

# **Suncor Energy Inc.**

## **Applications for Millennium Operational Amendment and Base Plant Tailings Management Plan**

October 25, 2017

**Alberta Energy Regulator**

Decision 20171025A: Suncor Energy Inc., Applications for Millennium Operational  
Amendment and Base Plant Tailings Management Plan

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## Abbreviations

ACFN	Athabasca Chipewyan First Nation
AEP	Alberta Environment and Parks
AER	Alberta Energy Regulator
CCME	Canadian Council of Ministers of the Environment
COPC	constituents of potential concern
CT	consolidated tailings
CWR	clay-to-water ratio
DDA	dedicated disposal area
DPL	demonstration pit lake
<i>EPEA</i>	<i>Environmental Protection and Enhancement Act</i>
ERP	enhanced review process
FMMCA	Fort McKay Métis Community Association
GoA	Government of Alberta
GMP	groundwater monitoring program
<i>ICAF</i>	<i>Integrated Compliance Assurance Framework</i>
MOA	Millennium Operational Amendment
<i>OSCA</i>	<i>Oil Sands Conservation Act</i>
OSEC	Oil Sands Environmental Coalition
PASS	passive aquatic storage system
RTR	ready to reclaim
SOC	statement of concern
STP	South Tailings Pond
<i>TMF</i>	<i>Tailings Management Framework for the Mineable Athabasca Oil Sands</i>
TMP	tailings management plan
TSS	total suspended solids
VSD	vertical strip drains

## Executive Summary

The Alberta Energy Regulator (AER) approves Suncor's applications 1857270, 1857274, 1890348, and 075-94 and issues the following approval amendments: *Oil Sands Conservation Act (OSCA)* approval 8535N, *Environmental Protection and Enhancement Act (EPEA)* approval 94-02-18 (appendix 1).

## Background

Fluid tailings management arising from oil sands mining falls squarely within the mandate of the AER, which is to ensure the safe, efficient, orderly, and environmentally responsible development of hydrocarbon resources over their entire life cycle. To be effective, the AER must regulate development in a way that reduces risk and ensures that Albertans reap the economic rewards of our energy resources. The Lower Athabasca region is an area of major industrial development driving Alberta's and Canada's economy.

The AER applies a risk-based approach to regulating, meaning higher-risk activities receive the greatest attention. 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.

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 regulation of tailings has been an ongoing and evolving issue in Alberta. In the last 10 years, tailings reduction technologies have quickly evolved. To accelerate tailings reduction, in 2009, the AER (then the Energy Resources Conservation Board) 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 (GoA) issued the *Tailings Management Framework for the Mineable Athabasca Oil Sands (TMF)* in 2015. As part of the implementation of the *TMF*, the AER released *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, which sets out the new requirements for fluid tailings management plans. *Directive 085* represents an evolution in how industry, the AER, and government will manage tailings. It addresses both existing fluid tailings and new fluid tailings growth.

## Suncor's Approvals

With Suncor's Oil Sands Base Plant approaching end of mine life (2033), the AER is concerned with the length of time remaining to resolve Suncor's site-specific issues. The AER must ensure that it has the

appropriate assurance Suncor's fluid tailings will meet *TMF* outcomes on time and that the approvals' conditions are clear and enforceable.

The approach in the attached approvals is to get appropriate and timely information so as to inform the approaching end of mine life regulatory decisions and manage risk. It is not sufficient to rely exclusively on outcomes-based approvals. This is acknowledged in section 4.1 of *Directive 085*:

The AER will include conditions in approvals that are outcomes based, manage risk and uncertainties, support flexibility and adaptive management, and are enforceable. The AER will build on approval conditions, where they exist, with respect to research and monitoring programs. At a minimum, approval conditions will address

- project-specific thresholds for both new and legacy fluid tailings,
- fluid tailings deposit performance and milestones,
- mitigation measures and contingency plans, and
- monitoring and reporting requirements.

To that end, the AER has added research, monitoring, evaluation and reporting requirements to Suncor's approvals to provide the information needed to verify the technology and deposit performance assumptions in order to ensure that Suncor's performance is tracking to the objective and outcomes of the *TMF* and the requirements of *Directive 085*.

While the AER will apply a risk-based approach to all of the tailings management plans, it should be noted that Suncor's approvals do not represent a precedent for other tailings management plan approvals. Each mine is unique; the AER must consider a variety of factors in every application review, including the mine plan and project bitumen production levels, lease geography and geology, mining and extraction processes, tailings treatment processes, and the age of the mine and existing infrastructure. Furthermore, each oil sands mine operator will have different technologies and different ways to achieve the outcome of the *TMF* and *Directive 085*. Like policy, tailings technology will continue to evolve. Consequently, these approvals reflect current project-specific considerations. Finally, each oil sands mine is subject to site-specific factors that will change as oil sands mine operators research and innovate.

