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Alberta Energy Regulator

Fort Hills Energy Corporation

Application for Fort Hills Tailings Management Plan

February 25, 2019

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Decision 20190225A: Fort Hills Energy Corporation; Application for Fort Hills Tailings Management Plan

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Abbreviations

ACFN	Athabasca Chipewyan First Nation
AER	Alberta Energy Regulator
CPTA	Centre Pit Tailings Area
DDA	dedicated disposal area
DPL	demonstration pit lake
EPEA	*Environmental Protection and Enhancement Act*
ERCB	Energy Resources Conservation Board
EUB	Energy and Utilities Board
FMMCA	Fort McKay Métis Community Association
ICAF	*Integrated Compliance Assurance Framework*
NPTA	North Pit Tailings Area
OPTA	Out-of-Pit Tailings Area
OSCA	*Oil Sands Conservation Act*
OSEC	Oil Sands Environmental Coalition
PASS	passive aquatic storage system
RTR	ready-to-reclaim
SOC	statement of concern
TMF	*Lower Athabasca Region: Tailings Management Framework for Mineable Athabasca Oil Sands*
TMP	tailings management plan
TSRU	tailings solvent recovery unit

Executive Summary

The Alberta Energy Regulator (AER) approves Fort Hills Energy Corporation's (Fort Hills) application 1881219, subject to the approval terms and conditions in appendix 1.

Background

The AER regulates tailings arising from oil sands mining operations to ensure that the tailings are managed in an efficient, safe, orderly, and environmentally responsible manner over their entire life cycle. Tailings are a by-product of the process used to extract bitumen from mined oil sands and consist of water, silt, sand, clay, and residual bitumen.

The AER applies a risk-based approach to regulating, where higher-risk activities receive the greatest regulatory oversight. Given the nature and scale of fluid tailings generated by oil sands mine operations, and the ongoing research and development of tailings treatment technology, fluid tailings management is one of Alberta's higher-risk industrial activities.

The regulation of tailings has been an evolving issue in Alberta. In 2009, the Energy Resources Conservation Board (ERCB) released *Directive 074: Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes*, introducing specific performance criteria for the reduction of fluid tailings and the formation of trafficable deposits. To further manage and decrease liability and environmental risk resulting from the accumulation of fluid tailings on the landscape, the Government of Alberta issued the *Lower Athabasca Region: Tailings Management Framework for Mineable Athabasca Oil Sands* (*TMF*) in 2015.

The *TMF* sets out the objective that fluid tailings accumulation is minimized by ensuring that fluid tailings are treated and reclaimed progressively during the life of a project and all fluid tailings associated with a project are ready to reclaim (RTR) within 10 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. As part of the implementation of the *TMF*, the AER released *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, which set out new requirements for fluid tailings management plans (TMPs), including both existing fluid tailings (i.e., legacy) and new fluid tailings.

Fort Hills' Approval

The Fort Hills' oil sands mine (Fort Hills Mine) was approved by an Alberta Energy and Utilities Board (EUB) panel decision in 2002 (*Decision 2002-089*). The Fort Hills Mine started production in December 2017 and tailings placement began in the Out-of-Pit Tailings Area (OPTA) (site map provided in appendix 2). Fort Hills is proposing to commence fluid tailings treatment and placement in the proposed Dedicated Disposal Area (DDA) in 2024.

On March 3, 2017, the AER registered application 1881219 filed by Suncor Energy Operating Inc. (Suncor) on behalf of Fort Hills pursuant to section 13 of the *Oil Sands Conservation Act* (*OSCA*) for the Fort Hills Mine TMP.

On March 3, 2017, the AER also registered *OSCA* application 1881217, *Environmental Protection and Enhancement Act* (*EPEA*) application 010-151469, and *Water Act* application 023-00151636, filed by Suncor on behalf of Fort Hills to amend its existing *OSCA*, *EPEA*, and *Water Act* approvals. The approval terms and conditions in appendix 1 include *OSCA* application 1881217 and *EPEA* application 010-151469. However, as this report is specifically concerned with the TMP and tailings management, the discussion that follows is confined to the terms and conditions that are related to tailings management.

Following public notice of application 1881219, the AER received five statements of concern (SOCs). One SOC was later withdrawn. In an effort to enhance the involvement, the AER provided opportunities for both Fort Hills and the remaining SOC filers— including the Athabasca Chipewyan First Nation (ACFN), the McKay Métis Sustainability Centre on behalf of the Fort McKay Métis Community Association (FMMCA), Métis Nation of Alberta Association Fort McMurray Local Council 1935 (McMurray Métis), and the Oil Sands Environmental Coalition (OSEC)—to provide feedback on circulated draft *OSCA* and *EPEA* approval terms and conditions related to tailings management. In addition, the AER conducted a meeting on September 18, 2018 to provide clarification on the intent of specific draft approval terms and conditions and to provide an opportunity for Fort Hills and SOC filers to provide input.

Ongoing Stakeholder and Indigenous Community Engagement

Both the *TMF* and *Directive 085* highlight the importance of transparency and involvement of stakeholders and indigenous communities in tailings management. Given this overarching principle, together with the concerns expressed by SOC filers, the approval requires Fort Hills to engage with stakeholders and indigenous communities on the activities undertaken in respect of fluid tailings management. This engagement will include conducting an annual forum and reporting to the AER on these engagement activities.

Fluid Tailings Profile

The AER is approving Fort Hills' new fluid tailings profile, subject to the approval terms and conditions. Fort Hills does not have a legacy fluid tailings profile.

The new fluid tailings profile did not meet the *TMF*'s objective, as all new fluid tailings did not achieve RTR status by 2073, 10 years after the end of mine life. Fort Hills proposed 4 Mm^3 of new fluid tailings would remain in the fluid tailings inventory in 2073. The AER modified the new fluid tailings profile, requiring Fort Hills to achieve ready-to-reclaim status of all new fluid tailings by 2073 and ensure compliance with the *TMF*.

The AER has also set thresholds based on the approved new fluid tailings profile.

Tailings Treatment Technology

Fort Hills proposed to treat its fluid tailings using a new technology—passive aquatic storage system (PASS) technology—that uses the addition of chemicals to dewater the tailings and reduce the mobility of contaminants. The treated tailings would be placed in a single deposit, the proposed DDA, and Fort Hills proposed that water would be placed on top of the treated tailings after the end of mine life (2073 to 2083), creating an aquatic closure outcome (otherwise known as a water-capped pit lake).

While there may benefits to the PASS technology, if successful, this proposed technology and the proposed long-term reclamation outcome for the proposed DDA are subject to further assessment, research, and future policy. Moreover, the AER is concerned with the risks posed by using a single, yet to be proven technology to treat all fluid tailings produced at the Fort Hills Mine, with placement in a single deposit of the proposed scale. Further, although Fort Hills indicated that the PASS deposit could support a water-capped pit lake or terrestrial reclamation outcome, the AER did not find sufficient evidence to support this conclusion.

To allow Fort Hills an opportunity to obtain the necessary evidence to provide the AER with assurance of its TMP's ability to meet the *TMF*'s objective and outcomes, the AER is requiring that Fort Hills conduct a demonstration of phase 1 of the PASS technology with a terrestrial reclamation outcome. The AER has put limitations on this demonstration, including the location (South Pit) and size (40 million cubic metres (Mm^3)). Fort Hills is required to submit a plan for the demonstration by September 30, 2021.

Within two years from the commencement of the demonstration, or by September 30, 2026, whichever date occurs first, Fort Hills is required to submit an amendment application for an updated tailings management plan (updated TMP).

Ready-to-Reclaim (RTR) Criteria

Fort Hills proposed the following RTR criteria:

- Subobjective 1: clay to water ratio (CWR) ≥0.5 annual average basis
- Subobjective 1 and 2: total suspended solids (TSS) ≤500 parts per million (ppm) annual average basis

The AER does not authorize Fort Hills' proposed subobjective 1 or subobjective 2 RTR criteria at this time as the AER has authorized a demonstration only and has not authorized Fort Hills' proposed use of PASS technology, the proposed DDA, or the preferred aquatic outcome for the proposed DDA (i.e., a water-capped pit lake).

RTR is a new concept and modifications to or new RTR criteria are expected. Significant research and monitoring results relevant to RTR are expected between now and the commencement of fluid tailings

treatment and treated tailings placement. The AER expects that research, including the demonstration, and monitoring results will inform and lead to modified or new RTR criteria.

Further, the AER has concerns with the adequacy of Fort Hills' proposed RTR criteria. These concerns included the following:

- The RTR criteria appeared to only support an aquatic closure outcome, which is subject to further assessment, research, and future policy.
- The proposed RTR criteria do not provide assurance that performance of the deposit, including its physical properties, is on a trajectory to support future stages of activity or achieve the deposit's targeted ecosites.
- No long-term treated tailings deposit properties were assessed to provide assurance that the tailings deposit could achieve stable targeted ecosites and the *TMF*'s outcomes.
- The use of an annual average limits the ability to assess risks and liabilities for underperforming deposits and the effect on a deposit's performance towards the targeted ecosites. The averaging process obscures meaningful understanding of the deposit volumes that have been treated unsuccessfully or are failing to improve as expected.

Fort Hills is required to provide RTR criteria as part of the updated TMP.

Enhancements to Research

Research is key to manage risk and resolve site-specific uncertainties in Fort Hills' TMP. While the AER is relying on a number of research conditions in the *EPEA* approvals to manage risk and resolve uncertainties, many of these research conditions require Fort Hills' to submit a report on what was conducted. With respect to the demonstration and capping, the AER is concerned with what the research is intended to achieve, how the research will be conducted, and when the uncertainties will be resolved. As such, Fort Hills is required to provide a research plan for the demonstration by September 30, 2021 and a research plan for capping by September 30, 2023.

A summary of milestones, along with the various plans and updates required by the approval, is in appendix 3.

20190220A

Fort Hills Energy Corporation (Fort Hills)
Application for Approval of Fort Hills Tailings Management Plan

Application 1881219

Decision

[1] The Alberta Energy Regulator (AER) approves Fort Hills Energy Corporation (Fort Hills) application 1881219, subject to the approval terms and conditions, and issues *Oil Sands Conservation Act* (*OSCA*) Approval No. 9241H. Further, the AER has made consequential amendments to *Environmental Protection and Enhancement Act* (*EPEA*) Approval 151469-01-01 (appendix 1). The approval terms and conditions in appendix 1 reflect decisions on *OSCA* application 1881217 and *EPEA* application 010-151469. However, as this report is specifically concerned with the TMP and tailings management, the discussion that follows is confined to the terms and conditions that are related to tailings management.

[2] In reaching its decision, the AER considered all materials constituting the record of Fort Hills' application 1881219 together with all relevant material from *OSCA* application 1881217, *EPEA* application 010-151469, and *Water Act* applications 023-00151636 and 010-00190012. The record consists of the applications, which includes supplemental information requests; supplemental information filed by Fort Hills; the statements of concern (SOCs) filed by the Athabasca Chipewyan First Nation (ACFN), the McKay Métis Sustainability Centre on behalf of the Fort McKay Métis Community Association (FMMCA), Métis Nation of Alberta Association Fort McMurray Local Council 1935 (McMurray Métis), and the Oil Sands Environmental Coalition (OSEC); and the feedback on draft conditions of approval provided by Fort Hills and the SOC filers.

[3] References in this decision to specific parts of the record are intended to assist the reader in understanding the AER's reasoning on a particular matter and do not mean that the AER did not consider all relevant portions of the record with respect to the matter.

[4] This report highlights the AER's consideration of the application 1881219.

Application

[5] The Fort Hills' oil sands mine (Fort Hills Mine) was approved by an Alberta Energy and Utilities Board (EUB) panel decision in 2002 (*Decision 2002-089*). The Fort Hills Mine is located about 80 kilometres north of Fort McMurray, Alberta, in the Regional Municipality of Wood Buffalo (site map provided in appendix 2). The Fort Hills Mine started production in December 2017 and tailings placement

began in the Out-of-Pit Tailings Area (OPTA). Fort Hills is proposing to commence fluid tailings treatment and placement in the proposed Dedicated Disposal Area (DDA) in 2024.

[6] On March 3, 2017, the AER registered application 1881219 filed by Suncor Energy Operating Inc. (Suncor) on behalf of Fort Hills pursuant to section 13 of the *OSCA*. Under application 1881219, Fort Hills sought approval for its tailings management plan (TMP) to 2073, which is ten years after the end of mine life.

[7] On March 3, 2017, the AER also registered *OSCA* application 1881217, *EPEA* application 010-151469, and *Water Act* application 023-00151636, filed by Suncor on behalf of Fort Hills to amend its existing *OSCA*, *EPEA*, and *Water Act* approvals. Under these applications, Fort Hills sought approval to modify its mine plan, align the mine plan with the TMP, improve saline basal water management, and update the reclamation and closure plan. A boundary was also modified as part of the mine amendment application, changing the boundary recognized by the *Water Act* and requiring amendment to Fort Hills' *Water Act* approval. During the review of the *Water Act* application, it was recognized that the change to the boundary also triggered an amendment to Fort Hills' *Water Act* licence. A director-initiated amendment was undertaken as there was no increase in surface water allocation (application 010-00190012).

Statements of Concern and Enhanced Involvement

[8] The AER published a public notice of application for application 1881219 and received five SOCs:

- Fort Chipewyan Métis Local 125: SOC 30749
- ACFN: SOC 30767
- FMMCA: SOC 30752
- McMurray Métis: SOC 30745
- OSEC: SOC 30625

[9] On January 28, 2018 the Fort Chipewyan Métis Local 125 withdrew their SOC.

[10] On July 4, 2018, the AER circulated draft conditions of approval that related to tailings management for feedback from Fort Hills and the SOC filers. This created an opportunity to enhance involvement in the application review and inform the decision on application 1881219. The AER decided to circulate the draft conditions of approval for feedback, rather than conduct a facilitated technical meeting with Fort Hills and the SOC filers based on a number of factors, including the nature and extent of the information provided by Fort Hills and the stage of Fort Hills operation.

[11] However, on August 3, 2018, Fort Hills requested a meeting with the AER to review the draft conditions of approval. The AER conducted a meeting on September 18, 2018, which included both Fort Hills and the SOC filers, to provide clarification on the intent of the draft approval terms and conditions and to provide an opportunity for Fort Hills and SOC filers to provide input.

[12] As a result of Fort Hills' request and the meeting, the AER extended the deadline for feedback on the draft conditions of approval.

[13] The AER received written feedback from Fort Hills and all SOC filers. SOC filers provided written feedback both in advance of and after the meeting.

[14] Upon receipt of the feedback, the AER reviewed the entire record, considered the SOCs and submissions by SOC filers and Fort Hills, and made its decision on application 1881219.

Approval Discussion

Introduction

[15] Fort Hills' TMP presents significant risks to the achievement of the *TMF*'s objective and outcomes, as the plan is reliant on a single, yet to be proven tailings treatment technology (the passive aquatic storage system [PASS]) to create a single treated tailings deposit (the proposed DDA) that is not closed until post end of mine life with a proposed closure outcome that is subject to further assessment, research, and future policy. As such, the AER is currently not prepared to approve construction of or placement of treated tailings in the proposed DDA until the AER is satisfied that the risks are mitigated and feasible alternative plans exist. To allow Fort Hills an opportunity to obtain the necessary evidence to provide the AER with assurance of the ability of Fort Hills' TMP to meet the *TMF*'s objective and outcomes, the AER is requiring that Fort Hills conduct a demonstration of phase 1 of the PASS technology with a terrestrial outcome (the demonstration).

[16] The approach in the approval granted by the AER is to reflect the *TMF* outcomes. In addition to the requirement to conduct a demonstration, the AER has set conditions that ensure appropriate information is captured and submitted to the AER in a timely manner to manage risk and make appropriate regulatory decisions over the course of the Fort Hills Mine.

[17] The approval terms and conditions address:

- stakeholder and indigenous community engagement;
- project-specific thresholds for fluid tailings volumes;
- tailings treatment technology and deposit performance plans and updates, including a plan for the demonstration, mitigation measures and research, monitoring, evaluation, and reporting; and
- environmental effects and implications.

[18] The approval terms and conditions are subject to the AER's *Integrated Compliance Assurance Framework* (*ICAF*) and *Manual 013*. In addition, the management actions as set out in the *TMF* and *Directive 085* are new tools available to the AER. A common theme in *ICAF*, the *TMF*, and *Directive 085* is a flexible approach; namely, to allow for the discretion to choose the tools appropriate to the specific circumstances to ensure the most effective compliance or enforcement outcome.

[19] The TMP was submitted as an application under *OSCA* and the decision on the application was made pursuant to *OSCA*. In addition, the AER made consequential amendments to the *EPEA* approval. This report also makes references to the *EPEA* and *Water Act* approvals issued to Fort Hills in relation to this project. Further, a measurement system plan letter issued pursuant to *OSCA* that is related to the matters discussed in this report is attached to this report.

Stakeholder and Indigenous Community Engagement

[20] The *TMF* and *Directive 085* describe the importance of transparency, engagement, and enhancing the understanding of fluid tailings management.

Decision Summary and AER Findings

[21] FMMCA and McMurray Métis indicated that they require continued engagement on tailings management and identified opportunities for such engagement, including annual performance presentations, technical tours of the tailings treatment technology and deposits, involvement in ongoing research, and involvement in work that supports achieving long-term reclamation outcomes. ACFN also indicated that it may request engagement on tailings deposit closure options and will request technical review of future tailings related submissions.

[22] OSEC commended Suncor, as a Fort Hills' partner, and their consistent leadership in the oil sands sector on engagement and their demonstrated commitment to dialogue and understanding.

[23] To increase transparency, information sharing, and involvement in tailings management, Fort Hills is required to engage stakeholders and indigenous communities on tailings management activities undertaken pursuant to the approval.

[24] The AER expects that

- the required engagement efforts will include the SOC filers on application 1881219;
- over the life cycle of Fort Hills' mine operation, the stakeholders and indigenous communities who are engaged may change to reflect the issues and concerns of the day, and, as such, the AER expects Fort Hills to conduct its engagement activities accordingly; and
- Fort Hills' engagement will incorporate its research and lessons learned from the demonstration and ongoing operations, will incorporate relevant lessons learned from industry, and will be timely and meaningful.

