel identify information deficiencies after reviewing the available information and considering any comments received, the Joint Review Panel shall require additional information from the Proponent. Any requirement for additional information will be issued by the Joint Review Panel as soon as is reasonably practicable following the close of the public comment period.
5. Should the Joint Review Panel conclude that it has sufficient information to proceed to hearing, it will announce the hearing following the close of the public comment period, providing for a minimum of notice 30 days prior to the commencement of the hearing.
6. Notwithstanding paragraph 4 above, if the Joint Review Panel is of the view that it requires additional information from the Proponent but the information deficiency is minor in nature, and the Joint Review Panel receives a commitment from the Proponent to provide the outstanding information, the Joint Review Panel may announce the hearing, providing for a minimum of 30 days notice prior to the commencement of the hearing.

Determination of Adequacy of Additional Information Requested by the Joint Review Panel

7. Upon receipt of additional information provided by the Proponent pursuant to a requirement under paragraph 4 above, the Joint Review Panel will ensure that the information is made available to the public, Aboriginal groups and government departments and agencies for review and comment for a minimum of 30 days.
8. If, after reviewing the additional information and any written comments from the public, Aboriginal persons and groups, government departments or agencies, or other technical experts, the Joint Review Panel concludes that it has sufficient information to proceed to hearing, it will announce the hearing, providing for a minimum of notice of 30 days prior to the commencement of the hearing.
9. If, after reviewing the additional information and any written comments received from the public, Aboriginal persons and groups, government departments or agencies, or other technical experts, the Joint Review Panel is still of the view that it does not have sufficient information to proceed to hearing, it shall inform the Proponent of the outstanding information requirements. Any additional information thereafter provided by the Proponent will be subject to public comment in the manner described in paragraph 7 above.

10. Notwithstanding paragraph 5 above, if the Joint Review Panel is of the view that it requires additional information from the Proponent but the information deficiency is minor in nature, and the Joint Review Panel receives a commitment from the Proponent to provide the outstanding information, the Joint Review Panel may announce the hearing, providing a minimum of 30 days notice prior to the commencement of the hearing.
11. If at any time during the review process the Joint Review Panel requests additional information from the Proponent, the Joint Review Panel may specify the date by which the Proponent must provide the information.

Public Hearing

12. The public hearing will provide Aboriginal groups, interested parties, government authorities and the Proponent with an opportunity to participate in the assessment.
13. The public hearing shall provide opportunities for timely and meaningful participation by the public, including Aboriginal persons and groups, in accordance with CEAA 2012 and subsection 34(3) of *REDA*. The Joint Review Panel shall conduct its hearing in substantial accordance with the AER's *Rules of Practice*. The Joint Review Panel will, however, attempt to make the review process as accessible as reasonably possible for individuals or groups who are not represented by legal counsel or who may lack experience with the quasi-judicial nature of the hearing process.
14. The Joint Review Panel shall hold the hearing in a location or locations selected by the Joint Review Panel, and will endeavour to hold at least a portion of the hearing in, or as near to as is practicable to, one or more communities that:
 - the Joint Review Panel believes may be affected by the project; or
 - are nearest to the location where the project is proposed to be carried out.
15. The Joint Review Panel shall make best efforts to complete the public hearing and close the hearing record within 45 days.

Joint Review Panel Report

16. Following the completion of the public hearing, the Joint Review Panel shall prepare and submit to the federal Minister of the Environment a report as required in article 5.3 of the Agreement. The Joint Review Panel shall provide the executive summary of the report in both official languages of Canada. The report will include:
 - A summary description of the Joint Review Panel's process;
 - The rationale, conclusions, and recommendations of the Joint Review Panel relating to the environmental assessment of the project;
 - Recommended mitigation measures and follow-up programs;

- an identification of those conclusions that relate to the environmental effects defined in section 5 of CEAA 2012; and
 - an identification of recommended mitigation measures that relate to the environmental effects defined in section 5 of CEAA 2012.
17. The Joint Review Panel shall also include within its report a summary of any comments received, including those from the public, Aboriginal groups and interested parties and the information as outlined in Part III.
 18. The Joint Review Panel shall identify in its report the mitigation measures it recommends, including as appropriate, any commitments identified by the Proponent in its Environmental Impact Assessment Report, or during the Joint Review Panel process.
 19. If the Joint Review Panel concludes that, taking into account the implementation of mitigation measures, the project is likely to cause significant adverse environmental effects, it may include in its report a summary of any information it has received on the justifiability of any such significant adverse environmental effects.
 20. Under its authority as the AER, the Joint Review Panel shall make a decision on the project applications and as appropriate, shall include conclusions about the justifiability of any significant adverse effects. In relation to its role as a review panel under CEAA 2012, the Joint Review Panel shall not make any conclusions or recommendations with respect to the justifiability of any significant adverse environmental effects.
 21. The report shall take into account and reflect the views of all Joint Review Panel Members.
 22. The Joint Review Panel may consider any requests made by Aboriginal groups to have the executive summary of the report translated into their Aboriginal languages. If the Joint Review Panel agrees with such a request, it must recommend to the Agency and the AER that such translations be provided by the Agency and the AER in a timely manner and include any conditions as to payment of the costs of translation that it considers appropriate.
 23. The Joint Review Panel will submit its report to the federal Minister of the Environment at the earliest possible date, and within the overall time limit established by the Federal Minister of the Environment for the review.
 24. Upon receiving the report submitted by the Joint Review Panel, the Federal Minister of the Environment and the AER will make the report available to the public and will advise the public that the report is available.
 25. In accordance with section 43(1)(f) of CEAA 2012, the Joint Review Panel may be required to clarify any of the conclusions and recommendations set out in its report with respect to the environmental assessment.

Timelines

26. The Joint Review Panel shall complete its mandate and submit its final report to

the federal Minister of the Environment within 300 days from the establishment of the Joint Review Panel.

27. The time period between the issuance by the Joint Review Panel of any request for information under paragraphs 4 or 9 hereof, and the Joint Review Panel's receipt of the requested information from the Proponent is not included in the timeline referred to in paragraph 26.
28. The Joint Review Panel may request clarification of its Terms of Reference by sending a letter signed by the chairperson to the President of the Agency and the Chief Executive Officer of the AER setting out the request. Upon receiving such a request, the President is authorized to act on behalf of the federal Minister of the Environment and collaborate with the AER to provide to the Joint Review Panel such clarification. The President and the Chief Executive Officer of the AER shall use best efforts to provide a response to the Joint Review Panel within 14 calendar days. The Joint Review Panel shall continue with the review to the extent possible while waiting for the response in order to adhere to the time periods of the original Terms of Reference. The Joint Review Panel shall notify the public of any clarifications to its Terms of Reference.
29. The Joint Review Panel may seek an amendment to its Terms of Reference by sending a letter signed by the chairperson to the federal Minister of the Environment and the AER setting out the request. As appropriate, the federal Minister of the Environment may delegate to the President of the Agency the authority to act on the federal Minister of the Environment's behalf and, in collaboration with the AER, consider and respond to any request from the Joint Review Panel to amend the Terms of Reference. The federal Minister of the Environment, or the President in case of such delegation, and the AER shall use best efforts to ensure a response is provided to the Joint Review Panel's letter within 14 calendar days. The Joint Review Panel shall continue with the review to the extent possible while waiting for the response in order to adhere to the timelines of these Terms of Reference. Any requests for amendments under this article, as well as any amendments to these Terms of Reference, shall be posted on the public registry.

Appendix 2 Cost Sharing Provisions

1. Cost Sharing

- 1.1** The AER and the Agency will collaborate to develop a budget estimate of expenses agreeable to both parties prior to the initiation of Joint Review Panel activities.
- 1.2** The costs of the joint review will be apportioned between the AER and the Agency in the manner set out in articles 1.3, 1.4 and 1.5.
- 1.3** The AER will be solely responsible for the following costs:
- salaries and benefits of the Joint Review Panel Chairperson and the member of the Joint Review Panel not appointed in accordance with article 3.2 of this agreement;
 - salaries and benefits of AER staff involved in the joint review;
 - travel-related expenses associated with the review incurred by Joint Review Panel Secretariat members who are AER staff; and
 - all costs associated with AER energy cost orders, as provided for in REDA.
- 1.4** The Agency will be solely responsible for the following costs, subject to the provisions of the Cost Recovery Regulations (SOR/2012-146):
- per diems of the Joint Review Panel member appointed in accordance with article 3.2 of this agreement;
 - salaries and benefits of Agency staff involved in the joint review, in accordance with Part 2 of the Cost Recovery Regulations;
 - travel-related expenses associated with the review incurred by Joint Review Panel Secretariat members who are Agency staff, in accordance with Part 1 of the Cost Recovery Regulations;
 - all costs associated with the Joint Review Panel's legal counsel retained by the Agency for the proceeding;
 - all costs associated with the federal Participant Funding Program;
 - translation of records and documents into the official languages of Canada other than translation required as outlined in article 5.5 of this Agreement, and in accordance with Part 1 of the Cost Recovery Regulations; and
 - all costs associated with the public registry established pursuant to section 78(1) of CEAA 2012.
- 1.5** The AER and the Agency agree to share as equally as possible all the costs listed below, incurred as part of the joint review from the signing of this Agreement to the date the report is issued by the Joint Review Panel. For those shareable costs subject to Treasury Board Secretariat directives, the Agency can only be

responsible for contributing to costs within the allowable limits. The shareable costs are as follows:

- travel-related expenses associated with the review incurred by the Joint Review Panel members;
- per diems and associated expenses of independent/non-government expert consultants, analysts and communications specialists retained by the Secretariat on behalf of the Panel;
- language translation and interpretation services and facilities related to the evidence, as required by the Joint Review Panel, but not including translation service referred to in article 5.5 of this Agreement;
- printing of any reports and documents distributed by the Joint Review Panel necessary for the Joint Review Panel's work;
- the publication of notices and releases;
- photocopying, including the reproduction of documents contained in the public registry, and postage related to the joint review;
- court reporting and transcription services as required by the Joint Review Panel;
- rentals associated with the public hearing, public meetings and public information office facilities and equipment;
- audio and audio-visual services at the hearing and public meetings; and
- miscellaneous reasonable expenditures relating to the joint review process, up to a maximum of five percent (5%) of the total budget for the joint review.

1.6 Shareable costs of the joint review as detailed in article 1.5 will be incurred at the sole discretion of the Joint Review Panel with due regard for economy and efficiency.

1.7 All expenses not listed above will need prior approval of both parties if they are to be equally shared.

2. Invoicing

2.1 The AER will be responsible for advancing funds for the payment of the shareable costs and will invoice the Agency for the amounts owed under this Agreement. In the event that the Agency is required to advance shareable funds directly, it will advance funds for payment and will invoice the AER as determined under this Agreement.

2.2 The invoicing will be done either at the end of each month or quarterly at the discretion of the AER. The invoice will cover all shareable costs paid by the AER.

2.3 Each invoice will be accompanied by a summary description of the shareable costs actually incurred and paid for the period covered by the invoice, in a form satisfactory to both parties and will be approved by an official acceptable to both

parties. Detailed information about incurred costs will be retained and made available to either party upon request.

- 2.4 Subject to compliance with the above requirements, each party will pay to the other the amount stated as being owed to it in the invoice within sixty (60) days of having received such invoice.
- 2.5 With respect to invoices covering the last period of any fiscal year (ending March 31), and the last invoice to be produced for the Joint Review Panel, each party may review and deduct from the invoice, any incurred shareable costs that have not been previously recovered, so as to determine a net transfer of shared costs from one party to another. The payment will be made within thirty (30) days of having received such invoice. An accounting of the shared expenses incurred by the Agency will be sent with the year-end and final payments, or earlier as may be requested by the AER.

3. Audit

- 3.1 Subject to this Agreement, both parties will keep open to audit and inspection by the Agency or the AER, or their duly authorized representative, all invoices, receipts, vouchers and documents of any nature or kind whatsoever that have been relied on by either of the two parties to calculate the shared cost of conducting the public review.
- 3.2 The party exercising its option to audit will be responsible for the cost of the audit.
- 3.3 Where an audit conducted by either party in connection with this Agreement reveals discrepancies regarding the amount billed to the Agency, and where prompt resolution between the parties is unattainable, an independent auditor acceptable to both parties will resolve the issue.

MEMORANDUM

Amendment to the Agreement to Establish a Joint Review Panel for the Frontier Oil Sands Mine Project

Between

The Minister of the Environment, Canada

– and –

The Alberta Energy Regulator, Alberta

WHEREAS each of the Parties signed the Agreement To Establish a Joint Review Panel for the Frontier Oil Sands Mine Project (hereinafter referred to as the Agreement) to establish a Joint Review Panel for the Frontier Oil Sands Mine Project (project); and

WHEREAS article 8.1 of the Agreement allows it to be amended by a written memorandum executed by both the Federal Minister of the Environment and the Chief Executive Officer of the Alberta Energy Regulator; and

WHEREAS the World Heritage Committee released a report following a reactive monitoring mission to Wood Buffalo National Park World Heritage Site that recommended that the State Party conduct an environmental and social impact assessment of the project in line with the International Union for Conservation of Nature World Heritage Advice Note, fully taking into account the Outstanding Universal Value of the World Heritage Site, including the Peace-Athabasca Delta;

WHEREAS the parties wish to amend portions of the Agreement and "Appendix 1 Terms of Reference" of the Agreement, to reflect certain project updates provided by the proponent and to give direction to the Joint Review Panel to consider the effects of the project on the Outstanding Universal Value of Wood Buffalo National Park World Heritage Site, including the Peace-Athabasca Delta in its environmental assessment of the project.

Now, therefore, the Parties hereby amend the Agreement as follows:

1. Part 5 of the Agreement, entitled "Record of Joint Review and Report," is amended by deleting paragraph 5.3 and replacing it as follows:

"On completion of the assessment of the project, the Joint Review Panel shall prepare a report. The report shall include an executive summary in both official languages of Canada. The report will set out the rationale, conclusions and recommendations of the Joint Review Panel relating to the environmental assessment of the project, including any mitigation measures and follow-up program, and a summary of comments received from the public, including Aboriginal persons and groups. The report will be conveyed to the Federal Minister of the Environment within the overall time limit for the review established by the Federal Minister of the Environment. Upon receipt, the Federal Minister of

the Environment will submit the report to the World Heritage Centre, for review by the International Union for Conservation of Nature with respect to the potential effects of the project on the Outstanding Universal Value of Wood Buffalo National Park World Heritage Site.”

2. Part I of Appendix 1 of the Agreement, entitled “Scope of the Project,” is amended as follows:

- a) by deleting the production volumes that appear in the last sentence of the first paragraph of Part I, and replacing them so that portion of the sentence reads as follows:

“..., the proposed project would produce 41 337 cubic metres per calendar day (260 000 barrels pcd) of partially deasphalted bitumen.”

- b) by deleting the last paragraph of Part I and replacing it with the following paragraph:

“The project would have a disturbance area of 29 217 hectares, resulting from two development phases. The Proponent proposes to start producing partially deasphalted bitumen in 2026. Mining operations would cease in 2066 with decommissioning and reclamation to be completed by 2081.”

3. The final paragraph of Part II of Appendix 1 of the Agreement, entitled “Scope of the Environmental Assessment of the Project,” is deleted and replaced with the following paragraph:

“As provided in paragraph 19(1)(j) and subsection 19(3) of CEAA 2012, the assessment by the Joint Review Panel shall also include a consideration of the additional following matters:

- a) effects of the project on asserted or established Aboriginal or treaty rights, to the extent the Joint Review Panel receives such information as provided in Part III hereof;
- b) community knowledge and aboriginal traditional knowledge (such as, but not limited to, traditional use studies) received during the joint review; and
- c) effects of the project on the Outstanding Universal Value of Wood Buffalo National Park World Heritage Site, including the Peace-Athabasca Delta.”

4. Part III of Appendix 1 of the Agreement, entitled “Scope of the factors,” is amended by adding the following new heading and paragraphs immediately before the heading “Cumulative Effects Assessment”:

“Effects on the Outstanding Universal Value of Wood Buffalo National Park, World Heritage Site, including the Peace-Athabasca Delta

Wood Buffalo National Park was designated as a World Heritage site by the United Nations Educational, Scientific and Cultural Organization’s (UNESCO) World Heritage Convention based on its integrity, its protection and management and because it met World Heritage criteria vii, ix and x, as follows:

- Criteria vii: The great concentrations of migratory wildlife are of world importance and the rare and superlative natural phenomena include a large inland delta, salt plains and gypsum karst that are equally internationally significant.
- Criteria ix: Wood Buffalo National Park is the most ecologically complete and largest example of the entire Great Plains-Boreal grassland ecosystem of North America, the only place where the predator-prey relationship between wolves and wood bison has continued, unbroken, over time.
- Criteria x: Wood Buffalo National Park contains the only breeding habitat in the world for the whooping crane, an endangered species brought back from the brink of extinction through careful management of the small number of breeding pairs in the park. The park's size (4.5 million ha), complete ecosystems and protection are essential for in-situ conservation of the whooping crane.

The Park's Outstanding Universal Value is described in its *Statement of Outstanding Universal Value*, which can be found on the UNESCO World Heritage Centre website on the site description page.

The Joint Review Panel shall accept as part of its record and review information related to the environmental effects of the project on the Outstanding Universal Value of Wood Buffalo National Park World Heritage Site, including the Peace-Athabasca Delta. This shall include any cumulative effects and any changes to the environment occurring on federal lands. The Joint Review Panel shall consider:

- Evidence presented concerning any potential effects of the project on the Outstanding Universal Value of Wood Buffalo National Park World Heritage Site, including the Peace-Athabasca Delta, including any effects as noted above under Aboriginal Rights and Interests;
- Evidence presented concerning the measures proposed to mitigate and monitor any identified effects on the Outstanding Universal Value of Wood Buffalo National Park World Heritage Site, including the Peace-Athabasca Delta.

The Joint Review Panel, based on its assessment of the environmental effects of the project, may recommend measures to mitigate any adverse environmental effects of the project on the Outstanding Universal Value of Wood Buffalo National Park World Heritage Site, including the Peace-Athabasca Delta.

The Joint Review Panel shall, in considering the alternative means of carrying out the project, have regard to the effects of the alternative means on the Outstanding Universal Value of Wood Buffalo National Park World Heritage Site."

5. Part V of Appendix 1 of the Agreement, entitled "Review Process" is amended by adding new paragraph 26 under the heading entitled "Joint Review Panel Report":

"In its report, the Joint Review Panel shall include a separate chapter outlining its rationale, conclusions and recommendations regarding the potential effects of the project on the Outstanding Universal Value of Wood Buffalo National Park World Heritage Site."

6 The Agreement, as hereby amended, remains in full force and effect in accordance with the terms thereof.



The Honourable Catherine McKenna
Minister of the Environment



Jim Ellis
Chief Executive Officer
Alberta Energy Regulator

AUG 14 2017

Date

August 16, 2017

Date

Appendix 3 Panel Decision on Notice of Question of Constitutional Law

September 22, 2018

By Email

Triune Law
Attention: Darlene Gladue-Quinn

Osler, Hoskin and Harcourt LLP
Attention: Martin Ignasiak

Minister of Justice and Attorney General of Alberta
Attention: David Sharko and Dushan Bednarsky

Attorney General of Canada
Attention: Robert Drummond and James Elford

All Parties

Dear Counsel:

Subject: Notice of Question of Constitutional Law of the Original Fort McMurray First Nation and the Clearwater River Band No. 175

On August 30, 2018, the Original Fort McMurray First Nation and the Clearwater River Band No. 175 (collectively the Filers) filed a joint Notice of Question of Constitutional Law (NQCL or Notice). The Notice was served on Teck Resources Limited (Teck), the Minister of Justice and Solicitor General of Alberta (Alberta) and the Attorney General of Canada (Canada). Each of Teck, Alberta and Canada responded to the NQCL and the Filers submitted a reply.

The Panel has determined that it will not hear submissions on nor consider and decide the questions raised in the Notice at the Teck Frontier Oil Sands Mine Project (Project) hearing scheduled to commence on September 25, 2018. The NQCL is dismissed. The questions posed in the Notice all ask that the Panel assess the adequacy of the Crown's consultation with the Filers, as holders of Aboriginal and Treaty rights. The Panel does not have the need, jurisdiction or ability to answer those questions.

The Panel's Function

In order to consider the Notice, it is necessary to understand the Panel's composition, purpose and functions.

In May of 2005, the governments of Canada and Alberta established a framework for conducting joint reviews of projects through the *Canada-Alberta Agreement on Environmental Assessment Cooperation (2005)*. Under this framework and pursuant to

provisions of the *Canadian Environmental Assessment Act, 2012* (CEAA, 2012) and the *Responsible Energy Development Act* (REDA), the Panel was established by agreement (the Joint Panel Agreement) between the Minister of the Environment, Canada and the Alberta Energy Regulator (AER) to review the Project as a joint review panel to evaluate that Project according to their respective authorities and avoid duplication and inefficiencies that could arise if Canada and the AER were to conduct separate reviews. The Panel is guided by its Terms of Reference.¹

As a joint panel, the Panel acts in two capacities – as a review panel conducting an environmental review at the request of the Minister of Environment, Canada and as a panel of AER hearing commissioners considering and, in some cases, deciding Teck’s applications made to the AER for approvals necessary for the Project. In each role, the relevant provisions of applicable legislation, such as the REDA and CEAA continue to apply.

As a federal review panel, the Panel has no final decision-making authority. It gathers information, conducts an assessment of the effects of the Project, including upon Aboriginal and Treaty rights, and prepares a report containing its recommendations regarding the Project which it provides to the Minister of Environment, Canada. It makes no decisions in relation to the Project. Decision making authority rests with the Minister of Environment, Canada or the Governor in Council. While the Project will require federal approvals to proceed, the Panel does not decide if those should be granted.

In contrast, as a panel of AER hearing commissioners, the Panel is the final decision-maker for some applications made to the AER by Teck. Only in its capacity as an AER panel does the Panel make final decisions.

Content of the NQCL

The NQCL first asserts that the Filers are Indians within section 91(24) of the *Constitution Act, 1867* and are adherents to Treaty No. 8 and hold rights to hunt, fish, trap and gather on traditional lands that will be adversely affected by the proposed Project. The NQCL also states that the Crown must consult and accommodate First Nations peoples even if existing Aboriginal title to the lands has not yet been proven.

The actual questions posed are:

1. Has the Crown in right of Alberta discharged the duty to consult and accommodate the Clearwater River Band (CRB) with respect to the potential adverse effects of the Project on the CRB’s Treaty Rights, as mandated by the Treaty and s. 35 of the *Constitution Act, 1982*?

¹ Joint Panel Agreement, Appendix 1, Terms of Reference.

2. Has the Crown in right of Alberta discharged the duty to consult and accommodate the Original Fort McMurray First Nation (OFMFN) with respect to OFMFN's Aboriginal Rights as mandated by s. 35 of the *Constitution Act, 1982*?
3. Has the Crown in right of Canada discharged the duty to consult and accommodate the CRB with respect to the potential adverse effects of the Project on the CRB's Treaty Rights, as mandated by the treaty and s. 35 of the *Constitution Act, 1982*?
4. Has the Crown in right of Canada discharged the duty to consult and accommodate the Original Fort McMurray First Nation (OFMFN) with respect to OFMFN's Aboriginal Rights as mandated by s. 35 of the *Constitution Act, 1982*?

The relief sought in the NQCL is:

1. The Panel deny the Project as the Crown in right of Alberta and/or Canada have failed to adequately discharge the duty to consult and accommodate the CRB and OFMFN.
2. A finding that the Project is not in the public interest and cannot be authorized unless and until the Crown has fully discharged its duties to consult and accommodate CRB with respect to potential adverse effects on its Treaty rights.
3. A finding that the Project is not in the public interest and cannot be authorized unless and until the Crown has fully discharged its duties to consult and accommodate OFMFN with respect to potential adverse effects on its Aboriginal rights.
4. In the alternative, Teck be directed to resolve the unresolved and serious issues regarding the development of its Project on the lands of the CRB and OFMFN.

Parties' submissions

Submissions were received from Teck, Alberta and Canada. All three respondents indicated that the questions being asked by the Filers were in essence asking the Panel to assess the Crown's consultation with them and the relief sought is premised on a finding by the Panel that consultation was not adequate.

Both Teck and Alberta were clear that in its capacity as a panel of AER hearing commissioners, the Panel has no jurisdiction to consider the questions in the NQCL or to determine the adequacy of the Crown in Right of Alberta's consultation with the filers because of the operation of REDA

Alberta also submitted that the Notice was deficient because it did not meet the notice requirements of the *Administrative Procedures and Jurisdiction Act* (APJA).² As a panel

² *Administrative Procedures and Jurisdiction Act*, RSA 2000 A-3

of AER hearing commissioners, the Panel's ability to consider questions of constitutional law is derived from the APJA.³ The APJA defines questions of constitutional law and also provides notice requirements for posing those questions.⁴

Teck and Canada both submitted that as a federal CEEA review panel guided by its Terms of Reference, the Panel is not required to answer the questions posed in the Notice, which requested an assessment of consultation adequacy. Both further submitted that, for the Panel as a CEEA review panel that will be making no decisions, the questions are premature.

In their reply to the submissions of Canada, Alberta and Teck, the Filers acknowledge that the questions in the Notice "ask about the *adequacy* of consultation". However, they say that precursory to that, their questions ask for a determination that the duty to consult exists and has been triggered in this proceeding. The Filers say the questions are two-part and the first part, does the duty to consult with the Filers exist, is not precluded from the Panel's determination.

The Question for the Panel

The first task for the Panel is to determine the actual question being asked of it in the NQCL. It is clear to the Panel from the questions and the relief sought that the NQCL is asking this Panel to assess the adequacy of the Crown's consultation with the Filers. The Filers acknowledge this in their reply submission. As noted in the first head of relief sought, the Filers want this Panel to find that the duty to consult was not "adequately discharged" and on that basis deny Teck's applications.

The Filers suggest the question(s) are two-part. While part two asks if consultation is adequate, the Filers say that part one asks the Panel to determine if the duty to consult with them exists and has been triggered.

Before considering that "part one" question, the Panel will address the ability or need to answer the adequacy question.

Adequacy of Consultation

The initial question the Panel must answer is whether it has the jurisdiction, ability or need to consider whether the Crown has adequately consulted with the Filers. The Panel is satisfied that it does not.

³ APJA section 10(c) and 16 and the *Designation of Constitutional Decision Makers Regulation*, A.R. 69/2009; The Panel's Terms of Reference, which form part of the Joint Panel Agreement, acknowledge the applicability of the APJA to the panel in its capacity as a panel of AER hearing commissioners. Joint Panel Agreement, Appendix 1, Terms of Reference, page A3.

⁴APJA, sections 10(a) and 12.

The Panel's Terms of Reference do not create that need. The Terms of Reference provide as follows at page A3:

The Joint Review Panel is not required by these Terms of Reference to make any determinations as to:

- the validity of asserted Aboriginal or treaty rights or the strength of such claims;
- the scope of the Crown's duty to consult an Aboriginal group; or
- whether the Crown has met its respective duties to consult or accommodate in respect of rights recognized and affirmed by section 35 of the *Constitution Act, 1982*.

The Panel, in both its capacities as set out above, is a creature of statute and only has the powers granted to it by the Legislature and Parliament. As an AER panel of hearing commissioners, the Panel is guided by REDA including section 21, which the Terms of Reference explicitly state has application to the Panel.⁵ Section 21 states:

The Regulator [AER] has **no jurisdiction** with respect to assessing the adequacy of Crown consultation associated with the rights of aboriginal peoples as recognized and affirmed under Part II of the *Constitution Act, 1982*. [emphasis added]

In the face of this provision, there can be no question that the Panel, in its capacity as a panel of AER hearing commissioners, has no ability to assess or determine the adequacy of the Crown's consultation with the Filers.

This Panel is not a decision-maker on behalf of the Crown in right of Canada. Under the Terms of Reference, the Panel shall summarize the claims of Aboriginal or Treaty Rights and shall consider the effects of the Project on such rights. However, the Panel is not required to make any determinations as to the scope of the Crown's duty to consult an Aboriginal group or whether it has met its duty consult or accommodate in respect of rights recognized and affirmed by section 35 of the *Constitution Act, 1982*.

Still, the Panel's activities form part of Canada's consultation with Indigenous peoples. Consultation by Canada may occur after the Panel issues its report and before federal decision-making occurs under CEAA, 2012 or other federal statutes respecting the issuance of approvals. The time for assessing the adequacy of consultation should occur after the Panel's report has been issued and considered. Thus, it would be premature for this Panel to assess the adequacy of Canada's consultation with the Filers.

In sum, the Panel has no need, ability or jurisdiction to assess the adequacy of the Crown's consultation with the Filers. Further, with respect to the alternative relief being sought by the Filers concerning Teck (Item 4 above), the Panel is of the view that such a direction is beyond the scope of the Panel's authority as set out by statute and its Terms of Reference.

⁵ Joint Panel Agreement, Appendix 1, Terms of Reference, page A3.

Does the Crown have a Duty to Consult with the Original Fort McMurray First Nation and Clearwater River Band 175?

The Panel is not persuaded that the issue of whether the Crown owes a duty to consult with the Filers can or should be extracted as a separate “precursory determination” from deciding if the Crown’s consultation was adequate. However, it is not necessary for the Panel to come to a conclusion on that issue. Given its conclusion above regarding assessing the adequacy of the Crown’s consultation with the Filers, there is no need to engage with the issue of the existence of a duty to consult in this matter. Even if we accept that there are two parts to the questions posed in the Notice, as the Panel cannot answer the second part of the question (adequacy of consultation), there is no requirement or value to answering the first part.

Requirements of the *Administrative Procedures and Jurisdiction Act*

With regard to the issue of whether the Filers complied with the notice requirements of the APJA, the Panel recognizes that there may be some merit to Alberta’s position that it did not receive adequate notice. The Panel also accepts that strict adherence to the notice requirements contained in the APJA must occur. However, given the above conclusions, the Panel does not consider it necessary to decide this issue.

Conclusion

The NQCL’s ask the Panel to assess the adequacy of Crown’s consultation with the Filers. The Panel’s Terms of Reference expressly state that the Panel is not required to address that issue. As an AER panel, the Panel lacks the jurisdiction to assess consultation adequacy. As a federal review panel, the Panel would be acting prematurely if it were to assess the sufficiency of consultation. For these reasons, the NQCL is dismissed and the Panel will not hear submissions in relation to or decide the questions in the NQCL at the hearing.

Yours truly,

<Original signed by>

Alex Bolton
Chair, Joint Review Panel

Appendix 4 Panel Decisions on Motions

Frontier Oil Sands Mine Project Joint Review Panel

August 10, 2018

Woodward & Co. Lawyers LLP
Attention : Eamon Hurley

Osler, Hoskin & Harcourt LLP
Attention : Martin Ignasiak

Dear Counsel:

**Subject: Teck Resources Limited Frontier Oil Sands Mine Project
Athabasca Chipewyan First Nation Motion re s. 20(1) of the *Responsible Energy Development Act***

The Joint Review Panel (the Panel) has considered the motion filed by Athabasca Chipewyan First Nation (ACFN) and the response to that motion provided by Teck Resources Limited (Teck).

The motion asks for an order that section 20(1) of the *Responsible Energy Development Act* (REDA) does not apply to the Teck proceeding. The Panel has decided that it cannot make such an order and therefore it has dismissed the motion.

Section 20(1) states:

ALSA regional plans

20(1) In carrying out its powers, duties and functions under this Act or any other enactment, the Regulator shall act in accordance with any applicable ALSA [*Alberta Land Stewardship Act*] regional plan.

The Panel acts as both an AER panel of hearing commissioners assigned to consider and decide applications made to the AER by Teck, and as a federal review panel under the *Canadian Environmental Assessment Act, 2012* conducting an environmental assessment of the Frontier Oil Sands Mine Project. Part IV of Appendix 1 of the Joint Panel Agreement for the Project states:

The Joint Review Panel shall conduct its review in a manner that discharges the responsibilities of the AER under REDA, the requirements set out in CEAA 2012, and the requirements set out in the Terms of Reference that were fixed and approved by the Federal Minister of the Environment and the AER.

The Joint Review Panel shall have all of the powers and duties of a panel described in section 45 of CEAA 2012 and of a panel of hearing commissioners described in REDA and the rules and regulations thereunder.

As a panel of AER hearing commissioners, the Panel is bound to follow all provisions of REDA, including section 20, in fulfilling its AER functions. It has no discretion in that

Frontier Oil Sands Mine Project Joint Review Panel

regard. The Panel notes that no authority to support a contrary view has been provided and the Panel is not aware of any such authority.

Further, in the Panel's initial review of LARP, the Panel sees nothing that would constrain the Panel's review of the project or erode its ability to comply with its assessment and reporting obligations under legislation and its Terms of Reference.

Finally, the relevance of a regional plan under ALSA, specifically the Lower Athabasca Regional Plan (LARP), to Teck's applications made to the AER is a matter that the parties can address at the hearing. The Panel believes it would, in any case, be premature at this stage of the proceeding to consider making any statements about the effect of section 20(1) of REDA on the Panel's mandate, and that any such discussion would need to occur with the benefit of all the information the Panel expects to receive in the hearing.

Yours truly,

<Original signed by>

Alex Bolton
Chair, Joint Review Panel

October 12, 2018

By Email

Keepers of the Athabasca and Hearing Participants

Attention: Jule Asterisk, Executive Director, Keepers of the Athabasca

Dear Ms. Asterisk:

This letter is the Panel’s decision on the motion of the Keepers of the Athabasca (“Keepers”) to have the Panel compel certain witnesses to attend the joint review hearing to provide evidence. For the reasons set out below, the Panel denies the motion.

On September 17, 2018, the Keepers, a participant in this joint review hearing, filed a request to the Panel pursuant to section 45 of the *Canadian Environmental Assessment Act, 2012* (“CEAA 2012”) and section 20(1) of the *Alberta Energy Regulator Rules of Practice* (“AER Rules of Practice”) to issue a summons to two named Alberta Energy Regulator (“AER”) employees to require them to attend the hearing to be cross-examined by the parties. On September 21, 2018, the AER filed a response to that request and on September 25, 2018, the Keepers filed an affidavit in relation to this matter.

The Panel’s Composition and Authority to Compel Witnesses

The Panel was created by agreement¹ (the “Joint Panel Agreement”) between the Minister of Environment, Canada and the AER to have a cooperative proceeding to conduct a joint review of the Frontier Oil Sands Mine Project (the “Project”) by the Canadian Environmental Assessment Agency (CEAA) and the AER. The Panel must conduct an assessment of the environmental effects of the Project in a manner consistent with the requirements of CEAA 2012, the *Responsible Energy Development Act* (REDA), the *Environmental Protection and Enhancement Act*, the *Oil Sands Conservation Act* and its Terms of Reference appended to the Joint Panel Agreement.

The Panel operates as both a panel of AER hearing commissioners and as a review panel under CEAA 2012 discharging all the associated responsibilities. As an AER panel, the Panel considers and in certain instances decides the applications made to the AER by Teck Resources Limited (“Teck”) for approvals related to the Project. As an AER panel, the Panel is governed by REDA and associated regulations and, as a consequence, has the powers set out therein. As a CEAA review panel under sections 38, 39 and 40, 42 and 43 of CEAA, 2012, the Panel must conduct an environmental assessment of the Project,

¹ CEAA No. 199, *An Agreement to Establish a Joint Review Panel for the Frontier Oil Sands Mine Project Between the Minister of the Environment, Canada and the Alberta Energy Regulator, Alberta*, dated May 11, 2016, as amended by CEAA No 340, *Amended Agreement to Establish a Joint Review Panel*, on September 17, 2016.

prepare a report and submit it to the Minister of Environment and Climate Change. In addition, the Panel must comply with its Terms of Reference.²

Sections 6.1 and 6.4 of the Joint Panel Agreement provide the Panel with the authority to compel government authorities with specialized information regarding the Project to provide that information to the Panel and allows the Panel to compel the attendance of the individuals with this information at the hearing to testify.

Pursuant to Part V – Review Process of the Terms of Reference, under the heading “Public Hearing” at Paragraph 13, the Panel shall conduct the hearing in substantial accordance with the *AER Rules of Practice*. At the same time, the Panel retains its powers and duties under section 45 of CEEA 2012.

Under the *AER Rules of Practice*, the Panel has the authority, pursuant to section 20, to issue a notice to attend requiring a person to attend an oral hearing and produce documents specified in the notice.

The test for determining whether to exercise the powers in section 20 to compel the attendance of an individual to provide evidence at a hearing is derived from the test applied by the AER’s predecessor, the Energy Resources Conservation Board (“ERCB”), whose powers to compel attendance at its hearings were substantially the same as those of the AER. This test was stated by a similarly constituted joint review panel assessing the EnCana Shallow Gas Infill Development Project as follows:

In Decision 94-2, the ERCB set out the factors it will consider when considering a request to compel the attendance of a witness. *“For the Board to consider compelling the attendance of a witness, it must be convinced that the evidence which would be adduced is crucial for the Board to understand the issues it is charged to address. Further, it must be clear that there is no other reasonable way to obtain this evidence. As a result, compelling and substantive reasons are needed for the Board to take such an action.”*³

Section 45 of CEEA 2012 provides that a review panel has the power to summon a person to appear as a witness to give evidence and produce any records and things that the panel considers necessary for conducting its environmental assessment of the designated project. In this instance, the designated project is the Project as defined. There is little direct guidance on the parameters for determining when a CEEA review panel will exercise this power. However, the jurisprudence relating to the exercise of the power to compel witnesses under Rule 41 of the Federal Court Rules,⁴ provides that for a witness to be compelled to attend, the following conditions must be met:

² Appendix 1 to the *Amended Agreement to Establish a Joint Review Panel for the Project* dated August 16, 2017.

³ *EnCana Shallow Gas Infill Development Project* (EUB Decision 2009-08), p. 196.

⁴ CEEA 2012, section 45(2), indicates a review panel has all the enforcement powers of a court of record. The Federal Court of Appeal is the court of record for a CEEA review panel.

- (i) the evidence is necessary;
- (ii) there is no other way of obtaining the evidence;
- (iii) it is clear that an applicant is not engaged in a fishing expedition but, instead, has raised a credible ground for review beyond the applicant's say-so; and
- (iv) a witness is likely to have relevant evidence on the matter.⁵

Thus, the test to be applied in exercising the discretion under section 20 of the *AER Rules of Practice* and the test under the Federal Court Rules for compelling the attendance of witnesses are substantially the same.

To compel the attendance of a witness, the Panel must be satisfied the evidence sought from the witness must be necessary, even crucial, for the Panel to carry out its functions and cannot be reasonably obtained from other sources. Such evidence must be relevant, but relevance alone is not sufficient.

Keepers' Submissions

The Keepers have requested that the Panel compel two named AER employees to attend the hearing because their attendance is necessary for a proper evaluation of Project based impacts and to inform the Panel of policy and regulatory frameworks necessary to understand the life cycle impacts and risk associated with the Project. The Keepers assert that the witnesses have critical evidence for the purposes of the hearing and Panel decisions that would not otherwise be available. They state that these witnesses can provide information to the Panel about an AER internal, unpublished study, estimating the amount of Alberta's environmental liabilities. The Keepers submit that it is crucial for the Panel to understand the scale of Alberta's currently unfunded environmental liabilities and the adequacy of existing regulatory programs to protect the public from inheriting these costs from industry. Further, the Keepers argue that only the requested witnesses can provide such information to the Panel.

On September 25, 2018, the Keepers submitted the affidavit of Regan Boychuk. Mr. Boychuk is an individual who testified in this proceeding on behalf of the Keepers. In that affidavit, Mr. Boychuk provides detailed information about the AER study and other information regarding Alberta's environmental liabilities.

AER's Response

The AER responded to the Keepers' request by letter dated September 21, 2018. The AER asserted that evidence regarding the degree of environmental liabilities in Alberta would say nothing about the effects of the proposed Project the Panel is to assess as set out in the Terms of Reference. In addition, the information sought by the Keepers can be obtained through its own witness as well as through the existence of "public estimates of regulators' license liability and mining financial security programs".

⁵ *Tsleil-Waututh v. Canada (Attorney General)*, 2017 FCA 128, [2017] F.C.J. No. 601, 280 A.C.W.S. (3d) 228 at para 103

The Panel's Conclusions

The Keepers' motion requires the Panel to determine if the evidence sought by the Keepers through the attendance of the two named AER employees is necessary and unavailable from other sources.

This panel is mandated by the Joint Panel Agreement to conduct an assessment of the environmental effects of the Project in a manner consistent with the requirements of CEAA 2012, REDA, EPEA, the OSCA and its Terms of Reference and to discharge its responsibilities under REDA and CEAA 2012.

The Panel is not persuaded that the information sought regarding the scale of Alberta's unfunded environmental liabilities is necessary or critical in order for the Panel to carry out and fulfill its mandate. The issues for the hearing relate to the effects of the Project as described in the Terms of Reference for the Panel and do not extend to include an examination of the Province's currently unfunded environmental liabilities.

Further, it is apparent that the Keepers have access to relevant information on the scale of Alberta's unfunded environmental liabilities and the adequacy of Alberta's existing regulatory programs associated with such liabilities that is already on the record of the proceeding through Mr. Boychuk's report submitted by the Keepers as part of their hearing submission. Mr. Boychuk's affidavit and testimony makes it clear that information has been provided to the Panel relating to the referenced internal and unpublished report prepared by the AER.

Additionally, the Panel has received evidence, both written and oral, from the Oil Sands Environmental Coalition regarding Alberta's currently unfunded environmental liabilities and the adequacy of existing regulatory programs related thereto. This information also includes publically available estimates of the Mine Financial Security Program liability and security held by the AER.

In light of the above considerations, the Panel declines to compel the attendance of the AER employees.

Yours truly,

<Original signed by>

Alex Bolton
Chair, Joint Review Panel

October 12, 2018

By Email

Mikisew Cree First Nation and Hearing Participants

Attention: Karey Brooks and Mark Gustafson

Dear Ms. Brooks and Mr. Gustafson:

This letter is the Panel’s decision on the motion of the Mikisew Cree First Nation (“MCFN”) for an order to have certain representatives of the Government of Alberta (“Alberta”) attend the hearing of this matter to speak to issues related to: the Lower Athabasca Regional Plan (“LARP”) and its frameworks, Alberta’s bison management proposals, and the report of the Aboriginal Consultation Office (“ACO”). For the reasons set out below, the Panel denies the motion.

On September 17, 2018, MCFN, a participant in this joint review hearing, filed a request pursuant to section 20(1) of the *Alberta Energy Regulator Rules of Practice* (“*AER Rules of Practice*”) and section 45 of the *Canadian Environmental Assessment Act, 2012* (“*CEAA 2012*”) to require representatives of Alberta to attend the Panel’s hearing. On September 21, 2018, Alberta filed a response to that request and on September 25, 2018, MCFN filed a reply.

The Panel’s Composition and Authority to Compel Witnesses

The Panel was created by agreement¹ (the “Joint Panel Agreement”) between the Minister of Environment, Canada and the Alberta Energy Regulator (“AER”) to have a cooperative proceeding to conduct a joint review of the Frontier Oil Sands Mine Project (the “Project”) by the Canadian Environmental Assessment Agency (“CEAA”) and the AER. The Panel must conduct an assessment of the environmental effects of the Project in a manner consistent with the requirements of CEAA 2012, the *Responsible Energy Development Act* (“*REDA*”), the *Environmental Protection and Enhancement Act*, the *Oil Sands Conservation Act* and its Terms of Reference appended to the Joint Panel Agreement.²

The Panel operates as both a panel of AER hearing commissioners and as a review panel under CEAA 2012 discharging all the associated responsibilities. As an AER panel, the Panel considers and in certain instances decides the applications made to the AER by

¹ CEAA No. 199, *An Agreement to Establish a Joint Review Panel for the Frontier Oil Sands Mine Project Between the Minister of the Environment, Canada and the Alberta Energy Regulator, Alberta*, dated May 11, 2016, as amended by CEARR No.340, *Amended Agreement to Establish a Joint Review Panel*, on September 17, 2016.

² Appendix 1 to the *Amended Agreement to Establish a Joint Review Panel for the Project* dated August 16, 2017.

Teck Resources Limited (“Teck”) for approvals related to the Project. As an AER panel, the Panel is governed by REDA and associated regulations and, as a consequence, has the powers set out therein. As a CEAA review panel under sections 38, 39 and 40, 42 and 43 of CEAA, 2012, the Panel must conduct an environmental assessment of the Project, prepare a report and submit it to the Minister of Environment, Canada.

In addition, pursuant to Part V – Review Process of the Terms of Reference, under the heading “Public Hearing” at Paragraph 13, the Panel shall conduct the hearing in substantial accordance with the *AER Rules of Practice*. At the same time, the Panel retains its powers and duties under section 45 of CEAA 2012.

Section 6 of the Joint Panel Agreement provides the Panel with the authority to compel government authorities with specialized information regarding the Project to provide that information to the Panel and allows the Panel to compel the attendance of those individuals at the hearing to testify.

Under the *AER Rules of Practice*, the Panel has the authority, pursuant to section 20, to issue a notice to attend requiring a person to attend an oral hearing and produce documents specified in the notice.

Section 45 of CEAA 2012 provides that a review panel has the power to summon a person to appear as a witness to give evidence and produce any records and things that the panel considers necessary for conducting its environmental assessment of the designated project. In this instance, the designated project is the Project as defined.

MCFN’s Submissions

MCFN submitted that the attendance of the requested individuals is necessary for an “adequate understanding” of measures that have been proposed for mitigating and managing potential impacts of the Project on MCFN’s Aboriginal and Treaty rights beyond the Project footprint and for the development of recommendations for government action to mitigate those impacts pursuant to the Panel’s mandate.

MCFN noted the Panel’s authority to compel the attendance of individuals to testify at the hearing pursuant to the Joint Panel Agreement, CEAA 2012 and the *AER Rules of Practice*. MCFN submitted that as there is no direct guidance on the test for compelling witnesses by a CEAA review panel or in relation to the test to compel in the *AER Rules of Practice*, the Panel should be guided by the case law relating to the test for compelling witnesses contained in the Federal Court Rules, as the Federal Court is the court of record under CEAA 2012. MCFN provided the Panel with its summary of jurisprudence stating that under Rule 41(1) of the Federal Court Rules, a witness may be subpoenaed where:

- The evidence is necessary;
- There is no other way to obtain the evidence;
- The applicant is not engaged in a fishing expedition; and,

- The witness is likely to have relevant evidence on the matter.³

MCFN notes that the Panel must consider any cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out and that the Panel must consider the effects of the Project on asserted or established Aboriginal or Treaty rights.

MCFN asks the Panel to compel the attendance of three individuals from Alberta Parks and Environment (“AEP”) because Alberta has provided materials to the Panel suggesting that cumulative effects on the environment and Treaty rights are adequately managed or mitigated as result of LARP. MCFN also notes that there are a number of frameworks established under LARP (the “Frameworks”) which together with LARP constitute Alberta’s framework for assessing and addressing cumulative effects in the minable oil sands region. REDA indicates that the AER must act in accordance with LARP and the Frameworks.

MCFN says consideration of LARP and the Frameworks is a key issue for the hearing process in relation to impacts on Aboriginal and Treaty rights and government mitigation of those effects. MCFN has raised concerns in the proceeding that LARP and its Frameworks cannot be used to assess impacts to its exercise of its rights. MCFN alleges that Alberta’s response to concerns about cumulative impacts is to point to LARP and its Frameworks, despite MCFN telling Alberta that LARP and its Frameworks are inadequate to address cumulative impacts. MCFN provides affidavit evidence on this topic and quotes from a finding of the 2015 LARP Review Panel to support its position.

MCFN also notes that the ACO has submitted materials to the Panel regarding cumulative effects of the Project on MCFN’s Aboriginal and Treaty rights that relate to how LARP and its Frameworks mitigate those effects. MCFN submits that the materials from the ACO indicate ACO has relied on information from AEP representatives regarding LARP and its Frameworks and the management of bison. Further, MCFN wants the Panel to make recommendations for amendments to LARP and its Frameworks. In MCFN’s submission, this means evidence on the “appropriateness” of LARP and its Frameworks regarding cumulative effects is necessary for the Panel to understand cumulative effects, mitigation of cumulative effects and the recommendations MCFN is asking the Panel to issue on those effects.

³ *Tsleil-Waututh v. Canada (Attorney General)*, 2017 FCA 128, at ¶ 103

In light of these considerations, MCFN wants to raise with AEP representatives:

- The adequacy of LARP and its thresholds for addressing impacts to MCFN's Treaty and Aboriginal rights; and,
- The extent to which LARP and the Frameworks consider or address Aboriginal and Treaty rights and traditional knowledge.

MCFN argues the only way for the Panel to get evidence on these issues and for MCFN to test Alberta's evidence is to have representatives from AEP who were involved in developing and implementing LARP and some Frameworks testify at the hearing.

MCFN also submits that the ACO's report on consultation adequacy (the "ACO Report") is relevant to the Panel's evaluation of proposed mitigation measures for impacts to MCFN's rights because the ACO Report contains recommendations on the appropriateness of mitigations measures which the Panel may rely on. The ACO Report is part of the record for the proceeding and indicates that all of MCFN's concerns are addressed by Teck's proposed mitigations or are outside the scope of consultation on the Project and better addressed by other mechanisms such as LARP. MCFN in its written submissions takes a contrary position, saying additional mitigations by Alberta are necessary. MCFN goes on to state that the Panel has a mandate to assess mitigation measures placed on the hearing record and to make recommendations to Alberta respecting additional mitigations measures that are necessary to address impacts to Aboriginal and Treaty rights and do not encroach on the limit to the Panel's jurisdiction regarding Crown consultation..

MCFN also notes that the ACO Report provides information from Alberta respecting potential provincial measures that may mitigate concerns regarding impacts to bison. MCFN notes that this evidence is directly contrary to MCFN's evidence filed in this proceeding. Project effects on wood bison and management of them is central to this proceeding. MCFN has asked the Panel to issue recommendations on this topic. As a consequence, MCFN submits that it needs to cross-examine AEP representatives to understand the measures Alberta will take with respect to the Ronald Lake Bison Herd. MCFN wants the Panel to compel the attendance of two AEP representatives who have been discussing Alberta's draft proposals regarding bison management with MCFN.

MCFN also submits that fairness requires the attendance of Alberta witnesses at the hearing to be cross-examined because Alberta participated in the information request process and provided submissions on mitigation measures. That evidence must be tested.

Alberta's Response

Alberta opposes MCFN's application to compel Alberta representatives to speak to the adequacy of Alberta's regulatory and policy regime. It submits that MCFN's assertions regarding the adequacy of Alberta's regulatory schemes are outside the mandate for this Panel which relates to the Project. Alberta notes that LARP is a regulation made by the Lieutenant Governor in Council under the *Alberta Land Stewardship Act*. Similarly, Alberta notes that the consultation framework, which MCFN raises, is pursuant to published documents.⁴ Alberta asserts that MCFN does not require further information to be able to continue to make submissions to the Panel regarding its views on the impacts of the Project.

Regarding the test for the Panel to apply to compel the attendance of witnesses at the hearing, Alberta submits that the test applied by a similarly constituted joint review panel which included the AER's predecessor, the Energy Resources Conservation Board (ERCB), should be applied in this case. The Court of Appeal of Alberta in discussing that test stated:

The Board followed its jurisprudence with respect to compelling the attendance of a witness. For the Board to consider compelling the attendance of a witness, it must be convinced that the evidence that would be adduced is critical for the Board to understand the issues it is charged to address. Further, it must be clear that there is no other reasonable way to obtain this evidence. Compelling and substantive reasons are needed for the Board to take such action....⁵

Alberta noted that this test does not substantially differ from the test under Rule 41 of the Federal Court Rules put forward by MCFN and is a high threshold for compelling a witness to testify.

In relation to Alberta's consultation with MCFN, Alberta notes that by operation of section 21 of REDA, which applies to the Panel, the consideration of the adequacy of Crown consultation has been excluded from the AER's mandate. Further, under the Panel's Terms of Reference, the AER is not required to make any determination

⁴ *The Government of Alberta's First Nations Consultation Policy on Land Management and Resource Development 2005* (Policy updated 2013) and *Alberta's First Nations Consultation Guidelines on Land Management and Resource Development 2007* (Guidelines updated 2014)

⁵ *Big Loop Cattle Co. Ltd. v. Alberta (Energy Resources Conservation Board)*, 2010 ABCA 328 at ¶127 & 29; Report of the Joint Review Panel EnCana Shallow Gas Infill Development Project Canadian Forces base Suffield National Wildlife Area, Alberta, CEAR No. 05-07-15620 and EUB Decision 2009-08, January 27, 2009, Appendix 6.

regarding the scope of the Crown's duty to consult or whether the Crown has met those duties.⁶

Alberta acknowledges that it provided its August 24, 2018 ACO Report which gives pre-hearing advice to the Panel. However, Alberta says that by operation of section 49(2) of REDA, the Panel has no jurisdiction to compel the ACO to present a witness to speak to the report, nor to be cross-examined on the ACO Report. Section 49(2) states:

Notwithstanding anything to the contrary, the Crown may file a written statement in a hearing or inquiry before the Regulator without presenting a witness to speak to the statement, and unless the statement is presented by a witness, the statement is not subject to cross-examination.

In Alberta's submission, the test for compelling witnesses to testify is not met in this circumstance. The issue for the Panel is assessing the environmental effects of the Project; it does not extend to assessing the entirety of Alberta's regulatory scheme. According to Alberta, the Panel's mandate regarding cumulative effects must be put in the context of the Project. The Panel is not the body before which Alberta must justify its legislative and policy choices. Evidence from AEP representatives regarding future amendments to legislation or policies in relation to Alberta's regulatory scheme are outside the scope of this Panel and not critical to the issue before the Panel.

Alberta submits that ACO representatives are not required to attend the hearing because the Panel has, by operation of section 21 of REDA, no jurisdiction with regard to assessing the ACO's consultation requirements for the Project. Evidence from these individuals is not critical to the issues before the Panel. Further, section 49(2) of REDA means the Panel has no jurisdiction to compel their attendance at the hearing on matters related to the ACO Report.

Alberta submits that there are other venues for MCFN to express its general dissatisfaction with Alberta's legislative and policy decisions. For example, LARP and its Frameworks and the Consultation frameworks are publicly available documents. The Panel doesn't require further information from Alberta to make recommendations to Alberta about managing the cumulative effects of the Project. Allegations of a failure of these instruments to mitigate cumulative effects and protect MCFN's Treaty rights are MCFN's position. Similarly, MCFN's position on alleged gaps in Alberta's management of the Ronald Lake Bison Herd and further measures MCFN would like implemented do not require AEP representatives to provide further information. MCFN can provide its position on these matters to the Panel.

⁶ CEAA No. 340, *Amended Agreement to Establish a Joint Review Panel, August 16, 2017 Appendix 1, Terms of Reference, page A1-3.*

MCFN's Reply

In reply, MCFN says section 21 of REDA does not make cross-examination of the ACO beyond the Panel's jurisdiction because MCFN is not seeking to have ACO witnesses testify about the adequacy of Crown consultation. The ACO Report contains opinions and advice about mitigation measures and impacts of the Project and mitigations are within the Panel's Terms of Reference. Evidence regarding development of the ACO Report and the extent to which proposed mitigations address impacts of the Project on MCFN's rights is relevant and necessary and within the Panel's mandate.

In regard to procedural fairness, MCFN notes that section 5 of the *Administrative Procedures and Jurisdiction Act* provides for cross-examination. MCFN asserts that to deny it an opportunity to test the ACO Report evidence creates an unjustifiable distinction at law based on the fact that the evidence relates to Aboriginal interests.

MCFN argues that section 49(2) of REDA does not preclude the Panel from compelling ACO witnesses to testify. In MCFN's submission, that section simply allows Alberta to submit evidence without presenting a witness to speak to it and no cross-examination will occur unless the statement is presented by a witness. MCFN says the provision explicitly contemplates that a witness may be presented to speak to a statement and that witness may be subject cross-examination. MCFN also cites section 50 of REDA and notes that while 50(3) specifically says a bench warrant cannot be issued against the Crown to compel attendance at a hearing, section 50 does not say a representative of Alberta cannot be cross-examined.

MCFN reiterates that evidence about LARP and its Frameworks is not outside the scope of the Panel's process. Teck and the ACO have relied on LARP and its Frameworks as potential mitigations of the Project's impacts on MCFN's rights; therefore, a proper understanding of the thresholds and frameworks is within the Panel's jurisdiction. In addition, MCFN asserts that the ACO needs to hear evidence with respect to how LARP does not consider or address MCFN's section 35 rights under the *Constitution Act, 1982*, MCFN's focus is on whether LARP and the Frameworks are adequate mitigations for this Project and whether the ACO has provided meaningful advice about this Project. Publicly available information is not sufficient. Information about how LARP was developed, the thresholds in it and the extent to which those thresholds consider or are protective of Aboriginal and Treaty rights is required.

Alberta and MCFN disagree on the effectiveness of the Ronald Lake Bison Herd cooperative management proposal. The proposal is cited in the ACO Report as a mitigation measure. MCFN's position is that the proposal is not effective. MCFN says evidence from Alberta representatives on this topic is relevant and within the Panel's mandate.

The Panels' Conclusions

As noted earlier, the Panel's authority to compel witnesses is derived from section 6 of the Joint Panel Agreement, section 20 of the *AER Rules of Practice* and section 45 of CEEA 2012. The Panel is satisfied that the test for it to apply in deciding if it should compel witnesses, including government representatives, requires it to determine two things: (i) whether the evidence sought is necessary, even critical, and (ii) whether that evidence is reasonably available from another source including from the parties to the proceeding.

The necessity of the evidence is determined in relation to the tasks and issues for this Panel as set out in the Joint Panel Agreement and the Terms of Reference. To be necessary, the evidence sought must be relevant. However, relevance alone is not sufficient. The evidence must be such that without it, the Panel cannot meet its mandate.

Alberta has asserted that section 49(2) of REDA removes the Panel's ability to compel its representatives and, in particular, the ACO representatives to testify at the hearing regarding the ACO Report. On a plain reading, that section allows Alberta to file documentary evidence in AER proceedings without having to present a witness to speak to that evidence. MCFN disagrees. The Panel notes that the Joint Panel Agreement explicitly states, at section 6.2, that section 49 of REDA has application to the Panel.

The Panel cannot accept MCFN's interpretation of section 49(2). It is apparent on the face of the section that it is intended to allow Alberta to file evidence in AER proceedings without providing a witness to speak to the evidence. The purpose of the section would be defeated if the AER were to exercise the power to compel Alberta to provide a witness where Alberta has elected not to voluntarily do so. For this reason, the Panel is satisfied it does not have the jurisdiction to compel the individuals who are requested by MCFN to speak to the ACO Report or any other matters MCFN says is evidence filed by Alberta in this proceeding. The fact the AER cannot obtain a bench warrant to compel the attendance of a Crown witness supports the Panel's conclusion in this regard. The Panel notes that Part of 1 of the *Administrative Procedures and Jurisdiction Act*, section 5, (relating to cross-examination), does not have application to the AER. The Panel's proceeding must be fair; however, it is subject to the provisions of REDA including section 49.

It also bears noting that section 20 of CEEA 2012 specifically requires federal authorities with expert information or knowledge regarding a project to make the information or knowledge available to the review panel on request. No similar provision exists with respect to REDA or other relevant legislation.

Even if section 49 of REDA did not apply, the starting point for determining if Alberta witnesses should be compelled to testify is whether their evidence is necessary for the Panel to meet its mandate which is centred on assessing the effects of the Project. Under the Terms of Reference, all issues and tasks for the Panel relate to the Project. The Panel

must assess environmental impacts of the Project. To this end, the impacts to Aboriginal and Treaty rights from the Project must be considered by the Panel. Cumulative effects must also be assessed in relation to the Project. Mitigations to be considered by the Panel are ones which mitigate the effects of the Project. The Panel has a number of functions, but they all exist within the context of assessing the Project in accordance with its Terms of Reference. With the exception of mitigations set out in the ACO Report, the evidence sought by MCFN from Alberta representatives does not directly relate to the impacts of the Project.

With respect to the mitigations set out in the ACO Report, if evidence on the topic is available to the Panel from other sources, it is not critical or necessary that the Alberta witnesses be compelled to attend. In this instance, most of the information to be provided by the witnesses sought by MCFN has already been or will be presented to the Panel.

The Panel also notes that it has already received from MCFN extensive information regarding mitigations and the limitations of LARP and its Frameworks. While the Panel questions the necessity of information regarding the development of LARP, a substantial amount of information has already been filed in this proceeding by the parties, including MCFN, on what the parties say are the short-comings of LARP and related instruments. The affidavits of Ms. Lepine, which were appended to MCFN's motion, provide extensive information to the Panel on this topic. MCFN can submit evidence at the hearing on this topic. We do not agree with MCFN, that the only way for the Panel to receive evidence on the inadequacy of LARP to address impacts to MCFN's Treaty and Aboriginal rights is to force Alberta representatives to testify. MCFN can and already has provided evidence on this topic. Finally, the Panel will reach its own conclusions on mitigations based on all evidence before it.

It also bears noting that while evidence, including the ACO Report, has been submitted in this proceeding where no opportunity has been provided to parties to test that evidence because no witness presented the evidence. The untested nature of this evidence will affect the weight which the Panel can place on it.

With respect to the adequacy of the Crown's consultation with MCFN, the Panel cannot assess or look behind that conclusion given its Terms of Reference.

Evidence from individuals to speak to possible future government action to ensure the Ronald Lake Bison Herd has sufficient habitat is not necessary. Evidence regarding discussions and even disagreements between AEP and MCFN regarding the herd can be provided by MCFN. Ms. Lepine's affidavit provides extensive information on what MCFN says are the problems with Alberta's management of the Ronald Lake Bison Herd.

The Panel agrees with Alberta that the adequacy of Alberta's policy and regulatory regime, as a discrete topic, is not something within the Panel's purview.

MCFN suggested that one reason ACO representatives should be compelled to attend the hearing is so that they can hear evidence regarding LARP. The purpose of compelling attendance at the Panel's hearing is not to force them to hear evidence.

The Panel agrees with Alberta that simply because MCFN disagrees with Alberta on a number of topics, does not mean it is necessary for Alberta to provide oral evidence on those topics. The Panel notes MCFN's position that it wants to "raise" issues with AEP regarding LARP and the Frameworks. The Panel's proceeding is not the forum for raising issues with Alberta. MCFN can provide its position and evidence on those topics to the extent such submissions and evidence are within the scope of the proceeding.

For the above reasons, the Panel is not prepared to compel the attendance of Alberta representatives at this hearing.

Yours truly,

<Original signed by>

Alex Bolton
Chair, Joint Review Panel

Appendix 5 Draft Approval Documents

MADE at the City of Calgary, in the
Province of Alberta, on

ALBERTA ENERGY REGULATOR

IN THE MATTER of a commercial scheme of Teck Resources Ltd. (hereinafter called “the Operator”) for the recovery of oil sands and production of oil sands products from the Wabisca-McMurray Deposit in the Athabasca Oil Sands Area, as outlined in Appendix A to this approval.

WHEREAS the Alberta Energy Regulator (AER) has issued Decision Report XX-XX on the XX day of July 2019 approving Application No. 1709793 by the Operator for the construction, operation and reclamation of an oil sands mine and processing plant known as the Frontier Oil Sands Mine Project (hereinafter called “the project”).

WHEREAS the Lieutenant Governor in Council, by Order in Council Number O.C. xxx/xx dated xxx, hereto attached as Appendix B, has authorized the granting of this approval.

The AER, pursuant to section 10 and 11 of the *Oil Sands Conservation Act*, chapter O-7 of the Revised Statutes of Alberta, 2000, hereby orders as follows:

1.
 - (1) The Operator’s scheme for the recovery of oil sands, the production of oil sands products from the processing of recovered or imported oil sands and oil sands products, and the export of oil sands and oil sands products as such scheme is described in
 - a) Application No. 1709793is approved, subject to the *Oil Sands Conservation Act*, the *Oil Sands Conservation Rules (OSCR)* and the terms and conditions herein contained.
 - (2) Subclause (1) does not preclude minor alterations in design or equipment provided the AER is satisfied, the alterations are compatible with the scheme, meet the approval conditions, are made for the better operation of the scheme, and do not result in adverse impacts that are unacceptable to the AER.
2. The Operator shall notify the AER of any proposed alteration or modification of the scheme or to any equipment proposed for use therein prior to effecting the alteration or modification.

3. Where, in the opinion of the AER, any proposed alteration or modification to the scheme or to any equipment proposed for use therein:

(a) is not of a minor nature,

(b) is not consistent with the scheme approved herein, or

(c) may not result in an improved or more efficient scheme or operation;

the alteration or modification shall not be proceeded with or effected without the further authorization of the AER. The Operator must provide evidence that this alteration or modification to the scheme or to any equipment will result in a benefit to the scheme or operation and be in the public interest.

4. The Operator shall provide its additional drilling plans to the AER as part of its annual mine plan submissions.

5. The Operator shall submit to the AER updates on resource estimation within its annual mine plan submissions.

6. If major changes to the approved mine plan are required due to changes to resource evaluation, the Operator shall submit a mine plan amendment application to the AER including any impacts to the approved mine plan and the project.

7. Starting on February 28, 2028, or such other dates as the AER may stipulate in writing, the Operator shall provide updates every two years to the AER on its engagement and collaboration efforts with ACFN and MCFN regarding the north pit development. The updates should include a summary of progress on the conditions and commitments agreed to by the parties.

8. Five years before mining in the Buckton Creek Watershed area, the Operator shall submit to the AER for approval a north pit development plan update. The north pit development plan shall include an updated mine plan and a closure and reclamation plan in accordance with the terms and conditions of its *Environmental Protection and Enhancement Act (EPEA)* and *Water Act* approvals.

9. The submission referred to in Clause 8 shall include how input derived from engagement and collaboration with indigenous groups was taken into consideration.

10. At least two years before any disturbance in the Buckton Creek Watershed area, the Operator shall file with the AER the corresponding north pit amendment application under the *Public Lands Act*.

11. Six months before construction begins, the Operator shall submit for review and approval detailed geotechnical designs of overburden disposal areas and reclamation material stockpiles.

12. Six months before construction, the Operator shall submit the final mine pit walls design to the AER for review and approval. The detailed design shall include:
 - (a) details as per section 8.3.1 of *Draft Directive 023: Oil Sands Project Applications*,
 - (b) additional characterizations of the quaternary channel,
 - (c) detailed assessment including:
 - (i) site specific foundation,
 - (ii) material characterization,
 - (iii) design parameters, and
 - (d) an assessment of potential risk to safe mining operations, including any instability on the Birch Mountain escarpment.
13. The Operator shall submit confirmation to the AER that agreements are in place between The Operator and Canadian Natural Upgrading Limited (CNUL) for the construction of CNUL compensation lakes at least six months before the start of construction of the Operator's compensation lake.
14. The Operator shall work with the adjacent oil sands lease holders and the AER to determine the economic resource potential and recovery plans for the south common lease boundary area of the project outside the Operator's oil sands leases prior to finalizing agreements.
15. The Operator shall submit to the AER for approval a south common lease boundary update five years before to any disturbance along the south common lease boundary, unless some other period is stipulated by the AER in writing.
16. The south common lease boundary update shall include the following:
 - (a) an update on the agreement between the common leaseholders for the orderly development of the oil sand resources;
 - (b) the mining or disturbance plan along the south lease boundary, including any changes to the approved mine plan;
 - (c) the details on the closure landform integration; and
 - (d) a closure and reclamation plan for the south common lease boundary area, consistent with the *EPEA* Approval terms and conditions.

17. Six months before construction of Reclamation Material Stockpile (RMS) A, the Operator shall submit confirmation to the AER that all required agreements and regulatory approvals are in place to place RMS A in the approved location, outside of the Operator's lease.
18. One year before beginning mining, the Operator shall submit a karst management plan for approval by the AER as part of the mine plan.
19. As part of the Annual Mine Plan, the Operator shall provide updates to the karst management plan, which shall include Devonian aquifer characterization, Devonian geohazard mapping, performance and monitoring programs, and mitigation measures for expected ingress incidents.
20. The Operator shall provide to the AER, within one year after the project starts operation, a post-construction comprehensive sound monitoring survey at critical receptor locations to verify noise levels are below limits set by *Directive 038: Noise Control (Directive 038)*.
21. The Operator shall provide an annual report of the noise monitoring at the project's site and at critical receptor locations if necessary until the project's peak year of noise emission to verify that the project's noise emission at various phases is below *Directive 038* limits.
22. the Operator shall submit a detailed measurement plan to the AER one year before starting operations that includes process and instrumentation diagrams, metering, sampling, analytical methods and material balance procedures for measurement and reporting requirements for oil sands ore mined, bitumen production and recovery, solvent losses, and asphaltene rejection.
23. The Operator shall submit a comprehensive site-specific emergency response plan to the AER at least six months before starting operations, prepared in accordance with *Directive 071 Emergency Preparedness and Response Requirements for the Petroleum Industry*. The ERP shall include how the Operator considered input derived from engagement and collaboration with indigenous groups as part of the ERP development.
24. The Operator shall comply with the requirements of *Directive 073: Requirements for Inspection and Compliance of Oil Sands Mining and Processing Plant Operations in the Oil Sands Mining Area*.
25. The Operator shall submit to the AER a commissioning and start-up plan, at least six months before starting operations. The plan shall include the following:
 - (a) process aids selection and dosage rates
 - (b) final plant layout
 - (c) final diluent selection
 - (d) commissioning and start-up sequence.