Another component of the *TMF* is enhanced transparency and the involvement of others in the review of tailings management plans. In light of this direction, the AER expanded involvement of others in the review of initial tailings management plan applications. The AER also used a new enhanced review process to make a decision on Suncor's applications. The primary purpose of the process was to help the AER in its decision making by providing opportunities for Suncor and statement of concern (SOC) filers—including the Oil Sands Environmental Coalition, McMurray Métis Local 1935, Athabasca Chipewyan First Nation, Fort McKay Métis Community Association, and Joslyn Energy Development



Incorporated—to provide further information on specific topics through an AER-facilitated discussion and feedback on circulated draft approval conditions. The circulation of draft approval conditions is expressly authorized under section 8 of the *Approvals and Registrations Procedure Regulation (EPEA)*. The concerns raised during the enhanced review process and as part of the feedback on circulated draft approval conditions informed the AER’s decision.

The following provides a summary of the primary issues together with the regulatory decisions in Suncor’s approvals.

### Ongoing Stakeholder Engagement

Both the *TMF* and *Directive 085* highlight the importance of transparency and involvement of stakeholders in tailings management. Given this overarching principle, together with the concerns expressed by stakeholders during the enhanced review process, the OSCA approval requires Suncor to engage with stakeholders, which will include holding an annual forum and reporting annually to the AER on engagement activities.

### Ready-to-Reclaim (RTR) Criteria

RTR criteria are used to track the performance of a tailings deposit towards its ability to meet proposed reclamation and closure outcomes, in the time predicted. Consequently, RTR criteria are critical to evaluate trends and performance management.

SOC filers raised concerns with the adequacy of Suncor’s proposed RTR criteria and uncertainty as to how the treated tailings will progress towards supporting reclamation. The AER has similar concerns, including whether the RTR criteria will provide an accurate view of how all of the tailings in a deposit are performing.

Suncor must achieve RTR criteria for all of the tailings by certain dates depending on the deposit and to evaluate and propose additional RTR criteria.

### Aquatic Closure

Suncor’s tailings management plan (TMP) results in over 70 per cent of its tailings being managed through a newly patented, unproven technology that uses the addition of chemicals to dewater the tailings and reduce the mobility of contaminants. Water will be placed on top of treated tailings after the end of mine life (2043–2053), creating an aquatic closure outcome in dedicated disposal area 3 (DDA3) (otherwise known as “water capping”). Suncor’s remaining tailings deposits will be closed terrestrially, including wetlands and aquatic features.

The proposed technology for DDA3 has uncertainties; Suncor acknowledges the addition of chemicals to reduce the mobility of contaminants released to the water cap has only been demonstrated at a lab scale to

date. Furthermore, Suncor's demonstration pit lake pilot test, a field-scale test of the proposed technology for DDA3, is set up to run over the next 15 years in parallel to commercial scale implementation of the technology at Suncor's site.

SOC filers raised concerns with the aquatic closure outcome and uncertainties with the proposed technology and want Suncor to provide a feasible and timely terrestrial closure outcome. The AER shares those concerns. In addition, GoA policy on water capping tailings and pit lakes (aquatic closure) is expected.

Suncor is prohibited from placing water over treated or untreated tailings until GoA policy is received and is required to meet future policy on water-capped tailings and pit lakes. Suncor must also conduct and report on research and monitoring to resolve uncertainties with the proposed tailings treatment and water capping for DDA3.

Suncor must propose the final closure outcome for DDA3 by 2023, which will include the results of DDA3 terrestrial and aquatic research and implementation design and planning. This is ten years before end of mine life. This is a critical deadline as it should provide enough time for Suncor to adjust their TMP to meet any applicable policy if water-capped tailings and pit lakes are restricted by any applicable policy in effect at that time.

### Enhancements to Research and Reporting

There is an emphasis on research in these approvals to manage risk and resolve uncertainties in the TMP. Industry has invested a significant amount on research to resolve tailings issues; yet, key issues to ensure that tailings can be managed to meet the *TMF* objective remain. Research to date has not solved all of the issues or addressed all of the risks. Given the state of the current information, research and monitoring is required to address uncertainties and risks that are unique to Suncor's TMP. Site-specific research is needed as a form of risk management to deal with unknowns on a timely basis. The results of that research and monitoring are critical to regulatory oversight of this TMP.