[25] Fort Hills is also required to hold an annual forum with stakeholders and indigenous communities regarding tailings management activities undertaken pursuant to the approval. The AER is not specifying the format of the forum (e.g., workshop, meeting) as the AER believes that it is appropriate to leave the design and scope of the event to Fort Hills. However, the AER expects the annual forum will be tailored to what has occurred in the past year and what is upcoming regarding tailings management activities. The forum can be used to provide information, gather input, and describe plans on how engagement will occur for the upcoming year. In addition, it is expected the following annual forums may be more robust:

- in 2021, as Fort Hills will be submitting a plan for the demonstration;

- in 2023, as Fort Hills will submit feasible alternative technologies to PASS technology, including an implementation plan; a capping research plan for tailings deposits; a consolidation model or engineering analysis for OPTA; an update on TSRU tailings management; and an updated assessment of the long-term hydrological sustainability of any proposed water-capped pit lake and the McClelland Lake Wetland Complex;
- in 2026, or within two years from the commencement of the demonstration, whichever date occurs first, as Fort Hills will submit an amendment application for an updated TMP and, if the plan continues to include a water-capped pit lake, a preliminary pit lake design.

[26] Fort Hills is required to report to the AER on the details of its engagement efforts on an annual basis.

Fluid Tailings Profiles and Project-Specific Thresholds

[27] Fort Hills does not have any fluid tailings that meet the definition of legacy fluid tailings, since the operation started in 2017.

[28] The *TMF* and *Directive 085* require that new fluid tailings must be treated and progressively reclaimed during the life of a project, with all fluid tailings RTR within ten years of end of mine life. The *TMF* and *Directive 085* also provide guidance that operators must consider in the development of their TMPs.

[29] The fluid tailings profile represents the volume of fluid tailings that are not RTR. The new fluid tailings profile is an important tool by which the performance of Fort Hills will be measured.

New Fluid Tailings Profile

Context

[30] The *TMF* defines new fluid tailings as fluid tailings that are produced after January 1, 2015. All new fluid tailings must be RTR within ten years of end of mine life. Fort Hills' end of mine life is 2063.

[31] Fort Hills commenced operations in 2017 and is employing fluid tailings generation reduction measures (i.e., thickeners, enhanced beach capture). Fort Hills is not proposing to commence fluid tailings treatment and placement in the proposed DDA until 2024.

Decision Summary and AER Findings

[32] Fort Hills' new fluid tailings profile did not meet the *TMF*'s objective, as all new fluid tailings did not achieve RTR status by 2073, 10 years after the end of mine life. Fort Hills proposed 4 Mm^3 of new fluid tailings would remain in the fluid tailings inventory in 2073. The AER modified the new fluid tailings profile, requiring Fort Hills to achieve ready-to-reclaim status of all new fluid tailings by 2073

and ensure compliance with the *TMF*. Further, Fort Hills provided data in 5-year intervals from 2026 until 2073, with which OSEC raised concerns. The AER interpolated annual volumes from the information provided by Fort Hills, and did not receive any opposing feedback during the circulation of the draft conditions of approval.

[33] Fort Hills' new fluid tailings profile is authorized as shown in appendix B of the approval (appendix 1) and figure 1, as the adjusted new fluid tailings profile meets the *TMF*'s objective.

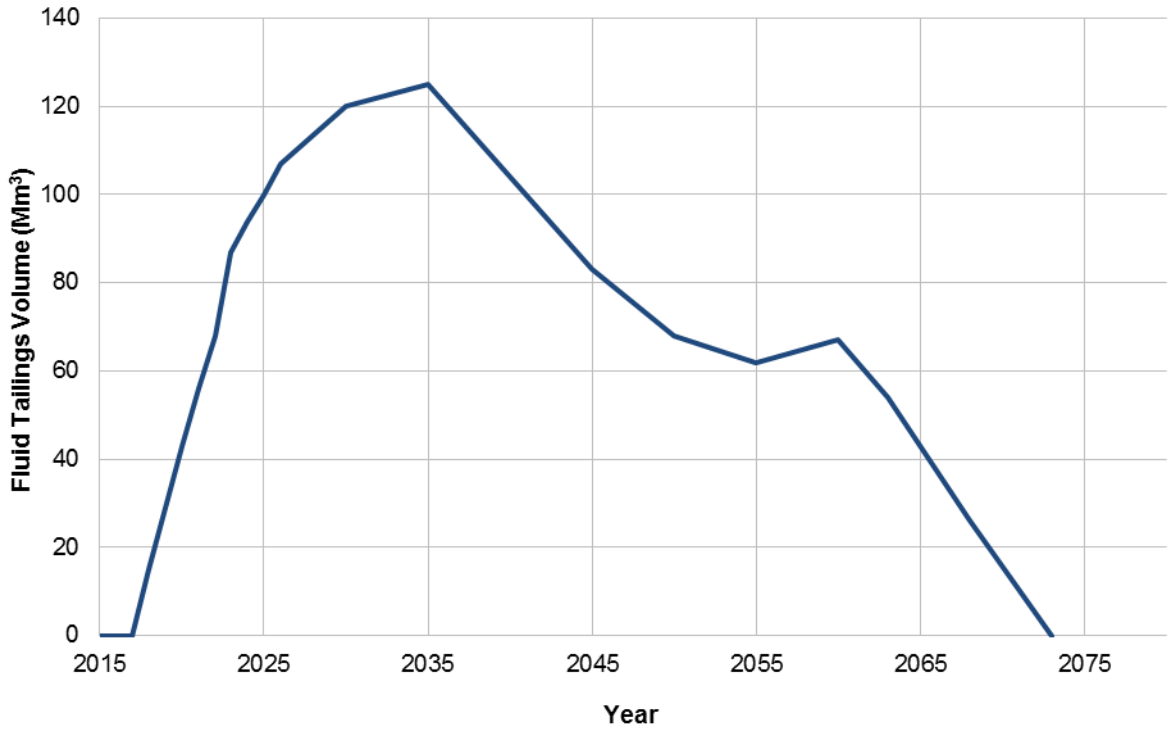


Figure 1. New fluid tailings profile

[34] Fort Hills is managing its fluid tailings growth through the use of thickeners and enhanced beach capture. Therefore, although tailings treatment is commencing later in the life cycle, there is a mechanism for accumulation management currently in place. More information on the thickeners and enhanced beach capture can be found in the "Technology Selection" section.

[35] FMMCA, McMurray Métis, and OSEC expressed concern with the time to accumulate a peak volume of fluid tailings. The *TMF* acknowledges that it may take more than three to ten years to accumulate the peak volume, and that new projects, particularly those seeking to use in-pit placement of tailings, could be at the higher end of the three to ten year timeframe. Fort Hills is proposing growth in tailings accumulation until 2035, which is 18 years from the start of mining operations to accumulate the peak volume. However, the *TMF* also acknowledges that peak volume, based on full production levels, may take more than 10 years to accumulate and that projects are expected to manage a fluid tailings

inventory in the range of what is expected to be produced during 3 to 10 years of full production. As the new fluid tailings profile's peak volume is about 10 years of full production, this is in alignment with the *TMF* and *Directive 085*.

[36] As Fort Hills' end of mine life is not until 2063, the AER expects Fort Hills to work to minimize fluid tailings generation and maximize fluid tailings treatment to minimize the peak volume and the volume at the end of mine life, in support of the *TMF*'s outcomes.

[37] Although the new fluid tailing profile is authorized, there are a number of concerns with respect to Fort Hills' ability to achieve the new fluid tailings profile.

[38] First, given the stage of operations at Fort Hills, the new fluid tailings profile is subject to a number of uncertainties. Fort Hills only recently commenced operations, and therefore did not have historical data to validate its fluid tailings generation model prior to submission of its new fluid tailing profile. A number of factors can influence the fluid tailings generation model, including ore quality, thickener and enhanced beach capture performance, tailings treatment technology performance, and tailings deposit performance. The AER is concerned that the actual fluid tailings accumulation will be different from the predicted volumes used to create the new fluid tailings profile. Fluid tailings accumulation that is greater than expected may result in Fort Hills being required by the AER to undertake mitigation measures to achieve the new fluid tailings profile.

[39] Second, at this time, the treatment of fluid tailings and placement of fluid or treated tailings is only authorized for a demonstration, and subobjective 1 or subobjective 2 RTR criteria are not authorized. Fort Hills' indicated that it cannot achieve the new fluid tailings profile without approval of elements that are foundational to the new fluid tailings profile, such as the RTR criteria and tailings treatment and placement. The AER expects that ongoing research of the PASS technology at the Fort Hills Mine and at the Suncor Millennium Mine, and future policy will inform regulatory decisions on the appropriateness of the RTR criteria and tailings treatment technology.

[40] The AER understands that Fort Hills proposed to start treatment of fluid tailings in 2024. The AER encourages Fort Hills to consider commencement of the demonstration prior to 2024, as well as evaluate the results and operational data from Suncor's Millennium Mine, to ensure there is sufficient evidence to inform regulatory decisions related to the new fluid tailings profile's foundational elements.

[41] The AER recognizes that, as Fort Hills' operation progresses, data collected or research results may change the projected new fluid tailings profile, which could necessitate an amendment application. Fort Hills is required to confirm its ability to meet the new fluid tailings profile when it submits an amendment application for the updated TMP. This is required by September 30, 2026, or within two years from the commencement of the demonstration, whichever date occurs first. The timing of the submission is intended to provide Fort Hills with time to reduce uncertainties and obtain operational data from the

demonstration and from the implementation of other tailings treatment technologies, research results from the demonstration and any other relevant research, and other evidence to support its technology choice and RTR criteria.

Thresholds

Context

[42] The volume of accumulated fluid tailings is the primary indicator in the *TMF* used to manage and decrease liability and environmental risk resulting from the accumulation of fluid tailings. Triggers and a limit (collectively referred to as "thresholds") will be set relative to the fluid tailings profiles. The thresholds will ensure that fluid tailings are not accumulating beyond a volume or at a rate that precludes operators from meeting the *TMF*'s objective. These are tools to be used to manage risks associated with TMPs. Various management actions are required when thresholds are exceeded.

[43] Three project-specific thresholds are set based on an operator's fluid tailings profiles in accordance with the *TMF* and *Directive 085*.

[44] The three thresholds are the profile deviation trigger, the total volume trigger, and the total volume limit:

- Profile deviation trigger:
  - Alerts regulators and operators when the volume of fluid tailings is growing 20 per cent faster than that approved for the profile. Additional management action is required when the profile deviation trigger is exceeded.
  - This trigger is based on when the fluid tailings volume growth is 20 per cent higher than that in the approved profile.
  - The *TMF* states that the profile deviation trigger allows a five-year rolling average to account for year-over-year variability.
- Total volume trigger
  - Indicates that the volume of fluid tailings has exceeded its approved maximum accumulation and requires additional management action.
  - The *TMF* states that this trigger is based on 100 per cent of the greater of the maximum approved fluid tailings volume profile or the end of mine life target.
- Total volume limit
  - Indicates that the volume of fluid tailings presents an unacceptable risk to the environment and potential long-term liability. Exceedance of this limit will compromise the ability of an

operator to have all of their fluid tailings in an acceptable management state (i.e., RTR) within ten years of the end of mine life. Therefore, the most severe management responses are initiated.

- The *TMF* states that this limit is based on 140 per cent of the greater of the maximum approved fluid tailings volume profile or the end of mine life target.

Decision Summary and AER Findings

[45] The *TMF* states the profile deviation trigger allows a five-year rolling average to account for year-over-year variability. To allow for year-over-year variability, the AER has set the profile deviation trigger for Fort Hills as a five-year rolling average of the annual profile deviation.

[46] The total volume trigger and limit are based on the greater of the maximum approved fluid tailings volume profile or end of mine life target, as per the *TMF* and *Directive 085*. As Fort Hills' maximum approved fluid tailings volume is 125 Mm^3, which is greater than the end of mine life target, the AER is setting the total volume trigger at 125 Mm^3 and the total volume limit at 175 Mm^3. The AER will review Fort Hills' new fluid tailings profile in its updated TMP to ensure the project-specific thresholds are appropriate.

Fluid Tailings Treatment Technology

[47] The *TMF* stipulates that all fluid tailings must be treated with an accepted technology. The risks, benefits, and trade-offs associated with the proposed technology must be understood, have contingencies identified, and risks mitigated.

Technology Selection

Context

[48] *Directive 085* requires operators to justify that selected technologies are the best available for the project.

[49] Fort Hills identified challenges with its previously approved tailings management approaches, which included the use of thickeners and in-pit placement of nonsegregating tailings (2007) and the thin-lift drying in both out-of-pit and in-pit locations (2010). The challenges with its 2007 approach included that fluid tailings treatment would be connected to bitumen production, necessitated a large footprint, numerous soft deposits would require reclamation, and sand for construction and capping would be limited. Challenges with its 2010 approach necessitated a large footprint, treatment would be impacted by seasonality, increased time would be required to achieve adequate strength, and substantial cost would be incurred.

[50] As a newly operating mine, Fort Hills Mine only recently began to generate tailings. These tailings are processed through thickeners and the thickened tailings produced are deposited into OPTA, with the Centre Pit Tailings Area (CPTA) and North Pit Tailings Area (NPTA) also proposed to receive thickened tailings in the future. Fort Hills is planning to continue to employ the thickeners to reduce the volume of fluid tailings generated.

[51] The thickeners are used to recover hot water from the tailings. However, the recovery of the hot water will increase the density of the thickened tailings stream, thereby reducing the volume of fluid tailings generated. In addition, Fort Hills indicated that it intends to use enhanced beach capture. Enhanced beach capture is the placement of coarse sand tailings in areas that contain fluid tailings (i.e., OPTA, CPTA, and NPTA), which improves fines capture and reduces the volume of fluid tailings generated. Fort Hills would use enhanced beach capture whenever practical to reduce the volume of fluid tailings.

[52] The new fluid tailings profile assumes that the thickeners and enhanced beach capture are successful at reducing fluid tailings growth. Fort Hills identified the following mitigation measures for thickener and enhanced beach capture underperformance:

- Make use of contingency containment space that exists in OPTA
- Begin treatment using PASS technology and placement in the proposed DDA earlier than planned
- Implement selective mining approach (i.e., feed fines avoidance) to reduce clay sent to the extraction and therefore reduce the volume of fluid tailings generated

[53] While Fort Hills proposed to continue using thickeners under application 1881219, previously identified tailings treatment technologies (e.g., nonsegregating tailings, thin-lift drying) would no longer be used. Rather, Fort Hills proposed to treat fluid tailings using a single technology, PASS technology, and place the treated tailings in a single in-pit deposit, the proposed DDA, starting in 2024. Fort Hills indicated that its proposed TMP under application 1881219 eliminated the challenges of its existing approach. A description of PASS technology, including its benefits, along with the AER's decision summary and findings with respect to PASS technology, are in subsequent sections.

[54] Fort Hills assessed consolidated tailings and nonsegregating tailings, direct placement of thickened tailings, and solids-liquid separators. Fort Hills concluded that these technologies, when compared to PASS technology, had equivalent performance, higher execution risk, longer reclamation timelines, reduced enhanced beach capture benefits, or operability and storage capacity challenges. Further, Fort Hills evaluated both in-pit and out-of-pit deposit options, and terrestrial and aquatic closure outcomes. Given the deposit characteristics, reclamation timelines, cost of implementation, and state of development, Fort Hills stated that it preferred a single, in-pit deposit (the proposed DDA) in the location of the South Pit, with an aquatic closure outcome.

[55] Fort Hills committed to monitoring other tailings treatment technologies to assess possible improvements to fluid tailings treatment performance.

Decision Summary and AER Findings

[56] The AER authorizes the continued use of existing infrastructure, specifically the continued use of thickeners which are expected to provide a benefit to tailings management as they can decrease the volumes of fluid tailings generated. The AER also expects that Fort Hills will operate its deposits (e.g., OPTA, CPTA, NPTA) to maximize enhanced beach capture as it provides a benefit by decreasing the volume of fluid tailings generated.

[57] The performance of the thickeners and enhanced beach capture are critical to the new fluid tailings profile. Given the stage of Fort Hills' operations and the limited performance data, the AER is concerned that the thickeners and enhanced beach capture may not perform as expected. Predicted fluid tailings volumes that are inconsistent with the actual generated fluid tailings may be the result of underperformance of the thickeners or enhanced beach capture. In addition to affecting the projected fluid tailings volumes, and therefore the new fluid tailings profile, underperformance could impact technology treatment capacity requirements, overall site storage, and long-term reclamation outcomes.

[58] To address the concerns regarding performance and mitigation, as part of annual reporting under *Directive 085*, Fort Hills will report on fluid tailings volumes generated. If the thickeners or enhanced beach capture are not performing as predicted or other operational assumptions are inaccurate, and fluid tailings volume and growth is greater than expected, Fort Hills will identify how it will mitigate fluid tailings volume and growth. As Fort Hills identified mitigation measures for underperformance of the thickeners and enhanced beach capture that do not focus on minimizing volume or growth (i.e., additional storage in contingency space in OPTA), the AER expects that Fort Hills will focus on the mitigation measures that reduce fluid tailings (i.e., earlier treatment, selective mining) to ensure thresholds are not exceeded and the *TMF*'s objective and outcomes are met.

[59] With respect to Fort Hills' technology selection, the AER understands that, if successful, PASS technology may provide benefits. However, the AER is concerned about the success of managing a TMP that is fully dependent on the success of a single tailings deposit, using a single tailings treatment technology that is in early stages of development. This concern is magnified by the fact that there are various risks and uncertainties associated with PASS technology; this includes the fact that the proposed aquatic closure outcome targeted by PASS technology is subject to further assessment, research, and policy.

[60] SOC filers expressed concern that Fort Hills did not provide a complete and detailed evaluation of technology options, including feasibility and selection of technology. Considering that PASS technology is yet to be proven, the AER believes that Fort Hills' evaluation of alternative technologies

was insufficient. In addition to its commitment to monitor other tailings treatment technologies to assess possible improvements to fluid tailings treatment performance, Fort Hills is required to

- annually report on its assessment of all fluid tailings treatment and management options being evaluated;
- by September 30, 2023, submit feasible alternative treatment technologies and an implementation plan to manage the volume of fluid tailings planned to be treated by the PASS technology and subsequently water capped; and
- by September 30, 2026, or within two years from the commencement of the demonstration, whichever date occurs first, provide an assessment of all fluid tailings treatment and management options evaluated as part of the updated TMP.

[61] The AER findings with respect to the use of PASS technology can be found in the sections that follow.

PASS Technology – Phase 1

Context

[62] PASS technology has four phases. Phase 1 adds a coagulant and a flocculant to fluid tailings pumped or dredged from OPTA (or NPTA later in the mine life) prior to placement in the proposed DDA. This phase is proposed to occur between 2024 and 2073. Phases 2 through 4 are described in the subsequent section.

[63] Fort Hills identified the following benefits of PASS technology:

- In-line flocculation, which is the addition of a flocculant used to dewater tailings, is a component of PASS technology. Fort Hills' operator, Suncor, has experience with in-line flocculation at the Suncor Millennium Mine.
- Fort Hills stated that PASS technology
  - is not connected to bitumen production,
  - does not result in numerous soft deposits that would require reclamation,
  - does not require a large footprint,
  - would initially dewater fluid tailings and immobilize contaminants, and
  - has the potential for either an aquatic or terrestrial closure option.