26. The Operator shall limit its annual average asphaltene rejection to less than ten weight per cent of bitumen production.
27. The Operator shall include updates on the optimization of the asphaltene rejection rates in its annual report of operation required under section 58 of the *OSCR*.
28. For the first 12 months of operations of each of the two project phases, the Operator shall limit its annual average site-wide solvent losses to not more than four volumes per thousand volumes of bitumen production.
29. 12 months after the start-up of bitumen production operations for each phase, and thereafter the Operator shall limit its annual average site-wide solvent losses to not more than three volumes per thousand volumes of bitumen production.
30. The Operator shall not discharge any untreated froth treatment tailings to the tailings disposal area.
31. The Operator shall not place treated or untreated tailings in any of the proposed end-pit lakes.
32. The Operator shall not place treated or untreated tailings in the Buckton Creek watershed.
33. The Operator shall only place tailings solvent recovery unit (TSRU) tailings in the External Tailings Areas (ETA), unless written authorization or an approval amendment is granted by the AER.
34. The Operator shall submit to the AER a tailings measurement system plan one year before starting tailings placement operations. The plan shall include all information in section 5 of *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, as amended or replaced (*Directive 085*) and any other information the AER may stipulate in writing.
35. The Operator shall achieve the tailings profile specified in Appendix C to this approval, Table C-1 and Figure C-1.
36. The Operator shall not exceed any of the profile deviation trigger, total volume trigger, or total volume limit specified in Appendix C, Table C-2.
37. If any limit or trigger in clause 36 is exceeded, the Operator shall comply with the management response or action directed by the AER.
38. The Operator shall not use any updated profile unless written authorization is obtained from the AER or the approval is amended.
39. Subject to clause 42, the Operator shall achieve the ready to reclaim criteria as set out in Appendix D to this approval, Table D-1.

40. The Operator shall meet the deposit milestones as set out Appendix E to this approval, Table E-1, or such other dates as the AER may stipulate in writing.
41. The Operator shall submit updated subobjective 2 ready-to-reclaim criteria for external tailings area 2 (dedicated disposal area 1) by December 31, 2025, or by any other date as the AER may stipulate in writing. The update shall include detailed evaluation and design of the proposed passive seepage control system for the external tailings areas that will be used post-closure.
- 42.
- (a) The Operator shall provide revised ready-to-reclaim criteria for deep centrifuge cake tailings deposits as part of the updated fluid tailings management plan, by December 31, 2032, or by any other date as the AER may stipulate in writing.
 - (b) If, at any time, the AER is not satisfied with the ready to reclaim criteria in Appendix D, Table D-1, the Operator shall address the issues, concerns or deficiencies identified in writing by the AER by the date specified by the AER.
 - (c) If, at any time, the Operator proposes any new or modified ready to reclaim criteria in Appendix D, Table D-1, the Operator shall:
 - (i) address the requirements in *Directive 085*;
 - (ii) demonstrate that the proposed new or modified ready to reclaim criteria do not result in changes to any of the ready to reclaim trajectory, targeted ecosites, milestones, or fluid tailings profile;
 - (iii) address any required updates to the measurement system plan; and
 - (iv) provide any other information the AER may require.
 - (d) The Operator shall not use any new or modified ready-to-reclaim criteria unless
 - (i) the Operator has provided the information required by subclause (b) to the satisfaction of the AER; and
 - (ii) the AER has amended the ready-to-reclaim criteria on Appendix D, Table D-1.
43. The Operator shall provide by December 31, 2025, or such other date as the AER may stipulate in writing, a plan.
44. The plan in clause 43 shall:
- (a) provide a pilot testing plan for deep centrifuge cake tailings deposit;
 - (b) describe how the Operator will ensure that
 - (i) all new fluid tailings are ready to reclaim within ten years of end of mine life;

- (c) describe the fluid tailings treatment technology options to be assessed;
 - (d) describe how the Operator will update the ready to reclaim trajectory and criteria for each type of deposit, including evidence that these types of deposits will reasonably achieve the targeted final landforms and the acceptable distribution of upland ecosite phases and wetland types;
 - (e) explain the approach to identify and mitigate uncertainties associated with the proposed tailings treatment technologies and implementation timeframes, tailings deposit performance, ready to reclaim trajectory, and environmental effects and implications; and
 - (f) provide any other information the AER may require.
45. The Operator shall provide a consolidation model or engineering analysis, along with any required supporting information, including milestones, as specified in writing by the AER, for the deep centrifuge cake tailings deposits by December 31, 2031, or by any other date as the AER may stipulate in writing.
46. If the model or engineering analysis in clause 45 is found deficient by the AER, the Operator shall correct all deficiencies identified in writing by the AER by the date specified by the AER.
47. The Operator shall submit to the AER for approval an updated fluid tailings management plan by December 31, 2032, or by any other date as the AER may stipulate in writing.
48. The plan in clause 47 shall comply with the application requirements in *Directive 085*, and shall include the following:
- (a) the results from the plan in clause 43;
 - (b) updated new fluid tailings profile that:
 - (i) incorporates current tailings treatment technology and tailings deposit performance data;
 - (ii) incorporates predicted tailings treatment technology and tailings deposit performance; and
 - (iii) provides an end of mine life target that is no greater than five years of fluid tailings production.
 - (c) an assessment of the proposed selected treatment technologies that ensure all new fluid tailings are ready to reclaim within ten years of end of mine life;
 - (d) where the Operator is proposing to place water, including industrial wastewater, above treated or untreated tailings for the purpose of creating a water capped deposit as a

closure landscape feature (“water capped pit lake”), feasible alternative tailings treatment technologies and an implementation plan;

- (e) evaluate emerging options for the treatment and placement of TSRU tailings;
- (f) an evaluation of the performance of past and current tailings deposits where similar tailings treatment technology and targeted ecosites were proposed;
- (g) updated ready to reclaim trajectory and criteria for each type of deposit, including ETA (DDA 1), ITA 1 and ITA 2, incorporating the evidence to support that each type of deposit will reasonably achieve the targeted final landforms and the acceptable distribution of upland ecosite phases and wetland types;
- (h) justification of the activities, materials and timelines necessary to achieve milestones;
- (i) an assessment of the performance and limitations for centrifuge cake tailings deposits and other types of deposits;
- (j) an explanation of how any consolidation model or engineering analysis results have been incorporated;
- (k) an explanation of how the research results, including capping research, and long-term reclamation outcomes have been incorporated;
- (l) mitigation of uncertainties associated with the tailings treatment technology TSRU tailings, tailings deposit performance and ready to reclaim trajectory; and
- (m) any other information the AER may require.

49. The Operator shall provide to the AER a plan that updates the fluid tailings management for each deposit: ETA 2 (DDA 1), ITA 1 and ITA 2 one year before placement of fluid tailings or treated tailings in each deposit, or by any other date as the AER may stipulate in writing.

50. The plans in clause 49 shall comply with the application requirements in *Directive 085*, and shall include, the following:

- (a) assess the implications to the fluid tailings profile;
- (b) provide a consolidation model or engineering analysis, along with any required supporting information, including milestones, as specified in writing by the AER, for the tailings deposit;
- (c) evaluate the performance of the tailings deposits where similar tailings treatment technology and targeted ecosites were proposed;

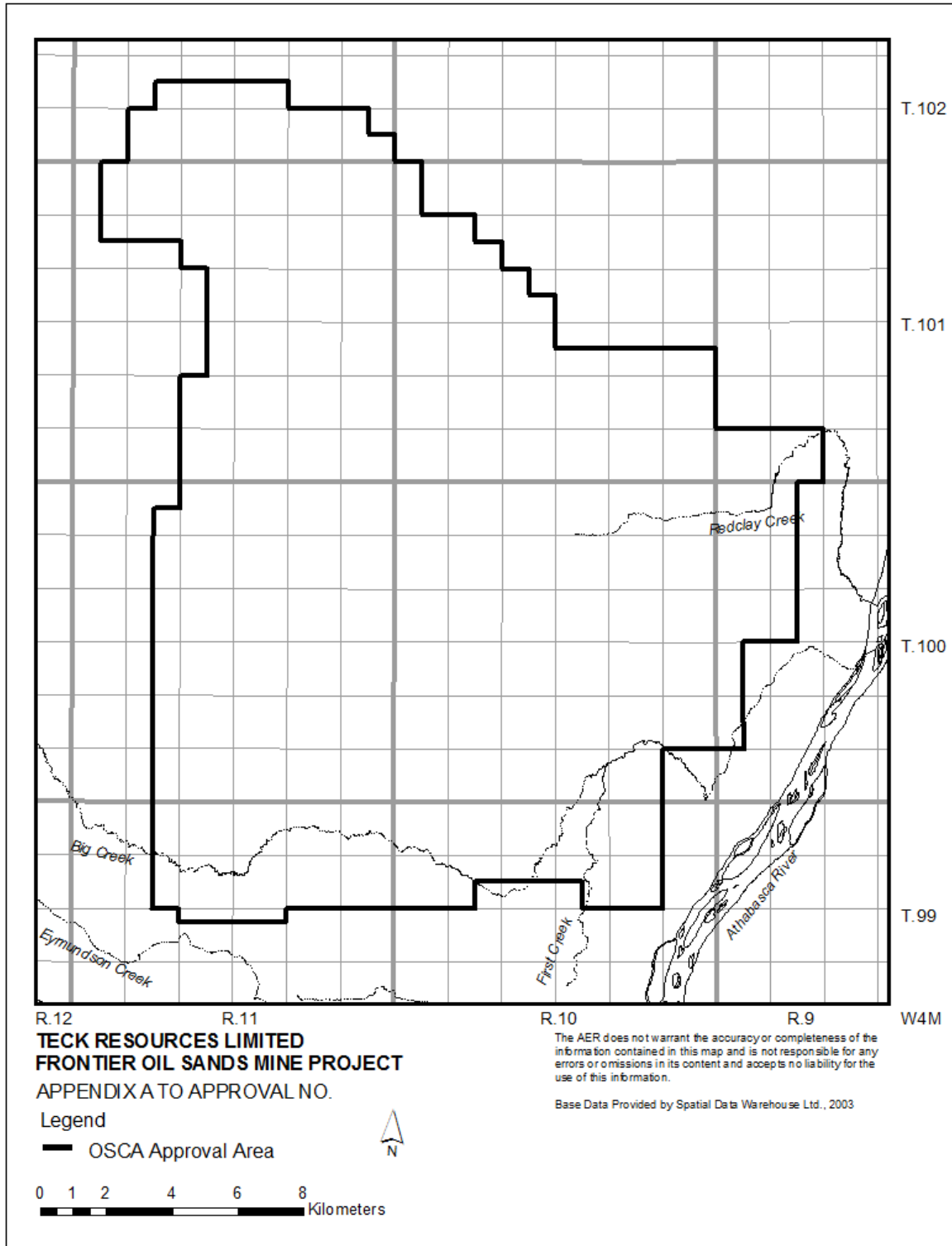
- (d) explain how research results, including capping research, and long-term reclamation outcomes have been incorporated;
 - (e) mitigate uncertainties associated with the tailings treatment technology, tailings deposit performance and ready to reclaim trajectory; and
 - (f) provide any other information the AER may require.
51. The Operator shall provide a capping research plan for its centrifuge cake tailings deposits by December 31, 2026, or such other date as the AER may stipulate in writing.
52. The plan in clause 51 shall include:
- (a) an explanation and rationale for the:
 - (i) research objectives;
 - (ii) hypothesis to be tested;
 - (iii) models to be developed;
 - (iv) key performance measures and criteria;
 - (v) experimental controls, the design and methodology for the research, model, or technique, and the research monitoring plans and methodologies;
 - (vi) applicability of each objective to addressing the risks and uncertainties and to achieving the targeted ecosites and long-term reclamation outcomes;
 - (vii) approach to incorporating research results into any plan;
 - (viii) incorporation of existing research results to date (both general and site-specific) into the research plan; and
 - (ix) a summary of the research completed to date that relates to the objectives identified in (i);
 - (b) the identification and explanation of research priorities that will ensure research results can be incorporated into any plans, including
 - (i) rationale for the sequence of the research;
 - (ii) timing of initiating and completing research; and
 - (iii) key activities;
 - (c) the proposed schedule for research results and data submission, with a mechanism to track progress over time; and
 - (d) any other information the AER may require.

53. The Operator shall not implement any of the plans in clauses 47, 49, and 51 unless a written authorization or approval amendment is granted by the AER.
54. The Operator shall monitor
- (a) the solids content of the centrifuge cake on a monthly basis, or such other basis as the AER may stipulate in writing;
 - (b) undrained shear strength (correlated from cone penetration testing), pore water pressure, and deposit consolidation in each treated tailings deposit on an annual basis, or such other basis as the AER may stipulate in writing; and
 - (c) any other parameter on the basis as specified in writing by the AER.
55. The Operator shall, in addition to any reporting requirements under *Directive 085*, provide in the annual fluid tailings management report:
- (a) a status update on the plan in clause 43 including:
 - (i) a progress update regarding the implementation priorities for the previous reporting period;
 - (ii) implementation priorities for the next reporting period; and
 - (iii) any limitations or constraints;
 - (b) for each treated tailings deposit, monitoring data including representative cross-sections to illustrate the variation of the following:
 - (i) solids and clay content;
 - (ii) undrained shear strength (correlated from cone penetration testing);
 - (iii) pore water pressure;
 - (iv) deposit consolidation;
 - (v) any other parameter considered relevant by the Operator; and
 - (vi) any other parameter specified by the AER.
 - (c) a summary of quarterly monitoring results for the solids content of the centrifuge cake;
 - (d) the available storage capacity of each tailings deposit or tailings pond that contains water or tailings at the end of the reporting period;
 - (e) annual storage capacity and volume requirements for the five years following the end of the reporting period; and

- (f) description of any implications to the tailings management plan resulting from resource sterilization due to avoidance of the Quaternary Channel, including but not limited to impacts to storage capacity changes.
56. The Operator shall not release any substance to the surrounding environment except as authorized under the *EPEA* approval.
57. The Operator shall
- (a) notify the AER of any proposed on-site fluid tailings pilots, prototypes or demonstrations at least six months prior to any proposed construction or implementation, or such other time as the AER may stipulate in writing; and
 - (b) not construct or implement any of the proposed on-site fluid tailings pilots, prototypes or demonstrations unless written authorization is obtained from the AER or the approval is amended.
58. The Operator shall engage with stakeholders and indigenous communities on the activities undertaken, or changes proposed to the activities undertaken, under this Scheme Approval in respect of tailings management.
- (a) TMP amendment applications shall include how input derived from engagement and collaboration with stakeholders and indigenous groups was taken into consideration.
59. Before starting operations, the Operator shall conduct a forum with stakeholders and indigenous communities on tailings management every three years; the Operator shall provide a report to the AER on the results of the engagement efforts undertaken in the reporting period by April 30, as per Clause 62.
60. Starting two years before the start of operations, and every year thereafter, the Operator shall conduct a forum with stakeholders and indigenous communities on tailings management. The Operator shall provide a report to the AER by April 30 on the results of the engagement efforts undertaken in the reporting period, as per clause 62.
61. Starting April 30 of the year after the start of operations, the Operator shall report engagement efforts undertaken in the reporting period as part of the annual fluid tailings management report, as per clause 62.
62. The reporting in clauses 59, 60 and 61 shall include:
- (a) how stakeholders and indigenous communities were identified for engagement;
 - (b) a list of stakeholders and indigenous communities identified in (a);

- (c) objectives for engagement, including gathering input and feedback on the development of tailings management submissions from stakeholders and Indigenous communities identified in (a);
 - (d) the type of engagement activity that was undertaken and the tailings specific information that was provided to each stakeholder and Indigenous community identified in (a);
 - (e) the specific frequency and duration of the engagement with each stakeholder and Indigenous community identified in (a);
 - (f) what specific feedback was provided by each stakeholder and Indigenous community identified in (a);
 - (g) what specific feedback on the report was provided by each stakeholder and Indigenous community identified in (a);
 - (h) how the feedback from previous engagement will be incorporated into future engagement and into tailings management;
 - (i) how the Operator addressed any outstanding concerns arising from engagement; and
 - (j) outcomes from the forum.
63. The Operator shall apply for an amendment to this Scheme Approval to align with any applicable government policy, including government policy related to
- (a) tailings water release;
 - (b) placement of any water above treated or untreated tailings to create a water-capped lake; and
 - (c) reclamation criteria.
64. The AER may,
- (a) upon its own motion, or
 - (b) upon the application of an interested person,
- rescind or amend this approval at any time if, in the opinion of the AER, circumstances so warrant.

Appendix A: Frontier Oil Sands Mine Project Area



Appendix B: Frontier Oil Sands Mine Project

Order in Council

DRAFT

Teck Resources Limited – Frontier Oil Sands Mine Project

Appendix C: Fluid Tailings Profile

Table C-1. New Fluid Tailings Profile

Year	Approved Profile New FT Inventory (million cubic metres)	Year	Approved Profile New FT Inventory (million cubic metres)
2026	19	2048	165
2027	54	2049	179
2028	89	2050	165
2029	115	2051	138
2030	137	2052	115
2031	161	2053	111
2032	163	2054	100
2033	169	2055	106
2034	190	2056	91
2035	205	2057	91
2036	223	2058	73
2037	231	2059	52
2038	210	2060	92
2039	205	2061	116
2040	154	2062	66
2041	167	2063	62
2042	200	2064	79
2043	188	2065	43
2044	169	2066	16
2045	175	2067	0
2046	183	2071	0
2047	169		

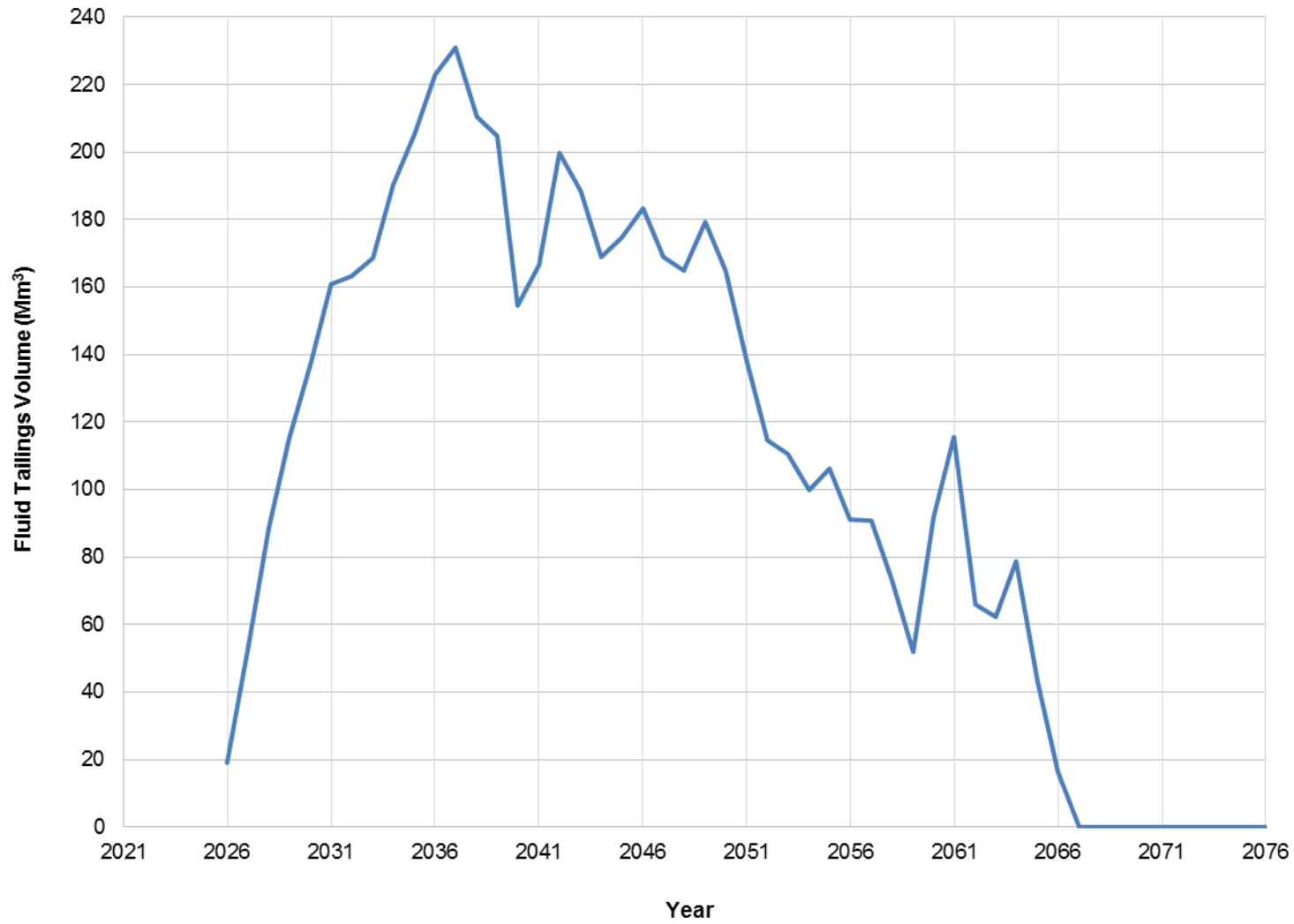


Figure C-1. New Fluid Tailings Profile

Table C-2. Thresholds for New Fluid Tailings Profile

Threshold Type	Trigger or Limit	Calculation Factors
Profile Deviation Trigger	20 per cent	$\text{annual deviation percent}_{\text{year}} = \frac{\text{New FT Inventory}_{\text{year}} - \text{Approved Profile New FT Inventory}_{\text{year}}}{\text{Approved Profile New FT Inventory}_{\text{year}}}$ $\text{profile deviation trigger}_{\text{year}} = \frac{\sum_{i=\text{year}-5}^{\text{year}-5} (\text{annual deviation percent}_i)}{\text{Count}(\text{annual deviation percent}_i; \text{annual deviation percent}_{i-5})}$
Total Volume Trigger	231 million cubic metres	n/a
Total Volume Limit	323 million cubic metres	n/a

Teck Resources Limited – Frontier Oil Sands Mine Project

Appendix D: Ready to Reclaim Criteria

Table D-1. RTR Criteria

Deposit	Subobjective	RTR criteria
ETA (DDA 1) (Thin lift centrifuge cake tailings)	Subobjective 1	A minimum of 50 percent solids by weight at deposition, based upon deposit sampling. A minimum of 65 percent solids by weight by the end of deposition, based upon deposit sampling. Completion of sand capping by 2066.
	Subobjective 2	Surface water: Closed-circuit drainage and collection in containment structures for surface flows and waters in contact with tailings are operating as designed. * Seepage: ETAs seepage control, using pumping wells during operation and a passive seepage control system post-closure, is operating as designed. Groundwater is monitored as required by <i>EPEA</i> approval.
ITA 1 (DDA 2) (Deep centrifuge cake tailings deposits)	Subobjective 1	Intentionally left blank
ITA 2 (DDA 3) (Deep centrifuge cake tailings deposits)	Subobjective 2	Intentionally left blank

* Refer to clause 41

Teck Resources Limited – Frontier Oil Sands Mine Project

Appendix E: Tailings Deposit Milestones

Table E-1. Deposit Milestones

Deposit	Tailings Placement		Capping or Closure Infill		Start of Further Reclamation Activities
	Start Year	Completion Year	Start Year	Completion Year	Start Year
ETA (DDA 1)	2028	2036	2044 ^a	2066 ^a	2070
ITA 1 (DDA 2)	2037	2050	2053 ^a	2058 ^a	2060
ITA 2 (DDA 3)	2050	2067	2064 ^a	2069 ^a	2073
ETA 1	2026	2044	2045 ^b	2054 ^b	2055
ETA 2	2044	2058	2059 ^b	2066 ^b	2067
ITA 3	2056	2066	2067 ^b	2073 ^b	2067

^a Capping

^b Closure Infill

**LICENCE TO DIVERT WATER
ALBERTA ENERGY REGULATOR
WATER ACT, R.S.A. 2000, c.W-3, as amended**

LICENCE NO.: 00303091-00-00

APPLICATION NO.: 001-00303091

FILE NO.: 00303079

PRIORITY NO.: 2015-06-15-XXX (Athabasca River)
2015-06-15-XXX (Surface Runoff)
2015-06-15-XXX (Aquifers)

EFFECTIVE DATE: <Month XX, 20XX>

EXPIRY DATE: <Month XX, 20XX>

SOURCE OF WATER:

- 1) Athabasca River;
- 2) Surface Runoff contributing to the Athabasca River, Redclay Creek, Big Creek and First Creek; and
- 3) Groundwater from Quaternary Aquifer and McMurray basal water sands Aquifer;

POINT OF DIVERSION:

All points where water is diverted from sources within the boundaries of the Fenceline as described in Appendix 1.

LICENSEE: Teck Resources Limited

Pursuant to the *Water Act*, R.S.A. 2000, c.W-3, as amended, a licence is issued to the Licensee to:

operate works and to divert up to the following volumes of water during any year of the respective phases:

- (a) 105.2 million cubic metres in each year of phase 1; and
- (b) 81.1 million cubic metres of water in any year of phase 2

Cumulatively from the sources of water for the purpose of industrial use at the Points of Use within the Fenceline

subject to the attached terms and conditions.

<Name>
Manager, Authorizations Branch
Alberta Energy Regulator

<Month XX, 20XX>

DRAFT

DEFINITIONS

- 1.0 All definitions from the Act and the Regulations apply except where expressly defined in this licence.
- 1.1 In all parts of this licence:
- (a) “Act” means the Water Act, RSA 2000, c. W-3, as amended;
 - (b) “Application” means the written submissions to the Director in respect of application number 001-00303091, and the submissions made in respect of Proceeding No. 344 and any subsequent applications for amendments of Licence No. 00303091-00-00;
 - (c) “Director” means an authorized employee of the Alberta Energy Regulator;
 - (d) “Fenceline” means the lands defined by the legal land locations, as described in Appendix 1 of this licence;
 - (e) “Phase 1” means early development of the Project and includes development of the External Tailings Area water cap and the start-up of train one and train two.
 - (f) “Phase 2” means the remainder of the Project life and can include operation of trains one, two, and three as well as filling of end pit lakes.
 - (g) “Point(s) of diversion” means the location(s) within the Fenceline where water is diverted from the source of water and identified in the Application;
 - (h) “Point of use” means the location(s) within the Fenceline in which the diverted water is used by the Licensee for the licenced purpose and identified in the Application;
 - (i) “Project” means all the activities carried out by the Licensee within the boundaries of the Fenceline for the Frontier Oil Sands Mine development;
 - (j) “Regulations” means the regulations, as amended, enacted under the authority of the Act;
 - (k) “Surface Runoff” means all surface water sources other than natural lakes and streams within the Fenceline; and
 - (l) “Water Use Reporting System” means the secure internet website provided by Alberta Environment at <https://www.alberta.ca/water-use-reporting-system.aspx> for submitting measuring and monitoring results electronically to the Director.

GENERAL

- 2.0 The Licensee shall immediately report to the Director by telephone any contravention of the terms and conditions of this licence at 1-780-422-4505.

- 2.1 The terms and conditions of this licence are severable. If any term or condition of this licence is held invalid, the application of such term or condition to other circumstances and the remainder of this licence shall not be affected thereby.
- 2.2 The Licensee shall not deposit or cause to be deposited any substance in, on or around the source of water that has or may have the potential to adversely affect the source of water.
- 2.3 The Licensee shall comply with the terms and conditions of the "Water Use Reporting System User Consent".
- 2.4 The rights and privileges granted are subject to periodic review on licence renewal and amendment by the Director to ensure the most beneficial use of the water in the public interest.

DIVERSION OF WATER

- 3.0 This licence is appurtenant to the legal land locations described in Appendix 1 of this licence.
- 3.1 The Licensee shall undertake the water diversion in accordance with the plans and reports filed in the following AER records:

TITLE	AER NUMBER
"Appendix 10.26: Section 7: Water Management Plan (Version 3)", dated October 2018, submitted by Teck Resources Limited	00303079-R001

- 3.2 The Licensee shall divert a total volume not to exceed:
- (a) 105.2 million cubic metres of water in any year during Phase 1; and
 - (b) 81.1 million cubic metres of water in any year during Phase 2;
- cumulative from all sources of water identified in this licence.
- 3.3 The Licensee shall divert:
- (a) from the Athabasca River:
 - (i) at NE 30-99-09-W4; and
 - (ii) with a maximum diversion rate of 4.2 cubic metres per second:
 - A. up to 98,000,000 cubic metres of water in any year during Phase 1;
 - and

- B. up to 60,000,000 cubic metres of water in any year during Phase 2;
- (b) from surface runoff sources tributary to the Athabasca River, Redclay Creek, Big Creek and First Creek not to exceed 14,900,000 cubic metres of water in any year; and
 - (c) from groundwater sources identified below not to exceed 14,700,000 cubic metres of water cumulatively in any year:
 - (i) with a maximum annual diversion of 3,400,000 cubic metres of water from the McMurray basal water sands Aquifer;
 - (ii) with a maximum annual diversion of 3,100,000 cubic metres of water annually from the Quaternary Aquifer around the External Tailings Area as part of the seepage control measures; and
 - (iii) with a maximum annual diversion of 8,200,000 cubic metres of water annually from the lateral inflows from the overburden into the mine pit.
- 3.4 The Licensee shall divert water only for the purpose specified in this licence.
- 3.5 The Licensee shall divert water only from the sources of water specified in this licence.
- 3.6 The Licensee shall divert water only from the following points of diversion:
- (a) the Athabasca River at NE 30-99-09-W4;
 - (b) from groundwater within the boundaries of the Fenceline; and
 - (c) from surface runoff within the boundaries of the Fenceline.
- 3.7 Unless otherwise authorized by the Director, prior to diverting any water from a specific source, the Licensee shall establish a method of determining the volume of water diverted from that source on a monthly basis.
- 3.8 The Licensee shall submit an analysis of ongoing and future diversion volume needs when requested in writing by the Director.
- 3.9 The Director reserves the right to amend this licence to reduce the maximum allowable diversion volume if, upon receipt of analysis required pursuant to 3.8 and 3.25, the Director is of the opinion that the Licensee has not demonstrated a need for the licensed maximum diversion volume.
- 3.10 The Licensee shall submit written notification to the Director of the proposed transition from Phase One to Phase Two no less than one year prior to the proposed date of transition.
- 3.11 Notwithstanding 3.10, the Director reserves the right to decide, upon review of the notification submitted pursuant to 3.10, the appropriate Phase of production in which this licence will be applicable to.

- 3.12 The Director will provide written notification to the Licensee of any decision pursuant to 3.11.
- 3.13 The Licensee shall submit written notification to the Director upon completion of the development of the External Tailings Area water cap and completion of start up for trains 1 and 2 as defined in Phase 1, in order to transition into Phase 2 of the licence for the remainder of the Project life.
- 3.14 The Director reserves the right to establish instream flow needs or other water conservation objectives governing the:

- (a) rate of diversion; and
- (b) timing of diversion

from the Athabasca River downstream of Fort McMurray in accordance with the *Lower Athabasca Region Surface Water Quantity Management Framework for the Lower Athabasca River*, as amended, effective upon written notice to the Licensee.

- 3.15 The Licensee shall comply with the *Lower Athabasca Region Surface Water Quantity Management Framework for the Lower Athabasca River*, as amended, unless otherwise authorized in writing by the Director.
- 3.16 To protect the aquatic environment, the Licensee shall reduce the maximum rate of water diversion or cease diverting water when ordered in writing by the Director.
- 3.17 This licence is based on knowledge available at the time of issue, and therefore the Director reserves the right to amend this licence to:
- (a) establish water conservation objectives;
 - (b) reduce the quantity of water diversion;
 - (c) establish a maximum rate of water diversion;
 - (d) require the Licensee to modify monitoring systems and the annual water monitoring information; and
 - (e) require the Licensee to evaluate offstream storage or alternative sources of water supply;

if, in the Director's opinion, an adverse effect has occurred, is occurring or may occur due to the diversion of water under this licence on:

- (f) the Athabasca River;
- (g) Big Creek;
- (h) Redclay Creek;

- (i) First Creek;
 - (j) other water users;
 - (k) instream flow needs;
 - (l) instream objectives; or
 - (m) the aquatic environment
- 3.18 Prior to diverting any water from the source of water, the Licensee shall equip the point of diversion from the Athabasca River with a meter, which measures:
- (a) cumulatively, the quantity of all water diverted; and
 - (b) the instantaneous rate of diversion.
- 3.19 The Licensee shall maintain each measuring device referred to in 3.18 when diverting any water.
- 3.20 The Licensee shall calibrate each measuring device referred to in 3.18 in accordance with manufacturer's specifications.
- 3.21 The Licensee shall establish groundwater monitoring well(s) in the Quaternary, Cretaceous and Devonian aquifers to verify the absence of impacts of the groundwater drawdown resulting from the Project activities on the surface water levels in the Peace-Athabasca Delta and Ronald Lake, and on groundwater springs between the Project and the Athabasca River.
- 3.22 The Licensee shall install the wells required in 3.21 prior to the Project construction.
- 3.23 The Licensee shall submit to the Director for licence amendment, at least 120 days prior to the beginning of Project construction, all required plans and supporting information for the groundwater monitoring wells referred to in 3.21.
- 3.24 The Licensee shall submit an update to the Water Management Plan, referenced in Report number 00303079-R001, to the Director at least 90 days prior to the commencement of construction of the Project, unless otherwise authorized in writing by the Director.
- 3.25 The plan referred to in 3.24 shall be updated by adding, at a minimum, the following:
- (a) The Athabasca River water diversion minimization plan;
 - (b) an analysis of future diversion volume needs; and
 - (c) any other information as required by the Director.
- 3.26 The Athabasca River water diversion minimization plan referred to in 3.25(a) shall include, at a minimum:

- (a) strategies for the following:
 - (i) maximizing the use of fresh water storage capacity;
 - (ii) minimizing non-essential fresh water use when Athabasca River flows are below 500 cubic metres per second;
 - (iii) maximizing diversions to fill fresh water storage when Athabasca River flows are above 700 cubic metres per second; and
 - (iv) minimizing the filling of fresh water storage when Athabasca River flows are below 500 cubic metres per second; and
 - (b) a summary of the Licensee's engagement and collaboration efforts with indigenous groups on the plan, which shall include:
 - (i) input received,
 - (ii) how the input was incorporated into the plan, and
 - (iii) identification of any areas of disagreement.
- 3.27 If the plan referred to in 3.24 is found deficient by the Director, the Licensee shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 3.28 The Licensee shall implement the plan referred to in 3.24 as authorized in writing by the Director.
- 3.29 The Licensee shall implement any changes to the plan referred to in 3.24 as authorized in writing by the Director.
- 3.30 Any changes to the plan referred to in 3.25, shall be authorized in writing by the Director before implementation.
- 3.31 The Licensee shall provide an update to the Athabasca River water diversion minimization plan referred to in 3.25(a), when requested in writing by the Director.
- 3.32 The Licensee shall not divert from the Athabasca River raw water intake for the purpose of end pit lake filling, when the flow in the Athabasca River below McMurray hydrometric station 07DA001 is below 600 cubic metres per second.
- 3.33 Notwithstanding 3.1, the Licensee shall not divert any water from the Athabasca River major basin for use in the Peace/Slave River major basin.
- 3.34 Notwithstanding 3.1, the Licensee shall not divert any water from the Peace/Slave River major basin for use in the Athabasca River major basin.
- 3.35 Notwithstanding 3.1, the Licensee shall divert the water only to the following points of use:

(a) all points within the boundaries of the Fenceline.

3.36 The Licensee shall not use any water from this licence for the initial filling of the Frontier Fish Habitat compensation lake.

MONITORING AND REPORTING

4.0 Unless otherwise authorized in writing by the Director, the Licensee shall:

- (a) monitor and record daily precipitation within the Fenceline;
- (b) monitor and record daily quantity of water diverted from the Athabasca River pursuant to this Licence;
- (c) measure the rate of diversion from the Athabasca river on a continuous basis using the meter specified in 3.18;
- (d) monitor and record monthly quantity of surface runoff intercepted from areas contributing to the Athabasca River, Redclay Creek, Big Creek and First Creek for the Project;
- (e) monitor and record the total number of cubic metres of water diverted each month from each source using the method specified in condition 3.7; and
- (f) maintain the well(s) referenced in 3.21 as observation well(s), equip the well(s) with an appropriate water level measuring device and conduct water level measurements on a monthly basis.

4.1 The Licensee shall record and retain all of the following information for a minimum of 5 years after being collected:

- (a) the place, date and time of all monitoring and measuring;
- (b) the results obtained pursuant to 4.0; and
- (c) the name of the individual who conducted the monitoring, measuring and sampling stipulated in (a) and (b).

4.2 The Licensee shall provide comparisons of hydrologic model results from the Project Environmental Impact Assessment to monitored data, when requested in writing by the Director.

4.3 The Licensee shall perform subsequent model recalibration upon the Director's review of the comparison of modelled results to the monitored data, as submitted pursuant to 4.2, when requested in writing by the Director.

- 4.4 The Licensee shall report to the Director the following monitoring results using the "Water Use Reporting System" on or before the end of the month following the month in which the information is based upon was collected:
- (a) daily quantity of water diverted from the Athabasca River;
 - (b) monthly quantity of surface runoff intercepted from areas contributing to the Athabasca River, Redclay Creek, Big Creek and First Creek for the Project;
 - (c) monthly quantity of water diverted from groundwater sources;
 - (d) monthly measurements of water levels from the observation well(s) including dates and times at which readings were taken; and
 - (e) and any other information required in writing by the Director.
- 4.5 The Licensee shall compile an Annual Water Use Report on or before March 31 of each year following the calendar year in which the information on which the report is based was collected.
- 4.6 The Licensee shall retain each Annual Water Use Report for a minimum of 5 years.
- 4.7 The Licensee shall submit an Annual Water Use Report to the Director:
- (a) on or before March 31 of each year following the calendar year in which the information on which the report is based was collected; or
 - (b) within a time period specified in writing by the Director.
- 4.8 The Annual Water Use Report shall include, at a minimum, the following information collected during the previous calendar year:
- (a) monthly precipitation within the Fenceline;
 - (b) periods and monthly peak rates of water diversion from the Athabasca River;
 - (c) total monthly and annual quantity of water diverted from the Athabasca River;
 - (d) total monthly and annual quantity of surface runoff intercepted from areas contributing to the Athabasca River, Redclay Creek, Big Creek and First Creek for the Project;
 - (e) total monthly and annual quantity of water diverted from groundwater sources;
 - (f) monthly measurements of water levels from the observation well(s);
 - (g) total monthly and annual quantity of water, including any water passing through a flow splitter, returned to each water body outside the Fenceline;

- (h) a summary describing how water withdrawals from the Athabasca River were minimized when flows in the Athabasca River were under 500 cubic metres per second;
- (i) a site plan showing the closed circuit drainage area within the Fenceline for the previous calendar year, and a site plan showing the proposed closed circuit drainage area within the Fenceline that is anticipated for the following calendar year; and
- (j) any other information required in writing by the Director.

COMPLAINT INVESTIGATION

5.0 The Licensee shall:

- (a) investigate all written complaints accepted by the Director relating to allegations of surface water and groundwater interference as a result of the diversion of the water or operation of the works; and
- (b) provide a written report to the Director, within a time specified in writing by the Director, detailing the results of the investigation relating to the complaint accepted by the Director in 5.0(a).

5.1 The Licensee shall satisfy the Director that the report submitted pursuant to 5.0(b) has identified remedial and/or mitigative measures relating to the alleged interference.

<Name>
Manager, Authorizations Branch
Alberta Energy Regulator

<Month XX, 20XX>

Appendix 1

Legal Subdivision	Quarter Section	Section	Township	Range	Meridian
		1 to 3, 11, 12	101	11	4
1 to 12, 15, 16		4	101	11	4
1, 8		9	101	11	4
1 to 11, 16		10	101	11	4
1		14	101	11	4
		1 to 12	101	10	4
	SE, SW	13 to 15	101	10	4
1 to 11, 15, 16		16	101	10	4
1 to 4		17	101	10	4
1, 2		18	101	10	4
1		21	101	10	4
		5, 6	101	9	4
		19, 30, 31	100	9	4
	NW, SW	7, 18, 20, 29, 32	100	9	4
		2 to 36	100	10	4
		1 to 4, 9 to 16, 21 to 28, 33 to 36	100	11	4
	NE, SE	5, 8, 17, 20, 29	100	11	4
	SE	32	100	11	4
	SE, SW	31	99	9	4
	NE, NW	30	99	9	4
	NW	20	99	10	4
	SW, NE, NW	19	99	10	4
		25, 26, 30 to 36	99	10	4
	SE, NE, NW	27	99	10	4
	NE, NW	28	99	10	4
	NW, NE, SW	29	99	10	4
	NW	13	99	11	4
	NE, NW	14, 15	99	11	4
		21 to 28, 33 to 36	99	11	4
	NE, SE	29, 32	99	11	4

DEFINITIONS

- 1.0 All definitions from the Act and the Regulations apply except where expressly defined in this Approval.
- 1.1 In all parts of this Approval:
- (a) "Act" means the Water Act, RSA 2000, c. W-3, as amended;
 - (b) "Application" means the written submissions to the Director in respect of application number 001-00303079, and the submissions made in respect of Proceeding No. 344 and any subsequent applications for amendments of Approval No. 00303079-00-00;
 - (c) "Director" means an authorized employee of the Alberta Energy Regulator;
 - (d) "Fenceline" means the defined fenceline for the Frontier Oil Sands Mine Project as included on Plan 00303079-P001;
 - (e) "Maintenance" means the routine repair, upkeep and preservation of the activity authorized under this approval;
 - (f) "Project" means the Frontier Oil Sands Mine Development; and
 - (g) "Regulations" means the regulations, as amended, enacted under the authority of the Act.

GENERAL

- 2.0 The Approval Holder shall immediately report to the Director by telephone, any contravention of the terms and conditions of this Approval at 1-780-422-4505.
- 2.1 The terms and conditions of this Approval are severable. If any term or condition of this Approval is held invalid, the application of such term or condition to other circumstances and the remainder of this Approval shall not be affected thereby.
- 2.2 This approval is based on the knowledge available at the time of issue and therefore is subject to review and modification. The Director reserves the right to amend the approval and/or require modifications to the works as deemed necessary.
- 2.3 The Approval Holder shall retain a copy of:
- (a) this Approval; and
 - (b) the plans and reports referred to in Section 3.4
- at the site of the activity at all times while conducting the activity.

PARTICULARS

- 3.0 This Approval is appurtenant to the lands set out in the plan noted in Condition 3.4 as No. 00303079-P001, hereafter called the Fenceline Plan, subject to obtaining the appropriate right of entry.
- 3.1 The Approval Holder shall, in addition to other requirements under this approval, construct, operate, manage, and maintain the works in accordance with the information as authorized in writing by the Director.
- 3.2 Subject to 3.3, this Approval authorizes the construction, operation and maintenance of the water intake at NE 30-99-09-W4 as part of the Project.
- 3.3 The Approval Holder shall submit for the Director's authorization, at least 180 days before the beginning of construction specified in condition 3.2, all detailed engineering plans and analysis reports for the water intake on the Athabasca River.
- 3.4 The Approval Holder shall undertake the activity in accordance with the following plans and reports:

TITLE	AER NUMBER
"Figure 7A-2: Proposed Project Fenceline for <i>Water Act</i> Application (Revised May 13, 2016)", submitted by Teck Resources Limited	00303079-P001
"Appendix 10.26: Section 7: Water Management Plan (Version 3)", dated October 2018, submitted by Teck Resources Limited	00303079-R001
"Project Update, Volume 1: Project Description, Section 4: Mine Plan", submitted by Teck Resources Limited, dated June 2015.	00303079-R002

- 3.5 The Approval Holder shall not undertake the activity in any manner or use any material that causes or may cause an adverse effect on the aquatic environment, human health or public safety.
- 3.6 The Approval Holder shall confine the activities to the work area as designated on the Fenceline Plan unless another area is designated by this approval.
- 3.7 The Approval Holder shall not deposit any substance that will adversely affect any water body outside the Fenceline Plan.
- 3.8 The Approval Holder shall prevent siltation and erosion of any water body outside the Fenceline Plan resulting from the activities.

- 3.9 The Approval Holder shall only release water to a water body as authorized by any approval for the Project issued under the *Environmental Protection and Enhancement Act* (EPEA).
- 3.10 The Approval Holder shall ensure maintenance is conducted on all major works within the Fenceline Plan.
- 3.11 The Approval Holder shall submit all detailed engineering plans and analysis reports for structures and activities within the Fenceline Plan, including but not limited to ditches and related structures such as drops, chutes, spillways, outfalls, and any other information as required when requested by the Director.
- 3.12 The Approval Holder shall submit to the Director all detailed engineering plans and analysis reports for Major Works with the potential to impact or alter the flow of water within the Fenceline Plan, including but not limited to dams, dykes, settling and water storage ponds, tailings ponds, end pit lakes, compensation lakes, flow splitters, fisheries enhancement structures, and re-alignments to streams or creeks.
- 3.13 The Approval Holder shall submit the information requirements in condition 3.12 at least 60 days, or another deadline specified in writing by the Director, before the beginning of construction of the individual works.
- 3.14 The Approval Holder shall, in addition to other requirements under this approval, construct all Major Works referred to in condition 3.12 and 3.17, in accordance with the plans, as authorized in writing by the Director.
- 3.15 The Approval Holder shall, in addition to other requirements under this Approval, receive an authorization to construct all Major Works referred to in condition 3.12 and 3.17 prior to commencement of construction.
- 3.16 Notwithstanding condition 3.4, the Approval Holder shall not construct the southern flow splitter structure and channel conveying flows from Big Creek and Unnamed Creek No. 2 into the southern off stream storage pond.

BUCKTON CREEK WATERSHED

- 3.17 Notwithstanding condition 3.13 and 5.2, the Approval Holder shall submit the information requirements in condition 3.12 at least 1 year, or another deadline specified in writing by the Director, before the beginning of construction of the individual Major Works in the Buckton Creek watershed.
- 3.18 The Major Works referred to in condition 3.17, include but are not limited to, dams, dykes, settling and water storage ponds, tailings ponds, end pit lakes, compensation lakes, flow splitters, fisheries enhancement structures, re-alignments to streams or creeks, ditches, spillways and outfalls.
- 3.19 Notwithstanding condition 3.12 and 3.13, the Approval Holder shall submit to the Director, all preliminary engineering plans and analysis reports for Major Works with the

potential to impact or alter the flow of water within the Buckton Creek watershed, including but not limited to dams, dykes, settling and water storage ponds, tailings ponds, end pit lakes, compensation lakes, flow splitters, fisheries enhancement structures, re-alignments to streams or creeks, ditches, spillways and outfalls.

- 3.20 The Approval Holder shall submit the information requirements in condition 3.19 to the Director for authorization, 5 years before the beginning of construction of the individual Major Works in the Buckton Creek watershed.
- 3.21 The submissions in conditions 3.17 and 3.19 shall include how input derived from engagement and collaboration with the Athabasca Chipewyan First Nation and the Mikisew Cree First Nation was taken into consideration.

WATER MANAGEMENT PLAN

- 3.22 The Approval Holder shall submit an update to the Water Management Plan, referenced in Report number 00303079-R001, to the Director at least 90 days prior to the commencement of construction of the Project, unless otherwise authorized in writing by the Director.
- 3.23 The plan referred to in 3.22 shall be updated by adding, at a minimum, the following:
- (a) Big Creek Geomorphologic Monitoring Plan;
 - (b) North Flow Splitter Operational Plan;
 - (c) Ronald Lake and Buckton Creek Monitoring Plan;
 - (d) Off Stream Fresh Water Storage Plan;
 - (e) design basis and water management philosophy for:
 - (i) release water drainage system;
 - (ii) stream realignment system; and
 - (iii) closed-circuit system;
 - (f) preliminary designs and details of water management areas and systems including:
 - (i) release water drainage ponds and associated catchment areas, drainage ditches or piping routes, and outlets;
 - (ii) stream realignment system and associated inflow stream sources, channels and outlets; and
 - (iii) closed circuit system ponds, sumps, and associated catchment areas, inflow sources, drainage ditches or piping routes, and outlets;

- (g) discussion on potential risks, issues and mitigation measures for the surface water management systems;
 - (h) summary of regular maintenance actions to be undertaken for the surface water management systems; and
 - (i) any other information as required by the Director.
- 3.24 The Big Creek Geomorphologic Monitoring Plan referred to in 3.23(a) shall include, at a minimum, the following:
- (a) monitoring of Big Creek downstream of NE-28-99-10-W4M; and
 - (b) identification of thresholds to determine when mitigation actions are required.
- 3.25 The North Flow Splitter Operational Plan referred to in 3.23(b) shall include, at a minimum, the following:
- (a) monitoring of flows in unnamed creek 17 and Red Clay Creek for at least 10 years prior to the construction of any Major Works, as referred to in 3.18, in the Buckton Creek watershed;
 - (b) operational monitoring and maintenance of the north flow splitter; and
 - (c) a summary of the Approval Holder's engagement and collaboration efforts with indigenous groups on the plan, which shall include:
 - (i) input received,
 - (ii) how the input was incorporated into the plan, and
 - (iii) identification of any areas of disagreement.
- 3.26 The Ronald Lake and Buckton Creek Monitoring Plan referred to in 3.23(c) shall include, at a minimum, the following:
- (a) Ronald Lake water levels;
 - (b) Ronald Lake outflows;
 - (c) monitoring of Ronald Lake water levels and outflows for at least 10 years prior to the construction of any Major Works, as referred to in 3.18, in the Buckton Creek watershed;
 - (d) methodology for demonstrating negligible impacts on Ronald Lake water levels and outflows and Buckton Creek flows; and
 - (e) a summary of Approval Holder's engagement and collaboration efforts with indigenous groups on the plan, which shall include:

- (i) input received,
- (ii) how the input was incorporated into the plan, and
- (iii) identification of any areas of disagreement.

- 3.27 The Off Stream Fresh Water Storage Plan referred to 3.23(d) shall include, at a minimum, a strategy for maintaining 90 days of off stream water storage capacity for purposes other than end pit lake filling.
- 3.28 If the plan referred to in subsection 3.23 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 3.29 The Approval Holder shall implement the plan referred to in subsection 3.23 as authorized in writing by the Director.
- 3.30 Any changes to the plan referred to in subsection 3.23, shall be authorized in writing by the Director before implementation.
- 3.31 The Approval Holder shall implement any changes to the plan referred to in subsection 3.23 as authorized in writing by the Director.
- 3.32 The Approval Holder shall provide an update to the Water Management Plan, referred to in 3.22, or components referred to in 3.23, when requested in writing by the Director.
- 3.33 The Approval Holder shall submit to the Director for authorization, 60 days prior to construction, all detailed engineering plans and analysis reports of the Red Clay Creek temporary diversion channel and gated control structure for the purposes of maintaining minimum flows in lower Red Clay Creek during filling of the fish habitat compensation lake.

ATHABASCA RIVER INTAKE

- 4.0 Subject to condition 4.1, the Approval Holder shall only conduct instream activities in the Athabasca River between July 16 and September 15, in any year.
- 4.1 The Approval Holder shall not conduct instream activities in the Athabasca River between January 1 and July 15 inclusive and between September 16 and December 31 inclusive in any year unless:
- (a) the activity is conducted according to the specifications of a qualified aquatic environment specialist, as defined in the Code of Practice for Outfall Structures on Water Bodies, as amended;

- (b) the qualified aquatic environment specialist's specifications complies with Schedule 4 of the Code of Practice for Outfall Structures on Water Bodies, as amended;
- (c) isolation techniques as described in Schedule 3 of the Code of Practice for Outfall Structures on Water Bodies, are used;
- (d) suspended solids resulting from the operation are not increased by more than 25 mg/L at any time when background levels are between 25 and 250 mg/L, and no more than 10% of background levels when the background levels are higher than 250 mg/L; and
- (e) total suspended solids are sampled at locations 50 metres upstream and 100 metres downstream of the construction site, during and immediately following any instream activity, unless alternate sites have been authorized in writing by the Director due to site specific restrictions.

4.2 The Approval Holder shall:

- (a) suspend the instream activities during the time periods set out in condition 4.1 if the applicable limit in 4.1(d) is exceeded at the downstream sampling location; and
- (b) not resume the instream activities until mitigation measures have been implemented to ensure compliance with the applicable limit in 4.1(d).

4.3 The Approval Holder shall construct any berm, cofferdam, or pad built into any water body:

- (a) using clean granular material; and
- (b) in such a way that no more than two thirds of the active channel width is restricted.

4.4 The Approval Holder shall provide a notification to the Director 15 days prior to the start of any instream maintenance activities within the Athabasca River.

4.5 The Approval Holder shall compile and retain a record of monitoring results in 4.1 for a minimum of 2 years.

DAM AND CANAL SAFETY

5.0 The Approval Holder shall follow the *Water (Ministerial) Regulation*, Part 6, "Dam and Canal Safety", and the associated *Alberta Dam and Canal Safety Directive* requirements for any authorization to construct, undertake a major repair, decommission, close, cease long-term operations, or operate in a limited way a dam or canal.

- 5.1 The Approval Holder shall not begin any activities associated with dam or canal construction, major repair, decommissioning, closure, long-term cessation, or limited operation unless written authorization or approval amendment for the plan is granted by the Alberta Energy Regulator.
- 5.2 For new dam or canal design and construction, the Approval Holder shall submit to the Director for written authorization or approval amendment at least 180 days before beginning of construction, or another deadline specified in writing by the Director, all required plans and supporting information for the proposed dam and canal under the provisions of the Act.
- 5.3 For changes to authorized dam or canal designs or consequence classification, the Approval Holder shall submit to the Director for written authorization or approval amendment at least 90 days before beginning of construction or the proposed change to consequence classification, or another deadline specified in writing by the Director, all required plans and supporting information for the changes under the provisions of the Act.
- 5.4 The Approval Holder shall provide a dam decommissioning plan to the Alberta Energy Regulator for written authorization or approval amendment:
 - (a) at least 12 months prior to performing any decommissioning activity;
 - (b) at least 12 months before beginning capping activities at any tailings pond or deposit; or
 - (c) when required by the Director.

CERTIFICATE OF COMPLETION

- 6.0 Within 90 days of completion of the Major Works referred to in condition 3.12 and 3.17, or when requested by the Director, the approval holder shall submit a report to the Director which contains, at a minimum:
 - (a) a statement that the activity or that part of the activity has been completed in accordance with the approval;
 - (b) a summary of the as-built construction, which may include as-built drawings, photographs and other details associated with the construction of the individual works;
 - (c) identification of significant deviations from the approved design and the rationale for the deviation;

- (d) an analysis and discussion on how any deviation from the approved design may affect performance of the individual works; and
- (e) any other information required by the Director.

<Name>

Manager, Authorizations Branch
Alberta Energy Regulator

<Month XX, 20XX>

DRAFT

APPROVAL

ALBERTA ENERGY REGULATOR
ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT
R.S.A. 2000, c.E-12, as amended.

APPROVAL NO.: 247548-00-00

APPLICATION NO.: 001-247548

EFFECTIVE DATE:

EXPIRY DATE:

APPROVAL HOLDER: Teck Resources Limited

ACTIVITY: **Construction, operation and reclamation of the**

Frontier Oil Sands Processing Plant and Mine

is subject to the attached terms and conditions.

Approvals Manager, Authorizations Branch
Alberta Energy Regulator

TERMS AND CONDITIONS ATTACHED TO APPROVAL

PART 1: DEFINITIONS

SECTION 1.1: DEFINITIONS

- 1.1.1 All definitions from the Act and the regulations apply except where expressly defined in this approval.
- 1.1.2 In all PARTS of this approval:
- (a) "Act" means the *Environmental Protection and Enhancement Act*, R.S.A. 2000, c.E-12, as amended;
 - (b) "air contaminant" means any solid, liquid or gas or combination of any of them in the atmosphere resulting directly or indirectly from the activities of man;
 - (c) "application" means, except where the context requires otherwise, the written submissions to the Director in respect of application number 001-247548 and any subsequent applications for amendments of approval number 247548-00-00;
 - (d) "BOD₅" means the Biochemical Oxygen Demand in milligrams per litre measured at 20°C over a 5 day period;
 - (e) "CBOD" means the carbonaceous BOD₅ in milligrams per litre which is measured after the nitrogenous demand has been inhibited with an inhibitory chemical;
 - (f) "CEM" means continuous emissions monitor;
 - (g) "CEMS Code" means the *Continuous Emissions Monitoring System Code*, Pub. No. Ref. 107, Alberta Environment, 1998, as amended;
 - (h) "CGA" means Cylinder gas audit as defined in the CEMS Code;
 - (i) "chemical" means any substance that is added or used as part of the treatment process;
 - (j) "Clearwater overburden" means overburden typically rated as poor or unsuitable as subsoil, with electrical conductivity greater than 5 dS m⁻¹ and sodium adsorption ratio greater than 8;
 - (k) "coarse texture" means a textural class coarser than sandy loam;
 - (l) "commencement of operations" means to start up the plant, process unit or equipment for the first time with the introduction of feed material, electrical or thermal energy and the simultaneous production of products for which the

TERMS AND CONDITIONS ATTACHED TO APPROVAL

- plant, process unit or equipment was designed excluding any predetermined period of commissioning or testing;
- (m) "composite sample" means a refrigerated sample (approximately 4°C) consisting of not less than twenty-four portions of equal volume collected sequentially at regular time intervals over a 24 hour period, unless otherwise authorized by the Director;
- (n) "container" means any portable device in which a substance is kept, including but not limited to drums, barrels and pails which have a capacity greater than 18 litres but less than 210 litres;
- (o) "coversoil" means any of the following:
- (i) upland surface soil;
 - (ii) transitional soil;
 - (iii) organic horizons; or
 - (iv) peat-mineral mix;
- (p) "daily determination of concentration" means the determination of the concentration of a water substance or parameter in any sample by procedures authorized in this approval, and if more than one sample is collected and analyzed per day, the arithmetic average of their analytical results shall be considered as the daily determination of concentration;
- (q) "day" means, for the purposes of sampling, any sampling period of 24 consecutive hours unless otherwise specified;
- (r) "decommissioning" means the dismantling and decontamination of a plant or any part of a plant undertaken subsequent to the termination or abandonment of any activity or any part of any activity regulated under the Act;
- (s) "decontamination" means the treatment or removal of substances from the plant and disturbed lands;
- (t) "direct placement" means a combined salvage and placement operation wherein reclamation material is moved directly from the area of salvage to the area of placement;
- (u) "Director" means the Alberta Energy Regulator (AER) or the individual authorized by the AER board of directors under section 6(2) of the *Responsible Energy Development Act* to carry out the powers, duties or functions of the named Director under the Act;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

- (v) "dismantling" means the removal of buildings, structures, process and pollution abatement equipment, vessels, storage facilities, material handling facilities, railways, roadways, pipelines and any other installations that are being or have been used or held for or in connection with the plant;
- (w) "disturbed land" means any land disturbed by the approval holder in any manner in association with the activity which is the subject of this approval;
- (x) "ecosite" means an ecological unit that develops under specific environmental influences (climate, moisture and nutrient regime), as defined in *Field Guide to Ecosites of Northern Alberta*, Beckingham and Archibald, 1996, as amended;
- (y) "ecosite phase" means a subdivision of an ecosite based on the dominant tree species in the canopy, as defined in *Field Guide to Ecosites of Northern Alberta*, Beckingham and Archibald, 1996, as amended;
- (z) "effluent stream" means any substance in a gaseous medium released by or from the plant;
- (aa) "fine texture" means a textural class finer than sandy loam and including sandy loam;
- (bb) "fine textured fluvial fan material" means the organic horizons and upper 0.5 m of mineral material of the Namur soil series, as identified in the application;
- (cc) "floating roof" means a structure that floats upon and is supported by the surface of a liquid being contained in a tank, which is equipped with a closure seal or seals to close the space between the structure edge and tank wall, for the purpose of limiting emissions to the atmosphere;
- (dd) "forest ecosystem" means the sum of the plants (predominantly trees and other woody vegetation), animals, environmental influences, and their interactions;
- (ee) "fugitive emissions" means air contaminant emissions to the atmosphere other than ozone depleting substances originating from a plant source other than a flue, vent, or stack but does not include sources which may occur due to breaks or ruptures in process equipment;
- (ff) "grab" means an individual sample collected in less than 30 minutes and which is representative of the substance sampled;
- (gg) "incompatible substances" means substances which when mixed can produce effects which are harmful to human health or to the environment such as heat, pressure, fire, explosion, violent reaction, toxic dusts, mists, fumes or gases, or flammable fumes or gases, and includes those substances listed in

TERMS AND CONDITIONS ATTACHED TO APPROVAL

Appendix 5 of the Guidelines for Industrial Landfills, Alberta Environment, June 1987, as amended;

- (hh) "industrial runoff" means precipitation that falls on, or traverses disturbed areas of the plant;
- (ii) "industrial runoff control system" means the parts of the plant that collect, store or treat industrial runoff from the plant;
- (jj) "industrial wastewater" means the composite of liquid wastes and water-carried wastes, any portion of which results from any industrial process or pit dewatering carried on at the plant;
- (kk) "industrial wastewater control system" means the parts of the plant that collect, store or treat industrial wastewater;
- (ll) "interception run-on" means precipitation that falls on, or traverses undisturbed areas that may otherwise drain as surface flow onto the plant;
- (mm) "ISO 17025" means the international standard, developed and published by International Organization for Standardization (ISO), specifying management and technical requirements for laboratories;
- (nn) "land reclamation" means the stabilization, contouring, maintenance, conditioning, reconstruction, and revegetation of the surface of the land to a state that permanently returns the plant to an equivalent land capability;
- (oo) "settlement" means a lowering of the ground surface (gradual or sudden) due to settling, by subsurface movement of earth materials or other means;
- (pp) "LFH" means the organic horizons developed primarily from accumulation of leaves, twigs and woody material with or without a minor component of mosses. They are normally associated with upland forested soils with imperfect drainage or drier, as defined in *The Canadian System of Soil Classification* (Third Edition), Agriculture and Agri-Food Canada, Publication 1646, 1998, as amended;
- (qq) "liquid waste" means a waste which contains free liquids as determined by US EPA Method 9095 Paint Filter Liquids Test, Test Methods for Evaluating Solid Wastes - Physical/Chemical Methods (EPA Publication No. SW-846);
- (rr) "local environmental authority" means Alberta Environment and Parks or the AER, in the Province of Alberta, or the agency that has the equivalent responsibilities for any jurisdiction outside the Province;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

- (ss) "manual stack survey" means a survey conducted in accordance with the *Alberta Stack Sampling Code*, Alberta Environment, 1995, as amended;
- (tt) "maximum daily" means the value not to be exceeded by any daily determination of concentration;
- (uu) "mine" means the disturbed lands but does not include the plant developed area;
- (vv) "mineral horizon" means a layer of soil containing 17% or less organic carbon by weight, as defined in *The Canadian System of Soil Classification* (Third Edition), Agriculture and Agri-Food Canada, Publication 1646, 1998, as amended;
- (ww) "month" means calendar month;
- (xx) "net or lower heating value" means the quantity of heat evolved on complete combustion where the combustion products remain as vapour at 15°C;
- (yy) "organic horizon" means an organic horizon (L, F, H or O) containing more than 17% organic carbon by weight, as defined in *The Canadian System of Soil Classification* (Third Edition), Agriculture and Agri-Food Canada, Publication 1646, 1998, as amended;
- (zz) "overburden" means material below the soil profile and above the bituminous sand;
- (aaa) "PAH" means polycyclic aromatic hydrocarbons;
- (bbb) "peat-mineral mix" means a mixture of an organic horizon with one of the following:
 - (i) underlying mineral material;
 - (ii) subsoil from another location; or
 - (iii) suitable overburden;
- (ccc) "placement polygon" means a distinct area of uniform reclamation cover design where a survey of the reclamation material has been carried out after placement;
- (ddd) "plant" means the Teck Resources Limited oil sands process plant, associated mines, and all associated infrastructure and equipment, including but not limited to, all buildings, structures, process and pollution-abatement equipment, vessels, storage facilities, material-handling facilities, roadways,

TERMS AND CONDITIONS ATTACHED TO APPROVAL

pipelines, tailings ponds, utilities and other installations, and includes the land that is being or has been used or held for or in connection with the following legal land description:

Oil Sands Lease	Legal Land Description				Boundary Described within Application No.
	Section(s)	Twp(s)	Range(s)	Meridian	
309, 310, 311, 351, 468, 470, 475, 476, 477, 607, 608, 609, 610, 744, 840	31	99	9	4	001-00247548
	5, 6, 7, 8, 16, 17, 18, 19, 20, 21, 28, 29, 30, 31, 32, 33, 34	100			
	3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33, 34	101			
	25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36	99	10		
	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36	100			
	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36	101	11		
	20, 21, 22, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36	99			
	1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36	100			
	1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36	101	102		
	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36	102			

(eee) "plant developed area" means the areas of the plant used for the storage, treatment, processing, transport, or handling of raw material, intermediate product, by-product, finished product, process chemicals, or waste material;

(fff) "QA/QC" means quality assurance and quality control;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

- (ggg) "quarter year" means a time period of three consecutive months designated as January, February and March; or April, May and June; or July, August and September; or October, November and December;
- (hhh) "RATA" means Relative Accuracy Test Audit as defined in the CEMS Code;
- (iii) "reclamation cover design" means the sequence and depth of successive layers of specific categories of reclamation material, beginning with coversoil and extending downward to and including the substrate on which it is placed;
- (jjj) "reclamation material" means:
- (i) coarse woody debris;
 - (ii) coversoil;
 - (iii) subsoil; or
 - (iv) suitable overburden;
- (kkk) "regulations" means the regulations issued pursuant to the Act as amended;
- (lll) "RSC" means reduced sulphur compounds;
- (mmm) "sedimentation pond" means a water treatment pond or a polishing pond that accepts water from muskeg drainage, overburden dewatering, overburden disposal areas, reclamation material storage areas, or any areas not yet disturbed by mining and discharges to the environment;
- (nnn) "sediments" means all fine sands, silts and clays or any other fines resulting from the settlement of impounded water or wastewater;
- (ooo) "self-sustaining" means able to support various land uses after land conservation and reclamation is complete without requiring the use of fertilizers or any other special management;
- (ppp) "soil" means the naturally occurring, unconsolidated mineral or organic material at least 10 cm thick that occurs at the earth's surface and is capable of supporting plant growth, as defined in *The Canadian System of Soil Classification* (Third Edition), Agriculture and Agri-Food Canada, Publication 1646, 1998, as amended;
- (qqq) "species at risk" means any species:
- (i) identified by the Alberta *Wildlife Act*, as amended, as 'Endangered', 'Threatened' or 'Species of Special Concern';

TERMS AND CONDITIONS ATTACHED TO APPROVAL

- (ii) listed in *The General Status of Alberta Wild Species*, 2010, as amended, as 'At Risk', 'May Be At Risk' or 'Sensitive';
- (iii) classified as 'at risk' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), as amended; or
- (iv) listed under Schedule 1 of the *Canadian Species at Risk Act*, as amended;
- (rrr) "subsoil" means a stratum that includes one or more of the following:
 - (i) that portion of the B horizon left after salvage of upland surface soil;
 - (ii) the C horizon of an upland soil; and
 - (iii) the C horizon of an organic soil (e.g., Terric layer);
- (sss) "substrate" means the material present at the surface of a terrestrial landform prior to the placement of reclamation material;
- (ttt) "suitable overburden" means overburden that has a pH less than or equal to 8.0, an electrical conductivity less than or equal to 5 dS m⁻¹ and a sodium adsorption ratio less than or equal to 8;
- (uuu) "tailings" means the waste residue separated in the process of extracting bitumen from oil sands;
- (vvv) "tank" means a stationary device, designed to contain an accumulation of a substance, which is constructed primarily of non-earthen materials that provide structural support, and without precluding the generality of the foregoing, may include substances such as wood, concrete, steel, and plastic;
- (www) "transitional soil" means a soil developed on mineral parent material under forest in locations with imperfect drainage or wetter, typically including organic horizons that are less than 40 cm in depth over a mineral horizon;
- (xxx) "TRS" means Total Reduced Sulphur as defined in the *Alberta Stack Sampling Code*, Alberta Environment, 1995, as amended;
- (yyy) "upland soil" means a soil developed on mineral parent material under forest in locations with imperfect drainage or drier, typically including LFH and A, B, and C horizons;
- (zzz) "upland subsoil" means the layer of soil directly below the coversoil and includes one or more of the following:

TERMS AND CONDITIONS ATTACHED TO APPROVAL

- (i) that portion of the B horizon left after salvage of upland surface soil;
and
 - (ii) the C horizon of an upland soil;
- (aaaa) "upland surface soil" means a stratum salvaged from an upland soil that includes the LFH, A horizon and in some cases part or all of the B horizon;
- (bbbb) "vapour recovery system" means a gathering and control system for collecting vapours and gases from specified storage tanks and processing units so as to direct the vapours and gases to subsequent treatment systems;
- (cccc) "volatile organic compounds (VOC)" means any organic compound that participates in atmospheric photochemical reactions, that is, any organic compound other than the following which have been excluded because of their negligible photochemical reactivity: methane, ethane, 1,1,1-trichlorethane, methylene chloride, chlorofluorocarbons (CFCs), fluorocarbons (FCs) and hydrochlorofluorocarbons (HCFCs);
- (dddd) "waste storage area" means the areas designated for waste container storage and/or waste tank storage as described in the applications;
- (eeee) "weeds" means plants that are defined as controlled weeds, nuisance weeds, or noxious weeds by the *Weed Control Act*, as amended;
- (ffff) "week" means any consecutive seven day period;
- (gggg) "weekly average" means the value by the arithmetic average of all daily determinations of concentration or as specified during any week;
- (hhhh) "wetland" means land saturated with water long enough to promote formation of water altered soils, growth of water tolerant vegetation, and various kinds of biological activity that are adapted to the wet environment, and separated into 5 classes: fen, bog, marsh, swamp, and shallow open water wetlands (includes open water areas < 2 m deep with wetland characteristics); and
- (iiii) "year" means calendar year, unless otherwise specified.