Further, this research and reporting is critical to help inform the 2023 decision milestone related to aquatic and terrestrial closure of DDA3. The AER fully expects Suncor's research to taper over time as research results resolve outstanding issues and risks.

A summary of the timing for the various submissions in the approval are in appendix 2.

**20171025A**

**Suncor Energy Inc.**

**Applications for Millennium Operational Amendment and Base Plant Tailings Management Plan**

**Applications 1857270, 1857274, 1890348, and 075-94**

**Decision**

[1] The AER approves Suncor's applications 1857270, 1857274, 1890348, and 075-94 and issues the following approval amendments: *Oil Sands Conservation Act (OSCA)* approval 8535N, *Environmental Protection and Enhancement Act (EPEA)* approval 94-02-18 (attached as appendix 1).

[2] In reaching its decision, the AER considered all relevant materials constituting the record of Suncor's application. The record consists of the application, which includes supplemental information requests; supplemental and rebuttal material filed by Suncor; the proceedings of the enhanced review process (ERP); and statements of concern (SOCs) from the Oil Sands Environmental Coalition, McMurray Métis Local 1935, Athabasca Chipewyan First Nation, Fort McKay Métis Community Association, and Joslyn Energy Development Incorporated.

[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 that matter.

**Applications**

[4] On April 27, 2016, Suncor registered application 1857274 pursuant to section 13 of *OSCA*. The application sought approval for Suncor's fluid tailings volumes profiles and its fluid tailings management plan (TMP) for new and legacy tailings at its oil sands base plant. A site map of Suncor's oil sands base plant is attached as appendix 5.

[5] On April 27, 2016, Suncor also registered applications 1857270 and 075-94 pursuant to sections 10 and 13 of *OSCA* and sections 66 and 70 of *EPEA*. The applications sought approval to modify Suncor's Millennium mining operation in support of its TMP (collectively called the Millennium Operational Amendment or MOA).

[6] On March 17, 2017, the AER denied Suncor's applications on the basis of inadequate information. The AER subsequently decided to reconsider Suncor's applications (May 23, 2017) primarily based on new information tendered by Suncor concerning its proposed tailings treatment

technology (permanent aquatic storage system), which was not made available to the AER earlier because Suncor was seeking patent protection. As a result, the AER proceeded with its review of Suncor's applications under application 1890348.

### Statements of Concern

[7] Following the legislative process under the *Responsible Energy Development Act*, the AER published public notice of application 1857270 for applications 1857270, 1857274, and 075-94 and received SOC's from the following:

- Athabasca Chipewyan First Nation (SOCs 30410 and 30411)
- Fort Chipewyan Métis Local 125 (SOCs 30388 and 30389; withdrawn March 13, 2015)
- Fort McKay First Nation (SOCs 30381 and 30382; withdrawn November 25, 2016)
- Fort McKay Métis (SOCs 30439 and 30440)
- McMurray Métis Local 1935 (SOCs 30383 and 30384)
- Joslyn Energy Development Incorporated (SOC 30302)
- Oil Sands Environmental Coalition (SOCs 30386 and 30387)

[8] On January 23, 2017, Suncor provided additional information to each SOC filer in response to the technical concerns each raised.

### Enhanced Review Process

[9] In an effort to meet the intent of the *Tailings Management Framework for the Mineable Athabasca Oil Sands (TMF)* and *Directive 085*, the AER adopted an approach that enhanced involvement in the review of Suncor's TMP applications. The primary purpose of the ERP is to help the AER in its decision-making by providing opportunities for the applicant and SOC filers to provide further information on specific topics. The ERP also provides an opportunity for SOC filers to engage with the applicant face-to-face in an AER-facilitated technical meeting on application-specific topics. The ERP technical meeting also provides an opportunity to explore solutions to outstanding application-specific concerns. It runs in parallel to the AER's application review process.

[10] The choice and content of ERP is not fixed or automatic. The ERP is an option available to the AER's decision maker to allow parties to participate in decision making and propose solutions to resolve outstanding application-specific issues or concerns. The decision to use an ERP will be made on an application-by-application basis. The AER expects all parties who attend an ERP technical meeting to be prepared to respond with all of the necessary information within the agreed upon scope of the ERP.

[11] The decision to use the ERP is based on a number of factors, including the issues and concerns raised by the SOC filers, the nature and magnitude of the changes proposed in the applications (e.g., impacts to boundaries, outcomes, environmental limits), the nature and extent of the information provided by the applicant, and the stage of operations (e.g., end of mine life schedule).