Decision Summary and AER Findings

[64] At this time, the AER believes that PASS technology is under development. The AER is not authorizing the use of PASS technology, as proposed by Fort Hills, because the AER did not find sufficient evidence to support the viability of the PASS technology at the scale proposed at the Fort Hills Mine. Additional information is required on PASS technology. Success of a yet to be proven tailings treatment technology needs to be demonstrated at a scale large enough to be representative of the proposed DDA.

[65] Further, while PASS technology is intended to target an aquatic outcome, and this outcome is preferred by Fort Hills, Fort Hills has indicated that PASS technology can have either an aquatic or terrestrial closure outcome. There is insufficient evidence to support this proposition. Aquatic closure concerns are being addressed through a number of approval conditions. However, there is currently no precedent or persuasive evidence regarding a terrestrial closure outcome for the proposed DDA.

[66] Therefore, the AER is requiring Fort Hills to conduct a demonstration of phase 1 of the PASS technology, at a scale large enough to be representative of the proposed DDA, with a terrestrial closure outcome. Following several years of implementation of the demonstration, Fort Hills must submit an amendment application updating its TMP.

[67] In the draft conditions of approval issued for feedback, the AER originally required Fort Hills to submit alternative mine and DDA designs in 2019, and an amendment application in 2022 with an updated TMP. SOC filers were generally supportive of these draft conditions of approval, while Fort Hills recommended modifications. As articulated at the September 18, 2018 meeting, the intent of the draft conditions was to address the risks associated with PASS technology implementation and the magnitude of the proposed DDA. After consideration of all the feedback, the AER determined that it could achieve the intent of the previous draft conditions through the required demonstration, with additional benefits, including

- providing the opportunity to collect and analyze site-specific data related to phase 1 of the PASS technology and deposit performance;
- permitting Fort Hills to treat fluid tailings and deposit the treated tailings in the South Pit, up to a maximum volume, without requiring an amendment; and
- focusing research on limitations and constraints to creating a terrestrial reclamation outcome.

[68] The data provided by Fort Hills in support of its TMP is at a lab-scale, is not conclusive, and is derived from data collected through the use of in-line flocculation technology at a different mine site. While the AER recognizes that Suncor, as the operator of Fort Hills Mine, has experience with in-line flocculation, there are a number of unique factors between the implementation of and experience with that technology, and Fort Hills' proposed use of PASS technology. These factors include the following:

- The targeted outcome of the PASS technology and the resulting deposit is distinct from the use of in-line flocculation to create a thin-lift tailings deposit at Suncor Millennium Mine.
- There is limited information on the ore beyond the immediate area of mining activity. It is expected that the ore properties will be site specific and will influence the fluid tailings characteristics.
- The extraction process will result in site-specific fluid tailings characteristics.
- Unlike in-line flocculation on its own, a coagulant is added as part of the PASS technology. Further, additives may need to be adjusted depending on the site-specific fluid tailings characteristics.
- As part of the Fort Hills' TMP, processing by thickeners, enhanced beach capture, and placement in OPTA all occur prior to in-line flocculation.

[69] Further, the AER considers the risks and uncertainties associated with PASS technology and the long-term performance of the treated tailings deposit as a high risk. These risks and uncertainties include dewatering performance, contaminant mobility, and long-term reclamation outcome performance and sustainability, be it aquatic or terrestrial. Additional data is required to provide assurance that the *TMF*'s outcomes can be achieved.

[70] Fort Hills commenced production in 2017. The AER expects that operation of the Fort Hills Mine will support understanding of site-specific tailings characteristics. In addition, Fort Hills is currently obtaining additional data on PASS technology through two activities. First, a demonstration pit lake (DPL) commenced in October 2017 at the Suncor Millennium Mine. The DPL is intended to address uncertainties and validate assumptions for PASS technology implementation at Millennium Mine and for aquatic closure. Operation of DDA3, which uses phase 1 of PASS technology and commenced in 2018, is also ongoing at the Suncor Millennium Mine. This operation should provide more details on treatment and deposit performance. The AER expects that Fort Hills will be able to use relevant results from the use of phase 1 of PASS technology at Suncor's Millennium Mine to support understanding of the technology and reduce uncertainties associated with the technology choice at the Fort Hills Mine.

[71] A significant uncertainty associated with PASS technology is its outcome. Fort Hills' preferred outcome—aquatic closure, is subject to further assessment, research, and future policy. While the DPL, currently underway at Suncor's Millennium Mine, is intended to obtain information on the potential for PASS technology to achieve an aquatic closure outcome, these results will not be site specific to Fort Hills. There are a number of site-specific issues that may limit the feasibility of an aquatic closure outcome in the proposed DDA at the Fort Hills Mine. More information on the AER's concerns with the feasibility of a water-capped pit lake at the Fort Hills Mine is in the "Surface Water and Groundwater" section.

[72] Fort Hills indicated that a terrestrial closure alternative exists, albeit with a timeframe of 60 or more years before closure is achieved. Fort Hills stated that it could make a final decision on capping (and the aquatic or terrestrial outcome) in 2069. However, its application did not provide sufficient information on the ability of fluid tailings treated by phase 1 of the PASS technology or the ability of the proposed DDA to achieve a terrestrial outcome in a timely manner.

[73] There is currently no precedent or persuasive evidence supporting terrestrial capping of a tailings deposit with the characteristics and at the scale of the proposed DDA. Further, a final decision on water capping in 2069 may effectively preclude any possibility of a terrestrial closure outcome due to technology limitations, settlement, time, cost, and material availability.

[74] The AER expects that operators will have an understanding of how treated tailings deposits will perform at closure well in advance of initiating closure activities. Fort Hills should understand the timeframe and costs to achieve closure outcomes. Even though Fort Hills is not proposing to make the closure decision until 2069, the creation of the single deposit is proposed to start in 2024. Therefore, it is necessary to investigate potential end of life performance issues now.

[75] The current maturity of PASS technology and the evidence needed to support the proposed DDA's long-term reclamation outcomes are not sufficiently proven to merit its sole selection for the life of the Fort Hills Mine. The AER has identified PASS uncertainties as a high risk and is therefore not permitting Fort Hills to execute its TMP as proposed.

[76] Fort Hills requires time to test the performance of its tailings treatment technology in a deposit representative of the proposed DDA and to obtain evidence to provide assurance that the *TMF* outcomes can be met. As such, the AER is authorizing a demonstration of phase 1 of the PASS technology. As noted, aquatic closure concerns are being addressed through a number of approval conditions but the ability to terrestrially reclaim a deposit created by phase 1 of PASS technology at the scale of the proposed DDA is unknown. Therefore, the demonstration must target a terrestrial closure outcome. The AER expects that the demonstration will focus on addressing site-specific uncertainties to ensure that the *TMF*'s objective and outcomes are met and that reclamation timelines are not extended.

[77] The required demonstration must be a deep deposit (approximately 40 metres) located in the South Pit. The depth should be sufficient to be representative of and allow Fort Hills to draw correlations to future proposed deposits (e.g., proposed DDA). Further, the deposit formed for the demonstration cannot exceed a volume of 40 Mm^3 of tailings treated by the PASS technology.

[78] The AER believes that such a deposit should allow Fort Hills to confirm phase 1 PASS technology assumptions; be indicative of treated tailings deposit performance in a larger scale deposit, such as the proposed DDA; and should be of a sufficient scale to assess risks and uncertainties with the ability to create a terrestrial closure outcome in a timely manner.

[79] Fort Hills is required to submit a plan for the demonstration by September 30, 2021. The timing for this submission allows time for the AER to consider and evaluate the suitability of the demonstration and ensure Fort Hills has sufficient time to construct and operate the demonstration prior to the updated TMP. As authorization to construct the demonstration is pertinent to the AER's decision-making authority under both *OSCA* and *EPEA*, provisions have been added to both the *OSCA* and *EPEA* approvals. In the draft conditions of approval issued for feedback, the AER prohibited phase 1 activities from being conducted without further approval. Some SOC filers were supportive of this. The AER has adjusted this prohibition to allow for phase 1 activity to occur for the demonstration only.

[80] Fort Hills' demonstration research must provide timely and site-specific information with respect to

- the implementation and performance of phase 1 of PASS technology in a deep, in-pit deposit and
- constraints or limitations to establishing a self-sustaining terrestrial boreal forest ecosystem.

[81] The AER expects the results of this demonstration and the DPL at Suncor's Millennium Mine will provide critical information to understanding the long-term viability of the PASS technology. If performance is not demonstrated or limitations to achieve closure outcomes are too restricting, Fort Hills will need to adjust its tailings treatment technology selection to ensure the *TMF*'s objective and the long-term reclamation outcomes can be achieved.

[82] Fort Hills must provide details that support its research, including the design of the demonstration, the objectives, and applicability of the design and objectives in addressing the uncertainties and risks associated with PASS technology and the terrestrial outcome option. The AER expects Fort Hills to use standard scientific methodology in the design of its research plan. Fort Hills should consider the benefits of peer-reviewed research. The requirements for the research and design details of the demonstration can be found in the *OSCA* approval.

[83] All research plans should include the following:

- a rationale for proposed monitoring that supports research;
- a discussion of how the selection of performance measures, criteria, and validation methods relate to implementation;
- the applicability and scalability of the research to full implementation; and
- a discussion on impact to long-term reclamation outcomes and timing for the mine.

[84] Research results will be made publicly available through the *Directive 085* annual report to the AER.

[85] Based on the contingencies identified by Fort Hills for thickener and enhanced beach capture underperformance, Fort Hills has indicated the possibility of commencing treatment and placement in advance of that planned timeframe (i.e., 2024). Therefore, the AER encourages Fort Hills to consider commencement of the demonstration prior to 2024 to ensure there is sufficient evidence to inform regulatory decisions related to the new fluid tailings profile's foundational elements.

[86] Under its *EPEA* approval, Fort Hills is also required to submit a plan for capping and terrestrial closure of the demonstration. Based on the fluid tailings production information provided by Fort Hills, the AER expects that the demonstration's deposit will take about 3 years to create. As in some cases, deposits can be capped within one year of final placement, the capping and terrestrial closure plan is required within two years from the commencement of the demonstration, or at least 12 months prior to capping, whichever date occurs first. This allows for sufficient time to evaluate the capping plan and modify the tailings deposit accordingly. This plan is a continuation of the research plan for the demonstration, focused on the capping and closure aspects, and therefore must and should provide similar details to other required research plans. The requirements for the capping and closure of the demonstration can be found in the *EPEA* approval.

[87] As the AER is only authorizing the demonstration and is restricting the volume of fluid tailings treated through phase 1 of the PASS technology to be placed in the South Pit to 40 Mm^3, Fort Hills is required to submit an amendment application for an updated TMP. The updated TMP is required by September 30, 2026, or within two years from the commencement of the demonstration, whichever date occurs first. The timing of the application is intended to provide Fort Hills with time to reduce uncertainties and obtain operational data from the demonstration and from the implementation of other tailings treatment technologies, research results from the demonstration and any other relevant research, and other evidence to support its technology choice and RTR criteria. Fort Hills is required to explain how this site-specific information, combined with Fort Hills' and other operators' fluid tailings research and results, have been incorporated into the updated TMP. The AER has set out a list of requirements for the updated TMP in the *OSCA* approval. A submission, in conjunction with the updated TMP, is also required under *EPEA*. The content of this submission is addressed in the "Surface Water and Groundwater" section.

[88] In the draft conditions of approval issued for feedback, the AER originally required an updated TMP by 2022. However, with the demonstration expected to start by 2024, the AER believes it is appropriate to receive the updated TMP in between the commencement of the demonstration and its conclusion.

[89] In addition to the research reporting required under *Directive 085* and the updated TMP submission, *Directive 085* requires operators to report on technology and deposit performance annually. Fort Hills must include, as part of this annual report, an update on fluid tailings management options

being evaluated to support the updated TMP. The AER expects that this assessment will include technologies, deposition strategies, and deposit design and configurations.

[90] If the uncertainties in Fort Hills' TMP (e.g., demonstration performance, single technology, single deposit, aquatic outcome) are not adequately addressed there are increased risks, including risks to Fort Hills (e.g., financial, reputational). If these uncertainties cannot be resolved or mitigated in suitable timeframes, or if the demonstration or future tailings deposits underperform, it is Fort Hills' responsibility to modify the TMP and manage its tailings deposits to achieve the *TMF* outcomes. Like every operator, Fort Hills is required to achieve a stable landscape and a diverse, locally common, and self-sustaining ecosystem, as established in the *TMF* outcomes.

PASS Technology – Phase 2, 3, and 4

Context

[91] Water capping technology involves the placement of water above untreated or treated tailings for the purpose of creating a water-capped deposit as a closure landscape feature ("water-capped pit lake"). Fort Hills stated that it does not use water capping as its tailings treatment technology. Rather, Fort Hills stated that it places an aquatic cover and that the tailings deposit is aquatically closed.

[92] However, after all treated tailings have been placed, Fort Hills plans to cap the proposed DDA with water in phase 2 of the PASS technology process to form an aquatic closure landscape. Phase 3 is controlled water flow return and phase 4 is water return under natural flow and pit lake development.

- Phase 2: placement of an aquatic cover (water cap) – 2073 to 2083
- Phase 3: controlled water return – 2083 to 2093
- Phase 4: water return under natural flow and pit lake development – 2093 onwards

Decision Summary and AER Findings

[93] SOC filers expressed concern with end-pit lakes and water-capped pit lakes.

[94] While Fort Hills maintains that it is not using water capping, the AER understands that phase 2 of the PASS technology process involves placing water above treated tailings for the purposes of creating a water-capped deposit as a closure landscape feature. The AER is of the view that this is, in effect, a water-capped pit lake.

[95] There are various uncertainties and risks associated with water capping. As a consequence, water capping is subject to further assessment, research, and future policy. Fort Hills' approval prohibits the creation of water-capped pit lakes and phase 2, 3, and 4 activities. Fort Hills and some SOC filers were supportive of this prohibition.

[96] The AER recognizes that extensive research on water-capped pit lakes continues and the Government of Alberta will likely be developing policy for water capping technology and water-capped pit lakes. If the feasibility of water-capped pit lakes is demonstrated and the Government of Alberta implements policies permitting their use, Fort Hills would need to apply to the AER to amend its approvals. Fort Hills may continue to plan on the basis that water-capped pit lakes are an option unless water-capped tailings technology proves to not be feasible and/or Government of Alberta policy does not allow it.

[97] The AER also recognizes that there is currently research on PASS technology and water capping occurring at the Suncor Millennium Mine. The AER expects that any research plans, whether they are concerned with water capping, the PASS technology, or some other matter, will focus on addressing site-specific uncertainties to ensure that the *TMF*'s objective and outcomes are met and that reclamation timelines are not extended. Fort Hills has not provided sufficient information for the AER to determine if the current research on PASS technology and water capping research, or the extensive research that continues on water-capped pit lakes, will address Fort Hills Mine site-specific uncertainties, such as the treated tailings deposit design and scale.

[98] To ensure that the AER has the most current information available to inform future decisions on water-capped pit lakes and PASS technology, Fort Hills is required, as part of its end-pit lake research and development report required under its *EPEA* approval, to:

- identify research required to address physical, chemical, and biological performance measures and criteria
- identify research that confirms or contradicts the predicted behaviour of tailings or treated tailings and resolves uncertainties about the behaviour of tailings within a pit lake
- provide the results of any other relevant research
- assess the applicability of research results to the Fort Hills Mine and identify how and when Fort Hills will address uncertainties where the research is not applicable

[99] The AER expects that the information gathered will address uncertainties and risks associated with phase 2, 3, and 4 of PASS technology and with water capping, including contaminant mobility, water cap thickness and implications to lake sustainability and performance, lake ecosystem and use limitations, associated activities necessary beyond the end of mine life, and liability management. Additional information on the AER's concerns with the sustainability of Fort Hills proposed water-capped pit lake, the South Pit Lake, are in the "Surface Water and Groundwater" section.

Feasible Alternative

Context

[100] The *TMF* states that "…until it is determined whether or not the technology is a successful treatment method, plans will be required to consider alternatives" and "…technologies that have yet to be proven will require contingency plans for treatment, including alternative technology options for meeting requirements."

[101] While Fort Hills described the technologies it evaluated in determining its proposed TMP, Fort Hills did not provide an alternative to PASS technology or to creating a water-capped pit lake, indicating that it believed the plan provided the best outcome.

Decision Summary and AER Findings

[102] SOC filers raised concerns with the lack of an alternative technology. As previously described, the AER believes that PASS technology has yet to be proven. As the *TMF* requires alternatives where technology is not yet proven, Fort Hills is required to provide, by September 30, 2023, feasible alternative treatment technologies and an implementation plan to manage the volume of fluid tailings planned to be treated by the PASS technology and subsequently water capped.

[103] The AER acknowledges that Fort Hills provided descriptions of technology alternatives to PASS technology as part of application 1881219. However, the description of alternatives provided to justify the selection of PASS technology does not constitute a feasible alternative technology and implementation plan for the Fort Hills Mine. The alternative provided must meet the *TMF*'s outcomes and *Directive 085* requirements, including RTR criteria and identification of risks and uncertainties and associated mitigation measures.

[104] In the draft conditions of approval issued for feedback, the AER originally required the alternative by 2019. The AER acknowledges that some SOC filers were supportive of obtaining the alternative in 2019. However, the AER is now requiring the alternative by 2023, in light of the following:

- Treatment of fluid tailings is not planned to commence until 2024. The submission of the alternative is still one year prior to treatment of fluid tailings and deposition in the South Pit.
- A demonstration of phase 1 of PASS technology, with a terrestrial outcome, is required.
- The timing provides Fort Hills with an ability to focus on the demonstration.
- Additional information on PASS technology will be available through its operation at Suncor's Millennium Mine.
- The timing aligns with Fort Hills' *EPEA* renewal.

Tailings Solvent Recovery Unit (TSRU) Tailings

Context

[105] In the froth treatment plant, paraffinic solvent is added to froth to help separate bitumen from water and solids. The water and solids (i.e., tailings) from the froth treatment plant are sent to the TSRU to recover the paraffinic solvent. Once the tailings are processed by the TSRU, they are known as TSRU tailings. Although TSRU tailings generally account for less than 10 per cent of the total fluid tailings generated, these tailings can pose higher environmental risks because they can contain residual paraffinic solvent, other hydrocarbons, and sulphides.

[106] Fort Hills proposed to place TSRU tailings in the west side of the OPTA until end of mine life (2063).

Decision Summary and AER Findings

[107] The AER is concerned with the management of TSRU tailings as these tailings pose unique risks and uncertainties. SOC filers raised concerns with the risks associated with TSRU tailings, the management of tailings that come in contact with TSRU tailings, and the risks associated with water-capped pit lakes such as end-pit lake water quality and sediment quality.