PART 2: GENERAL

SECTION 2.1: GENERAL

- 2.1.1 The approval holder shall immediately report to the Director by telephone any contravention of the terms and conditions of this approval at 1-780-422-4505.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

- 2.1.2 The approval holder shall submit a written report to the Director within seven days of the reporting pursuant to subsection 2.1.1.
- 2.1.3 An application for renewal of this approval shall be submitted by the approval holder to the Director a minimum of 12 months prior to the approval expiry date unless otherwise authorized in writing by the Director.
- 2.1.4 Any discrepancy between the application or any document and the terms and conditions of this approval shall be resolved in favour of the approval.
- 2.1.5 The terms and conditions of this approval do not affect any rights or obligations created under any other approval issued by the AER.
- 2.1.6 The mention of trade names, commercial products or named technologies in this approval does not constitute an endorsement or recommendation by Her Majesty the Queen in Right of Alberta, her employees, agents, the AER and the Director for general use.
- 2.1.7 The terms and conditions of this approval are severable. If any term or condition of this approval or the application of any term or condition is held invalid, the application of such term or condition to other circumstances and the remainder of this approval shall not be affected thereby.
- 2.1.8 The approval holder shall immediately notify the Director in writing if any of the following events occurs:
- (a) the approval holder is served with a petition into bankruptcy;
 - (b) the approval holder files an assignment in bankruptcy or Notice of Intent to make a proposal;
 - (c) a receiver or receiver-manager is appointed for the approval holder;
 - (d) an application for protection from creditors is filed for the benefit of the approval holder under any creditor protection legislation; or
 - (e) any of the assets, which are the subject matter of this approval, are seized for any reason.
- 2.1.9 If the approval holder monitors for any substances or parameters which are the subject of operational limits as set out in this approval more frequently than is required and using procedures authorized in this approval, then the approval holder shall provide the results of such monitoring as an addendum to the reports required by this approval.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

- 2.1.10 The approval holder shall submit all monthly reports required by this approval to be compiled or submitted to the Director on or before the end of the month following the month in which the information was collected, unless otherwise specified in this approval.
- 2.1.11 The approval holder shall submit all annual reports required by this approval to be compiled or submitted to the Director on or before April 15 of the year following the year in which the information was collected, unless otherwise specified in this approval.

SECTION 2.2: RECORD KEEPING

- 2.2.1 The approval holder shall record and retain all the following information for a minimum of ten years:
- (a) the names and addresses of all persons who discover any contravention of the Act, the regulations or this approval;
 - (b) the names and addresses of all persons who take any remedial action arising from the contravention of the Act, the regulations or this approval; and
 - (c) a detailed description of the remedial measures taken in respect of a contravention of the Act, the regulations or this approval.
- 2.2.2 The approval holder shall record and retain all the following information in respect of any sampling conducted or analyses performed in accordance with this approval for a minimum of ten years, unless otherwise authorized in writing by the Director:
- (a) the place, date, and time of sampling;
 - (b) the dates the analyses were performed;
 - (c) the analytical techniques, methods, or procedures used in the analyses;
 - (d) the names of the persons who collected and analyzed each sample; and
 - (e) the results of the analyses.

SECTION 2.3: ANALYTICAL REQUIREMENTS

- 2.3.1 With respect to any sample required to be taken pursuant to this approval, the approval holder shall ensure that collection, preservation, storage, handling and analysis shall be conducted in accordance with the following:
- (a) for air:

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- (i) the *Alberta Stack Sampling Code*, Alberta Environment, 1995, as amended;
 - (ii) the *Methods Manual for Chemical Analysis of Atmospheric Pollutants*, Alberta Environment, 1993, as amended;
 - (iii) the *Air Monitoring Directive*, Alberta Environment and Parks, 2016, as amended; and
 - (iv) the *CEMS Code*, Alberta Environment, 1998, as amended;
- (b) for industrial wastewater, runoff, groundwater and domestic wastewater parameters:
- (i) the *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, and the Water Environment Federation, 2012, as amended;
- (c) for whole effluent toxicity tests:
- (i) the *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout*, Environment Canada, Environmental Protection Series 1/RM/13, 2000, as amended;
 - (ii) the *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia Magna*, Environment Canada, Environmental Protection Series 1/RM/14, 2000, as amended;
 - (iii) the *Biological Test Method: Growth Inhibition Test Using the Freshwater Alga*, Environment Canada, Environmental Protection Series, 1/RM/25, 2007, as amended;
 - (iv) the *Biological Test Method: Test of Reproduction and Survival Using the Cladoceran Ceriodaphnia dubia*, Environment Canada, Environmental Protection Series 1/RM/21, 2007, as amended;
 - (v) the *Biological Test Method: Test of Larval Growth and Survival Using Fathead Minnows*, Environment Canada, Environmental Protection Series 1/RM/22, 2011, as amended; and
 - (vi) the *Biological Test Method: Toxicity Test Using Luminescent Bacteria (Photobacterium phosphoreum)*, Environment Canada, Environmental Protection Series, 1/RM/24, 1992, as amended;
- (d) for soil:

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- (i) *Soil Sampling and Methods of Analysis*, Second Edition, CRC Press, 2008, as amended; and
- (e) for waste:
 - (i) the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, USEPA, SW-846, 1986, as amended;
 - (ii) the *Methods Manual for Chemical Analysis of Water and Wastes*, Alberta Environmental Centre, Vegreville, Alberta, 1996, AECV96-M1 as amended;
 - (iii) the *Toxicity Characteristic Leaching Procedure (TCLP)* USEPA Regulation 40 CFR261, Appendix II, Method No. 1311, as amended; and
 - (iv) the *Standard Methods for the Examination of Water and Wastewater*, published jointly by the American Public Health Association, American Water Works Association, and the Water Environment Federation, 2012, as amended;

unless otherwise authorized in writing by the Director.

- 2.3.2 With the exception of field measurements, the approval holder shall analyze all samples that are required to be obtained by this approval in a laboratory accredited pursuant to ISO 17025, as amended, for the specific parameter(s) to be analyzed, unless otherwise authorized in writing by the Director.
- 2.3.3 The term sample as used in subsection 2.3.2 does not include samples directed to continuous monitoring equipment, until specifically required in writing by the Director.
- 2.3.4 The approval holder shall comply with the terms and conditions of any written authorization issued by the Director under subsection 2.3.2.

PART 3: CONSTRUCTION

SECTION 3.1: GENERAL

- 3.1.1 The approval holder shall construct the Frontier project as described in the application, and shall include, at a minimum, all of the following components, designated in the application:
 - (a) bitumen extraction plants;
 - (b) cogeneration and heat integration plants;

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- (c) external and in-pit disposal areas;
- (d) external tailings areas;
- (e) froth treatment plants;
- (f) mine pits;
- (g) ore preparation plants;
- (h) steam generation facilities;
- (i) storage facilities;
- (j) tailings preparation and management facilities; and
- (k) associated facilities;

unless otherwise specified within this approval.

- 3.1.2 The approval holder shall notify the Director in writing at least 14 days before commencement of operations of the Frontier Oil Sands Project.
- 3.1.3 All aboveground and underground storage tanks shall conform to *Directive 073: Requirements for Inspection and Compliance of Oil Sands Mining and Processing Plant Operations in the Oil Sands Mining Area*, AER, 2008.
- 3.1.4 All aboveground storage tanks containing liquid hydrocarbons or organic compounds shall conform to the *Environmental Guidelines for Controlling Emissions of Volatile Organic Compounds from Aboveground Storage Tanks*, CCME, PN1180, as amended.
- 3.1.5 The approval holder shall submit a notification to the Director 60 days prior to the installation of an aboveground or underground storage tank.
- 3.1.6 The notification referred to in subsection 3.1.5, shall include the following information:
 - (a) for aboveground and underground storage tank(s):
 - (i) a description of the tank including equipment name and identification number, size, location, contents, wall specification, process flow diagram and description, storage time, operation strategy, environmental sensitivity of the storage site and primary and secondary containment;
 - (ii) leak detection, emission control and recovery measures;

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- (iii) tank inspection and monitoring;
 - (iv) a map of the location of the tank; and
 - (v) a statement that the tank installation and operation will meet the requirements of AER Directive 073;
- (b) for underground storage tank(s) in addition to (a):
- (i) a justification why an underground storage tank has to be installed rather than an aboveground storage tank; and
 - (ii) groundwater protection and monitoring measures; and
- (c) any other information as required in writing by the Director.
- 3.1.7 The approval holder shall submit a Traditional Land Use Mitigation, Monitoring and Adaptive Management Plan to the Director at least 180 days prior to the commencement of construction of the Frontier Oil Sands Project, unless otherwise authorized in writing by the Director.
- 3.1.8 The plan referred to in subsection 3.1.7 shall provide a summary of the engagement and collaboration efforts with indigenous groups on the plan, which shall include:
- (a) input received;
 - (b) how the input was incorporated into the plan; and
 - (c) identification of any areas of disagreement.
- 3.1.9 If the plan referred to in subsection 3.1.7 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

SECTION 3.2: AIR

- 3.2.1 All boilers and heaters, which have a capacity equal to or greater than 10.5 GJ/hr of energy input, shall meet the more stringent standard of either the *Multi-Sector Air Pollutants Regulations*, SOR/2016-151, 2018, Published by the Minister of Justice, as amended, or the *Emission Guidelines for Oxides of Nitrogen (NOx) for New Boilers, Heaters and Turbines Using Gaseous Fuels Based on a Review of Best Available Technology Economically Achievable (BATEA)*, Alberta Environment, 2007, as amended.
- 3.2.2 All new combustion turbines with a power rating equal to or greater than 1 MW, shall meet the more stringent standard of either the *Guidelines for the Reduction of*

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Nitrogen Oxide Emissions from Natural Gas-fuelled Stationary Combustion Turbines, Environment and Climate Change Canada, 2017, or the *Emission Guidelines for Oxides of Nitrogen (NOx) for New Boilers, Heaters and Turbines Using Gaseous Fuels Based on a Review of Best Available Technology Economically Achievable (BATEA)*, Alberta Environment, 2007, as amended.

3.2.3 The approval holder shall construct all stacks according to the height requirements as prescribed in TABLE 3.2-A, unless otherwise authorized in writing by the Director.

TABLE 3.2-A: STACK HEIGHTS

STACK	MINIMUM HEIGHT ABOVE GRADE (m)
Each of seven Auxiliary Steam Boiler Exhaust Stacks	38
Each of three Flare Stacks	150
Each of two Cogeneration Stacks	50
Each of two Cogeneration By-Pass Stacks	50
Each of three Recycled Solvent Heater Stacks	44
Each of three Sulphur Recovery Unit Flash Drum Feed Heater Stacks	44
Each of three Sulphur Recovery Unit Column Feed Heater Stacks	44
Each of four Natural Gas Heater Stacks	9

3.2.4 Prior to commencement of operations, the approval holder shall install the following minimum systems on the emergency flare stacks:

- (a) wind guard on pilot light;
- (b) pilot light; and
- (c) automatic igniter;

unless an equivalent system is authorized in writing by the Director.

3.2.5 The approval holder shall install pollution-abatement equipment as specified in the application, unless written authorization or an approval amendment is obtained from the Director.

3.2.6 Exhaust stacks of boilers and heaters shall be equipped with sampling facilities, in order to comply with the monitoring requirements as required in subsections 3.2.7 and 4.1.37.

3.2.7 The sampling facilities required in subsection 3.2.6 shall, at a minimum, be installed, operated and maintained to comply with the:

- (a) *Alberta Stack Sampling Code*, Alberta Environment, 1995, as amended;

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- (b) *CEMS Code*, Alberta Environment, 1998, as amended; and
 - (c) *Air Monitoring Directive*, Alberta Environment and Parks, 2016, as amended;
- unless otherwise authorized in writing by the Director.

3.2.8 The approval holder shall submit the following detailed design information to the Director:

- (a) for new or replacement boilers and heaters, which have a capacity equal to or greater than 10.5 GJ/hour of energy input:
 - (i) stack dimensions;
 - (ii) predicted emissions; and
 - (iii) plans for demonstration of conformance;with the requirements prescribed in subsection 3.2.1;
- (b) for new or replacement combustion turbines, which have a power rating equal to or greater than 1 MW:
 - (i) stack dimensions;
 - (ii) predicted emissions; and
 - (iii) plans for demonstration of conformance;
- (c) for new or replacement Tailings Solvent Recovery Units (TSRU) with regards to:
 - (i) efficiency;
 - (ii) service factor;
 - (iii) the expected amount of emissions of volatile organic compounds and potentially odorous compounds; and
 - (iv) a plan to prevent the release of untreated froth treatment tailings and associated solvent directly to the tailings pond; and
- (d) an air monitoring plan for the ambient air monitoring station, which shall include, at a minimum, the following:
 - (i) the design specifications;

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- (ii) the proposed QA/QC program;
 - (iii) the proposed location of the air monitoring station, including site documentation; and
 - (iv) a summary of the engagement and collaboration efforts with indigenous groups on the plan, which shall include:
 - (A) input received;
 - (B) how the input was incorporated into the plan; and
 - (C) identification of any areas of disagreement.
- 3.2.9 The approval holder shall submit the detailed information at least 90 days prior to commencing the construction or installation of the project components referred to in subsection 3.2.8, unless otherwise authorized in writing by the Director.
- 3.2.10 The approval holder shall obtain written authorization or an approval amendment from the Director prior to commencing the construction or installation of the project components referred to in subsection 3.2.8.
- 3.2.11 Prior to commencement of operations, the approval holder shall submit a Fugitive VOC Leak Detection and Repair Program for the facilities associated with the project, unless otherwise authorized in writing by the Director.
- 3.2.12 The program referred to in subsection 3.2.11 shall comply with the *Management of Fugitive Emissions at Upstream Oil and Gas Facilities*, Canadian Association of Petroleum Producers, 2007, as amended, unless otherwise authorized in writing by the Director.
- 3.2.13 If the program referred to in subsection 3.2.11 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 3.2.14 The approval holder shall implement the program referred to in subsection 3.2.11 as authorized in writing by the Director.
- 3.2.15 Any changes to the program referred to in subsection 3.2.11 shall be authorized in writing by the Director before implementation.

SECTION 3.3: INDUSTRIAL WASTEWATER AND RUNOFF

- 3.3.1 The approval holder shall design and construct the industrial wastewater control system as described in the application, and the system shall include, at a minimum, all of the following:

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- (a) a plant site drainage system including recycle water pond sized to handle a 1 in 100 years, 24 hour precipitation event;
- (b) a tailings seepage collection system located to capture seepage from the external tailings areas; and
- (c) be constructed in accordance with the approved EPEA Water Management Plan;

unless otherwise authorized in writing by the Director.

3.3.2 The approval holder shall design and construct the industrial runoff control system, and at a minimum, all of the following design criteria shall be met:

- (a) adequate pond retention time to remove 15 micron and greater sized particles for all precipitation events up to and including a 1 in 10 years precipitation event occurring over 24 hours;
- (b) design to meet the release limits specified in TABLE 4.2-A; and
- (c) be constructed in accordance with the approved EPEA Water Management Plan;

unless otherwise authorized in writing by the Director.

3.3.3 The approval holder shall submit an EPEA Water Management Plan to the Director at least 90 days prior to the commencement of construction of the Frontier Oil Sands Project, unless otherwise authorized in writing by the Director.

3.3.4 The plan referred to in subsection 3.3.3 shall include, at a minimum, the following:

- (a) design basis and water management philosophy for:
 - (i) industrial runoff;
 - (ii) interception run-on; and
 - (iii) industrial wastewater;
- (b) designs and details of water management areas and systems including:
 - (i) each industrial runoff facilities and associated catchment areas, drainage ditches and outlets;
 - (ii) each interception run-on facilities and associated catchment areas, drainage ditches and outlets; and

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- (iii) each industrial wastewater facilities and associated catchment areas, inflow sources, drainage ditches or piping routes, and outlets;
- (c) discussion on potential risks, issues and mitigation measures such as flocculant usage, for the surface water management systems;
- (d) protocols for surface water maintenance activities;
- (e) prior to filling, a plan to monitor the concentrations of mercury, methyl-mercury and any parameters known to influence their concentration on a seasonal basis from surface water sources that would be used to fill the off-stream storage ponds and fish habitat compensation lake;
- (f) a mitigation plan to address elevated mercury concentrations in source waters which may result in methyl mercury production at levels harmful to aquatic life;
- (g) a plan to develop snowmelt models and implement a site-specific snow melt monitoring program;
- (h) a mitigation plan to address project related effects if observed in (g);
- (i) a water quality and aquatic ecosystem effects monitoring program to validate predictions on water quality and aquatic health within planned end pit lakes;
- (j) a mitigation plan to address any harmful effects to aquatic health if observed in (i);
- (k) the submission of the Hydrology and Water Quality Mitigation, Monitoring and Adaptive Management Plan, which shall include, at a minimum, the following:
 - (i) plans for conducting and monitoring of snow transects to test for contaminants deposition from the project;
 - (ii) a plan to verify the accuracy of the project's environmental assessments on water quality;
 - (iii) a plan for baseline water quality monitoring for the Ronald Lake and Buckton Creek watersheds;
 - (iv) a detailed schedule for implementation of (i), (ii) and (iii); and
 - (v) a summary of the engagement and collaboration efforts with indigenous groups on the plan, which shall include:
 - (A) input received,

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- (B) how the input was incorporated into the plan, and
 - (C) identification of any areas of disagreement,
 - (l) changes to the Aquatic Environmental Effects Monitoring Plan referred to in subsection 4.2.4 that would adjust project effects monitoring;
 - (m) the submission of a North Pit Water Quality Plan five years prior to proceeding with the north pit development, which shall include, at a minimum, the following:
 - (i) evaluations on the effects of the north pit development on water quality within Buckton Creek and Ronald Lake; and
 - (ii) development of a Ronald Lake monitoring plan for the management of water quality; and
 - (n) any other information as required in writing by the Director.
- 3.3.5 If the plan referred to in subsection 3.3.3 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 3.3.6 The approval holder shall implement the plan referred to in subsection 3.3.3 as authorized in writing by the Director.
- 3.3.7 Any changes to the plan referred to in subsection 3.3.3, shall be authorized in writing by the Director before implementation.
- 3.3.8 The approval holder shall remove all vegetation and organic soils from the footprint of the fish habitat compensation lake and the off-stream storage ponds during their construction, to reduce the potential for mercury methylation.

SECTION 3.4: WASTE MANAGEMENT

- 3.4.1 The approval holder shall submit a Waste Management Plan to the Director at least 90 days prior to the commencement of the construction phase, unless otherwise authorized in writing by the Director.
- 3.4.2 The plan referred to in subsection 3.4.1 shall include, but is not limited to all of the following:
- (a) detailed procedures for classifying, measuring, segregating and labelling of waste produced from the plant;

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- (b) detailed protocols for the handling, storing, transporting and disposal of the following waste categories produced from the plant:
 - (i) solid waste;
 - (ii) semi-solid waste (e.g. sludge);
 - (iii) liquid waste; and
 - (iv) spilled waste;
- (c) plant layout illustrating all of the following:
 - (i) waste transfer areas;
 - (ii) waste storage areas; and
 - (iii) waste disposal areas;
- (d) design philosophy and engineering specifications of the following:
 - (i) waste transfer areas;
 - (ii) waste storage areas; and
 - (iii) waste disposal areas;
- (e) detailed protocols for monitoring and inspection of the following:
 - (i) waste transfer areas;
 - (ii) waste storage areas; and
 - (iii) waste disposal areas;
- (f) detailed nuisance protocols for the management of the following:
 - (i) odours and dust; and
 - (ii) insects, birds and other scavenging wildlife; and
- (g) any other information as required in writing by the Director.

3.4.3 If the plan referred to in subsection 3.4.1 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

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- 3.4.4 The approval holder shall implement the plan referred to in subsection 3.4.1 as authorized in writing by the Director.
- 3.4.5 Any changes to the plan referred to in subsection 3.4.1 shall be authorized in writing by the Director before implementation.
- 3.4.6 The approval holder shall submit plans and specifications for the construction of waste storage areas to the Director at least 90 days prior to commencing construction of the waste storage areas.
- 3.4.7 The approval holder shall construct the waste storage areas referred to in subsection 3.4.6 in accordance with the plans and specifications as authorized in writing by the Director.
- 3.4.8 The approval holder shall submit an approval amendment application to the Director at least six months prior to commencing construction of the on-site Class II and Class III landfills, unless otherwise authorized in writing by the Director.
- 3.4.9 The approval holder shall obtain an approval amendment from the Director prior to the commencement of construction of the on-site Class II and Class III landfills.
- 3.4.10 The approval holder shall submit an approval amendment application to the Director at least six months prior to commencing construction of any brine storage ponds, unless otherwise authorized in writing by the Director.
- 3.4.11 The approval holder shall obtain an approval amendment from the Director prior to the commencement of construction of any brine storage ponds, unless otherwise directed in writing by the Director.

SECTION 3.5: DOMESTIC WASTEWATER

- 3.5.1 The approval holder shall obtain an approval amendment from the Director prior to the commencement of construction of the domestic wastewater treatment system, unless otherwise directed in writing by the Director.
- 3.5.2 The approval holder shall submit an approval amendment application to the Director at least six months prior to commencing construction of any domestic wastewater system, unless otherwise authorized in writing by the Director.

SECTION 3.6: LAND CONSERVATION

- 3.6.1 The approval holder shall conduct land conservation activities as described in the application unless otherwise:
 - (a) specified in this approval; or

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- (b) authorized in writing by the Director.
- 3.6.2 The approval holder shall stabilize ditches and trenches that discharge directly to natural watercourses, wetlands and waterbodies, in order to minimize erosion and sediment input.
- 3.6.3 The approval holder shall conduct all activities in a manner that minimizes erosion and sedimentation on:
 - (a) all disturbed lands;
 - (b) reclaimed lands; and
 - (c) on all lands adjacent to the project lease boundary.
- 3.6.4 The approval holder shall immediately report any major geotechnical failure within the plant, excluding mine faces, to the Director.
- 3.6.5 The approval holder shall submit a Stabilization and Reclamation Plan for any incident referred to in subsection 3.6.4 to the Director, by the date specified in writing by the Director.
- 3.6.6 If the plan referred to in subsection 3.6.5 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 3.6.7 The approval holder shall implement the plan referred to in subsection 3.6.5 as authorized in writing by the Director.
- 3.6.8 The approval holder shall manage woody debris in accordance with:
 - (a) *Directive 2009-01 Management of Wood Chips on Public Land, Alberta Sustainable Resource Development, 2009, as amended;*
 - (b) *Best Management Practices #3 of Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region of Alberta, Alberta Environment and Water, 2012, as amended;* or
 - (c) as directed in writing by the Director.
- 3.6.9 The approval holder shall conduct all activities in a manner that minimizes each of the following:
 - (a) soil loss;
 - (b) soil degradation;

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- (c) physical disturbance of adjacent forest cover;
 - (d) loss of timber; and
 - (e) loss of plant propagules in the LFH.
- 3.6.10 The approval holder shall immediately suspend salvage or placement of reclamation material if directed to do so in writing by the Director, or when:
- (a) wet conditions;
 - (b) high wind velocities; or
 - (c) any other field condition or operation;
- will result in mixing, loss or degradation of the reclamation material.
- 3.6.11 The approval holder shall only recommence salvage or placement of reclamation material when the field conditions in subsection 3.6.10 no longer exist or if directed to do so in writing by the Director.
- 3.6.12 The approval holder shall conduct direct placement of reclamation material on recontoured portions of the disturbed land that are ready for permanent reclamation, wherever possible, unless otherwise authorized in writing by the Director.
- 3.6.13 The approval holder shall salvage upland surface soil from all land to be disturbed, unless otherwise authorized in writing by the Director.
- 3.6.14 The approval holder shall salvage the surface organic horizon and the underlying mineral material immediately below the surface organic horizon from transitional soil on all land to be disturbed, unless otherwise authorized in writing by the Director.
- 3.6.15 Where there is insufficient upland surface soil and transitional soil to meet the reclamation objectives in Part 7 of this approval, the approval holder shall salvage other coversoil.
- 3.6.16 The approval holder shall salvage upland subsoil from all land to be disturbed, unless otherwise authorized in writing by the Director.
- 3.6.17 Where there is insufficient upland subsoil to meet the reclamation objectives in Part 7 of this approval, the approval holder shall salvage suitable overburden.
- 3.6.18 The approval holder shall minimize mixing of the following during salvage and stockpiling:
- (a) upland surface soil and subsoil;

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- (b) upland surface soil and peat-mineral mix;
- (c) transitional soil and subsoil in stockpiles;
- (d) upland surface soil of coarse texture, fine texture, and fine textured fluvial fan material; and
- (e) subsoil of coarse texture and subsoil of fine texture;

unless otherwise authorized in writing by the Director.

- 3.6.19 The approval holder shall comply with Best Management Practices #11 through #16 of *Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region of Alberta*, Alberta Environment and Water, 2012, as amended, unless otherwise authorized in writing by the Director.
- 3.6.20 The approval holder shall submit a Weed Management Plan to the Director at least 90 days prior to the commencement of the construction phase, unless otherwise authorized in writing by the Director.
- 3.6.21 The plan referred to in subsection 3.6.20 shall include, but is not limited to all of the following:
- (a) an assessment of the potential adverse effects of non-native invasive species and noxious weeds to grow throughout the construction, operations and closure phases of the project;
 - (b) objectives being pursued by the Weed Management Plan, including mitigation objectives;
 - (c) proposed management actions or mitigation measures throughout the construction, operations and closure phases of the project;
 - (d) identification of indicators to trigger the implementation of management actions or mitigation measures as identified in (c);
 - (e) details of any necessary monitoring; and
 - (f) any other information as required in writing by the Director.
- 3.6.22 If the plan referred to in subsection 3.6.20 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 3.6.23 The approval holder shall implement the plan referred to in subsection 3.6.20 as authorized in writing by the Director.

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3.6.24 Any changes to the plan referred to in subsection 3.6.20 shall be authorized in writing by the Director before implementation.

PART 4: OPERATIONS

SECTION 4.1: AIR

OPERATIONS

- 4.1.1 The approval holder shall not release any effluent streams to the atmosphere except as provided in this approval.
- 4.1.2 The approval holder shall only release effluent streams to the atmosphere from the sources designated as the following in the application:
- (a) auxiliary steam boilers exhaust stacks (1540-BR-0007; 1540-BR-0008; 1540-BR-0009; 1540-BR-0010; 2540-BR-0007; 2540-BR-0008; and 2540-BR-0009);
 - (b) flare stacks (1440-FR-1001; 1440-FR-2001; and 2440-FR-0001);
 - (c) cogeneration stacks (1540-BR-0005 & 1540-TG-0005; and 1540-BR-0006 & 1540-TG-0006);
 - (d) natural gas heater stacks (1530-HF-0001A; 1530-HF-0001B; 2530-HF-0001A; and 2530-HF-0001B);
 - (e) recycled solvent heater stacks (1410-FH-1001; 1410-FH-2001; and 2410-FH-0001);
 - (f) sulphur recovery unit feed heater stacks (1420-FH-1001; 1420-FH-1002; 1420-FH-2001; 1420-FH-2002; 2420-FH-0001; and 2420-FH-0002);
 - (g) building heating, ventilation and air conditioning (HVAC) units;
 - (h) pressure relief valves;
 - (i) emergency and back-up generator exhaust stacks;
 - (j) fire pump stacks;
 - (k) mine mobile equipment (trucks and shovels, conveyors and transfer points, etc);
 - (l) exposed mine faces, active mining areas, the tailings ponds, emergency dump ponds, oil sands stockpiles, subject to the requirements of subsection 4.1.9; and

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(m) any additional utilities or processing unit vents or stacks associated with the plant, for which written authorization or an approval amendment has been obtained from the Director.

4.1.3 In addition to the limits specified in subsection 4.1.33, the approval holder shall not operate the process equipment, unless and until, the pollution-abatement equipment associated with the process equipment is fully operational, unless otherwise authorized in writing by the Director.

4.1.4 The approval holder shall continuously operate the emergency flare stacks with the following minimum systems:

- (a) wind guard on pilot light;
- (b) pilot light; and
- (c) automatic igniter;

unless an alternative system is authorized in writing by the Director.

4.1.5 The approval holder shall ensure the combustion of all combustible gases released to the emergency flare stacks.

4.1.6 The approval holder shall maintain and operate the following:

- (a) a vapour recovery system to collect and treat vapours and gases, designated in the application as:
 - (i) TSRUs;
 - (ii) solvent recovery units (SRUs);
 - (iii) froth separation units (FSUs);
 - (iv) solvent tanks; and
 - (v) slop tanks;
- (b) a floating roof system for:
 - (i) diluent storage tanks; and
 - (ii) diluted bitumen storage tanks;

unless otherwise directed in writing by the Director.

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- 4.1.7 The approval holder shall ensure that all tailings streams from the froth treatment units are processed through a TSRU to minimize solvent discharges to the tailings ponds and no untreated tailings are being routed to the tailings ponds, unless otherwise authorized in writing by the Director.
- 4.1.8 Except as provided for by the Director in writing, the approval holder shall control fugitive emissions and any source not specified in subsection 4.1.2 in accordance with subsection 4.1.9 of this approval.
- 4.1.9 The approval holder shall not release a substance or cause to be released a substance that causes or may cause any of the following:
- (a) the impairment, degradation or alteration of the quality of natural resources;
 - (b) material discomfort, harm or adversely affect the wellbeing or health of a person; or
 - (c) harm to property or to plant or animal life.
- 4.1.10 The approval holder shall submit a VOC and RSC Emissions Monitoring Plan to the Director at least 90 days prior to commencement of operations, unless otherwise authorized in writing by the Director.
- 4.1.11 The plan referred to in subsection 4.1.10 shall include:
- (a) detailed methodology to quantify and characterize monitoring of the following sources:
 - (i) slurry preparation units;
 - (ii) extraction process vents;
 - (iii) froth de-aerator vents;
 - (iv) froth treatment tailings outlets;
 - (v) TSRU outlets
 - (vi) tank vents;
 - (vii) fluid tailings management and storage facilities;
 - (viii) exposed oil sands mining areas;
 - (ix) mobile sources;

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- (x) centrifuged tailings and cake deposition site;
 - (xi) any other significant fugitive or point sources; and
 - (xii) any other sources identified in writing by the Director;
- (b) a proposed approach in improving and implementing measurement methodologies for tailings facilities and exposed oil sands mining areas; and
- (c) any other information as required in writing by the Director.
- 4.1.12 The plan referred to in subsection 4.1.10 shall comply with the *Management of Fugitive Emissions at Upstream Oil and Gas Facilities*, Canadian Association of Petroleum Producers, 2007, as amended, unless otherwise authorized in writing by the Director.
- 4.1.13 If the plan referred to in subsection 4.1.10 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 4.1.14 The approval holder shall implement the plan referred to in subsection 4.1.10, as authorized in writing by the Director.
- 4.1.15 Any changes to the plan referred to in subsection 4.1.10 shall be authorized in writing by the Director before implementation.
- 4.1.16 The approval holder shall submit a Dust Management and Mitigation Plan to the Director at least 90 days prior to the commencement of construction of the Frontier Oil Sands Project, unless otherwise authorized in writing by the Director.
- 4.1.17 The plan referred to in subsection 4.1.16 shall include, at a minimum, all of the following:
- (a) a discussion on proposed dust control practices and their effectiveness;
 - (b) a list of all dust exposure areas or locations of concern;
 - (c) a list of all dust generation activities of concern;
 - (d) a list of all dust suppressants or any other chemicals proposed for application;
 - (e) measures to control and mitigate dust from the locations identified in (b);
 - (f) measures to control and mitigate dust from the activities identified in (c);

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- (g) quantitative criteria and thresholds to trigger control/mitigative measures identified in (e) and (f);
- (h) dust monitoring;
- (i) contingency plans to respond to dust issues from operations; and
- (j) any other dust management specified in writing by the Director;
- (k) a summary of the engagement and collaboration efforts with indigenous groups on the plan, which shall include:
 - (i) input received;
 - (ii) how the input was incorporated into the plan; and
 - (iii) identification of any areas of disagreement;

unless otherwise authorized in writing by the Director.

- 4.1.18 If the plan referred to in subsection 4.1.16 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 4.1.19 The approval holder shall implement the plan referred to in subsection 4.1.16 as authorized in writing by the Director.
- 4.1.20 Any changes to the plan referred to in subsection 4.1.16 shall be authorized in writing by the Director before implementation.
- 4.1.21 The approval holder shall submit an Exposed Bitumen Mine Face Fugitive Emissions Minimization Plan to the Director at least 90 days prior to commencement of operations, unless otherwise authorized in writing by the Director.
- 4.1.22 The plan referred to in subsection 4.1.21 shall include the following:
 - (a) a detailed approach and methodology on how the approval holder will optimize the project's mine development to minimize exposed bitumen mine face fugitive emissions;
 - (b) a detailed approach on how the approval holder will track and measure the efficacy of the plan; and
 - (c) any other mine face fugitive emissions minimization approaches identified in writing by the Director.

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- 4.1.23 If the plan referred to in subsection 4.1.21 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 4.1.24 The approval holder shall implement the plan referred to in subsection 4.1.21 as authorized in writing by the Director.
- 4.1.25 Any changes to the plan referred to in subsection 4.1.21 shall be authorized in writing by the Director before implementation.
- 4.1.26 The approval holder shall operate, repair and maintain all of the project's mine mobile equipment with Tier IV emission standards or its equivalent.
- 4.1.27 For the project's mine mobile equipment, the approval holder shall:
- (a) use low-sulphur diesel fuels for the operations; and
 - (b) not remove emission control technologies.
- 4.1.28 The approval holder shall submit a Mine Mobile Equipment Emissions Management Plan to the Director at least 90 days prior to commencement of operations, unless otherwise authorized in writing by the Director.
- 4.1.29 The plan referred to in subsection 4.1.28 shall include:
- (a) an Emissions Control Technology Maintenance Program, to provide information on the combined use of individual vehicle fuel usage indicators, vehicle emissions testing, and electronic diagnosis techniques to trigger maintenance;
 - (b) a Retrofit and Replacement Plan and Schedule, to ensure mine mobile equipment conversion to best-in-class technology is utilized;
 - (c) an inventory of mine mobile equipment, including power rating, model year, anticipated replacement date and emission tier;
 - (d) any other information or actions as required in writing by the Director;
- unless otherwise authorized in writing by the Director.
- 4.1.30 If the plan referred to in subsection 4.1.28 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 4.1.31 The approval holder shall implement the plan referred to in subsection 4.1.28 as authorized in writing by the Director.

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4.1.32 Any changes to the plan referred to in subsection 4.1.28 shall be authorized in writing by the Director before implementation.

LIMITS AND PERFORMANCE TARGETS

4.1.33 Releases of the following substances to the atmosphere shall not exceed the limits specified in TABLE 4.1-A.

TABLE 4.1-A: LIMITS

EMISSION SOURCE	SUBSTANCE	LIMIT
Each of seven 192.5 MW Auxiliary Boilers	Nitrogen Oxides (expressed as NO ₂)	12.0 kg/hr
Each of four 7.3 MW Natural Gas Heaters	Nitrogen Oxides (expressed as NO ₂)	0.5 kg/hr
Each of three 8.2 MW Recycled Solvent Heaters	Nitrogen Oxides (expressed as NO ₂)	0.5 kg/hr
Each of three 99.4 MW SRU Flash Drum Feed Heaters	Nitrogen Oxides (expressed as NO ₂)	5.8 kg/hr
Each of three 69.7 MW SRU Column Feed Heaters	Nitrogen Oxides (expressed as NO ₂)	4.1 kg/hr
Each of two Cogeneration Units	Nitrogen Oxides (expressed as NO ₂)	18.4 kg/hr
7.6 MW HVAC-Plant Area (Phase 1) Space Heater	Nitrogen Oxides (expressed as NO ₂)	0.5 kg/hr
8.7 MW HVAC-Mine Maintenance Area (Phase 1) Space Heater	Nitrogen Oxides (expressed as NO ₂)	0.6 kg/hr
5.3 MW HVAC-Camp Area (Phase 1) Space Heater	Nitrogen Oxides (expressed as NO ₂)	0.4 kg/hr
3.9 MW HVAC-Mine Maintenance Area (Phase 2) Space Heater	Nitrogen Oxides (expressed as NO ₂)	0.3 kg/hr

4.1.34 The approval holder shall ensure the total solvent losses through the TSRUs are not more than:

- (a) 108 m³/cd on a quarter year average basis, for the first 12 months of operations for phase 1;
- (b) 81 m³/cd on a quarter year average basis, thereafter for phase 1;
- (c) 165 m³/cd on a quarter year average basis, for the first 12 months of operations for phase 1 and 2; and
- (d) 124 m³/cd on a quarter year average basis, thereafter for phase 1 and 2.

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- 4.1.35 The approval holder shall immediately upon discovery of an emission in excess of an approval limit, take steps to reduce the excessive emission.
- 4.1.36 In addition to the limits specified in TABLE 4.1-A, the approval holder shall strive to meet the NOx emission performance target in TABLE 4.1-B.

TABLE 4.1-B: PERFORMANCE TARGET

EMISSION SOURCE	SUBSTANCE	PERFORMANCE TARGET
Each of seven 192.5 MW Auxiliary Boilers	Nitrogen Oxides (expressed as NO ₂)	5.5 kg/hr
Each of four 7.3 MW Natural Gas Heaters	Nitrogen Oxides (expressed as NO ₂)	0.3 kg/hr
Each of three 8.2 MW Recycled Solvent Heaters	Nitrogen Oxides (expressed as NO ₂)	0.3 kg/hr
Each of three 99.4 MW SRU Flash Drum Feed Heaters	Nitrogen Oxides (expressed as NO ₂)	2.9 kg/hr
Each of three 69.7 MW SRU Column Feed Heaters	Nitrogen Oxides (expressed as NO ₂)	2.0 kg/hr
Each of two 97.3 MW Cogeneration Units	Nitrogen Oxides (expressed as NO ₂)	16.4 kg/hr
7.6 MW HVAC-Plant Area (Phase 1) Space Heater	Nitrogen Oxides (expressed as NO ₂)	0.3 kg/hr
8.7 MW HVAC-Mine Maintenance Area (Phase 1) Space Heater	Nitrogen Oxides (expressed as NO ₂)	0.3 kg/hr
5.3 MW HVAC-Camp Area (Phase 1) Space Heater	Nitrogen Oxides (expressed as NO ₂)	0.2 kg/hr
3.9 MW HVAC-Mine Maintenance Area (Phase 2) Space Heater	Nitrogen Oxides (expressed as NO ₂)	0.2 kg/hr

Note: The NOx emission performance target was determined according to Alberta Environment's *Emission Guidelines for Oxides of Nitrogen (NOx) for New Boilers, Heaters and Turbines Using Gaseous Fuels Based on a Review of Best Available Technology Economically Achievable (BATEA)*, 2007, as amended.

MONITORING AND REPORTING

- 4.1.37 The approval holder shall monitor the air emission sources as required in TABLE 4.1-C, unless otherwise authorized in writing by the Director.

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4.1.38 The approval holder shall report to the Director the results of the air emission source monitoring as required in TABLE 4.1-C, unless otherwise authorized in writing by the Director.

TABLE 4.1-C: SOURCE MONITORING OF EMISSIONS

EMISSION SOURCE	PARAMETER	METHOD	FREQUENCY	REPORTING FREQUENCY			REPORT TO
				Special	Monthly	Annually	
Each of the stacks for boilers and heaters with capacities greater than 262.5 GJ/hr	Nitrogen Oxides (expressed as NO ₂), Total Effluent Stream Flow Rate (Volume), Temperature	CEM, as per CEMS Code	Continuously				
Each of the stacks for boilers and heaters with capacities greater than 105 GJ/hr	Nitrogen Oxides (expressed as NO ₂)	Manual Stack Survey	Once per year after initial verification test	Within 30 days after the survey is done	Yes (as required by subsection 4.1.45)	Yes (as required by subsection 4.1.47)	Director
Each of the stacks for boilers and heaters with capacities equal to or greater than 10.5 GJ/hr			Initial verification test within six months of commissioning				
Cogeneration unit exhaust stacks	Nitrogen Oxides (expressed as NO ₂), Total Effluent Stream Flow Rate (Volume), Temperature	CEM, as per CEMS Code	Continuously				
	Nitrogen Oxides (expressed as NO ₂)	Manual Stack Survey	Initial verification test within six months of commissioning	Within 30 days after the survey is done			

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EMISSION SOURCE	PARAMETER	METHOD	FREQUENCY	REPORTING FREQUENCY			REPORT TO
				Special	Monthly	Annually	
			Once per year after initial verification test				

- 4.1.39 The approval holder shall conduct CEMS tests or manual stack survey tests in the following manners, unless otherwise authorized in writing by the Director:
 - (a) during periods of scheduled manual stack survey tests or CEMS tests, such as Relative Accuracy Test, the facility shall be operated at a rate of at least 90% of “normal” production. Normal Production is defined as the average production or throughput for the facility over the previous month; and
 - (b) at least 30 days must elapse between the completion of a satisfactory manual stack survey or a CGA or a RATA, which demonstrates compliance with the approval limits, and the commencement of the next manual stack survey or CGA or RATA for that source.
- 4.1.40 The approval holder shall notify the Director in writing a minimum of 14 days prior to any manual stack survey that is required to be conducted by this approval, unless otherwise authorized in writing by the Director.
- 4.1.41 The approval holder shall submit the monthly CEMS Code data required in subsection 4.1.38, electronically as outlined in the *Air Monitoring Directive*, Alberta Environment and Parks, 2016, as amended, unless otherwise directed by the Director.
- 4.1.42 The approval holder shall monitor ambient air parameters as specified in TABLE 4.1-D, unless otherwise authorized in writing by the Director.
- 4.1.43 The approval holder shall report to the Director the results of the ambient air monitoring as required in TABLE 4.1-D, unless otherwise authorized in writing by the Director.

TABLE 4.1-D: AMBIENT MONITORING AND REPORTING

MONITORING STATION(S)	PARAMETER(S)	MONITORING PERIOD	REPORTING	
			MONTHLY	ANNUALLY
One continuous ambient air monitoring station, as per <i>Air Monitoring Directive</i>	Nitrogen Oxides (expressed as NO ₂), Hydrocarbons, PM2.5, Total Reduced Sulphur, Wind Speed, and Wind Direction	Three months prior to commencing operations, and continuously thereafter	Yes	Yes

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- 4.1.44 The approval holder shall notify the Director, or cause the Director to be notified, if the regional ambient air quality monitoring organization amends the regional ambient air quality monitoring network to include any ambient monitoring station operated by the approval holder.
- 4.1.45 The approval holder shall submit a Monthly Air Emissions Summary Report to the Director, unless otherwise authorized in writing by the Director.
- 4.1.46 The report referred to in subsection 4.1.45 shall contain the following:
 - (a) the monitoring results collected in accordance with TABLE 4.1-C and TABLE 4.1-D;
 - (b) an assessment of the emissions of air contaminants relative to the limits specified in TABLE 4.1-A and subsection 4.1.34 of this approval;
 - (c) an assessment of the performance of the air emission control and monitoring equipment, and an interpretation of significant variations in equipment performance;
 - (d) a summary of contraventions reported pursuant to subsection 2.1.1; and
 - (e) any other information as required in writing by the Director.
- 4.1.47 The approval holder shall submit an Annual Air Emissions Summary and Evaluation Report to the Director, unless otherwise authorized in writing by the Director.
- 4.1.48 The report referred to in subsection 4.1.47 shall contain the following information:
 - (a) monthly summaries of ambient air quality monitoring information collected by the approval holder or through participation in the regional monitoring, including the air monitoring readings greater than the *Alberta Ambient Air Quality Objectives and Guidelines Summary, 2016*, as amended;
 - (b) a discussion of the likely reasons, and any mitigation measures taken, for ambient air quality readings which were greater than the *Alberta Ambient Air Quality Objectives and Guidelines Summary, 2016*, as amended;
 - (c) a summary and discussion of source monitoring conducted in accordance with TABLE 4.1-C;
 - (d) a summary of any readings from source emission monitoring (manual stack surveys and continuous emission monitoring) that exceeded approval limits and a discussion of the causes and remedial actions taken;

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- (e) an overview of the operation and performance of air emissions control equipment, and a summary of plant modifications and operational changes that may affect atmospheric emissions;
- (f) a summary of the performance of the TSRU in reducing solvent losses, and an assessment of the solvent losses to the tailings ponds relative to the limits specified in subsection 4.1.34;
- (g) a summary and discussion of the results from the:
 - (i) authorized Fugitive VOC Leak Detection and Repair Program;
 - (ii) authorized VOC and RSC Emissions Monitoring Plan;
 - (iii) authorized Dust Management and Mitigation Plan;
 - (iv) authorized Exposed Bitumen Mine Face Fugitive Emissions Minimization Plan;
 - (v) authorized Mine Mobile Equipment Emissions Management Plan; and
 - (vi) authorized Air Quality Mitigation, Monitoring and Adaptive Management Plan;
- (h) a summary of the approval holder's efforts to minimize and reduce all atmospheric emissions, and an outline of steps or procedures which will be taken to minimize future emissions, and a plan for timely implementation;
- (i) the status and results of the environmental effects monitoring (biomonitoring) program required in subsection 4.1.60 including:
 - (i) a summary of the data and the results of any ecological effects monitoring related to acidification, eutrophication or direct effects on terrestrial receptors that was conducted during the previous year after the approval holder has been operating the plant for one year;
 - (ii) a description of the monitoring program planned for the present year; and
 - (iii) a description of the approval holder's plans for consultation with other stakeholders during the present year regarding the design and results of the biomonitoring program;
- (j) a summary of the status and the results of any special ambient air quality studies, environmental effects studies (e.g., biomonitoring), and related health

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- studies that the approval holder either participated in or conducted independently;
- (k) a summary of the status and the results of any non-confidential atmospheric emissions reduction reports and studies that the approval holder either participated in or conducted independently;
 - (l) a comparison summary of actual NO_x emissions to the performance target referred to in TABLE 4.1-B;
 - (m) a summary of the following information, if the NO_x performance target referred to in TABLE 4.1-B is not achieved:
 - (i) an explanation of why the performance target was not met; and
 - (ii) the proposed steps and measures that will be implemented to meet the NO_x performance target;
 - (n) a summary of the results of any other air-related monitoring that was conducted to fulfil the requirements of this approval; and
 - (o) any other information as required in writing by the Director.
- 4.1.49 The approval holder shall submit a Continuous Improvement Report to the Director, two years prior to the expiry of EPEA Approval No. 247548-00-00, unless otherwise as authorized in writing by the Director.
- 4.1.50 The report referred to in subsection 4.1.49 shall:
- (a) summarize the approval holder's performance in minimizing atmospheric emissions between the years of EPEA Approval No. 247548-00-00 being issued and three years prior to the expiry of EPEA Approval No. 247548-00-00;
 - (b) identify and evaluate all options for further reduction of the following air contaminant emissions:
 - (i) sulphur dioxide;
 - (ii) hydrogen sulphide and other reduced sulphur compounds;
 - (iii) particulates;
 - (iv) oxides of nitrogen;
 - (v) volatile organic compounds; and

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- (vi) any other parameters requested in writing by the Director;
 - (c) identify the most technically feasible and cost-effective reduction options;
 - (d) provide a detailed explanation of how cost effectiveness was determined;
 - (e) provide an estimate of the time that would be required to implement each reduction option if it were required; and
 - (f) any other information requested in writing by the Director.
- 4.1.51 The approval holder shall submit an Air Quality Mitigation, Monitoring and Adaptive Management Plan to the Director, at least 90 days prior to commencement of operations, unless otherwise authorized in writing by the Director.
- 4.1.52 The plan referred to in subsection 4.1.51 shall include, at a minimum, the following:
- (a) the measurement and management of:
 - (i) all point and non-point sources of oxides of nitrogen emissions;
 - (ii) all sources of acidifying emissions;
 - (iii) all sources of particulate matter (i.e. PM_{2.5}) and secondary organic aerosol precursors, including analytically unresolved hydrocarbons;
 - (iv) total suspended particulates, polycyclic aromatic compounds, and metals; and
 - (v) hydrocarbons, reduced sulphur compounds, and odours; and
 - (b) any other information as required in writing by the Director;
- unless otherwise authorized in writing by the Director.
- 4.1.53 If the plan referred to in subsection 4.1.51 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 4.1.54 The approval holder shall implement the plan referred to in subsection 4.1.51 as authorized in writing by the Director.
- 4.1.55 Any changes to the plan referred to in subsection 4.1.51 shall be authorized in writing by the Director before implementation.

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REGIONAL INITIATIVES

- 4.1.56 The approval holder shall participate in any regional initiatives as a result of management actions from the *Lower Athabasca Region Air Quality Management Framework*, Government of Alberta, 2012, as amended, to the satisfaction of the Director, when requested in writing by the Director.
- 4.1.57 The approval holder shall participate in regional initiatives undertaken to assess the potential effects of oxides of nitrogen emissions.
- 4.1.58 The approval holder shall participate in any regional odour and air quality management initiatives, to the satisfaction of the Director, when requested in writing by the Director.
- 4.1.59 The approval holder shall participate as a member of a regional ambient air quality monitoring organization as authorized in writing by the Director.
- 4.1.60 The approval holder shall:
- (a) conduct ambient air quality environmental effects monitoring (biomonitoring) through participation and support of regional monitoring; and
 - (b) support the status and results of the monitoring, that are submitted annually to the Director by regional monitoring;
- in a manner satisfactory to the Director.
- 4.1.61 The approval holder shall:
- (a) participate in, on an ongoing basis, an acid deposition monitoring program for aquatic and terrestrial ecosystems through regional initiatives or another program authorized in writing by the Director;
 - (b) support the program results of the acid deposition monitoring program referred to in (a), that are reported annually by regional initiatives or another program authorized in writing by the Director; and
 - (c) support the program design of the acid deposition monitoring program referred to in (a), including but not limited to monitoring frequency, timing, aerial coverage, and endpoints to ensure it is sufficiently robust as to detect potential impacts in the receiving environment as determined by periodic peer review conducted by regional initiatives or another program authorized in writing by the Director;
- in a manner satisfactory to the Director.

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- 4.1.62 The participation referred to in subsection 4.1.61 may be in the form of, though not limited to, providing financial and in-kind support, scientific guidance, and consultation with regional stakeholders.

SECTION 4.2: INDUSTRIAL WASTEWATER AND RUNOFF

OPERATIONS

- 4.2.1 The approval holder shall not release any substances from the plant to the surrounding watershed, except as authorized under this approval.
- 4.2.2 The approval holder shall operate industrial wastewater and runoff systems as described in the application, unless otherwise authorized in writing by the Director.
- 4.2.3 The approval holder shall manage industrial wastewater and industrial runoff in the following manner:
- (a) industrial wastewater shall be contained in the industrial wastewater control system for use as recycle water;
 - (b) plant developed area runoff (including plant site drainage, drainage and seepage control at the External Tailings Areas and External Disposal Areas that contain tailings fines, drainage at mine pits and in-pit tailings storage areas) shall be contained in the industrial wastewater control system for use as recycle water;
 - (c) industrial wastewater shall not be placed in end pit lakes;
 - (d) drainage from muskeg dewatering, overburden dewatering, overburden storage areas, reclamation material storage areas, and industrial runoff from reclamation material storage areas, undeveloped areas, and external disposal areas which do not contain tailings fines, shall be directed to sedimentation ponds, or the industrial wastewater control system for use as recycle water;
 - (e) sedimentation ponds shall not receive industrial wastewater, plant developed area runoff or domestic wastewater;
 - (f) in accordance with the approved EPEA Water Management Plan referred to in subsection 3.3.3;
 - (g) drainage and industrial runoff identified by (d) shall be only discharged from the following locations:
 - (i) release to Unnamed Creek #5 (Sedimentation Pond 1);

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- (ii) release to Redclay Creek Interception Channel (Sedimentation Pond 2);
- (iii) release to Unnamed Creek #2 (Sedimentation Pond 3);
- (iv) release to Redclay Creek Interception Channel (Sedimentation Pond 4); and
- (v) release to Unnamed Creek #17 (Sedimentation Pond 5); and
- (h) interception run-on shall be only discharged from the following locations:
 - (i) release to Big Creek;
 - (ii) release to Frontier's Fish Habitat Compensation Lake through Redclay Creek;
 - (iii) release to the Unnamed Creek #17; and
 - (iv) release to Unnamed Creek #18;

unless an amendment or a written authorization is obtained from the Director.

4.2.4 The approval holder shall submit an Aquatic Environmental Effects Monitoring Plan to the Director at least 120 days prior to commencement of operations, unless otherwise authorized in writing by the Director.

4.2.5 The plan referred to in subsection 4.2.4 shall:

- (a) conduct ongoing aquatic environmental effects monitoring for potential effects from the operation of the plant, including atmospheric emissions, on:
 - (i) water, snow and sediment quality, including but not limited to:
 - (A) naphthenic acids;
 - (ii) resident aquatic biota, including, but not limited to, all of the following:
 - (A) fisheries, including methyl mercury tissue concentration;
 - (B) benthos;
 - (C) aquatic habitat; and
 - (D) aquatic plants, including heavy metals and PAH tissue concentrations;

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- (b) include a proposal on a course of action for any mitigation and/or adaptive management approaches that would be required as a result of project related effects if observed in (a);
 - (c) include downstream monitoring of the following locations:
 - (i) Athabasca River; and
 - (ii) Ronald Lake and Buckton Creek should the north pit be developed;
 - (d) include an aquatic ecosystem effects monitoring program to validate predictions on aquatic health downstream from the Frontier Project;
 - (e) include a mitigation plan to address any harmful effects to aquatic health if observed in (d);
 - (f) a summary of the engagement and collaboration efforts with indigenous groups on the plan, which shall include:
 - (i) input received;
 - (ii) how the input was incorporated into the plan; and
 - (iii) identification of any areas of disagreement; and
 - (g) any other information as required in writing by the Director.
- 4.2.6 The approval holder shall ensure that the monitoring program referred to in subsection 4.2.4, is designed (including but not limited to monitoring frequency, timing, spatial coverage, endpoints) to sufficiently detect potential impacts in the receiving environment, to the satisfaction of the Director.
- 4.2.7 If the plan referred to in subsection 4.2.4 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 4.2.8 The approval holder shall implement the plan referred to in subsection 4.2.4, as authorized in writing by the Director.
- 4.2.9 The plan required in subsection 4.2.4 shall be conducted by the approval holder, or alternatively another program authorized in writing by the Director.
- 4.2.10 Any changes to the plan referred to in subsection 4.2.4 shall be authorized in writing by the Director before implementation.

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LIMITS

4.2.11 Releases from the sedimentation ponds directly to natural water streams shall not exceed the limits specified in TABLE 4.2-A.

TABLE 4.2-A: LIMITS - SEDIMENTATION PONDS

PARAMETER	LIMITS
Total Suspended Solids	The greater of: 10% above upstream sample of the receiving stream, or maximum daily of 50 mg/L
5 Day Biochemical Oxygen Demand	5.0 mg/L
Dissolved Oxygen (D.O.) (These are Minimum Levels)	Minimum daily of 5.0 mg/L and weekly average of 6.5 mg/L
Ammonia-Nitrogen	Maximum daily of 2.5 mg/L and monthly average of 1.0 mg/L
Chlorides	Maximum monthly average of 120 mg/L
Acute Lethality Test Using Rainbow Trout (<i>Oncorhynchus mykiss</i>)	50% or greater survival in a 100% industrial runoff water sample
BTEX	Maximum monthly average of 1 ug/L
F1-F3 CCME Fraction Hydrocarbons	Maximum monthly average of 50 ug/L
pH	6.0 - 9.5 pH units
Floating Solids	Not present except in trace amounts
Visible Foam	Not present except in trace amounts
Oil and Grease	10 mg/L

4.2.12 Releases from the interception channels shall not exceed the limits specified in TABLE 4.2-B.

TABLE 4.2-B: LIMITS – INTERCEPTION CHANNELS

PARAMETER	LIMITS
Total Suspended Solids	Maximum daily of 50 mg/L
pH	6.0 - 9.5 pH units
Floating Solids	Not Present Except in Trace Amounts
Visible Foam	Not Present Except in Trace Amounts
Oil or Other Substances	Not Present in Amounts Sufficient to Create a Visible Film or Iridescent Sheen

MONITORING AND REPORTING

4.2.13 The approval holder shall monitor the sedimentation ponds and interception channels as specified in TABLE 4.2-C and TABLE 4.2-D throughout the release period, as appropriate, unless otherwise authorized in writing by the Director.

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4.2.14 The approval holder shall report to the Director the results of the monitoring as required in TABLE 4.2-C and TABLE 4.2-D, unless otherwise authorized in writing by the Director.

4.2.15 For the purpose of TABLE 4.2-C and TABLE 4.2-D:

- (a) sampling location A is defined as the discharge point of the locations specified in subsection 4.2.3(g), prior to mixing with the receiving stream; and
- (b) sampling location B is defined as the discharge point of the locations specified in subsection 4.2.3(h), prior to mixing with the receiving stream;

unless otherwise authorized in writing by the Director.

TABLE 4.2-C: MONITORING AND REPORTING FOR SEDIMENTATION PONDS

MONITORING			REPORTING			REPORT TO
Parameter, test or reporting requirement	Frequency	Sample Type	Sampling Location	Monthly	Annually	
Flow (in cubic metres/day)	Daily, during release	Calculated or estimated	A	Yes (as required by 4.2.22)	Yes (as required by 4.2.24)	Director
pH	3 times per week, during release	Grab	A			
Total Suspended Solids (in mg/L)	3 times per week, during release	Grab	A			
Nutrients, major cations and anions, DOC, DIC, TDS, hardness, alkalinity, electric conductivity	Weekly, during release	Grab	A			
5 Day Biochemical Oxygen Demand	Weekly, during release	Grab	A			
Ammonia-Nitrogen (in mg/L)	Weekly, during release	Grab	A			
Total recoverable and dissolved metals	Monthly, during release	Grab	A			
Total and methyl mercury at DL < 0.1 ng/L	Monthly, during release	Grab	A			
CCME F1, F2, F3 hydrocarbons (Characterize alkyl and parent PAHs if detected in F1-F3), BTEX	Monthly during release	Grab	A			
Naphthenic Acids	Monthly, during release	Grab	A			
Dissolved Oxygen (D.O.) (in mg/L)	3 times per week, during release (October 1 to March 31 only)	Grab	A			

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MONITORING			REPORTING			REPORT TO
Parameter, test or reporting requirement	Frequency	Sample Type	Sampling Location	Monthly	Annually	
96-Hour Acute Lethality Test Using Rainbow Trout (<i>Oncorhynchus mykiss</i>)	Monthly, during release	Grab	A			
48-Hour Static Acute Lethality Test Using Daphnia Magna	Monthly, during release	Grab	A			
Chronic Lethality Test Using Ceriodaphnia and Fathead Minnows (including Microtox IC metric)	Every two months, during release	Grab	A			
Sampling location A as defined in subsection 4.2.15						

TABLE 4.2-D: MONITORING AND REPORTING FOR INTERCEPTION CHANNELS

MONITORING			REPORTING			REPORT TO
Parameter, test or reporting requirement	Frequency	Sample Type	Sampling Location	Monthly	Annually	
Flow (in cubic metres/day)	Daily, during release	Calculated or estimated	B			Director
pH	3 times per week, during release	Grab	B			
Total Suspended Solids (in mg/L)	3 times per week, during release	Grab	B			
Nutrients, major cations and anions, DOC, DIC	Monthly, during release	Grab	B			
5 Day Biochemical Oxygen Demand	Monthly, during release	Grab	B			
Ammonia-Nitrogen (in mg/L)	Monthly, during release	Grab	B	Yes (as required by 4.2.22)	Yes (as required by 4.2.24)	
Total recoverable and dissolved metals	Monthly, during release	Grab	B			
Total and methyl mercury at DL < 0.1 ng/L	Monthly, during release	Grab	B			
CCME F1, F2, F3 hydrocarbons (Characterize alkyl and parent PAHs if detected in F1-F3), BTEX	Monthly during release	Grab	B			
Naphthenic Acids	Monthly, during release	Grab	B			
Dissolved Oxygen (D.O.) (in mg/L)	Weekly, during release (October 1 to March 31 only)	Grab	B			
Sampling location B as defined in subsection 4.2.15						

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- 4.2.16 The approval holder shall provide the following to the Director, if the acute lethality test using rainbow trout is equal to or less than 70% survival:
- (a) confirmation of test results;
 - (b) evaluation of potential sources of toxicity;
 - (c) a proposal on a course of action to mitigate toxicity; and
 - (d) any other information as requested in writing by the Director.
- 4.2.17 If the proposal referred to in subsection 4.2.16(c) is found deficient by the Director, the approval holder shall correct all deficiencies as outlined in writing by the Director, within the timeline specified in writing by the Director.
- 4.2.18 The approval holder shall implement the proposal referred to in subsection 4.2.16(c) as authorized in writing by the Director.
- 4.2.19 The approval holder shall submit a plan to the Director describing the actions to be implemented in order to mitigate any adverse effects detected by the Aquatic Environmental Effects Monitoring implemented under subsection 4.2.4.
- 4.2.20 The plan referred to in subsection 4.2.19 shall be submitted to the Director within 6 months of any actual or potential adverse effects being determined to be attributed to activities authorized by the approval, unless otherwise authorized in writing by the Director.
- 4.2.21 The approval holder shall implement the plan required in subsection 4.2.19, as authorized in writing by the Director.
- 4.2.22 The approval holder shall submit a monthly Industrial Wastewater and Runoff Report to the Director, unless otherwise authorized in writing by the Director.
- 4.2.23 The report required in subsection 4.2.22 shall include, at a minimum, all of the following information:
- (a) a summary of all monitoring data collected for TABLE 4.2-C and TABLE 4.2-D;
 - (b) in addition to reporting pursuant to subsection 2.1.1, a summary of any approval contraventions; and
 - (c) any other information as required in writing by the Director.
- 4.2.24 The approval holder shall submit an annual Industrial Wastewater and Runoff Report to the Director, unless otherwise authorized in writing by the Director.

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4.2.25 The report referred to in subsection 4.2.24 at a minimum, all of the following:

- (a) with respect to sedimentation pond releases:
 - (i) a description of all sedimentation ponds and outfalls;
 - (ii) a table including pond size (m³), latitude and longitude coordinates, catchment areas, types of discharge, discharge routes, discharge frequency and volumes, pond status, and decommissioning schedule;
 - (iii) a drainage map indicating all sedimentation ponds, catchment area boundaries, outfalls, drainage routes, flow direction, ultimate discharge locations and receiving streams;
 - (iv) all data collected in accordance with subsection 4.2.13, submitted in digital file when requested in writing by the Director;
 - (v) a description of quality assurance and quality control measures that were implemented and the data related to the implementation of those measures;
 - (vi) the results of toxicity testing and water quality monitoring including:
 - (A) for applicable parameters in TABLE 4.2-C, a summary of the annual average and monthly average mass release rates to the receiving stream in kg per day, including a description of the calculation or measurement methods that were used to quantify the mass release rate;
 - (B) a summary of each water quality parameter listed in TABLE 4.2-C, including the minimum and maximum annual values, the mean annual value, the median annual value, the standard deviation, the standard error, and a comparison with relevant guidelines and approval limits;
 - (C) a trend analysis of annual values (median and mean annual values) for water quality parameters that exceed approval contraventions or relevant guidelines; and
 - (D) appropriate charts and graphs to describe the data, demonstrate historical performances of applicable parameter and a comparison with relevant guidelines; and
 - (vii) an interpretation of the results of the monitoring;
- (b) with respect to interception channel releases:

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- (i) a description of all interception channels and outfalls to receiving streams;
 - (ii) a table including interception channel locations, catchment areas, types of discharge, discharge routes, discharge frequency and volumes, interception channel status, and decommissioning schedule;
 - (iii) a drainage map indicating all interception channels, catchment area boundaries, discharge locations, drainage routes, flow direction, ultimate discharge locations and receiving streams;
 - (iv) all data collected in accordance with subsection 4.2.13, submitted in digital file when required in writing by the Director;
 - (v) a description of quality assurance and quality control measures that were implemented and the data related to the implementation of those measures;
 - (vi) the results of water quality monitoring referred in TABLE 4.2-D; and
 - (vii) an interpretation of the results of the monitoring referred to in (vi);
- (c) with respect to industrial wastewater:
- (i) a description of all industrial wastewater ponds including enclosed industrial wastewater drainage system, recycle ponds, tailings ponds and any other industrial wastewater ponds;
 - (ii) a table including pond size (m³), site coordinates, types of wastewater, sources of wastewater, pumps and pipe or drainage connection routes, liners, groundwater monitoring wells, seepage collection and mitigation, pond status, decommissioning schedule and ultimate disposal of the industrial wastewater during the operation and at the end of mine life;
 - (iii) a map indicating all industrial wastewater ponds, pumps and pipe or drainage connection routes, catchment area boundaries if applicable, flow direction, ultimate discharge locations, potential spill ways and containment/mitigation measures if applicable;
 - (iv) a statement on the performance of the industrial wastewater and runoff control system during the previous year, and a description of any planned modifications in the coming year;
 - (v) a record of the quantity of substances which have been added to, or consumed in the plant's industrial process. The National Pollutant

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Release Inventory regulation shall be used as a guide to which substances to record and report;

- (vi) a record of the quantity of substances which may have an effect on the quality of the industrial wastewater generated. The National Pollutant Release Inventory regulation shall be used as a guide to which substances to record and report;
 - (vii) the volume of liquid (including solids fraction) discharged to the tailings ponds during each month;
 - (viii) the volume of liquid recycled to the extraction plant from the tailings ponds during each month;
 - (ix) the free water level in the tailings pond at the end of each calendar month;
 - (x) a wastewater (quantity and quality) characterization analysis of the recycle water pond and each tailings ponds; and
 - (xi) a water quantity and composition summary of non-tailings industrial wastewater or waste streams disposed to the tailings ponds;
- (d) a loading assessment for the affected receiving streams, by comparing changes in constituent loadings to the receiving streams, including identification and quantification of contaminant seepage to surface water, if any, considering modelled contaminant transport in groundwater;
 - (e) a discussion of water quality conditions at upstream and downstream sampling locations on the Athabasca River as compared to water quality triggers and limits for the Athabasca River at Old Fort as specified in the *Lower Athabasca Region Surface Water Quality Management Framework*;
 - (f) the aquatic environmental effects monitoring data collected in accordance with subsection 4.2.4;
 - (g) the results and associated discussions of the results from the plans referred to in subsections 3.3.4(e), 3.3.4(f), 3.3.4(g) and 3.3.4(h);
 - (h) the results and assessment from updated predictive aquatic models that are required to be recalibrated and run every five years;
 - (i) a summary of any approval contraventions; and
 - (j) any other information as required in writing by the Director.

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REGIONAL INITIATIVES

- 4.2.26 The approval holder shall participate in any regional initiatives as a result of management actions from the *Lower Athabasca Region Surface Water Quality Management Framework for the Lower Athabasca River*, Government of Alberta, 2012, as amended, to the satisfaction of the Director, when requested in writing by the Director.
- 4.2.27 The approval holder shall participate in any regional initiatives for the research and monitoring of the Peace Athabasca Delta and the Wood Buffalo National Park, to the satisfaction of the Director.