[12] On May 26, 2017, the AER notified SOC filers that it would conduct an ERP on Suncor's applications. SOC filers and Suncor were informed through this notice that the ERP would consist of written submissions and questions for the applicant, a facilitated technical meeting between SOC filers and the applicant, and the submission of final written comments.

[13] At an ERP planning meeting with ERP participants on June 23, 2017, the following proposed scope for the facilitated technical meeting was discussed and agreed to:

- passive aquatic storage system (PASS) technology for DDA3
  - risks and uncertainties
  - mitigation and contingency plans
  - DDA3 RTR and performance criteria
  - terrestrial closure
- RTR and performance criteria
  - Mine Dump 9
  - Ponds 5, 6, and 7
  - DDA2 (added during the ERP technical meeting)

[14] The AER acknowledged there were additional topics of concern for the participants. It was agreed there would be an opportunity for participants to provide the AER comments on topics of concern deemed out of scope for the technical meeting as part of the opening and closing remarks and written submissions.

[15] The facilitated technical meeting was held on July 17 and 18, 2017, in Edmonton. Participants included AER technical employees and delegated decision maker together with representatives from Suncor, the Oil Sands Environmental Coalition (OSEC), Fort McKay Métis Community Association (FMMCA), Athabasca Chipewyan First Nation (ACFN), and a technical consultant jointly representing McMurray Métis Local 1935 (MM 1935), FMMCA, and ACFN. Joslyn Energy Development Incorporated chose not to participate in the facilitated technical meeting because their concerns were not within scope of the discussions.

[16] The technical meeting included discussion on several site-specific topics, including proposed tailings treatment technology risks, uncertainties in reclamation timing, mitigations and contingencies, and tailings deposit RTR and performance criteria.

[17] Given the concerns expressed at the technical meeting and the stated desire of the participants to provide input on any proposed approval conditions, the AER circulated draft approval conditions for feedback. The AER received written feedback from the SOC filers and Suncor, including Suncor's rebuttal.

[18] Upon receipt of these materials, the AER reviewed the entire record, considered the submissions of ERP participants and Suncor, and made its decision on Suncor's applications.

[19] This decision report highlights the AER's consideration of the applications, the main concerns raised by SOC filers, and the AER's decision on the applications.

[20] The following summarizes concerns put forward by participants through the ERP.

#### OSEC

- Uncertainty in how the treated deposits will progress to RTR status and the need for additional RTR and performance criteria.
- Deferral of reclamation activities that will increase public liability.
- Unclear decision points for triggering mitigation actions or implementing a terrestrial closure option for DDA3.
- Lack of a fully developed terrestrial contingency plan for DDA3.
- Additional topics of concern were raised with regards to
  - inadequate compliance and enforcement mechanisms outlined in *Directive 085*,
  - public liability and transparency of information with respect to the Mine Financial Security Program,
  - management of cumulative tailings volumes and overall cumulative effects of tailings on the regional landscape,
  - need for ongoing stakeholder engagement and involvement in tailings management, and
  - water quality and water release to the environment.

## FMMCA

- Water quality degradation from groundwater seepage and surface water discharge, and limited opportunities to participate and learn about Suncor's groundwater monitoring plan and regional monitoring.
- Limited opportunity to participate and inform on the construction design and implementation of the demonstration pit lake (DPL) pilot test.
- Uncertain assumptions in the TMP and the need for a more defined adaptive management framework.
- Need for capacity and ongoing community engagement and involvement in tailings management.
- Time taken from initial treatment of fluid tailings to reclamation certification and the return to traditional use activities.
- PASS technology's lack of demonstrated success and lack of a viable terrestrial option for DDA3.
- Limited RTR criteria and uncertainty as to how the treated deposits will progress to be ready for reclamation.
- Additional topics of concern were raised with regards to
  - GoA multistakeholder policy initiatives;
  - linkages to other regulatory components, such as life of mine closure plans; and
  - long- and short-term geotechnical stability of impoundments.