[108] Fort Hills is not permitted to place TSRU tailings in any deposit except the OPTA. However, as some of the fluid tailings generated by TSRU tailings and the TSRU tailings are being deposited in OPTA, which contains fluid tailings that are then treated, substances of concern in TSRU tailings could migrate beyond OPTA and be placed in the proposed DDA. Where TSRU tailings are introducing risk, mitigation would be required.

[109] Fort Hills' measurement system plan is required to include identification of substances of concern in TSRU tailings, and measurement location and measurement methodology for substances of concern. The measurement system plan would verify if Fort Hills is effectively controlling the movement of substances from the TSRU tailings, and should be used to measure substances of concern that pose risks to any long-term reclamation outcomes (e.g., aquatic, terrestrial, wetland). The AER expects that Fort Hills will leverage the knowledge gained from other mineable oil sands operators and mines to identify known TSRU tailings markers and deposit sampling methodologies to identify areas that may require increased monitoring in the future.

[110] Given the limited information on TSRU tailings provided, it is uncertain how Fort Hills will manage the risks to the surrounding environment and long-term reclamation outcomes from TSRU tailings placed in OPTA.

[111] While the AER notes that TSRU tailings placement is only permitted in OPTA at this time, the risks from the migration of substances of concern from TSRU tailings may need to be managed or

mitigated in other tailings deposits. Further, Fort Hills is early in its operations and may propose to place or move TSRU tailings into other deposits in the future. This could include the treatment of TSRU tailings or the placement of TSRU tailings in a deposit that could be water capped. Fort Hills has not provided sufficient information for the AER to determine whether the existing PASS technology or water capping research will address Fort Hills Mine's site-specific uncertainties, such as the management of risks from the substances of concern in TSRU tailings to long-term reclamation outcomes. Prior to Fort Hills' proposing to place or move TSRU tailings from OPTA, the AER expects Fort Hills to address the site-specific uncertainties associated with reclamation of deposits containing TSRU tailings or substances of concern in TSRU tailings.

[112] Fort Hills is required to address the uncertainties with and treatment of TSRU tailings in an update on TSRU tailings management by September 30, 2023. The update must provide the composition and properties of the various tailings streams, including fluid tailings, in the deposit where TSRU tailings will be placed (i.e., OPTA), evaluate options for the treatment and placement of TSRU tailings including fluid tailings from TSRU tailings, describe any changes being evaluated for how Fort Hills is managing its TSRU tailings, evaluate the impact TSRU tailings has to the performance of tailings treatment, and explain how research results relevant to the Fort Hills' TSRU tailings have been incorporated. This update is coordinated with the submission of an update under *EPEA* that is required with the renewal application (by November 15, 2023). An update under *EPEA* is also required by September 30, 2026, which is coordinated with the submission of the updated TMP application. The submissions under *EPEA* are expected to address risks posed by TSRU tailings to long-term reclamation outcomes and targeted ecosites.

[113] In the draft conditions of approval issued for feedback, the AER originally required the TSRU tailings update by 2022. However, the AER is now requiring the TSRU tailings update by 2023 to provide Fort Hills with the ability to focus on the demonstration and to align with the Fort Hills' *EPEA* renewal.

[114] Further, Fort Hills continues to research tailings and reclamation under its *EPEA* approval. The AER anticipates this research will address site-specific TSRU tailings risks and uncertainties, such as the environmental effects of paraffinic froth and the effects to each targeted long-term reclamation closure option.

Storage

Context

[115] Site-wide storage space is needed to contain and manage fluid tailings, treated tailings, and water, including industrial wastewater. Where on-site storage capacity is exceeded, there is the potential to compromise tailings management, increase land disturbance, require the construction of additional storage facilities, sterilize resources, delay progressive reclamation activities, and impact dam safety.

[116] Fort Hills has provided its planned fluid storage capacity requirements and planned storage capacity availability at Fort Hills from 2017 to 2073.

Decision Summary and AER Findings

[117] The AER is concerned that Fort Hills may require additional storage capacity than predicted because

- there is limited information on the ore beyond the immediate area of mining activity;
- detailed in-pit design will continue to occur as the mine progresses, including the placement of material on the South Pit floor to minimize the interaction between the Basal and Devonian groundwater and any materials to be placed in the South Pit;
- there is limited information on thickener and enhanced beach capture performance, which may result in more fluid tailings generated than predicted;
- tailing treatment technology and deposit performance is uncertain; and
- the storage capacity requirements for nonfluid tailings (e.g., industrial wastewater) were not provided.

[118] These uncertainties could affect the available storage capacity and require more fluid storage than predicted. The AER expects Fort Hills will continue to verify and update its storage planning assumptions and storage activities as the Fort Hills Mine progresses.

[119] Fort Hills is required to report annually on the available storage capacity of each tailings deposit or pond that contains water or tailings, and to estimate the storage volume requirements for the next five years. Such reports should denote the available storage capacity of each structure with time, as well as identify the volume of all fluid tailings, nonfluid tailings, and water intended to be placed within each respective structure.

[120] Further, given the uncertainties associated with fluid tailings generation, fluid tailings treatment technology and deposit performance, and available storage, and as Fort Hills is only proposing a single deposit to manage its treated tailings, Fort Hills is required to identify contingency placement locations for treated tailings deposits in the updated TMP. The AER recognizes that additional information may be available at the time of the updated TMP to reduce the current uncertainties.

Pilots, Prototypes, and Demonstrations

Context

[121] Innovation is a principle of the *TMF* and *Directive 085*.

[122] Fort Hills indicated that it will continue to participate and leverage existing research initiatives, and continue to monitor for possible improvements to fluid tailings treatment performance. Fort Hills also highlighted the development work it is involved in (e.g., DPL at Suncor Millennium Mine, treatment wetland field pilot).

Decision Summary and AER Findings

[123] The AER recognizes that there are a number of research projects that Fort Hills is involved with to improve its knowledge around fluid tailings treatment and reclamation, as well as to validate its proposed PASS technology. In addition, the AER is requiring a demonstration at the Fort Hills Mine.

[124] In addition to the required demonstration, Fort Hills is expected to continue to innovate. To facilitate innovation at Fort Hills and to address administrative inconsistencies between *OSCA* and *EPEA*, the AER has updated the requirements in Fort Hills' *OSCA* approval to be consistent with the principles of the *TMF* and *Directive 085*, and the requirements under *EPEA*.

[125] Fort Hills is required to notify the AER six months in advance of any proposed on-site pilots, on-site prototypes, or on-site demonstrations. Fort Hills may not construct or implement any proposed on-site pilots, on-site prototypes, or on-site demonstrations unless a written authorization or approval amendment is granted.

[126] The AER continues to support and acknowledge the importance of technological innovation, understanding, and certainty concerning fluid tailings treatment options.

Ready-to-Reclaim (RTR) Criteria

[127] As stated in the *TMF* and *Directive 085*, fluid tailings are considered RTR when they have been processed with an accepted technology, placed in their final landscape position, and meet performance criteria (i.e., RTR criteria).

[128] RTR criteria support the objective of reclaiming oil sands mining projects to self-sustaining locally common boreal forest ecosystems that are integrated with the surrounding area and consistent with the values and objectives identified in local, subregional, and regional plans.

[129] RTR criteria are used to track the performance of a tailings deposit towards its ability to be reclaimed as predicted and in the time predicted. Consequently, RTR criteria are critical in evaluating trends and managing performance.

[130] There are two subobjectives that address different aspects of performance:

- Subobjective 1: The deposit's physical properties are on a trajectory to support future stages of activity.

- Subobjective 2: To minimize the effect the deposit has on the surrounding environment and ensure that it will not compromise the ability to reclaim to a locally common, diverse, and self-sustaining ecosystem.

The *TMF* and *Directive 085* allow operators to develop RTR criteria that are suitable to their type of tailings, technology, deposit, and future reclamation activities. *Directive 085* provides guidance on RTR criteria and requires operators to include information that supports their choice of RTR criteria.

Subobjective 1 and Subobjective 2 RTR Criteria

Context

[131] Fort Hills proposed the following RTR criteria:

- Subobjective 1: clay to water ratio (CWR) ≥0.5 annual average basis
- Subobjective 1 and 2: total suspended solids (TSS) ≤500 parts per million (ppm) annual average basis

Decision Summary and AER Findings

[132] The AER has authorized a demonstration only and has not authorized Fort Hills' proposed use of PASS technology, the proposed DDA, or the preferred aquatic outcome for the proposed DDA (i.e., a water-capped pit lake). As such, the AER is not authorizing RTR criteria as it is considered premature at this time. Further, the AER has concerns with respect to the proposed RTR criteria. The AER considered the following when making this decision:

- A demonstration of 40 Mm^3 is authorized.
- RTR is a new concept, and modifications to RTR criteria or new RTR criteria are expected.
- Fort Hills did not propose to commence treatment and placement of tailings, and therefore meet RTR criteria, until 2024. RTR status cannot be achieved until treatment and placement commences *and* RTR criteria are met.
- Significant research and monitoring results related to the PASS technology, the treated tailings deposits formed by PASS technology, and the Fort Hills Mine fluid tailings, are expected to be obtained between now and 2024.
- Research and monitoring results will inform and lead to modified or new RTR criteria.
- The proposed RTR criteria
    - do not provide assurance that the performance of the deposit, including its physical properties, is on a trajectory to support future stages of activity or achieve the deposit's targeted ecosites;

  - do not appear to be able to track deposit variability, which may be significant considering the size of the proposed deposit and the degree of uncertainty in the predicted PASS deposit performance; and
  - appear to only support an aquatic closure outcome, which is subject to further assessment, research, and future policy.
- No long-term treated tailings deposit properties were assessed to provide assurance that the tailings deposit could achieve stable targeted ecosites and the *TMF*'s outcomes.
- The use of an annual average limits the ability to assess risks and liabilities for underperforming deposits and the effect on a deposit's performance towards the targeted ecosites. The averaging process obscures meaningful understanding of the deposit volumes that have been treated unsuccessfully or are failing to improve as expected.

[133] In accordance with *Directive 085*, where treated tailings meet their RTR criteria, they can be removed from the fluid tailings inventory because they are on a trajectory to meet long-term reclamation outcomes. Fort Hills cannot remove treated fluid tailings from the fluid tailings inventory at this time until RTR criteria are authorized. The *OSCA* approval will need to be revised to include RTR criteria for each tailings deposit that contains treated fluid tailings. Once RTR criteria are established, in circumstances where RTR criteria are no longer met or there is a deviation from the expected trajectory, Fort Hills must identify the volume not meeting the RTR criteria and the degree of nonperformance.

[134] Fort Hills is required to provide RTR trajectory and criteria, supported by evidence, as part of the updated TMP. The timing for this is expected to allow Fort Hills to incorporate its research results and lessons learned into its future proposed RTR criteria.

[135] The AER recognizes that by not authorizing RTR criteria at this time there is a potential that fluid tailings volumes may exceed a new fluid tailings profile threshold. Where a threshold is exceeded, the AER will take the appropriate management action.

Measurement

Context

[136] *Directive 085* requires operators to submit a measurement system plan six months from the date of an approved TMP.

Decision Summary and AER Findings

[137] As no RTR criteria have been authorized at this time, the AER does not expect the measurement system plan will address RTR criteria. However, Fort Hills is required to develop a measurement system

plan for fluid tailings volume and TSRU tailings monitoring (see appendix 4 for requirements). The measurement system plan must include:

- definitions of parameters for fluid tailings;
- reference to standards and procedures used to measure fluid tailings and treated tailings;
- an explanation of and justification for measurement procedures that are unique to Fort Hills and its plan;
- evidence that the plan will address the measurement outcomes as per section 5 of *Directive 085*;
- an explanation of how each deposit will be measured using deposit sampling, calculated, and reported;
- a description of the fluid and TSRU tailings deposit sampling, measurement, and survey program; and
- justification of how measurement, sampling, and spacing intervals will
  - identify any characteristic markers that specifically indicate the presence of TSRU tailings,
  - show the variation of the fluid and TSRU tailings deposit properties, and
  - identify if any material in the tailings deposit is not performing to expectations.

[138] The measurement system plan will also need to be updated as appropriate for the demonstration. The AER encourages Fort Hills to submit as much detail as possible on the measurement system plan for the demonstration with the demonstration plan in 2021.

Deposit Milestones

Context

[139] *Directive 085* provides that approval terms and conditions will address fluid tailings deposit milestones. *Directive 085* requires applicants to identify critical milestones for each deposit including deposit preparation, start of fluid tailings placement, capping, and start of further reclamation activities.

Decision Summary and AER Findings

[140] A summary of the milestones, along with the various plans and updates required by the approval, are in appendix 3. As Fort Hills' proposed capping and further reclamation activities are subject to future regulatory decisions, the AER has not identified these timelines in appendix 3.

Environmental Effects and Implications

[141] The *TMF*'s objective is to minimize fluid tailings accumulation, which may reduce environment effects such as seepage, occurrences of wildlife contact with tailings ponds, and the tailings footprint.

Context

[142] Efforts to minimize fluid tailings volumes may result in potential changes or trade-offs to other environmental risks and effects to air, land, and water. These changes or trade-offs must be identified and their short-term and long-term implications to environmental performance assessed. The identity, nature, location, and magnitude of environmental effects and implications need to be understood.

[143] For approved projects, the proposed TMP should be consistent with the previously predicted environmental outcomes or identify any inconsistencies. The existing and proposed monitoring plans will confirm that environmental performance is achieved.

[144] TMPs, including mitigation measures and contingency plans, will minimize the risk of environmental effects over the life of a project.

[145] The following sections do not explicitly describe non-tailings related matters considered under *OSCA* application 1881217, *EPEA* application 010-151469, and *Water Act* applications 023-00151636 and 010-00190012, filed by Suncor on behalf of Fort Hills to amend its existing *OSCA*, *EPEA*, and *Water Act* approvals.

Air

[146] Fort Hills concluded that the changes in the TMP would result in reductions from previously assessed air and odour emissions.

[147] FMMCA and ACFN raised concerns with air quality and the air quality assessment, specifically the level of detail for fugitive emissions quantification. Fort Hills did not request any changes to air emission limits in the *EPEA* approval, or air emission source monitoring and reporting requirements. No air emissions limits in the *EPEA* approval are being amended as a result of the applications. The AER encourages Fort Hills to discuss fugitive emissions with FMMCA and ACFN, and expects that the effectiveness of its operations in reducing fugitive emissions is addressed in its *EPEA* renewal (by November 15, 2023). The demonstration also provides an opportunity for Fort Hills to research and validate any uncertainties regarding fugitive emissions.

[148] The AER recognizes there is ongoing work on *Recurrent Human Health Complaints Technical Information Synthesis Fort McKay Area* (September 2016), which may result in modified or new conditions related to odours and emissions.

Surface Water and Groundwater

[149] Many SOC filers expressed concerns about water management and water quality, including surface water and groundwater control measures, water capping, the McClelland Lake Wetland Complex, and the effects of climate change.

[150] Fort Hills' plan to operate its thickeners and place the thickened tailings in OPTA is consistent with its previous approvals. As part of the TMP, Fort Hills did not propose to alter the existing surface water and groundwater control measures for OPTA during operations, which manage surface water and groundwater risks during the operating phase. However, the AER acknowledges that Fort Hills will be expanding surface water and groundwater control measures (e.g., perimeter groundwater seepage collection system) to the expanded OPTA area. Fort Hills must continue to operate these control measures to manage risks to water quality in accordance with the terms and conditions of its *EPEA* approval. The AER expects that surface water and groundwater control measures, including duration, will continue to be addressed in Fort Hills' *EPEA* renewal applications and life of mine closure plan.

[151] With respect to long-term surface water and groundwater, Fort Hills provided a water quality assessment. The results of the assessment indicated that concentrations of some parameters are higher than previously predicted, largely due to change in the closure plan (e.g., pit lake size, amount of tailings sand at surface). Fort Hills characterized the magnitude of change as small.

[152] At this time, Fort Hills' water quality model assessment lacks the necessary detail to evaluate the uncertainties and risks concerning water quality, the viability of the water-capped pit lake, the effect of source water quality on the viability of the water-capped pit lake, and the ability of the water-capped pit lake to become a self-sustaining boreal forest lake ecosystem. Fort Hills is required to continue to research pit lakes and evaluate the risks to and uncertainties regarding water quality as part of its *EPEA* approval.

[153] Further, the AER notes that the Government of Alberta has not accepted the use of chronic effects benchmarks or other guidelines as water quality limits for discharge to the receiving environment and that further policy direction from the Government of Alberta for water quality in pit lakes and releases is expected. The AER recognizes that Fort Hills will continue to update its water quality assessments, and expects that Fort Hills will modify these assessments in accordance with future Government of Alberta direction. Updated water quality assessment results and achieving the *TMF*'s outcomes need to be considered in updates to the TMP, including the evaluation of fluid tailings treatment and management options.

[154] The AER is concerned with the feasibility and sustainability of the proposed water-capped pit lake, South Pit Lake, for the following reasons:

- To sustain this water-capped pit lake, Fort Hills indicated
  - an increased reclamation watershed area, and
  - a possible need to design for increased water supply to the water-capped pit lake from surface areas (e.g., CPTA).

- Fort Hills indicated a reduced volume of water going to the McClelland Lake Wetland Complex post end of mine life (e.g., at closure).
- With respect to the area of the water-capped pit lake and the relationship to wind disruption, there was insufficient information provided to evaluate risks to achieving or mitigating the depth of the water cap.
- Fort Hills provided a range of depths for the water cap, which the AER is concerned could be highly variable due to PASS technology and deposit uncertainties. Further, as Fort Hills has limited contingency space for treated tailings, the ultimate depth of the water cap is uncertain, which may impact
  - the sustainability of the water-capped pit lake;
  - types of substances of concern and the water quality expressed from the deposit to the water cap;
  - the performance of the water to prevent resuspension or mobilization of substances of concern, allow for bioremediation of some substances of concern, and dilute some substances of concern; and
  - the achievement of a lake ecosystem in a timely manner.
- There was insufficient information to determine the sensitivity and resilience of the water-capped pit lake to long-term hydrological sustainability under late 21st century regional climate change scenarios developed by the *Intergovernmental Panel on Climate Change*.

[155] The AER requires more information to determine whether risks to the feasibility and sustainability of the water-capped pit lake are manageable, and whether the water-capped pit lake's needs can be balanced by the need to also sustain the McClelland Lake Wetland Complex. Therefore, Fort Hills is required to provide an updated assessment of the long-term hydrological sustainability of both the water-capped pit lake and the McClelland Lake Wetland Complex by September 30, 2023. This assessment must address water levels and hydrological connectivity and results modelled from a range of late 21st century regional climate change scenarios developed by the *Intergovernmental Panel on Climate Change*. This assessment must be updated and submitted with the updated TMP.