SECTION 4.3: WASTE MANAGEMENT

OPERATIONS

- 4.3.1 The approval holder shall only accept waste generated from the following sources:
- (a) the Frontier plant; and
 - (b) any other facilities as approved by the Director.
- 4.3.2 The approval holder shall dispose of waste generated at the plant only to facilities holding a current Approval, Registration, as otherwise authorized under the Act, or to facilities approved by a local environmental authority outside of Alberta.
- 4.3.3 The approval holder shall store hazardous waste or hazardous recyclables in containers or tanks in accordance with the *Hazardous Waste Storage Guidelines*, 1988, Alberta Environment, as amended.
- 4.3.4 The approval holder shall store all waste containers and unrinsed empty containers in waste storage areas.
- 4.3.5 The approval holder shall immediately transfer all waste that is unloaded to waste storage areas.
- 4.3.6 The approval holder shall use the following when transferring substances to, from, or between tanks, or between trucks:
- (a) couplings equipped with seals that are compatible with the substance transferred;
 - (b) the necessary precautions to prevent spills when the couplings are disconnected;
 - (c) emergency shut-off valves; and

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- (d) established transfer areas and associated curbing, paving and catchment areas.
- 4.3.7 Wastes shall be transferred only at designated transfer areas designed to contain spills and leaks.
- 4.3.8 The approval holder shall provide and maintain an adequate aisle space between containers in the waste storage area to allow inspection, unobstructed movement of personnel, fire protection equipment, spill control equipment and decontamination equipment to any area of the waste storage area. Inspection aisles shall be arranged such that each container is exposed to view from at least one side.
- 4.3.9 The approval holder shall prevent incompatible substances from coming into direct contact with one another.
- 4.3.10 The Director may amend this approval to add additional limits, targets or other requirements for managing tailings disposal, if further regulatory direction is provided in accordance with the following requirements:
 - (a) the *Lower Athabasca Region Tailings Management Framework for the Mineable Athabasca Oil Sands*, 2015, Alberta Government, as amended; and
 - (b) AER Directive 085: *Fluid Tailings Management for Oil Sands Mining Projects*, 2016, as amended.
- 4.3.11 The approval holder shall not use any chemicals for treating tailings unless the approval holder is authorized to do so in writing by the Director, or an approval amendment is obtained from the Director.
- 4.3.12 The approval holder shall prevent the placement of any forms of tailings within any end pit lakes.

MONITORING AND REPORTING

- 4.3.13 Prior to the consignment or storage of any waste generated at the plant, the approval holder shall identify, characterize and classify the waste but not including industrial runoff and air effluent streams, in accordance with the:
 - (a) *Industrial Waste Identification and Management Options*, Alberta Environment, 1996, as amended;
 - (b) *Alberta User Guide for Waste Managers*, Alberta Environment, 1996, as amended; and
 - (c) approved Waste Management Plan referred to in subsection 3.4.1.

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- 4.3.14 The approval holder shall measure or, when not practical to measure, estimate the quantity of waste generated at the plant each year.
- 4.3.15 The approval holder shall maintain an inventory of waste stored in waste storage areas supported by weekly inspections.
- 4.3.16 The approval holder shall compile all the information required by subsections 4.3.13 and 4.3.14 in an Annual Waste Management Summary Report:
 - (a) as indicated in TABLE 4.3-A; and
 - (b) in accordance with the:
 - (i) *Industrial Waste Identification and Management Options*, Alberta Environment, 1996 as amended; and
 - (ii) *Alberta User Guide for Waste Managers*, Alberta Environment, 1996, as amended.

TABLE 4.3-A: ANNUAL WASTE MANAGEMENT SUMMARY

WASTE NAME	UNIFORM WASTE CODE				QUANTITY (kg or L)		STORED	RECYCLED		DISPOSED	
	WC	PIN	Class	Mgmt	Hazardous	Non-hazardous	On-site	On-site	Off-site	On-site	Off-site
TOTAL											

- 4.3.17 The approval holder shall include in the report referred to in subsection 4.3.16, a summary of recycling, repurposing, or disposal of scrap tires associated with the mine fleet.
- 4.3.18 The approval holder shall submit the report referred to in subsection 4.3.16 to the Director.

SECTION 4.4: DOMESTIC WASTEWATER

Not used at this time.

SECTION 4.5: GROUNDWATER

MONITORING AND REPORTING

- 4.5.1 The approval holder shall submit a proposal for a Groundwater Monitoring Program for the Frontier project, which shall include, at a minimum, all of the following:

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- (a) a plan to gather additional information and to report on the hydrogeology, including but not limited to hydraulic properties, groundwater levels and baseline groundwater quality of the:
 - (i) Quaternary Channel along the western mine pit boundary; and
 - (ii) Quaternary, Basal McMurray (Basal Water Sands Aquifer) and Upper and Middle Devonian units in the external tailings pond area and between the project area and the Athabasca River;
- (b) a map and description of surface water drainage patterns;
- (c) a lithologic description and map(s), including cross-section(s), of the surficial and the upper bedrock geologic materials;
- (d) map(s) and cross-section(s) showing depth to water table or potentiometric surface, patterns of groundwater movement and hydraulic gradients;
- (e) the hydraulic conductivity of all surficial and bedrock materials;
- (f) lithologs of all boreholes drilled for groundwater investigation purposes;
- (g) construction and completion details of existing groundwater monitoring wells;
- (h) a site map showing the location and type of current and historical potential sources of groundwater contamination;
- (i) a map showing the location of existing and additional proposed groundwater monitoring wells;
- (j) a rationale for proposed groundwater monitoring well locations and completion depths, which includes consideration of potential sources of groundwater contamination, migration pathways and receptors including domestic use aquifers, springs and surface water bodies;
- (k) a description of groundwater monitoring well development protocols;
- (l) a list of parameters to be monitored and the monitoring frequency for each groundwater monitoring well or group of groundwater monitoring wells;
- (m) a description of the groundwater sampling and analytical QA/QC procedures;
- (n) details of a groundwater response plan specifying actions to be taken should contaminants be identified through the Groundwater Monitoring Program;
- (o) seepage management and monitoring plan, including but not limited to:

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- (i) details of seepage control system for the external tailings areas, including but not limited to interception well locations, well completion depths, pumping rates and supporting hydrogeologic information;
 - (ii) details of seepage control system performance monitoring plan and assessment criteria;
 - (iii) a plan to provide periodic updates to seepage modelling results for construction, operation and post closure phases of the project, based on additional geological information, aquifer test results and monitoring; and
 - (iv) updated contingency mitigation measures to limit the effects of seepage from external and in-pit tailings areas;
- (p) a Basal Water Sands aquifer depressurization monitoring plan, including but not limited to:
- (i) aquifer test results and interpretations for the Basal Water Sands;
 - (ii) a plan to monitor water levels, record depressurization water volumes and hydrochemistry;
 - (iii) a plan to provide periodic updates to hydrogeological numerical model based on additional geological information, aquifer test results and monitoring; and
 - (iv) details regarding participation with other industry operators in the regional delineation of the Basal McMurray Aquifer and basal water handling;
- (q) a summary of the engagement and collaboration efforts with indigenous groups on the plan, which shall include:
- (i) input received,
 - (ii) how the input was incorporated into the plan, and
 - (iii) identification of any areas of disagreement,
- (r) any other information relevant to groundwater quality at the project site; and
- (s) any other information as required in writing by the Director.

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- 4.5.2 The proposal referred to in subsection 4.5.1 shall be submitted to the Director, at least 24 months prior to commencement of operations of the external tailings pond system, unless otherwise authorized in writing by the Director.
- 4.5.3 If the Groundwater Monitoring Program proposal is found deficient by the Director, the approval holder shall correct all deficiencies as outlined in writing by the Director within 120 days of the deficiency letter.
- 4.5.4 The approval holder shall implement the Groundwater Monitoring Program referred to in subsection 4.5.1, as authorized in writing by the Director.
- 4.5.5 The samples extracted from the groundwater monitoring wells shall be collected using scientifically acceptable purging, sampling and preservation procedures so that a representative groundwater sample is obtained.
- 4.5.6 The approval holder shall:
- (a) protect from damage; and
 - (b) keep locked except when being sampled;
- all groundwater monitoring wells, unless otherwise authorized in writing by the Director.
- 4.5.7 If a representative groundwater sample cannot be collected because the groundwater monitoring well is damaged or is no longer capable of producing a representative groundwater sample, the approval holder shall:
- (a) clean, repair or replace the groundwater monitoring well; and
 - (b) collect and analyze a representative groundwater sample prior to the next scheduled sampling event;
- unless otherwise authorized in writing by the Director.
- 4.5.8 In addition to the sampling information recorded in subsection 2.2.2, the approval holder shall record the following sampling information for all groundwater samples collected:
- (a) a description of purging and sampling procedures;
 - (b) the static elevations above sea level, and depth below ground surface of fluid phases in the groundwater monitor well prior to purging;
 - (c) the temperature of each sample at the time of sampling;

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- (d) the pH of each sample at the time of sampling; and
- (e) the specific conductance of each sample at the time of sampling.

4.5.9 The approval holder shall carry out remediation of the groundwater in accordance with the following:

- (a) *Alberta Tier 1 Soil and Groundwater Remediation Guidelines*, Alberta Government, 2019, as amended; and
- (b) *Alberta Tier 2 Soil and Groundwater Remediation Guidelines*, Alberta Government, 2019, as amended.

4.5.10 The approval holder shall compile an Annual Groundwater Monitoring Program Summary Report, which shall include, at a minimum, all of the following:

- (a) a completed Record of Site Condition form, Alberta Energy Regulator, March 2019;
- (b) a legal land description and a map illustrating the project boundaries;
- (c) a topographic map;
- (d) a description of the industrial activity and processes;
- (e) a map showing the location of all surface and groundwater users and, a listing describing surface water and water well use details, within a five kilometre radius of the plant;
- (f) a general hydrogeological characterization of the region within a five kilometre radius of the plant;
- (g) a detailed hydrogeological characterization, including an interpretation of groundwater flow patterns;
- (h) geological cross-section(s) (3-dimensional maps) showing depth to water table, patterns of groundwater movement and hydraulic gradients, in order to illustrate the hydrogeologic framework for the aquifers being monitored;
- (i) borehole logs and completion details for groundwater monitoring wells;
- (j) a map showing locations of all known buried channels within at least five kilometres of the plant;
- (k) a map of surface drainage within the plant and surrounding area to include nearby water bodies;

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- (l) a map of groundwater monitoring well locations and a table summarizing the existing Groundwater Monitoring Program;
- (m) a summary of any changes to the Groundwater Monitoring Program made since the last groundwater monitoring report;
- (n) analytical data recorded as required in subsections 4.5.4 and 4.5.8;
- (o) a summary of fluid elevations recorded as required in subsection 4.5.8(b) and an interpretation of changes in fluid elevations;
- (p) an interpretation of QA/QC program results;
- (q) an interpretation of all the data in this report, including the following:
 - (i) diagrams indicating the location and extent of any contamination;
 - (ii) a description of probable sources of contamination; and
 - (iii) the extent of contamination identified;
- (r) a summary and interpretation of the data collected since the Groundwater Monitoring Program began, including:
 - (i) control charts which indicate trends in contaminant concentrations; and
 - (ii) the migration of contaminants;
- (s) a description of the following:
 - (i) contaminated groundwater remediation techniques employed;
 - (ii) source elimination measures employed;
 - (iii) risk assessment studies undertaken; and
 - (iv) risk management studies undertaken;
- (t) a sampling schedule for the following year;
- (u) recommendations, including at a minimum, the following:
 - (i) for changes to the Groundwater Monitoring Program; and
 - (ii) for remediation, risk assessment or risk management of contamination identified;

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- (v) a summary of participation undertaken in accordance with subsection 4.5.12;
- (w) an update on additional hydrogeologic investigations of the Quaternary Channel, Basal McMurray (Basal Water Sands Aquifer) and Devonian Formations;
- (x) details of the seepage management and monitoring program for the external tailings areas, including but not limited to:
 - (i) map(s) and table(s) showing locations and completion details of seepage interception structures including wells, ditches and barriers;
 - (ii) table(s) of measurements recorded as part of the seepage control system performance assessment program, including measurements of pumping rates, groundwater levels and groundwater quality;
 - (iii) a summary and interpretation of seepage control system performance assessment; and
 - (iv) recommendations for changes to the seepage management and monitoring program to make it more effective;
- (y) details from the Basal Water Sands Aquifer depressurization monitoring program, including as a minimum:
 - (i) a map displaying locations of Basal Aquifer depressurization wells;
 - (ii) a summary of Basal Aquifer depressurization pumping rates and volumes;
 - (iii) table(s) of historical groundwater quality measured from each Basal Aquifer depressurization well; and
 - (iv) a summary of and interpretation of how Basal Aquifer depressurization may affect results reported from groundwater monitoring wells;
- (z) a summary and interpretation of Devonian Formation hydraulic monitoring and testing undertaken as part of the Annual Mine Operation Plan (Karst Management Plan);
- (aa) an update on groundwater flow and solute transport model; and
- (bb) any other information as required in writing by the Director.

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- 4.5.11 The approval holder shall implement any proposals or changes outlined in the Annual Groundwater Monitoring Program Summary Report as authorized in writing by the Director.

REGIONAL INITIATIVES

- 4.5.12 The approval holder shall participate in regional groundwater initiatives supporting the Groundwater Management Framework for the Lower Athabasca Oil Sands Region, and will include at a minimum all of the following:

- (a) regional groundwater quality assessment studies;
- (b) development and implementation of a regional groundwater monitoring network;
- (c) continuous monitoring of the network; and
- (d) assessments of potential groundwater quality impacts to groundwater resources in the region;

on an ongoing basis and to the satisfaction of the Director.

SECTION 4.6: FISH, WILDLIFE AND BIODIVERSITY

OPERATIONS

- 4.6.1 The approval holder shall remove floating or emergent vegetation from the industrial wastewater pond footprint.
- 4.6.2 The approval holder shall have mitigation measures in place and shall take reasonable necessary steps to prevent wildlife from coming into contact with industrial wastewater.
- 4.6.3 The approval holder shall maintain a setback distance from the Athabasca River and its tributaries for the project area, as per Government of Alberta policy or as directed by the Director.
- 4.6.4 In addition to any other requirement specified in this approval, the approval holder shall conduct wildlife mitigation in accordance with the *Master Schedule of Standards and Conditions* (MSSC), Alberta Energy Regulator and Government of Alberta, November 22, 2018, as amended, unless otherwise authorized in writing by the Director.
- 4.6.5 The approval holder shall submit a Bird Protection Plan to the Director at least 180 days prior to commencement of operations, unless otherwise authorized in writing by the Director.

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4.6.6 The plan referred to in subsection 4.6.5 shall include the following, unless otherwise authorized in writing by the Director:

- (a) techniques and procedures, using the Best Available Technology Economically Achievable (BATEA), research and monitoring results, to prevent bird contact with industrial wastewater and to prevent bird mortalities associated with industrial wastewater, including but not limited to:
 - (i) reducing the attractiveness of ponds to birds through design, construction and operational measures;
 - (ii) prevention of and elimination of floating or emergent vegetation from the ponds;
 - (iii) minimizing the presence of floating bitumen from the ponds;
 - (iv) minimizing the bird nesting habitat around the ponds;
 - (v) minimizing habituation of birds to the ponds;
 - (vi) a description of the bird deterrent technology;
 - (vii) a description of bird deterrent locations, including a map;
 - (viii) a schedule for implementation of the bird deterrent program including initial start-up and annual deployment; and
 - (ix) a description of how adaptive management principles will be used to foster continuous improvement of the bird deterrent program;
- (b) a plan for monitoring and documenting:
 - (i) avian mortality;
 - (ii) avian contacts;
 - (iii) timing of incidents; and
 - (iv) bird species affected;

which is consistent with the Oil Sands Bird Contact Monitoring Program, or any other initiative deemed acceptable to the Director;
- (c) a plan to facilitate research into long-term effects of contact with industrial wastewater on bird health and survivorship;

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- (d) a description and results of a baseline study on stopover habitat use by migratory waterfowl in the project development area prior to the construction phase;
 - (e) a plan to monitor the occurrence, movements and habitat use of whooping cranes on and/or adjacent to the project development area; and
 - (f) any other information as required in writing by the Director.
- 4.6.7 If the plan referred to in subsection 4.6.5 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 4.6.8 The approval holder shall implement the plan referred to in subsection 4.6.5 as authorized in writing by the Director.
- 4.6.9 The approval holder shall submit a Wildlife and Caribou Mitigation and Monitoring Plan to the Director at least 180 days prior to the commencement of construction of the Frontier Oil Sands Project, unless otherwise authorized in writing by the Director.
- 4.6.10 The plan referred to in subsection 4.6.9 shall include, at a minimum, all of the following:
- (a) a description of the strategies that will be implemented to meet the desired outcomes as stated in the MSSC, as amended;
 - (b) a description of the approval holder's alignment with the Woodland Caribou Policy for Alberta, Alberta Sustainable Resource Development, 2011, as amended, including any Alberta caribou policies or range plans released prior to program submission;
 - (c) a description of the strategies that will be implemented to mitigate the effects of the project on Woodland Caribou, while aligning with the desired outcomes as stated in the Caribou Protection Plan Guidelines and Caribou Calving Information, Environment and Sustainable Resource Development, September 14, 2012, as amended;
 - (d) strategies for identifying wildlife features to meet MSSC requirements;
 - (e) a description of how the desired outcomes will be measured, and demonstrated;
 - (f) a description of the strategies and actions that will be implemented, considering the mitigation hierarchy, to mitigate project and site-specific effects on fish and wildlife species at risk and of cultural significance throughout the life of the project that may occur through:

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- (i) direct habitat loss,
 - (ii) indirect habitat loss,
 - (iii) habitat fragmentation and effects on fish and wildlife movement, and
 - (iv) mortality;
- (g) detailed descriptions of mitigation measures to minimize project-induced impacts to fisheries and aquatic habitat at a Hydrologic Unit Class 8 scale;
- (h) a description of the adaptive management approach that will be used to assess and improve the effectiveness of mitigations;
- (i) a description of how the wildlife monitoring will align with and support regional monitoring, consistent with provincially recognized priorities;
- (j) a description of methods that will be implemented to prevent habituation of nuisance wildlife, consistent with Alberta Bear Smart Guidelines, 2011, as amended;
- (k) methods to prevent bird collisions with project infrastructure, including towers and transmission lines;
- (l) measures to maintain and facilitate habitat connectivity throughout the life of the project, within the project area, and between the project area and adjacent lands;
- (m) avoidance of wildlife species at risk habitat and migrating bird nests and application of appropriate setbacks to key wildlife habitat features and nests;
- (n) identification of areas of potential risks for wildlife;
- (o) measures to prevent wildlife from coming into contact with areas of risk for wildlife as identified in subsection 4.6.10 (l) including, but not limited to, disturbed areas that may contain process affected waters or bitumen;
- (p) a plan and schedule to conduct research and monitoring to address at a minimum, the following:
- (i) the presence, general abundance and distribution of wildlife in the local study area;
 - (ii) early successional wildlife establishment including habitat; and

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- (iii) the specific habitat requirements of species at risk for the purposes of reclamation planning;
 - (q) progress in achieving the wildlife habitat levels as outlined in subsection 7.4.12;
 - (r) wildlife habitat use on the reclaimed land;
 - (s) a description of the strategies that will be implemented to mitigate the effects of the project on moose and moose habitat; and
 - (t) any other information as required in writing by the Director.
- 4.6.11 If the plan referred to in subsection 4.6.9 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 4.6.12 The approval holder shall implement the plan referred to in subsection 4.6.9 as authorized in writing by the Director.
- 4.6.13 The approval holder shall submit a Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan to the Director at least 180 days prior to the commencement of construction of the Frontier Oil Sands Project, unless otherwise authorized in writing by the Director.
- 4.6.14 The plan referred to in subsection 4.6.13 shall include, at a minimum, the following:
- (a) a description of the strategies that will be implemented to meet the desired outcomes of preventing range shift and contact between the Ronald Lake bison herd and the Delta bison herd in Wood Buffalo National Park;
 - (b) a description of how the desired outcomes identified in (a) will be measured and demonstrated;
 - (c) the probability of success of the strategies identified in (a);
 - (d) a description of the strategies and actions that will be implemented, considering the mitigation hierarchy, to mitigate project and site-specific effects on the Ronald Lake bison herd throughout the life of the project that may occur through:
 - (i) direct habitat loss,
 - (ii) indirect habitat loss,
 - (iii) habitat fragmentation and effects on fish and wildlife movement,

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- (iv) disease risk, and
- (v) mortality;
- (e) a description of the adaptive management approach that will be used to assess and improve the effectiveness of mitigations;
- (f) a description of how the monitoring will align with and support regional monitoring, consistent with provincially and federally recognized priorities;
- (g) measures to maintain and facilitate habitat connectivity throughout the life of the project, within the project area, and between the project area and adjacent lands;
- (h) a plan and schedule to conduct research and monitoring to address at a minimum, the following:
 - (i) the presence, general abundance and distribution of the Ronald Lake bison herd;
 - (ii) the specific habitat requirements of the Ronald Lake bison herd for the purposes of reclamation planning; and
 - (iii) the risk of range shift and contact between the Ronald Lake bison herd and the Delta bison herd in Wood Buffalo National Park;
- (i) progress in achieving the Ronald Lake bison herd's habitat levels as outlined in subsection 7.4.12;
- (j) Ronald Lake bison herd's use on the reclaimed land;
- (k) a summary of the engagement and collaboration efforts with indigenous groups on the plan, which shall include:
 - (i) input received,
 - (ii) how the input was incorporated into the plan, and
 - (iii) identification of any areas of disagreement, and
- (l) any other information as required in writing by the Director.

4.6.15 If the plan referred to in subsection 4.6.13 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

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4.6.16 The approval holder shall implement the plan referred to in subsection 4.6.13 as authorized in writing by the Director.

MONITORING AND REPORTING

4.6.17 The approval holder shall submit a Bird Protection Plan Annual Report to the Director, unless otherwise authorized in writing by the Director.

4.6.18 The report referred to in subsection 4.6.17 shall include, at a minimum, all of the following:

- (a) summary of activities related to the implementation of the Bird Protection Plan for the previous year;
- (b) summary of the results of monitoring and research conducted;
- (c) proposed adjustments to the Bird Protection Plan for the upcoming year;
- (d) maps and figures as needed to illustrate (a) to (c) above; and
- (e) any other information requested in writing by the Director.

4.6.19 The approval holder shall implement any proposed changes outlined in the report referred to in subsection 4.6.17 as authorized in writing by the Director.

4.6.20 The approval holder shall submit a Comprehensive Wildlife Report to the Director according to the following schedule:

- (a) for the first Comprehensive Wildlife Report, on or before July 15, 2022;
- (b) for the second Comprehensive Wildlife Report, on or before July 15, 2025;
and
- (c) for the third Comprehensive Wildlife Report , on or before July 15, 2028;

unless otherwise authorized in writing by the Director.

4.6.21 The report referred to in subsection 4.6.20 shall include, at a minimum, all of the following:

- (a) the methods and results of the monitoring conducted in the Ronald Lake Bison, Wildlife, and Caribou Mitigation and Monitoring Programs;
- (b) the mitigations implemented in the Ronald Lake Bison, Wildlife, and Caribou Mitigation and Monitoring Programs;

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- (c) discussion of the effectiveness of the mitigations implemented in the Ronald Lake Bison, Wildlife, and Caribou Mitigation and Monitoring Programs relative to measureable outcomes as identified in the approved Ronald Lake Bison, Wildlife, and Caribou Mitigation and Monitoring Programs;
- (d) adaptive management measures taken or planned;
- (e) changes in habitat availability and habitat conditions for species at risk and of cultural significance, which have been identified in the application, stakeholder consultation, and Wildlife Sensitivity Maps, as amended;
- (f) changes proposed to the:
 - (i) Wildlife, and Caribou Mitigation and Monitoring Programs; and
 - (ii) Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan;
- (g) a summary of methods used and/or results obtained through the regional wildlife monitoring initiatives below:
 - (i) Oil Sands Bird Contact Monitoring Program in subsection 4.6.6(b);
 - (ii) Ronald Lake bison herd's independent evaluation committee in subsection 4.6.28;
 - (iii) any other regional wildlife monitoring initiative the approval holder participates in;
- (h) a summary of methods used and results obtained for project specific monitoring conducted pursuant to the Bird Protection Plan in subsection 4.6.5;
 - (i) proposed changes to any of the regional or project specific initiatives described in (g) and (h); and
 - (j) any other information as required in writing by the Director.

4.6.22 The approval holder shall implement the proposed changes to the mitigation and monitoring programs outlined in the report referred to in subsection 4.6.20 as authorized in writing by the Director.

REGIONAL INITIATIVES

4.6.23 To the satisfaction of the Director, the approval holder shall participate in the Oil Sands Bird Technical Team (OSBTT), and OSBTT directed research projects to

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support the Oil Sands Bird Contact Monitoring Program and provide the information described in subsection 4.6.6.

4.6.24 To the satisfaction of the Director, the approval holder shall fund, participate and provide in-kind support to the Ronald Lake Bison Technical Team (RLBTT), and RLBTT directed research projects to support the Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan and provide the information described in subsection 4.6.14(h).

4.6.25 To the satisfaction of the Director, the approval holder shall participate in regional initiatives that assess wildlife and fish resources, to accomplish the following:

- (a) analysis of regional data sets, supplemented by additional field data where necessary, to validate fish and wildlife habitat suitability index (HSI) models; and
- (b) long-term monitoring of specifically selected species and species at risk to quantify cumulative impacts on wildlife and fish populations in the region;

unless otherwise authorized in writing by the Director.

4.6.26 To the satisfaction of the Director, the approval holder shall monitor the long-term cumulative effects on biodiversity and wildlife in the region, through regional initiatives.

4.6.27 To the satisfaction of the Director, the approval holder shall participate in regional biodiversity initiatives supporting for the development of the Biodiversity Management Framework.

4.6.28 The approval holder shall provide financial and in-kind support for an independent evaluation of the proposed mitigation measures to prevent range shift and contact between the Ronald Lake bison herd and the Delta bison herd in Wood Buffalo National Park.

PART 5: ENVIRONMENTAL MONITORING FOR RESEARCH AND DEVELOPMENT

SECTION 5.1: TAILINGS

REPORTING

5.1.1 The approval holder shall submit or cause to be submitted to the Director, a Tailings Research Report on environmental aspects of tailings research and development according to the following schedule:

- (a) for the first Tailings Research Report, on or before April 30, 2021; and

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(b) subsequent Tailings Research Reports every three years thereafter;
unless otherwise authorized in writing by the Director.

5.1.2 The report referred to in subsection 5.1.1 shall include, at a minimum, all of the following:

(a) for general:

- (i) tailings research projects and findings during the last three-year period;
- (ii) planned tailings research and development activities for the next five year period; and
- (iii) research assumptions, predictions, and validations concerning long term chemistry and mineralogy of tailings, tailings water, and additives or polymers, and their implications to the environment, human health and reclamation, based on research topics referred to in subsection 5.1.2;

(b) for terrestrial ecosystem research:

- (i) time required for tailings to consolidate to a trafficable surface;
- (ii) capping research that identifies capping objectives in addition to rooting-zone protection for tailings deposits and defines the capping requirements to fulfill these objectives;
- (iii) capping materials required to cover tailings deposits;
- (iv) geotechnical stability of reclaimed tailings and their surfaces over time;
- (v) settlement rate over reclaimed tailings deposit and its potential impacts to terrestrial ecosystem;
- (vi) characterization of tailings release water and any treatment required;
- (vii) movement of salts from tailings release water during deposition or seepage and its impact on plant development due to the uptake of organic compounds, heavy metals and salts from tailings release water;
- (viii) techniques required to isolate tailings waters from terrestrial lands;

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- (ix) identification of local native vegetation species suitable for re-establishment on terrestrial lands affected by tailings waters; and
- (x) seepage of tailings release water into groundwater, including:
 - (A) expected volumes of water entering the groundwater regimes;
 - (B) flow regimes of the groundwater;
 - (C) impacts of affected groundwater; and
 - (D) any proposed mitigation that may be implemented;
- (c) for wetland ecosystem research:
 - (i) hydrologic models to create treatment wetlands or other wetland types associated with tailings in the reclaimed landscape;
 - (ii) capping objectives in addition to rooting-zone protection for wetland ecosystems on tailings deposits;
 - (iii) suitable capping materials and depth of reclamation materials required to cover tailings deposits;
 - (iv) chemical characterization (composition, concentration, toxicity) and rate of pore water release and surface runoff from tailings deposits;
 - (v) environmental fate, including degradation rates of substances of concern in tailings release waters, their partitioning and modelling of sediment-water column interactions;
 - (vi) stability of reclaimed tailings surfaces over time, the implications to the size and type of wetland ecosystems and the ability to create self-sustaining, locally common boreal forest wetlands;
 - (vii) impact of all potentially released waters on aquatic ecosystems, including the impact on sediments;
 - (viii) identification of suitable soils, site preparation and soil placement for wetlands constructed on tailings deposits or those affected by tailings water inflows;
 - (ix) wetland revegetation including:
 - (A) identification of local native wetland vegetation species suitable to inhabit the tailings affected wetlands; and

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- (B) revegetation techniques for target wetland vegetation species suitable to inhabit the tailings wetlands;
- (x) seepage of tailings release water into groundwater or surface water, including:
 - (A) expected volumes of water release into either groundwater or surface runoff;
 - (B) flow regimes of the groundwater and surface waters;
 - (C) impacts to groundwater or surface waters and subsequent down gradient or downstream effects; and
 - (D) any proposed mitigation that may be implemented;
- (xi) validation of expected scenarios with field-collected data that describes hydrology and water quality of tailings seepage within the receiving environment;
- (xii) identification of seepage water released from tailings, placed coversoil, subsoil or overburden into groundwater or surface water; and
- (xiii) validation that developing wetlands are from surface drainage and not from breakthrough of tailings to the surface;
- (d) for human health risk assessment:
 - (i) an assessment of human receptor exposure to industrial wastewaters and tailings material stored at the plant site, as well as the impacts from reclamation activities; and
 - (ii) the chemicals to be evaluated in the human health risk assessment shall include, but not limited to:
 - (A) dust (PM2.5 and PM10);
 - (B) salts;
 - (C) naphthenic acids (acid extractable organics);
 - (D) acrylamide and polyacrylamide or any applied coagulants and flocculants in the dried tailings, in-pit treated tailings deposit and the associated pore water, expressed water or throughflow;

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- (E) reduced sulphur compounds; and
 - (F) naturally occurring radioactive material;
- (e) for long-term chemistry and mineralogy:
- (i) assessment of the long-term chemistry and mineralogy of treated tailings deposit including the buffering capacity of tailings material and associated pore water, expressed water, or throughflow in mine tailings deposits, and changes in their chemical and mineralogical composition under varying reduction-oxidation conditions;
 - (ii) detailed examination of the biogeochemical processes and probable geochemical end points of processes occurring within the products resulting from the tailings process, with specific attention to reduction-oxidation processes under water saturated and unsaturated conditions;
 - (iii) a description of a water monitoring program that includes mass balance, sampling procedures, sampling frequency and chemical composition analysis of the water within and resulting from the bitumen extraction process;
 - (iv) detailed evaluation of concentrations of acrylamide and polyacrylamide or any applied coagulants and flocculants in the dried tailings, in-pit treated tailings deposit and the associated pore water, expressed water, or throughflow;
 - (v) examination of whether the monitoring and research results alter the conclusions put forth in the application with respect to ecological or human health effects; and
 - (vi) investigation of long term stability, physical and chemical, of materials added to tailings, such as coagulants and flocculants, and their influence on geotechnical stability, settlement rate and water holding capacity of treated tailings; and
- (f) any other information as required in writing by the Director.

5.1.3 If the report referred to in subsection 5.1.1 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

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SECTION 5.2: END PIT LAKES

REPORTING

- 5.2.1 The approval holder shall submit an End Pit Lake Research and Development Report to the Director, on or before April 30, 2021, and every two years thereafter, unless otherwise authorized in writing by the Director.
- 5.2.2 The report referred to in subsection 5.2.1 shall address, at a minimum, all of the following:
- (a) a proposed schedule for all research and development undertaken, including a mechanism to track progress towards meeting the schedule over time;
 - (b) water budgets and solute mass balances for end pit lakes including quantities, sources and quality of water to be used to fill the lake, and including groundwater recharge and seepage rates and quality;
 - (c) estimates of end pit lakes' water quality concentrations at closure for parameters identified as substances of concern by the Director, including assumptions on decay rates and partitioning;
 - (d) confirmation of the assumptions and expectations for water quality release outlined in the application, including refinement, update, and validation of the predictive models;
 - (e) identification of key uncertainties in the water budget and solute mass balances and proposed research to address these uncertainties with particular attention to the hydrology of the effective catchment area, uncertainty due to potential climate change and connectivity with groundwater;
 - (f) an indication of treatment efficiency required for end pit lakes to maintain suitable water quality given the quality of the source waters identified in (a) and the research;
 - (g) the role of wetlands, riparian habitat and littoral zone in creating continuity between the reclaimed landscape and end pit lakes;
 - (h) watershed hydrologic connections and associated closure goals and targets for fish and fish habitat;
 - (i) consideration of potential elevated contaminant influences on fish ecology, health, palatability and consumption safety;

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- (j) consideration of long-term shoreline retrogression and related effects on littoral zone, adjacent wetlands, landforms, and water budget and solute mass balances (especially in relation to evaporation);
- (k) identification of research that will be required to ensure end pit lakes adequately:
 - (i) treats site drainage;
 - (ii) provides a sustainable aquatic ecosystem and aquatic habitat;
 - (iii) is geotechnically stable; and
 - (iv) achieves other functions such as shoreline protection and flood buffering;
- (l) lake design features which:
 - (i) promote natural biodegradation and detoxification rates for toxic parameters;
 - (ii) minimize erosion and protect shorelines;
 - (iii) promote recreational, domestic and commercial fisheries potential; and
 - (iv) optimise water residence time with particular consideration of salinity;
- (m) biodegradation, detoxification and dilution of parameters identified as substances of concern by the Director;
- (n) adaptive incorporation of any guidelines prepared or provided by the Director related to end pit lakes;
- (o) data submission and reporting schedule;
- (p) applicability, uncertainties/risks assessment, learnings and lessons of other oil sands end pit lakes' research projects;
- (q) the research related to human health risk assessment and long term chemistry and minerology for end pit lakes; and
- (r) any other information as required in writing by the Director.

5.2.3 If the report referred to in subsection 5.2.1 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

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REGIONAL INITIATIVES

- 5.2.4 The approval holder shall participate in regional end pit lakes' research and monitoring initiatives, to the satisfaction of the Director.
- 5.2.5 The approval holder shall support and participate in the development of end pit lakes' performance criteria and targets through regional initiatives, to the satisfaction of the Director.

SECTION 5.3: WETLANDS

MONITORING AND REPORTING

- 5.3.1 The approval holder shall undertake or participate in a study on reclamation techniques that examines the viability of bog/fen creation for a portion of the final landscape.
- 5.3.2 The approval holder shall submit a Wetland Research Plan to the Director, on or before September 30, 2020, unless otherwise authorized in writing by the Director.
- 5.3.3 The plan referred to in subsection 5.3.2 shall include, at a minimum, the following:
- (a) a five year plan and schedule to conduct wetland research through regional initiatives or approval holder led initiatives;
 - (b) a plan and schedule to build at least one site specific pilot wetland;
 - (c) provide opportunities for monitoring, model validation, and other wetland research initiatives, and incorporation of findings into the update of the *Guideline for Wetland Establishment on Reclaimed Oil Sands Leases*, Cumulative Environmental Management Association (CEMA), 2014, as amended;
 - (d) expected criteria and performance measures for reclaimed wetlands including measures of wetland sustainability (including water quality and quantity), ecological function, traditional use, and biodiversity;
 - (e) development of hydrology models for the creation of sustainable wetlands;
 - (f) reclamation material salvage and placement techniques including consideration for vegetative propagule retention;
 - (g) vegetation establishment techniques;
 - (h) development of tools and techniques to manage source and availability of target vegetation species over time;

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- (i) assessment of ecological function of wetland types and potential to maintain and enhance biodiversity;
 - (j) for wetlands specifically designed for treatment, demonstration of predicted wetland treatment efficacy, including but not limited to an assessment of the following:
 - (i) identification of input and output water quality required;
 - (ii) water retention times;
 - (iii) capacity for treatment;
 - (iv) needs for active management;
 - (v) additional criteria for these treatment wetlands;
 - (vi) targeted vegetation species and their density; and
 - (vii) long-term plans for the treatment wetlands, including plans for vegetation management, decommissioning, and/or conversion to wetlands with other uses and functions;
 - (k) a plan for dissemination of results of any research undertaken;
 - (l) data submission and reporting schedule; and
 - (m) any other information as required in writing by the Director.
- 5.3.4 If the plan referred to in subsection 5.3.2 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 5.3.5 The approval holder shall implement the plan referred to in subsection 5.3.2 as authorized in writing by the Director.
- 5.3.6 Any changes to the plan referred to in subsection 5.3.2 shall be authorized in writing by the Director before implementation.
- 5.3.7 The approval holder shall submit a Wetland Monitoring Plan to the Director, on or before December 31, 2020, unless otherwise authorized in writing by the Director
- 5.3.8 The plan referred to in subsection 5.3.7 shall include, at a minimum, all of the following:
- (a) a summary of any wetland and water body monitoring conducted to date;

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- (b) an analysis of the results from monitoring conducted in (a);
- (c) a plan to monitor natural undisturbed wetlands for natural variability to serve as reference conditions for comparing against potentially impacted or reclaimed wetlands;
- (d) a plan to monitor and understand the effects of mine development on wetlands potentially impacted by oil sands mining, including but not limited to the following:
 - (i) direct and indirect hydrological alterations including surface water and groundwater withdrawals;
 - (ii) seepage, drainage, dewatering and industrial runoff;
 - (iii) roads or other infrastructure constructed within wetlands; and
 - (iv) any other disturbances that may affect wetlands;
- (e) corrective measures and a schedule of implementation, where appropriate, to protect oil sands mine affected wetlands outside of the project area;
- (f) reporting schedule; and
- (g) any other information as required in writing by the Director.

5.3.9 If the plan referred to in subsection 5.3.7 is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

5.3.10 The approval holder shall implement the plan referred to in subsection 5.3.7 as authorized in writing by the Director.

5.3.11 Any changes to the plan referred to in subsection 5.3.7 shall be authorized in writing by the Director before implementation.

REGIONAL INITIATIVES

5.3.12 The approval holder shall participate in the activities of regional wetland research initiatives, to the satisfaction of the Director.

5.3.13 The approval holder shall identify and participate in regional initiative(s) to develop a consistent approach to gathering the information described in subsection 5.3.8.

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PART 6: FINANCIAL SECURITY

SECTION 6.1: MINE FINANCIAL SECURITY PROGRAM

- 6.1.1 The approval holder shall calculate, report and submit financial security in accordance with the:
- (a) *Mine Financial Security Program Standard*, AER, 2014, as amended; and
 - (b) *Guide to the Mine Financial Security Program*, AER, 2017, as amended.

PART 7: RECLAMATION

SECTION 7.1: GENERAL

- 7.1.1 The approval holder shall conduct reclamation as described in the application unless otherwise:
- (a) specified in this approval; or
 - (b) authorized in writing by the Director.

SECTION 7.2: DECOMMISSIONING

- 7.2.1 The approval holder shall apply for an amendment to this approval to reclaim the plant by submitting to the Director, a:
- (a) Decommissioning Plan; and
 - (b) Land Reclamation Plan.

- 7.2.2 The approval holder shall submit the:

- (a) Decommissioning Plan; and
- (b) Land Reclamation Plan;

referred to in subsection 7.2.1, at least one year prior to the plant ceasing operation, except for repairs and maintenance, unless otherwise authorized in writing by the Director.

SECTION 7.3: RECLAMATION AND LIFE OF MINE CLOSURE PLANNING

- 7.3.1 The approval holder shall reclaim disturbed land to a self-sustaining, locally common boreal forest ecosystem, integrated with the surrounding area, unless otherwise authorized in writing by the Director.

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- 7.3.2 Using the pre-disturbance landscape as a reference for mine reclamation and closure planning, the approval holder shall return an acceptable distribution of upland ecosite phases and wetland types on the post-disturbance landscape, as presented and updated through Mine Reclamation Plans, Life of Mine Closure Plans, and approval amendment applications.
- 7.3.3 The approval holder shall submit a Life of Mine Closure Plan to the Director, on or before December 31, 2020, unless otherwise authorized in writing by the Director.
- 7.3.4 The approval holder shall prepare Life of Mine Closure Plans, in accordance with *Specified Enactment Direction 003: Direction for Conservation and Reclamation Submissions under an Environmental Protection and Enhancement Act Approval for Mineable Oil Sands Sites*, December 2018, as amended, unless otherwise directed in writing by the Director.
- 7.3.5 In addition to the requirement specified in subsection 7.3.4, Life of Mine Closure Plans shall include:
- (a) strategies to minimize and mitigate any impacts to the Annual Allowable Cut by the plant;
 - (b) a description of the following, related to the Growth and Yield Program referred to in subsection 7.3.16(c):
 - (i) a schedule for establishment of relevant permanent and temporary sample plots,
 - (ii) a description of how these plots meet the objectives of monitoring forest yield and forest ecosystem development, and of providing trend information on silvicultural strategies and treatments, and reclamation success, and
 - (iii) a description of the sampling protocols for varying types of plots;
 - (c) a program proposal to conduct research on preserving rare plant propagules, and on the successful transplant procedures onto reclaimed sites;
 - (d) a program proposal to demonstrate continuous improvement in biodiversity, both in the number of species planted and on the number of habitat community types on reclaimed sites, by meeting the following:
 - (i) planting additional species that are above the minimum number of species recommended in the *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region*, Cumulative Environmental Management Association (CEMA), 2010, and

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- (e) a reporting schedule proposal on the programs referred to in (c) and (d), to validate continuous improvement in biodiversity on reclaimed sites; and
- (f) a summary of the engagement and collaboration efforts with indigenous groups on the plan, which shall include:
 - (i) input received,
 - (ii) how the input was incorporated into the plan, and
 - (iii) identification of any areas of disagreement,

unless otherwise directed in writing by the Director.

7.3.6 Five years prior to disturbance of the following areas, the approval holder shall submit focused Life of Mine Closure Plans to the Director:

- (a) south lease boundary area; and
- (b) north pit area.

7.3.7 The Life of Mine Closure Plan for the north pit area referred to in subsection 7.3.6(b), shall include a design for the north mine end pit lake watershed, such that flows in Buckton Creek at the 27th Baseline (Wood Buffalo National Park boundary) are within 5% of natural flows.

7.3.8 If Life of Mine Closure Plans are found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

7.3.9 The approval holder shall implement Life of Mine Closure Plans, as authorized in writing by the Director or as set out in an approval amendment obtained from the Director.

7.3.10 The approval holder shall submit a Mine Reclamation Plan to the Director according to the following schedule:

- (a) on or before December 31, 2019;
- (b) on or before September 30, 2022;
- (c) on or before September 30, 2025; and
- (d) on or before September 30, 2028;

unless otherwise authorized in writing by the Director.

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- 7.3.11 The approval holder shall prepare each Mine Reclamation Plan referred to in subsection 7.3.10, in accordance with *Specified Enactment Direction 003: Direction for Conservation and Reclamation Submissions under an Environmental Protection and Enhancement Act Approval for Mineable Oil Sands Sites*, December 2018, as amended, unless otherwise directed in writing by the Director.
- 7.3.12 If the Mine Reclamation Plans are found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.
- 7.3.13 The approval holder shall implement the Mine Reclamation Plans referred to in subsection 7.3.10, as authorized in writing by the Director.
- 7.3.14 In addition to the requirements specified in subsections 7.3.4 and 7.3.11, the Life of Mine Closure Plan and the Mine Reclamation Plans shall each:
- (a) be consistent with the values and objectives in the *Fort McMurray-Athabasca Oil Sands Subregional Integrated Resource Plan*, Alberta Sustainable Resource Development, 2002, as amended;
 - (b) be consistent with the *Lower Athabasca Regional Plan (2012-2022)*, Alberta Government, 2012, as amended, under the *Land Use Framework*, Alberta Government, 2008, as amended;
 - (c) be consistent with completed sub-regional plans associated with the *Lower Athabasca Regional Plan (2012-2022)*, Alberta Government, 2012, as amended, under the *Land Use Framework*, Alberta Government, 2008, as amended;
 - (d) be consistent with the *Lower Athabasca Region Tailings Management Framework for the Mineable Athabasca Oil Sands*, Government of Alberta, 2015, as amended, and *Directive 085 Fluid Tailings Management for Oil Sands Mining Projects*, AER, 2016, as amended; and
 - (e) ensure that reclaimed features have natural appearances characteristic of the region.
- 7.3.15 Harvesting, clearing, and reforestation information to be provided in the Mine Reclamation Plans, and the Life of Mine Closure Plan referred to in subsection 7.3.3, shall be suitable for integration into the applicable Forest Management Plan, unless otherwise directed in writing by the Director.
- 7.3.16 The approval holder shall:
- (a) complete and submit vegetation surveys on all reclaimed areas using survey systems in compliance with the *Alberta Regeneration Standards for the*

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Mineable Oil Sands, Alberta Environment and Sustainable Resource Development, 2013, as amended, and any other applicable standards approved by the Government of Alberta for use at oil sands mines;

- (b) submit records of activity and performance, in a format and following protocols acceptable to the Government of Alberta, related to the revegetation of reclaimed lands;
- (c) establish a Growth and Yield Program as approved by the Government of Alberta for reclaimed lands, consistent with the requirements of the *Alberta Forest Management Planning Standard*, Alberta Sustainable Resource Development, 2006, as amended;
- (d) comply with the requirements of the *Alberta Forest Genetic Resource Management and Conservation Standards*, Alberta Agriculture and Forestry, 2016, as amended; and
- (e) comply with any Government of Alberta policy related to the deployment of propagules for use in reclamation;

unless otherwise authorized in writing by the Director.

SECTION 7.4: PROGRESSIVE RECLAMATION

BACKFILLING AND CONTOURING

- 7.4.1 The approval holder shall not bury snow, ice, or other material, which causes instability or unacceptable settlement in tailings sand and overburden disposal areas or mined out pits.
- 7.4.2 The approval holder shall recontour all final slopes no steeper than 3 horizontal to 1 vertical (18°), over the total height of any engineered structure, unless otherwise authorized in writing by the Director.
- 7.4.3 The approval holder shall construct all structures and slopes to be geotechnically stable with minimal erosion.
- 7.4.4 The approval holder shall design all landforms to have self-sustaining and integrated surface drainage systems to convey surface runoff to adjacent watercourses, waterbodies, or wetlands.
- 7.4.5 Subject to subsection 4.2.3, the approval holder shall establish surface drainage on disturbed land that is integrated with undisturbed land.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

PLACEMENT OF RECLAMATION MATERIAL

7.4.6 The approval holder shall use all coversoil and subsoil salvaged according to Section 3.6 of this approval for the purpose of reclamation.

7.4.7 Prior to placement of reclamation material as per subsection 7.4.8, the approval holder shall provide rooting-zone protection by capping the following materials and locations with a minimum average depth of 1.0 m of suitable overburden or tailings sand which meets the chemical criteria for suitable overburden:

- (a) impervious material such as rock;
- (b) overburden containing elevated concentrations of petroleum hydrocarbons;
- (c) Clearwater overburden;
- (d) reject from oil sands processing;
- (e) centrifuged tailings; and
- (f) the plant developed area;

unless otherwise authorized in writing by the Director.

7.4.8 The approval holder shall place reclamation material as follows:

- (a) a minimum average depth of 0.5 m (50 cm) fine textured fluvial fan material on:
 - (i) materials and locations referred to in subsection 7.4.7; and
 - (ii) substrate which meets the chemical criteria for suitable overburden; and
- (b) a minimum average depth of 0.2 m (20 cm) of coversoil other than fine textured fluvial fan material on:
 - (i) materials and locations referred to in subsection 7.4.7; and
 - (ii) substrate which meets the chemical criteria for suitable overburden;

unless otherwise authorized in writing by the Director.

7.4.9 Notwithstanding subsection 7.4.8, the Director may authorize in writing a reduction of the minimum average depth of reclamation material in consideration of underlying substrate, slope-position, aspect and the revegetation target.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

7.4.10 The approval holder shall conduct a survey of reclamation material after placement to assess the following parameters as they affect establishment of vegetation:

- (a) depth;
- (b) physical properties; and
- (c) chemical properties;

using standard protocols found acceptable to the Director.

7.4.11 The approval holder shall report on the results of the assessment referred to in subsection 7.4.10 in the annual report referred to in subsection 7.6.1.

BIODIVERSITY ON THE RECLAIMED LANDSCAPE

7.4.12 To the satisfaction of the Director, the approval holder shall:

- (a) re-establish, at a minimum, a diversity of fish, moose, bison and other wildlife habitat levels on the reclaimed land similar to that which existed prior to disturbance, in appropriate proportions relative to the currently authorized Life of Mine Closure Plan;
- (b) demonstrate through monitoring, progress in achieving a diversity of fish, moose, bison and other wildlife habitats levels on the reclaimed land as outlined in (a); and
- (c) demonstrate through monitoring, progress in achieving a net positive impact on biodiversity in the region.

SECTION 7.5: RECLAMATION MONITORING

7.5.1 The approval holder shall submit a Reclamation Monitoring Program proposal to the Director, when notified in writing by the Director.

7.5.2 The proposal referred to in subsection 7.5.1 shall include, at a minimum, the following:

- (a) methods to track and report on cumulative increases in vegetation species, ecosite phases and wetland classes as reclamation proceeds throughout the life of the Frontier project;
- (b) monitoring of settlement on revegetated upland areas;
- (c) details of how reclamation will optimize and accelerate the return of high biodiversity potential to the region;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

- (d) reporting on changes to biodiversity throughout the life of the Frontier project; and
- (e) any other information as required in writing by the Director.

7.5.3 If the Reclamation Monitoring Program proposal is found deficient by the Director, the approval holder shall correct all deficiencies identified in writing by the Director by the date specified in writing by the Director.

7.5.4 The approval holder shall implement the Reclamation Monitoring Program referred to in subsection 7.5.1, as authorized in writing by the Director.

SECTION 7.6: MONITORING AND REPORTING

7.6.1 The approval holder shall submit an Annual Reclamation Progress Tracking Report to the Director.

7.6.2 The approval holder shall prepare and submit the Annual Reclamation Progress Tracking Report referred to in subsection 7.6.1, in accordance with *Specified Enactment Direction 003: Direction for Conservation and Reclamation Submissions under an Environmental Protection and Enhancement Act Approval for Mineable Oil Sands Sites*, December 2018, as amended, unless otherwise directed in writing by the Director.

SECTION 7.7: REGIONAL INITIATIVES

7.7.1 The approval holder shall participate in any regional multi-stakeholder forum that may be developed for end land use planning, to the satisfaction of the Director.

Approvals Manager, Authorizations Branch
Alberta Energy Regulator

Appendix 6 List of Panel Recommendations

Recommendation 1 – The panel recommends that **Teck** re-evaluate the type of emission controls that would meet the objectives of the CCME guidelines as it finalizes the design of all project tanks.

Recommendation 2 – The panel recommends to **Teck** that if the domestic wastewater treatment system triggers an *EPEA* approval, the panel expects Teck to comply with the *Wastewater System Standards for Performance and Design* (GOA, 2013) and the *Wastewater System Guidelines for Design, Operating and Monitoring* (GOA, 2013) of the *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems*.

Teck will need to apply to the appropriate authority, Alberta Environment and Parks, for an *EPEA* approval for the construction, operation and reclamation of the potable water treatment plant.

Recommendation 3 – The panel recommends **Teck** consider the following documents when finalizing the project's waste management plan:

- *Industrial Waste Identification and Management Options* (Alberta Environmental Protection, 1996)
- *AER Directive 073: Requirements for Inspection and Compliance of Oil Sands Mining and Processing Plant Operations in the Oil Sands Mining Area* (AER, 2008)

Recommendation 4 – The panel recommends that **Alberta** consider Fort McKay's recommendations related to mine tailings, reclamation, and closure as part of Alberta's efforts to assess and manage cumulative effects within the Lower Athabasca region.

Recommendation 5 – The panel recommends that **Canada** consider Fort McKay's recommendations related to mine tailings, reclamation, and closure as part of Canada's efforts to assess and manage cumulative effects within the Lower Athabasca region.

Recommendation 6 – The panel recommends that **Teck** implement Natural Resources Canada's recommendations to:

- adhere to all the components of both the *FireSmart Guidebook for the Oil and Gas Industry* as well as the Canadian Association of Petroleum Producers' *Emergency Preparedness Guide for Hazards Associated with Wildfires*;
- train Frontier project firefighting staff as provincial Type 2 wildland firefighters, including Incident Command System training for crew members and leaders;
- implement a Grass Fuel Management Plan for Industrial Zone 3;
- firefighting staff be equipped for suppression of grass and forest fires (e.g., portable gas powered water pumps, hand tools) with equipment compatible with provincial standards; and

- collaborate closely with area staff from Alberta Agriculture and Forestry to adequately mitigate wildfire risk and provide for appropriate response.

Recommendation 7 – The panel recommends to **Alberta** that a mitigation and management plan be developed under the *LARP Air Quality Management Framework* to prevent the proliferation of secondary organic aerosols in the mineable oil sands area.

Recommendation 8 – The panel recommends **Teck** to develop and implement a plan to provide employee training on minimizing mine mobile equipment idling and the importance of avoiding tampering with emissions control systems.

Recommendation 9 – The panel recommends that **Teck** develop a mitigation and management plan under the *LARP Air Quality Management Framework* to prevent the proliferation of secondary organic aerosols in the mineable oil sands area.

Recommendation 10 – The panel recommends that **Teck**:

- Demonstrate a commitment to "best-in-class" GHG emissions performance through the implementation of relevant technologies and practices over the life of the project.
- Demonstrate a commitment to continually improve the efficiency of energy use and related greenhouse gas emissions in an effort to outperform regulations that are in effect.
- Connect to the electricity grid by the start of Phase 1 operations in order to sell its excess low intensity electricity, as available.

Recommendation 11 – The panel recommends **Teck** provide information on the Frontier project noise complaint investigation process to potentially impacted residents and communities.

Recommendation 12 – The panel recommends that **Teck** include water level monitoring in groundwater wells installed between the project area and the area of groundwater use on the west bank of the Athabasca River to demonstrate that the impacts to the drawdown in the Quaternary aquifer does not extend to the local users.

Recommendation 13 – The panel recommends that before starting dewatering activities, **Teck**

- conduct a survey of springs on the west bank of the Athabasca River downgradient of the project and
- establish baseline groundwater level or flow rate and baseline groundwater chemistry in the spring (artesian well) used by Mr. Hoffmann and the trappers and any other springs that might be in use.

Recommendation 14 – The panel recommends that **Alberta** evaluate the merits of implementing an effective tracing system (e.g., isotopic tracing) for all tailings ponds near the Athabasca River as part of the tailings risk assessment proposed as part of the multi-jurisdictional Action Plan for Wood Buffalo National Park World Heritage Site or as part of the Joint Oil Sands Monitoring Program.

Recommendation 15 – The panel recommends that **Alberta** consider the recommendations made by Mikisew regarding indicator parameters and groundwater quality thresholds when revising and finalizing the *Lower Athabasca Region Groundwater Management Framework*.

Recommendation 16 – The panel recommends that **Canada** evaluate the merits of implementing an effective tracing system (e.g., isotopic tracing) for all tailings ponds near the Athabasca River as part of the tailings risk assessment proposed as part of the multi-jurisdictional Action Plan for Wood Buffalo National Park World Heritage Site or as part of the Joint Oil Sands Monitoring Program.

Recommendation 17 – The panel recommends that **Alberta** review and consider ACFN and Mikisew’s recommendations related to the number of monitoring stations, inclusion of additional parameters, and inclusion of community based monitoring data in the *Lower Athabasca Region: Surface Water Quality Management Framework for the Lower Athabasca River* as part of future reviews or updates.

Recommendation 18 – The panel recommends that **Alberta** ensure that regional monitoring of PAHs and metals in soils, sediments, and surface waters, including deposition to surrounding regions such as Wood Buffalo National Park and the Peace Athabasca Delta, be conducted as part of the oil sands monitoring program.

Recommendation 19 – The panel recommends that **Canada** ensure that regional monitoring of PAHs and metals in soils, sediments, and surface waters, including deposition to surrounding regions such as Wood Buffalo National Park and the Peace Athabasca Delta, be conducted as part of the oil sands monitoring program.

Recommendation 20 – The panel recommends that **Teck** continue to use conservative assumptions related to end-pit lakes to account for uncertainties and ensure water quality targets can be met through natural development of the lakes and implemented mitigation measures.

Recommendation 21 – The panel recommends that **Teck** explore opportunities to incorporate monitoring being conducted under the community-based monitoring program, which has relevance to local project-related effects.

Recommendation 22 – The panel recommends to **Alberta** and **Canada** that monitoring of water quality in Lake Claire be considered in the future design of regional oil sands monitoring programs.

Recommendation 23 – The panel recommends to **Alberta** and **Canada** that regional monitoring of PAHs and metals in soils, sediments, and surface waters, including deposition to surrounding regions such as WBNP and the PAD region, should be conducted as part of the regional Oil Sands Monitoring Program.

Recommendation 24 – The panel recommends that the Government of **Alberta** update the SWQuanMF with an emphasis on developing rules under low open water flows and updating the navigation index and trigger.

Recommendation 25 – The panel recommends to **Canada** that Parks Canada and ECCC work with First Nations and other indigenous groups; the governments of Alberta, British Columbia, Northwest Territories, and Saskatchewan; and industry and other interested parties to implement the Wood Buffalo National Park World Heritage Site Action Plan to address the cumulative impact of hydropower development, climate change, and water withdrawals on the Peace-Athabasca Delta.

Recommendation 26 – The panel recommends that the Government of **Canada** work with First Nations and other indigenous groups, provincial and territorial governments, and industry and other interested parties to develop and implement an action plan to address the cumulative impact of hydropower development, climate change, and water withdrawals on the Slave River Delta.

Recommendation 27 – The panel recommends that **Teck** participate in the regional cumulative effects assessment being led by DFO. This participation may include leading some components of the cumulative effects assessment or providing financial resources or appropriately qualified technical expertise.

Recommendation 28 – The panel recommends that **Teck** finalize and implement the fisheries offsetting plan and associated monitoring program for the Frontier project. This plan should meet the provisions of the *Fisheries Protection Policy Statement*, October 2013, and the *Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting*, November 2013. The plan should consider designs for fish passage from the offsetting lake to the Athabasca River. Teck should engage with stakeholders and indigenous communities to solicit input as to the target fish species in the lake, design of aquatic and terrestrial habitat features, and the potential to include other components of cultural significance. The plan should include feedback received during engagement and describe how the information was considered.

Recommendation 29 – The panel recommends that **Teck** further delineate aquatic impacts and habitat availability in the locations of the raw water intake, associated infrastructure, and the Athabasca River Bridge. This information should be incorporated into the fisheries offsetting plan.

Recommendation 30 – Following the collection of additional baseline information to further inform methyl mercury modelling in the offsetting lake and downstream environments, the panel recommends that **Teck** engage with DFO, Environment and Climate Change Canada, indigenous communities, and other potential interested stakeholders on the results and any further mitigation measures proposed.

Recommendation 31 – The panel recommends that **Teck** consider further development of alternative offsetting measures as outlined in Fisheries and Oceans Canada's *Fisheries Productivity Investment Policy*. Teck should engage with indigenous communities and other stakeholders regarding research opportunities that would form part of the offsetting plan.

Recommendation 32 – The panel recommends that **Teck** complete a detailed monitoring plan to monitor and report on the mitigation and offsetting measures. The plan and reporting should include but not be limited to the following:

- monitoring and reporting requirements to demonstrate that the offsetting measures have been effective in counterbalancing the impacts to fish and fish habitat,
- undertake a validation of the HSI models used to predict the impacts to fish and fish habitat and determine the amount of offsetting required,
- report on mitigation measures applied and any changes to the mitigation measures,
- any corrective actions or contingency measures utilized to ensure further habitat destruction or permanent alteration to habitat does not occur, and
- how feedback received during indigenous consultation on the plan has been considered or incorporated, as appropriate.

Recommendation 33 – The panel recommends that **Teck** maintain involvement in the Fisheries Sustainable Habitat FiSH Committee with the goal of validating the habitat suitability index models. Teck should use the validated watercourse HSI models to verify and report on predictions made in the environmental assessment related to the quality and quantity of fish habitat impacted by the project. Teck should validate and verify the predictions made by the waterbody HSI models.

Recommendation 34 – The panel recommends that **Teck** further develop and implement an adaptive management strategy to monitor and update plans related to the mitigation strategies and offsetting plans. Teck should engage with appropriate government agencies as well as indigenous communities in the development of the strategy. Teck should include how feedback received during the engagement sessions has been considered or incorporated, as appropriate.

Recommendation 35 – The panel recommends that **Teck** finalize a monitoring program specific to the construction and operation of the raw water intake. This monitoring should include velocity and flow measurements across fish exclusion screens to verify predictions made in the detailed design.

Recommendation 36 – The panel recommends that **Teck** further develop and implement an adaptive management strategy for the closure and reclamation landscape. Teck should engage with appropriate government agencies as well as indigenous communities in the development of the strategy. Teck should include how feedback received during the engagement sessions has been considered or incorporated, as appropriate.

Recommendation 37 – The panel recommends that **Teck** design closure landscapes such that they may be integrated into the natural environment. Teck should work with DFO during the design phase and throughout the life of the project to design, implement, and monitor aquatic habitat on the reclaimed landscape. Teck should maintain involvement in regional groups and engage with indigenous communities with regards to the closure landscape. Teck should report on how the feedback received during engagement has been considered or incorporated, as appropriate.

Recommendation 38 – The panel recommends that **Alberta** consider Fort McKay’s recommendations related to cumulative effects to the aquatic environment as part of Alberta’s efforts to assess and manage cumulative effects within the Lower Athabasca region.

Recommendation 39 – The panel recommends that the **DFO, Teck, ACFN, and other interested indigenous communities** work collaboratively to explore the acceptability of identifying fish habitat mitigation and compensation measures in lieu of, at least in part, the currently proposed fish habitat compensation lake.

Recommendation 40 – The panel recommends that **Canada** consider Fort McKay’s recommendations related to cumulative effects to the aquatic environment as part of Canada’s efforts to assess and manage cumulative effects within the Lower Athabasca region.

Recommendation 41 – The panel recommends to **Alberta** and **Canada** that regional monitoring of PAHs and metals in soils, sediments, and surface waters, including deposition to surrounding regions such as WBNP and the PAD region, should be conducted as part of the regional Oil Sands Monitoring Program.

Recommendation 42 – The panel recommends that **Alberta** consider the recent research on base cation deposition from dust and the potential implications to soil acidification as part of its *Alberta Acid Deposition Management Framework*.

Recommendation 43 – The panel recommends that **Teck** revise the total area of proposed littoral areas that will meet the definition for wetland class in future submissions of updated reclamation and closure plans, in order to accurately report the extent of Teck’s planned reclaimed wetland area relative to what will be disturbed by the project.

Recommendation 44 – The panel recommends that **Teck**:

- Continue to provide in-kind and financial support to facilitate the research, data collection and analysis work of the Ronald Lake Bison Herd Technical Advisory Team and support monitoring and mitigation measures undertaken by Alberta Environment and Parks or the Parks Canada Agency to maintain the health and viability of the Ronald Lake bison herd over the life of the project.
- Draw on work undertaken by the Ronald Lake Bison Herd Technical Team and information obtained through the implementation of Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan to guide studies Teck may fund on the herd over the life of the project.
- Support studies commissioned by responsible authorities to monitor disease status of the Ronald Lake bison over the life the project based on guidance of the Ronald Lake Bison Herd Technical Team.

Recommendation 45 – The panel recommends that **Alberta**

- Continue to support the work of the Ronald Lake Bison Technical Advisory Team to monitor the status of the Ronald Lake herd, inform recovery planning and identify the need for additional management actions.
- In collaboration with federal agencies, complete its provincial Bison Management Plan consistent with the requirements of the Wood Bison Recovery Strategy. The provincial plan should include a management plan for the Ronald Lake Bison herd that identifies core habitat and is consistent with the requirements of the Wood Bison Recovery Strategy.
- Implement a co-management approach for the Ronald Lake bison involving indigenous groups, industry and relevant provincial and federal authorities.
- Maintain the current prohibition on non-indigenous hunting of the Ronald Lake Bison herd until a management plan is complete for the herd and the ongoing viability of the herd is assured.
- Consider the need and feasibility of establishing a captive breeding herd nucleus of Ronald Lake bison that could be used to re-establish a disease free herd in the event that the herd cannot be prevented from interacting with diseased Wood Buffalo National Park bison and it becomes diseased.

Recommendation 46 – The panel recommends that

- **ECCC** continue to support the work of the Ronald Lake Bison Technical Advisory Team to monitor the status of the Ronald Lake herd, inform recovery planning and support adaptive management.
- **ECCC** complete the Species at Risk Imminent Threat Analysis for the wood bison currently underway as soon as possible so that the results of the assessment may be used to further inform federal decisions related to the Frontier project.
- **ECCC** complete its work to define critical habitat for the Ronald Lake bison population as required by the *Recovery Strategy for the Wood Bison (Bison bison athabascae) in Canada* as soon as possible so that this work can further inform federal decisions related to the Frontier project.
- **Parks Canada** undertake a study to assess the range, movements and habitat use of diseased bison in Wood Buffalo National Park to inform the development of mitigation measures and adaptive management planning to protect the Ronald Lake bison; and, that Parks Canada complete its bison disease transmission management plan by 2020.
- **ECCC** consider the need and feasibility of establishing a captive breeding herd nucleus of Ronald Lake bison that could be used to re-establish a disease free in the event that the herd cannot be prevented from interacting with diseased Wood Buffalo National Park bison and it becomes diseased.

- **ECCE** participate in a co-management approach for the Ronald Lake bison involving indigenous groups, industry and relevant provincial and federal authorities should such an approach be established.

Recommendation 47 – The panel recommends that **Teck**

- Participate in caribou-focused habitat restoration projects and opportunities to restore linear features outside the project disturbance area in the ranges of the Red Earth and Richardson herds. Work with Alberta Environment and Parks and indigenous communities to identify appropriate caribou-focused restoration projects to participate in.
- Support further study of potential caribou movement corridors across the Athabasca River if such work is prioritized by the oil sands monitoring program, which Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation.

Recommendation 48 – The panel recommends that **Alberta**

- Complete and implement critical range management plans for woodland caribou in northeastern Alberta, particularly for the Red Earth and Richardson range herds.
- In cooperation with federal agencies, develop and implement criteria, indicators and thresholds to track and validate the health, stability and sustainability of the woodland caribou, including population numbers and demographics and, the quality and quantity of habitat, including critical habitat.
- Consider implementing co-management roles for ACFN, Mikisew and other indigenous groups in the development and implementation of the range management plans for the Red Earth and Richardson herds.

Recommendation 49 – The panel recommends that **Canada**

- Complete the federal Recovery Strategy and Action Plan for Woodland Caribou, as it pertains to the Red Earth and Richardson range herds.
- In cooperation with provincial agencies, develop and implement criteria, indicators and thresholds to track and validate the health, stability and sustainability of the woodland caribou, including population numbers and demographics and, the quality and quantity of habitat, including critical habitat.
- Consider implementing co-management roles for ACFN, Mikisew and other indigenous groups in the development and implementation of the Federal Recovery Strategy and Action Plan for Woodland as it relates to the Red Earth and Richardson range herds.

- Develop and implement criteria, indicators and thresholds to track and validate the health, stability and sustainability of the woodland caribou, including: population numbers and demographics; and, the quality and quantity of habitat, including critical habitat.

Recommendation 50 – The panel recommends that **Alberta** consider including moose as a LARP biodiversity management framework indicator.

Recommendation 51 – The panel recommends that **Teck** work with ECCC, with input from the AER, AEP and Indigenous communities to develop and implement a compensation plan within the regional study area that protects habitat for old-growth, wetland and other SARA-listed migratory bird species.

Recommendation 52 – The panel recommends that **ECCC** consider the need for conservation offsets and a compensation plan to further mitigate effects to old-growth, wetland and other SARA-listed migratory bird species prior to making its decisions related to the Frontier project.

Recommendation 53 – The panel recommends that **Canada** consider the need for conservation offsets and a compensation plan to further mitigate effects to old-growth, wetland and other SARA-listed migratory bird species prior to making its decisions related to the Frontier project.

Recommendation 54 – The panel recommends that Canada consider the need for broader studies, monitoring and tracking of the health, stability, and sustainability of migratory birds, including short term acute and chronic effects of oil sands development, as recommended by Teck and ACFN.

Recommendation 55 – The panel recommends that **Teck** work with ECCC, Alberta and Indigenous community to determine if additional conservation agreements may be necessary to achieve Teck's conservation and biodiversity objectives.

Recommendation 56 – The panel recommends that **Alberta** review and considers the recommendations made by Fort McKay First Nation, ACFN, and Mikisew related to monitoring and management of regional cumulative effects as part of any current or future reviews of the *Lower Athabasca Regional Plan* and Alberta's frameworks for managing cumulative effects.

Recommendation 57 – The panel recommends that **Alberta** consider ACFN and Mikisew recommendations related to funding and co-management of any protected areas established in the area of the proposed biodiversity stewardship area.