## MM 1935

- Water quality degradation from groundwater seepage and surface water discharge, and limited opportunities to participate and learn about Suncor's groundwater monitoring plan and regional monitoring.
- Limited opportunity to participate and inform on the construction design and implementation of the DPL pilot test.
- Uncertain assumptions in the TMP and the need for a more defined adaptive management framework.
- Need for capacity and ongoing community engagement and involvement in tailings management.
- Time taken from initial treatment of fluid tailings to reclamation certification and the return to traditional use activities.
- PASS technology's lack of demonstrated success and lack of a viable terrestrial option for DDA3.
- Limited RTR criteria and uncertainty as to how the treated deposits will progress to be ready for reclamation.
- Additional topics of concern were raised with regards to

- GoA multistakeholder policy initiatives;
- linkages to other regulatory components, such as life of mine closure plans; and
- long- and short-term geotechnical stability of impoundments.

## ACFN

- Effect of tailings on water quality and quantity in the Athabasca River.
- Emphasis on economics over environment and social considerations, including the multigenerational loss of access to the land.
- Overreliance on lakes in post-closure landscapes and lack of a viable terrestrial option for DDA3.
- Uncertainty with modelling assumptions, “scaling up” from controlled tests and unproven technology performance.
- Inadequate criteria for evaluating performance and triggering mitigation or contingency plans.
- Reclamation timelines that represent a multigenerational loss of access to and use of lands.
- Additional topics of concern were raised with regards to
  - inadequate compliance and enforcement measures to address compliance issues;
  - limited ability to be included in planning, monitoring, research, follow-up, and adaptive management of tailings;
  - need for greater transparency and access to information; and
  - future environmental and sociocultural liability.

## Associated Stakeholder Issues

[21] The AER recognizes the importance of the issues raised by SOC filers that fall outside the scope of these specific applications or the authority of the AER, relate to previous or separate decisions, or relate to matters that are administered by the Government of Alberta (GoA).

[22] Upcoming opportunities for stakeholders to provide input on these issues are as follows:

- Suncor’s *EPEA* approval expires on August 12, 2018. Suncor is required to submit a separate application for renewal of the *EPEA* Approval and the AER expects to receive this application in late 2017 or early 2018. Public notice of application will be issued as per the requirements of the *Responsible Energy Development Act*.
- *TMF* implementation and associated policy development continues. GoA policy on water capping tailings and pit lakes (aquatic closure), ready-to-reclaim (RTR) criteria and reclamation criteria, and water management and tailings water release is expected.



## Approval Conditions

### Introduction

[23] The approach in the approvals granted by the AER is to reflect *TMF* outcomes and ensure appropriate information is captured in a timely manner to manage risk and make appropriate regulatory decisions as the Suncor's mining operations approach end of mine life. This approach – including research, monitoring, evaluation, and reporting requirements for Suncor on top of setting outcomes in the approvals – is acknowledged in *Directive 085* as necessary for fluid tailings regulatory oversight.

[24] Generally, the approval conditions address

- stakeholder engagement;
- project-specific thresholds for both new and legacy fluid tailings;
- tailings treatment technology and tailings deposit performance and milestones, including
  - mitigation measures and
  - research, monitoring, evaluation, and reporting; and
- environmental effects and implications.

[25] The approval conditions will manage risk and uncertainties, and support flexibility and adaptive management. Approval conditions must be enforceable. The AER has a full suite of enforcement and compliance tools available. The AER's *Integrated Compliance Assurance Framework (ICAF)* and *Manual 013* are applicable to the approvals. In addition, the management actions as set out in the *TMF* and *Directive 085* are tools available to the AER. A common theme in ICAF, the *TMF*, and *Directive 085* is a flexible approach; namely, to allow for the AER's discretion to choose the appropriate tools to the specific circumstances to ensure the most effective outcome.

[26] Details of the main decisions are set out below.

## Stakeholder Engagement

### Issue

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

### Context

[28] The issue of ongoing stakeholder engagement on oil sands tailings management was raised frequently by ERP participants in both their submissions and during the ERP technical meeting. Suncor

acknowledged and committed to maintaining ongoing dialogue and engagement with the indigenous communities in the oil sands area.

#### Decision

[29] Suncor must engage with stakeholders and indigenous communities about tailings management activities, including an annual forum. Suncor must also report annually to the AER on the engagement undertaken.

#### Suncor

[30] In response to the draft approval conditions relating to engagement, Suncor stated it is supportive of the draft approval conditions relating to stakeholder engagement and prides itself on its engagement efforts with respect to its operations. Suncor also stated that it will continue to engage with aboriginal communities and stakeholders throughout the life cycle of the operation of its facilities.

#### SOC Filers

[31] McMurray Métis, FMMCA, and ACFN each explicitly expressed concerns in their SOC's on limited opportunities and need for capacity to participate and inform tailings and research plans.