[156] Further, there are also long-term performance risks and uncertainties with the PASS technology and the performance of the proposed DDA as an aquatic closure ecosystem. Therefore, if Fort Hills continues to propose creating a water-capped pit lake in 2026, Fort Hills' submission must also include the following:

- A preliminary pit lake design and feasibility study based upon results of existing required research. As part of this study, Fort Hills is required to assess whether the research results are applicable to the

Fort Hills Mine's site-specific situation, including tailings, the tailings deposit, and the reclamation outcomes, including lake uses and ecosystem type.

- An update to the 2023 assessment of the long-term hydrological sustainability of both the water-capped pit lake and the McClelland Lake Wetland Complex.
- Identification of any remaining uncertainties for water-capped pit lake research, including an explanation and timelines for how the uncertainties will be addressed.

Tailings Water Release

[157] Fort Hills did not seek authorization to release water from Fort Hills Mine as part of its TMP application.

[158] Water release from the Fort Hills Mine is not authorized except in accordance with Fort Hills' *EPEA* approval.

[159] Fort Hills is required to continue to research and evaluate the risks to and uncertainties respecting tailings water release as part of its *EPEA* approval.

Other Technical Issues

[160] This section contains technical issues that do not fit into the previous sections.

Capping

Context

[161] Adequate capping material, such as tailings sand, is necessary for landform contouring and stability. It provides, among other things, increased tailings deposit strength and trafficability, manages settlement, controls the location of the groundwater table, controls surface water drainage, and prevents tailings pore water from contaminating reclaimed areas.

[162] Fort Hills requires tailings sand for the following activities:

- infill beaching;
- construction for the purposes of building dams and tailings containment structures; and
- tailings deposit capping.

Decision Summary and AER Findings

[163] Fort Hills' ability to meet *TMF* outcomes and future reclamation outcomes will be compromised if there are insufficient capping materials.

[164] Fort Hills must ensure there is adequate tailings sand, or other types of capping material, available to supports its activities. Pursuant to its *EPEA* approval, Fort Hills is required to prepare its life of mine closure plan and mine reclamation plan 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* (*SED003*), as amended. *SED003* requires the following to be a part of the plans:

- capping material types, objectives, and implications to developing long-term reclamation outcomes;
- material balances for sand and any other suitable capping materials; and
- mitigation plans for capping material shortages.

[165] *SED003* also addresses annual reclamation progress tracking reports, under which Fort Hills is required to provide material balances for sand and any other suitable capping materials to meet terrestrial and wetland outcomes.

[166] Fort Hills is also required to submit a capping research plan by September 30, 2023 for its deposits containing coarse sand tailings, thickened tailings, and TSRU tailings. Fort Hills' research must provide timely and site-specific information with respect to capping material needs and availability, and how shortages may affect alternative tailings treatment technology selection or future reclamation activity.

[167] FMMCA and McMurray Métis indicated that capping information should already exist within the mineable oil sands industry. FMMCA also expressed its support for a capping research plan that clearly identified unknowns and would demonstrate how progress would be made to mitigate site-specific uncertainties. The AER acknowledges that the industry and Fort Hills have provided some capping research information. However, there are gaps in that information. With respect to Fort Hills, it did not specify what uncertainties associated with the TMP the research is planning to address with respect to how capping material shortages may affect tailings treatment technology selection, future reclamation activity, or the achievement of the *TMF*'s outcomes. The AER's expectations regarding research plans are set out in the PASS Phase 1 section and equally apply to capping research.

[168] The AER acknowledges that both the *OSCA* and *EPEA* approvals have requirements related to research; however, their purposes are different. The *OSCA* research requirements require Fort Hills to define its research programs to ensure that they are focused on addressing uncertainties in the TMP, including definition of the goals and timing of the research plan. The *EPEA* research requirements are focused on identifying issues and providing reporting requirements. The research requirements in *OSCA* do not define how the research must be conducted. Rather, they require that the research conducted address relevant issues and uncertainties in a timeframe that will enable future regulatory decisions.

[169] In the draft conditions of approval issued for feedback, the AER originally required the capping research plan by 2022. However, the AER is now requiring the capping research plan by 2023 to provide Fort Hills with the ability to focus on the demonstration and to align with the Fort Hills' *EPEA* renewal, which will include additional information related to capping, such as an updated life of mine closure plan.

[170] In addition to updating the AER annually on its capping research plan as part of the report required under *Directive 085* and updating on capping and stability as part of its tailings research report required under its *EPEA* approval, Fort Hills is required to explain how the results of capping research have been incorporated in the updated TMP. The AER expects that Fort Hills will explain whether the results of capping research impacts its tailings treatment technology selection (i.e., inform the need for any alternative or supplemental tailings treatment technology), targeted ecosites, future reclamation activity, or the ability to achieve the *TMF*'s outcomes.

OPTA, CPTA, and NPTA

Context

[171] OPTA is the primary storage area for fluid tailings, and receives thickened tailings, all TSRU tailings, and fluid tailings from CPTA and NPTA. OPTA commenced operation in 2017 and will operate until 2063 (end of mine life). Placement of fluid tailings in the CPTA is not planned to commence until 2030, with operation into the 2050s, and placement in the NPTA is not planned to commence until 2055, with operation until end of mine life.

[172] Since OPTA, CPTA, and NPTA are planned to store fluid tailings for a significant period of time, there is potential for a remnant volume of fluid tailings to be left in these area that will need to be reclaimed in place. These remnant volumes are expected to settle, resulting in tailings pore water seeping upward. This upward flux can cause a rise in the water table, contamination of soil cover, discharge to surface water drainage systems, and a change in the size, quality, and distribution of wetlands. This threatens both *TMF* and long-term reclamation outcomes.

Decision Summary and AER Findings

[173] The AER acknowledges that the tailings placed in OPTA, CPTA, and NPTA are not defined by Fort Hills as treated fluid tailings, as described under *Directive 085*. However, OPTA, CPTA, and NPTA will store fluid tailings prior to treatment. In addition, there is the potential that remnant volumes of fluid tailings will be left in place to be reclaimed within the tailings areas. Therefore, the critical role OPTA, CPTA, and NPTA have in tailings management make them relevant to the AER's decision on the TMP.

[174] Uncertainties regarding deposit settlement for OPTA, CPTA, and NPTA were not addressed sufficiently by Fort Hills.

[175] To better understand the risks to the *TMF*'s outcomes, Fort Hills is required to provide by September 30, 2023 for OPTA, and in future deposit plans for CPTA and NPTA, a consolidation model or engineering analysis. The model or engineering analysis is required to include any supporting information, including milestones, which the AER specifies. These models or analyses provide a basis to predict future settlement, flux, piezometric pressures, groundwater table levels, pore water discharge to surface drainage systems, and capping material requirements. Further, it is expected these models and analyses will provide additional information on the performance of OPTA against expectations, including volumes of fluid tailings in OPTA, future remnant volume predictions, and implications to the new fluid tailings profile.

[176] In the draft conditions of approval issued for feedback, the AER originally required the OPTA consolidation model or engineering analysis by 2022. However, the AER is now requiring the model or analysis by 2023 to provide Fort Hills with the ability to focus on the demonstration and to align with the Fort Hills' *EPEA* renewal, to incorporate any research results, and to align with other submissions required under *OSCA*, such as the capping research plan.

[177] Fort Hills' TMP provides limited information on the CPTA and NPTA. The AER expects tailings management to evolve between now and the commencement of tailings placement in these areas. As such, an updated plan is required one year prior to placement in each of CPTA and NPTA to ensure the AER is provided with the most current information.

[178] These future plans submitted for CPTA and NPTA must address basic information on the tailings deposits, including size, volume, duration, design, and chemical and physical properties; identify and justify the minimum and maximum volume of fluid tailings and water that will be stored; evaluate performance of similar deposits; and incorporate research results and the long-term reclamation outcomes.

[179] In the draft conditions of approval issued for feedback, the AER prohibited Fort Hills from expanding or modifying the CPTA to an aboveground facility unless an approval amendment or written authorization was provided. The intent of this draft condition was to address a site-specific future risk that the CPTA could be converted to an aboveground structure to manage fluid tailings storage capacity by ensuring future authorization would be required. There was substantial discussion regarding this draft condition at the meeting held on September 18, 2018. As there are existing controls to manage the site-specific future risk identified, including the future plans submitted for CPTA, *Water Act* requirements regarding dams, and *OSCA* requirements regarding geotechnical designs for structures, the AER has not included a condition explicitly prohibiting expansion or modification of the CPTA to an aboveground facility.

Remnant Volume

[180] Fort Hills indicated there would be a small volume of fluid tailings remaining in the tailings areas because of the difficulty in completely removing all fluid tailings from a tailings pond or deposit. The presence of remnant fluid tailings without RTR criteria does not comply with the *TMF*, which states that all fluid tailings must be in a RTR state within 10 years after the end of mine life.

[181] The AER recognizes that it is not technically feasible to remove all fluid tailings from a tailings pond or deposit. The volume that remains will require appropriate management to ensure reclamation outcomes can be achieved, including capping the tailings pond or deposit with suitable materials, reclamation material placement, and management for groundwater seepage. These issues will be addressed on an ongoing basis as part of Fort Hills' mine reclamation and life of mine closure plans.

TMP and OSCA Mine Plan Alignment

[182] *Directive 085* requires that TMPs include sufficient information to demonstrate alignment with existing approvals and plans, including the mine plan issued under *OSCA*. Where alignment does not occur, the applicant must identify the inconsistencies and describe how alignment will be achieved.

[183] To this end, Fort Hills' application 1881217 provided the mine plan changes to accommodate the TMP by decoupling mining and tailings activities, proposing to store all treated fluid tailings in one below grade deposit, and eliminating the need for multiple in-pit soft deposits.

TMP and EPEA Plan Alignment

[184] *Directive 085* requires that TMPs include sufficient information to demonstrate alignment with existing approvals and plans, including the *EPEA* life of mine closure plan. Where alignment does not occur, the applicant must identify the inconsistencies and describe how alignment will be achieved.

[185] To this end, Fort Hills' application 010-151469 provided the life of mine closure plan changes to accommodate the TMP.

[186] In light of the required demonstration, the TMP and the *EPEA* life of mine closure plan are not aligned. An updated life of mine closure mine is required at the time of the next *EPEA* renewal, which is expected in 2023. In addition to alignment of the TMP with the *EPEA* life of mine closure plan, the AER expects that long-term reclamation concerns are addressed at that time. Possible further revisions to the life of mine closure plan may also be required when the updated TMP is submitted.

[187] The AER has addressed other long-term reclamation concerns, such as the targeted reclamation outcome of the treated tailings deposit, the feasibility and sustainability of water-capped pit lakes, and sustainability of the McClelland Lake Wetland Complex, through other *EPEA* approval conditions. Matters regarding long-term reclamation concerns are also subject to future policy direction and decisions.

[188] The draft *EPEA* conditions of approval issued for feedback included updates to content for the life of mine closure plan and mine reclamation plan. After feedback was sought, the AER issued *SED003*. *SED003* incorporated the life of mine closure plan, mine reclamation plan, and annual reclamation progress tracking report content that appeared in the draft *EPEA* conditions of approval issued for feedback. The AER deemed it administratively desireable to replace section 3.6, 6.5, and 7.2 and modify section 7.3 of the *EPEA* approval in light of the newly issued *SED003*.

Additives

[189] McMurray Métis sought more information concerning the chemicals to be used at Fort Hills.

[190] Fort Hills provided information on the proposed coagulant, but did not update the information on the proposed flocculant for PASS technology. The historically identified flocculants and the newly identified coagulant for use for the PASS technology have been used in controlled circumstances without adverse effect, and are authorized for use to treat fluid tailings under Fort Hills' *EPEA* approval. Further details about the flocculants and coagulants proposed for the demonstration are expected as part of the demonstration plan in 2021. Fort Hills may also propose to change or introduce additional chemicals in the future. In that case, Fort Hills must obtain authorization or approval amendment from the AER prior to changing or introducing additional chemicals.

[191] As part of the TMP, Fort Hills did not address the additives used in the thickeners. The AER requires additional information on the additives being used by Fort Hills in the thickeners to confirm the type of polyacrylamide (appendix 5).

[192] Research requirements under Fort Hills' *EPEA* approval are expected to provide the necessary information concerning the long-term environmental uncertainties with and risks to the targeted ecosites associated with the polymers and additives. Fort Hills can and should also draw upon existing industry research.

Dam Decommissioning

[193] The AER is concerned that Fort Hills may not be able to decommission dams when tailings ponds and deposits still contain treated fluid tailings, even if those tailings deposits have achieved RTR status.

[194] In accordance with its *Water Act* approval, Fort Hills is required to submit a plan for decommissioning dams at least twelve months before commencing capping any tailings pond or deposit.

[195] Future work with respect to dam decommissioning may result in modified or new decommissioning requirements.

Conclusion

[196] Fort Hills' TMP presents significant risks to the achievement of the *TMF*'s objective and outcomes, as the plan is reliant on a single, yet to be proven tailings treatment technology (PASS) to create a single, in-pit tailings deposit (the proposed DDA) that is not closed until post end of mine life and proposed to be water capped. The approach in the approval granted by the AER reflects the *TMF* outcomes and a risk-based approach tailored to project-specific considerations. Further, the approval sets conditions that ensure appropriate information is captured in a timely manner to manage risk and inform appropriate regulatory decisions over the course of the Fort Hills Mine operation.

[197] The AER is concerned about the success of managing a TMP that is fully dependent on the success of a single tailings deposit, at the scale of the proposed DDA, and using a single tailings treatment technology that is in early stages of development. This concern is magnified by the fact that there are various risks and uncertainties associated with PASS technology, particularly long-term reclamation outcomes. Fort Hills' preferred aquatic closure outcome (i.e., a water-capped pit lake) is subject to further assessment, research, and policy, while the possibly of a terrestrial reclamation outcome was not supported by sufficient evidence.

[198] As such, the AER is currently not prepared to approve construction of or placement of treated tailings in the proposed DDA until the AER is satisfied that the risks are mitigated and feasible alternative plans exist. To allow Fort Hills an opportunity to obtain the necessary evidence to provide the AER with assurance of the ability of Fort Hills' TMP to meet the *TMF*'s objective and outcomes, the AER is requiring that Fort Hills conduct a demonstration of phase 1 of the PASS technology with a terrestrial reclamation outcome. The AER expects this demonstration to commence by 2024, and is requiring that Fort Hills submit feasible alternative treatment technologies and an implementation plan by September 30, 2023.

[199] The approval also requires Fort Hills to provide an amendment application for an updated TMP by September 30, 2026, or within two years from the commencement of the demonstration, whichever date occurs first. The primary issues of concern at that time will be whether the risks and uncertainties associated with the PASS technology in a single deposit have been reduced and long-term reclamation outcome feasibility and sustainability. If Fort Hills continues to propose a water-capped pit lake, the updated TMP must also include an update to the feasible alternative treatment technologies and an implementation plan.

[200] In alignment with the enhanced transparency and increased role of stakeholders and indigenous communities introduced by the *TMF* and *Directive 085*, the AER expanded the involvement of stakeholders and indigenous communities in the review of Fort Hills' TMP by circulating the draft approvals. That transparency continues through the approval terms and conditions.

[201] This approval takes a balanced approach to the continued involvement of stakeholders and indigenous communities. The approval requires Fort Hills to engage with stakeholders and indigenous communities about tailings management, including holding an annual forum and annually reporting on its engagement efforts to the AER. The approval also provides Fort Hills with the flexibility in who it engages with and how it undertakes its engagement activities.

[202] If the uncertainties in Fort Hills' TMP (e.g., demonstration performance, single technology, single deposit, aquatic outcome) are not adequately addressed there are increased risks, including risks to Fort Hills (e.g., financial, reputational). If these uncertainties cannot be resolved or mitigated in suitable timeframes, or if the demonstration or future tailings deposits underperform, it is Fort Hills' responsibility to modify the TMP and manage its tailings deposits to achieve the *TMF* outcomes.

[203] Like every operator, Fort Hills is required to achieve a stable landscape and a diverse, locally common, and self-sustaining boreal forest ecosystem, as established in the *TMF* outcomes.

Dated in Calgary, Alberta, on February 25, 2019.

Alberta Energy Regulator

Paul Ferensowicz
Senior Advisor
Alberta Energy Regulator

Appendix 1 Approval

COMMERCIAL SCHEME
Approval No. 9241H

MADE at the City of Calgary, in the Province of Alberta, on <*original dated*>	<*original signed*> ALBERTA ENERGY REGULATOR

IN THE MATTER of a commercial scheme of Fort Hills Energy Corporation (hereinafter called "the Operator") for the recovery of crude bitumen from the **Wabiskaw-McMurray Deposit in the Athabasca Oil Sands Area** located in the project area outlined in Appendix A of this approval.

WHEREAS the Operator has applied to the Alberta Energy Regulator (hereinafter called the "AER") to amend the approval for its commercial scheme under the *Oil Sands Conservation Act* in respect of the Mine Amendment and Tailings Management Plan; and

WHEREAS the AER is confining substantive changes in this Scheme Approval No. 9241H (hereinafter called "the Scheme Approval") to those arising from the Mine Amendment and Tailings Management Plan applications;

WHEREAS the AER deems it administratively desirable to consolidate the Scheme Approval and all previously issued amendments to the Scheme Approval granted under the *Oil Sands Conservation Act* and to make housekeeping amendments for the sake of clarity and consistency.

Therefore, pursuant to Section 13 of the *Oil Sands Conservation Act*, being chapter O-7 of the Revised Statutes of Alberta 2000, the AER orders as follows:

1.

(a) The scheme applied for by the Operator for the recovery of crude bitumen from the area shown on the attached hereto marked Appendix A to this Scheme Approval,

(i) Application No. 1096587,
(ii) Application No. 1384704,
(iii) Application No. 1520897,
(iv) Application No. 1625896,
(v) Application No. 1642643,
(vi) Application No. 1672871,
(vii) Application No. 1674178,
(viii) Application No. 1893914,
(ix) Application No. 1899346,
(x) Application No. 1881217, and
(xi) Application No. 1881219

is approved, subject to the *Oil Sands Conservation Act*, the *Oil Sands Conservation Rules* and the terms and conditions herein contained.

(b) Subclause (a) does not preclude alterations in design or equipment, provided that the AER is satisfied that the alterations are compatible with the outline of the scheme, meet the operating criteria in the Scheme Approval, are made for the better operation of the scheme, and do not result in unacceptable adverse impacts.