Recommendation 58 – The panel recommends that **Alberta** consider providing further policy direction or guidance on the use of conservation offsets as part of any future updates to the *Lower Athabasca Regional Plan*.

Recommendation 59 – The panel recommends that **Alberta** finalize and implement the biodiversity management framework under the *Lower Athabasca Regional Plan* as soon as possible.

Recommendation 60 – The panel recommends that **Canada** review and consider the recommendations made by Fort McKay First Nation, ACFN, and Mikisew related to monitoring and management of regional cumulative effects in the oil sands region for areas of federal responsibility.

Recommendation 61 – The panel recommends that **Teck**, in preparing its access management plan, work with appropriate regulatory agencies and stakeholders to identify key concerns and considerations with respect to access management in the project area.

Recommendation 62 – The panel recommends that **Teck** contact AER before commencing work on the plan to request a terms of reference for the plan.

Recommendation 63 – The panel recommends that **Teck** support the Mikisew – Athabasca Chipewyan community-based monitoring program and incorporate this program into Teck’s monitoring and reporting programs for the Frontier project.

Recommendation 64 – The panel recommends that **Teck** support the community health baseline study for the oil sands region, should Alberta and Canada conduct such a study.

Recommendation 65 – The panel recommends that **Alberta** consider the need to include lead monitoring as part of regional monitoring programs.

Recommendation 66 – The panel recommends that **Canada** and **Alberta** initiate and implement a Crown-led ten year community health baseline study and include representation from local communities and oil sands operators.

Recommendation 67 – The panel recommends that **ECCC** complete the development of a water quality guideline for naphthenic acids as soon as possible as this has been a long standing concern for communities and has been a recommendation in previous joint review panel reports.

Recommendation 68 – The panel recommends that **Canada** consider the need to include lead monitoring as part of regional monitoring programs.

Recommendation 69 – The panel recommends that **Canada** and **Alberta** initiate and implement a Crown-led ten year community health baseline study and include representation from local communities and oil sands operators.

Recommendation 70 – The panel recommends that **Teck** provide its detailed project executions plans to transport of large mining equipment and oversized loads to Alberta Transportation for review and feedback at least three months prior to starting construction.

Recommendation 71 – The panel recommends that **Canada** and **Alberta** consider the environmental management objectives, commitments, and recommendations identified in the September 17, 2018, joint letter from Athabasca Chipewyan and Teck.

Recommendation 72 – The panel recommends that **Canada** and **Alberta** review and consider the recommendations made by Fort McKay First Nation.

Recommendation 73 – The panel recommends that **Canada** and **Alberta** consider the project conditions jointly proposed by the Mikisew and Teck in the August 31 Mikisew hearing submission to the panel.

Recommendation 74 – The panel recommends that **Canada** and **Alberta** consider establishing a project oversight committee, as described by the Mikisew. Indigenous membership on the committee should not be limited to the Mikisew, and may include any group that is affected by the Frontier project, as appropriate.

Recommendation 75 – The panel recommends that **Alberta** complete its review of the Mine Financial Security Program and implement any changes required to address the Auditor General’s recommendation to ensure that Albertans are protected from assuming reclamation and closure liabilities such as those associated with the Frontier project.

Recommendation 76 – The panel recommends that the Government of **Alberta** consider passing a special Act authorizing licences and amendments to licences, which meet specific criteria defined in the Act, to be issued for the transfer of water between the Peace/Slave River basin and the Athabasca River basin.

Recommendation 77 – The panel recommends that **Alberta** complete its review of the Mine Financial Security Program and implement any changes required to address the Auditor General’s recommendation to ensure that Albertans are protected from assuming reclamation and closure liabilities such as those associated with the Frontier project.

Appendix 7 Recommendations from the Government of Canada

This appendix is intended to assist the reader and is not part of the hearing record. It is consolidated from documents on the project registry at <https://www.ceaa-acee.gc.ca/050/evaluations/proj/65505?culture=en-CA>.

Recommendations of Fisheries and Oceans Canada

Recommendation 1:

Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation to Teck Resources Ltd. to participate in the regional cumulative effects assessment being led by DFO. This participation may include leading some components of the cumulative effects assessment and/or providing financial resources or appropriately qualified technical expertise.

Recommendation 2:

Fisheries and Oceans Canada recommends that the Joint Review Panel's report include a recommendation to Teck Resources Ltd. to complete detailed design and implement the Detailed Fisheries Offsetting Plan. This plan should meet the provisions of the Fisheries Protection Policy Statement, October 2013 and the Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting, November 2013. The plan must consider designs for fish passage from the offsetting lake to the Athabasca River. Teck should consult with stakeholders and Indigenous communities to solicit input as to the target fish species in the lake, design of aquatic and terrestrial habitat features and the potential to include other components of cultural significance. The plan should include feedback received during consultation and describe how the information was considered.

Recommendation 3:

Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation to Teck Resources Ltd. to further delineate aquatic impacts and habitat availability in the locations of the raw water intake, associated infrastructure and the Athabasca River Bridge. Teck should further undertake an options analysis for the location of the raw water intake. This information should be incorporated into the Detailed Fisheries Offsetting Plan.

Recommendation 4:

Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation to Teck Resources Ltd. that Teck engage the appropriate departments, agencies, experts and Indigenous communities to further delineate potential mitigation measures for the Ronald Lake Bison Herd.

Recommendation 5:

Fisheries and Oceans Canada recommends that the Joint Review Panel's report include a recommendation that requires Teck Resources Ltd. to collect baseline information to further inform methyl mercury modelling in the offsetting lake and downstream environments. Teck should consult on the results of the baseline data collection and any further mitigation measures proposed with DFO, Environment and Climate Change Canada, Indigenous Communities and other potential interested stakeholders.

Recommendation 6:

Fisheries and Oceans Canada recommends that the Joint Review Panel's report include a recommendation that supports the further development of alternative offsetting measures as outlined in Fisheries and Oceans Canada's Fisheries Productivity Investment Policy. Teck should consult with Indigenous communities and other stakeholders regarding research opportunities that would form part of the offsetting plan.

Recommendation 7:

Fisheries and Oceans Canada recommends that the Joint Review Panel's report include a recommendation that Teck Resources Ltd complete a detailed monitoring plan to monitor and report on the mitigation and offsetting measures. The plan should include but not be limited to the following:

- monitoring and reporting requirements to demonstrate that the offsetting measures have been effective in counterbalancing the impacts to fish and fish habitat;
- undertake a validation of the HSI models used to predict the impacts to fish and fish habitat and determine the amount of offsetting required;
- report on mitigation measures applied and any changes to the mitigation measures;
- any corrective actions or contingency measures utilized to ensure further habitat destruction or permanent alteration to habitat does not occur; and
- how feedback received during Indigenous consultation on the plan has been considered or incorporated, as appropriate.

Recommendation 8:

Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation that Teck Resources Ltd maintain involvement in the Fish Committee with the goal of validating the Habitat Suitability Index Models. DFO recommends that the Joint Review Panel's Report include a recommendation that Teck Resources Ltd. use the validated watercourse HIS models to verify and report on predictions made in the environmental assessment related to the quality and quantity of fish

habitat impacted by the Project. DFO recommends that the Joint Review Panel's Report include a recommendation that Teck validate and verify the predictions made by the waterbody HSI models.

Recommendation 9:

Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation that Teck Resources Ltd. further develop and implement an adaptive management strategy to monitor and update plans related to the mitigation strategies and offsetting plans. Teck should consult with appropriate government agencies as well as Indigenous communities in the development of the strategy. Teck should include how feedback received during the consultation sessions has been considered or incorporated, as appropriate.

Recommendation 10:

Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation that Teck Resources Ltd. finalize a monitoring program specific to the construction and operation of the raw water intake. This monitoring should include velocity and flow measurements across fish exclusion screens to verify predictions made in the detailed design.

Recommendation 11:

Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation that Teck Resources Ltd. further develop and implement an adaptive management strategy for the closure and reclamation landscape. Teck should consult with appropriate government agencies as well as Indigenous communities in the development of the strategy. Teck should include how feedback received during the consultation sessions has been considered or incorporated, as appropriate.

Recommendation 12:

Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation that Teck Resources Ltd. design closure landscapes such that they may be integrated into the natural environment. Teck should work with DFO during the design phase, and throughout the life of the Project, to design, implement and monitor aquatic habitat on the reclaimed landscape. Teck should maintain involvement in regional groups and undertake consultations with Indigenous communities with regards to the closure landscape. Teck should report on how the feedback received during consultations has been considered or incorporated, as appropriate.

Recommendations of Environment and Climate Change Canada

Recommendation 8.1

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Provide an outline of its spill response measures and systems relating to upset releases to water and soil. The outline should cover environmental risk information for each type of accident or malfunction scenario. It should also cover an assessment of the effectiveness of proposed preparedness and response measures, as well as systems aimed to reduce the environmental consequences.
- 2) Develop comprehensive Emergency Response and Spill Contingency plans. These plans should identify, describe and evaluate the potential impacts of all reasonably foreseeable Project-related accidents and malfunctions involving the potential release of chemicals or hazardous materials.
- 3) Develop comprehensive Emergency Response plans that identify site-specific environmental sensitivities, specific and detailed procedures, and associated timeframes that would ensure a prompt response, regulator notification, as well as cleanup in the event of a chemical or hazardous substance spill or threat of release.
- 4) Provide the plans, measures and systems information identified in (1), (2) and (3) for review prior to construction and upon request of interested stakeholders and Indigenous groups. All such plans should be updated regularly throughout the life of the Project and provided to relevant authorities prior to the commencement of the Operations Phase.

Recommendation 4.1 - Ronald Lake Wood Bison Herd

The Project will result in substantial loss of range and habitat for the Ronald Lake herd, causing a reduction in the range's carrying capacity which, in turn, will result in a high risk of a range shift, disease transmission and reduction in the herd's population size. Some of Teck's proposed mitigation measures are uncertain and others are unlikely to be effective at mitigating Project effects. Based on the proposed mitigations, the Project could thus significantly alter the conservation value of the herd. If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Fund an independent evaluation of mitigation measures to prevent range shift and contact of the Ronald Lake herd and diseased Delta bison herd in WBN P. The independent evaluation should include participation of Indigenous groups and other knowledgeable experts. Results of the evaluation should be used by Teck to inform mitigation planning. Mitigation should be implemented in a timely manner to prevent adverse Project effects on the herd, and monitored throughout the life of the mine.
- 2) As part of a follow-up monitoring program, continue to fund studies on the Ronald Lake bison herd to determine movements, habitat use and behavior of the herd prior to, during and following Project

construction. Monitoring should be continued for the duration of the Project, and used to inform adaptive management efforts to reduce Project effects.

- 3) Fund an independent study of the landscape features and habitats between the Ronald Lake and Delta bison herds to identify potential movement corridors between the herds to inform mitigation planning. This study should be completed prior to Project construction.
- 4) Fund an independent study to assess the range, movements and habitat use of diseased Delta bison in WBNP to inform mitigation planning. This study should be completed prior to Project construction.
- 5) Fund an independent study to monitor the disease status of the Ronald Lake herd at regular intervals throughout the duration of the Project.

Recommendations 4.2 - Boreal Woodland Boreal Caribou

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Develop and implement a compensation plan within the Red Earth caribou range prior to Project construction to mitigate for permanent and long-term loss of caribou habitat. The compensation plan should: target restoration of linear disturbance features in the Red Earth range, and be based on a minimum 4:1 (reclaimed: disturbed) compensation ratio.

The plan should be developed, to the satisfaction of ECCC, in consultation with Indigenous groups. The effectiveness of the compensation plan should be monitored over time, and adaptive management applied to address any deficiencies in intended outcomes.

- 2) Complete a comprehensive field study to determine movements of Red Earth and Richardson caribou across the Athabasca River adjacent to and north of the Project development area, for the purpose of identifying active movement corridors between the ranges. If river crossing sites are limited north of the mine, measures should be taken to maintain movement of caribou across the Athabasca River adjacent to the mine (e.g., by increasing the Athabasca River set-back) and north around the mine. This study should be completed prior to Project construction, to the satisfaction of ECCC, and in consultation with Indigenous groups. Movement of caribou across the Athabasca River adjacent to the mine should be monitored throughout Project operations to ensure range connectivity is maintained.
- 3) Monitor the occurrence of wolves and caribou in the vicinity of the mine prior to and following Project construction to determine whether incidental predation on caribou increases following mine construction. If incidental predation occurs or increases, Teck should work with the Government of Alberta to implement appropriate mitigation measures.

Recommendation 4.3.1 Migratory Birds

It is ECCC's view that the Project represents a high mortality risk for whooping cranes as the proposed mitigation measures are unlikely to substantially reduce or eliminate this risk. If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Investigate and implement alternative designs for its external tailings areas, to the extent possible. This includes measures to:
 - Eliminate or reduce gently sloping sand beaches within external tailings areas, as well as adjacent shallow water areas; - cover external tailings areas;
 - reduce the size of external tailings areas; and
 - Continuously remove all bitumen and oil from the surface of external tailings areas.
- 2) Investigate and, to the extent possible, implement new technologies to deter whooping cranes from external tailings areas. This could include the use of drones to continuously patrol potential landing and stopover areas during the migration season, and dissuade cranes from landing in these areas.
- 3) Monitor the occurrence, movements and habitat use of whooping cranes on (and adjacent to) its lease to determine the response of birds to development of the Frontier Mine, and to inform mitigation planning. Information should also be collected on interactions of whooping cranes with external tailings areas and other industrial waterbodies on the Frontier Lease. Data should be used by Teck to evaluate the success of mitigation measures (e.g., deterrents, reclamation) and to improve performance of these measures, as necessary.
- 4) Contribute funding to regional monitoring of whooping cranes in the oil sands region, to inform understanding of broader cumulative effects and risks posed by oil sands developments.

Recommendation 4.3.2

Consistent with the MBCA, Teck must exercise due diligence to deter birds from contacting deleterious substances in its process-affected waterbodies; therefore, ECCC does not consider it necessary to recommend mitigation measures that are required to meet federal legislation. It is assumed that Teck will implement best-available bird deterrent technology, should the Project be approved and built. Numerous migratory birds, however, continue to land on process affected waterbodies (including external tailings areas) despite the presence of best-available bird deterrent technology, resulting in the potential for significant cumulative off-site effects. If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Initiate a study or series of studies, in collaboration with other oil sands mine operators (as part of regional monitoring efforts), to determine the extent of off-site effects on migrating birds resulting from contact with oil sheen.

- 2) Investigate and implement alternative designs for its external tailings areas, to the extent possible.

This includes measures to:

- cover external tailings areas to prevent bird landings;
- reduce the size of external tailings areas; and,
- continuously remove all bitumen and oil from the surface of external tailings areas.

In addition, because of the potential significant residual local scale effects on migratory bird habitat, in particular stopover habitat because of the loss of Unnamed Lake 1 and Unnamed Lake 2, and uncertainty in the success of end-pit lakes, ECCC recommends that the Panel request that Teck:

- 3) Develop and implement a compensation plan within the RSA to protect from future disturbance stopover habitat equivalent to that which would be disturbed by the Project (in particular lake habitat), for the purpose of maintaining migratory bird stopover habitat within an important waterfowl migration corridor. The compensation plan should be developed in consultation with the Government of Alberta, ECCC and Indigenous groups.

Recommendations 4.3.3

The Project will contribute to likely existing significant cumulative regional effects on terrestrial and wetland-dependent SARA-listed migratory bird species. The effects of the Project on Canada warbler may also be high-magnitude and thus significant at the regional scale. The success of reclamation is currently uncertain; loss of old-growth forests will be long-term, while loss of peatlands may be permanent. If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Develop and implement a compensation plan within the RSA to protect from future disturbance habitat for old-growth, wetland and other SARA-listed migratory bird species equivalent to that which would be disturbed by the Project, for the purpose of maintaining migratory bird populations in the RSA. The compensation plan should be developed in consultation with the Government of Alberta, ECCC and Indigenous groups.

Recommendation 4.4 - Rodenticides in fisher and marten

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Implement an integrated pest management (IPM) plan to monitor pest presence, monitor the effectiveness of pest control strategies utilized, and, in accordance with Federal and any provincial standards, apply rodenticides only when needed, given that the Frontier Project is situated near high quality fisher and marten habitat.
- 2) Take measures to avoid rodent infestations (e.g. effective handling and removal of waste, exclusion measures, mechanical control measures).

- 3) Use first generation ARs in lieu of SGARs should chemical intervention be required to control rodent population outbreaks.

Recommendation 5.1 - Canadian Ambient Air Quality Standards

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Take an iterative approach to air quality management and make any necessary adaptations to project equipment or procedures to prevent project emissions from contributing to deteriorating air quality in the local and regional area.

Recommendations 5.3 - Fine Particulate Matter and Secondary Organic Aerosols

The SOA contribution to the total PM_{2.5} has not been determined. If the Project is approved,

ECCC recommends that the Panel request Teck to:

- 1) Implement mitigation measures that reduce PM_{2.5} and specifically target SOA precursor emissions. This means that the Proposed Air Quality, Mitigation, Monitoring, and Adaptive Management Plan for total PM_{2.5} should include mitigation that targets all PM_{2.5} sources, one of which are SOA precursors (analytically unresolved hydrocarbons).

Recommendation 5.4 - Off-Road Air Emissions

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Implement a retrofit and replacement schedule demonstrating off-road equipment conversion to best-in-class technology, starting with final Tier IV engines, with new engines meeting the Off-Road Compression Ignition Engine Emission Regulations (under the Canadian Environmental Protection Act, 1999);
- 2) Not remove emission control technologies from off-road equipment;
- 3) Implement an emission control technology maintenance program, which may include combined use of individual vehicle fuel usage indicators, vehicle emission testing, and electronic diagnosis techniques to trigger maintenance: and
- 4) Provide employee training on minimizing off-road equipment idling and the importance of avoiding tampering with emissions control systems.

Recommendation 5.5 - Greenhouse Gasses

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Demonstrate a commitment to "best-in-class" GHG emissions performance through the implementation of relevant technologies and practices over the life of the Project.

- 2) Beginning in 2020 and continuing every fifth year thereafter, undertake an analysis on the feasibility of using commercially available and emerging (at pilot or demonstration stage) technologies and practices which have the potential to reduce Project GHG emissions, such as at-face slurring, hybrid (aqueous and nonaqueous) bitumen extraction and tailings solvent recovery unit heat recovery. ECCC suggests that these reports should describe all technological and environmental opportunities, document any technologies and practices implemented by the Project, and propose implementation of selected technologies and environmental practices. The report should also provide a rationale with technical and/or economic considerations for selected and excluded technologies and environmental practices in relation to the best-in-class performance objective.
- 3) Commit to implementing the plan to connect to the electricity grid by the start of Phase 1 in order to sell its low intensity electricity, as Teck has stated in the grid connection plans.
- 4) Develop and implement an energy management system to achieve its objective of continual improvement in energy efficiency and related GHG emissions mitigation. The energy management system would include but not be limited to the following actions:
 - Conducting a review (analyzes energy data, identify areas of significant energy use and identify areas for energy performance improvement opportunities).
 - Establishing emissions and energy baseline, setting objectives and targets that are measurable, and having timelines for achievement over the life of the Project that aligns with best-in-class performer.
 - Establishing and implementing an action plan to achieve the objectives and targets.
 - Monitoring and assessing energy and GHG performance yearly.

Recommendations 6.1 - Polycyclic Aromatic Compounds and Metals

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Implement a follow-up program to validate PAC and metal predictions to assess their accuracy and include:
 - A program to monitor PACs and metals, including emissions from all sources and deposition to surrounding regions, including WBNP and the PAD region. Monitored parameters should be consistent with all of the analyses that are currently monitored under the Joint Oil Sands Monitoring plan (which includes 45 elements, a full suite of water chemistry, and >50 PAC compounds). PACs monitored should not be limited to parent PAHs, and should include alkylated PAHs, PAH transformation products, including nitro and oxy-PAHs, and dibenzothiophenes (DBTs). Metals monitored should include those included as part of Teck's EA. but should include metals associated with bitumen resource extraction activities (e.g. aluminum, mercury, vanadium, and zinc).

- Monitoring of abiotic (e.g. air, water, suspended sediments) and biotic environmental compartments. Monitoring activities should provide data to better understand and quantify, through mass-balance models, the movement of contaminants such as mercury to downstream areas, i.e. the PAD/Lake Athabasca.
- 2) Develop follow-up programs and mitigation measures, as part of an adaptive management strategy, in the event that soil and water COPC levels exceed predictions. Mitigation measures should include measures to reduce source emissions of PACs and metals (e.g. retaining riparian buffers to reduce erosion).
 - 3) Reassess risks to wildlife health should soil and water concentrations exceed guidelines for the protection of wildlife health (e.g. CCME guidelines). This should include:
 - An assessment of "worst-case" scenarios (e.g. assess levels in wildlife downstream of the Project in years following high riverine flow).
 - Development of follow-up programs and mitigation measures (e.g. retaining riparian buffers to reduce erosion), as part of an adaptive management strategy

Recommendation 7.1 - Adaptive Management

Based on the extended timelines for model predictions, and the cumulative uncertainties associated with modeling, ECCC requests that an adaptive management regime be implemented by Teck. This is to ensure the environmental performance of the Project does not impair aquatic ecological integrity.

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Incorporate formal Adaptive Management Plans for operational and environmental components, and commit to updating the plans on an ongoing basis.
- 2) As a key basis for adaptive management, predictive aquatic models should be recalibrated every five years with best available information. Simulations should be rerun that estimate predicted impacts to the aquatic environment.
- 3) Make results of monitoring and model updates publicly available.

Recommendation 7.2 - Mercury and Methylmercury - Baseline Levels and Estimates of Mercury Methylation in the FHCL and OSSP

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Conduct appropriate baseline monitoring in advance of constructing the FHCL which includes:
 - High frequency baseline total and methylmercury measurements in water used in the FHCL, OSSP, and downstream waterbodies. This would entail using a reputable laboratory with method

detection limits less than or equal to 0.2 and 0.02 (nanogram per litre) ng/L for total mercury and methylmercury respectively;

- Soil core flooding experiments using the soils proposed to be flooded and the addition of mercury stable isotopes. The approach/experimental design described in Calder et al. (2016) and Schartup et al. (2015) should be used;
 - Baseline food web measurements including measurements of carbon and nitrogen isotopes, total mercury and methylmercury in fishes, and fish eating wildlife and lower food web organisms; and,
 - Baseline mercury stable isotope measurements in fishes, fish-eating wildlife and lower food web organisms. This should be used to trace/differentiate among changing sources of mercury and methylmercury to food web organisms. Methods outlined in Li et al. (2016), Calder et al. (2016), Senn et al. (2010) and Blum et al. (2014) should be used.
- 2) Using the baseline monitoring data and analyses recommended above, model mercury and methylmercury loading in the FHCL and OSSP and use these results to identify whether mitigation measures are needed.

Recommendation 7.3 - Modeling Mercury and Methylmercury Loadings to the Peace Athabasca Delta

ECCC recommends that the Panel request Teck to conduct further monitoring and modeling prior to construction of the FHCL. This would better quantify the potential for mercury releases from the Project, in order to inform future operations and management. Such a study should be done in accordance with the most recent modeling approaches. If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Model both inorganic mercury and methylmercury levels in the downstream environment (Athabasca River and Peace-Athabasca Delta) based on an updated estimate of predicted inorganic mercury and methylmercury concentrations in the FHCL obtained using methods described in Recommendation 7.2.
- 2) Investigate methods such as stable mercury isotope analysis to identify the potential of the downstream environment for mercury methylation to occur. This would inform modelling/predictions of methylmercury production from newly added inorganic mercury in the downstream ecosystems.
- 3) Identify and implement appropriate mitigation measures in line with the updated predictions for methylmercury production and potential downstream loadings.

Recommendation 7.4 - Seepage-Affected Groundwater

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Identify and implement appropriate options for mitigation and adaptive management in conjunction with ongoing monitoring and model updates through life-of-project which could include:
 - Tracking contaminant concentrations in groundwater and surface waters (specifically in Redclay and Big Creeks) to audit the model predictions.
- 2) Conduct chronic bioassays using local aquatic species and site water, at their predicted toxicant concentrations in Redclay and Big creeks, to identify any chronic toxicity and potential impacts on biota in creeks.
- 3) As technologies progress, identify and implement appropriate options for optimizing the physical barrier (seepage control system) and for treatments that reduce toxicity and SOPC concentrations in ETA waters.

Recommendation 7.5 - Water Levels of Lake Athabasca

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Demonstrate the applicability of the Lake Athabasca water level relationships and modelling results to the broader Peace-Athabasca Delta - Lake Athabasca connected system.
- 2) As a key basis for adaptive management, validate the conclusions provided in JRP IR 10.23 via water level modelling updates every 5 years to demonstrate confidence of the projected water level changes, including but not limited to:
 - Estimation of potential effects on lake water levels as a result of the Project and cumulative water withdrawal in a historical and projected climate change context.
 - Results of model updates and water levels simulation results should be publically available.

Recommendation 8.1 - Spill Response Measures and Systems

If the Project is approved, ECCC recommends that the Panel request Teck to:

- 1) Provide an outline of its spill response measures and systems relating to upset releases to water and soil. The outline should cover environmental risk information for each type of accident or malfunction scenario. It should also cover an assessment of the effectiveness of proposed preparedness and response measures, as well as systems aimed to reduce the environmental consequences.

- 2) Develop comprehensive Emergency Response and Spill Contingency plans. These plans should identify, describe and evaluate the potential impacts of all reasonably foreseeable Project-related accidents and malfunctions involving the potential release of chemicals or hazardous materials.
- 3) Develop comprehensive Emergency Response plans that identify site-specific environmental sensitivities, specific and detailed procedures, and associated timeframes that would ensure a prompt response, regulator notification, as well as cleanup in the event of a chemical or hazardous substance spill or threat of release.
- 4) Provide the plans, measures and systems information identified in (1), (2) and (3) for review prior to construction and upon request of interested stakeholders and Indigenous groups. All such plans should be updated regularly throughout the life of the Project and provided to relevant authorities prior to the commencement of the Operations Phase.

Recommendations of Health Canada

Recommendation 4.1-1:

HC suggests that the JRP recommend that Teck:

- Acknowledge that if Tier IV vehicles are not available during the early stages of the Project, the PM_{2.5} model predictions should be considered invalid, thus a plan should be prepared in advance if vehicles other than Tier IV mine fleet vehicles will be deployed at the beginning of Project operations.
- Implement a retrofit and replacement schedule demonstrating off-road equipment conversion to best-in-class technology, starting with Tier IV engines as they become

Recommendation 4.1-2:

HC suggests that the JRP recommends that Teck:

- Monitor baseline concentrations of COPCs.
- Monitor hourly and annual concentrations of the COPCs expected to be near or above baseline concentrations (for example, but not limited to NO₂, SO₂, PM_{2.5}).

Recommendation 4.2-3:

HC suggests that the JRP recommend that Teck:

- Specify the concentrations of polyacrylamide or its breakdown products (i.e. acrylamide) that would trigger non-routine sampling and analysis, followed by the completion of a quantitative HHRA.
- Determine the capability of downstream drinking water treatment plants to meet the most stringent drinking water guidelines for acrylamide prior to construction and operations.
- Include measures to communicate immediately with impacted drinking water treatment facilities and/or users in Teck's spill response measures and systems relating to releases to water and soil.

Recommendation 4.3-1:

HC suggests that the JRP recommend that Teck:

- Ensure that a complaint resolution process is in place for the duration of the Project.
- Provide information on the complaint investigation process to potentially impacted residents and communities.

Recommendation 4.4-1:

HC suggests that the JRP recommend that Teck:

- Monitor methylmercury concentrations in fish throughout the lifetime of the project to confirm that changes are consistent with modelled predictions and that existing consumption advisories remain protective of human health.

Recommendation 4.4-2:

HC suggests that the JRP recommend that Teck:

- Monitor for changes in lead concentrations in environmental media for the duration of the project. Environmental media to be monitored include but are not limited to: air, surface soils, water and sediment. If lead concentrations in environmental media are increasing, country foods should also be analyzed to re-assess the potential risk to human health.

Recommendations of Natural Resources Canada

Recommendation 1:

NRCan recommends that the Panel request Teck evaluate Syncrude's data from the commercial-scale implementation of fluid fine tailings centrifugation to determine if the actual reliability of centrifugation and the post-depositional drying of the centrifuge cake are consistent with Teck's proposed tailings management plan

Recommendation 2:

NRCan recommends that the JRP request that Teck update the groundwater flow and transport models regularly (e.g., at suitable intervals based on the information collected during project operations on), including:

- Information from hydrostratigraphic knowledge (e.g., 3D delineation of units, karst features and structures such as faults);
- Hydraulic properties of hydrofacies within hydrostratigraphic units (e.g., hydraulic conductivity, storage coefficient, porosity);
- Groundwater quantity (e.g., outflow volumes, magnitude and extent of drawdown);
- Groundwater quality monitoring, spatial and temporal evolution (trends) of contaminant or indicator component.

This would provide information required to verify the predictions of the current numerical models and to increase confidence in the results of the future updated models for any anticipated groundwater related issues. As stated by Teck, "Measured solute concentration profiles will be compared between sampling events and against values predicted by the groundwater model. The data will be used to assess trends in the evolution of groundwater chemistry and consistency with model predictions."

Environment and Climate Change Canada (ECCC) is also supportive of this recommendation that Teck undertake to monitor and update the model regularly.

Recommendation 3:

NRCan recommends that the JRP request that Teck monitor for possible groundwater drawdown in the Lake Claire watershed and WBNP by installing monitoring wells near Ronald Lake and at the boundary of WBNP. The monitoring report(s) should be sent to the responsible authority for appropriate actions.

Recommendation 4:

NRCan supports Teck's plans to establish a Reclamation Working Group (RWG) and recommends consideration of the following:

- Terms of Reference be established that specify the governance, membership, and roles and responsibilities of the RWG;
- Sub-groups be established, as needed, within the RWG structure to ensure all aspects of reclamation are covered;
- As Teck's Reclamation Plan contains little detail about reclamation practices and timelines, the RWG should provide input on reclamation targets and timelines;
- Indigenous participation in the RWG is critical to ensure that Indigenous viewpoints are respected and integrated into reclamation activities;
- The RWG actively monitor the recovery of ecosystem services during and following reclamation activity, with particular attention paid to rare plants and plants of Indigenous importance;
- Incorporate continuous improvement as a guiding principle for the RWG's mandate, review reclamation successes and failures, and consult with relevant authorities if reclamation targets are not achieved, and
- Ensure stable funding to support the activities of the RWG over the entire term of the project.

Recommendation 5:

NRCan recommends that:

- Teck adhere to all the components of both the *FireSmart Guidebook for the Oil and Gas Industry* as well as the *Canadian Association of Petroleum Producers' Emergency Preparedness Guide for Hazards Associated with Wildfires*.
- Project firefighting staff are trained as provincial Type 2 wildland firefighters, including Incident Command System training for crew members and leaders.
- A Grass Fuel Management Plan be implemented for Industrial Zone 3.
- Firefighting staff be equipped for suppression of grass and forest fires (e.g., portable gas powered water pumps, hand tools) with equipment compatible with provincial standards.
- Teck collaborate closely with area staff from Alberta Agriculture and Forestry to adequately mitigate wildfire risk and provide for appropriate response.

Recommendations of Parks Canada

Recommendation 5.1-1:

Parks Canada recommends to the JRP that Teck be required to:

- Fund an independent evaluation of mitigation measures by a committee of scientific and Indigenous knowledge experts to prevent range shift and contact of the Ronald Lake herd and diseased Delta bison herd in WBNP. Results of the evaluation should be used by Teck to inform mitigation planning. Mitigation should be implemented in a timely manner to prevent adverse Project effects on the herd, and monitored throughout the life of the mine.
- Fund an independent study of the landscape features and habitats between the Ronald Lake and Delta bison herds to identify potential movement corridors between the herds to inform mitigation planning. This study should be completed prior to Project construction.
- Fund an independent study to assess the range, movements and habitat use of diseased Delta bison in WBNP to inform mitigation planning. This study should be completed prior to Project construction.

Recommendation 6.1-1:

Parks Canada recommends to the JRP that Teck be required to complete baseline studies on stopover habitat use by migratory waterfowl in the PDA prior to construction.

Recommendation 6.1-2:

Parks Canada recommends to the JRP that Teck be required to develop and implement a compensation plan within the RSA to protect from future disturbance stopover habitat equivalent to that which would be disturbed by the Project (in particular lake habitat), for the purpose of maintaining migratory bird stopover habitat within an important waterfowl migration corridor. The compensation plan should be developed in consultation with the Government of Alberta, ECCC and Indigenous groups.

Recommendation 6.2-1:

Parks Canada recommends to the JRP that Teck be required to:

- a) participate in the Oil Sands Bird Technical Team; and
- b) contribute to studies and research on regional waterfowl, including waterfowl migration routes

Recommendation 6.2-2:

Parks Canada recommends that the JRP that Teck be required to monitor the number of waterfowl migrating over the site in spring and fall using a methodology that could be used consistently across operators in the MOSA.

Recommendation 8.1-1:

Parks Canada recommends to the JRP that Teck be required to:

- a) Develop spill response measures and systems relating to releases to water and soil for approval prior to the commencement of construction
- b) Develop an emergency response plan for approval prior to construction that would include:
 - i) project and site-specific mitigation measures and response procedures to minimize the environmental effects of an accident or malfunction reaching WBNP;
 - ii) information on how to mitigate effects and prevent contaminants from entering the PAD and WBNP WHS;
 - iii) effective emergency response capacity and training of staff;
 - iv) commitment to continue diligence to be in state of preparedness/readiness;
 - v) commitment to sufficient response materials and equipment available in strategic locations; and
 - vi) community notification and emergency communications procedures will be incorporated into the plan, particularly for drinking water and traditional land users.
 - vii) Initiate community awareness and education initiatives about emergency responses.
- c) Initiate community awareness and education initiatives about emergency responses.
- d) Provide Parks Canada with an opportunity to review and comment on the plan.
- e) Commit to fund the cleanup and restoration costs of affected areas within WBNP.

Recommendation 8.2-1:

Parks Canada recommends to the JRP that Teck be required to conduct water quality monitoring in Ronald Lake, Buckton Creek, and Lake Claire for at least 5 years prior to operation of the mine with 4 season collection and multiple sample sites and regularly during mine operation.

Recommendation 8.2-2:

Parks Canada recommends to the JRP that at least 5 years prior to proceeding with development in the watershed draining into Ronald Lake, Teck be required to submit for approval an analysis that demonstrates that:

- a) Water quality in Buckton Creek and Lake Claire meets site specific water quality objectives set by Parks Canada in collaboration with Indigenous groups and others for those water bodies; and,

- b) Development of the watershed draining into Ronald Lake according to an updated mine plan, will not result in water quality within Buckton Creek and Lake Claire exceeding site specific water quality objectives set by Parks Canada in collaboration with Indigenous groups and others for those water bodies.

Recommendation 8.2-3:

Parks Canada recommends to the JRP that Teck be required to evaluate every 8 years whether there is additional best available technology to mitigate water and air quality effects.

Recommendation 9.1-1:

Parks Canada recommends to the Panel that Teck not be permitted to withdraw water from the Athabasca River when the flow rates at the Athabasca below the McMurray Station are below the Aboriginal Extreme Flow of 500 m³/s (AXF).

Recommendation 9.2-1:

Parks Canada recommends to the JRP that at least 5 years prior to proceeding with development in the watershed draining into Ronald Lake, Teck be required to submit for approval an analysis that demonstrates that:

- a) Lake Claire water levels meet water regime objectives as determined by Parks Canada in collaboration with Indigenous groups and others; and,
- b) Development of the watershed draining into Ronald Lake according to an updated mine will not result in project impacts to flow in Buckton Creek of more than 5% of natural flows in summer, fall, winter and floods in perpetuity.

Recommendation 9.2- 2:

Parks Canada recommends to the JRP that Teck be required to monitor water flows in Buckton Creek for 15 years prior to starting development in the watershed draining into Ronald Lake.

Recommendation 9.2-3:

Parks Canada recommends to the JRP that Teck be required to monitor for possible groundwater drawdown in the Lake Claire watershed and WBNP by installing monitoring wells near Ronald Lake and at the boundary of WBNP.

Appendix 8 Teck's Response to the Government of Canada's Recommendations

This appendix is intended to assist the reader and is not part of the hearing record. It is consolidated from documents on the project registry at <https://www.ceaa-acee.gc.ca/050/evaluations/proj/65505?culture=en-CA>.

Table A-1: Teck’s Responses to Recommendations from the Government of Canada

Agency	Recommendation from Government	Teck Response
Topic 4.1: Ronald Lake Wood Bison Herd		
ECCC Recommendation 4.1		
ECCC	<p>The Project will result in substantial loss of range and habitat for the Ronald Lake herd, causing a reduction in the range's carrying capacity which, in turn, will result in a high risk of a range shift, disease transmission and reduction in the herd's population size. Some of Teck's proposed mitigation measures are uncertain and others are unlikely to be effective at mitigating Project effects. Based on the proposed mitigations, the Project could thus significantly alter the conservation value of the herd. If the Project is approved, ECCC recommends that the Panel request Teck to:</p>	<p>Teck does not agree with the statement.</p> <p>Teck's assessment findings as they pertain to the potential effects of the Frontier Project on the Ronald Lake bison herd are not consistent with ECCC's statement.</p>
ECCC	<p>1. Fund an independent evaluation of mitigation measures to prevent range shift and contact of the Ronald Lake herd and diseased Delta bison herd in WBNP. The independent evaluation should include participation of Indigenous groups and other knowledgeable experts. Results of the evaluation should be used by Teck to inform mitigation planning. Mitigation should be implemented in a timely manner to prevent adverse Project effects on the herd, and monitored throughout the life of the mine.</p>	<p>Teck agrees, in part, with the recommendation.</p> <p>Regardless of the status of the Project, the Ronald Lake bison herd will benefit from further studies on mitigation measures. Teck has already completed an evaluation of methods to maintain separation of the Ronald Lake bison herd from herds located entirely within Wood Buffalo National Park in the response to JRP IR 7.5 (Appendix 7.5, Attachment II). In addition, Teck's draft Ronald Lake bison mitigation monitoring and adaptive management plan (see response to JRP IR 7.5, Appendix 7.5) includes a systematic process for adapting to Project monitoring data that differs from predictions. Consideration of the recommended work is within the mandate of the Ronald Lake Bison Herd Technical Team, which Teck is committed to support.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<i>implement the Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project, continue to support the Ronald Lake Bison Herd Technical Team as well as monitoring and mitigation measures undertaken by Alberta Environment and Parks or the Parks Canada Agency to maintain the health and viability of the Ronald Lake bison herd over the life of the Project.</i>
ECCC	2. As part of a follow-up monitoring program, continue to fund studies on the Ronald Lake bison herd to determine movements, habitat use and behavior of the herd prior to, during and following Project construction. Monitoring should be continued for the duration of the Project, and used to inform adaptive management efforts to reduce Project effects.	<p>Teck agrees, in part, with the recommendation.</p> <p>Regardless of the status of the Project, the Ronald Lake bison herd will benefit from further studies on mitigation measures.</p> <p>Teck would agree to a recommendation that <i>Teck draw on work undertaken by the Ronald Lake Bison Herd Technical Team and information obtained through the implementation of Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan to guide studies Teck may fund on the herd over the life of the Project.</i></p>
ECCC	3. Fund an independent study of the landscape features and habitats between the Ronald Lake and Delta bison herds to identify potential movement corridors between the herds to inform mitigation planning. This study should be completed prior to Project construction.	<p>Teck agrees, in part, with the recommendation.</p> <p>Regardless of the status of the Project, the Ronald Lake bison herd will benefit from further studies on mitigation measures. Teck has already completed an evaluation of methods to prevent use of possible movement corridors in the response to JRP IR 7.5 (Appendix 7.5, Attachment II). In addition, Teck's Ronald Lake bison mitigation monitoring and adaptive management plan (see response to JRP IR 7.5, Appendix 7.5) includes a systematic process for adapting to Project monitoring data that differs from expectations.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and</i></p>

Table A-1: Teck’s Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<p><i>implement the Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project, continue to support the Ronald Lake Bison Herd Technical Team as well as monitoring and mitigation measures undertaken by Alberta Environment and Parks or the Parks Canada Agency to maintain the health and viability of the Ronald Lake bison herd over the life of the Project.</i></p>
ECCC	<p>4. Fund an independent study to assess the range, movements and habitat use of diseased Delta bison in WBNP to inform mitigation planning. This study should be completed prior to Project construction.</p>	<p>Teck does not agree with the recommendation.</p> <p>Regardless of the status of the Project, the Ronald Lake bison herd will benefit from further studies on mitigation measures.</p> <p>The Project is predicted to have no effects on diseased Delta bison that are the responsibility of Parks Canada Agency. Teck has already completed an evaluation of methods to maintain separation of the Ronald Lake Bison Herd from herds located entirely within Wood Buffalo National Park in the response to JRP IR 7.5 (Appendix 7.5, Attachment II). In addition, Teck's draft Ronald lake bison mitigation monitoring and adaptive management plan (see response to JRP IR 7.5, Appendix 7.5) includes a systematic process for adapting to Project monitoring data should it differ from predictions.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project, continue to support the Ronald Lake Bison Herd Technical Team as well as monitoring and mitigation measures undertaken by Alberta Environment and Parks or the Parks Canada Agency to maintain the health and viability of the Ronald Lake bison herd over the life of the Project.</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
ECCC	5. Fund an independent study to monitor the disease status of the Ronald Lake herd at regular intervals throughout the duration of the Project.	<p>Teck agrees, in part, with the recommendation.</p> <p>Regardless of the status of the Project, the Ronald Lake bison herd will benefit from further studies on mitigation measures.</p> <p>Teck does not have the mandate or authority to capture bison for the purpose of blood or tissue sampling that is necessary to determine their disease status. However, as identified Section 6.2 of the draft Ronald Lake bison mitigation monitoring and adaptive management plan (see response to JRP IR 7.5, Appendix 7.5), we share an interest in maintaining the disease-free status of the Ronald Lake Bison Herd and, therefore, expect to contribute to the efforts of the responsible authorities.</p> <p>Teck would agree with a recommendation that <i>Teck support studies commissioned by responsible authorities to monitor the disease status of the Ronald Lake bison herd over the life of the Project based on the guidance of the Ronald Lake Bison Herd Technical Team.</i></p>
Topic 4.2: Boreal Woodland Boreal Caribou		
ECCC Recommendations 4.2		
ECCC	1. Develop and implement a compensation plan within the Red Earth caribou range prior to Project construction to mitigate for permanent and long-term loss of caribou habitat. The compensation plan should: target restoration of linear disturbance features in the Red Earth range, and be based on a minimum 4:1 (reclaimed: disturbed) compensation ratio. The plan should be developed, to the satisfaction of ECCC, in consultation with Indigenous groups. The effectiveness of the	<p>Teck does not agree with the recommendation.</p> <p>Teck notes that the Project is not located within the Red Earth caribou range, and therefore respectfully suggests this is not an appropriate approval condition.</p> <p>As stated in the response to JRP IR 7.7, if habitat cannot be reclaimed</p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	compensation plan should be monitored over time, and adaptive management applied to address any deficiencies in intended outcomes.	<p>or is not used as expected within the Project Disturbance Area (PDA), whether as core or as secondary habitat, Teck has the ability to become involved in caribou-focused habitat restoration projects and opportunities to restore linear features outside the PDA. Teck's involvement in such measures will be based on the biodiversity management planning process that is described in the response to JRP IR 7.15(a). In addition, for Indigenous communities, Teck has committed to additional funds to reclaim linear disturbances in response to community concern and interest in caribou.</p> <p>Teck would agree with a recommendation that <i>Teck participate in caribou-focused habitat restoration projects and opportunities to restore linear features outside the PDA following Teck's biodiversity management planning process.</i></p>
ECCC	2. Complete a comprehensive field study to determine movements of Red Earth and Richardson caribou across the Athabasca River adjacent to and north of the Project development area, for the purpose of identifying active movement corridors between the ranges. If river crossing sites are limited north of the mine, measures should be taken to maintain movement of caribou across the Athabasca River adjacent to the mine (e.g., by increasing the Athabasca River set-back) and north around the mine. This study should be completed prior to Project construction, to the satisfaction of ECCC, and in consultation with Indigenous groups. Movement of caribou across the Athabasca River adjacent to the mine should be monitored throughout Project operations to ensure range connectivity is maintained.	<p>Teck does not agree with the recommendation.</p> <p>Teck does not have sufficient scope of authority to reasonably conduct this work, particularly with respect to the limits on Teck's ability to collect/obtain data required to complete a movement study of the Red Earth and Richardson caribou. For example, industry is not authorized to deploy radio-collars on caribou in Alberta.</p> <p>Teck would agree with a recommendation that <i>Teck support further study of potential caribou movement corridors across the Athabasca River if such work is prioritized by the Joint Oil Sands Monitoring Program, which Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation.</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
ECCC	3. Monitor the occurrence of wolves and caribou in the vicinity of the mine prior to and following Project construction to determine whether incidental predation on caribou increases following mine construction. If incidental predation occurs or increases, Teck should work with the Government of Alberta to implement appropriate mitigation measures.	<p>Teck agrees, in part, with the recommendation.</p> <p>The occurrence of wolves and caribou in the vicinity of the mine prior to and following Project construction can be a component of the draft wildlife mitigation, monitoring and adaptive management plan (see response to JRP IR 7.14, Appendix 7.14). If Project monitoring detects incidental predation, Teck will work with the government of Alberta to implement mitigation measures as deemed appropriate. Teck will also make monitoring available to the Joint Oil Sands Monitoring Program, which Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation to inform regional monitoring and mitigation.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the Wildlife Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project and if warranted, implement additional mitigation measures related to changes in incidental predation on caribou following mine construction, in consultation with appropriate regulators. Teck will make available its monitoring data to the Joint Oil Sands Monitoring Program.</i></p>
Topic 4.3: Migratory Birds		
ECCC Recommendation 4.3.1		
ECCC	It is ECCC's view that the Project represents a high mortality risk for whooping cranes as the proposed mitigation measures are unlikely to substantially reduce or eliminate this risk. If the Project is approved, ECCC recommends that the Panel request Teck to:	<p>Teck does not agree with the statement.</p> <p>Teck proposes that bird deterrent methods discussed in the draft Waterfowl Protection Plan (see response to JRP IR 7.10,</p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		Appendix 7.10) are proven and robust.
ECCC	1. Investigate and implement alternative designs for its external tailings areas, to the extent possible. This includes measures to: - Eliminate or reduce gently sloping sand beaches within external tailings areas, as well as adjacent shallow water areas; - cover external tailings areas; - reduce the size of external tailings areas; and - Continuously remove all bitumen and oil from the surface of external tailings areas.	<p>Teck agrees, in part, with the recommendation.</p> <p>The draft Waterfowl Protection Plan (see response to JRP IR 7.10, Appendix 7.10) identifies monitoring, mitigation and adaptive management necessary to deter waterfowl, including whooping cranes, from using waste water ponds and tailings areas. If necessary based on monitoring, the adaptive management program will identify alternate designs for external tailings areas in consideration of constraints imposed by competing imperatives such as <i>Directive 085</i> and dam safety.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the Waterfowl Protection Plan for the Frontier Project.</i></p>
ECCC	2. Investigate and, to the extent possible, implement new technologies to deter whooping cranes from external tailings areas. This could include the use of drones to continuously patrol potential landing and stopover areas during the migration season, and dissuade cranes from landing in these areas.	<p>Teck agrees, in part, with the recommendation.</p> <p>The draft waterfowl protection plan (see response to JRP IR 7.10, Appendix 7.10) identifies monitoring, mitigation and adaptive management necessary to deter waterfowl, including whooping cranes, from using waste water ponds and tailings areas. If necessary based on monitoring, the adaptive management program will identify alternate designs for external tailings areas in consideration of constraints imposed by competing imperatives such as <i>Directive-085</i> and dam safety.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the Waterfowl Protection Plan for the Frontier Project.</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
ECCC	3. Monitor the occurrence, movements and habitat use of whooping cranes on (and adjacent to) its lease to determine the response of birds to development of the Frontier Mine, and to inform mitigation planning. Information should also be collected on interactions of whooping cranes with external tailings areas and other industrial waterbodies on the Frontier Lease. Data should be used by Teck to evaluate the success of mitigation measures (e.g., deterrents, reclamation) and to improve performance of these measures, as necessary.	Teck agrees with the recommendation. The draft waterfowl protection plan (see response to JRP IR 7.10, Appendix 7.10) identifies monitoring, mitigation and adaptive management necessary to deter waterfowl, including whooping cranes, from using waste water ponds and tailings areas.
ECCC	4. Contribute funding to regional monitoring of whooping cranes in the oil sands region, to inform understanding of broader cumulative effects and risks posed by oil sands developments.	Teck agrees, in part , with the recommendation. Teck is mandated to fund the Joint Oil Sands Monitoring Program in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation and will support regional monitoring of whooping cranes if prioritized by the program managers. Teck would agree with the recommendation that <i>Teck participate in the Joint Oil Sands Monitoring Program</i> .
ECCC Recommendation 4.3.2		
ECCC	Consistent with the MBCA, Teck must exercise due diligence to deter birds from contacting deleterious substances in its process-affected waterbodies; therefore, ECCC does not consider it necessary to recommend mitigation measures that are required to meet federal legislation. It is assumed that Teck will implement best-available bird deterrent technology, should the Project be approved and built. Numerous migratory birds, however, continue to land on process affected waterbodies	The draft waterfowl protection plan (see response to JRP IR 7.10, Appendix 7.10) identifies monitoring, mitigation and adaptive management necessary to deter waterfowl, including whooping cranes, from using waste water ponds and tailings areas using best available bird deterrent technology.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	(including external tailings areas) despite the presence of best-available bird deterrent technology, resulting in the potential for significant cumulative off-site effects. If the Project is approved, ECCC recommends that the Panel request Teck to:	
ECCC	1. Initiate a study or series of studies, in collaboration with other oil sands mine operators (as part of regional monitoring efforts), to determine the extent of off-site effects on migrating birds resulting from contact with oil sheen.	<p>Teck agrees, in part, with the recommendation.</p> <p>Teck is willing to support regional monitoring of the extent of off-site effects on migrating birds resulting from contact with oil sheen if prioritized by the Joint Oil Sands Monitoring Program, which Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation.</p> <p>Teck would agree with a recommendation that <i>Teck participate in the Joint Oil Sands Monitoring Program.</i></p>
ECCC	<p>2. Investigate and implement alternative designs for its external tailings areas, to the extent possible. This includes measures to:</p> <ul style="list-style-type: none"> • cover external tailings areas to prevent bird landings; • reduce the size of external tailings areas; and, • continuously remove all bitumen and oil from the surface of external tailings areas. 	<p>Teck agrees, in part, with the recommendation.</p> <p>The draft waterfowl protection plan (see response to JRP IR 7.10, Appendix 7.10) identifies monitoring, mitigation and adaptive management necessary to deter waterfowl, from using waste water ponds and tailings areas. If necessary based on monitoring, the adaptive management program will identify alternate designs for external tailings areas in consideration of constraints imposed by competing imperatives such as <i>Directive 085</i> and dam safety.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the Waterfowl Protection Plan for the Frontier Project.</i></p>

Table A-1: Teck’s Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
ECCC	In addition, because of the potential significant residual local scale effects on migratory bird habitat, in particular stopover habitat because of the loss of Unnamed Lake 1 and Unnamed Lake 2, and uncertainty in the success of end-pit lakes, ECCC recommends that the Panel request that Teck:	
ECCC	1. Develop and implement a compensation plan within the RSA to protect from future disturbance stopover habitat equivalent to that which would be disturbed by the Project (in particular lake habitat), for the purpose of maintaining migratory bird stopover habitat within an important waterfowl migration corridor. The compensation plan should be developed in consultation with the Government of Alberta, ECCC and Indigenous groups.	<p>Teck agrees, in part, with the recommendation.</p> <p>Teck's preferred approach to offsetting lost migratory bird stop-over habitat is discussed in the response to JRP IR 7.15: <i>Teck is willing to pursue biodiversity offsets for residual environmental effects related to the Project; however, there is no legislative or regulatory process in place to allow biodiversity offsets to be acquired in the Project area. In spite of these limitations to acquire biodiversity offsets, Teck will commit to the following:</i></p> <ul style="list-style-type: none"> • <i>Completing the biodiversity management planning process to identify preferred biodiversity elements to be considered for offsetting residual Project-effects. This would be done with the understanding that the draft biodiversity management plan can only provide context for negotiation of a Conservation Agreement because there are practical limitations to realizing meaningful biodiversity offsets in Alberta.</i> • <i>Engaging with regulators, Indigenous communities and stakeholders during the biodiversity management planning process and during ongoing work to understand and define how biodiversity offsets might be realized in Alberta.</i> • <i>Negotiating a Conservation Agreement with ECCC, which includes input from the AER and AEP.</i> • <i>Providing routine reports to ECCC, AER and AEP after the Project is operating that summarizes progress on realizing meaningful biodiversity offsets for the Project</i>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		Teck would agree with a recommendation that <i>Teck negotiate a Conservation Agreement with ECCC that includes input from the AER and AEP, based upon the finalized Biodiversity Management Plan developed for the Frontier Project.</i>
ECCC Recommendations 4.3.3		
ECCC	The Project will contribute to likely existing significant cumulative regional effects on terrestrial and wetland-dependent SARA-listed migratory bird species. The effects of the Project on Canada warbler may also be high-magnitude and thus significant at the regional scale. The success of reclamation is currently uncertain; loss of old-growth forests will be long-term, while loss of peatlands may be permanent. If the Project is approved, ECCC recommends that the Panel request Teck to:	
ECCC	1 . Develop and implement a compensation plan within the RSA to protect from future disturbance habitat for old-growth, wetland and other SARA-listed migratory bird species equivalent to that which would be disturbed by the Project, for the purpose of maintaining migratory bird populations in the RSA. The compensation plan should be developed in consultation with the Government of Alberta, ECCC and Indigenous groups.	Teck agrees, in part , with the recommendation. Our preferred approach is discussed in the response to JRP IR 7.15: <i>Teck is willing to pursue biodiversity offsets for residual environmental effects related to the Project; however, there is no legislative or regulatory process in place to allow biodiversity offsets to be acquired in the Project area. In spite of these limitations to acquire biodiversity offsets, Teck will commit to the following:</i> <ul style="list-style-type: none"> • <i>Completing the biodiversity management planning process to identify preferred biodiversity elements to be considered for offsetting residual Project-effects. This would be done with the understanding that the draft BMP can only provide context for negotiation of a</i>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<p><i>Conservation Agreement because there are practical limitations to realizing meaningful biodiversity offsets in Alberta.</i></p> <ul style="list-style-type: none"> • <i>Engaging with regulators, Indigenous communities and stakeholders during the biodiversity management planning process and during ongoing work to understand and define how biodiversity offsets might be realized in Alberta.</i> • <i>Negotiating a Conservation Agreement with ECCC, which includes input from the AER and AEP.</i> • <i>Providing routine reports to ECCC, AER and AEP after the Project is operating that summarizes progress on realizing meaningful biodiversity offsets for the Project</i> <p>Teck would agree with a recommendation that <i>Teck negotiate a Conservation Agreement with ECCC that includes input from the AER and AEP, based upon the finalized Biodiversity Management Plan for the Frontier Project.</i></p>
Topic 4.4: Rodenticides in fisher and marten		
ECCC Recommendation 4.4		
ECCC	1. Implement an integrated pest management (IPM) plan to monitor pest presence, monitor the effectiveness of pest control strategies utilized pest control strategies utilized, and, in accordance with Federal and any provincial standards, apply rodenticides only when needed, given that the Frontier Project is situated near high quality fisher and marten habitat.	<p>Teck agrees, in part, with the recommendation.</p> <p>Pest management should be a component of the Nuisance Wildlife Prevention Protocol that Teck committed to develop in Volume 1, Section 18.5, Table 18.5-15 of the Integrated Application instead of a separate plan.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<i>implement the Nuisance Wildlife Prevention Protocol for the Frontier Project including a section on pest management.</i>
ECCC	2. Take measures to avoid rodent infestations (e.g. effective handling and removal of waste, exclusion measures, mechanical control measures).	Teck agrees with the recommendation. Teck would agree with a recommendation that <i>Teck finalize and implement the Nuisance Wildlife Prevention Protocol for the Frontier Project including a section on pest management.</i>
ECCC	3. Use first generation ARs in lieu of SGARs should chemical intervention be required to control rodent population outbreaks.	Teck agrees with the recommendation. Teck would agree with a recommendation that <i>Teck finalize and implement the Nuisance Wildlife Prevention Protocol for the Frontier Project including a section on pest management.</i>
Topic 5.1: Canadian Ambient Air Quality Standards		
ECCC Recommendation 5.1		
ECCC	1. Take an iterative approach to air quality management and make any necessary adaptations to project equipment or procedures to prevent project emissions from contributing to deteriorating air quality in the local and regional area.	Teck agrees with the recommendation. The recommendation is consistent with the Adaptive Management Program described in Section 8 of the draft air quality mitigation, monitoring and adaptive management plan provided in response to JRP IR 3.18, Appendix 3.18.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
Topic 5.3: Fine Particulate Matter and Secondary Organic Aerosols		
ECCC Recommendations 5.3		
ECCC	The SOA contribution to the total PM25 has not been determined. If the Project is approved, ECCC recommends that the Panel request Teck to:	
ECCC	1. Implement mitigation measures that reduce PM25 and specifically target SOA precursor emissions. This means that the Proposed Air Quality, Mitigation, Monitoring, and Adaptive Management Plan for total PM25 should include mitigation that targets all PM25 sources, one of which are SOA precursors (analytically unresolved hydrocarbons).	Teck agrees with the recommendation. Teck would agree with the recommendation that <i>Teck finalize and implement the Air Quality Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project to include SOA precursor emissions.</i>
Topic 5.4: Off-Road Air Emissions		
ECCC Recommendation 5.4		
ECCC	1. Implement a retrofit and replacement schedule demonstrating off-road equipment conversion to best-in-class technology, starting with final Tier IV engines, with new engines meeting the Off-Road Compression Ignition Engine Emission Regulations (under the Canadian Environmental Protection Act, 1999);	Teck agrees, in part , with the recommendation. Teck would agree with the recommendation that <i>Teck use a minimum of Tier IV engines, or equivalent for the haul truck fleet for the Frontier Project.</i>
ECCC	2. Not remove emission control technologies from off-road equipment;	Teck agrees with the recommendation.
ECCC	3. Implement an emission control technology maintenance program, which may include combined use of individual vehicle fuel usage indicators, vehicle emission testing, and electronic diagnosis techniques to trigger maintenance: and	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
ECCC	4. Provide employee training on minimizing off-road equipment idling and the importance of avoiding tampering with emissions control systems.	Teck agrees with the recommendation.
Topic 5.5 Greenhouse Gasses		
ECCC Recommendation 5.5		
ECCC	1. Demonstrate a commitment to "best-in-class" GHG emissions performance through the implementation of relevant technologies and practices over the life of the Project.	<p>Teck agrees, in part, with the recommendation.</p> <p>As discussed in the response to ESRD/CEA Round 1 SIR 342, Teck's goal for the Project is to continually improve the efficiency of energy use and greenhouse gas emission reduction technologies in an effort to outperform regulations that are in effect. To achieve this, we have committed to develop a Greenhouse Gas Management Plan (see response to AER Round 5 SIR 39) and an Energy Management System (see response to JRP IR 3.15[c]).</p> <p>Teck would agree with a recommendation that <i>Teck develop and finalize a Greenhouse Gas Management Plan and an Energy Management System for the Frontier Project.</i></p>
ECCC	2. Beginning in 2020 and continuing every fifth year thereafter, undertake an analysis on the feasibility of using commercially available and emerging (at pilot or demonstration stage) technologies and practices which have the potential to reduce Project GHG emissions, such as at-face slurring, hybrid (aqueous and nonaqueous) bitumen extraction and tailings solvent recovery unit heat recovery. ECCC suggests that these reports should describe all technological and environmental	<p>Teck agrees, in part, with the recommendation.</p> <p>As discussed in the response to ESRD/CEAA Round 1 SIR 342, our goal for the Project is to continually improve the efficiency of energy use and greenhouse gas emission reduction technologies in an effort to outperform regulations that are in effect. To achieve this, we have committed to develop a Greenhouse Gas Management Plan (see response to AER Round 5 SIR 39) and an Energy Management</p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	opportunities, document any technologies and practices implemented by the Project, and propose implementation of selected technologies and environmental practices. The report should also provide a rationale with technical and/or economic considerations for selected and excluded technologies and environmental practices in relation to the best-in-class performance objective.	System (see response to JRP IR 3.15[c]). Teck would agree with a recommendation that <i>Teck develop and finalize a Greenhouse Gas Management Plan and an Energy Management System for the Frontier Project.</i>
ECCC	3. Commit to implementing the plan to connect to the electricity grid by the start of Phase 1 in order to sell its low intensity electricity, as Teck has stated in the grid connection plans.	Teck agrees, in part , with the recommendation. Teck would agree with a recommendation that <i>Teck implement the plan to connect to the electricity grid by the start of Phase 1 operations in order to sell its excess low intensity electricity, as applicable.</i>
ECCC	4. Develop and implement an energy management system to achieve its objective of continual improvement in energy efficiency and related GHG emissions mitigation. The energy management system would include but not be limited to the following actions: <ul style="list-style-type: none"> • Conducting a review (analyzes energy data, identify areas of significant energy use and identify areas for energy performance improvement opportunities). • Establishing emissions and energy baseline, setting objectives and targets that • are measurable, and having timelines for achievement over the life of the Project • that aligns with best-in-class performer. • Establishing and implementing an action plan to achieve the objectives and • targets. • Monitoring and assessing energy and GHG performance 	Teck agrees, in part , with the recommendation. Teck committed to developing an Energy Management System in the response to JRP IR 3.15(c). The recommendation generally aligns with the stated plan; however the flexibility to follow the indicator system described, will enable consistency across our global operations and the coordination of efforts to continually improve our energy efficiency. Teck would agree with a recommendation that <i>Teck develop and implement an Energy Management System for the Frontier Project to achieve continual improvement in energy efficiency and related GHG emission mitigation. The energy management system should include the following elements 1) Designation of Accountabilities, 2) Integration of GHG costs into budgeting processes and decisions, 3) Setting energy use and GHG emission performance targets, 4) tracking and</i>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	yearly.	<i>measurement of direct and indirect energy use and GHG emissions, 5) public reporting of performance and progress on targets, and 6) sustainability reporting.</i>
Topic 6.1 Polycyclic Aromatic Compounds and Metals		
ECCC Recommendations 6.1		
ECCC	<p>1. Implement a follow-up program to validate PAC and metal predictions to assess their accuracy and include: A program to monitor PACs and metals, including emissions from all sources and deposition to surrounding regions, including WBNP and the PAD region. Monitored parameters should be consistent with all of the analyses that are currently monitored under the Joint Oil Sands Monitoring plan (which includes 45 elements, a full suite of water chemistry, and >50 PAC compounds). PACs monitored should not be limited to parent PAHs, and should include alkylated PAHs, PAH transformation products, including nitro and oxy-PAHs, and dibenzothiophenes (DBTs). Metals monitored should include those included as part of leek's EA. but should include metals associated with bitumen resource extraction activities (e.g. aluminum, mercury, vanadium, and zinc). • Monitoring of abiotic (e.g. air, water, suspended sediments) and biotic environmental compartments. Monitoring activities should provide data to better understand and quantify, through mass-balance models, the movement of contaminants such as mercury to downstream areas, i.e. the PAD/Lake Athabasca.</p>	<p>Teck does not agree with the recommendation.</p> <p>Teck is willing to support regional monitoring of the PACs and metals, including emissions from all sources and deposition to surrounding regions, including WBNP and the PAD region as prioritized by the Joint Oil Sands Monitoring Program, which Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation.</p> <p>Teck would agree with the recommendation that <i>Teck finalize and implement the Hydrology and Water Quality Mitigation, Monitoring and Adaptive Management Plan, Wildlife Mitigation and Monitoring Plan, and Air Quality Mitigation Monitoring and Adaptive Management Plan for the Frontier Project, and that Teck participate in the Joint Oil Sands Monitoring Program.</i></p>
ECCC	2. Develop follow-up programs and mitigation measures, as part of an adaptive management strategy, in the event that soil	Teck agrees, in part , with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	and water COPC levels exceed predictions. Mitigation measures should include measures to reduce source emissions of PACs and metals (e.g. retaining riparian buffers to reduce erosion).	<p>The recommendation is consistent with Teck's adaptive management strategy as outlined in dedicated sections of the draft wildlife mitigation and monitoring plan (see response to JRP IR 7.14, Appendix 7.14), draft hydrology and water quality mitigation monitoring and adaptive management plan (see response to JRP IR 10.25, Appendix 10.25), draft air quality mitigation monitoring and adaptive management plan (see response to JRP IR 3.18, Appendix 3.18) and draft reclamation monitoring plan (see response to JRP IR 6.9, Appendix 6.9).</p> <p>Teck would agree with the recommendation that <i>Teck finalize and implement the Wildlife Mitigation, Monitoring and Adaptive Management Plan, the Hydrology and Water Quality Mitigation, Monitoring and Adaptive Management Plan, and the Air Quality Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project.</i></p>
ECCC	<p>3. Reassess risks to wildlife health should soil and water concentrations exceed guidelines for the protection of wildlife health (e.g. CCME guidelines). This should include:</p> <ul style="list-style-type: none"> • An assessment of "worst-case" scenarios (e.g. assess levels in wildlife downstream of the Project in years following high riverine flow). • Development of follow-up programs and mitigation measures (e.g. retaining riparian buffers to reduce erosion), as part of an adaptive management strategy. 	<p>Teck agrees, in part, with the recommendation.</p> <p>The recommendation is consistent with Teck's adaptive management strategy as outlined in dedicated sections of the draft wildlife mitigation and monitoring plan (see response to JRP IR 7.14, Appendix 7.14), draft hydrology mitigation monitoring and adaptive management plan (see response to JRP IR 10.25, Appendix 10.25) and the draft air quality mitigation monitoring and adaptive management plan (see response to JRP IR 3.18, Appendix 3.18).</p> <p>Teck would agree with the recommendation that <i>Teck finalize and implement the Wildlife Mitigation, Monitoring and Adaptive Management Plan, the Hydrology and Water Quality Mitigation,</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<i>Monitoring and Adaptive Management Plan and the Air Quality Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project.</i>
Topic 7.1 Adaptive Management		
ECCC Recommendation 7 .1		
ECCC	Based on the extended timelines for model predictions, and the cumulative uncertainties associated with modeling, ECCC requests that an adaptive management regime be implemented by Teck. This is to ensure the environmental performance of the Project does not impair aquatic ecological integrity. If the Project is approved, ECCC recommends that the Panel request Teck to:	
ECCC	1. Incorporate formal Adaptive Management Plans for operational and environmental components, and commit to updating the plans on an ongoing basis.	Teck agrees with the recommendation. We note that Adaptive Management is a standard component of the mitigation and monitoring programs we have provided in response to JRP IRs.
ECCC	2. As a key basis for adaptive management, predictive aquatic models should be recalibrated every five years with best available information. Simulations should be rerun that estimate predicted impacts to the aquatic environment.	Teck agrees with the recommendation.
ECCC	3. Make results of monitoring and model updates publicly available.	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
Topic 7.2: Mercury and Methylmercury - Baseline Levels and Estimates of Mercury Methylation in the FHCL and OSSP		
ECCC Recommendation 7 .2		
ECCC	<p>1. Conduct appropriate baseline monitoring in advance of constructing the FHCL which includes:</p> <ul style="list-style-type: none"> • High frequency baseline total and methylmercury measurements in water used in the FHCL, OSSP, and downstream waterbodies. This would entail using a reputable laboratory with method detection limits less than or equal to 0.2 and 0.02 (nanogram per litre) ng/L for total mercury and methylmercury respectively; • Soil core flooding experiments using the soils proposed to be flooded and the addition of mercury stable isotopes. The approach/experimental design described in Calder et al. (2016) and Start-up et al. (2015) should be used; • Baseline food web measurements including measurements of carbon and nitrogen isotopes, total mercury and methylmercury in fishes, and fish eating wildlife and lower food web organisms; and, • Baseline mercury stable isotope measurements in fishes , fish-eating wildlife and lower food web organisms. This should be used to trace/differentiate among changing sources of mercury and methylmercury to food web organisms. Methods outlined in Li et al. (2016), Calder et al. (2016), Senn et al. (2010) and Blum et al. (2014) should be used. 	<p>Teck does not agree with the recommendation.</p> <p>The draft detailed fisheries offsetting plan in response to JRP IR 2.1, Appendix 2.1 includes mitigation, monitoring and adaptive management that will verify that the primary mitigation of organic soil removal will be successful in a manner consistent with existing compensation lakes in the oil sands region. The recommendation provided by DFO (recommendation 5) is viewed by Teck as appropriate.</p> <p>Teck would agree with a recommendation that <i>Teck collect baseline information to further inform methyl mercury modelling in the offsetting lake and downstream environments and that Teck consult on the results of the baseline data collection and any further mitigation measures proposed with DFO, Environment and Climate Change Canada, Indigenous Communities and other stakeholders, as appropriate.</i></p>
ECCC	<p>2. Using the baseline monitoring data and analyses recommended above, model mercury and methylmercury loading in the FHCL and OSSP and use these results to identify whether mitigation measures are needed.</p>	<p>Teck does not agree with the recommendation.</p> <p>The draft detailed fisheries offsetting plan in response to JRP IR 2.1, Appendix 2.1 includes mitigation, monitoring and adaptive management plan that will verify that the primary mitigation of organic soil removal</p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<p>will be successful in a manner consistent with existing compensation lakes in the oil sands region. The recommendation provided by DFO (recommendation 5) is viewed by Teck as appropriate.</p> <p>Teck would agree with a recommendation that <i>Teck collect baseline information to further inform methyl mercury modelling in the offsetting lake and downstream environments and that Teck consult on the results of the baseline data collection and any further mitigation measures proposed with DFO, Environment and Climate Change Canada, Indigenous Communities and other stakeholders, as appropriate.</i></p>
Topic 7.3: Modeling Mercury and Methylmercury Loadings to the Peace Athabasca Delta		
ECCC Recommendation 7 .3		
ECCC	ECCC recommends that the Panel request Teck to conduct further monitoring and modeling prior to construction of the FHCL. This would better quantify the potential for mercury releases from the Project, in order to inform future operations and management. Such a study should be done in accordance with the most recent modeling approaches. If the Project is approved, ECCC recommends that the Panel request Teck to:	
ECCC	1. Model both inorganic mercury and methylmercury levels in the downstream environment (Athabasca River and Peace-Athabasca Delta) based on an updated estimate of predicted inorganic mercury and methylmercury concentrations in the FHCL obtained using methods described in Recommendation 7.2.	<p>Teck does not agree with the recommendation.</p> <p>The draft detailed fisheries offsetting plan in response to JRP IR 2.1, Appendix 2.1 includes mitigation, monitoring and adaptive management plan that will verify that the primary mitigation of organic soil removal will be successful in a manner consistent with existing compensation lakes in the oil sands region. The recommendation provided by DFO</p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<p>(recommendation 5) is viewed by Teck as appropriate.</p> <p>Teck would agree with a recommendation that <i>Teck collect baseline information to further inform methyl mercury modelling in the offsetting lake and downstream environments and that Teck consult on the results of the baseline data collection and any further mitigation measures proposed with DFO, Environment and Climate Change Canada, Indigenous Communities and other stakeholders, as appropriate.</i></p>
ECCC	<p>2. Investigate methods such as stable mercury isotope analysis to identify the potential of the downstream environment for mercury methylation to occur. This would inform modelling/predictions of methylmercury production from newly added inorganic mercury in the downstream ecosystems.</p>	<p>Teck does not agree with the recommendation.</p> <p>The draft detailed fisheries offsetting plan in response to JRP IR 2.1, Appendix 2.1 includes mitigation, monitoring and adaptive management plan that will verify that the primary mitigation of organic soil removal will be successful in a manner consistent with existing compensation lakes in the oil sands region. The recommendation provided by DFO (recommendation 5) is viewed by Teck as appropriate.</p> <p>Teck would agree with a recommendation that <i>Teck collect baseline information to further inform methyl mercury modelling in the offsetting lake and downstream environments and that Teck consult on the results of the baseline data collection and any further mitigation measures proposed with DFO, Environment and Climate Change Canada, Indigenous Communities and other stakeholders, as appropriate.</i></p>
ECCC	<p>3. Identify and implement appropriate mitigation measures in line with the updated predictions for methylmercury production</p>	<p>Teck does not agree with the recommendation.</p>