[32] A common theme from the SOC filers during the ERP and in the feedback on the draft conditions was enhanced engagement and collaboration. The section "Enhanced Review Process" summarizes the concerns put forward by participants through the ERP.

[33] OSEC expressed concerns with public consultation and stakeholder involvement.

[34] McMurray Métis expressed concerns that there has been limited opportunity for it to participate and be informed on the construction design and implementation of the DPL pilot test. Additionally, they believe there is a need for capacity funding, ongoing community engagement, and involvement in tailings management.

[35] FMMCA expressed concerns that there is currently no engagement of Métis and other aboriginal groups on tailings and reclamation research and feels it is essential to be engaged in a meaningful way in research and reclamation planning. FMMCA also noted Suncor did not provide discussion on involving FMMCA in aquatic monitoring plans for DDA3 or on what types of active management will be implemented during the pit lake filling period.

[36] ACFN raised concerns with its limited ability to be included in the planning, monitoring, research, follow-up, and adaptive management of tailings and that there was a lack of consultation with the community on the aquatic closure of DDA3. ACFN also noted a need for greater transparency and access to information, and that there was no discussion on involving ACFN in aquatic monitoring plans for DDA3 or on what types of active management will be implemented during the pit lake filling period.

ACFN sought further explanation of some aspects of Suncor's applications, including technology selection and why certain RTR criteria were not selected.

[37] Recommendations from OSEC, McMurray Métis, FMMCA, and ACFN focused on involvement in the planning, construction, operation, and monitoring of tailings management research and plans and the development of research and reclamation plans; a workshop or multistakeholder forum; and capacity funding for engagement activities.

## AER

[38] To increase transparency and involvement of others in fluid tailings management, it is the AER's expectation that Suncor's engagement efforts respecting tailings management will continue to include the SOC filers on these applications. It is expected that over the life cycle of Suncor's mine operations the stakeholders who are engaged may change to reflect the issues and concerns of the day. As such, the AER is not specifying exactly who Suncor must engage with. It is the AER's expectation that Suncor's engagement will be informed by its research and ongoing operations and be timely and meaningful.

[39] A common theme in the feedback on the draft approval conditions was engagement and collaboration on the various plans and submissions. It is the AER's expectation that Suncor in its ongoing engagement efforts will engage with its stakeholders on these plans and submissions, both in the creation of them and in the reporting back on efforts undertaken and the results of the various plans. The AER also expects stakeholders to participate in good faith and provide meaningful input to Suncor.

[40] ACFN, FMMCA, McMurray Métis, and OSEC also requested there be a requirement for an annual forum or workshop to be held to discuss various issues and reports on tailings management.

[41] The AER is not specifying the format of the annual forum (e.g., workshop or meeting). The AER believes, based on Suncor's extensive engagement experience, that it is appropriate to leave the design and scope of the forum to Suncor. However, it is the AER's expectation the annual forum will be tailored to what has occurred in the past year and what is upcoming. It can provide information to stakeholders, gather input from stakeholders, and plan on how engagement will occur for the upcoming year. In addition, it is expected the annual forums in 2022 and 2023 may be more robust as these are the critical time frames for tailings management regulatory decisions, such as the determination of the appropriate closure option (e.g., terrestrial versus aquatic).

[42] Suncor 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

### Issue

[43] New and legacy fluid tailings must be treated and progressively reclaimed during the life of the project, with all fluid tailings RTR ten years after the end of mine life. The *TMF* provides fluid tailings inventory profile guidelines that operators must consider in the development of their TMP.

[44] The fluid tailings profile represents the volume of fluid tailings that do not meet RTR criteria and both the legacy and new fluid tailings profiles are key measurement tools against which the performance of an operator will be measured.

### Legacy (Equivalent) Fluids Tailings Profile

#### Context

[45] Legacy fluid tailings are fluid tailings that existed prior to January 1, 2015. All legacy tailings must be RTR by the end of mine life.

[46] It is not possible to physically distinguish between the treatment of legacy and new fluid tailings when legacy and new fluid tailings are placed in the same deposit. For these situations the *TMF* and *Directive 085* recognize the concept of legacy (equivalent) volumes. The operator may allocate the volume meeting RTR criteria to either its legacy (equivalent) volume inventory or its new fluid tailings volume inventory. A legacy (equivalent) volume is an accounting volume.

#### Decision

[47] The AER finds that Suncor's legacy (equivalent) fluid tailings profile meets the objective of the *TMF*.