2. The Operator shall notify the AER of any proposed material 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 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 major 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.
   (a) At least five years prior to start-up of mining activities in Mining Areas adjacent to the Athabasca River (Centre and North Pits in Application No. 1881217), the Operator shall submit the results of technical investigations and an updated mine plan.
   (b) The information referred to in clause 4(a) shall include
      (i) additional resource drilling to provide more data for the geologic model,
      (ii) oxidation testing to confirm recoverability of the bitumen resource in the potentially affected areas,
      (iii) detailed mapping of the east bank of the Athabasca River ("the River") adjacent to all proposed pit walls,
      (iv) site-specific geotechnical stability analyses,
      (v) a hydrogeological field program to determine the level of hydraulic conductivity between the River and the proposed pit areas,
      (vi) design of a system for monitoring erosion along the east bank of the River,
      (vii) development of groundwater seepage models to assess the degree of seepage that may be expected from the River during mining,
      (viii) design of dewatering systems capable of handling the forecast seepage flows into the pit areas,
      (ix) completion of an economic evaluation of bitumen recovery at various setback distances from the River in light of the findings of the foregoing detailed investigations,
      (x) completion of the final design of the west pit walls in Centre and North Pits, and
      (xi) any other information the AER may require.

5.
   (a) On or before 28 February of each year, the Operator shall submit a summary for the previous year indicating the amount of asphaltene rejected on an annual basis.
   (b) The amount of asphaltenes rejection shall be limited to 10 percent by weight.

6. The Operator shall
   (a) carry out its operations to limit solvent loss to the tailings area and scheme to not more than four volumes per thousand volumes of whole bitumen production, expressed on an annual basis,
   (b) not discharge untreated froth tailings to any tailings area, and

(c) only place tailings solvent recovery unit (TSRU) tailings in the out of pit tailings area (OPTA).

7. The Operator shall submit, when directed by the AER, a water management plan consisting of plant and site wide water balances, an evaluation of associated environmental impacts, and an evaluation of impacts to the mine plan within a reasonable time after each of the following water related issues is resolved:
   (a) detailed design for tailings management,
   (b) detailed evaluation and design of seepage control from the OPTA,
   (c) treatment or management of basal aquifer water,
   (d) in-stream flow needs and need for on-site temporary water storage, and
   (e) implementation of recommendations from the McClelland Lake Wetland Complex sustainability committee.

8.
   (a) The Operator shall submit the operational plan for the sustainability of the non-mined portion for the McClelland Lake Wetland Complex by September 30, 2021, or such other date as the AER may stipulate in writing.
   (b) The operational plan referred to in clause 8(a) shall include:
      (i) as per requirements outlined in the Operator's *Water Act* approval no. 00151636-01-00, as amended; and
      (ii) any other information the AER may require.

9. The Operator shall provide details on the coordination of activities at the lease boundary upon reaching an agreement with Syncrude.

10. The Operator shall submit a detailed geotechnical design for the in-situ pillar at the south boundary of the South Pit, by June 30, 2019, or such other date as the AER may stipulate in writing.

11. The Operator shall submit the detailed geotechnical designs for all in-pit and external overburden disposal and sand storage areas, at least six months prior to field preparation, or such other date as the AER may stipulate in writing.

12. The Operator shall design the base cap of the South Pit to minimize the interaction between the Basal and Devonian groundwater and any materials to be placed in the South Pit.

13. In accordance with section 8.3.1 of *Draft Directive 023: Oil Sands Project Applications*, as amended, at least six months prior to mining any final pit wall, the Operator shall submit a report containing a detailed geotechnical stability evaluation for the final pit wall the Operator proposed to mine.

14. The Operator shall conduct a demonstration
   (a) to test the performance of phase 1 of the Passive Aquatic Storage System (PASS) technology in a deep, in-pit deposit; and
   (b) to identify any constraints or limitations to establishing a self-sustaining locally common terrestrial boreal forest ecosystem.

15. The demonstration referred to in clause 14 shall
   (a) be a deep deposit located in the South Pit; and

(b) not exceed a volume of 40 million cubic meters of tailings treated by the PASS technology.

16. The Operator may only place 40 million cubic metres of tailings treated by PASS technology in the South Pit. This limit is in respect of tailings treated by PASS technology and does not apply to other materials necessary for
    (a) the implementation of the demonstration; or
    (b) the construction and operation of the South Pit.

17. The Operator shall submit a plan for the demonstration referred to in clause 14 by September 30, 2021, or such other date as the AER may stipulate in writing.

18. The plan referred to in clause 17 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 plans, including the plan referred to in clause 36;
        (viii) summary of the research completed to date (both general and specific) that relates to the objectives identified in (i), including the applicability of the research to the Operator's circumstances and how the Operator will address uncertainties and risks where the research is not applicable;
    (b) identification and explanation of research priorities that will ensure research results can be incorporated into the plan referred to in clause 36 including
        (i) rationale for the sequencing of the research;
        (ii) timing of initiating and completing research; and
        (iii) key activities;
    (c) proposed schedule for research results and data submission, with a mechanism to track progress over time;
    (d) a map identifying the location and extent of the demonstration treatment technology and deposit;
    (e) the design of the demonstration treatment technology, including treatment chemicals, and the deposit;
    (f) rationale of how the design supports
        (i) prediction of future treatment technology and deposit performance;
        (ii) prediction of reclamation timelines;
        (iii) identification of constraints or limitations to establishing a self-sustaining locally common terrestrial boreal forest ecosystem;
    (g) a description of how the demonstration, including the treatment technology and deposit, will be operated;
    (h) the proposed characterization and volume of treated tailings, treatment chemicals, and water to be placed on a quarterly basis;

(i) a description of how the demonstration will achieve the targeted terrestrial ecosites and long-term reclamation outcomes, including identification of the targeted ecosites and the activities that will be undertaken to achieve the outcomes;
(j) an analysis of any implications to the profile referred to in clause 28;
(k) any other information the AER may require.

19. The Operator shall not commence the demonstration referred to in clause 14 unless an approval amendment or written authorization is granted by the AER.

20. The Operator shall provide by September 30, 2023, or such other date as the AER may stipulate in writing, a plan for the feasible alternative technologies to PASS technology including an implementation plan, that addresses the application requirements specified in *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, as amended or replaced (hereinafter called *Directive 085*).

21. The Operator shall provide a capping research plan for tailings deposits containing any of the following types of tailings: coarse sand tailings, thickened tailings, and tailings solvent recovery unit tailings, by September 30, 2023, or such other date as the AER may stipulate in writing.

22. The plan referred to in clause 21 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;
  (ix) summary of the research completed to date that relates to the objectives identified in (i);
(b) 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) 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.

23. The Operator shall provide, by September 30, 2023, or such other date as the AER may stipulate in writing, for the OPTA, a consolidation model or engineering analysis, including milestones, along with any required information specified in writing by the AER.

24. If the model or engineering analysis referred to in clause 23 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.

25. The Operator shall provide, 1 year prior to placement of tailings in each of the CPTA or North Pit Tailings Area (NPTA), or such other date as the AER may stipulate in writing, a plan that updates tailings management in each of these tailings areas.

26. Each plan referred to in clause 25 shall:

    (a) provide the size, volume, and duration of each of the tailings area;
    (b) provide the design of each of the tailings area;
    (c) provide a consolidation model or engineering analysis, including milestones, along with any required information, specified in writing by the AER, for each tailings area;
    (d) provide the composition and the chemical and physical properties of the tailings in each tailings area;
    (e) identify and justify the minimum and maximum volume of fluid tailings and water that is proposed to be stored in each tailings area during operation;
    (f) evaluate the performance of similar tailings deposits, and explain how these performance results have influenced the operation of each tailings area;
    (g) explain how research results and long-term reclamation outcomes have been incorporated;
    (h) provide any other information the AER may require.

27. The Operator shall not implement any of the designs or plans referred to in clause 4, 7, 8, 10, 11, 20, 21, or 25 unless an approval amendment or written authorization is granted by the AER.

28. The Operator shall achieve the profile specified in Appendix B, Table 1 and Figure 1.

29. The Operator shall not exceed any of the profile deviation trigger, total volume trigger or total volume limit specified in Appendix B, Table 2.

30. If any limit or trigger referred to in clause 29 is exceeded, the Operator shall comply with the management response or action directed by the AER.

31. Subject to clause 32, the Operator shall achieve the ready to reclaim criteria as set out in Appendix C.

32.

    (a) If, at any time, the AER is not satisfied with the ready to reclaim criteria in Appendix C, the Operator shall address the issues, concerns or deficiencies identified in writing by the AER by the date specified by the AER.
    (b) If, at any time, the Operator proposes new or any modifications to the ready to reclaim criteria in Appendix C, the Operator shall:
        (i) address the requirements in *Directive 085*;
        (ii) demonstrate that the 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.
    (c) The Operator shall not use any new or modified ready to reclaim criteria unless
        (i) the Operator has provided the information required by subclause 32(b) to the satisfaction of the AER; and
        (ii) the AER has revised Appendix C to allow the new or modified ready to reclaim criteria.

33. The Operator shall not remove treated fluid tailings from the fluid tailings inventory unless the AER has revised Appendix C to include ready to reclaim criteria for each tailings deposit

containing treated fluid tailings.

34. The Operator shall provide, by September 30, 2023, or such other date as the AER may stipulate in writing, an update on TSRU tailings management.

35. The update in clause 34 shall:

    (a) include the composition and the chemical and physical properties of the various tailings streams, including fluid tailings, in the OPTA;
    (b) evaluate the options for the treatment and placement of TSRU tailings, including fluid tailings from TSRU tailings;
    (c) describe any changes being evaluated for the management of TSRU tailings;
    (d) evaluate how TSRU tailings impact the tailings treatment;
    (e) explain how research results relevant to the Operator's TSRU tailings have influenced or will influence the operation of the tailings deposits and long-term reclamation outcomes; and
    (f) provide any other information the AER may require.

36.

    (a) Subject to clause (b), the Operator shall provide by September 30, 2026 or within 24 months of commencement of the pilot, whichever date occurs first, an application for an updated tailings management plan.
    (b) Notwithstanding the submission dates referred to in clause (a), the AER may stipulate the date on which the Operator must provide the plan referred to in clause (a).

37. The plan referred to in clause 36 shall comply with the application requirements in *Directive 085:* and shall include, but not be limited to the following:

    (a) confirm the Operator's ability to meet the profile referred to in clause 28;
    (b) provide an assessment of all fluid tailings treatment and management options evaluated;
    (c) describe and provide rationale for the proposed treatment technologies;
    (d) provide the treated tailings deposit design;
    (e) where the Operator is continuing to propose the use of PASS technology, provide an update on PASS technology research results, justify how these research results relate to this mine, and provide an assessment of PASS scale-up and implementation risks, uncertainties, and mitigations;
    (f) where the Operator is continuing to propose the use of PASS technology or to place any water, which includes 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"), provide an update to the feasible alternative technologies and implementation plan referred to in clause 20;
    (g) evaluate the performance of past or current tailings deposits where similar tailings, tailings treatment technology, and targeted ecosites were used or proposed;
    (h) provide ready to reclaim trajectory and criteria for each type of deposit, including the evidence to support that each type of deposit will reasonably achieve the targeted final landforms and range of ecosites based upon the acceptable distribution of upland ecosite phases and wetland types for the mine;
    (i) identify contingency placement locations for treated tailings deposits, that does not include the DDA;
    (j) justify the required activities, materials and timelines to achieve milestones;
    (k) explain how research results, including the pilot and capping and technology research, and long-term reclamation outcomes have been incorporated;

(l) explain the mitigation measures that will be employed and related timing to manage uncertainties associated with the tailings treatment technology, tailings deposit performance, and ready to reclaim trajectory;
(m) explain the mitigation measures for any identified limitations, including material availability, that may constrain achieving the targeted landforms and range of ecosites; and
(n) provide any other information the AER may require.

38. The Operator shall not implement the plan clause 37 unless an approval amendment is granted by the AER.

39. The Operator shall not place any water, which includes industrial wastewater, above treated or untreated tailings for the purpose of creating a water capped pit lake.

40. With the exception of the demonstration referred to in clause 14, the Operator shall not conduct phase 1 activities as identified in Application No. 1881219 unless an approval amendment is granted by the AER.

41. The Operator shall not conduct phase 2, 3, or 4 activities in DDA as identified in Application No. 1881219 unless an approval amendment is granted by the AER.

42. The Operator shall, in addition to any reporting requirements under *Directive 085*, provide in the annual fluid tailings management report:

(a) an update on fluid tailings treatment management options being evaluated to support clause 37(b);
(b) the available storage capacity of each tailings deposit or pond or tailings area that contains water or tailings at the end of the reporting period; and
(c) annual storage capacity and volume requirements for the five years following the end of the reporting period

unless otherwise authorized in writing by the AER.

43. The Operator shall

(a) notify the AER of any proposed on-site fluid tailings pilots, prototypes or demonstrations at least 6 months, or such other time as the AER may stipulate in writing, prior to any proposed construction or implementation; and
(b) not construct or implement any of the proposed on-site fluid tailings pilots, prototypes or demonstrations unless written authorization or approval amendment is obtained from the AER.

44. The Operator shall submit a research plan regarding closure options for any of the tailings deposits or tailings areas upon request by the AER.

45. The Operator shall engage with stakeholders and indigenous communities on the activities undertaken under this Scheme Approval in respect of tailings management.

46. The Operator shall conduct an annual forum with stakeholders and indigenous communities on the activities undertaken under this Scheme Approval in respect of tailings management.

47. The Operator shall report in the annual fluid tailings management report on engagement efforts undertaken in the reporting period.

48. The report referred to in clause 47 shall include the following:

(a) how the 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 this report was provided by each stakeholder and indigenous community identified in (a);
(h) how the feedback and learnings 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 annual forum.

49. The Operator shall not release any substance to the surrounding environment except as authorized under the EPEA Approval.

50. The Operator shall apply for an amendment to this Scheme Approval to align with any applicable government policy, including, but not limited to

(a) tailings water release;
(b) placement of any water above treated or untreated tailings to create a water-capped pit lake; and
(c) reclamation criteria.

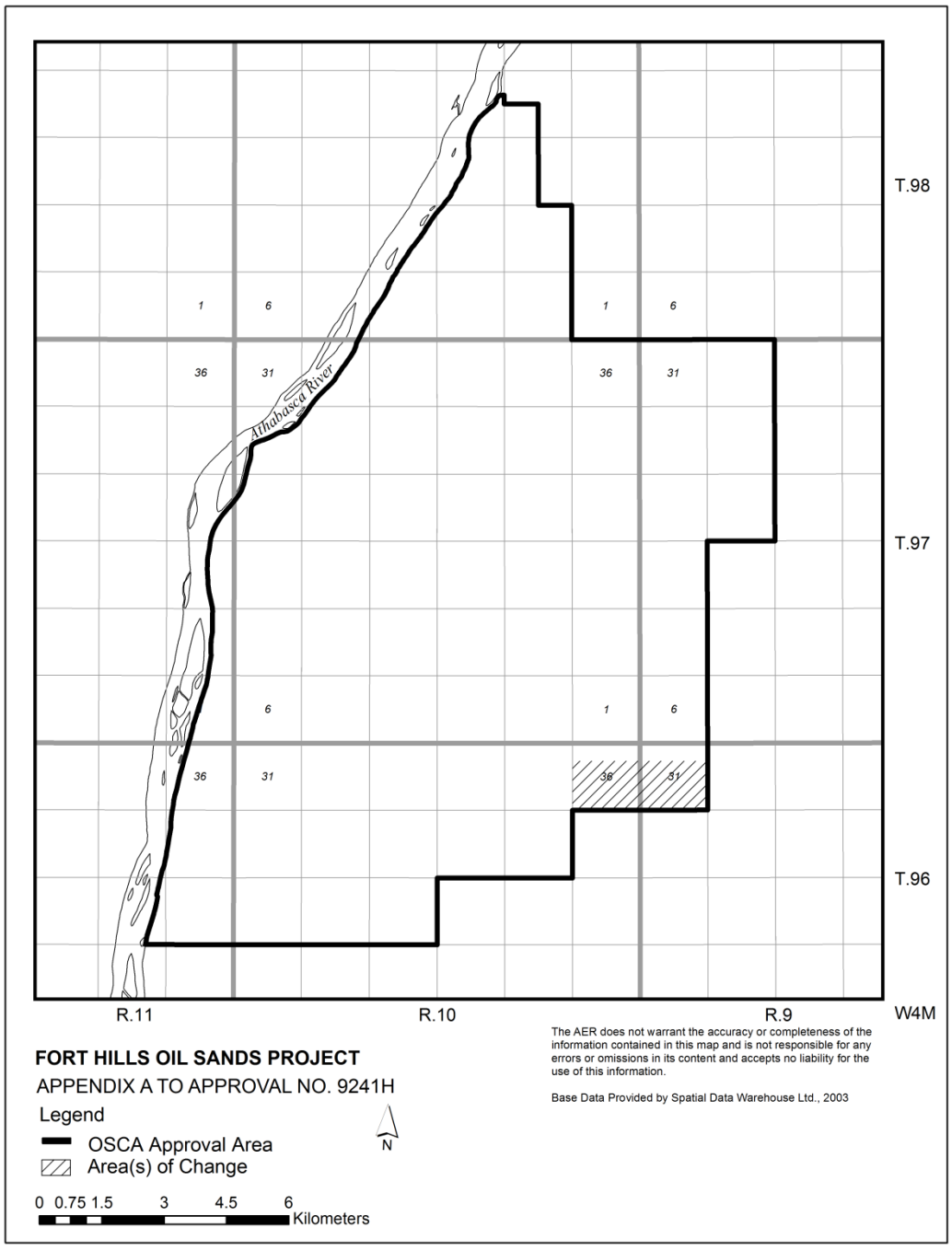
51. The AER may,
(a) upon its own motion, or
(b) upon the application of an interested person,

rescind or amend this approval at any time if, in the opinion of the AER, circumstances so warrant.