Table A-1: Teck’s Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	and potential downstream loadings.	<p>The draft detailed fisheries offsetting plan in response to JRP IR 2.1, Appendix 2.1 includes mitigation, monitoring and adaptive management plan that will verify that the primary mitigation of organic soil removal will be successful in a manner consistent with existing compensation lakes in the oil sands region. The recommendation provided by DFO (recommendation 5) is viewed by Teck as appropriate.</p> <p>Teck would agree with a recommendation that <i>Teck collect baseline information to further inform methyl mercury modelling in the offsetting lake and downstream environments and that Teck consult on the results of the baseline data collection and any further mitigation measures proposed with DFO, Environment and Climate Change Canada, Indigenous Communities and other stakeholders, as appropriate.</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
Topic 7.4 Seepage-Affected Groundwater		
ECCC Recommendation 7 .4		
ECCC	1. Identify and implement appropriate options for mitigation and adaptive management in conjunction with ongoing monitoring and model updates through life-of-project which could include: <ul style="list-style-type: none"> Tracking contaminant concentrations in groundwater and surface waters (specifically in Redclay and Big Creeks) to audit the model predictions. 	Teck agrees with the recommendation.
ECCC	2. Conduct chronic bioassays using local aquatic species and site water, at their predicted toxicant concentrations in Redclay and Big creeks, to identify any chronic toxicity and potential impacts on biota in creeks.	Teck agrees, in part , with the recommendation. Teck would agree to a recommendation that <i>Teck conduct chronic bioassays using local aquatic species and site water, at their predicted toxicant concentrations in advance of construction at select locations in Redclay and Big Creek proximate to but downgradient of the proposed External Tailings areas.</i>
ECCC	3. As technologies progress, identify and implement appropriate options for optimizing the physical barrier (seepage control system) and for treatments that reduce toxicity and SOPC concentrations in ETA waters.	Teck agrees with the recommendation.
Topic 7.5: Water Levels of Lake Athabasca		
ECCC Recommendation 7 .5		
ECCC	1. Demonstrate the applicability of the Lake Athabasca water level relationships and modelling results to the broader Peace-Athabasca Delta - Lake Athabasca connected system.	Teck does not agree with the recommendation. Monitoring of Lake Athabasca is a regional initiative that is beyond the scope of a single proponent.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		Teck would agree with a recommendation that <i>Teck participate in the Joint Oil Sands Monitoring Program.</i>
ECCC	<p>2. As a key basis for adaptive management, validate the conclusions provided in JRP IR 10.23 via water level modelling updates every 5 years to demonstrate confidence of the projected water level changes, including but not limited to:</p> <ul style="list-style-type: none"> • Estimation of potential effects on lake water levels as a result of the Project and cumulative water withdrawal in a historical and projected climate change context. • Results of model updates and water levels simulation results should be publically available. 	<p>Teck does not agree with the recommendation.</p> <p>Monitoring of Lake Athabasca is a regional initiative that is beyond the scope of a single proponent.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement Hydrology and Water Quality Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project and that Teck participate in the Joint Oil Sands Monitoring Program.</i></p>
Topic 8.1: Spill Response Measures and Systems		
ECCC Recommendation 8.1		
ECCC	<p>1. Provide an outline of its spill response measures and systems relating to upset releases to water and soil. The outline should cover environmental risk information for each type of accident or malfunction scenario. It should also cover an assessment of the effectiveness of proposed preparedness and response measures, as well as systems aimed to reduce the environmental consequences.</p>	Teck agrees with the recommendation.
ECCC	<p>2. Develop comprehensive Emergency Response and Spill Contingency plans. These plans should identify, describe and evaluate the potential impacts of all reasonably foreseeable Project-related accidents and malfunctions involving the potential release of chemicals or hazardous materials.</p>	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
ECCC	3. Develop comprehensive Emergency Response plans that identify site-specific environmental sensitivities, specific and detailed procedures, and associated timeframes that would ensure a prompt response, regulator notification, as well as cleanup in the event of a chemical or hazardous substance spill or threat of release.	Teck agrees with the recommendation.
ECCC	4. Provide the plans, measures and systems information identified in (1), (2) and (3) for review prior to construction and upon request of interested stakeholders and Indigenous groups. All such plans should be updated regularly throughout the life of the Project and provided to relevant authorities prior to the commencement of the Operations Phase.	Teck agrees with the recommendation.
4.1 AIR QUALITY		
HC Recommendation #4.1-1:		
HC	Acknowledge that if Tier IV vehicles are not available during the early stages of the Project, the PM2s model predictions should be considered invalid, thus a plan should be prepared in advance if vehicles other than Tier IV mine fleet vehicles will be deployed at the beginning of Project operations.	Teck agrees, in part , with the recommendation. Teck would agree with the recommendation that <i>Teck use a minimum of Tier IV engines, or equivalent for the haul truck fleet for the Frontier Project.</i>
HC	Implement a retrofit and replacement schedule demonstrating off-road equipment conversion to best-in-class technology, starting with Tier IV engines as they become available.	Teck agrees, in part , with the recommendation. Teck would agree with the recommendation that <i>Teck use a minimum of Tier IV engines, or equivalent for the haul truck fleet for the Frontier Project.</i>
HC Recommendation #4.1-2:		

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
HC	Monitor baseline concentrations of COPCs.	Teck agrees with the recommendation.
HC	Monitor hourly and annual concentrations of the COPCs expected to be near or above baseline concentrations (for example, but not limited to NO ₂ , SO ₂ , PM _{2.5}).	Teck agrees with the recommendation.
4.2 DRINKING WATER QUALITY		
HC Recommendation #4.2-3:		
HC	Specify the concentrations of polyacrylamide or its breakdown products (i.e. acrylamide) that would trigger non-routine sampling and analysis, followed by the completion of a quantitative HHRA.	Teck agrees, in part , with the recommendation. Teck would agree to a recommendation that <i>Teck incorporate a threshold for acrylamide into Section 7 of the Hydrology and Water Quality Mitigation Monitoring and Adaptive Management Plan (see response to JRP IR 10.25, Appendix 10.25). The need to complete a Human Health Risk Assessment would be based on the outcome of the Adaptive Management Program described in Section 8 of the plan.</i>
HC	Determine the capability of downstream drinking water treatment plants to meet the most stringent drinking water guidelines for acrylamide prior to construction and operations.	Teck does not agree with the recommendation. The closest water treatment plant downstream of the Project is located in Fort Chipewyan, which is about 110km from the Frontier Project. The capability of this facility is not under the control or responsibility of Teck and is separate from Teck's obligation to manage release waters. This in conjunction with Teck's expectation that measurable amounts of polyacrylamide or acrylamide will not be released to the receiving environment means that the monitoring proposed by Teck for polyacrylamide and acrylamide is adequate. Consistent with Teck's response to ESRD/CEAA Round 3 SIR 37c.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<p><i>Teck will monitor at specific locations including, but not necessarily limited to:</i></p> <ul style="list-style-type: none"> • <i>release water from locations where polymer treatment is applied</i> • <i>porewater from in-pit DDAs where polymer treated tailings are stored</i> • <i>in groundwater wells downgradient from such locations</i> <p><i>Release waters would likely be monitored most frequently (e.g., weekly to monthly initially and quarterly thereafter) to confirm that the polymer dosing rate is appropriate. Porewater and groundwater sampling frequency would be less frequent (e.g., quarterly or semi-annually). Should groundwater monitoring indicate polymer mobility or the presence of acrylamide monomer, operational mitigation and additional monitoring of seepage interception wells would likely be initiated.</i></p> <p><i>Teck would agree to a recommendation that Teck finalize and implement the Groundwater Monitoring Plan and the Hydrology and Water Quality Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project.</i></p>
HC	Include measures to communicate immediately with impacted drinking water treatment facilities and/or users in Teck's spill response measures and systems relating to releases to water and soil.	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
4.3 NOISE		
HC Recommendation #4.3-1:		
HC	Ensure that a complaint resolution process is in place for the duration of the Project.	Teck agrees with this recommendation; recognizing the recommendation is consistent with Alberta Energy Regulator Directive-038.
HC	Provide information on the complaint investigation process to potentially impacted residents and communities.	Teck agrees with this recommendation; recognizing the recommendation is consistent with Alberta Energy Regulator Directive-038.
4.4 COUNTRY FOODS		
HC Recommendation #4.4-1:		
HC	Monitor methylmercury concentrations in fish throughout the lifetime of the project to confirm that changes are consistent with modelled predictions and that existing consumption advisories remain protective of human health.	<p>Teck agrees, in part, with the recommendation.</p> <p>The recommendation should be focused on the Fish Habitat Compensation Lake and included in the monitoring program described in the draft detailed fisheries offsetting plan (see response to JRP IR 2.1, Appendix 2.1).</p> <p>Teck would agree with a recommendation that <i>Teck finalize the Detailed Fisheries Offsetting Plan and associated monitoring program for the Frontier Project to include surface water quality monitoring of substances of concerns, including methylmercury. The monitoring results should be considered by the adaptive management program described in Section 7 of the draft detailed fisheries offsetting plan.</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
HC Recommendation #4.4-2:		
HC	Monitor for changes in lead concentrations in environmental media for the duration of the project. Environmental media include but are not limited to: air, surface soils, water and sediment. If lead concentrations in environmental media are increasing, country foods should also be analyzed to re-assess the potential risk to human health.	<p>Teck does not agree with the recommendation.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the mitigation and monitoring plans developed for the Frontier Project.</i></p>
5. Wolf-Bison Predator Prey Relationship		
5.1 Issue: Changes Resulting from Increased Corridor Density & Habitat Changes around WBNP		
Recommendation 5.1-1:		
PCA	Fund an independent evaluation of mitigation measures by a committee of scientific and Indigenous knowledge experts to prevent range shift and contact of the Ronald Lake herd and diseased Delta bison herd in WBNP. Results of the evaluation should be used by Teck to inform mitigation planning. Mitigation should be implemented in a timely manner to prevent adverse Project effects on the herd, and monitored throughout the life of the mine.	<p>Teck agrees, in part, with the recommendation.</p> <p>Regardless of the status of the Project, the Ronald Lake bison herd will benefit from further studies on mitigation measures. Teck has already completed an evaluation of methods to maintain separation of the Ronald Lake bison herd from herds located entirely within Wood Buffalo National Park in the response to JRP IR 7.5 (Appendix 7.5, Attachment II). In addition, Teck's draft Ronald Lake bison mitigation monitoring and adaptive management plan (see response to JRP IR 7.5, Appendix 7.5) includes a systematic process for adapting to Project monitoring data that differs from predictions.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project, continue to support the Ronald Lake Bison Herd Technical Team as well as monitoring and</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<i>mitigation measures undertaken by Alberta Environment and Parks or the Parks Canada Agency to maintain the health and viability of the Ronald Lake bison herd over the life of the Project.</i>
PAC	Fund an independent study of the landscape features and habitats between the Ronald Lake and Delta bison herds to identify potential movement corridors between the herds to inform mitigation planning. This study should be completed prior to Project construction.	<p>Teck agrees, in part, with the recommendation.</p> <p>Regardless of the status of the Project, the Ronald Lake bison herd will benefit from further studies on mitigation measures. Teck has already completed an evaluation of methods to prevent use of possible movement corridors in the response to JRP IR 7.5 (Appendix 7.5, Attachment II). In addition, Teck's draft Ronald Lake bison mitigation monitoring and adaptive management plan (see response to JRP IR 7.5, Appendix 7.5) includes a systematic process for adapting to Project monitoring data that differs from expectations.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project, continue to support the Ronald Lake Bison Herd Technical Team as well as monitoring and mitigation measures undertaken by Alberta Environment and Parks or the Parks Canada Agency to maintain the health and viability of the Ronald Lake bison Herd over the life of the Project.</i></p>
PCA	Fund an independent study to assess the range, movements and habitat use of diseased Delta bison in WBNP to inform mitigation planning. This study should be completed prior to Project construction.	<p>Teck does not agree with this recommendation.</p> <p>The Project is predicted to have no effects on diseased Delta bison that are the responsibility of Parks Canada Agency. Teck has already completed an evaluation of methods to maintain separation of the Ronald Lake bison herd from herds located entirely within Wood</p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<p>Buffalo National Park in the response to JRP IR 7.5 (Appendix 7.5, Attachment II). In addition, Teck's draft Ronald Lake bison mitigation monitoring and adaptive management plan (see response to JRP IR 7.5, Appendix 7.5) includes a systematic process for adapting to Project monitoring data should it differ from predictions.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan for the Frontier Project, continue to support the Ronald Lake Bison Herd Technical Team as well as monitoring and mitigation measures undertaken by Alberta Environment and Parks or the Parks Canada Agency to maintain the health and viability of the Ronald Lake bison herd over the life of the Project.</i></p>
6. Migratory Waterfowl		
6.1. Issue: Changes in Migratory Waterfowl Stopover Habitat		
Recommendation 6.1-1:		
PCA	Parks Canada recommends to the JRP that Teck be required to complete baseline studies on stopover habitat use by migratory waterfowl in the PDA prior to construction.	Teck agrees with the recommendation.
Recommendation 6.1-2:		
PCA	Parks Canada recommends to the JRP that Teck be required to develop and implement a compensation plan within the RSA to protect from future disturbance stopover habitat equivalent to that which would be disturbed by the Project (in particular lake habitat), for the purpose of maintaining migratory bird stopover habitat within an important waterfowl migration corridor. The	<p>Teck agrees, in part, with the recommendation.</p> <p>Teck's preferred approach to offsetting lost migratory bird stop-over habitat is discussed in the response to JRP IR 7.15: <i>Teck is willing to pursue biodiversity offsets for residual environmental effects related to the Project; however, there is no legislative or regulatory process in</i></p>

Table A-1: Teck’s Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	compensation plan should be developed in consultation with the Government of Alberta, ECCC and Indigenous groups.	<p><i>place to allow biodiversity offsets to be acquired in the Project area. In spite of these limitations to acquire biodiversity offsets, Teck will commit to the following:</i></p> <ul style="list-style-type: none"> • <i>Completing the biodiversity management planning process to identify preferred biodiversity elements to be considered for offsetting residual Project-effects. This would be done with the understanding that the draft BMP can only provide context for negotiation of a Conservation Agreement because there are practical limitations to realizing meaningful biodiversity offsets in Alberta.</i> • <i>Engaging with regulators, Indigenous communities and stakeholders during the biodiversity management planning process and during ongoing work to understand and define how biodiversity offsets might be realized in Alberta.</i> • <i>Negotiating a Conservation Agreement with ECCC, which includes input from the AER and AEP.</i> • <i>Providing routine reports to ECCC, AER and AEP after the Project is operating that summarizes progress on realizing meaningful biodiversity offsets for the Project</i> <p>Teck would agree with a recommendation that <i>Teck negotiate a Conservation Agreement with ECCC that includes input from the AER and AEP, based upon the finalized Biodiversity Management Plan for the Frontier Project.</i></p>
6.2. Issue: Changes in Migration Routes		
Recommendation 6.2-1:		
PCA	Parks Canada recommends to the JRP that Teck be required to: a) participate in the Oil Sands Bird Technical Team; and b) contribute to studies and research on regional waterfowl,	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	including waterfowl migration routes.	
Recommendation 6.2-2:		
PCA	Parks Canada recommends that the JRP that Teck be required to monitor the number of waterfowl migrating over the site in spring and fall using a methodology that could be used consistently across operators in the MOSA.	<p>Teck agrees, in part, with the recommendation.</p> <p>The scope of the recommendation requires regional input and thus is the purview of the Joint Oil Sands Monitoring Program that Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation. Teck will support the recommended standardized monitoring if prioritized by the regional monitoring program managers.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the Waterfowl Protection Plan for the Frontier Project and that Teck participate in the Joint Oil Sands Monitoring Program.</i></p>
8. Water Quality in the PAD		
8.1. Issue: Changes to Water Quality - Accidents and Malfunctions		
Recommendation 8.1-1:		
PCA	a) Develop spill response measures and systems relating to releases to water and soil for approval prior to the commencement of construction.	Teck agrees with the recommendation.
PCA	b) Develop an emergency response plan for approval prior to construction that would include: i) project and site-specific mitigation measures and response procedures to minimize the environmental effects of an accident or malfunction reaching WBNP;	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	ii) information on how to mitigate effects and prevent contaminants from entering the PAD and WBNP WHS; iii) effective emergency response capacity and training of staff; iv) commitment to continue diligence to be in state of preparedness/readiness; v) commitment to sufficient response materials and equipment available in strategic locations; and vi) community notification and emergency communications procedures will be incorporated into the plan, particularly for drinking water and traditional land users.	
PCA	c) Initiate community awareness and education initiatives about emergency responses.	Teck agrees with the recommendation.
PCA	d) Provide Parks Canada with an opportunity to review and comment on the plan.	Teck agrees with the recommendation.
PCA	e) Commit to fund the cleanup and restoration costs of affected areas within WBNP.	Teck does not agree with the recommendation. This recommendation is not required as cleanup and restoration is governed by other regulations including the Oil and Gas Conservation Rules (AR 151/1971), by which Teck is legally bound.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
8.2. Issue: Changes to Water Quality in the PAD		
Recommendation 8.2-1:		
PCA	Parks Canada recommends to the JRP that Teck be required to conduct water quality monitoring in Ronald Lake, Buckton Creek, and Lake Claire for at least 5 years prior to operation of the mine with 4 season collection and multiple sample sites and regularly during mine operation.	<p>Teck agrees, in part, with this recommendation.</p> <p>The scope of monitoring in the recommendation is regional and thus is the purview of the Joint Oil Sands Monitoring Program that Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation.</p> <p>Teck would agree with the recommendation that <i>Teck monitor the Ronald Lake Watershed in accordance with the finalized Hydrology and Water Quality Mitigation Monitoring and Adaptive Management Plan and preconstruction baseline monitoring plan for the Frontier Project, and that Teck participate in the Joint Oil Sands Monitoring Program.</i></p>
Recommendation 8.2-2:		
PCA	Parks Canada recommends to the JRP that at least 5 years prior to proceeding with development in the watershed draining into Ronald Lake, Teck be required to submit for approval an analysis that demonstrates that	<p>Teck agrees, in part, with this recommendation.</p> <p>The scope of monitoring in the recommendation is regional and thus is the purview of the Joint Oil Sands Monitoring Program that Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation.</p> <p>Teck would agree with the recommendation that <i>Teck monitor the Ronald Lake Watershed in accordance with the finalized Hydrology and Water Quality Mitigation Monitoring and Adaptive Management Plan and preconstruction baseline monitoring plan for the Frontier Project,</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<i>and that Teck participate in the Joint Oil Sands Monitoring Program.</i>
PCA	a. Water quality in Buckton Creek and Lake Claire meets site specific water quality objectives set by Parks Canada in collaboration with Indigenous groups and others for those water bodies; and,	<p>Teck agrees, in part, with this recommendation.</p> <p>The scope of monitoring in the recommendation is regional and thus is the purview of the Joint Oil Sands Monitoring Program that Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation.</p> <p>Teck would agree with the recommendation that <i>Teck monitor the Ronald Lake Watershed in accordance with the finalized Hydrology and Water Quality Mitigation Monitoring and Adaptive Management Plan and preconstruction baseline monitoring plan for the Frontier Project, and that Teck participate in the Joint Oil Sands Monitoring Program.</i></p>
PCA	b. Development of the watershed draining into Ronald Lake according to an updated mine plan, will not result in water quality within Buckton Creek and Lake Claire exceeding site specific water quality objectives set by Parks Canada in collaboration with Indigenous groups and others for those water bodies.	<p>Teck agrees, in part, with this recommendation.</p> <p>The scope of monitoring in the recommendation is regional and thus is the purview of the Joint Oil Sands Monitoring Program that Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation.</p> <p>Teck would agree with the recommendation that <i>Teck monitor the Ronald Lake Watershed in accordance with the finalized Hydrology and Water Quality Mitigation Monitoring and Adaptive Management Plan and preconstruction baseline monitoring plan for the Frontier Project, and that Teck participate in the Joint Oil Sands Monitoring Program.</i></p>
Recommendation 8.2-3:		

Table A-1: Teck’s Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
PCA	Parks Canada recommends to the JRP that Teck be required to evaluate every 8 years whether there is additional best available technology to mitigate water and air quality effects.	<p>Teck does not agree with the recommendation.</p> <p>Teck believes review of BATEA should be undertaken at logical points in the life-cycle of equipment, which is unlikely to match a fixed 8 year period.</p> <p>Teck would agree with a recommendation that <i>Teck will regularly review BATEA as part of continual improvements to the finalized mitigation and monitoring plans developed for the Frontier Project.</i></p>
9. PAD Hydrology		
9.1. Issue: Changes in Water Quantity: Athabasca River		
Recommendation 9.1-1:		
PCA	Parks Canada recommends to the Panel that Teck not be permitted to withdraw water from the Athabasca River when the flow rates at the Athabasca below the McMurray Station are below the Aboriginal Extreme Flow of 500 m3 ls (AXF).	<p>Teck does not agree with the recommendation.</p> <p>Teck would agree to a recommendation that <i>Teck's water withdrawals from the Athabasca River adhere to the Surface Water Quantity Management Framework.</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
9.2. Issue: Changes in Water Quantity: Ronald Lake - Buckton Creek Watershed		
Recommendation 9.2-1:		
PCA	Parks Canada recommends to the JRP that at least 5 years prior to proceeding with development in the watershed draining into Ronald Lake, Teck be required to submit for approval an analysis that demonstrates that:	
PCA	a. Lake Claire water levels meet water regime objectives as determined by Parks Canada in collaboration with Indigenous groups and others; and,	<p>Teck does not agree with the recommendation.</p> <p>Lake Claire is a regional waterbody and thus within the purview of the Joint Oil Sands Monitoring Program that Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation. Teck will support the recommended monitoring if prioritized by the regional monitoring program managers.</p> <p>Teck notes that Indigenous communities have informed Teck's objective for the Hydrology and Water Quality Mitigation Monitoring and Adaptive Management Plan to have negligible effects to water quantity and quality in Buckton Creek Watershed and Lake Claire.</p> <p>Teck would agree with a recommendation that <i>Teck manage flows from Ronald Lake in accordance with the finalized Hydrology and Water Quality Mitigation Monitoring and Adaptive Management plans for the Frontier Project and that Teck participate in the Joint Oil Sands Monitoring Program.</i></p>
PCA	b. Development of the watershed draining into Ronald Lake according to an updated mine will not result in project impacts	Teck does not agree with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	to flow in Buckton Creek of more than 5% of natural flows in summer, fall, winter and floods in perpetuity.	<p>Teck notes that Indigenous communities have informed Teck's objective for the Hydrology and Water Quality Mitigation Monitoring and Adaptive Management Plan to have negligible effects to water quantity and quality in Buckton Creek Watershed and Lake Claire.</p> <p>Teck would agree with a recommendation that <i>Teck manage flows in Buckton Creek in accordance with the finalized Hydrology and Water Quality Mitigation Monitoring and Adaptive Management plans for the Frontier Project and that Teck participate in the Joint Oil Sands Monitoring Program.</i></p>
Recommendation 9.2-2:		
PCA	Parks Canada recommends to the JRP that Teck be required to monitor water flows in Buckton Creek for 15 years prior to starting development in the watershed draining into Ronald Lake.	<p>Teck does not agree with this recommendation.</p> <p>Buckton Creek is a regional waterbody and thus within the purview of the Joint Oil Sands Monitoring Program that Teck is mandated to fund in accordance with Section 2 of the Alberta Oil Sands Monitoring Program Regulation. Teck will support the recommended monitoring if prioritized by the regional monitoring program managers.</p> <p>Teck notes that Indigenous communities have informed Teck's objective for the Hydrology and Water Quality Mitigation Monitoring and Adaptive Management Plan to have negligible effects to water quantity and quality in Buckton Creek Watershed and Lake Claire.</p> <p>Teck would agree with a recommendation that <i>Teck finalize and implement the Hydrology and Water Quality Mitigation Monitoring and Adaptive Management plans for the Frontier Project and that Teck</i></p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<i>participate in the Joint Oil Sands Monitoring Program.</i>
Recommendation 9.2-3:		
PCA	Parks Canada recommends to the JRP that Teck be required to monitor for possible groundwater drawdown in the Lake Claire watershed and WBNP by installing monitoring wells near Ronald Lake and at the boundary of WBNP.	<p>Teck does not agree with the recommendation.</p> <p>Ronald Lake and Lake Claire are located about 13 km and 52 km north, respectively, of the north limit of the PDA in remote undisturbed locations. Monitoring at such a distance from the project is not necessary given the monitoring already planned in the Hydrology and Water Quality Mitigation Monitoring and Adaptive Management Plan and Groundwater Monitoring Plan for the Frontier Project. Planned monitoring will include locations at the north side of the PDA in the direction of the catchments that drain to Ronald Lake / WBNP. Monitoring at these locations would provide ample groundwater information prior to mine development occurring in the catchments that drain to WBNP.</p> <p>Teck would agree with a recommendation that <i>Teck install monitoring wells in the Quaternary, Cretaceous and Devonian aquifer(s) proximal to the planned mine footprint between the PDA and Ronald Lake prior to the beginning of construction, with the need for additional monitoring, if any, established through the Adaptive Management Plan that will be part of the finalized Groundwater Monitoring Plan for the Frontier Project.</i></p>
Department of Fisheries and Oceans Canada		
Recommendation 1		
DFO	Fisheries and Oceans Canada recommends that the JRP's	Teck agrees with the recommendation.

Table A-1: Teck’s Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	<p>Report include a recommendation to Teck Resources Ltd. to participate in the regional cumulative effects assessment being led by DFO. This participation may include leading some components of the cumulative effects assessment and/or providing financial resources or appropriately qualified technical expertise.</p>	
Recommendation 2		
DFO	<p>Fisheries and Oceans Canada recommends that the JRP's report include a recommendation to Teck Resources Ltd. to complete detailed design and implement the Detailed Fisheries Offsetting Plan. This plan should meet the provisions of the Fisheries Protection Policy Statement, October 2013 and the Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting, November 2013. The plan must consider designs for fish passage from the offsetting lake to the Athabasca River. Teck should consult with stakeholders and Indigenous communities to solicit input as to the target fish species in the lake, design of aquatic and terrestrial habitat features and the potential to include other components of cultural significance. The plan should include feedback received during consultation and describe how the information was considered.</p>	<p>Teck agrees with the recommendation.</p>

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
Recommendation 3		
DFO	Fisheries and Oceans Canada recommends that the JRP's report include a recommendation to Teck Resources Ltd. to further delineate aquatic impacts and habitat availability in the locations of the raw water intake, associated infrastructure and the Athabasca River Bridge. Teck should further undertake an options analysis for the location of the raw water intake. This information should be incorporated into the Detailed Fisheries Offsetting Plan.	<p>Teck agrees, in part, with the recommendation.</p> <p>Teck does not plan to update the options analysis that was provided in Volume 1, Section 2.1.7 of the Project Update.</p> <p>Teck would agree with a recommendation that <i>Teck finalize the Detailed Fisheries Offsetting Plan for the Frontier Project, including required fisheries offsets for the River Water Intake and Bridge, to the satisfaction of Fisheries and Oceans Canada.</i></p>
Recommendation 4		
DFO	Fisheries and Oceans Canada recommends that the JRP's report include a recommendation to Teck Resources Ltd. that Teck engage the appropriate departments, agencies, experts and Indigenous communities to further delineate potential mitigation measures for the Ronald Lake Bison Herd.	<p>Teck agrees with the recommendation.</p> <p>The recommendation is addressed in the draft Ronald Lake Bison Mitigation Monitoring and Adaptive Management Plan for the Frontier Project that will be finalized prior to construction.</p>
Recommendation 5		
DFO	Fisheries and Oceans Canada recommends that the JRP's report include a recommendation that requires Teck Resources Ltd. to collect baseline information to further inform methyl mercury modelling in the offsetting lake and downstream environments. Teck should consult on the results of the baseline data collection and any further mitigation measures proposed with DFO, Environment and Climate Change Canada, Indigenous Communities and other potential interested stakeholders.	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
Recommendation 6		
DFO	Fisheries and Oceans Canada recommends that the JRP's report include a recommendation that supports the further development of alternative offsetting measures as outlined in Fisheries and Oceans Canada's Fisheries Productivity Investment Policy. Teck should consult with Indigenous communities and other stakeholders regarding research opportunities that would form part of the offsetting plan.	Teck agrees with the recommendation.
Recommendation 7		
DFO	<p>Fisheries and Oceans Canada recommends that the JRP's report include a recommendation that Teck Resources Ltd. complete a detailed monitoring plan to monitor and report on the mitigation and offsetting measures. The plan should include but not be limited to the following:</p> <ul style="list-style-type: none"> • monitoring and reporting requirements to demonstrate that the offsetting measures have been effective in counterbalancing the impacts to fish and fish habitat; • undertake a validation of the HSI models used to predict the impacts to fish and fish habitat and determine the amount of offsetting required; • report on mitigation measures applied and any changes to the mitigation measures; • any corrective actions or contingency measures utilized to ensure further habitat destruction or permanent alteration to habitat does not occur; and • - how feedback received during Indigenous consultation on the plan has been considered or incorporated, as appropriate. 	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
Recommendation 8		
DFO	Fisheries and Oceans Canada recommends that the JRP's report include a recommendation that Teck Resources Ltd. maintain involvement in the FiSH Committee with the goal of validating the Habitat Suitability Index Models. DFO recommends that the Joint Review Panel's report include a recommendation that Teck Resources Ltd. use the validated watercourse HSI models to verify and report on predictions made in the environmental assessment related to the quality and quantity of fish habitat impacted by the Project. DFO recommends that the Joint Review Panel's Report include a recommendation that Teck validate and verify the predictions made by the waterbody HSI models.	Teck agrees with the recommendation.
Recommendation 9		
DFO	Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation that Teck Resources Ltd. further develop and implement an adaptive management strategy to monitor and update plans related to the mitigation strategies and offsetting plans. Teck should consult with appropriate government agencies as well as Indigenous communities in the development of the strategy. Teck should include how feedback received during the consultation sessions has been considered or incorporated, as appropriate.	Teck agrees with the recommendation.
Recommendation 10		
DFO	Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation that Teck	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	Resources Ltd. finalize a monitoring program specific to the construction and operation of the raw water intake. This monitoring should include velocity and flow measurements across fish exclusion screens to verify predictions made in the detailed design.	
Recommendation 11		
DFO	Fisheries and Oceans Canada recommends that the Joint Review Panel's Report include a recommendation that Teck Resources Ltd. further develop and implement an adaptive management strategy for the closure and reclamation landscape. Teck should consult with appropriate government agencies as well as Indigenous communities in the development of the strategy. Teck should include how feedback received during the consultation sessions has been considered or incorporated, as appropriate.	Teck agrees with the recommendation.
Recommendation 12		
DFO	Fisheries and Oceans Canada recommends that the Joint Review Panel's report include a recommendation that Teck Resources Ltd. design closure landscapes such that they may be integrated into the natural environment. Teck should work with DFO during the design phase, and throughout the life of the Project, to design, implement and monitor aquatic habitat on the reclaimed landscape. Teck should maintain involvement in regional groups and undertake consultations with Indigenous communities with regards to the closure landscape. Teck should report on how the feedback received during consultations has been considered or incorporated, as	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	appropriate.	
CHAPTER 2- Tailings Management		
2.1 Issue: Data on the Viability of Centrifugation as a Tailings Treatment Process		
Recommendation 1:		
NRCAN	NRCAN recommends that the Panel request Teck evaluate Syncrude's data from the commercial-scale implementation of fluid fine tailings centrifugation to determine if the actual reliability of centrifugation and the post-depositional drying of the centrifuge cake are consistent with leek's proposed tailings management plan.	Teck agrees, in part , with the recommendation. Teck would agree with a recommendation that <i>Teck, through its participation in Canada's Oil Sands Innovation Alliance, evaluate the performance of the centrifugation process according to Teck's finalized and approved Tailings Management Plan for the Frontier Project.</i>
CHAPTER 3 - Hydrogeology: groundwater quantity and flow		
3.5 Issue: Impact of Drawdown from Mine Dewatering on Surface Water		
Recommendation 2:		
NRCAN	NRCAN recommends that the JRP request that Teck update the groundwater flow and transport models regularly (e.g. , at suitable intervals based on the information collected during project operations on), including: <ul style="list-style-type: none"> • Information from hydrostratigraphic knowledge (e.g., 30 delineation of units, karst features and structures such as faults); • Hydraulic properties of hydrofacies within hydrostratigraphic units (e.g., hydraulic conductivity, storage coefficient, porosity); • Groundwater quantity (e.g., outflow volumes, magnitude and extent of drawdown); • Groundwater quality monitoring, spatial and temporal evolution (trends) of contaminant or indicator component. 	Teck agrees with the recommendation.

Table A-1: Teck's Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	<p>This would provide information required to verify the predictions of the current numerical models and to increase confidence in the results of the future updated models for any anticipated groundwater related issues. As stated by Teck, "Measured solute concentration profiles will be compared between sampling events and against values predicted by the groundwater model. The data will be used to assess trends in the evolution of groundwater chemistry and consistency with model predictions." Environment and Climate Change Canada (ECCC) is also supportive of this recommendation, that Teck undertake to monitor and update the model regularly.</p>	
3.6 Issue: Groundwater Drawdown and Possible Impacts to Wood Buffalo National Park		
Recommendation 3:		
NRCAN	<p>NRCAN recommends that the JRP request that Teck monitor for possible groundwater drawdown in the Lake Claire watershed and WBNP by installing monitoring wells near Ronald Lake and at the boundary of WBNP. The monitoring report(s) should be sent to the responsible authority for appropriate actions.</p>	<p>Teck does not agree with the recommendation.</p> <p>Ronald Lake and Lake Claire are located about 13 km and 52 km north, respectively, of the north limit of the PDA) in remote undisturbed locations. Monitoring at such a distance from the project is not necessary given the monitoring already planned in the Hydrology and Water Quality Mitigation Monitoring and Adaptive Management Plan and Groundwater Monitoring Plan for the Frontier Project. Planned monitoring will include locations at the north side of the PDA in the direction of the catchments that drain to Ronald Lake / WBNP. Monitoring at these locations would provide several decades of groundwater information prior to mine development occurring in the catchments that drain to WBNP.</p> <p>Teck would agree with a recommendation that <i>Teck install monitoring</i></p>

Table A-1: Teck’s Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
		<i>wells in the Quaternary, Cretaceous and Devonian aquifer(s) proximal to the planned mine footprint between the PDA and Ronald Lake prior to the beginning of construction, with the need for additional monitoring, if any, established through the Adaptive Management Plan that will be part of the finalized Groundwater Monitoring Plan for the Frontier Project.</i>
CHAPTER 4 - Forestry		
4.1 Issue: Reclamation Working Group		
Recommendation 4:		
NRCAN	<p>NRCAN supports Teck's plans to establish a Reclamation Working Group (RWG) and recommends consideration of the following:</p> <ul style="list-style-type: none"> • Terms of Reference be established that specify the governance, membership , and roles and responsibilities of the RWG; • Sub-groups be established, as needed, within the RWG structure to ensure all aspects of reclamation are covered; • As Teck's Reclamation Plan contains little detail about reclamation practices and timelines, the RWG should provide input on reclamation targets and timelines; • Indigenous participation in the RWG is critical to ensure that Indigenous viewpoints are respected and integrated into reclamation activities; • The RWG actively monitor the recovery of ecosystem services during and following reclamation activity, with particular attention paid to rare plants and plants of Indigenous importance; • Incorporate continuous improvement as a guiding principle for the RWG's mandate, review reclamation successes and failures, and consult with relevant authorities if 	Teck agrees with the recommendation.

Table A-1: Teck’s Responses to Recommendations from the Government of Canada (continued)

Agency	Recommendation from Government	Teck Response
	reclamation targets are not achieved, and <ul style="list-style-type: none"> • Ensure stable funding to support the activities of the RWG over the entire term of the project. 	
4.2 Issue: Wildfires		
Recommendation 5:		
NRCAN	NRCAN recommends that: <ul style="list-style-type: none"> • Teck adhere to all the components of both the FireSmart Guidebook for the Oil and Gas Industry as well as the Canadian Association of Petroleum Producers' Emergency Preparedness Guide for Hazards Associated with Wildfires. • Project firefighting staff are trained as provincial Type 2 wildland firefighters, including Incident Command System training for crew members and leaders. • A Grass Fuel Management Plan be implemented for Industrial Zone 3. • Firefighting staff be equipped for suppression of grass and forest fires (e.g., portable gas powered water pumps, hand tools) with equipment compatible with provincial standards. • Teck collaborate closely with area staff from Alberta Agriculture and Forestry to adequately mitigate wildfire risk and provide for appropriate response. 	Teck agrees with the recommendation.

Appendix 9 Recommendations from Indigenous Groups

This appendix is intended to assist the reader and is not part of the hearing record. It is consolidated from documents on the project registry at <https://www.ceaa-acee.gc.ca/050/evaluations/proj/65505?culture=en-CA>.

Recommendations of the Athabasca Chipewyan First Nation

5.2 Recommendations

This study has determined that the SWQMF does not deliver protection for Indigenous navigability in the lower Athabasca River. The findings have also shown that Teck's EIA materials do not accurately assess the potential effects of its proposed Project on Indigenous navigability of this river. Due to the nature of SWQMF's structure and priorities, Teck cannot assure regulators that its compliance with SWQMF will not detrimentally affect Indigenous navigability. If the Project is approved, mitigations will be required. In addition, changes to SWQMF are needed either as part of the mitigations or to address the potentially unrecognized impacts associated with existing oilsands mines operating in compliance with SWQMF.

In support of these findings and implications, this study provides 12 recommendations for consideration by the Panel.

A. Amendments to Surface Water Quantity Management Framework

- 1) Create new SWQMF weekly triggers.

Include two effective weekly triggers to protect open-water Indigenous navigability. Require a full cut-off at the AXF (500 m³/s at WSC 07DA001) reflecting the flow required for full Indigenous navigability. Include a second weekly trigger at 700 m³/s requiring operators to lower their withdrawals to a total maximum of 20 m³/s as a precautionary limit to assist them in adjusting their operations and to moderate impacts to Indigenous navigability in the transition toward reaching the AXF.

- 2) Remove 4.4-m³/s low-flow exemption.

Revise the current exemption permitting withdrawals of 4.4 m³/s at any flow so that it does not apply to the open-water season. The exemption has been established to address concerns present during the winter that are inapplicable during the open-water season.

- 3) Reconfigure SWQMF's Aboriginal Navigation Index.

Reconfigure the Aboriginal Navigation Index so that it is zero at the AXF (500 m³/s, measured at WSC 07DA001). Retain negative values of the index. Consider renaming it the Indigenous Navigability Index (INI).

4) Amend SWQMF's Aboriginal Navigation Trigger.

Redesign SWQMF's Aboriginal Navigation Trigger to be a proactive and effective advanced-warning system in support of Indigenous navigability. In it, include:

- considerations of long-term (multi-annual) and short-term (daily, weekly, seasonal) changes in navigability;
- explicit effective management interventions should navigability loss occur due to oilsands withdrawals; and
- close collaboration with ACFN and other Indigenous groups to identify and verify issues requiring management action.

5) Incorporate downstream flow monitoring data into SWQMF decision-making.

Apply data from existing or new hydrometric monitoring stations downstream of the oilsands region into the SWQMF to verify available water for Indigenous navigability and to improve understanding of navigability dynamics. Focus discharge measurements on flow rates below the ABF (1600 m³/s).

6) Support CBM and incorporate updates to thresholds into SWQMF.

Provide long-term support to Indigenous-led community-based monitoring (CBM) and work closely with First Nations, under an active adaptive management approach, to incorporate CBM data and Indigenous knowledge concerning Indigenous navigability and its thresholds into SWQMF decision making.

7) Expand public reporting on the State of Indigenous Navigability.

Report publicly on the State of Indigenous Navigability and including field information, hydrometric data, verified weekly operator water-withdrawal records, trigger responses, and progress under adaptive management.

B. Revisions to Teck's Effects Assessment of Project on Indigenous Navigability

8) Improve understanding of river bathymetry.

Teck to gather river bathymetry data emphasizing sections of the lower Athabasca River between the Frontier Mine and the Peace-Athabasca Delta that are valued for Indigenous land use and expected to experience navigability limitations under low-flow conditions. Work closely with affected

Indigenous communities to optimize reaches targeted.

9) Expand Project effects assessment on Indigenous navigability.

Teck to expand its assessment of Project effects on Indigenous navigability through examination of multiple limiting locations and in consideration of the types of river habitats, access situations, transport requirement etc. needed for Indigenous-use purposes.

10) Provide credible climate change analysis and seasonal flow projections.

Teck to revise and update its climate change analysis in consideration of credible climate scenarios and including plausible emissions scenarios and data from the Intergovernmental Panel on Climate Change (IPCC) Assessment Report 5. Include flow projections that identify seasonal 100-year low flows of the Athabasca River relevant to Indigenous navigability.

C. Long-Term Oilsands and Water-Use Planning

11) Re-assess projected expansion of oilsands mining in light of requirements of Indigenous navigability.

Government of Alberta to revisit proposed build-out of the oilsands industry in light of its potential incompatibility with traditional-use practices in relation to Indigenous navigability.

Focus assessment on the implications of climate change and seasonal river flow projections in light of the Government of Alberta's obligations in maintaining Indigenous navigability and access to Indigenous lands.

12) Examine changes to oilsands water use to reduce conflict with Indigenous navigability.

In light of the water-resource requirements needed to sustain Indigenous navigability, examine conventional oilsands design and practice to discover opportunities to reduce impacts to Indigenous navigability. Potential opportunities that should be coordinated across the oilsands industry include explicit scheduling of the timing of filling of End Pit Lakes, re-examination of capacity requirements for off-stream water storage, and revisions to oilsands water licenses in order to reduce the rates of water withdrawals permitted under water licenses and to avoid seasonal conflict with the needs of Indigenous navigability.

6.5 Recommendations

- Halt activities within the current bison range (male and female locations combined) until sufficient information is available to understand how the effects of industrial development on the RLBH can be mitigated. In particular, this requires:
 - the understanding of the risk that bison may move northward and become contaminated with the diseases that exist in the park;

- information on whether or not sufficient forage will exist, along with connectivity of habitat patches, to maintain the RLBH in perpetuity; and
- information on changes in predation and survival of the bison.
- Once such information exists, design mitigation measures, including mining activity schedules, the mine footprint, and maintenance of bison movement corridors, with the objective to protect the RLBH.
- Design a monitoring program that measures the effectiveness of mitigation.
- Establish, without delay, a group or committee that would be tasked with protecting the RLBH. Provide a framework and draft terms of reference for how such a group or committee should operate. This group or committee would differ from the currently existing Technical Team (TT) in that the TT aims at identifying the information needs and then finding ways to fill critical information gaps. The TT does not in any way recommend mitigation measures or management plans. The information that emerges as a result of the work that the TT does, will be in part useful for the management and protection of the RLBH, but a group or committee that has an objective to manage the herd would need the mandate and authority to make decisions about the management of the herd.

8.0 Recommendations

This Section contains a list of potential implementable recommendations that may reduce the predicted effects of the proposed Project on migratory waterbirds in the MOSR and PAD. The Panel should consider recommending these as approval conditions should the Project be approved. The list is based on our review of the risks posed to migratory birds by the Project, and outstanding concerns and information gaps related to the Project identified in this report. The recommendations are intended to provide broad discussion points on how some key outstanding issues related to oil sands and Project impacts on migratory water birds could be addressed by the federal and provincial government and Teck in discussion with the ACFN and their experts.

Overall, Teck has not provided the necessary information that would allow for a comprehensive risk assessment for migratory birds in the LSA, RSA or the PAD nor an assessment of impact on ACFN harvesting practices. Teck has not acknowledged or mitigated the heightened risk to migratory birds posed by the unique location of the proposed Project. Teck's tailings ponds will be located within an established migratory flyway, close to the Athabasca River and further north (closest to the PAD) than any other operator, potentially creating higher risk for migrating birds compared to other tailings ponds in the region. Although many of the impacts resulting from the proposed Project and presence of large external tailings area along an important migratory corridor may be not avoidable, outstanding information gaps and risks to migratory birds could be addressed using a precautionary approach that is

informed by both local Indigenous Knowledge (IK) and western science. Recommendations include, but are not limited to, the following:

- 1) Alberta, Canada, and Teck, as appropriate, to work with ACFN to reduce uncertainty, address knowledge gaps, and update the state of regional knowledge on these information gaps and, where appropriate, gather further data to inform an accurate effects assessment and, subsequently develop precautionary mitigation measures for migratory birds. This work should incorporate of local IK and involve participation in existing regional monitoring and research programs and development of Project-specific programs.
- 2) Alberta, Canada, and Teck, as appropriate, to conduct baseline studies on stopover habitat use in the MOSR (at minimum in the LSA) by migratory waterbirds, prior to Project construction in order to provide a baseline for effects monitoring during the Project lifetime and measure success of reclamation.
- 3) Alberta, Canada, and Teck, as appropriate, to work with ACFN to comprehensively assess lethal and sub-lethal impacts on wild migratory bird health and fitness associated with exposure to contaminants. This should include long-term studies of single and/or multiple OSPW-related toxin exposures in order to detect latent, subtle, or cumulative effects of toxin exposure.
- 4) Teck to develop, test and implement an avian deterrence system that is innovative and inclusive of current research and knowledge and develop mitigation programs with ACFN that goes beyond the commitment to incorporate the 'best available technology economically achievable' (BATEA).
- 5) Teck to work with ACFN to provide a detailed methodology for how they will systematically test the effectiveness of the planned deterrent systems. Monitoring programs to test mitigation effectiveness, not just operational/ compliance monitoring, needs to be developed. Monitoring needs to address migratory bird behaviour and deterrent efficacy during low light conditions (dusk, night, dawn).
- 6) Alberta and Canada to work with ACFN to develop quantitative targets, benchmarks, or thresholds of bird deterrent performance that would be used to trigger management action should mitigations be ineffective. Teck to develop adaptive management programs that are triggered by these quantitative targets and performance thresholds. Alberta and Canada to conduct annual independent performance reviews and develop and enforce clear and effective consequences should quantitative targets, benchmarks, or thresholds of deterrent performance not be met.
- 7) Alberta and Canada to work with ACFN to develop and implement a compensation plan within the MOSR that Teck must adopt to protect existing natural wetland habitats currently used by migratory waterbirds as stopover and breeding habitat. The conservation site(s) should contain at minimum the equivalent size and diversity of the habitat types to be disturbed by the Project.

- 8) Teck to work with government, industry and ACFN to develop a consistent, science-based multivariate framework for assessing the composition and toxicity of external industrial waterbodies at mine sites in relation to risks to birds in order to provide an evidence-based evaluation of the potential risk to migratory birds posed by industrial waterbodies at a mine site.
- 9) Alberta, Canada, and Teck, as appropriate, to work with ACFN to develop and implement procedures to recover, stabilize and transport live oiled/contaminated birds recovered from industrial waterbodies to an accredited rehabilitation facility.
- 10) Alberta, Canada, and Teck, as appropriate, to study the cumulative effects of inhalation contaminant exposure for migratory birds resulting from waterbirds flying through emission plumes or landing on tailings ponds and exposed to airborne toxicants (including hydrogen sulfide, sulfur dioxide, nitrogen dioxide, ozone and particulate matter) using ecologically relevant endpoints.
- 11) Alberta, Canada, and Teck, as appropriate, to monitor broad scale and long-term changes to migration routes in the MOSR. To assist this data collection, oil sands operators, including Teck, should be required to monitor the number of waterbirds migrating over the PDA in spring and fall.
- 12) Alberta, Canada, and Teck, as appropriate, to monitor the long-term health of reclaimed wetlands – and the migratory birds that use them - to determine if they are comparable to natural wetlands in terms of functionality and health and to incorporate results into regulatory approvals and Project reclamation plans.

Joint Recommendations of the Athabasca Chipewyan First Nation and Teck

1. Ronald Lake Bison Herd

1.1 Ronald Lake Bison Herd Objectives: Restoring and maintaining a healthy, stable and self-sustaining Ronald Lake Bison Herd ("RLBH") of sufficient size and stability to support ACFN biodiversity objectives, ACFN traditional and cultural uses (including harvesting), and the cultural relationship between ACFN and the RLBH (the "RLBH Objectives").

1.2 Mitigation and Management Commitments: In furtherance of the RLBH Objectives, Teck will:

- a) work collaboratively with ACFN through Participation Agreement implementation with respect to Teck's wildlife mitigation, monitoring, and adaptive management plans, including those that pertain to RLBH;
- b) include restoration of high-quality bison habitat as quickly as reasonably possible as a key reclamation objective;
- c) establish policies restricting employees from conducting any hunting while employed by Teck;
- d) establish policies regarding use of roads to avoid collisions with RLBH and other wildlife; and
- e) participate in and support regional initiatives regarding management of the RLBH, including working collaboratively on those Crown strategies and plans set out below.

1.3 Requested Recommendations: Teck and ACFN are jointly in favour of the following Crown actions to support the RLBH Objectives:

- a) by 2019, implementing a complete ban on hunting RLBH by non-Indigenous hunters;
- b) by 2020, identifying and protecting, by legally effective means, a sufficient area of adequate and contiguous critical habitat for the RLBH to survive and increase beyond current population levels within ACFN territory. The establishment of the Biodiversity Stewardship Area may contribute towards the fulfillment of this condition (see 5.3 below). ACFN will have a decision-making role in the development and governance of this protected area;
- c) by 2020, finalizing key provincial and federal strategies and initiatives for management of the RLBH, including the:
 - i) provincial Bison Management Plan;
 - ii) Parks Canada bison disease transmission management plan; and
 - iii) federal Recovery Strategy and Action Plan for Wood Bison;

- d) by 2020, formalizing a co-management and shared decision-making role for ACFN in the management of the RLBH, including those provincial and federal strategies and plans noted above; and
- e) by 2020, the development and implementation of criteria to track and validate the health, stability and sustainability of the RLBH, including:
 - i) population numbers and demographics;
 - ii) mortality, disease, and human interactions with the RLBH; and
 - iii) the quality and quantity of habitat, including critical habitat.

2. Woodland Caribou

2.1 Caribou Objectives: Restoring and maintaining healthy, stable and self-sustaining Woodland Caribou Herds in the Red Earth and Richardson ranges (collectively the "Caribou") of sufficient size and stability to support ACFN biodiversity objectives, ACFN traditional and cultural uses (including harvesting), and the cultural relationship between ACFN and the Caribou (the "Caribou Objectives").

2.2 Mitigation and Management Commitments: In furtherance of the Caribou Objectives, Teck will:

- a) work collaboratively with ACFN through Participation Agreement implementation with respect to Teck's wildlife mitigation, monitoring, and adaptive management plans, including those that pertain to Caribou;
- b) direct progressive reclamation of the Project with a view to restoring high-quality Caribou habitat in the Project area as quickly as reasonably possible;
- c) participate in caribou habitat restoration projects and opportunities to restore linear features outside the PDA in the ranges of the Red Earth and Richardson ranges, to be informed by Teck's collaboration with ACFN on Teck's biodiversity management planning processes;
- d) establish policies restricting employees from conducting any hunting while employed by Teck;
- e) establish policies regarding use of roads to avoid collisions with Caribou and other wildlife; and
- f) participate in and support regional initiatives regarding management of Caribou, including working collaboratively on those Crown strategies and plans set out below.

2.3 Requested Recommendations: Teck and ACFN are jointly in favour of the following Crown actions to support the Caribou Objective:

- a) By 2020, the implementation of critical Provincial and Federal management plans regarding woodland caribou in northeastern Alberta, particularly the Red Earth and Richardson range herds, that will advance the federal goal of 65% undisturbed habitat, including:

- i) provincial Woodland Caribou range protection plan; and
 - ii) the federal Recovery Strategy and Action Plan for Woodland Caribou; and
- b) a co-management role for ACFN in the development and implementation of the above-mentioned Crown management plans related to the woodland caribou;
 - c) by 2020, the development and implementation of a conservation offset program to allow Teck, as prioritized through collaboratively developed biodiversity management plan, to participate in the reclamation of linear disturbances in caribou habitat outside of the Project Area; and
 - d) by 2020, the development and implementation of criteria, indicators and thresholds to track and validate the health, stability and sustainability of the Caribou, including:
 - i) population numbers and demographics; and
 - ii) the quality and quantity of habitat, including critical habitat.

3. Water Quantity

3.1 Water Quantity Objectives: Supporting natural water quantity flows in the Athabasca River and the Ronald Lake Watershed, to enable ACFN members to navigate these waterbodies and access adjacent ACFN reserves, territories, and the Peace Athabasca Delta at their pleasure; and support ecological needs in the Athabasca River, Ronald Lake Watershed, and the Peace Athabasca Delta (the "Water Quantity Objectives").

3.2 Mitigation and Management Commitments: In furtherance of the Water Quantity Objectives, Teck will:

- a) work collaboratively with ACFN through Participation Agreement implementation with respect to development and implementation of mitigation, monitoring, and adaptive management plans related to water quantity;
- b) install hydraulic gauges on the Athabasca River, immediately upstream of the River Water Intake (RWI) and downstream of the Project;
- c) measure and share water intake data with Regulatory Authorities and ACFN;
- d) use the Aboriginal Extreme Flow (500 m³/s) as measured immediately upstream of the RWI as a key monitoring indicator and performance threshold, by:
 - i) planning water withdrawals to avoid or minimize water intake, including where feasible stopping or reducing river water intake, when Aboriginal Extreme Flow (500 m³/s) conditions exist;
 - ii) using the off-stream storage pond during low flow periods;

- iii) filling up the off-stream storage pond during high-flow periods;
 - iv) demonstrating continual improved performance on water intake by decreasing water consumption over the life of the Project; and
 - v) advising ACFN and relevant Regulatory Authorities regarding Teck water withdrawal management actions;
- e) conduct baseline monitoring of water levels and in-flow hydrology of the Ronald Lake Watershed and associated watercourses where Teck will use flow-splitters;
- f) design and operate flow-splitters to maintain pre-Construction hydrology as informed by baseline measurements and regular monitoring of indicators and thresholds of the Ronald Lake Watershed; and
- g) engage with ACFN through the implementation of the Participation Agreement to continually review best available technology and water management practices, and implement ACFN-Teck consensus recommendations to reduce water intake and improve water management performance so as to achieve the Water Quantity Objectives.

3.3 Requested Recommendations: Teck and ACFN are jointly in favour of the following Crown actions to support the Water Quantity Objectives:

- a) by 2020, reconfigure the Lower Athabasca River Surface Water Quantity Management Framework (SWQMF) Aboriginal Navigation Index so that it is zero at the Aboriginal Extreme Flow (500 m³/s). Retain negative values of the index in calculations and decision-making. Consider renaming it the Indigenous Navigability Index (INI);
- b) by 2020, amend the SWQMF's Aboriginal Navigation Trigger to be a proactive and effective advanced-warningsystem in support of Indigenous navigability. In it, include:
 - i) considerations of long-term (multi-annual) and short-term (daily, weekly, seasonal) changes in navigability;
 - ii) explicit effective management interventions should navigability loss occur due to oil sands withdrawals; and
 - iii) close collaboration with ACFN and other Indigenous groups to identify and verify issues requiring management action;
- c) by 2020, incorporate flow monitoring data from existing or new hydrometric monitoring stations downstream of the oil sands region into the SWQMF to verify available water for Indigenous navigability and to improve understanding of navigability dynamics. Focus discharge measurements on flow rates below the ABF (1600 m³/s);

- d) by 2020, provide long-term support to Indigenous-led community-based monitoring ("CBM") programs and work closely with First Nations, under an active adaptive management approach, to incorporate CBM data and Indigenous knowledge concerning navigability and its thresholds into SWQMF decision making;
- e) by 2020, require all oil sands operators to take regular and frequent measurements of surface water and groundwater use and make this data available to Indigenous communities and regulatory authorities, on this basis or upon reasonable request to support navigability and Indigenous land use activities;
- f) by 2020, report publicly on the State of Indigenous Navigability and include field information, hydrometric data, verified weekly operator water-withdrawal records, trigger responses, and progress under adaptive management;
- g) by 2020, implement regulations, set targets, and incentive all oil sands operators to demonstrate continual improvement in water management , including efficiency of use and water withdrawals from the Athabasca River; and
- h) by 2020, advance improved water use efficiency in the oil sands by facilitating the sharing and implementation of best-in class water use expertise and technology between all oil sands operators.

4. Water Quality

4.1 Water Quality Objectives: Having water quality in the Athabasca River, Ronald Lake Watershed, and the Peace Athabasca Delta to a quality that can support ACFN biodiversity objectives and the exercise of Aboriginal and Treaty Rights (the "Water Quality Objectives").

4.2 Mitigation and Management Commitments: In furtherance of the Water Quality Objectives, Teck will:

- a) work collaboratively with ACFN through Participation Agreement implementation with respect to development and implementation of mitigation, monitoring, and adaptive management plans related to water quality, including:
 - i) sampling sediment in addition to water as a means to monitor sediment quality;
 - ii) ensuring appropriate monitoring during Construction, to monitor any contaminant spikes in the Athabasca River;
 - iii) ensuring monitoring and sampling protocols accurately assess constituent loads during the rising and falling hydrograph limbs, such as through more frequent discharge and concentration measures throughout the freshet period;

- iv) supporting greater understanding of the variability in aerial deposition rates and snowmelt, both spatially and temporally across each watershed within the Local Study Area by conducting snow survey and watercourse sampling conducted collaboratively with ACFN when snow is melting in each watershed in the Local Study Area;
- v) monitor surface and groundwater as a means to inform water quality planning; and
- vi) meet or exceed all regulatory approval conditions regarding water quality and water discharge.

4.3 Requested Recommendations: Teck and ACFN are jointly in favour of the following Crown actions to support the Water Quality Objectives:

- a) by 2020, revise the Lower Athabasca River Surface Water Quality Management Framework (SWQMF) to expand the number of monitoring sites and frequency of monitoring events as determined jointly by ACFN and local Indigenous communities; and
- b) by 2020, incorporate an Indigenous caucus in the Joint Oil Sands Monitoring Plan, and revise the SWQMF to incorporate water quality monitoring results from the ACFN and other Indigenous community CBM program and ensure that the CBM program has sufficient capacity to carry out this work.

5. Biodiversity Stewardship Area

5.1 BSA Objectives: Establishing, in a timely way, a permanently protected area (the "Biodiversity Stewardship Area" or "BSA") under legislation or other legally effective means that is sufficient in size, ecological capacity and habitat quality to support ACFN biodiversity objectives, the exercise of ACFN Aboriginal and Treaty Rights, and the culturally important relationships between ACFN and local wildlife, including the RLBH (the "BSA Objectives"), through creation of the Biodiversity Stewardship Area consistent with boundaries set out in the attached map.

5.2 Mitigation and Management Commitments: In furtherance of the BSA Objectives, Teck will:

- a) commit its Twin Lake Leases and northern-most portion of Lease 840 to the Biodiversity Stewardship Area (the "BSA Leases") by formally transferring or conveying the BSA Leases to a Regulatory Authority for the purpose of permanently protecting the Biodiversity Stewardship Area once the Authority has established an appropriate mechanism for establishing the BSA.

5.3 Requested Recommendations: Teck and ACFN are jointly in favour of the following Crown actions to support the BSA Objectives:

- a) By 2020, the establishment of the Biodiversity Stewardship Area as a legislated protected area, taking steps to consolidate, purchase, or otherwise transfer the leases in this area to the BSA;

- b) a joint management and shared decision-making role for ACFN in the governance of the BSA; and
- c) incorporation in the BSA legislative and regulatory means to protect RLBH, Caribou, and migratory bird critical habitat to support the RLBH, Caribou, and Migratory Bird Objectives.

6 North Pit Development

6.1 North Pit Objective: Conducting a transparent and collaborative process regarding a consensus recommendation whether to develop the North Pit, including consideration of ACFN biodiversity, water quantity and quality objectives, ACFN Aboriginal and Treaty Rights, and the cultural relationship between ACFN and local wildlife.

6.2 North Pit Mitigation Commitments: In furtherance of the North Pit Objective, Teck will:

- a) carry out a collaborative planning process with respect to the North Pit development with ACFN prior to submitting applications for the Public Lands (MSL) needed to construct and operate the North Pit;
- b) prior to or as part of final licensing applications to start construction in the North Pit for the purposes of extracting hydro-carbon resources, Teck will provide a report which:
 - i) demonstrates how Teck has met its commitments with respect to RLBH, caribou, water quantity and quality, the biodiversity stewardship area, and tailings management commitment; and
 - ii) a summary of the collaborative North Pit process, including a summary of any reports, studies, modeling or other data collected as part of the North Pit SDM Process, and areas of consensus and non-consensus regarding North Pit development between ACFN and Teck; and
- c) recognize that, should ACFN and Teck fail to reach a consensus recommendation and Teck proceeds with development of the North Pit, ACFN will have the right to make submissions to the regulator to oppose the amendments to the Regulatory Approvals.

7 Climate Change

7.1 GHG Objective: Minimizing Project greenhouse gas emissions ("GHGs").

7.2 Mitigation and Management Commitments: In furtherance of the GHG Objective, Teck will:

- a) work collaboratively with ACFN through Participation Agreement implementation with respect to the development and implementation of Teck's GHG plans and reduction efforts, including:
 - i) continually reviewing and implementing best available technology and GHG emissions reductions practices; and

- ii) demonstrating continuous GHG emissions reductions from Project operations over the life of the mine.

8 Fish and Fish Habitat

8.1 Fish and Fish Habitat Objectives: The Parties are committed to the shared objective of ensuring that mitigation and compensation for Project impacts to fish habitat are implemented in a manner that is locally and cultural appropriate and supports ACFN Aboriginal and Treaty rights to harvest fish in ACFN territory (the "Fish Objectives").

8.2 Mitigation and Management Commitments: In furtherance of the Fish Objectives, Teck will:

- a) work collaboratively with ACFN through Participation Agreement implementation with respect to Teck's mitigation, monitoring, and adaptive management plans, including those that pertain to fish and fish habitat;
- b) use best available information to identify fish habitat within the lower Athabasca River basin that can be replaced, restored, or enhanced by Teck, to the satisfaction of ACFN, for Teck to create fish habitat compensation units and advance the Fish Objectives;
- c) design the water intake to minimize entrainment and impingement of fish;
- d) as approved by Regulatory Authorities, implement fish habitat mitigation and compensation measures to advance the Fish Objectives within ACFN harvesting areas identified collaboratively with ACFN in lieu of, at least in part, the fish habitat compensation lake;
- e) engage ACFN on Teck's Complimentary Measures Program to identify opportunities for Teck funding for ACFN led initiatives to enhance fish productivity and habitat in ACFN's harvesting areas; and
- f) undertake regular monitoring of fish habitat, fish tissue quality (including mercury levels), fish species diversity and benthic biodiversity in ACFN harvesting areas.

8.3 Requested Recommendation: Teck and ACFN are jointly in favour of the following Crown actions to support the Fish Objectives:

- a) By 2019, constructive engagement between the Department of Fisheries and Oceans, Teck, ACFN, and other interested Indigenous communities regarding the acceptability of identifying fish habitat mitigation and compensation measures to achieve the Fish Objective in lieu of, at least in part, the currently proposed fish habitat compensation lake.

9 Migratory Birds

9.1 Migratory Bird Objectives: Avoiding acute and chronic mortality of migratory birds in tailings ponds, maintaining sufficient and adequate stop-over habitat for migratory birds in the Lower Athabasca Region, and supporting ACFN's Aboriginal and Treaty rights to hunt migratory birds in ACFN territory (the "Migratory Bird Objectives").

9.2 Mitigation and Management Commitments: In furtherance of the Migratory Bird Objectives, Teck will:

- a) work collaboratively with ACFN through Participation Agreement implementation with respect to Teck's mitigation, monitoring, and adaptive management plans, including those that pertain to migratory birds and migratory bird habitat;
- b) initiate reclamation of areas disturbed by the Project as soon as reasonably possible;
- c) consult with ACFN about applications for reclamation certification of wetlands, and apply for reclamation certification of wetlands only upon obtaining consensus with ACFN in accordance with the Participation Agreement
- d) in relation to the Project's tailings pond bird deterrent system, Teck will:
 - i) use industry best practices that have been tested and implemented, and explore innovative systems as supported by most current research, to demonstrate continuous reductions of bird contacts with tailings ponds and process affected water over the life of the mine;
 - ii) consult with ACFN on the selection of the system;
 - iii) work with ACFN to provide a detailed methodology for how Teck will systematically test the mitigation effectiveness of the planned deterrent systems;
 - iv) upon implementation of the system, include an evaluation of the effectiveness of the system in the application for renewal of the Environmental Protection and Enhancement Act regulatory approval for the Project;
 - v) implement a monitoring program that counts bird contacts with tailings ponds/process affected water as well as bird mortalities in tailings ponds;
 - vi) develop adaptive management programs that are triggered by these quantitative targets and performance thresholds.
 - vii) demonstrate continuous improvements towards achieving the Migratory Bird Objectives by implementing further management actions as recommended by ACFN; and
 - viii) Implement wetland offsets as determined under the biodiversity management plan.