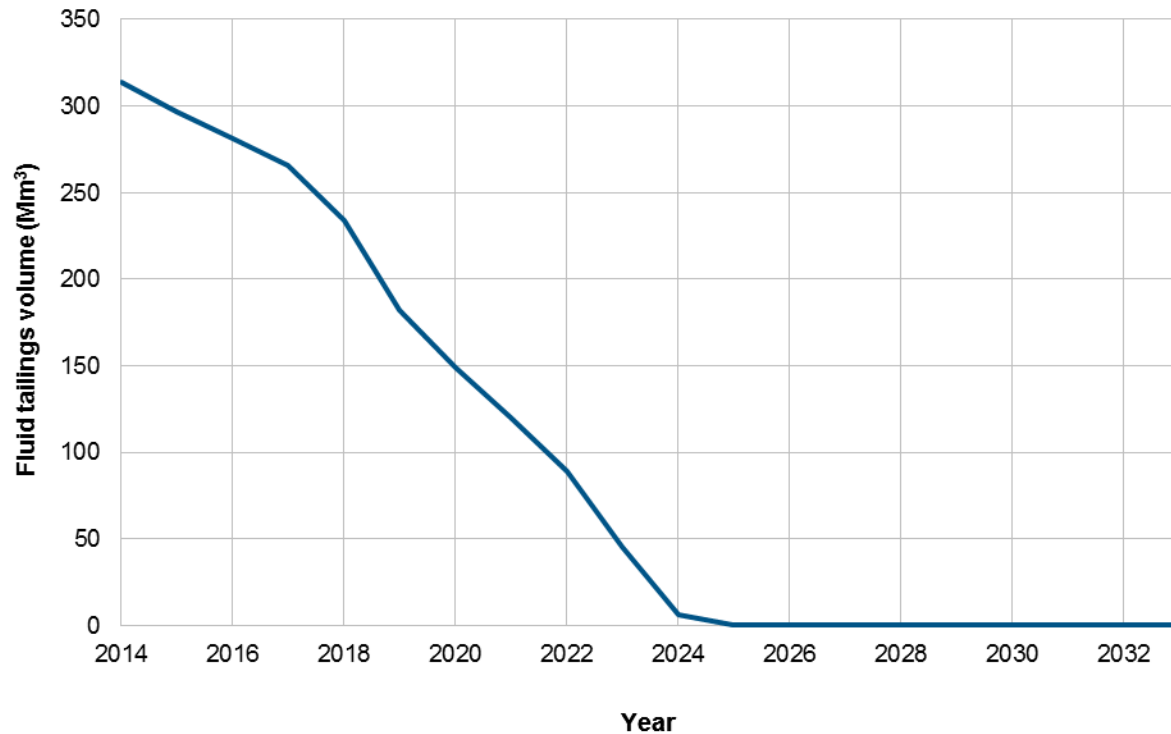
[48] Suncor must achieve the legacy (equivalent) tailings profile depicted in figure 1.

[49] To demonstrate measureable progress of the deposits that contain legacy fluid tailings, Suncor must meet specified milestones.

#### Suncor

[50] Suncor stated that its legacy (equivalent) fluid tailings profile was based on the following assumptions:

- The volume of legacy fluid tailings was estimated at 314 Mm<sup>3</sup>.
- The volume of tailings treated was allocated to its legacy (equivalent) fluid tailings inventory first, and to new fluid tailings inventory second.



**Figure 1. Profile of legacy (equivalent) fluid tailings**

- An equivalent volume of legacy tailings would be treated and would achieve RTR status by 2025, eight years before the end of mine life.
- The end of the mine life was 2033.

[51] Suncor indicated that legacy fluid tailings were contained in Pond 1A, Pond 2/3, Pond 5, Pond 6, Pond 7, DDA1, Pond 8B, the South Tailings Pond (STP), and SD8.

[52] Suncor's legacy (equivalent) fluid tailings profile is shown in figure 1.

#### SOC Filers

[53] No specific concerns regarding Suncor's profile of legacy (equivalent) fluid tailings were raised by SOC filers. However, they did highlight the importance of progressive reclamation and managing legacy tailings ponds. OSEC expected that any future changes to RTR criteria do not result in a change to Suncor's profile.

#### AER

[54] The AER agrees that effective management of reclamation progress requires timely reporting and robust monitoring and planning. Suncor's legacy (equivalent) fluid tailings profile meets the objective of the TMF because an equivalent volume of Suncor's legacy fluid tailings will be progressively treated during mine life and will achieve RTR status by 2025, eight years before the end of mine life.

[55] Suncor's use of legacy (equivalent) volumes and the legacy (equivalent) tailings profile is appropriate given that active tailings ponds and deposits contain a mixture of legacy and new fluid tailings.