52. AER Approval No. 9241H rescinds Approval No. 9241, 9241A, 9241B, 9241C, 9241D, 9241E, 9241F, and 9241G.

FORT HILLS ENERGY CORPORATION

APPENDIX A TO APPROVAL NO. 9241H



FORT HILLS ENERGY CORPORATION

APPENDIX B TO APPROVAL NO. 9241H

Table 1. New Fluid Tailings (FT) Profile

Year	Approved Profile New FT Inventory (million cubic metres)	Year	Approved Profile New FT Inventory (million cubic metres)
2015	0	2045	83
2016	0	2046	80
2017	0	2047	77
2018	15	2048	74
2019	29	2049	71
2020	43	2050	68
2021	56	2051	67
2022	68	2052	66
2023	87	2053	65
2024	94	2054	64
2025	100	2055	62
2026	107	2056	63
2027	111	2057	64
2028	114	2058	65
2029	117	2059	66
2030	120	2060	67
2031	121	2061	63
2032	122	2062	59
2033	123	2063	54
2034	124	2064	49
2035	125	2065	43
2036	121	2066	38
2037	117	2067	32
2038	113	2068	26
2039	109	2069	22
2040	104	2070	18
2041	100	2071	13
2042	96	2072	9
2043	92	2073	0
2044	88		

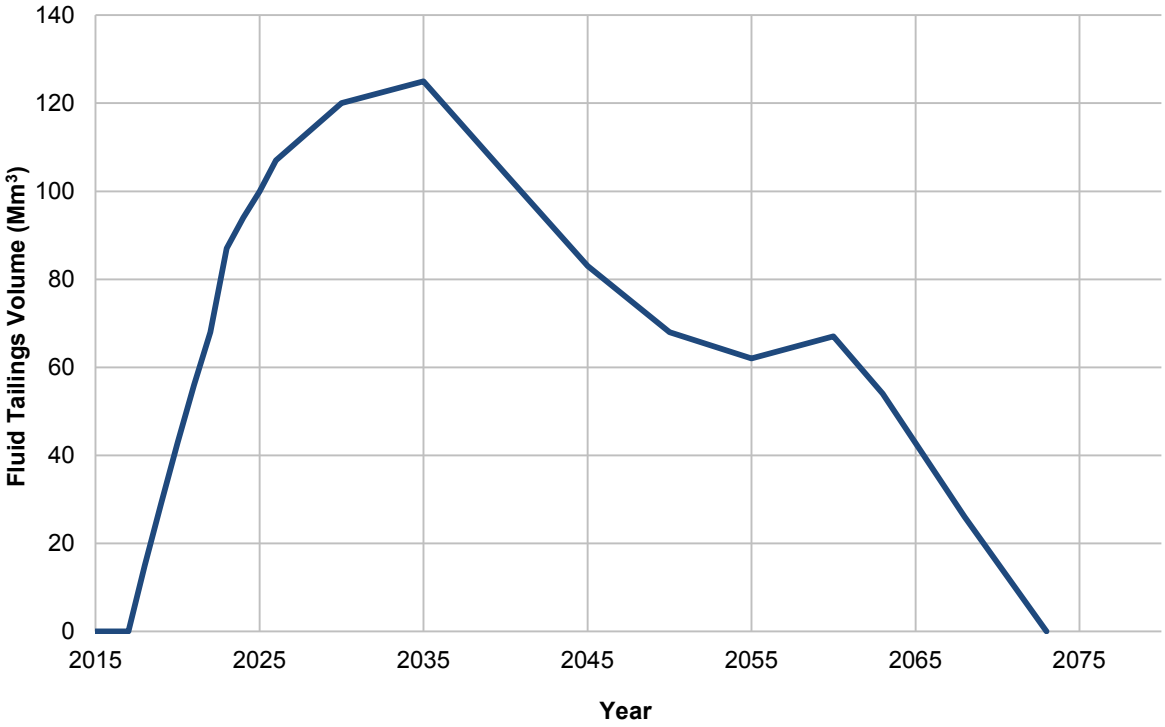


Figure 1. New Fluid Tailings Profile

Table 2. Thresholds for New Fluid Tailings Profile

Threshold Type	Trigger or Limit	Calculation Factors
Profile Deviation Trigger	20 per cent	$\text{annual deviation percent}_{year} = \frac{\text{New FT Inventory}_{\text{year}} - \text{Approved Profile New FT Inventory}_{\text{year}}}{\text{Approved Profile New FT Inventory}_{\text{year}}}$ $\text{profile deviation trigger}_{\text{year}} = \frac{\sum_{i=year}^{year-5}(\text{annual deviation percent}_i)}{\text{Count}(\text{annual deviation percent}_{\text{i}}\text{: annual deviation percent}_{\text{i}-5})}$
Total Volume Trigger	125 million cubic metres	n/a
Total Volume Limit	175 million cubic metres	n/a

FORT HILLS ENERGY CORPORATION

APPENDIX C TO APPROVAL NO. 9241H

Table 1. RTR Criteria

Deposit	Subobjective	RTR criteria
Intentionally left blank	Intentionally left blank	Intentionally left blank

AMENDING APPROVAL

ALBERTA ENERGY REGULATOR

ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT
R.S.A. 2000, c.E-12, as amended.

APPROVAL NO.: 151469-01-01

APPLICATION NO.: 010-151469

EFFECTIVE DATE: *<original dated>*

EXPIRY DATE: November 15, 2024

APPROVAL HOLDER: Fort Hills Energy Corporation

Pursuant to Division 2, of Part 2, of the *Environmental Protection and Enhancement Act*, R.S.A.2000, c.E-12, as amended, the approval for the following activity:

Construction, Operation and Reclamation of the Fort Hills Oil Sands Processing Plant and Mine

is amended as per the attached terms and conditions.

<original signed>

Paul Ferensowicz
Alberta Energy Regulator

<original dated>

TERMS AND CONDITIONS ATTACHED TO APPROVAL

Environmental Protection and Enhancement Act Approval No. 151469-01-00 is hereby amended as follows:

1. Subsection 1.1.2 (l), (t), and (y) are deleted.

2. Subsection 1.1.2 (eee) and (iii) are deleted and substituted with the following:

   (eee) "OPTA" means out-of-pit tailings area as described in the renewal application 007-151469 and application 010-151469;

   (iii) "plant" means the Fort Hills Oil Sands Processing Plant and 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, pipelines, tailings ponds, and other installations, and includes the Augmented Project Area and the land that is being or has been used or held for or in connection with the Fort Hills Processing Plant, the decommissioned Fort Hills Experimental Oil Sands Processing Plant and associated Mines including augmented project area as described in Application No. 010-151469 within Oil Sands Leases 7404080933, 7400120008, 7406020437, 7406020438, 7405090634 and 7404080932, located within Townships 96, 97, and 98, Ranges 9,10, and 11, west of the 4th Meridian;

3. The following definitions are added to Subsection 1.1.2:

   (d.1) "Augmented Project Area" means the addition of 262 ha to the approved project area as described in the application;

   (eee.1) "OPTA East Stage 1" means out-of-pit tailings area as described in the renewal application 007-151469 and application 010-151469;

   (eee.2) "OPTA East Stage 2" means out-of-pit tailings area as described in the application 010-151469;

   (ppp.1) "settlement" means a lowering of the ground surface (gradual or sudden) due to settling, by subsurface movement of earth materials or other means;

4. Subsection 3.1.2 (e) is deleted.

5. The following is added after Subsection 3.3.2:

   New Muskeg Dewatering and Industrial Runoff Ponds

   3.3.3 The approval holder shall submit the design details to the Director at least 60 days prior to construction of the new ponds identified in application no. 010-151469 for water management in the OPTA East Stage 1 area and the reclamation material storage areas RMS 4 and 5 in the vicinity of OPTA East.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

3.3.4 If the design details referred to in subsection 3.3.3 are 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.

6. Subsections 3.6.23 to 3.6.29 are deleted.

7. The following is added after Section 3.6:

SECTION 3.7: Tailings Management Facilities and Demonstration

3.7.1 The approval holder shall construct the OPTA and tailings thickeners as described in applications No. 003-151469, 007-151469 and 010-151469, unless otherwise authorized in writing by the Director.

OPTA East

3.7.2 The approval holder shall construct the OPTA East Stage 1 and Stage 2 as described in the application no. 010-151469, unless otherwise authorized in writing by the Director.

Demonstration PASS, Deep Deposit and Terrestrial Closure

3.7.3 The approval holder shall conduct a demonstration

(a) to test the performance of phase 1 of the Passive Aquatic Storage System (PASS) technology in a deep, in-pit deposit; and

(b) to identify any constraints or limitations to establishing a self-sustaining locally common terrestrial boreal forest ecosystem.

3.7.4 The demonstration referred to in subsection 3.7.3 shall

(a) be a deep deposit located in the South Pit; and

(b) not exceed a volume of 40 million cubic metres of tailings treated by the PASS technology.

3.7.5 The approval holder shall submit a proposed plan for the demonstration referred to in subsection 3.7.3 on or before September 30, 2021, or such other date as the Director may stipulate in writing.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

3.7.6 The proposed plan referred to in subsection 3.7.5 shall include, at a minimum, the following:

(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 plans;

(viii) summary of the research completed to date (both general and specific) that relates to the objectives identified in (i), including the applicability of the research to the approval holder's circumstances and how the approval holder will address uncertainties and risks where the research is not applicable;

(b) identification and explanation of research priorities that will ensure research results can be incorporated into the submission referred to in subsection 4.7.6, including

(i) rationale for the sequencing of the research;

(ii) timing of initiating and completing research; and

(iii) key activities;

(c) proposed schedule for research results and data submission, with a mechanism to track progress over time;

(d) a map identifying the location and extent of the demonstration treatment technology and deposit;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(e) the design of the demonstration treatment technology, including treatment chemicals, and the deposit;

(f) rationale of how the design supports

(i) prediction of future treatment technology and DDA performance;

(ii) prediction of reclamation timelines; and

(iii) identification of constraints or limitations to establishing a self-sustaining locally common terrestrial boreal forest ecosystem;

(g) a description of how the demonstration, including the treatment technology and deposit, will be operated;

(h) the proposed characterization and volume of treated tailings, treatment chemicals, and water to be placed on a quarterly basis;

(i) a description of how the demonstration will achieve the targeted terrestrial ecosites and long-term reclamation outcomes, including identification of the targeted terrestrial ecosites and the activities that will be undertaken to achieve the outcomes;

(j) an analysis of any implications to the fluid tailings profile; and

(k) any other information required by the Director.

3.7.7 If the proposed plan referred to in subsection 3.7.5 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.

3.7.8 The approval holder shall not commence construction of the treatment technology or deposit for the demonstration referred to in subsection 3.7.5 unless written authorization or an approval amendment is obtained from the Director.

3.7.9 The approval holder shall implement the demonstration referred to in subsection 3.7.5 as authorized in writing by the Director.

3.7.10 The approval holder may only place 40 million cubic metres of tailings treated by PASS technology in the South Pit. This limit is in respect of tailings treated by PASS technology and does not apply to other materials necessary for

(a) the implementation of the demonstration; or

(b) the construction and operation of the South Pit.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

3.7.11

(a) Subject to subsection (b), the approval holder shall submit a proposed plan for the capping and terrestrial closure of the demonstration deposit referred to in subsection 3.7.5 at least 12 months prior to capping or within 24 months of commencement of the demonstration, whichever date occurs first.

(b) Notwithstanding the submission dates in subsection (a), the Director may stipulate the date on which the approval holder must provide the proposed plan in subsection (a).

3.7.12 The proposed plan referred to in subsection 3.7.11 shall include, at a minimum, the following:

(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 plans;

(b) identification and explanation of research priorities that will ensure research results can be incorporated into the submission referred to in subsection 4.7.6, including

(i) rationale for the sequencing of the research;

(ii) timing of initiating and completing research; and

(iii) key activities;

(c) a map including location and extent of the capping;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(d) a description and figure of the landform and reclamation cover design;

(e) a description of the target soil moisture regime, target ecosite and target site type for the landform and reclamation cover design;

(f) a description of the capping techniques to be employed;

(g) the design details for the capping, including the rationale and supporting justification how the design of the cap supports;

(i) confirmation of the ready to reclaim criteria trajectory for the targeted ecosites;

(ii) prediction of future reclamation performance on DDAs;

(iii) prediction of reclamation timelines;

(iv) identification of constraints or limitations to establishing a self-sustaining locally common boreal forest ecosystem;

(h) proposed schedule for research results and data submission, with a mechanism to track progress over time;

(i) any other information requested in writing by the Director.

3.7.13 If the proposed plan referred to in subsection 3.7.11 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.

3.7.14 The approval holder shall not commence construction of the cap for the demonstration referred to in subsection 3.7.5, unless written authorization or an approval amendment is obtained from the Director.

South Pit and DDA

3.7.15 With the exception of the demonstration referred to in in subsection 3.7.5, the approval holder shall not commence construction of the DDA in the South Pit as described in application 010-151469, unless an approval amendment is obtained from the Director.

3.7.16 The approval holder shall design the base cap of the South Pit to minimize the interaction between the Basal and Devonian groundwater and any materials to be placed in the South Pit.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

8. The following is added after Section 3.7:

SECTION 3.8: Basal Depressurization Water Management

3.8.1 The approval holder shall not construct or operate:

(a) saline basal depressurization water storage unless an approval amendment is obtained from the Director;

(b) pilots to reinject saline basal depressurization water to non-saline aquifers or use or dispose in pit unless an approval amendment is obtained from the Director.

9. Subsection 4.2.3 is deleted and replaced with the following:

4.2.3 The approval holder shall manage the industrial wastewater and industrial runoff in the following manners:

(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 Area, drainage at mine pits and in-pits tailings storage areas) shall be contained in the industrial wastewater control system for use as recycle water;

(c) non-saline basal depressurization water shall be contained in saline basal depressurization water storage or the industrial wastewater control system for use as recycle water;

(d) saline basal depressurization water shall be contained in saline depressurization water storage;

(e) industrial runoff from muskeg dewatering, overburden dewatering, and drainage from overburden storage areas and reclamation material storage area shall be directed to sedimentation ponds, or the industrial wastewater control system for use as recycle water;

(f) sedimentation ponds shall not receive industrial wastewater, plant developed runoff or domestic wastewater;

(g) in accordance with the approved Fort Hills Surface Water Management Plan (SWMP);

(h) industrial runoff shall be only discharged to the Athabasca River watershed from the following outfall locations:

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(i) Pond 1;

(ii) Pond 1A;

(iii) Pond 2;

(iv) Pond 3;

(v) Pond 4;

(vi) Pond 5B;

(vii) Pond 7;

(viii) Pond 10;

(ix) Pond 14;

(x) construction);

(xi) Site Security Pond 1; and

(xii) Site Security Pond 2;

(i) industrial runoff shall be only discharged to the McClelland Lake Wetland Complex watershed from the following outfall locations:

(i) OPTA (RMS) Sump; and

(ii) Pond 16

unless otherwise authorized in writing by the Director.

10. The following section is added after Subsection 4.2.18:

Acute Toxicity Lethality Test Management Plan

4.2.20 The approval holder shall provide the following to the Director, if the acute lethality test using rainbow trout or Ceriodaphnia or fathead minnows is 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

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(d) any other information as requested in writing by the Director.

4.2.21 If the proposal referred to in subsection 4.2.20(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.

4.2.22 The approval holder shall implement the proposal referred to in subsection 4.2.20(c) as authorized in writing by the Director.

11. The following section is added after Subsection 4.2.18:

Basal and Saline Basal Depressurization Water Management

4.2.25 The approval holder shall develop a Basal Depressurization Water Management Operations program proposal to manage the quantity and quality of basal depressurization water placed in OPTA and the industrial wastewater control system for use as recycle water.

4.2.26 The approval holder shall submit the proposal referred in subsection 4.2.25 on or before June 30, 2019, unless otherwise authorized in writing by the Director.

4.2.27 The approval holder shall obtain an amendment to this approval prior to commencing any management operations or disposing of saline basal depressurization water.

4.2.28 The approval holder shall manage the non-saline basal depressurization water as described in the Application No. 010-1515469 until saline basal depressurization water storage and management operations amendments are obtained.

12. The following section is added after Subsection 4.3.19:

End Pit Lakes Water Return

4.3.20 The approval holder shall obtain an amendment to this approval prior to the commencement of any water release from end pit lakes to the Athabasca River or any other water bodies.

13. The following section is added after Section 4.6:

SECTION 4.7: TAILINGS MANAGEMENT OPERATIONS

4.7.1 With the exception of the demonstration referred to in in subsection 3.7.5, the approval holder shall not conduct phase 1 activities unless an approval amendment is obtained from the Director.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

4.7.2 The approval holder shall not conduct phase 2, 3, and 4 activities, unless an approval amendment is obtained from the Director.

4.7.3 The approval holder shall not place any water, which includes 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").

4.7.4 The approval holder shall submit on or before September 30, 2023, or such other date as the Director may stipulate in writing, the following:

(a) an update on TSRU tailings management; and

(b) feasible alternative technologies to PASS technology, including an implementation plan, that addresses the application requirements specified in *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, as amended or replaced;

(c) if the approval holder is proposing to place any water, which includes industrial wastewater, above treated or untreated tailings for the purpose of creating a water capped pit lake, an updated assessment of the long-term hydrological sustainability of both the water capped pit lake and the McClelland Lake Wetland Complex, addressing

(i) water levels and hydrological connectivity; and

(ii) results modelled from a range of late 21st century regional climate change scenarios developed by the Intergovernmental Panel on Climate Change.

4.7.5 If the information referred to in subsection 4.7.4 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.

4.7.6 Subject to subsection 4.7.7, the approval holder shall submit, in conjunction with the application for an updated tailings management plan required under *Oil Sands Conservation Act* approval no. 9241H, on or before September 30, 2026 or within 24 months of commencement of the demonstration, whichever date occurs first, the following:

(a) an update on TSRU tailings management;

(b) if the approval holder is proposing to place any water, which includes industrial wastewater, above treated or untreated tailings for the purpose of creating a water capped pit lake

(i) a preliminary pit lake design, including

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(A) the supporting treated tailings deposit design, and

(B) a feasibility study based upon the research results required under section 6.2, including the assessment that the research results are applicable to the site specific tailings, the tailings deposit type, the water capped pit lake use(s), and the aquatic ecosystem type;

(ii) an update to the assessment referred to in subsection 4.7.4(c); and

(iii) identification of any remaining uncertainties for water capped pit lake research, including an explanation, justification, and timelines on how these uncertainties will be addressed; and

(c) an explanation of the mitigation measures that will be employed and related timing to manage uncertainties associated with the target ecosites achievement;

(d) any other information required by the Director.

4.7.7 Notwithstanding the submission dates in subsection 4.7.6, the Director may stipulate the date on which the approval holder must provide the information required in subsection 4.7.6.

4.7.8 If the information referred to in subsection 4.7.6 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.

4.7.9 The approval holder shall only use the following chemicals for treatment of any fluid tailings or in fluid or treated tailings deposits in this approval:

(a) the flocculants identified in application 010-151469; and

(b) the coagulant identified in application 010-151469;

unless written authorization or approval amendment is obtained from the Director.

4.7.10 The approval holder shall:

(a) notify the Director of any proposed on-site fluid tailings pilots, prototypes or demonstrations at least 6 months, or such other time as authorized in writing, prior to any proposed construction or implementation; and

(b) not construct or implement any of the proposed on-site fluid tailings pilots, prototypes or demonstrations unless written authorization or approval amendment is obtained from the Director.

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4.7.11 The approval holder shall apply for an amendment to this Approval to align with any applicable government policy, including, but not limited to:

(a) tailings water release;

(b) placement of any water above treated or untreated tailings to create pit lakes; and

(c) reclamation criteria.