9.3 Requested Recommendation: Teck and ACFN request the following Crown action in support of the Migratory Bird Objectives:

- a) The development and implementation of a wetland offset program to allow Teck and other parties to offset migratory bird habitat loss and/or protect existing natural wetland habitats currently used by migratory water birds as stopover and breeding habitat outside of the Project Area and within the MOSR; and
- b) develop criteria, indicators and thresholds to track and validate the health, stability and sustainability of migratory birds, including:
 - i) population numbers and demographics;
 - ii) mortality, and contacts with industrial waterbodies;
 - iii) the quality and quantity of habitat, including critical habitat; and
 - iv) quantitative thresholds related to bird contacts on industrial waterbodies; and
- c) with the participation of ACFN, Indigenous communities, and oil sand operators as appropriate through the Joint Oil Sands Monitoring Program, conduct broader studies, monitoring, and tracking of the health, stability and sustainability of migratory birds including short and long-term regional migratory bird studies to:
 - i) assess the acute and chronic impacts of oil sands development to migratory birds;
 - ii) support development of criteria and thresholds to track and validate the health, stability and sustainability of migratory birds; and
 - iii) support improved regional planning and management of migratory bird health and viability; and
- d) the participation of ACFN, and other interested local Indigenous communities, in the Oil Sands Bird Contact Monitoring Program, with industry funding to facilitate this participation as necessary.

10 Community Based Monitoring and Information Sharing

10.1 CBM Objective: The Parties are committed to the shared objectives of ensuring that the ACFN Community Based Monitoring Program (the "CBM Program") has an integral role in monitoring and reporting on Environmental Effects and ACFN Concerns, and has sufficient capacity to carry out this function ("the CBM Objectives").

10.2 Requested Recommendation: Teck and ACFN request the following Crown action in support of the CBM Objectives:

- a) The development and operationalization of a multi-stakeholder monitoring committee - comprised of ACFN, local Indigenous communities, and provincial and federal regulatory authorities - to oversee Project-specific monitoring, follow-up compliance verification, and adaptive management over the lifecycle of the Project.

11 Health

11.1 Mitigation and Management Commitments: Teck will, through collaboration with ACFN, finalize its hazard management plan, including:

- a) hazard identification and inventory of areas potentially affected;
- b) measures to minimize Project hazards;
- c) details of risks posed by hazards; and
- d) measures to manage risks;
- e) an emergency response plan that includes emergency planning zones for the Poplar Point Reserve and Point Brule;
- f) a fire protection and response plan that includes:
 - i) opportunities for ACFN's first responders to participate in Teck's training and practice exercises;
 - ii) a mutual aid protocol for the Parties to assist each other in emergency management; and
 - iii) widely applied and tested industry best practices for Project fire protection, detection, alarming and suppression.

11.2 Requested Recommendation: Teck and ACFN request the Crown take the following action in support of ACFN's health concerns and objectives:

- a) Starting in 2020, the implementation of a Crown -led 10 year community health baseline study commencing upon Project approval, with follow-up monitoring occurring every five (5) years; and
- b) Teck will work cooperative with ACFN, other Indigenous communities, and the Crown on conduct of the study, including an offer to provide funding consistent with regional industry participation and funding.

12 Air Quality

12.1 *Air Quality Objective:* Reducing Project emissions of pollutants that contribute to acute and chronic health impacts to ACFN members and regional biodiversity in the Lower Athabasca Region (the "Air Quality Objective").

12.2 *Mitigation and Management Commitments:* In furtherance of the Air Quality Objective, Teck will:

- a) promptly respond to odour complaints reasonably attributable to the Project and consult with ACFN regarding the complaint;
- b) participate in any regional initiatives for odour management relevant to the Project and implement any resulting recommendations that are endorsed by the EMC or required by Regulatory Authorities;
- c) avoid solvent loss of more than four (4) volumes per thousand (1000) volumes of bitumen production average on an annual average basis and endeavor to reduce solvent loss of three (3) volumes per thousand (1000) volumes of bitumen;
- d) use NO_x management abatement on stationary boiler and heater equipment that results in NO_x emission concentrations which meet or exceed the compliance limits in the Interim Emission Guidelines for Oxides of Nitrogen (NO_x) for New Boilers¹ Heaters and Turbines Using Gaseous Fuels Based on a Review of Best Available Technology Economically Achievable; and using reasonable efforts strive to meet the performance targets set out in the same guidelines;
- e) apply principles of "best available technology economically achievable" for continuous improvement to decide on the need for and selection of prudent technology upgrades and capital expenditures for emission control performance;
- f) identify ways in which slash burning can be reasonably managed to minimize impacts to ACFN Members, Poplar Point or Point Brule;
- g) develop specific monitoring plan, including community based monitoring, for Poplar Point and Point Brule; and
- h) construct a continuous monitoring station at Poplar Point to be operated by ACFN that:
 - i) monitors noise;
 - ii) monitors NO, NO₂, NO_x, SO₂, PAH, TRS, NMHC, THC, PM_{2.5}, and O₃;
 - iii) monitors typical meteorological parameters, including wind speed, wind direction, temperature and relative humidity; and
 - iv) passively monitors for acid deposition and nitrogen deposition.

13. Bridge

13.1 Bridge Objectives: Minimizing any increases in access to the Project Area by recreationalists and hunters via the bridge and any changes to navigation on the Athabasca River from the bridge (the "Bridge Objectives").

13.2 Mitigation and Management Commitments: In furtherance of the Bridge Objectives, Teck will:

- a) monitor and quantify the navigability of the Athabasca River near the Project bridge; and
- b) request permission from Regulatory Authorities to decommission the bridge once it is no longer required for the Project, including conducting of reclamation and post-closure monitoring.

14. Tailings

14.1 Tailings & Seepage Objectives: Ensuring that Project tailings do not negatively impact water quality or biodiversity in the Athabasca River, Ronald Lake Watershed, or the Peace Athabasca Delta ("the Tailings Objectives").

14.2 Mitigation and Management Commitments: In furtherance of the Tailing Objectives, Teck will:

- a) work collaboratively with ACFN through Participation Agreement implementation with respect to the development and implementation of Teck's tailings and seepage management plan;
- b) design the Project to minimize the material balance of fluid fine tailings at the end of the life of mine;
- c) not place any tailings materials in the end-pit lakes, including mature fine tailings without obtaining the consent of ACFN;
- d) not place fluid fine tailings in an end pit lake unless Teck can demonstrate that this option is superior to all other options for reclamation;
- e) continue to research land based tailings technology and evaluate new tailings technologies that become available for incorporation into the Project with the aim of optimizing tailings management, increasing opportunities for direct placement and increasing the speed and success of reclamation;
- f) test tailings cap water to ensure it meets a standard of quality that is consistent with applicable Regulatory Approvals or any agreed criteria set through Project Agreement implementation before transferring the water to end pit lakes;
- g) divert watercourses upstream of the Project and runoff from undisturbed areas around the Project into diversion channels that drain to natural watercourses until such time that the water quality of the end pit lakes meets the water discharge standard;

- h) ensure no discharge from end pit lakes or other process-affected water enters surface water systems, including fish habitat compensation areas, until water meets required water quality discharge standard;
- i) fill end pit lakes primarily with Athabasca River water in alignment with the Surface Water Quantity Management Framework for the Lower Athabasca River and with run-off from reclaimed areas; and
- j) establish a protocol with ACFN for providing prompt notice, monitoring, training, and responding in the event of any accidental or unplanned release of storm-water, tailings, tailings affected or process affected water.

15. Reclamation

15.1 Reclamation Objectives: Returning the Project Area, as quickly as reasonably possible, to a landscape that is as close to its pre-disturbance condition as possible and that supports the continuation of the exercise of ACFN's Aboriginal and Treaty rights (the "Reclamation Objectives").

15.2 Mitigation and Management Commitments: In furtherance of the Reclamation Objectives Teck will:

- a) engage ACFN in the quantification, development and validation of the mine liabilities reclamation security estimate for the Project;
- b) work collaboratively with ACFN through implementation of the Participation Agreement on ongoing reclamation plans and conduct of progressive reclamation work;
- c) reviewing prescriptions to identify ways in which the pre-disturbance conditions of the Project area can be restored with the same number and types of species and ecosites currently present on the landscape through reclamation work;
- d) design mitigation measures to support proper management, and where prudent and consistent with best reclamation practices, avoiding and minimizing of settlement over time;
- e) prepare maps that indicate the likely development of landforms, such as lakes, on reclaimed landscapes at different times during Reclamation and Closure; and
- f) provide for adaptive management actions and corrective measures to be taken where long-term monitoring results suggest that the Reclamation Objectives are not being achieved.

16. Access and Traditional Use Management

16.1 *Mitigation and Management Commitments:* In support of ACFN's objectives regarding access and traditional use management, Teck will:

- a) finalize, review and update, its Access Management Plan through collaborative work with ACFN with the objective of:
 - i) providing reasonable access to ACFN members to and through non-active portions of the Project Area;
 - ii) development of a hazard management plan that better supports shared hazard identification and communication to ACFN members; and
 - iii) development of a fire protection and response plan that includes opportunities for ACFN's first responders to participate in Teck's training and practice exercises, and a mutual aid protocol for the Parties to assist each other in emergency management; and
- b) finalize, review and update a noise management plan through collaborative work with ACFN, with the objective of minimizing sensory disturbance which may impact ACFN members' sense of place or cause avoidance of preferred use areas, including by:
 - i) using proven industry best management practices for noise control and mitigation with an emphasis on reducing pure tonal and bird cannon noise;
 - ii) consulting ACFN regarding development of flight patterns for Project-related air transport;
 - iii) promptly responding to noise complaints of ACFN members even if noise levels are in compliance with AER Directive 038: Noise Control and consult with ACFN regarding the complaints;
 - iv) implementing additional noise monitoring if recommended by committees established pursuant to the Participation Agreement; and
 - v) developing a light management plan with the objective of minimizing Project-related light pollution and promptly responding to light pollution complaints of ACFN members.

17. Heritage Resources

17.1 *ACFN Heritage Resources Objective:* The Parties are committed to avoiding or minimizing impacts of the Project on Heritage Resources.

17.2 Mitigation and Management Commitment: In furtherance of the ACFN Heritage Resources Objective, Teck will:

- a) use reasonable efforts to avoid or minimize impacts to Heritage Resources, including through implementation of the chance-find and cultural heritage management plan which will include:
 - i) train and educate employees, contractors and other Project personnel who may encounter Heritage Resources in their work, on how to identify Heritage Resources and how to avoid adversely affecting them;
 - ii) promptly identify the location and nature of the Heritage Resources to the ACFN, subject to any applicable Laws related to confidentiality of information related to Heritage Resources, including a report ("Site Report") for ACFN;
 - iii) protect the Heritage Resource as required by Applicable Law and protocols developed by the EMC;
 - iv) treat all information with respect to the finding of the Heritage Resources as Confidential Information, except to the extent that Teck is required by Applicable Law to report the finding to Regulatory Authorities or share such information with other Participating Communities; and
 - v) consult with and obtain advice from the ACFN regarding the significance of the Heritage Resource to the ACFN.

Recommendations of Fort McKay First Nation

Fort McKay First Nation (Fort McKay) requests that the Joint Review Panel making the following recommendations:

A. Air Quality

- 1) The Federal and Provincial Governments:
 - a) involve Fort McKay as a partner in establishing specific community, Reserve Land and Traditional Territory air quality objectives and requirements related to achieving Fort McKay's air quality vision;
 - b) Once specific community, Reserve Land and Traditional Territory air quality objectives and requirements are developed, they be used by the Federal and Provincial Governments in cumulative air quality impact assessments of new and/or expanded industrial projects, in associated project approval decision making and in other air quality management decisions.

EIA Development Scenarios Required by Alberta

- 2) The Government of Alberta revise its Standard EIA Terms of Reference for oil sands projects to require background, current and project only case air quality impact assessments in addition to the standard baseline, application and planned development cases.

The use of Ambient Air Quality Objectives and Standards in Assessing Project and Cumulative Impacts

- 3) The Federal and Provincial Governments develop mandatory instructions on how air quality criteria are to be used in assessing air quality impacts and also specify the approach that applicants must use to rate the magnitude of predicted air quality changes and that this guidance be developed in consultation with regional communities like Fort McKay.
- 4) The Government of Alberta revise its Standard EIA Terms of Reference for oil sands projects to require project and cumulative air emission impacts be assessed against any applicable air quality criteria that aboriginal communities like Fort McKay have established for their communities and/or Reserve Lands.

Air Emission Estimates and Impact Assessment Uncertainties

- 5) The Federal-Provincial Oil Sands Monitoring Program continue its systematic and comprehensive characterization and quantification of all air emission sources and/or source types associated with oil sands development; and that this work cover the entire range of operating and/or upset conditions associated with each source or source type.

- 6) The Oil Sands Monitoring Program continue to generate as reliable as possible oil sands development related air emission inventories for a wide range of air contaminants and that these inventories be used to track trends in air contaminant emissions associated with oil sands development.
- 7) Federal and/or Provincial Governments ensure that oil sands emission data is publically available on a timely basis.
- 8) The Federal and Provincial Governments develop mandatory Guidance Document that provides specific guidance on when, where, and how emission factors are to be used for certain sources and that there be a strong technical basis for these emission factors, i.e. they are based on actual measurement data from oil sands developments.
- 9) In cumulative effects decision making related to oil sands development Federal and/or Provincial agencies apply the “precautionary principle”.

Air Emission Management

- 10) The Government of Alberta revise its Standard EIA Terms of Reference to require that EIAs thoroughly evaluation all possible air emission minimization management options and controls.
- 11) Provincial and federal regulators develop and/or update, on a regular basis e.g. every five years, best available technology economically achievable (BATEA) based limits for certain common and significant oil sands development air emission source types e.g. boilers, heaters, co-generation units, sulphur recovery units, mobile equipment, etc. to reflect advancements in, and availability of, new practices and/or emission control technologies.
- 12) Provincial and federal regulators provide Fort McKay and other regional stakeholders with the opportunity to have a meaningful role in the development of BATEA limits for oil sands developments.
- 13) Provincial and federal regulators establish a “best practices” benchmarking process that would provide an open and transparent mechanism for assessing whether or not “best practices” are being required and/or employed for minimizing emissions from oil sands development.

Air Modelling

- 14) Regulatory authorities use air quality modelling predictions, and particularly predicted exceedances of objectives and standards, to guide cumulative effects management actions and policy and the establishment of “best management” practices and controls.
- 15) The Government of Alberta revise its Standard EIA Terms of Reference to require that project proponents assess predicted air quality impacts in relation to relevant air quality criteria e.g. CAAQS and LAR air quality thresholds and limits.

- 16) Governments of Canada and Alberta develop specific and mandatory guidelines on air modelling use and model inputs that will allow model predictions over time, and between projects, to be compared.
- 17) Government of Canada conduct regional air quality modelling on a periodic basis to provide benchmark model predictions that can be used to evaluate and validate EIA modelling outputs.

Air Emission Related Impact Management Frameworks

- 18) Governments of Alberta and Canada give priority to developing and/or completing already partially developed air emission related impact thresholds and associated implementation frameworks/plans for oil sands-related air emission parameters of relevance in terms of potential regional impacts e.g. acidification, eutrophication, alkalization, odours and dust.
- 19) Governments of Alberta and Canada:
 - a) develop region specific thresholds and associated frameworks/plans in a multi- stakeholder forum and in collaboration with those whose environment and/or health is affected and being managed by these thresholds using a process similar to one used by CEQA;
 - b) once developed, Governments adopt the region specific thresholds and associated frameworks/plans as the impact assessment criteria that project proponents must use and clearly indicate that project proponents will be required to control their emissions to stay below specified thresholds.

Upset Conditions and Associated Emissions

- 20) The Government of Alberta revise the Standard Terms of References for EIAs for oil sands projects to include details on possible upset events, how the likely frequency of such events is determined, options to reduce or eliminate such events and how such events are managed in terms of ensuring that associate releases are managed/treated to extent possible and do not pose a risk to communities or the public.

Odour Assessment

- 21) Government of Alberta and Canada provide clear mandatory direction in EIA terms of reference regarding the approach to be followed in conducting odour impact assessments.
- 22) Government of Alberta and Canada develop regulatory standards for developers to undertake periodic detailed odorant source emission quantification and characterization on all major and potentially significant project odorant emission sources.
- 23) Government of Alberta and Canada develop regulatory standards that require “best practices” to manage all odorant emission sources associated with the proposed development.

Dust

- 24) Federal and Provincial Governments take a more active role in addressing regional oil sands related dust issues. This more active role could involve one or more of the following:
- a) Developing specific guidance on how fugitive dust emissions are to be:
 - i) estimated and characterized,
 - ii) modelled and assessed in terms of environmental, health and nuisance impacts, and
 - iii) managed (i.e. outline the approach and considerations that must be part of a project’s dust mitigation plan);
 - b) Including fugitive dust emission management requirements in the oil sands Base- Level Industrial Emission Requirements (BLIERS) that are currently under development;
 - c) Participating in a study with Fort McKay to better quantify the magnitude and spatial extent of dust fall in Fort McKay, on Fort McKay’s Reserve Lands and throughout its Traditional Territory;
 - d) Ensuring that material management and interim and final reclamation planning includes considerations related to minimizing the potential for dust generation;
 - e) Establishing a regional multi-stakeholder working group to address the issue of dust in the region; and/or
 - f) Funding studies and/or programs related to technology and dust management practice development to identify and demonstrate economic and effective methods to minimize dust generation associated with oil sands mining facilities in the AOSR.

Monitoring

- 25) Federal and Provincial Governments, in conjunction with Fort McKay, develop a long term air quality monitoring program focused on the both comprehensive measurement of ambient air quality and the factors affecting air quality in Fort McKay and on Fort McKay’s Traditional Lands Reserve Lands.
- 26) Governments provide funding for community based monitoring and providing access to government air scientists and experts to assist Fort McKay in interpreting and understanding air quality data and in developing its own monitoring programs.
- 27) The Government of Canada participate in the assessment of oil sands projects until Alberta has a functioning cumulative effects management system that demonstrates, protective measures are in place for the monitoring and management of cumulative effects or Canada conducts a regional impact assessment under the proposed Bill C-68.

B. Wildlife

Species at Risk

- 1) Government of Canada should implement recovery strategies that include action plans to provide mechanisms to protect critical habitat and species at risk populations.
- 2) The Governments of Canada and Alberta through OSM develop monitoring that determines the effectiveness of recovery strategies (i.e., measure populations).

Woodland Caribou

- 3) The Governments of Alberta and Canada through OSM should prioritize caribou, wolf, deer, moose population monitoring to assist will caribou recovery efforts. Caribou monitoring should include DNA analysis.
- 4) Government of Canada and Alberta immediately finalize caribou range plans that outline specific steps for providing immediate action to recover caribou populations. Action should occur before completion of the Alberta Government’s planned 3-year socio-economic study.

Wildlife Health

- 5) Alberta Health and Wellness and Health Canada should complete health studies on food consumption and the health impacts of country foods as recommendation by the Review Panel 2015.

Regional Wildlife Monitoring and Management

- 6) The Governments of Canada and Alberta review OSM's approximate budget of approximately \$60 million dollars annually and assess whether this is adequate to fulfill its large mandate. For example, two projects that incorporate western science and traditional knowledge were not funded through the EMSD in 2018/2019.
- 7) Moose should be a LARP BMF indicator and the Government of Canada and Alberta should work together to ensure adequate management of moose populations and their habitat. Moose should be considered a species at risk in wildlife management units where populations are well below Alberta Government goals.
- 8) The Governments of Canada and Alberta should develop protocols that can effectively measure cumulative effects in the oil sands region. The current ABMI grid pattern and rotation frequency is ineffective at measuring meaningful biodiversity indicators (e.g., species at risk)at scales (e.g. WMU and the LARP area) smaller than the province of Alberta.

- 9) The Governments of Canada and Alberta should develop an effective monitoring program that measures changes in wildlife populations in a timely manner (e.g., five years) and provides sound data to determine mitigation and recovery plan effectiveness.

Reclamation and Re-colonization

- 10) The Government of Canada work with Government of Alberta to re-fund CEMA or to develop an alternative multi-stakeholder committee to assess the return of wildlife to reclaimed oil sands land.
- 11) The Government of Canada and Alberta through their participation in OSM should require standardized monitoring of wildlife on reclaimed lands in the oil sands region.

Conservation offsets and Habitat Protection

- 12) Government of Canada should work with the Government of Alberta to develop a formal process for conservation offsets and habitat protection that preserve the suite of species (e.g., species at risk and culturally important wildlife species) and ecosystems and maintain local and regional biodiversity in consideration of traditional territories of Aboriginal communities.

Wood Buffalo National Park Strategic Environmental Assessment

- 13) The Government of Canada should work with the Government of Alberta to complete a Strategic Environmental Assessment similar to the one complete for the WBNP of the Fort McKay traditional territory that evaluates impact to values and resources that are important to the Community.

C. Fisheries and Aquatic Resources

- 1) Alberta and Canada should establish meaningful consultation with communities regarding regional aquatics monitoring.
- 2) Alberta and Canada should provide communities the annual data analyses and reporting of government and other regional monitoring programs.
- 3) Alberta and Canada should provide funding for communities to technically review draft annual monitoring reports and incorporate feedback into final reports.
- 4) Alberta and Canada sharing of data and a comprehensive understanding of regional aquatic systems, compilation of all aquatic research and monitoring data and reports into a single online portal.

Complementary Measures/offsets

- 5) Department of Fisheries and Ocean ("DFO") should be flexible in the percentage of fisheries offsets that is acceptable as complementary measures. The allowable percentage of complementary measures should be more flexible to enable research or offset projects that are of high value to Fort McKay to be implemented

Fisheries Offset Planning

- 6) DFO should play a strong role in encouraging other proponents to engage communities in fisheries offset planning, similar to the way Teck has done.
- 7) DFO require that decisions about fish and fish habitat, including offsets, incorporate the traditional knowledge and concerns of Indigenous peoples.
- 8) DFO consult with Fort McKay about how the upcoming revised Fisheries Act will be implemented regarding projects in the oil sands region.
- 9) DFO collaborate with Fort McKay on an action plan to prevent and/or respond to impacts to water and fish that might be caused by the wide range of cumulative stresses that may occur. Development and implementation of a comprehensive plan for the Moose Lake area remains a gap to preserve the Area for future generations.

Fort McKay's Action Plan Outline

- 10) DFO engage in ongoing consultation with Fort McKay to understand the community's concerns about water quality, fish, and fish habitat in the Moose Lake area, in the Ells and McKay Rivers, and other lakes and rivers in their traditional territory (i.e. east side of the Athabasca River).
- 11) DFO develop an affirmative action plan for protecting water quality, fish and fish habitat in these areas applying list of knowledge and information gaps.
- 12) DFO support the implementation of research plans to address the knowledge and information gaps, and provide scientific and technical advice to Fort McKay.
- 13) DFO seek opportunities to link knowledge gaps with research-related complementary measures and/or offsetting projects.

Fort McKay's Research or Knowledge Gaps

- 14) DFO prepare an Action Plan, which incorporate the following as offsets or complementary measures:
 - a) Moose Lake
 - i) continue to compile baseline limnology, water quality, water quantity (water balance), and bathymetry so that future change may be detected and remedied, if possible.
 - ii) chemical composition and quantification of aerial fallout (fugitive dust), which could be incorporated into the air monitoring station on Namur Lake, with a goal of determining the importance to lake contaminant and nutrient input assessments;
 - iii) record and map fish habitat characteristics to better understand the habitats of walleye, northern pike and other species.

- iv) Fish (walleye, northern pike, whitefish, lake trout, other species) population and fish health monitoring;
 - v) Studies of in-lake and out-of-lake nutrient sources (nutrient budgets) that promote algal blooms; studies of aquatic invertebrate communities, and bottom sediments;
- b) Ells and Mackay Rivers
- i) Fish population and fish health monitoring in selected reaches, including fish tagging studies to track the migration of key fish species;
 - ii) Aquatic studies and traditional use support, including fish habitat mapping, habitat improvements and/or restoration of key traditional use areas of the Rivers.
- c) Ells and Mackay Rivers, and Namur/Gardiner Lakes and their key inflows and outflows – Explore ways to enhance or restore degraded aquatic habitat, where feasible.
- d) Other rivers and lakes on the east side of the Athabasca River are also within Fort McKay's traditional territory and could be considered for research projects as well.
- 15) DFO undertake or support the following assessments for Fort McKay's Moose Lake, Ells River and Mackay River specific studies:
- a) Regional climate modelling to extrapolate information about the future quality and quantity of fish habitat.
 - b) The impacts of forestry, development, other land changes, plus climate change on the hydrology in large areas of wetlands/muskeg to better understand the influence of changes in water levels on fish communities.
 - c) On the assumption that future discharges or seepage from any tailings holding areas will result in cumulative inputs, develop oil sands process water contaminant loading estimates and other studies for key contaminants including acid-extractible organics (naphthenic acids), metals, soluble polycyclic organic compounds (PACs) and salts.
 - d) Cumulative impacts to all aspects of aquatic systems from all regional development and land uses, future climate change, aerial pollution (gases and dust fallout) should be further studied.
- 16) DFO support Fort McKay in their efforts to monitor and protect the aquatic resources and important fisheries in the Moose Lake (Namur L, Gardiner L, Ells River) area as well as the suggested cumulative effects focused studies aimed at protecting the fisheries in Fort McKay's traditional territory.

D. Wetlands

Alberta Wetland Policy

- 1) Government of Alberta Wetland Policy be immediately revised to require specific description of the wetland types lost from the pre-disturbance landscape and the functional type of wetland being reclaimed in the closure plan and require as regulatory standard the same and wetland types as pre-disturbance are replaced on the landscape post-disturbance.

Alberta Wetland Mitigative Directive

- 2) The Government of Alberta should immediately revise Alberta Wetland Mitigative Directive to require the Reclamation Proposal from Alberta Mitigation Directive to require information of what using appropriate reclamation techniques specifically entail as part of any application to operate an oil sand mine to ensure development aligns with the new Alberta Wetland Policy.

Water for Life: Alberta's Strategy for Sustainability

- 3) The Government of Alberta should complete the wetland offset program and a conservation offset program as soon as possible for public lands as both are critical to mitigate cumulative effects on the landscape. The programs should provide protection status to the offsets for the long term not temporary and require equivalency in their description and ongoing monitoring to demonstrate the functional value of these offsets.

Federal Policy

- 4) The Government of Canada apply Federal Conservation Allowances in respect to the cumulative loss of wetlands and the ecological services and biodiversity provided by wetlands.

Current research and knowledge gaps with respect to cumulative impacts to wetlands and wetland restoration and reclamation

- 5) The Government of Alberta and Canada establish a regional wetland monitoring system immediately under the authority of the joint Alberta Canada oil sands monitoring agreement. A monitoring plan that represents the entire oil sands area needs to be established for wetlands and biodiversity.
- 6) The Government of Alberta and Alberta should developing regional plans for reclamation of wetlands and surface water movement across the mined landscape rather than project by project reclamation that is not integrated over the larger regional landscape.

E. Tailings, End Pit Lake, Reclamation and Closure Landscape

- 1) The Government of Alberta and Canada establish a multi-stakeholder initiative similar to CEMA or re-fund CEMA with stable funding to address current priority management and knowledge gaps with respect to tailings management integration into final reclamation and closure landscape.
 - a) complete the work of the Closure Coordination Task Group to develop a Landscape Design Guidance Document for designing oil sands mining landforms for natural appearance and landform integration (See Donald Report Section 2.4).
 - b) follow up the gaps identified in the End Pit Lake Guidance Document (See Donald Report at Table 2.2).
 - c) as priority issue, develop risk pathways for chemicals of potential concern in treated tailings deposit by treatment technology and placement on landscape and to understand risks to reclamation of treated tailings deposits by treatment technology and placement on landscape. As the placement of treated tailings is about to ramp up with the approval of the tailings management plans and implementation of the treatment technologies at all of the mines, it is an extremely high priority to convene a multi-stakeholder table to include Aboriginal communities in the risk assessment work. The results of this work could also contribute to further developing the liability calculations of treated tailings deposits on the landscape under the Mine Financial Security Program which is another critical gap.
 - d) as priority issue, develop climate mitigation and adaptation planning for oil sands mine reclamation with inclusion of Aboriginal communities and conducting a regional analysis of climate change for the mineable oil sands is required, with consideration of a Ecosystem Based Approach prompted by the International Union for Conservation of Nature.
 - e) follow up the gaps identified in 2015 for reclamation planning, operations, effectiveness monitoring, and certification compiled by CEMA's Reclamation Working Group (See Donald Report Section 2.3).

F. Oil Sands Monitoring

- 1) The Government of Alberta and Canada through the Oil Sands Monitoring (OSM):
 - a) commit to long-term, reliable, and stable funding to the Wood Buffalo Environmental Association (WBEA) for the duration of resource extraction and project life-cycle;
 - b) enter into a Traditional Knowledge (TK) sharing agreement with Fort McKay with respect to the confidentiality and intellectual property in TK and to ensure the integrity of the science and data collected through TK to be applied for all funding programs;

- c) commit to long-term funding for Fort McKay's community based monitoring for water quantity and quality and air quality in the Moose Lake Area;
 - d) commit to long-term funding for Oski-Otin to continue at Fort McKay,
 - e) commit to increased speciated hydrocarbon/VOC monitoring in the region; and
 - f) that Alberta implement a responsible performance target for THC/NMHC as part of its Ambient Air Quality Objectives.
- 2) To the Governments of Alberta and Canada increase funding:
 - a) to OSM to ensure timely dissemination of information in plain and accessible language and formats.
 - b) the development and implementation of easily accessible and consistently formatted, one-page summary documents that outline the findings and associated significance of any focused study aspects of the OSM program, as well as long-term monitoring results, and trends so that stakeholders at all levels can easily understand the findings from each of the components of the OSM program.
 - c) the development of a single all-encompassing online portal that is user-friendly and allows stakeholders to be able to quickly access meaningful environmental monitoring information trends in long-term monitoring, reports, and one-page summaries, etc.
 - 3) The Governments of Alberta and Canada through OSM prioritize the inclusion of TEK and rights-based indicators into OSM program designs, so that Aboriginal and Treaty rights are meaningfully protected through direct monitoring and reporting as a priority.
 - 4) Alberta and Canada provide the resources and financial support for Fort McKay to develop and implement a community-based monitoring (CBM) program to track and measure indicators that support Fort McKay's right-based activities.
 - 5) Alberta and Canada should commit to working with Fort McKay to use the findings from the CBM to assess, respond and adapt environmental management practices in an effort to sustain and improve the capacity of Fort McKay community members to exercise their land-based rights.
 - a) Alberta and Canada should develop and implement, in cooperation with Fort McKay, an integrated, scientifically valid and culturally relevant, and transparent system for assessing and monitoring cumulative environmental and cultural impacts in the region.

G. Inclusion of Aboriginal Peoples in Land Use Planning

- 1) The Government of Alberta respond to or implement CEMA's submitted Indigenous Community-Specific Engagement Guidelines, Traditional Knowledge Research Guidelines Revised Edition or

Indigenous Traditional Knowledge Framework as model governance structure for multi-stakeholder organizations.

- 2) The Government of Canada support aboriginal communities in the region have the Government of Alberta recognize the correct nature and scope of their Treaty 8 rights.
- 3) The Government of Canada support and participate in the development of the Moose Lake Access Management Planning process as necessary.
- 4) The Government of Canada and Alberta participate in co-planning initiatives with a view of applying the principles and structure preferred by Fort McKay.

Recommendations of the Kátl'odeeche First Nation

KFN relied on the recommendations made in the *Strategic Environmental Assessment of Wood Buffalo National Park World Heritage Site*, Parks Canada, May 2018.

Available online at <https://www.ceaa-acee.gc.ca/050/documents/p65505/122894E.pdf>.

From KFN Submission

The issues identified in the SEA, and the associated recommendations in the SEA, offers the only comprehensive guide for ensuring that cumulative impacts from oil sands activities, climate change, and other industrial activities and anthropogenic changes are managed and mitigated such that the Park's natural ecosystems and world heritage value are not irreversibly damaged.

SEA Recommendations

- 1) Implement cross-jurisdictional cooperation (including Indigenous governments) in order to achieve the world heritage desired outcomes for the PAD and the national park by:
 - Recognizing the fact that water releases are complex hydrological events with potential negative consequences, consult with communities upstream and downstream of the PAD to ensure intervention risks are understood and acceptable.
 - Providing major water releases from the Bennett Dam at appropriate opportunities during the early freshet to encourage ice-jam events capable of flooding the PAD's perched basins
 - Investigating and implementing strategies to promote favourable flooding conditions on the Peace River, involving reducing water flow in late fall to promote lower and thicker ice cover freeze up, as well as increasing water flow during spring freshet and summer open water season.
 - Reviewing the relative success of past attempts to restore flood conditions in the PAD, including the following releases of water from the Bennett dam to inform above work:
 - In the spring of 1996, approximately 500 m³/s was released for approximately a week to augment hydrometeorological conditions favourable to ice jam formation (a large spring snowpack, high ice cover strength, and intense spring snowmelt). The augmented release increased the ice-jam flooding near the PAD and increased flood elevations in the PAD by 20 cm (Maclean, 2018).
 - In July of 1996, approximately 5,000 m³/s was released for approximately seven weeks due to of a structural fault (sinkhole) in the dam, resulting in an emergency spill to draw down the reservoir by 3 metres while repairs took place. The spill resulted in the contribution of additional water to the delta through an extended period of flow reversals on delta channels (Maclean, 2018). However, following this spill, water levels were again reduced on the Peace

River and water flowing from Lake Athabasca toward the Slave River resulted in the degradation of the winter road and open water on the Rivière des Rochers, causing vehicle damage and loss of life.

- 2) Consider options for strategically placed water management/control structures within the PAD, recognizing flow regulation, water withdrawals, and projected climate change impacts on available water resources and implement using an adaptive management approach, including:
 - Reviewing past attempts to control outflow on the PAD, conducting modelling analyses of interventions in Recommendation 1 and climate change, identifying appropriate feasible objectives and evaluating implications of any options for the downstream.
 - Developing options for constructing ice dams, improvement to or additional rockfill weirs, inflatable/gated weirs, and/or retentive/flexible flow barriers at strategic points within the PAD to restore water levels in the PAD in the short term and long term.
 - As noted by MCFN (2007), a control dam on the Quatre Fourches River at Dog Camp would immediately raise water levels in the Delta, and greatly improve water levels in both Lake Claire and Lake Mamawi.
 - Establishing a monitoring system in the PAD to measure ice conditions (thickness and quality), water levels, advise on water release measures, and to verify the effectiveness of physical interventions measures (flow releases and flow barriers) on an ongoing basis.
 - Developing a PAD water management group to monitor the success of implementing water release/control measures.
- 3) Work with Alberta's Climate Change office and federal climate change specialists to determine more precise climate change model projections for the Athabasca and Peace River basins
- 4) Update the water flow framework for the Athabasca River (the Surface Water Quantity Management Framework or SWQMF) to incorporate all three world heritage desired outcomes for the PAD, including:
 - Completing the work required to address gaps in knowledge related to impacts to the PAD identified in SQWMF.
 - Including a mechanism that provides mitigation for navigation and access by Indigenous people.
- 5) Install additional monitoring capability at the hydrological stations on the Athabasca River below the Fort McMurray oil sands area, including:
 - Investigating options for the Embarras, Old Fort and/or 27th Baseline stations
 - Investigating the ability to measure water depths to provide data for navigational studies on the Athabasca River.

- Assessing water quality in terms of flow rates (AECOM, 2010)
 - Estimating sediment and nutrient loads to the PAD
- 6) Install a hydrometric monitoring station on the Peace River at the 5th meridian.
- 7) Develop a hydrologic and hydraulic model of the watershed for the Peace, Athabasca, Lake Athabasca and PAD system that could be used to understand the cumulative impacts of upstream developments and activities and assess restoration options.
- 8) Conduct a water balance of the entire lower Athabasca River basin or, alternately, Fort McMurray downstream to the PAD, and Peace River basin considering:
- Weekly surface water demand (m^3/s) for oil sands facilities from the mainstem Athabasca River
 - Weekly surface water withdrawals from tributary rivers of the Athabasca River (i.e., not the main stem as measured at the Fort McMurray station)
 - Municipal and other non-industrial water withdrawals
 - Projected weekly start up surface water demand for the three new conventional mine projects coming on line (mainstem AR and tributary)
 - Weekly groundwater demand for in-situ oil sands facilities
 - Projected groundwater demand for reasonably foreseeable in-situ projects coming on line
 - Annual volume of surface water being diverted by conventional and in-situ oil sands facilities from rain/snow and muskeg/peat water
 - Weekly peak demand for surface water for the oil sands (mainstem and tributary)
 - Weekly low flow surface water demand during the winter (if any)
 - Annual volume of in-situ process water being injected into deep formations (and the depth of injection)
 - Groundwater discharge rate into the Athabasca River downstream of the oil sands • Water volumes entering the PAD from the Athabasca River
 - Annual estimate of total volume of surface water being removed by conventional oil sands facilities
 - Annual estimate of total volume of groundwater being removed by in-situ oil sands facilities
- 9) In order to determine the difference between climate variability and anthropogenic effects on the Athabasca River over the past fifty years, investigate the naturalized flows (flow conditions that would have existed without the effect of industrial, agricultural, and municipal water withdrawals) below the Fort McMurray hydrometric station.

7.3.2 Environmental Assessment

One objective of this SEA was to inform project environmental assessments. Project environmental assessments are forward looking with an opportunity to prevent future impacts rather than fix them afterwards. The following recommendations support the fulfillment of this objective.

- 10) Submit this SEA to the Joint Review Panel for the Teck Frontier Oil Sands Mine Project for consideration.
- 11) Revise the Guidelines for the Preparation of an Environmental Impact Statement for the Amisk Hydroelectric Project to include a requirement to evaluate the effects on the Outstanding Universal Values of WBNP and the effects the project would have on the ability to restore the PAD.
- 12) Refer projects under the Canadian Environmental Assessment Act, 2012 (or subsequent legislation) and Mackenzie Valley Resource Management Act for environmental assessment when they might have significant adverse environmental effects on the World Heritage Values of WBNP world heritage site and evaluate those potential impacts as part of the assessment.
- 13) Include an analysis of the impacts of projects within WBNP on the World Heritage Values of WBNP proportionate to the risk of the project to the World Heritage Values.
- 14) Build on the experience of this SEA by including ITK related to WBNP in project assessments.

7.3.3 Tailings Ponds Risk Assessment

RMM recommendation 6 requested a systematic risk assessment of the tailings ponds of the Alberta Oil Sands region with a focus on risks to the PAD. Chapter 4 and 5 describe how the desired outcomes related to the PAD are not being achieved. The pathway of effect related to the water quality on the Athabasca River was found to have a declining trend and a declining/stable trend in the PAD. As a result, additional work is recommended to reduce the unknowns and understand if the tailings ponds are contributing to the trends in water quality from the Athabasca River. Recommendations related to the tailings pond risk assessment below are for consideration by Alberta in leading this aspect of the Action Plan.

- 15) The evaluation of the risk of the tailings ponds on the PAD and OUV objectives (as described in Chapter 5) should include an evaluation of the probability and consequence of catastrophic failure as well as risks from seepage, VOCs, GHG emissions and bird impacts.
- 16) Ensure active involvement of relevant Indigenous groups in the risk assessment process so that Indigenous views and perspectives are represented and taken into account to support trust in the restoration of resource quality.
- 17) Ensure that the risk assessment captures the cumulative impact of both existing and future tailings ponds facilities within the Athabasca River basin

- 18) Establish a governance structure and terms of reference for this assessment to be conducted at arm's length from government and industry. The model, terms of reference and findings from the review of the Mount Polley tailings breach in British Columbia may be a helpful guide in this regard.

7.3.4 Conservation Area Connectivity

There are a mix of desired outcomes for wolf-bison predator prey relationship, karst, Whooping Crane and PAD water quality being achieved and not being achieved. However, each includes pathways of effects that are on the border of WBNP. The increased linear corridor density and habitat changes and surface water quality pathways of effects were both found to be expecting additional pressures from climate change and reasonably foreseeable development. The karst hydrology and Whooping Crane changes in nesting habitat and food availability pathways were both found to lack information required to project future impacts. RMM recommendations 10 and 11 relate to creating a buffer around WBNP. More important than a buffer around WBNP, is the ability to situate WBNP as a protected area in an ecologically connected landscape. A suite of different tools could be used achieve this goal, but in order to select the right tools for the right location to achieve the desired outcomes, a systematic analysis must be conducted as outlined in RMM recommendation 11. By systematically evaluating the relevant desired outcomes and pathways of effects for specific locations, the appropriate tools can be selected. Forest management agreements are highlighted as one of those potential tools needing examination. Recommendations below are for consideration by Alberta and Northwest Territories in leading this aspect of the Action Plan.

- 19) When conducting the systematic assessment of options required by RMM recommendation 11, consider:
- Protection of Whooping Crane habitat and supporting hydrology beyond the WBNP boundary
 - Protection of hydrology supporting karst within WBNP
 - Habitat protection for bison herds ranging beyond the WBNP boundary
 - Implications for changes to other species that may affect the wolf-bison relationship such as deer, moose and caribou
 - Opportunities to reduce the risk to water quality
- 20) A number of the forest management agreements bordering WBNP are held by Indigenous groups. These agreements present opportunities for management to address the issues identified in SEA recommendation 18 either through long term conservation forest management agreements, protected areas that permit timber harvesting (permitted in some IUCN category VI parks), Indigenous protected and conserved areas or other effective area-based conservation measures.

7.3.5 Wildlife and Habitat Conservation

There are a mix of desired outcomes for wolf-bison predator prey relationship and Whooping Crane that are being achieved and not being achieved. The following recommendations support the desired outcomes for Whooping Crane and the wolf- bison relationship, respond to the information gaps identified and address pathways of effect related to habitat and hunting/disease management. Note that additional recommendations related to bison and Whooping Crane can be found in Section 7.3.4. Recommendations below are for consideration by multiple jurisdictions in leading this aspect of the Action Plan.

- 21) Analyze bison population data in light of the end of wolf control to better understand the population's natural range of variability.
- 22) Complete the identification and protection of Whooping Crane critical habitat to meet desired outcomes.
- 23) Implement additional measures to protect the Wabasca Bison herd and the entire Ronald Lake Bison Herd range from non-Indigenous hunting.
- 24) While maintaining or restoring the ecological integrity of WBNP, minimize the risk of disease and parasite transmission to or from cattle. Proactively consider implementing management actions that support the wood bison recovery goal of the local population levels being sufficient "to sustain traditional Aboriginal harvesting activities, consistent with existing Aboriginal and Treaty rights of Aboriginal peoples of Canada"

7.3.6 Water Quality

The RMM recommendations did not explicitly include actions related to water quality. Yet, this SEA has shown that there are increasing risks to water quality and the desired outcome is already not being achieved. Identification of actions to mitigate impacts on water quality is particularly difficult as a result of the gaps in understanding, whether because no data have been collected or because monitoring does not show there are concerns, yet issues continue to be identified in the PAD. Following the precautionary approach, action should be taken before water quality effects in the PAD become too difficult or impossible to reverse.

- 25) Consider implementing a water quality improvement plan for each watershed draining into the PAD using inspiration from similar plans from other places with sensitive receiving waters from multiple drainages.

7.3.7 Monitoring and Science

Recommendations below are for consideration by Environment Canada and Parks Canada in leading this aspect of the Action Plan in collaboration with others.

While the lack of understanding of the karst and salt plains is likely not an issue given the current threats, monitoring programs can be designed for these values with limited additional effort. For example, satellite monitoring could include measurements of the extent of the salt plains. If the Pine Point Mine moves to production, additional research into the hydrology of the region would help to ensure that the information is available during the environmental assessment to ensure desired outcomes for the karst and salt plains are achieved.

26) Opportunistically include monitoring and research on karst and salt plains in other research and monitoring programs.

27) If Pine Point Mine becomes closer to an application for full mine operation, conduct research on hydrological connectivity between the mine site and the karst and Whooping Crane habitat.

Lack of analysis and information are obstacles to achieving the desired outcomes for migratory waterfowl. As a result, recommendations related to these outcomes focus on understanding the situation better.

28) Analyze breeding waterfowl data for the PAD to better define the quantitative objectives breeding bird populations in the PAD and to better understand the relationship between breeding waterfowl population trends in the PAD and elsewhere in North America.

29) Develop a multi-partner project to understand changes in waterfowl migration around WBNP. A key element of this project should be a more detailed exploration of ITK about changes in waterfowl migration. During the SEA discussions, Indigenous land users discussed in much greater detail the changes they had seen by species and differences in spring and fall migration patterns etc. It wasn't possible to explore all this detail in the SEA, but it would be helpful in the context of this project.

30) Establish an approach to monitoring and understanding waterfowl migration numbers and routes.

Chapter 6 predicted that climate change may contribute to the pathway of effect related to fire in the Great Plains Boreal Grasslands in the future. Although the desired outcome is currently being achieved, the WBNP fire management plan is a key tool to maintain habitat across the park in the context of a changing climate.

31) Complete the WBNP fire management plan including consideration of climate change.

ITK was integral to the completion of this SEA and will be important to achieve the desired outcomes and implement the Action Plan, yet multiple Indigenous groups indicated they may have to systematically gather Action Plan related ITK.

32) Support ITK studies that can feed into the Action Plan implementation. A robust monitoring program will be essential as the Action Plan is implemented.

Based on the experience of this SEA, the following recommendations would support all monitoring for all desired outcomes.

33) Implement approaches to monitoring for all monitoring recommendations that integrate ITK and science and engage local land users, including Community Based Monitoring programs. The Peace-Athabasca Delta Ecological Monitoring Program provides an example of the approach that could be used.

34) Ensure monitoring information and hydrological data is provided by regulatory and industry bodies in a transparent and easily accessible format.

35) Ensure data collected by researchers on world heritage values is shared in a manner that it can benefit broader ongoing work.

36) Use integrated monitoring approaches, particularly in the PAD, to support understanding in this very complex ecosystem. For example, monitor sediment, ground water, fish, water, snow, wildlife and air in an interconnected manner. This approach can help with understanding the linkages between biota and the dynamic abiotic processes that are characteristic of the PAD.

37) Develop and implement objectives to maintain/restore traditional resources (such as bison, muskrat, moose, migratory waterfowl, fish and traditional plants) and biodiversity in the PAD.

Invasive species were found to be a pathway of effect on the desired outcomes for the wolf-bison relationship and Great Plains boreal-grasslands. However, there is still not a lot known about the pathway of effect. As a result, the recommendation focuses on restoration and action, while learning to address gaps.

38) Develop and implement adaptive management approaches for managing invasive species (such as thistle) using science and ITK.

The SEA has shown there are increasing risks to water quality and the desired outcome is already not being achieved. There are also gaps in information related to water quality and air quality which these recommendations are aimed at addressing.

39) Develop and implement site specific guidelines for water and sediment quality in the Athabasca and Peace Rivers and Athabasca River estuary in Lake Athabasca, including:

- Referring to CCME 2003 for published approaches;
- Providing a better information about water quality concerns, particularly for parameters which are associated with the commonly occurring highly suspended sediments, such as total metals, total petroleum hydrocarbons (TPH) including F1-F2 fractions and nutrients.

- 40) Implement a large-scale monitoring program for PACs and PAHs in the PAD, including:
- Expanding the scope of the current JOSM PAH water monitoring program to snow sampling, spring runoff sampling, and an expanded water sampling within PAD water bodies and tributary rivers;
 - Implement an air quality monitoring program for PAHs and RCSs in Fort Chipewyan;
 - Distinguishing between petrogenic vs. pyrogenic PAHs in PAD.
- 41) Update and expand the Surface Water Quality Management Framework for the Lower Athabasca Region to include monitoring stations in the Peace Athabasca Delta, a more comprehensive selection of oil sands related contaminants and guidelines or thresholds relevant to the desired outcomes for the PAD.
- 42) Implement a fish monitoring program for western Lake Athabasca and the PAD.
- 43) Develop life-cycle assessment (LCA) for major pollutants such as Hg including global sources when applicable.
- 44) Initiate a study of natural sources of pollutants originating from bitumen deposits through which the Athabasca River and its tributaries are incised, or other sources responsible for loading of PAD sediments
- a) Propose measures how to manage natural pollution from bitumen and groundwater in order to manage cumulative effects on the PAD.
 - b) Quantify contribution of tributaries to the mass balance of contaminants of potential concern (COPC'-s) that influence water quality in PAD.
 - c) Assess Birch Mountain contribution to PAD pollution from its natural Black Shale deposits and propose measures to control it.

Recommendations of the Mikisew Cree First Nation

Part 1 - Biodiversity and Stewardship Area

- Recommend that the Governments of Alberta and Canada commit to implementing the full Biodiversity Stewardship Area proposed by Mikisew by the time Project construction starts.
- Recommend that, before issuance of final licenses and permits for the Project, the Government of Alberta codevelop and commit meaningful funding to a management plan and cooperative management arrangement for the Biodiversity Stewardship Area.

Part 2 – Bison

- Recommend that the Governments of Alberta and Canada commit to implementing the full Biodiversity Stewardship Area proposed by Mikisew by the time Project construction starts.
- Recommend that, within the next year, the Governments of Alberta and Canada enter into an agreement with indigenous communities respecting research, monitoring and co-management of the Ronald Lake Bison herd under the Species At Risk Act.

Part 3 – Better Management

- In your capacity as the AER, draft approvals to fully adopt Mikisew’s proposed regulatory conditions and to create room for an independent indigenous advisory committee to work with regulators respecting the oversight of the Project.
- Recommend that the Governments of Canada and Alberta enter into an agreement with Mikisew and other interested indigenous groups to establish and fund the proposed Project Oversight Committee before final approvals for the Project are issued, and for the life of the Project.
- Recommend that funding for the Committee come from governments (as is the case with recent LNG and pipeline committees).

Part 5 – Environmental Management Recommendations

Water Quality

- Recommend that governments immediately include more sites for management, and improve statistical framework for detecting change to improve efficiency and accuracy prior to issuing final approvals. Include acid-extractible organics.

Water Quantity

- Recommend that governments immediately implement water quantity thresholds relating to indigenous access, including implementing ANI and ABX as short term triggers.

Tailings

- Recommend that governments immediately undertake, with indigenous involvement, a cumulative risk assessment of tailings impoundments. The commitment to undertake this should be made prior to issuing final approvals.

Biodiversity

- Recommend that governments develop legally binding thresholds for moose, the Ronald Lake Bison herd population and other indicators needed to maintain Treaty rights prior to issuing final approvals.

Air Quality

- Recommend that governments reduce NO₂ and SO₂ triggers and limits to be in line with CAAQs and develop thresholds for total hydrocarbons prior to issuing final approvals.

Groundwater

- Recommend that governments add indicators for pH, temperature, and reduce existing water quality thresholds to 75% of the Canadian Drinking Water Guidelines prior to issuing final approvals.

Research and Monitoring

- Recommend that governments provide us with the resources needed to holistically monitor Project effects on our culture, places of importance to us and our health for the life of the project. Specifically:
 - Recommend that Governments provide investments in the purchase of monitoring equipment and the establishment of a centre in Fort Chipewyan to support the capacity and monitoring before construction on the Project; and
 - Recommend that Governments provide annual funding for the life of the Project to support Mikisew's community based monitoring program to undertake that holistic monitoring and that Governments commit to funding for such monitoring as part of their decision on whether to issue final approvals for the Project.

Part 5 – Culture & Food Security

- Recommend that the Governments of Alberta and Canada commit to fund improvements to health, education and water services and to invest in the cultural retention & food security programs needed to make for a vibrant Mikisew community. These commitments should be made prior to issuing final approvals for the Project.

- We need you to recommend our Ni-ke-chi-na-ho-nan Framework to Governments in its entirety, with the requirement that the Framework is funded by the Governments, and implemented by the Indigenous communities. Governments must commit to the Framework prior to issuing final approvals.

Joint Recommendations of the Mikisew Cree First Nation and Teck

APPENDIX 2: JOINTLY PROPOSED PROJECT CONDITIONS

Explanatory Note: The list of conditions included in this Appendix is not meant to be comprehensive and should not be interpreted to limit the content, scope or range of any conditions, plans or reporting requirements for the Project. Nor should it be interpreted as Mikisew's agreement that only the conditions included in this Appendix are required for the Project. Mikisew expects that Project approvals will include additional monitoring and mitigation measures consistent with best practices and the protection of Mikisew's Treaty rights. Mikisew expressly reserves the right to propose additional mitigation, monitoring and reporting conditions during engagement with regulators and Review Panel Report is released.

General

- 1) The Proponent shall, throughout the life of the Designated Project, ensure that its actions in meeting the conditions set out in this Decision Statement are informed by the best available knowledge, including Traditional Knowledge, based on validated methods and models which are the subject of consultation with Indigenous Groups as contemplated in paragraph 2 below where relevant to potential adverse effects to section 35 rights or Indigenous culture, undertaken by qualified individuals and apply the best available economically and technologically feasible mitigation strategies for the Designated Project at time of refurbishment or upgrades.
- 2) The Proponent shall carry out consultation for the plans required in this Decision Statement in a manner whereby it:
 - a) provides, to each government department and agency, management and technical committees and Indigenous group requiring consultation:
 - i) an opportunity to provide input during the development of the plan;
 - ii) a draft plan of sufficient detail and completeness to allow that government department and agency, management and technical committees and Indigenous group to prepare its views or information on the draft plan; and
 - iii) a reasonable period for that government department and agency, management and technical committees and Indigenous group to prepare and present its views or information on the draft plan unless the timeframe is otherwise specified;
 - b) considers, fully and impartially, the views or information received;
 - c) is able to demonstrate to the Agency its appropriate consideration of the views or information received;

- d) provides rationales for why input that was received but not incorporated into the plan in a manner proposed by a government department and agency, management and technical committee, or Indigenous group was not incorporated as proposed;
 - e) identifies opportunities for the engagement of government departments and agencies, management and technical committees, and Indigenous groups during the implementation of the plan, as appropriate.
- 3) All monitoring plans for the Designated Project will be subject to the consultation obligations contemplated in section 2, which will include consultation regarding inclusion of measures that are relevant to potential effects on Indigenous and treaty rights and include the use of Traditional Knowledge.

Project Construction and Operation in the Buckton watershed

- 1) The approval holder shall submit to the Director, five years prior to undertaking timber salvage, tree clearing and grubbing activities for the extraction of hydro-carbon resources from the North Pit, the following update reports:
 - a) analysis reports for major structures in the Ronald Lake watershed with the potential to impact water, including but not limited to: dams, dykes, storage or settling ponds, ditches, spillways and outfalls;
 - b) an evaluation, undertaken in consultation with Indigenous groups, of the approval holders' compliance with approval conditions respecting water quantity and quality to that point in time and the performance of the Project relative to the predictions and conclusions pertaining to adverse effects of the Designated Project on water quality and quantity;
 - c) an evaluation, undertaken in consultation with Indigenous groups, of the status of the Ronald Lake Bison Herd and any critical habitat identified through a Recovery Strategy or Action Plan and the accuracy of the predictions and conclusions in the environmental assessment pertaining to the adverse effects of the Designated Project on bison; and
 - d) an evaluation, undertaken in consultation with Indigenous groups, of the approval holder's performance respecting water quantity management relative to the Athabasca River Indigenous Base Flow (500 m³/s) threshold.
- 2) The approval holder shall not conduct the extraction of hydrocarbon resources from the North Pit without receiving the Public Lands (MSL) approvals needed to construct and operate the North Pit, the applications for which must be submitted no later than four (4) years from the date the Approval Holder submits the updated reports under Condition 1.

- 3) The Proponent will consult with Indigenous groups regarding the mine plan, and environmental and other management measures for the North Pit prior to submitting applications for the Public Lands (MSL) needed to construct and operate the North Pit to the Director for approval.
- 4) The approval holder shall submit to the Director as part of its application for the necessary North Pit MSL approvals, the following:
 - a) current mine plan for the North Pit portion of the Designated Project in the Ronald Lake watershed;
 - b) an operation plan for the sustainability of the non-mined portions of Ronald Lake watershed and to achieve no greater than a negligible effect on water quantity and water quality in the Ronald Lake watershed, Frog Creek and the southern end of Lake Claire during construction and
 - c) an updated evaluation under condition 1; and
 - d) a report summarizing the outcomes of consultation or other engagement with Indigenous groups regarding the development and management of the North Pit.
- 5) The operational plan referred to in condition 4 shall contain, at a minimum
 - a) physical, biological and cultural baseline conditions for the Ronald Lake watershed and the southern end of Lake Claire;
 - b) design features or measures, and other as required for the protection of the non-mined portions of Teck's oil-sands leases within the Ronald Lake watershed and to achieve no greater than a negligible Project effect on water quantity and water quality in the Ronald Lake watershed, Lake Claire and in the Peace Athabasca Delta;
 - c) a monitoring and follow-up program containing, as a minimum,
 - i) methods for the approval holder to characterize, quantify, and track the following annually, including for 10 years following initiation of final reclamation of the Designated Project:
 1. quantity and quality of water released daily from the Designated Project
 2. quantity, quality and flow-rate of waters at the outlet of Ronald Lake for
 3. surface water levels and water quality in the Ronald Lake watershed and
 - ii) details of where the approval holder will rely on regional monitoring efforts to characterize and quantify water quality in the southern end of Lake Claire;
 - d) indicators and thresholds developed in consultation with Indigenous Groups for monitoring Project effects by the approval holder or through the approval holder's participation in regional monitoring effects, to the Ronald Lake watershed and the southern end of Lake Claire, including adjacent areas relevant to the exercise of Indigenous culture and rights;

- e) the necessary contingency mitigation measures to achieve no greater than a negligible effect on water quality and quantity in the Ronald Lake watershed and the southern end of Lake Claire and to comply with water quantity and quality conditions for the Ronald Lake watershed; and
 - f) a detailed schedule for implementation of each component of the plan.
- 6) To obtain the MSL amendment necessary to extract hydro-carbon resources from the North Pit, the approval holder shall satisfy the Director, in consultation with Indigenous groups, that the approval holder has
- a) operated the Designated Project to have the predicted negligible effects of the Designated Project on water quality and quantity in the Ronald Lake watershed and southern end of Lake Claire;
 - b) verified the accuracy of the environmental assessment as it pertains to the effects of the Designated Project to the Ronald Lake Bison Herd;
 - c) planned water withdrawals from the Athabasca River with an objective of avoiding or minimizing water intake when Aboriginal Base Flow is not met;
 - d) established appropriate plans to not place mature or non-treated tailings into the North Pit lake;
 - e) confirmed that the current draft of Mine Reclamation Plan and the Life of Mine Closure Plan relevant to the North Pit have been the subject of consultation with Indigenous groups as contemplated in General Condition 2 and other approval conditions specific to consultation respecting Reclamation, and will undergo additional consultation as it evolves during mining;
 - f) promptly implemented remedial action(s) for all non-compliance events at the Designated Project; and
 - g) provided an effective operation plan for the sustainability of the non-mined portions of Teck's oil sands leases in the Ronald Lake watershed and to achieve no greater than a negligible Project effect on water quantity and water quality in the Ronald Lake watershed, Lake Claire and in the Peace Athabasca Delta.

Operations: Water Management

Use and Diversion of Water

- 1) The Proponent will design the water diversion structures contemplated in the Application to have no greater than negligible Project effects to water quantity and quality of receiving watercourses, including those north of the Designated Project to and from Ronald Lake.
- 2) Prior to construction, the proponent shall, in consultation with Indigenous groups, submit an updated mine water balance that takes into account an updated climate assessment and includes a plan for avoiding or minimizing potential effects to water levels in the Peace Athabasca Delta.

Monitoring and Reporting

- 3) Prior to constructing the water intake system the proponent shall submit to the Director for approval an updated Hydrology and Water Quality Mitigation, Monitoring and Adaptive Management Plans.
- 4) The Proponent's Hydrology and Water Quality Mitigation, Monitoring and Adaptive Management Plans shall contain the following:
 - a) an operational plan for managing water withdrawals to minimize water intake during periods of low-flow in the Athabasca River, informed by the objective of avoiding or minimizing water withdrawals when water levels are below Indigenous Base Flow and including measures to achieve that objective;
 - b) plans for maximizing water reuse for the Designed Project, and minimizing water withdrawals from the Athabasca River;
 - c) methods to monitor and quantify the navigability of the Athabasca River near the Project bridge and at least one location further downstream, provided monitoring need not duplicate monitoring activities for the Project bridge or navigability that are functionally equivalent to activities undertaken by Joint Oil Sands Monitoring Program (JOSMP);
 - d) methods and a follow-up program for tracking the proponent's water withdrawals in relation to the Indigenous Base flow;
 - e) plans for conducting snow transects to test deposition of contaminants on a frequency developed with Indigenous groups, provided monitoring need not duplicate monitoring activities that are functionally equivalent to monitoring activities undertaken by the JOSMP;
 - f) methods to ensure that the Designated Project causes no greater than negligible changes to the quantity of water in and flowing into Lake Claire from watersheds or streams that flow from the area in and around the Ronald Lake watershed and adjacent areas;
 - g) a follow-up program to verify the accuracy of the environmental assessment as it pertains to the adverse effects of the Designated Project on water quality and quantity; and
 - h) a detailed schedule for implementation of each component of the plan
- 5) The Proponent shall annually review monitoring data from, and update regularly, the Hydrology and Water Quality Mitigation, Monitoring and Adaptive Management Plans, in consultation with Indigenous groups, to incorporate any changes required or technically and economically feasible to decrease water intensity and Project effects on Indigenous navigability over time.

Water Intake & Storage Design

- 6) The Proponent will design its Athabasca River water intake system in accordance with the Application, and to:
 - a) allow for complete shut-off of the intake system; and
 - b) minimize entrainment and impingement of fish.
- 7) The Proponent will design the onsite water storage pond to have enough water for the Designated Project to operate for a minimum of 90 days without using the Athabasca River water intake system.

Water Discharge

- 8) The Proponent will consult with Indigenous groups on the establishment, review, and adaptation of water discharge criteria which supports maintenance of aquatic health of the Peace Athabasca Delta, including end pit lake water release criteria, prior to discharging waste or process affected waters into waters that may reach the Ronald Lake watershed or Lake Claire

Emergency Response Plan

- 9) The Proponent will develop, in consultation with Indigenous groups, an emergency response plan which includes:
 - a) systems for timely notification and updates regarding any non-compliance which may pose an immediate threat to human health or the environment;
 - b) plans for testing and responding to any unplanned water or other releases from the Designated Project.

Operations: Tailings

Limit

- 1) The Proponent will not place mature or non-treated tailings into the North Pit lake.
- 2) The Proponent will not place mature fine or fluid fine tailings in any end pit lake.

End Pit Lakes

- 3) The Proponent will limit post-closure end-pit lakes to only those needed as water treatment vessels.
- 4) Prior to filling any end pit lakes, the Proponent will submit to the Director for approval an operational plan with the objective of avoiding or minimizing water withdrawals to the Indigenous Base Flow during the filling of any end pit lake and including measures to achieve that objective.
- 5) The Proponent shall design and build all end-pit lakes to be viable aquatic ecosystems capable of supporting local natural aquatic species and communities.

Monitoring and Reporting

- 6) The Proponent's Hydrology and Water Quality Mitigation, Monitoring and Adaptive Management plan will include:
 - a) a follow-up program for monitoring and managing discharge of cap water to pit lakes to ensure pit lakes meet applicable regulatory criteria and any criteria developed under condition 8; and
 - b) a follow-up program for monitoring and managing end-pit lakes and all other discharge points to confirm all discharges from end-pit lakes meet applicable regulatory criteria.

Environment: Air

- 1) The Proponent shall include in the Air Quality Mitigation, Monitoring and Adaptive Management Plan, among other things, the installation of an attribution station north of the Designated Project to conduct air monitoring, and consult with Indigenous groups on the final placement of the station in coordination with any pertinent Government initiatives/requirements

Environment: Water

- 1) The Proponent shall conduct follow-up monitoring to confirm performance relative to predictions in the Application respecting Designated Project effects on water quantity and water quality, and will inform Indigenous communities regarding results of follow-up monitoring.

Environment: Wildlife

- 1) Prior to initiating construction and following consultation with Indigenous groups, the proponent shall submit to the Director for approval updated wildlife monitoring and mitigation plans.
- 2) The Proponent's Wildlife Mitigation, Monitoring and Adaptive Management plan for the Designated Project will include:
 - a) consideration of available draft or final species at risk recovery strategies applicable to the Ronald Lake Bison Herd, including critical habitat identification;
 - b) consideration of latest available information from the Ronald Lake Bison Herd Technical Team;
 - c) consideration of latest available traditional knowledge or other information regarding the Ronald Lake Bison Herd from Indigenous communities;
 - d) a follow-up program to verify the accuracy of the environmental assessment as it pertains to the response of the Ronald Lake Bison Herd over the life of the Designated Project.
- 3) The Proponent shall review annually, and update regularly as needed, Wildlife Mitigation, Monitoring and Adaptive Management plan in response to new information as it becomes available regarding the Ronald Lake Bison Herd.

- 4) During construction and operations, the Proponent will report annually on the implementation of its Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan and summarize any available data regarding the health, population size, viability and accessibility of the Ronald Lake Bison Herd.
- 5) The approval holder shall participate in regional initiatives regarding migratory birds, caribou, moose and bison, to the satisfaction of the Agency, should there be any such initiative(s) during the construction or operation of the Designated Project.
- 6) The Proponent shall prohibit employees and contractors associated with the Designated Project from fishing and hunting in the Project area while at the Project area for the purpose of performing work or Providing services, unless an employee or contractor is provided access by the Proponent for exercising Indigenous rights, to the extent that such access is safe.

Environment: Human Health

- 1) The Proponent shall consult regarding its Dust Management Plan in accordance with the requirements of section 2 of General conditions above, during all phases of the Designated Project. The Dust Management Plan must include mitigations to limit, among other things, the type and volume of fugitive dust and tailings area emissions that may reach Lake Claire.
- 2) The approval holder shall participate and support regional health studies respecting Indigenous peoples. The approval holder will consult with Indigenous communities in developing the following up monitoring programs required for the Project to confirm performance relative to predictions in the Application which are relevant to regional health studies and assessments.
- 3) Joint Recommendation to Government: The Governments of Alberta and Canada shall, prior to construction co-develop and undertake a regional health baseline study for Indigenous peoples, including the bioavailability and bioaccumulation of contaminants in fish and wildlife consumed by Indigenous peoples from the Peace Athabasca Delta. The Government of Alberta and Canada shall, in consultation with Indigenous groups, co-develop and implement a follow-up program to update the baseline study to track any changes to the health of Indigenous peoples, including the bioavailability and bioaccumulation of contaminants in fish and wildlife consumed by humans from the Peace Athabasca Delta.

Environment: Traditional Land Use and Culture

- 1) Joint Recommendation to Government: The Governments of Alberta and Canada should sustain on a long-term basis a significantly increased financial investment for the expansion of the Indigenous-led community-based monitoring program located in the lower Athabasca River and Peace Athabasca Delta.
- 2) Joint Recommendation to Government: The Governments of Alberta and Canada should improve investments in community health and cultural retention in Fort Chipewyan if the Project is approved.

Environment: Reclamation

- 1) The Proponent shall reclaim land to a self-sustaining ecosystem that supports equivalent land use capacity, including the use of lands and resources by Indigenous groups for traditional purposes.
- 2) The Proponent shall consult with Indigenous groups regarding the Mine Reclamation Plan and the Life of Mine Closure Plan, including with reference to any standards developed by Indigenous groups.

Environment: Peace Athabasca Delta

- 1) The approval holder shall participate in regional initiatives regarding the protection and management of the Peace Athabasca Delta, to the satisfaction of the Agency, should there be any such initiative(s) during the construction or operation of the Designated Project.

APPENDIX 3: MEASURES FOR GOVERNMENTS PERTAINING TO OUTSTANDING ISSUES

- 1) Alberta and Canada to establish an effective stewardship area around the Project in the size and nature of Mikisew's proposed Biodiversity Stewardship Area. In particular, protect all bison habitat and areas of the Buckton and McIvor watershed around the Project to create a buffer around Wood Buffalo National Park.
- 2) Alberta and Canada to manage all land adjacent to Wood Buffalo National Park, including at a minimum areas within ecosystem boundaries of watersheds that flow into the Peace Athabasca Delta and potential conservation corridors, in a way that meets IUCN standards for a protected and conserved area.
- 3) Establish an agreement under section 11 of the Species at Risk Act for the life of the Project to fully resource a tripartite bison co-management arrangement for the Ronald Lake Bison Herd.
- 4) Alberta and Canada to increase investments in Peace Athabasca Delta research and fund the expansion of the Indigenous-led community-based monitoring program located in the lower Athabasca River and Peace Athabasca Delta.
- 5) Canada to develop, fund and implement a robust Action Plan for Wood Buffalo National Park.
- 6) Alberta and Canada to guarantee effective indigenous involvement in project monitoring and follow-up activities through the establishment and funding of a new project management committee.
- 7) Canada to develop, in full consultation with Mikisew, water quality standards for the Peace Athabasca Delta.
- 8) Sustain on a long-term basis a significantly increased financial investment for the expansion of the Indigenous-led community-based monitoring program located in the lower Athabasca River and Peace Athabasca Delta.
- 9) Alberta and Canada to improve investments in community health and cultural retention in Fort Chipewyan if the Project is approved.
- 10) Establish, in collaboration with Indigenous Peoples, a systematic and iterative Integrated Environmental Health Monitoring Program for the northern part of the LAR, Wood Buffalo National Park and the PAD. The program must be based on cause-effect relationships between stressors and impacts to Wood Buffalo National Park's OUV and Indigenous Health Indicators
- 11) Canada should review and add all Polycyclic aromatic hydrocarbons (PAHs) to the Priority Substances List under the Canadian Environmental Protection Act, 1999 as a focus on the 16 United States Environmental Protection Agency parent compounds alone grossly underestimates potential risk to wildlife consumers (especially fish consumers) and apex predators.

- 12) Expand hydrometric and water-depth monitoring downstream of the Frontier mine and closely tie real-time information to mine water-withdrawal planning. Among other things, Alberta and Canada to install new air attribution stations water flow gauges and other monitoring equipment to improve regional and ambient monitoring around the Project area and in the Peace Athabasca Delta.
- 13) Alberta and Canada Implement a system of isotopic tracing or another effective tracing system for all tailings ponds near the Athabasca River to better detect and trace the ongoing seepage of tailings materials into the Athabasca River
- 14) Canada and Alberta to establish the following legislated controls and iterative systems to decrease source inputs to the Wood Buffalo National Park and PAD before construction and operation of the Project;
 - a) Improved standards for dust suppression at mine faces and coke piles.
 - b) Regulatory requirement for mine fleet upgrades to meet Tier IV standards.
 - c) More robust project emissions monitoring for all sources to frequently validate assumptions in EIA, to better inform appropriate EPEA approval clauses and emission limits, and to trigger adaptive management action if EIA assumptions are not met
 - d) Prohibitions on future development in close proximity to Wood Buffalo National Park and the PAD to limit the cumulative increase in source inputs to the Wood Buffalo National Park and PAD, through the creation of an effective protected area along the southern boundary of Wood Buffalo National Park
- 15) Alberta to revise its Surface Water Quantity Management Framework to:
 - a) include an effective short-term trigger to protect open-water Indigenous navigability;
 - b) to revise its short-term trigger for the ice-covered season to provide for a cutoff flow at 100 m³/s to protect winter fish survival; and
 - c) cease water withdrawals in the open-water period when discharge in the Athabasca River drops below the Aboriginal Extreme Flow (500 m³/s at Fort McMurray WSC gauge)
- 16) In the absence of Alberta revising the Surface Water Quantity Framework as required, Canada to exercise its authority under the Navigation Protection Act to establish a navigation regulation for the Athabasca River with the same components as those recommended above.
- 17) Revise the Surface Water Quality Framework for the Lower Athabasca Region, in consultation with and requiring indigenous endorsement, to include monitoring stations in the Peace Athabasca Delta and a more comprehensive selection of oil sands related contaminants.
- 18) Alberta to promptly address all findings of the LARP Review Panel.

- 19) Alberta and Canada to fully implement all outstanding recommendations of the Joint Review Panel for the Shell Jackpine Mine Expansion Project.
- 20) Alberta and Canada to conduct a comprehensive Baseline Health Study for Fort Chipewyan residents as recommended in the 2003 EUB Decision Report. In addition, a study of the state of other Indigenous Health Indicators in Fort Chipewyan should be undertaken
- 21) Government of Alberta to revisit and re-examine proposed full build out of the oilsands industry due to potential incompatibility with climate change and river flow projections and in light of the Government of Alberta's obligations in maintaining pre-existing Treaty and Indigenous Rights.
- 22) Establish a modelling database which incorporates recent scientific advances to improve consistency in model predictions for contaminant fate and transport in environmental media and identification of risks.
- 23) Conduct a systematic risk assessment of the tailings ponds of the Alberta Oil Sands region with a focus on risks to the Peace Athabasca Delta, and submit the report of this assessment to the World Heritage Centre, for review by IUCN, in accordance with Paragraph 172 of the Operational Guidelines

Recommendations of the Northwest Territory Métis Nation

The NWTMN also relied on the recommendations found in Park Canada's SEA.

Strategic Environmental Assessment of Wood Buffalo National Park World Heritage Site, Parks Canada, May 2018.

Available online at <https://www.ceaa-acee.gc.ca/050/documents/p65505/122894E.pdf> .

Specifically, recommendations:

- 4) Update the water flow framework for the Athabasca River (the Surface Water Quantity Management Framework or SWQMF) to incorporate all three world heritage desired outcomes for the PAD, including:
 - Completing the work required to address gaps in knowledge related to impacts to the PAD identified in SQWMF.
 - Including a mechanism that provides mitigation for navigation and access by Indigenous people.
- 7) Develop a hydrologic and hydraulic model of the watershed for the Peace, Athabasca, Lake Athabasca and PAD system that could be used to understand the cumulative impacts of upstream developments and activities and assess restoration options.
- 8) Conduct a water balance of the entire lower Athabasca River basin or, alternately, Fort McMurray downstream to the PAD, and Peace River basin considering:
 - Weekly surface water demand (m^3/s) for oil sands facilities from the mainstem Athabasca River
 - Weekly surface water withdrawals from tributary rivers of the Athabasca River (i.e., not the main stem as measured at the Fort McMurray station)
 - Municipal and other non-industrial water withdrawals
 - Projected weekly start up surface water demand for the three new conventional mine projects coming on line (mainstem AR and tributary)
 - Weekly groundwater demand for in-situ oil sands facilities
 - Projected groundwater demand for reasonably foreseeable in-situ projects coming on line
 - Annual volume of surface water being diverted by conventional and in-situ oil sands facilities from rain/snow and muskeg/peat water
 - Weekly peak demand for surface water for the oil sands (mainstem and tributary)
 - Weekly low flow surface water demand during the winter (if any)

- Annual volume of in-situ process water being injected into deep formations (and the depth of injection)
- Groundwater discharge rate into the Athabasca River downstream of the oil sands • Water volumes entering the PAD from the Athabasca River
- Annual estimate of total volume of surface water being removed by conventional oil sands facilities
- Annual estimate of total volume of groundwater being removed by in-situ oil sands facilities

14) Build on the experience of this SEA by including ITK related to WBNP in project assessments.

16) Ensure active involvement of relevant Indigenous groups in the risk assessment process so that Indigenous views and perspectives are represented and taken into account to support trust in the restoration of resource quality.

17) Ensure that the risk assessment captures the cumulative impact of both existing and future tailings ponds facilities within the Athabasca River basin

Appendix 10 Other Recommendations

This appendix is intended to assist the reader and is not part of the hearing record. It is consolidated from documents on the project registry at <https://www.ceaa-acee.gc.ca/050/evaluations/proj/65505?culture=en-CA>.

Recommendations of the Canadian Parks and Wilderness Society

If the Panel recommends conditions to attach to the Project's approval, those conditions should, at a minimum, include the following recommendations:

- 1) That, the Governor in Council should not make any final decision before it complies with section 172 of the Operational Guidelines for the Implementation of the World Heritage Convention;
- 2) That the Governor in Council should not make a final decision until the multijurisdictional Action Plan for WBNP is completed; and
- 3) That the Governor in Counsel should submit the Panel's report to the World Heritage Committee to assist it in seeking appropriate solutions to ensure that the Outstanding Universal Value of the WBNP is fully preserved.

Further, finally, and in the alternative, CPAWS states that, despite Teck's total failure to identify viable options for mitigating the Project's further marginal compromise of the PAD's hydrology, one imperfect but possible option remains: replace it with water already sequestered for human activity. As such, if the Panel recommends conditions to attach to the Project's approval, those conditions should recommend:

- 4) That, before construction of the Project can commence, Teck must conclude good faith efforts to secure, at its cost, an offset to replace an equivalent amount of water the Project withdraws from the Athabasca River in the form of additional discharge from the WAC Bennett Dam into the Peace River.
- 5) That, before construction of the Project can commence, Teck must, at its cost, support research on the efficacy of bird deterrent systems as is needed due to the lack of rigorous testing of deterrent systems. 80 It must consult with experts on migratory birds and fully incorporate the most up to date Bird Monitoring Protocol produced by the Research on Avian Protection Project (RAPP).

Recommendations of the Keepers of the Athabasca

- Disclose separate values for liabilities incurred and revisions to estimated cash flows.
- Identify and correct any internal control system deficiencies underlying high year-over-year rates of revision to expected cash flows.
- Establish an asset retirement savings plan to assure timely settlement of DRPs. The savings plan should account for the possibility of significant unanticipated acceleration in settlement dates.
- Include DRP payments in the obligations table reported in the annual *Management Discussion and Analysis*. If the amounts are discounted, it is important to supplement the disclosures with undiscounted figures so that analysts can see the total amount of undiscounted expected cash flows. If amounts include an inflation adjustment, this fact should be disclosed along with the un-inflated amounts. If expected cash flows are truncated (e.g., disregarded beyond n years), disclose the truncation period, the justification for the truncation, and the total period over which settlement of existing DRPs is expected to occur. If some obligations require perpetual asset retirement activities (e.g., water containment or treatment – both highly relevant to Teck’s operations), disclose the annual undiscounted and un-inflated cost of these activities.
- Recognize that DRPs are “critical accounting estimates” and provide useful, non-boilerplate MD&A disclosures that will improve forecasting.
- Disclose the following additional information, if not included elsewhere:
 - The undiscounted value of new decommissioning and restoration provisions incurred during the year. Separately disclose data for provisions assumed in business combinations.
 - The expected number of years over which Teck’s existing DRPs will be settled, the expected cash flow compounded annual growth rates (CAGRs) over that period, and the factors contributing to the anticipated cash flow CAGRs.
 - The historical and anticipated future order and pace of DRP settlement.
- Absent information to the contrary, it is expected that similar assets will be retired on a first-in-first-out basis. If asset retirement costs related to newer assets will be incurred prior to decommissioning and restoration provisions for older assets, and the change in that order will have a significant impact on the amount and timing of expected cash flows, Teck should disclose this information.
- Also, absent information to the contrary, it is expected that Teck would on average retire one year of DRPs (incurred 30 to 60 years ago) every year. This could be called an “equilibrium pace.”

- To assist analysts in making projections from historical DRP payments, Teck should disclose whether recent DRP settlement costs reflect an accelerated, equilibrium, or deferred pace of retirement.
 - The undiscounted amount of market risk premium with an explanation of how this amount was determined.

The discount rate used to calculate the present value of expected cash flows and, if the rate includes a credit adjustment, an explanation of how the credit adjustment was determined taking into consideration “the effects of all terms, collateral, and existing guarantees” specifically related to Teck’s DRPs.

- Reasons for historical trends in the rate of revisions to expected cash flows and expectations for future revision rates.
- Historical DRP/CapEx ratios, forecasted changes in this ratio, and the underlying causes of such changes.
- The amount and types of financial assurance, including restricted assets, in place to secure settlement of DRPs.
- Details about any decommissioning and restoration savings programs designed to assure the availability of sufficient resources to satisfy DRPs in a timely manner as they come due.

Recommendations of the Oil Sands Environmental Coalition

3.1 Full security option

Teck's response to Question 5.4(b) in the JRP's Information Request 5 provides project liability estimates. Teck estimates the total life-of-project liability to be \$11.8 billion, maximum liability to peak at \$4.3 billion, and liability at EML to be \$2.9 billion.

In the maximum liability scenario, the highest liability for the project would be reached at the end of the year in 2037 when the fluid tailings inventory will reach 230 Mm³ in ETA1. This volume will be processed at the centrifuge facility over seven years. If the mine should close in 2037, 54% of the Project Disturbed Area will be unreclaimed, with the total cost estimate under the MFSP of \$4.3 billion.

Teck then states that under the current MFSP, if the company chooses or is required to provide full security, it would provide \$4.3 billion. As per Section 5.1 of the MFSP Guide, the program provides an option whereby approval holders may elect to pay the full amount of financial security any time an MFSP annual report is submitted. With full financial security in place, the approval holder is not subject to MFSP deposits or triggers, and reporting requirements are reduced.

The Pembina Institute recommends that this full security option under Section 5.1 of the MFSP Guide be set as a condition of any forthcoming approval decision to be issued by the JRP for the Frontier Mine. However, this recommendation is put forth with four important caveats.

Caveat 1: Payment schedule and management actions for non-compliance must be delineated

Under the full security option in Section 5.1 of the MFSP guide, the approval holder for the Frontier Mine must be required to submit their financial security estimate to the director of the AER no later than June 30 each year using the appropriate form in the MFSP annual report (Schedule 3 of the MFSP Guide). The amount of financial security will be based on the MFSP liability calculations, and certified by the approval holder's designated financial representative.

As per Section 5.1.2 of the MFSP Guide, the approval holder of the Teck Frontier Mine may request return of all or part of the security posted when reclamation work is done that results in a significant decrease in MFSP liability. This includes facility demolition, remediation of an area, or surface reclamation of an area.

In alignment with the arguments made in 2.2.2 that the Teck Frontier Mine should be able to cover its own liability if it is an economically viable project, the security required will be equivalent to disturbance over time. This would equate to a smaller amount at the outset of operations and increase over time to the maximum of \$4.3 billion in 2037, and decrease thereafter as reclamation activities are deemed successful. This would result in the phased return of deposits to the operator.

Finally, management actions for non-compliance must be clearly delineated should the operator of the Teck Frontier mine fail to post the required security at any point. This should include a range of options, ranging from financial penalties to forced project closure. Clear triggers should be delineated for these various management actions, to ensure stakeholders and the Alberta public can independently verify whether Teck is in compliance and, if not, whether the regulator is enforcing the decision.

Caveat 2: Must be binding upon sale or transfer of license

Any forthcoming conditions of approval must clearly state that the full security option under Section 5.1 of the MFSP Guide is *required* for the Frontier Mine, and that this requirement will be binding upon the sale of rights to the project to another operator at any time in the future.

Caveat 3: Must be secured with a letter of credit or cash

In its response to question 5.4(c) of the JRP's Information Request 5, Teck provides three options for posting additional security payments (in order of preference):

- 1) Secure against Project resource or other Alberta resource owned by Teck
- 2) Letter of credit
- 3) Cash

Option 1 must be omitted from consideration, as it is not a permitted form of security under Section 21 of the EPEA Conservation and Reclamation Regulation.

Per Section 4.6 of the MFSP Guide, Options 2 and 3 (letter of credit²⁷ or cash deposit) are both valid options for posting security.

Caveat 4: Costs must be verified by a third-party audit

According to the MFSP guide, liability is defined as “[t]he sum of the third-party (fair value) costs to suspend, abandon, remediate, and surface reclaim all the disturbed land associated with the approval.” Furthermore, third-party costs are defined as “the costs to suspend, abandon, remediate, and surface reclaim a site that would be reasonably accessible by the Government of Alberta, or another third party, in the event of an unexpected default of the operation.

Pursuant to the concerns raised in Section 2.3.2 of this submission concerning lack of clarity and transparency in the MFSP Guide’s calculation methodologies for both assets and liabilities, an audit of Teck’s MFSP submissions is recommended to verify the estimates that have been provided prior to the commencement of operations. Per Section 7.4 of the MFSP Guide, a Level 4 audit (i.e. a detailed audit by a third-party auditor reporting to the AER) is recommended prior to commencement of operations and every five years thereafter.

Appendix 11 Teck's Consolidated List of Commitments

This appendix is intended to assist the reader and is not part of the hearing record. It is consolidated from documents on the project registry at <https://www.ceaa-acee.gc.ca/050/evaluations/proj/65505?culture=en-CA>.

The mitigation measures outlined below reflect commitments made by Teck should the project be approved. The mitigation measures aim to mitigate against potential adverse environmental effects that the project may have on asserted or established Aboriginal or treaty rights, current use of lands and resources for traditional purposes or physical and cultural heritage and include proposed mitigation measures that have resulted from discussions with Indigenous groups throughout the environmental assessment (EA) process. The mitigation measures apply to areas within the Local Study Area (LSA) and Regional Study Area (RSA) as well as mitigation measures for specific uses, practices or activities that occur outside of the boundaries of the RSA where a potential effect of the project may occur. The mitigation measures below are applicable to the Athabasca Chipewyan First Nation, Fort Chipewyan Métis Local 125, Fort McKay First Nation, Fort McKay Métis, Fort McMurray Métis Local 1935, Lac La Biche Métis Local 1909, Métis Nation of Alberta Region 1, and Mikisew Cree First Nation unless otherwise specified.

Specific mitigation measures proposed by each potentially affected Indigenous group as indicated in their Traditional Land Use or Cultural Impact Assessment studies are included in the individual Indigenous group's sections entitled Assessing Effects to Aboriginal and Treaty Rights from the Frontier project.

Hydrology and Water Quality

1. Teck is committed to continue to consult meaningfully with, and engage, all potentially affected Indigenous groups at both a project-specific and regional level to reduce and mitigate potential project and cumulative effects on hydrology and surface water quality, including continuing discussions regarding hydrology and surface water quality concerns and is prepared to consider additional mitigation measures to address these concerns.
2. Teck has developed a Draft Hydrology and Water Quality Mitigation, Monitoring and Adaptive Management Plan. Once finalized, the plan will include a communication management section, which will outline how findings of the program will be communicated to interested parties.
3. Teck also commits to implement an adaptive management program to monitor the effectiveness of the mitigation measures and evaluate monitoring results to determine if adaptations are warranted.

Changes in flows, water levels and open water areas

The Athabasca River will satisfy the project's makeup water requirements, and an off-stream storage pond (OSSP) will supply the project with water during periods when river water withdrawal is restricted.

4. Teck commits to implement the following mitigation measures to reduce changes in flows and water levels in receiving waterbodies:
 - 4.1. Reduce changes to flows in Ronald Lake by using a flow splitter on the Redclay Creek diversion during operations;
 - 4.2. Reduce changes to flows in Big Creek by using a flow splitter on the Big Creek diversion during operations;
 - 4.3. Distribute muskeg drainage operations through the mine life, thereby avoiding a large increase in flows in the receiving waters;
 - 4.4. Reduce effects of closed-circuit operations on flows and water levels in receiving waters by diverting natural watercourses that will not be disturbed by the mining operations around the mining area to receiving watercourses;
 - 4.5. Reduce river-water withdrawal requirements from the Athabasca River by maximizing closed-circuit recycling of surface and groundwater where practical, and by storing sufficient amounts of water in an off-stream storage pond in the event of extended withdrawal restrictions from the Athabasca River;
 - 4.6. Progressively construct and develop diversion systems, which helps limit the change in open-water areas during construction and operation by providing new drainage channels to replace the loss of natural watercourses and waterbodies;
 - 4.7. Reduce changes to flows and water levels in receiving waters by developing a closure drainage layout that will limit changes in drainage areas contributing flows to the receiving watercourses relative to predevelopment conditions;
 - 4.8. Design watercourses, waterbodies and wetlands during reclamation to attenuate floods.

Changes in sediment yields, concentrations and channel regimes (geomorphology)

5. Teck commits to implement the following mitigation measures to limit release of Total Suspended Solids (TSS):
 - 5.1. Follow relevant regulatory guidelines, standards and best management practices during construction and operation to reduce the risk of increased sediment loadings to receiving watercourses.
 - 5.2. Construct and operate sedimentation ponds to settle TSS where necessary.

- 5.3. Control sediment generation in diversion channels through revegetation of streambanks, overbank areas and berms as soon as possible after construction and by the use of channel armour (riprap), where required.
 - 5.4. Direct muskeg and overburden drainage waters to polishing ponds equipped with oil-separation capability.
 - 5.5. Reduce sediment yields from reclaimed surfaces by developing appropriate final topography and soil moisture conditions.
 - 5.6. Resuspension of sediments from the bottom of polishing ponds, wetlands and pit lakes will be reduced through appropriate hydraulic design.
 - 5.7. Reduce gullying and channel erosion by developing robust and sustainable reclamation drainage systems with built-in self-healing capability and robustness similar to natural drainage systems.
6. Teck commits to implement the following mitigation measures to reduce changes in flood flows and geomorphology downstream of the project:
- 6.1. Limit changes in flood flows in receiving watercourses relative to predevelopment conditions. Mitigation measures listed for the “reduce changes in flows and water levels” above are relevant for mitigating flood flows.

Direct water emissions

7. Teck commits to implement the following mitigation measures to limit the release of ions, nutrients, metals, polycyclic aromatic hydrocarbons (PAHs) and other parameters during operations and closure and protect sediment quality in downstream watercourses and waterbodies:
 - 7.1. Recycle process-affected waters and runoff within the project disturbance area (PDA) in a closed-circuit system during operations.
 - 7.2. Using a perimeter ditch and groundwater wells to capture and pump back seepages and runoff from the external tailings areas (ETAs) back into the tailings areas during operations.
 - 7.3. Design the closure drainage system to capture seepage and runoff from ETAs, external disposal areas (EDAs) and the Frontier project plant site and directing it to wetlands, pit lakes or constructed reclamation lakes during the mine closure management phase.
 - 7.4. Use wetlands, constructed reclamation lakes and pit lakes during and after the decommissioning and closure phases to provide biological remediation and settling of particulate materials in reclamation waters before discharge.

7.5. Respond to spills using best management practices. Project activities will follow safety protocols designed to limit accidents and reduce effects if an accident should occur.

8. Teck commits to the following mitigation measures to manage depressurization water during preproduction:

8.1. Teck plans to manage depressurization water during preproduction by storing approximately half of it in a storage pond at surface and reinjecting the remaining half into the BWS aquifer.

Pit lake releases

9. Teck will leverage the knowledge gained through its other reclamation efforts, along with research through regional initiatives such as Canada's Oil Sands Innovation Alliance (COSIA), to develop healthy, functional ecosystems in the project pit lakes.

10. Teck also commits to implement the following mitigation measures when designing closure drainage and pit lakes for hydrological sustainability and to promote effective passive treatment of process-affected waters and to support a viable aquatic ecosystem prior to release and to sequester tailings and other mine waste in the most appropriate location at mine closure:

10.1. Exclude tailings from pit lakes.

10.2. Do not release water from pit lakes until acceptable quality is achieved.

10.3. Maintain the water balance of the pit lakes with sufficient inflows to compensate for evaporative losses.

10.4. Manage the rate of Athabasca River water input to pit lakes as appropriate to confirm water quality filling targets are met and to comply with Athabasca river low flow restrictions.

10.5. Include wetlands reclamation lakes for treatment purposes in reclamation drainages to the pit lakes.

Changes in quality of groundwater and surface water downgradient of EDAs

11. Teck commits to implement the following mitigation measures to maintain surface water quality in consideration of surface flows into and out of the project area and groundwater discharge:

11.1. Groundwater and surface waters draining EDAs will be captured if monitoring data indicate that the drainage waters are unsuitable for release.

Air Quality and Odour

12. Teck commits to implement an adaptive management program to monitor the effectiveness of the mitigation measures and evaluate monitoring results to determine if adaptations are warranted.

NOX emissions

13. Teck commits to implement the following mitigation measures to reduce NOX emissions from combustion sources:

- 13.1. Use natural gas as a fuel for the cogeneration plant and boilers and heaters.
- 13.2. Dry low NOX technology to reduce NOX emissions and increase cogeneration plant efficiency.
- 13.3. Boiler and heater technology that will meet provincial and federal government emission requirements.
- 13.4. Purchase Tier IV compliant haul trucks when they become available.
- 13.5. Optimize mine planning to reduce haul distances.
- 13.6. Develop and implement an anti-idling program for the mine fleet.

SO2 emissions

14. Teck commits to implement the following mitigation measures to reduce SO2 emissions from combustion sources:

- 14.1. Use natural gas as a fuel for the cogeneration plant and boilers and heaters.
- 14.2. Use ultra-low sulphur diesel for the mine fleet.

PM2.5 and dust emissions

15. Teck commits to implement the following mitigation measures to reduce PM2.5 emissions from combustion sources:

- 15.1. Use natural gas as a fuel for the cogeneration plant and boilers and heaters.
- 15.2. Boiler and heater technology that will meet provincial and national government emission requirements.
- 15.3. Purchase Tier IV compliant haul trucks when they become available.
- 15.4. Optimize mine planning to reduce haul distances.
- 15.5. Develop and implement an anti-idling program for the mine fleet.

16. Teck commits to implement the following mitigation measures to reduce fugitive dust emissions:

- 16.1. Dust mitigation measures to be applied to onsite roads during construction include appropriate selection of road materials, limiting vehicle speeds, surface watering, progressive reclamation, temporary vegetation of disturbed land and retain natural vegetation as windbreaks.

Hydrocarbon and reduced sulphur emissions and secondary organic aerosol precursor emissions

17. Teck commits to implement the following mitigation measures to reduce fugitive plant emissions:

- 17.1. Use floating roof tanks where appropriate and a vapour recovery system to condense and recover vapours from storage tanks and process areas.
- 17.2. Use dual solvent vapour recovery units to provide full redundancy.
- 17.3. Conduct a leak detection and repair (LDAR) program to identify leaking components and to prioritize associated repairs.

18. Teck commits to implement the following mitigation measures to reduce fugitive mine face emissions:

- 18.1. Mitigation not currently known.

19. Teck commits to implement the following mitigation measures to reduce fugitive tailings area emissions:

- 19.1. Tailing solvent recovery unit to maintain losses to less than four volumes of solvent to 1,000 volumes of bitumen produced.

20. Teck commits to implement the following mitigation measures to reduce hydrocarbon and reduced sulphur emissions from combustion sources:

- 20.1. Use natural gas as a fuel for the cogeneration plant and boilers and heaters.
- 20.2. Purchase Tier IV compliant haul trucks when they become available.
- 20.3. Optimize mine planning to reduce haul distances.
- 20.4. Develop and implement an anti-idling program for the mine fleet.

Odour

21. Teck has developed a draft Odour Management and Response Plan. The draft Plan. The Plan's goals are mitigation, monitoring, participation in regional complaint process, and correlation of complaints to project activities to determine response actions. The Plan will be finalized following consultation with Indigenous communities, regulators and stakeholders.
22. At any time during project operation, nearby residences will be able to contact Teck if they are concerned that project operations are causing odours. The contact will be documented, investigative action will be initiated to determine the potential source, and the caller will be notified. If a source can be identified, a review will be undertaken to implement corrective action to reduce the potential for future occurrences.

Acoustics

Change in sound levels

23. Teck has made an overall commitment to managing and promptly addressing all noise-related concerns and will develop a Noise Management Plan.
24. Teck also commits to implement the following mitigation measures to reduce changes in sound levels:
 - 24.1. Vehicles will be maintained in good working condition (e.g., mufflers will be maintained) and speed limits will be enforced.
 - 24.2. Emergency alarms will be tested during daytime, where reasonably practical.
 - 24.3. Acoustic performance of building wall construction will meet a minimum sound transmission class (STC) rating of 29, based on published data in the North American Insulation Manufacturers Association for a pre-engineered structure.
 - 24.4. For outdoor equipment, the manufacturer incorporates mitigation in the equipment design to achieve the published sound power level.
 - 24.5. Noise effects will be mitigated using various measures, including but not limited to the following:
 - 24.5.1. haul trucks exhaust silencer
 - 24.5.2. haul truck speed

- 24.5.3. trip frequency (number of trips per daytime and nighttime period)
 - 24.5.4. route location or alignment
 - 24.6. Ventilation openings (i.e., air intake and exhaust openings) will be fitted with appropriate acoustic silencers, louvers, or plenums, where applicable, to reduce outdoor sound transmission from indoor equipment.
 - 24.7. Buildings housing indoor noise-generating equipment will be appropriately sealed to reduce noise.
 - 24.8. Where practical, flanking path and penetrations from plumbing, heating ducts and electrical wire in the buildings will be properly insulated and covered to reduce noise.
 - 24.9. Appropriate acoustical lagging will be installed to provide additional attenuation to the steel casing, where practical.
 - 24.10. Vibration isolation pads, resilient mounts on equipment, resilient pipe support systems, and dampers will be installed where appropriate.
25. Teck will incorporate best management practices to reduce project-related noise into Daily Operational Procedures, Long-Term Operational Procedures, design for low-noise facilities, and performance measurement as described in SPOG (2012) Best Practices Document, where appropriate, including:
- 25.1. Daily Operational Procedures: Keeping compressor station doors and windows closed
 - 25.1.1. Using belt dressing
 - 25.1.2. Inspecting and repairing mufflers
 - 25.1.3. Running fans slower at night (variable frequency drive [VFD])
 - 25.1.4. Using vent silencers on buildings
 - 25.1.5. Using soundproofing (insulation and lagging)
 - 25.1.6. Troubleshooting transient noise
 - 25.1.7. Minimizing flaring and venting
 - 25.1.8. Considering gravel pack around compressor building skids
 - 25.1.9. Developing noise check in daily reading sheets

25.2. Long-Term Operational Procedures

25.2.1. Responding quickly to noise concerns

25.2.2. Establishing baseline noise levels (in plant, at fence-line, or both) and resurvey to determine trends

25.2.3. Conducting regular assessment of noise control opportunities

25.2.4. Using best practical technology for noise control

25.2.5. Maintaining communication links with noise sensitive receptors and communities

25.2.6. Being aware of noise from contractors (e.g., service rigs) and developing processes to meet best practice expectations

25.2.7. Scheduling work to create the least amount of noise effects on noise sensitive receptors and keeping those affected informed

25.3. Design for Low Noise Facilities

25.3.1. Considering low noise electric drives versus engine driven compressors

25.3.2. Designing cooler fans for low tip velocity

25.3.3. Orienting noise sources away from residents

25.3.4. Using acoustical pipe lagging

25.3.5. Installing VFDs on coolers

25.4. Performance Measurement

25.4.1. Conducting measurements and establishing baseline data

25.4.2. Using best practices as part of the company's operating procedures

Visual

26. Teck commits to implement the following mitigation measures to reduce changes to visual effects:

26.1. Maintaining vegetated buffers between the project and the Athabasca River as well as along project transportation corridors to the extent feasible where safety concerns are not an issue.

26.2. Using construction materials that reduce contrast, limit visual attraction to project features, and blending built structures into the natural surrounding environment.

- 26.3. Using construction materials, where practicable, that minimize light reflection, potentially reducing viewing distances of project features
- 26.4. Reclamation techniques will be used that integrate closure plans with the surrounding landscape.
- 26.5. Teck will seek to develop closure plans that:
 - 26.5.1. Include integration and contouring of slopes that mimic natural topography.
 - 26.5.2. Focus on establishing a variety of vegetation communities.
 - 26.5.3. Avoid unnatural-looking breaks at development boundaries.
- 26.6. Planting a narrow band of white spruce along the edge of the river water intake (RWI) cofferdam and plant dogwood on the cofferdam, except in areas where tall vegetation would impede any maintenance or present safety concerns.
- 26.7. Completing reclamation in the RWI area to minimize erosion and slope instability.
- 26.8. Using lighting that minimizes light pollution.
- 26.9. At closure, infrastructure will be removed and the project will be reclaimed using vegetation types similar, though not identical to existing conditions, creating a continuous vegetated landscape.
- 26.10. A lighting plan will be developed during future stages of engineering to avoid over-illumination. Lighting design will be part of future stages of engineering, and Teck will consult with interested Indigenous communities about lighting considerations.
- 26.11. Finish the Athabasca River Bridge with low-glare materials and plant vegetation buffers near the bridge. Teck also commits to clear minimal vegetation and to vegetate cleared areas.
- 26.12. Retain treed buffers around or near watercourses.

Fish and fish habitat

27. Teck commits to implement an adaptive management program to monitor the effectiveness of the mitigation measures and evaluate monitoring results to determine if adaptations are warranted.

Change in productive fish habitat

28. Fish habitat of equivalent or higher productivity than that affected by the project will be created through offsetting measures where prevention of adverse habitat alteration or loss (i.e., reduced

habitat productivity or loss of productive habitat area) is not feasible (see the draft Detailed Fisheries Offsetting Plan).

29. Teck also commits to implement the following mitigation measures to avoid or reduce changes in fish habitat quantity or quality:

29.1. To avoid or reduce sedimentation:

29.1.1. Temporary and permanent erosion and sediment control measures for construction activities and disturbed areas.

29.1.2. Stabilization and revegetation of disturbed areas.

29.1.3. Isolation of instream work areas where they are required.

29.1.4. Best management practices and regulatory guidelines for construction activities in and near watercourses/waterbodies for erosion and sediment control.

29.1.5. Polishing ponds or other measures to reduce suspended sediment concentrations in discharge waters to avoid increases in sedimentation in the receiving environment.

29.1.6. Appropriate design of constructed channels and ponds to reduce internal erosion and generation of suspended sediments.

29.1.7. Appropriate design and construction of reclaimed landscape to reduce sediment yield.

29.2. To avoid or reduce changes to water quality:

29.2.1. Passing muskeg drainage and overburden water through polishing ponds and drainage ditches to reduce changes in water temperatures and dissolved oxygen concentrations.

29.2.2. Recycling of process affected waters during operations.

29.2.3. Capture and recycling of ETA seepage and run off water during operations, and use of a passive seepage control system at closure.

29.2.4. Use of wetlands, pit lakes and constructed reclamation lakes in the closure drainage system to provide biological remediation before release to the environment.

29.2.5. Removal of organic material from fish habitat compensation lake (FHCL) area prior to flooding.

- 29.3. To avoid or reduce changes to habitat area:
- 29.3.1. Diversion of watercourses around the PDA to return natural upslope water back to the diverted watercourse to preserve flows and avoid elimination of downstream habitats.
 - 29.3.2. Provision of a flow splitter on the diversion channel that will collect water from both upper Redclay Creek and Unnamed Creek 17 to appropriately apportion the flows in lower Redclay Creek and Unnamed Creek 17 to avoid flow changes in the Ronald Lake watershed.
 - 29.3.3. Operation of the RWI and Off Stream Storage Pond (OSSP) in compliance with the Lower Athabasca River Surface Water Quantity Management Framework.
 - 29.3.4. Design of the closure drainage channels and pit lakes to provide habitats capable of supporting aquatic ecosystems.
 - 29.3.5. Best management practices and regulatory guidelines to ensure construction and operation of the RWI, Athabasca River bridge and watercourse crossings associated with access roads do not interfere with fish passage and access to available habitats.

Change in fish abundance

30. Teck commits to implement the following mitigation measures to avoid or reduce changes in fish abundance:
- 30.1. Fish rescue operations to capture and relocate fish prior to habitat dewatering.
 - 30.2. Screening of the RWI in compliance with regulatory guidelines to mitigate fish entrainment or impingement.
 - 30.3. Best management practices and regulatory guidelines for scheduling construction activities in and near waterbodies/watercourse to avoid sensitive time periods in adjacent or downstream fish-bearing watercourses.
 - 30.4. Education of project personnel on sustainable fishing practices to support a Teck applied prohibition on their fishing in watercourses or waterbodies in the PDA to mitigate potential increases in recreational fishing pressure.
 - 30.5. Access Management Plan for the PDA to limit access to fish bearing habitats to mitigate increased fishing pressure.

Change in fish and fish habitat diversity

31. Teck commits to implement the following mitigation measures to avoid or reduce changes in fish and fish habitat diversity:
 - 31.1. Several of the measures intended to avoid or mitigate effects to fish habitat and fish abundance also apply to fish and fish habitat diversity, in cases where they preserve fish and productive fish habitats or create new habitats, including:
 - 31.1.1. Diversions designed to preserve flows and avoid elimination of downstream habitats.
 - 31.1.2. Closure drainage channels and pit lakes designed to provide habitats capable of supporting aquatic ecosystems.
 - 31.1.3. Fish rescue operations.
 - 31.1.4. Screening of the RWI.
 - 31.1.5. Education and prohibition of project personnel from fishing in the PDA.
 - 31.1.6. Access Management for the PDA to limit access to fish bearing habitats.

Wildlife

32. Teck has developed a Draft Wildlife Mitigation, Monitoring and Adaptive Management Plan (WMMP). Teck has proposed steps to Indigenous groups that would provide the opportunity for land users and community members to provide direct input into developing wildlife mitigation measures. Input will refine this draft WMMP. Once finalized, the plan will include a communication management section, which will outline how findings of the program will be communicated to interested parties.
33. Teck also commits to implement an adaptive management program to monitor the effectiveness of the mitigation measures and evaluate monitoring results to determine if adaptations are warranted.

Change in wildlife habitat availability

34. Teck commits to implement the following mitigation measures to reduce direct habitat loss:
 - 34.1. Limit the size of the east side access road right-of-way (ROW) and temporary workspace to the extent practical.
 - 34.2. Limit the Athabasca River bridge footprint in riparian areas.
 - 34.3. Carry out progressive reclamation to reclaim disturbed wildlife habitat as portions of the mine footprint become available.

- 34.4. Develop a weed management plan.
35. Teck commits to implement the following mitigation measures to reduce indirect habitat loss:
- 35.1. Implement strategies to reduce noise and light effects, including design considerations (e.g., Frontier project plant site engineering and aerodrome operation within regulatory and safety constraints).
- 35.2. Limiting employee and contractor access to identified areas of high-quality habitat adjacent to project footprint.
36. Teck commits to developing a Biodiversity Management Plan (BMP) with the underlying goal of optimizing reclamation during operations to reduce offsetting of residual environmental effects.

Change in wildlife landscape connectivity

37. Teck commits to implement the following mitigation measures to reduce change to landscape connectivity:
- 37.1. Carry out progressive reclamation to restore habitat for movement as portions of the mine footprint become available.
- 37.2. To maintain connectivity between Birch Mountains and Athabasca River:
- 37.2.1. Coordinate development activities with Canadian Natural Resources Limited (CNRL) who acquired the Pierre River Mine oil sands leases formerly held by Shell Canada Limited should CNRL reapply for and develop the Pierre River Mine project.
- 37.2.2. Develop an integrated land management strategy for the project in consultation with industry, the province, Indigenous communities, and stakeholders.
- 37.3. Provide wildlife passage under both sides of the Athabasca River Bridge and river water intake bridge to Dalkin Island to allow north–south wildlife movement along river banks using crossing design considerations (e.g., bridge height and length) outlined in Clevenger and Huijser (2011) and GOA (2011).
- 37.4. Set up educational signage to limit human use of wildlife underpasses.
- 37.5. Evaluate wing fencing along the approach to crossing passages (at least 2.4 m high for large mammals as per GOA 2011) as part of the crossing structure design.
- 37.6. Provide appropriate walking substrate along the wildlife underpass.
- 37.7. Create vegetated buffers adjacent to wildlife underpasses to increase movement opportunities for a variety of species.

- 37.8. Provide coarse woody debris (e.g., stumps) along the wildlife underpass to provide cover and increase use by furbearers and other small mammals.

Change in wildlife mortality risk

38. Teck commits to implement the following mitigation measures to reduce wildlife mortality risk resulting from vehicle–wildlife collisions:
 - 38.1. Implement fly-in/fly-out policy for workers to reduce vehicular traffic volume.
 - 38.2. Erect wildlife cautionary signage on access roads.
 - 38.3. Foster environmental awareness with speed restrictions on access roads report project-related wildlife fatalities.
 - 38.4. Provide vegetation maintenance at roadsides (vegetation will be trimmed regularly to discourage roadside foraging and prevent visual obstruction of wildlife).
 - 38.5. Develop seed mixes for roadside reclamation from less palatable species to reduce wildlife attraction to road edges.
 - 38.6. Design the road to maximize line of sight.
 - 38.7. Remove road kill as soon as practical.
39. Teck commits to implement the following mitigation measures to reduce wildlife mortality risk resulting from wildlife interactions with equipment:
 - 39.1. Implement preconstruction surveys for active wildlife habitat features (e.g., nests, breeding wetlands) before starting early works.
 - 39.2. Avoid vegetation clearing during the recommended May 1 to August 10 migratory bird-breeding period for the boreal ecozone per Environment Canada guidelines; note that in species at risk habitat, a more conservative breeding window of April 1 to August 31 might apply (Gregoire 2014, pers. comm.); complete nest surveys if clearing activities occur during the breeding window.
 - 39.3. Conduct owl nest search if clearing is scheduled within the non-migratory breeding bird window, March 1 to April 15 (based on Enhanced Approval Process guidelines for barred owl, GOA 2013).
 - 39.4. Reduce on disturbance of amphibian breeding and overwintering habitat (where possible).
40. Teck commits to implement the following mitigation measures to reduce wildlife mortality risk resulting from interactions with Infrastructure:

- 40.1. Create fuel and chemical spill contingency and response plans.
 - 40.2. Confirm adequate spill protection for all fuel storage facilities.
 - 40.3. Monitor and maintain waste disposal sites, wastewater storage areas and runoff control structures to prevent surface water impacts.
 - 40.4. During overburden dewatering, intermittently backslope the sides of drainage ditches to allow for wildlife crossings and to reduce the potential for entrapment.
 - 40.5. Use visible markers, such as aviation spheres and spiral vibration dampeners to make transmission lines near waterfowl staging and potential stopover areas more visible to birds, and where possible, design transmission lines to match the height of surrounding trees to reduce wire strikes by birds.
41. Teck commits to implement the following mitigation measures to reduce wildlife mortality risk resulting from wildlife–human conflicts:
- 41.1. Implement a food waste-management strategy to prevent attraction of nuisance wildlife.
 - 41.2. Confirm wildlife is not harassed or fed (to prevent habituation).
 - 41.3. Provide wildlife awareness training to project staff and contractors to reduce disturbance and negative human/bear interactions.
 - 41.4. Provide all field staff with bear-aware training courses, personal protective equipment (e.g., bear spray, bear bangers, air horns) and training on proper use of equipment.
 - 41.5. Develop a nuisance wildlife mitigation and monitoring plan in cooperation with the regulators.
42. Teck commits to implement the following mitigation measures to reduce wildlife mortality risk resulting from increased hunter access:
- 42.1. Implement deactivation plans for roads no longer in use.
 - 42.2. Prohibit construction and operations personnel and contractors from hunting and trapping while working.
 - 42.3. Disallow personal recreational vehicle use onsite.
 - 42.4. Prohibit firearms on project lands or at project facilities.
 - 42.5. Consider requesting a Directors Order to limit public access to the west side of the Athabasca River along project roads.

Waterfowl

43. Teck also commits to implement an adaptive management program to monitor the effectiveness of the mitigation measures and evaluate monitoring results to determine if adaptations are warranted.

Change in bird mortality risk

44. Teck commits to implement the following mitigation measures to reduce migratory water bird mortality risk resulting from the use of ponds:
- 44.1. Develop detailed construction and operational procedures and mitigation measures to reduce wildlife mortality during tailings area start-up.
 - 44.2. Design the sides of wastewater ponds to reduce attractiveness to birds (e.g., using gravel for sides).
 - 44.3. Clear trees and above-ground vegetation including shrubs, herbs and the ground layer prior to placement of tailings into tailings disposal areas.
 - 44.4. Remove peat from tailings area prior to flooding.
 - 44.5. Develop detailed construction and operational procedures and mitigation measures to reduce wildlife mortality during tailings area start-up.
 - 44.6. Reduce attractiveness of tailings areas for birds by keeping the inner walls of the tailings dyke free of vegetation.
 - 44.7. Keep slopes of tailings areas as steep as possible to reduce “black beach” areas.
 - 44.8. Implement procedure for removing any peat mats that float to the surface of the tailings area.
 - 44.9. Implement procedure for controlling floating bitumen mats.
 - 44.10. Manage the use and operation of anthropogenic lighting around wastewater ponds and tailings areas.
 - 44.11. Bird deterrent systems will be used to discourage birds from landing on wastewater ponds and tailings areas.
45. Teck commits to implement the following mitigation measure to reduce the potential for birds to land in ponds containing process-affected water:
- 45.1. Bird deterrent systems will be installed on all ponds associated with the project that have process-affected water that could be detrimental to birds.

46. Teck commits to implement the following mitigation measures to maximize recovery efficiency should birds use ponds:
 - 46.1. Develop procedure for handling of any bird recovered from wastewater ponds or tailings areas.
 - 46.2. Procedure will be in compliance with directions received from the local Alberta Fish and Wildlife office and/or the Alberta Environment and Parks (AEP) wildlife biologist.
 - 46.3. Procedure will also be in compliance with directions from Environment and Climate Change Canada with respect to whooping cranes.
47. Teck commits to implement the following mitigation measures to reduce the potential for bird mortality risk resulting from interaction with transmission and distribution lines:
 - 47.1. Designing transmission and distribution lines, where possible, to match the height of surrounding trees to reduce wire strikes by birds.
 - 47.2. Marking of transmission and distribution lines in areas near waterfowl staging and potential stopover areas.
48. Teck has developed a Draft Waterfowl Protection Plan. Teck will continue to pursue collaborative engagement processes, as outlined in the WMMP for the project as the primary mechanism in which it will engage with potentially affected Indigenous groups regarding the Waterfowl Protection Plan. Once finalized, the plan will include a communication management section, which will outline how findings of the program will be communicated to interested parties.

Bison

49. Teck has developed a Draft Ronald Lake Bison Mitigation, Monitoring and Adaptive Management Plan. Teck has proposed steps to Indigenous groups that would provide the opportunity for land users and community members to provide direct input into developing wildlife mitigation measures, including those specific to bison. Once finalized, the plan will include a communication management section, which will outline how findings of the program will be communicated to interested parties.
50. Teck will also work with the responsible authority to explore possible mitigations for which Teck does not have the authority to implement independently.
51. Teck commits to implement an adaptive management program to monitor the effectiveness of the mitigation measures and evaluate monitoring results to determine if adaptations are warranted.

Change in bison habitat availability

52. Teck commits to implement the following mitigation measures to reduce direct habitat loss:

- 52.1. Limit the size of the east side access road right-of-way (ROW) and temporary workspace to the extent practical.
- 52.2. Limit the Athabasca River bridge footprint in riparian areas.
- 52.3. Carry out progressive reclamation to reclaim disturbed wildlife habitat as portions of the mine footprint become available.
- 52.4. Develop a weed management plan.

53. Teck commits to implement the following mitigation measures to reduce indirect habitat loss:

- 53.1. Implement strategies to reduce noise and light effects, including design considerations (e.g., Frontier project plant site engineering and aerodrome operation within regulatory and safety constraints).
- 53.2. Limiting employee and contractor access to identified areas of high-quality habitat adjacent to project footprint.

Change in bison landscape connectivity

54. Teck commits to implement the following mitigation measures to reduce change to landscape connectivity:

- 54.1. Carry out progressive reclamation to restore vegetated corridors as portions of the mine footprint become available.
- 54.2. To maintain connectivity between Birch Mountains and Athabasca River:
 - 54.2.1. Coordinate development activities with Canadian Natural Resources Limited (CNRL) who acquired the Pierre River Mine oil sands leases formerly held by Shell Canada Limited should CNRL reapply for and develop the Pierre River Mine project.
 - 54.2.2. Develop an integrated land management strategy for the project in consultation with industry, Indigenous stakeholders and the Province.
- 54.3. Provide wildlife passage under both sides of the Athabasca River bridge and river water intake bridge to Dalkin Island to allow north–south wildlife movement along river banks using crossing design considerations (e.g., bridge height and length) outlined in Clevenger and Huijser (2011) and GOA (2011):

- 54.3.1. Set up educational signage to limit human use of wildlife underpasses.
- 54.3.2. Evaluate wing fencing along the approach to crossing passages (at least 2.4 m high for large mammals as per GOA 2011) as part of the crossing structure design.
- 54.3.3. Provide appropriate walking substrate along the wildlife underpass.
- 54.3.4. Create vegetated buffers adjacent to wildlife underpasses to increase movement opportunities for a variety of species.

Change in bison mortality risk

55. Teck commits to implement the following mitigation measures to reduce bison mortality risk resulting from vehicle–bison collisions:

- 55.1. Implement fly-in/fly-out policy for workers to reduce vehicular traffic volume.
- 55.2. Erect wildlife cautionary signage on access roads.
- 55.3. Foster environmental awareness with speed restrictions on access roads, report project-related wildlife fatalities.
- 55.4. Provide vegetation maintenance at roadsides (vegetation will be trimmed regularly to discourage roadside foraging and prevent visual obstruction of wildlife).
- 55.5. Develop seed mixes for roadside reclamation from less palatable species to reduce wildlife attraction to road edges.
- 55.6. Design the road to maximize line of sight.

56. Teck commits to implement the following mitigation measures to reduce bison mortality risk resulting from bison-human interactions - interactions with infrastructure:

- 56.1. Create fuel and chemical spill contingency and response plans.
- 56.2. Confirm adequate spill protection for all fuel storage facilities.
- 56.3. Monitor and maintain waste disposal sites, wastewater storage areas and runoff control structures to prevent contamination of surface waters.
- 56.4. During overburden dewatering, intermittently backslope the sides of drainage ditches to allow for wildlife crossings and to reduce the potential for entrapment.

57. Teck commits to implement the following mitigation measures to reduce bison mortality risk resulting from hunter access:
- 57.1. Construct predator access blocks to deter predator use (i.e., reduce line of sight) on linear features in the PDA that may leave core bison areas susceptible to predation.
 - 57.2. Deactivate roads in the PDA no longer in use.
 - 57.3. Implement employee / contractor policies to prohibit hunting within the project area.
 - 57.4. Reduce linear features in the closure landscape.
 - 57.5. Reduce width of linear features in the closure landscape.
58. Teck commits to implement the following mitigation measures to reduce bison mortality risk resulting from disease transmission to the Ronald Lake bison herd:
- 58.1. Implement progressive reclamation in the PDA to create suitable Ronald Lake bison habitat and reduce the potential of shifting habitat use northward.
 - 58.2. Mitigations associated with reducing hunter and predator access.
 - 58.3. Mitigations associated with reducing wildlife human conflict.
 - 58.4. Mitigations associated with reducing indirect habitat loss.

Vegetation

59. Teck commits to implement an adaptive management program to monitor the effectiveness of the mitigation measures related to reclamation and evaluate monitoring results to determine if adaptations are warranted.

Change in vegetation

60. Teck is committed to continue working with potentially affected Indigenous groups to refine the closure, conservation and reclamation (CC&R) plan through the life of the project and to incorporate input from Indigenous groups on reclamation monitoring and thresholds and document the establishment of traditional use vegetation in the reclaimed landscape. Teck plans to co-create Reclamation Working Group(s) with potentially affected Indigenous groups to seek input to the project's reclamation plan and measures and targets to determine its success. It anticipates that species of traditional importance will be identified by Reclamation Working Group(s) and incorporated into reclamation planning as feasible. In addition, collaborative participation is planned in reclamation research both from a project and regional perspective. Results of this research will be incorporated into future project plans.

61. Teck also commits to implement the following mitigation measures to reduce change in vegetation:
- 61.1. Reclamation of the closure landscape will focus on generating a sustainable landscape that is designed to maximize diversity through the generation of landforms that include:
 - 61.1.1. topographic diversity and associated diversity in moisture regimes
 - 61.1.2. aspect diversity
 - 61.1.3. substrate diversity including both fine- and coarse- grained landforms
 - 61.1.4. mesotopography
 - 61.2. Removal of existing linear disturbances that are currently fragmenting the landscape.
 - 61.3. Mitigation to reduce effects on community diversity will focus on research results and strategies as summarized in:
 - 61.3.1. Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region (2nd Edition) (ESRD 2010)
 - 61.3.2. Guideline for Wetland Establishment on Reclaimed Oil Sands Leases (3rd Edition) (CEMA 2014)
 - 61.3.3. Oil Sands Marshes: A Knowledge Transfer (Charette et al. 2012)
 - 61.3.4. Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region of Alberta (MacKenzie 2011)
 - 61.3.5. Restoration and Reclamation of Boreal Ecosystems: Attaining Sustainable Development (Vitt and Bhatti 2012)
 - 61.3.6. Riparian Classification and Reclamation Guide, Revised Edition (Mihajlovich 2012)
 - 61.4. Include peatlands in detailed CC&R planning should research results and recommendations prove to be feasible and appropriate.
 - 61.5. Work with the governments of Alberta and Canada and look to their guidance on the development of a Conservation Agreement.
 - 61.6. Plant additional species on the reclamation landscape, including those with traditional value, to supplement those recommended in provincial reclamation guidelines.
 - 61.7. Mitigation for rare plant species will be achieved through avoidance whenever possible. In areas where avoidance is not possible, alternate mitigation strategies will be developed to promote conservation of these species and associated genetic diversity.

- 61.8. A weed management plan will be implemented throughout the life of the project including during reclamation and at closure.
- 61.9. Develop and implement a program to salvage and relocate known occurrences of rare (vascular) plant species to areas outside of the project area in consultation with Indigenous communities.
- 61.10. Incorporate species of traditional important as identified through the Reclamation Working Group(s) into reclamation planning, as feasible.
- 61.11. Engage Indigenous communities in preparing plans to harvest and collect seeds, and will invite community members to harvest and collect seeds of rare and culturally important species before disturbance, for use in reproducing the species and revegetation of the project area.

Historical resources

- 62. Teck commits to implement the following mitigation measures regarding changes to historical resources within the project disturbance area:
 - 62.1. Historical resources sites in the PDA that Alberta Culture and Tourism (ACT) determines to have moderate to high heritage value will likely have requirements for further study. These might include some or all of the following:
 - 62.1.1. Additional shovel testing to identify site boundaries, areas of highest artifact density, activity areas and areas with unique or specialized artifacts.
 - 62.1.2. Archaeological excavation at sites with high interpretive potential.
 - 62.1.3. Mapping and documentation at specific sites.
- 63. Teck will phase the required supplemental historic resources impact assessment (HRIA) studies to ensure completion of all necessary studies in the PDA in advance of vegetation clearing in each development area.
- 64. Teck will also work collaboratively with local First Nation and Aboriginal communities on mitigation studies, in an effort to address local concerns and interests in relation to historical resources in the area.

Socio-economics

- 65. Teck's socio-economic mitigation measures are applicable to Athabasca Chipewyan First Nation, Fort Chipewyan Métis Local 125, Fort McKay First Nation, Fort McKay Métis, Fort McMurray

Métis Local 1935, Lac La Biche Métis Local 1909, Métis Nation of Alberta Region 1, Mikisew Cree First Nation, and Fort McMurray #468 First Nation unless otherwise specified.

Change to housing needs

66. Teck commits to implement the following mitigation measures regarding housing needs:
- 66.1. Provide on-site, lodge-based accommodations during construction and operations to reduce the project's effect on the resident population and associated effects on social infrastructure and housing in the region.
 - 66.2. Offer lodge amenities and services – including individual rooms and shared spaces, the quality of the food services and free-time activities – that are competitive with other lodge accommodations in the region.

Change to social infrastructure needs

67. Teck commits to implement the following mitigation measures regarding social infrastructure needs:
- 67.1. Maintain explicit and enforced lodge, workplace and flight policies with regards to the use of alcohol, drugs and illegal activities.
 - 67.2. Provide onsite security services, including controlled gates, check-in procedures, perimeter security fencing and lodge-based security officers on duty 24 hours.
 - 67.3. Offer in-house security services to assist the Royal Canadian Mounted Police (RCMP) within, and sometimes outside, the project lease boundaries (e.g., securing accident scenes and assisting with highway closures).
 - 67.4. Develop and implement an emergency response plan which includes the required personnel, procedures and equipment resources (e.g., vehicles, fire response, medical response and rescue).
 - 67.5. Develop required mitigation measures for areas adjacent to the project area based on the FireSmart Wildfire Assessment System and implement in the emergency response plan.
 - 67.6. Enter into mutual aid agreements with the Regional Municipality of Wood Buffalo (RMWB) and other oil sands companies that include:
 - 67.6.1. responding to motor vehicle accidents on Highway #63
 - 67.6.2. responding to forest fire threats to Fort McKay
 - 67.6.3. responding to regional spills

- 67.7. Participate in the management of regional emergencies at the RMWB's Regional Emergency Operations Centre.
- 67.8. Make available onsite health services, including an on-site medical facility staffed by qualified health professionals providing 24-hour on-site primary, emergency and occupational health services.
- 67.9. Consider financial and in-kind contributions to the Northern Lights Health Foundation, where appropriate, to support the efforts of Alberta Health Services to meet the needs of Wood Buffalo residents. Recognizing some of the health concerns in the region Teck is prepared to make health promotion and disease prevention initiatives a focus of their community investment policy.
- 67.10. Provide helicopter or fixed-wing aircraft access via the on-site aerodrome for injured workers requiring rapid evacuation for off-site medical care.
- 67.11. Discuss with other industrial proponents near the project options for coordinating on-site health facilities and resources.
- 67.12. Assess and support school events and education initiatives identified by rural schools in the study area, as appropriate.
- 67.13. Provide employees with access to the company's confidential Employee and Family Assistance Plan, which provides support for families and individuals who might experience difficulty dealing with personal, family or work-life issues that can affect one's health and well-being.
- 67.14. Consider support for community level initiatives including social groups providing assistance to those in need.
- 67.15. Continue providing direct support to community initiatives through its social investment programs.
- 67.16. Offer shift schedules that provide workers with sufficient time off to enjoy leisure activities in their home communities.
- 67.17. Make available onsite recreational opportunities and facilities.

Change to transportation needs

68. Teck commits to implement the following mitigation measures regarding transportation needs (applicable to Athabasca Chipewyan First Nation, Fort Chipewyan Métis Local 125, Fort McKay

First Nation, Fort McKay Métis, Fort McMurray Métis Local 1935, Métis Nation of Alberta Region 1, Mikisew Cree First Nation, and Fort McMurray #468 First Nation concerns):

- 68.1. Construct and operate an aerodrome near the project site.
- 68.2. Use on-site as well as regional lodge accommodations during both construction and operations to reduce worker commutes.
- 68.3. Use bus service for transporting construction and operations workers.
- 68.4. Limit private vehicles brought to the project site.
- 68.5. Schedule truck traffic, including oversized loads, to off-peak hours.
- 68.6. Use an on-site concrete batch plant; and attempt to source aggregates from pits near to site.
- 68.7. Enforce lodge, workplace and flight policies with regards to the use of alcohol, drugs and illegal activities.
- 68.8. Work with the local RCMP to confirm communication on local effects.
- 68.9. Support the efforts of RMWB and Oil Sands Community Alliance (OSCA) to work with the provincial government to progress improvements to highway infrastructure in a timely way.
- 68.10. Keep responsible regional and provincial planners informed of the project's development plans and their timing.
- 68.11. Consult and cooperate with other operators regarding shift scheduling with a view to reduce overlap in commuter traffic.
- 68.12. Provide funding to assist in the maintenance and safety of applicable segments of Highway #63 from Fort McKay to Fort Chipewyan that are affected by the project.

Change to municipal infrastructure needs

69. Teck commits to implement the following mitigation measures regarding municipal infrastructure (applicable to Mikisew Cree First Nation, Athabasca Chipewyan First Nation, Fort Chipewyan Métis Local 125, Fort McKay First Nation, and Fort McKay Métis concerns):

- 69.1. Provide water and sewer services for the different mining areas and the associated processing facilities and infrastructure, including on-site lodges.

70. Teck commits to implement the following mitigation measures regarding choice of fly-in/fly-out (applicable to Mikisew Cree First Nation, Athabasca Chipewyan First Nation, and Fort Chipewyan Métis Local 125 concerns):

- 70.1. A FIFO lodge-based approach to construction and operations.
- 70.2. Ongoing monitoring of the operations FIFO model and revisiting the approach should local circumstances change.
- 70.3. Teck's monitoring will take into consideration input received via its workers, contractors and ongoing local stakeholder and Indigenous engagement process. This would likely include feedback with respect to the social and economic effects of the FIFO model on individual workers, their families and communities.
- 70.4. Commitment to include Fort Chipewyan in a FIFO program.
- 70.5. Engage with potential employees living in Fort Chipewyan to discuss shift schedules and other travel and lodging logistics that influence their choice to work at the project versus other opportunities.
- 70.6. Discuss with local communities the design of FIFO shifts that best benefit its employees and families while remaining logistically and financially feasible.
- 70.7. Remain open to engaging in broader, regional initiatives, for example through the OSCA and its study of the use of aerodromes in the region.

Change to employment, business and training opportunity needs

71. Teck commits to implement the following mitigation measures regarding employment, business and training opportunity needs:
 - 71.1. Specific contractual commitments to Indigenous communities on employment, business and training opportunities will be made within Participation Agreements negotiated between Teck and the Indigenous community.
 - 71.2. Prioritize recruiting residents from the region first, Alberta second, followed by the rest of Canada, then North America and then overseas countries.
 - 71.3. Draw on various sources of labour in Canada that are traditionally under-represented in the labour market, including Indigenous people, immigrants and women.
 - 71.4. Put in place a policy to hire local businesses and contractors that are competitive and able to meet the company's needs is already in place.

- 71.5. Teck will consult with Indigenous communities regarding procurement and employment initiatives such as:
 - 71.5.1. Establishing mechanisms to enhance employment prospects of local residents, including preferential consideration.
 - 71.5.2. Using procurement processes that regard local ownership and prevalence of workers residing locally as positive criteria in goods and services vendor selection competitions.
 - 71.5.3. Establishing monitoring programs that measure local involvement, gather feedback and work with interested parties on how to improve results.
- 71.6. Implement Teck's relevant charters, codes and policies, including its Indigenous Peoples Policy, when working with Indigenous peoples in seeking to develop lasting mutual benefits that respect Indigenous community's values – including hiring, training and retention of Indigenous employees.
- 71.7. Utilize what Teck's has learned to date from local Indigenous communities with which it is engaged for the project to overcome oil sands specific challenges to Indigenous employment and procurement.
- 71.8. Consider work experience in lieu of a high school graduation for Indigenous peoples.
- 71.9. Work with the Fort McMurray Chamber of Commerce, the Northeastern Alberta Aboriginal Business Association (NAABA) and others to maximize contracting and employment opportunities in the region.
- 71.10. Offer a choice of worker turnaround cycles and opportunity to earn premium pay through overtime.
- 71.11. Continue to work with the Indigenous communities in the area and specifically with the communities of Fort McKay and Fort Chipewyan to develop Indigenous employment and business development program(s) guided by a commitment to: maximize opportunities for local Indigenous businesses to supply services and products in support of project construction and operations; hire qualified Indigenous people from the communities surrounding the project and support education, training and investment initiatives in local Indigenous communities, where appropriate.

- 71.12. Teck's Indigenous community employment and business development program(s) will engage with Indigenous communities on establishing employment and procurement policies and procedures, as well as adaptive management mechanisms specific to Indigenous community employment and procurement.
- 71.13. Teck's Indigenous community employment and business development program(s), as well as community-specific Participation Agreements will take into consideration input provided by local Indigenous communities, and will be guided by a commitment to: develop substantial opportunities for local Indigenous businesses to supply services and products in support of project construction and operations; hire qualified Indigenous people from the communities surrounding the project and support education, training and investment initiatives in local Indigenous communities, where appropriate.
- 71.14. Continuously monitor Teck's local employment and procurement policies and programs, along with reporting the results of this monitoring as part of ongoing community consultation.
- 71.15. Teck has yet to determine the exact reporting and monitoring mechanisms for its local procurement and employment policies, but will engage with Indigenous communities on mechanisms and expects they will likely be similar to mechanisms used by Teck's other operations. These might include:
- 71.15.1. Total employment, attraction and retention rates, average salary levels and other general human resource data. Where possible, the data will be disaggregated at the local community level.
 - 71.15.2. Procurement activity, including examination of goods and services sourced from providers in local communities, value and length of contracts, types of goods and services provided and employment and enterprise effects associated with procurement.
 - 71.15.3. Additional potential mechanisms are identified in Teck's draft socio-economic monitoring plan in response to JRP IR 5.15(a).
- 71.16. Continue supporting local labour force skills development, and work with communities, government and other industrial proponents on programs that assist community members overcome labour market barriers.

Change to culture

72. Teck commits to implement the following mitigation measures regarding changes to culture:

- 72.1. Continue to expand Teck's knowledge of, and engagement with, local stakeholders and Indigenous communities near the project to confirm ongoing and growing participation in project-related benefits, as well as the design of appropriate and effective mitigation measures to reduce any adverse effect. These efforts are envisioned to include capacity building support within Participation Agreements for Indigenous communities.
- 72.2. Provide cultural diversity awareness training to employees and contractors, focusing on respect for traditional land users as well as respect for Indigenous world views, customs and values.
- 72.3. Consider supportive workplace practices as Teck develops workplace policies and seek local Indigenous community input into cultural awareness programming to be provided at the project site.
- 72.4. Carry out a review of Teck's standard bereavement policy, including a review of policies from other fly in/fly out operations in Alberta, as operation specific policies are developed during future planning phases.
- 72.5. Continuing to provide cultural awareness training for all project staff and contractors.
- 72.6. Considering key Indigenous access routes and access preferences in the project's draft Access Management Plan (AMP).
- 72.7. Considering cultural keystone species in the wildlife management and mitigation plan, FHCL and biodiversity management plan.
- 72.8. Incorporating and using Indigenous place names where applicable.
- 72.9. Supporting community-led projects to document Indigenous place names in their respective traditional territories.
- 72.10. Contributing to language retention programs and other programs that support retaining Indigenous culture, knowledge and practice (e.g., culture camps for youth).
- 72.11. Discuss with local communities the design of fly in/fly out shifts that best benefit its employees and families while remaining logistically and financially feasible.

Access

73. Teck has developed a draft access management plan (AMP) for the project to facilitate access to or through Teck's mineral surface lease to the extent possible while maintaining worker and public safety. Teck has proposed next steps to Indigenous groups that would provide the opportunity for land users and community members to provide direct input into developing access mitigation measures. This input will refine the draft AMP.
74. Teck commits to implement an adaptive management program to monitor the effectiveness of the mitigation measures and evaluate monitoring results to determine if adaptations are warranted.

Change to access near the project disturbance area

75. Teck commits to implement the following mitigation measures to reduce potential effects on changes to access near the project disturbance area:
- 75.1. All individuals wanting to gain access to or through lands being actively developed, which is generally Teck's mineral surface lease (MSL), will be required to submit an access request.
 - 75.2. Traditional land users will be granted temporary access to and through the PDA according to the policy and processes set out in the AMP.
 - 75.3. Traditional land users will not have to meet worker site access requirements but will be escorted by someone who has permanent site access (i.e., a worker).
 - 75.4. Access through, and to portions of the PDA not being actively developed will not require an access request form be submitted. Individuals will be required to contact the site's security office and provide adequate notice about when they plan to be in the area, who will be present, and the intended activities and general location(s) as they relate to Teck leases. All individuals passing through the PDA will have to check in at the security office and will be escorted by a Teck worker. Teck understands that Aboriginal communities desire that the advance notice period.
 - 75.5. Throughout the life of the mine, access to locations in the PDA by Aboriginal community members will be based on mine advance. For safety reasons, harvesting and use of firearms would not be permitted in areas being actively mined or within and around facilities associated with the mine.
 - 75.6. The River Road will be maintained through operations and will provide access to the Fish Habitat Compensation Lake, aerodrome, and areas north of the PDA.

Traditional land use

76. Teck has developed a Draft Traditional Land Use Mitigation, Monitoring and Adaptive Management Plan. Teck will continue to seek input and engage with Indigenous groups, as well as regulators where appropriate, as part of finalizing this plan. Once finalized, Teck will continue to pursue collaborative engagement processes with Indigenous groups as outlined in the plan. Through these collaborative engagement processes Teck will aim to minimize and mitigate potential project effects on traditional land use. Once finalized, the plan will include a communication management section, which will outline how findings of the program will be communicated to interested parties.
77. Teck commits to implement an adaptive management program to monitor the effectiveness of the mitigation measures and evaluate monitoring results to determine if adaptations are warranted.
78. Change in availability of resources (wildlife, fish and vegetation), culturally important sites or areas for traditional activities and use of lands
79. Teck commits to implement the following mitigation measures to reduce changes in availability of resources (wildlife, fish and vegetation), culturally important sites or areas for traditional activities and use of lands:
- 79.1. Grant traditional land users temporary access to and through the PDA according to the policy and processes set out in the draft access management plan.
 - 79.2. Implement measures to mitigate project-related effects on wildlife through the wildlife monitoring and mitigation plan.
 - 79.3. Engage Indigenous communities in the development of a biodiversity management plan.
 - 79.4. Implement measures to mitigate project-related effects on fish and fish habitat through the detailed fisheries offsetting plan.
 - 79.5. Implement measures to reduce project-related effects on vegetation through the conservation closure and reclamation plan and the reclamation monitoring plan.
 - 79.6. Historical resources sites in the PDA that Alberta Culture and Tourism (ACT) determines to have moderate to high heritage value will meet the requirements of ACT and aim to meet the desires of Indigenous communities.
80. Teck commits to implement the following mitigation measures to reduce effects on the land use experience for traditional land users:
- 80.1. Establish Participation Agreements with Indigenous communities.
 - 80.2. Invite traditional users to harvest traditional plants before disturbance.

- 80.3. Support the planning and implementation of an excursion for Indigenous communities within the terrestrial local study area prior to project-related disturbance to describe Indigenous values, access and to recommend mitigation to avoid or limit effects on Indigenous access values.
- 80.4. Provide cultural diversity awareness training to employees and contractors focusing on respect for Indigenous land users, traplines, cabins, trails and equipment, as well as respect for Indigenous world views, customs and values.
- 80.5. Compensate Indigenous trappers following industry-community standards and the Alberta Trappers Compensation Program.
- 80.6. Project personnel will be prohibited from fishing, hunting and trapping within the PDA during work rotations, which is when Teck's policies' can be enforced.
- 80.7. Project personnel will be prohibited from using personal recreation vehicles within the PDA.
- 80.8. Investigate with potentially affected Indigenous communities through the Reclamation Working Group the concept of incorporating cultural values into reclamation planning.
- 80.9. Supporting documentation of community-specific cultural heritage.