14. The following is added after Subsection 4.5.11:

Groundwater Monitoring

4.5.12 The approval holder shall submit the proposals for the Groundwater Monitoring Program for the OPTA East and the South Pit to the Director 6 months prior to:

(a) the placement of the sand storage in the OPTA East; and

(b) the placement of treated fluid tailings for the demonstration referred to in 3.7.5

unless otherwise authorized in writing by the Director.

4.5.13 The approval holder shall implement the Groundwater Monitoring Program referred to in subsection 4.5.12 as authorized in writing by the Director.

15. The following is added after Subsection 6.1.2 (b)(viii):

6.1.2 (b) (ix) capping objectives in addition to rooting-zone protection for tailings deposits;

16. The following is added after subsection 6.1.2 (c)(ix):

6.1.2 (c)

(x) stability of reclaimed surfaces over time, and the implications to the extent and type of reclaimed ecosystems for different tailings deposit designs;

(xi) capping objectives in addition to rooting-zone protection for tailings deposits; and

(xii) validation that developing wetlands are from surface drainage and not from breakthrough of tailings to the surface.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

17. Subsection 6.2.4 (k) is deleted and replaced with the following:

6.2.4 (k) identification of research required to ensure the EPLs adequately:

(i) treats site drainage;

(ii) provides a sustainable aquatic ecosystem and aquatic habitat;

(iii) is geotechnically stable;

(iv) achieves other functions such as shoreline protection and flood buffering; and

(v) provides sustainable lake levels under both current and future climate change scenarios;

18. Subsection 6.2.4 (p) is deleted and replaced with the following:

6.2.4 (p) identification of research required to address physical, chemical and biological performance measures and criteria for pit lakes including measures of aquatic ecosystem and habitat sustainability, ecological function, traditional use, biodiversity and human health and from long-term chemistry research issues identified in subsection 6.1.2 (d) and (e),

(q) identification of research that confirms or contradicts the predicted behavior of tailings or treated tailings and resolves uncertainties about the behavior of tailings within a pit lake;

(r) the results of any other relevant research;

(s) an assessment of the research results in (r) applicable to site specific tailings, tailings deposit type, water capped pit lake use(s) and aquatic ecosystem type, and identification of any remaining uncertainties including an explanation, justification and timelines on how these uncertainties will be addressed; and

(t) any other information as required in writing by the Director.

TERMS AND CONDITIONS ATTACHED TO APPROVAL

19. The following is added after Subsection 6.5.3:

6.5.4 The approval holder shall submit a Reclamation Monitoring Program proposal to the Director, when notified in writing by the Director.

6.5.5 The approval holder shall prepare the Reclamation Monitoring Program proposal referred to in subsection 6.5.4 as directed in writing by the Director.

6.5.6 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.

6.5.7 The approval holder shall implement the Reclamation Monitoring Program referred to in subsection 6.5.4, as authorized in writing by the Director

20. Section 7.2 is deleted and replaced with the following:

SECTION 7.2: RECLAMATION AND LIFE OF MINE CLOSURE PLANNING

7.2.1 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.

7.2.2 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.

7.2.3 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.

7.2.4 The approval holder shall submit a Mine Reclamation Plan to the Director according to the following schedule:

(a) for the first Mine Reclamation Plan, on or before December 31, 2019;

(b) for the second Mine Reclamation Plan, on or before September 30, 2022;

(c) for the third Mine Reclamation Plan, on or before September 30, 2025; and

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(d) for the fourth Mine Reclamation Plan, on or before September 30, 2028;

unless otherwise authorized in writing by the Director.

7.2.5 The approval holder shall prepare each Mine Reclamation Plan referred to in subsection 7.2.4 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.

7.2.6 If the Mine Reclamation Plan 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.

7.2.7 The approval holder shall implement the Mine Reclamation Plan referred to in subsection 7.2.4, as authorized in writing by the Director.

7.2.8 The approval holder shall submit an updated Life of Mine Closure Plan to the Director in the next renewal application, unless otherwise authorized in writing by the Director.

7.2.9 The approval holder shall prepare the Life of Mine Closure Plan referred to in subsection 7.2.8 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.

7.2.10 In addition to the requirements specified in Subsection 7.2.9, the Life of Mine Closure Plan referred to in 7.2.8 shall include, at a minimum, all of the following forest resource information:

(a) strategies to minimize and mitigate any impacts to the Annual Allowable Cut by the Fort Hills Mine Project; and

(b) a description of the following, related to the Growth and Yield Program referred to in subsection 7.2.14(c);

(i) the 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

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(iii) a description of the sampling protocols for varying types of plots;

unless otherwise directed in writing by the Director.

7.2.11 If the Life of Mine Closure Plan 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.

7.2.12 The Mine Reclamation Plan referred to in subsection 7.2.4 and the Life of Mine Closure Plan referred to in subsection 7.2.8 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, August 2012, as amended, under the *Land Use Framework*, Alberta Government, December 2008, as amended;

(c) be consistent with completed sub-regional plans associated with the *Lower Athabasca Regional Plan (2012-2022)*, Alberta Government, August 2012, as amended, under the *Land Use Framework*, Alberta Government, December 2008, as amended;

(d) be consistent with any framework developed for tailings management; and

(e) ensure that reclaimed features have natural appearances characteristic of the region.

7.2.13 The information provided in the Life of Mine Closure Plan referred to in 7.2.8 and the Mine Reclamation Plan referred to in 7.2.4 regarding harvesting, clearing and reforestation shall be suitable for integration into the applicable Forest Management Plan and periodically updated by the Forest Management Agreement holder.

7.2.14 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 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;

TERMS AND CONDITIONS ATTACHED TO APPROVAL

(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, December 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.

21. Subsection 7.3.5 is deleted.

22. Subsections 7.3.13 to 7.3.19 are deleted.

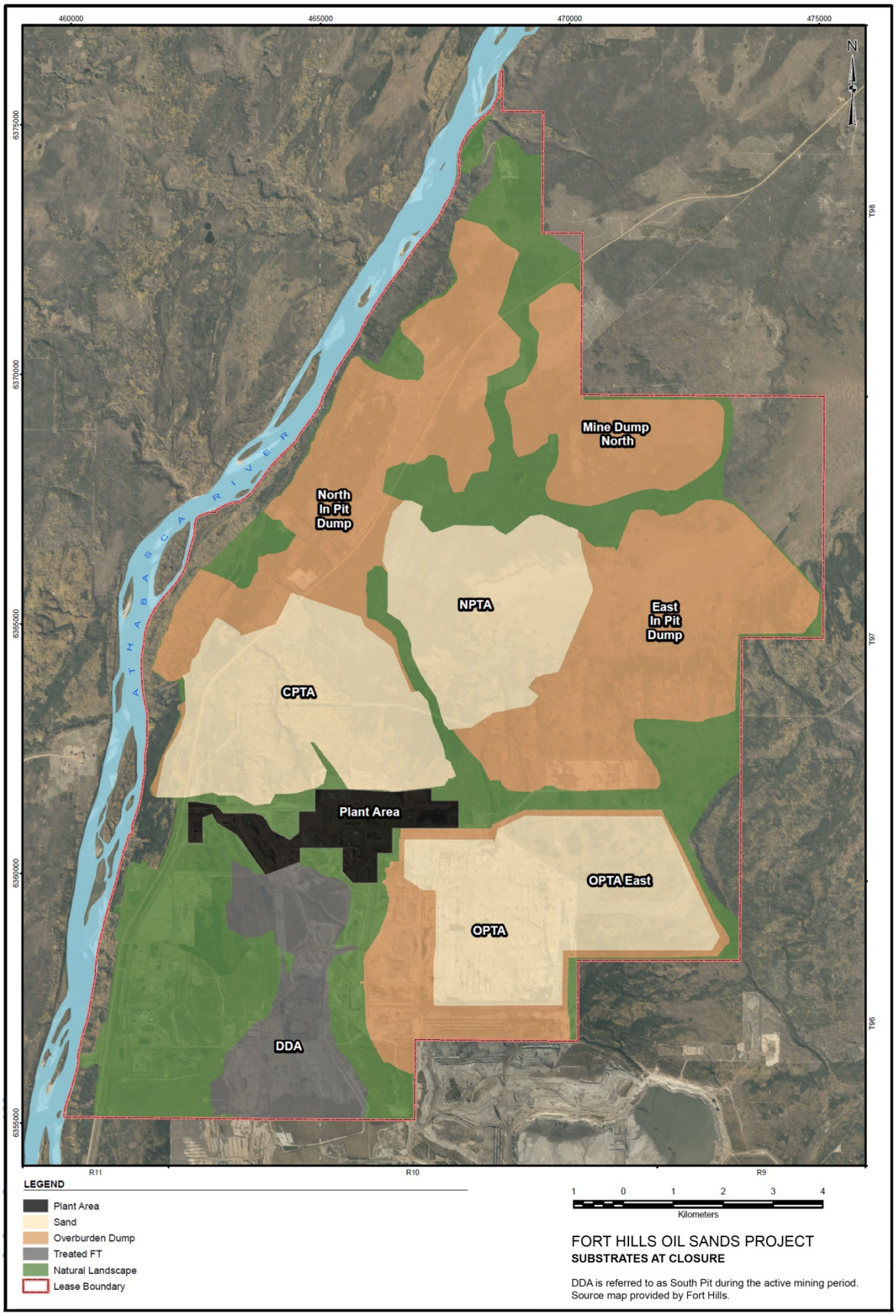
23. Subsections 7.3.24 to 7.3.26 are deleted and replaced with the following:

7.3.24 The approval holder shall prepare and submit the Annual Reclamation Progress Tracking Report referred to in subsection 7.3.23 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.

<original signed>
Paul Ferensowicz
Alberta Energy Regulator

<original dated>

Appendix 2 Site Map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Mine Dump North
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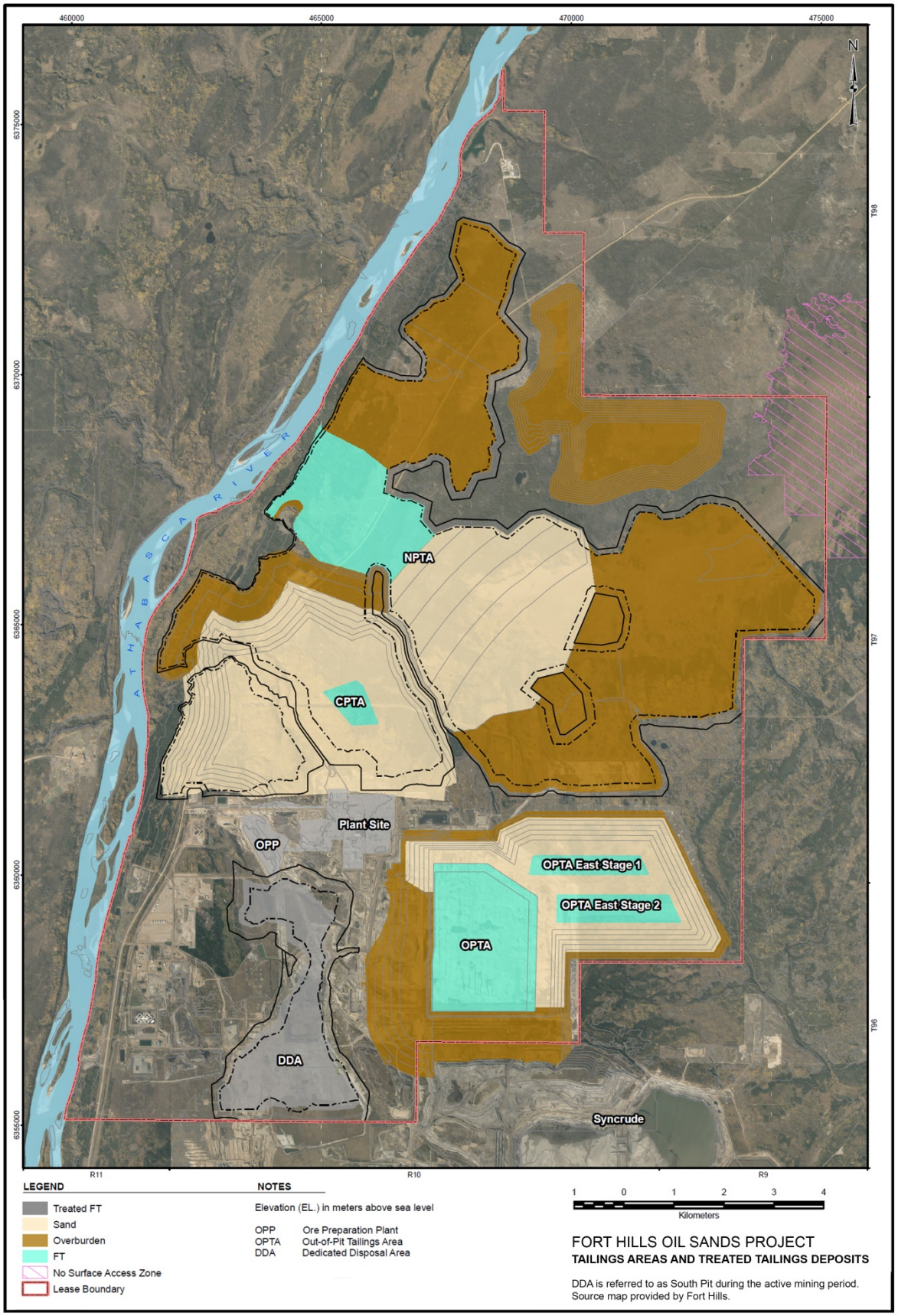
FORT HILLS OIL SANDS PROJECT
SUBSTRATES AT CLOSURE
DDA is referred to as South Pit during the active mining period.
Source map provided by Fort Hills.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R11
R10
R9
LEGEND
Treated FT
Sand
Overburden
FT
No Surface Access Zone
Lease Boundary
NOTES
Elevation (EL.) in meters above sea level
OPP Ore Preparation Plant
OPTA Out-of-Pit Tailings Area
DDA Dedicated Disposal Area
1 0 1 2 3 4
Kilometers
FORT HILLS OIL SANDS PROJECT
TAILINGS AREAS AND TREATED TAILINGS DEPOSITS
DDA is referred to as South Pit during the active mining period.
Source map provided by Fort Hills.

Appendix 3 Submissions and Deposit Milestones Timelines

						Expected demonstration commencement		
Month	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026** [a]
April		Additional reporting under *Directive 085* commences (annually)						
August	Measurement system plan							
September			Demonstration plan		Feasible alternative technologies to PASS and implementation plan Capping research plan Consolidation model or engineering analysis for OPTA Update on TSRU tailings management Assessment on hydrological sustainability of water capped pit lake and McClelland Lake Wetland Complex			Application for updated TMP in conjunction with submission under *EPEA*

[a] Or within two years from the commencement of the demonstration

Not shown: future deposit plans, capping milestones, or start of further reclamation activities

Appendix 4 *OSCA* Measurement System Plan Requirements

Alberta Energy Regulator

Calgary Head Office
Suite 1000, 250 – 5 Street SW
Calgary, Alberta T2P 0R4
Canada

www.aer.ca

<original dated>

By email only

Jason Heisler, Manager Regulatory Approvals
Suncor Energy Inc. on behalf of **Fort Hills Energy Corporation**
150 6 Avenue SW
Calgary, AB T2P 3E3

jheisler@suncor.com

Fort Hills Energy Corporation
Fort Hills Mine Tailings Management Plan
Measurement System Plan Requirements

Dear Mr. Heisler:

In accordance with *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, the Alberta Energy Regulator (AER) requires Fort Hills Energy Corporation (Fort Hills) to submit by August 30, 2019, or on such other date stipulated by the AER, a measurement system plan for fluid tailings and treated tailings volumes.

Further, as per clause 6(c) of Approval No. 9241H, Fort Hills may place tailings solvent recovery unit (TSRU) tailings only in the out of pit tailings area (OPTA). The measurement system plan must also include identification of substances of concern from TSRU tailings, and measurement locations and measurement methodology for the substances of concern.

The measurement system plan must include the following:

- Key definitions of parameters for fluid tailings.
- Reference of standards and procedures used to measure fluid tailings and treated tailings.
- An explanation of and justification for measurement procedures that are unique to Fort Hills and this plan.
- Evidence that the plan will address the measurement outcomes in section 5 of *Directive 085*, as amended.

- An explanation of how each deposit will be measured, calculated, and reported.
- A description of the fluid and TSRU tailings deposit sampling, measurement, and survey program.
- Justification of how measurement, sampling, and spacing intervals will
  - identify any characteristic markers that specifically indicate the presence of TSRU tailings
  - show the variation of the fluid and TSRU tailings deposit properties, and
  - identify if any material in the tailings deposit is not performing to expectations.
- Any other information the AER may require.

If you have any questions regarding this correspondence, please contact Jim Jordan at (403) 297-8504 or jim.jordan@aer.ca.

Regards,

<original signed>

Paul Ferensowicz

cc: Tara.Wang@aer.ca
Cynthia.Estrop@aer.ca
Eric.Chiu@aer.ca
Steven.vanLingen@aer.ca
Hannah.Laplante@aer.ca

Appendix 5 *EPEA* Additive Use

Alberta Energy Regulator

Calgary Head Office
Suite 1000, 250 – 5 Street SW
Calgary, Alberta T2P 0R4
Canada

www.aer.ca

File No. 4101-00151469-02-0203
<original dated>

By email only

Jason Heisler, Manager Regulatory Approvals
Suncor Energy Inc. on behalf of **Fort Hills Energy Corporation**
150 6 Avenue SW
Calgary, AB T2P 3E3

jheisler@suncor.com

***Environmental Protection and Enhancement Act* Application 010-151469**
Approval No. 151469-01-00, as amended
Additive Use

Dear Mr. Heisler:

In accordance with subsection 4.7.9 of *Environmental Protection and Enhancement Act* Approval No. 151469-01-00, as amended, the Alberta Energy Regulatory (AER) requires Fort Hills Energy Corporation (Fort Hills) to submit by June 15, 2019, or on such other date stipulated by the AER, the following information about each of the additives currently used by Fort Hills for thickening tailings:

- the MSDS sheet for each additive
- the technical data sheet and Certificate of Analysis for each additive
- for each additive, the
    - form,
    - ionic character,
    - generic name,
    - material descriptions, and
    - ecological toxicity information; and
- any other information the AER may require.

If you have any questions regarding this correspondence, please contact Karen McCallion at (403) 642-9240 or Karen.mccallion@aer.ca.

Regards,

<original signed>

Paul Ferensowicz

cc: Karen.McCallion@aer.ca
Hannah.LaPlante@aer.ca
Cynthia.Estrop@aer.ca
Steven.vanLingen@aer.ca