[56] Because any volume of treated tailings, including new fluid tailings, is allocated to Suncor's legacy (equivalent) fluid tailings inventory first, the profile does not demonstrate progress of the treated tailings deposits towards reclamation. To demonstrate measureable progress of the deposits that contain legacy fluid tailings, Suncor is required to meet the following milestones:

- Pond 8B will be drained and mined out from 2018 to 2021.
- Pond 5, Pond 6, and Pond 7 must achieve RTR status in 2019, 2028, and 2033, respectively.
- DDA1 must achieve RTR status by 2033.
- RTR criteria for remnant tailings, which include fluid tailings volumes in the STP and SD8, must be submitted by September 30, 2022.
- A plan for extended use for Pond 1A and Pond 2/3 must be submitted by September 30, 2023.

## Profile of New Fluid Tailings

### Context

[57] New fluid tailings are fluid tailings that are produced after January 1, 2015. The *TMF* specifies that new fluid tailings from the project must be RTR within ten years after the end of mine life.

### Decision

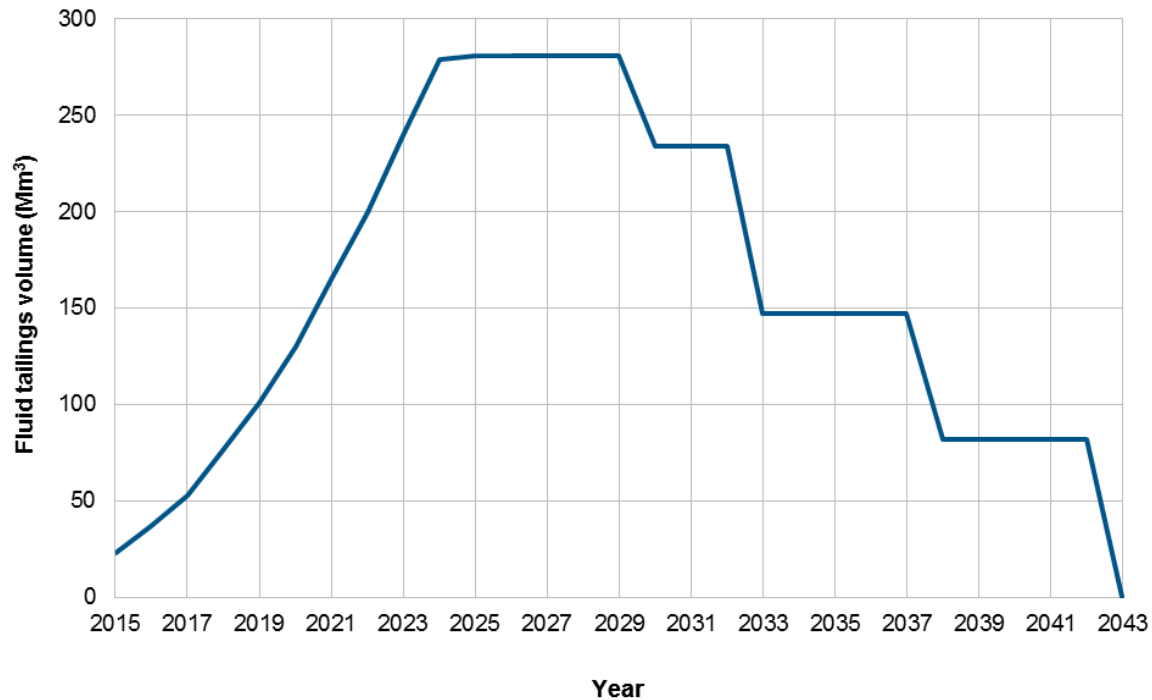
[58] The AER finds that Suncor's new fluid tailings profile, with modifications, meets the objective of the *TMF*. The AER modified Suncor's new fluid tailings profile to require Suncor to achieve zero new fluid tailings volume (from 18 million cubic metres in Suncor's application) by 2043 (which is 10 years after mine life) to ensure compliance with the *TMF*.

[59] Suncor must achieve the fluid tailings profile outlined in figure 2.

### Suncor

[60] Suncor stated the following:

- New fluid tailings volumes inventory would peak at 281 Mm<sup>3</sup> in 2025, which is less than the 10 years of fluid tailings accumulation allowed by the *TMF*.
- The new fluid tailings volume accumulation would decline to 147 Mm<sup>3</sup> at the end of mine life (2033), which was less than the five years of accumulated fluid tailings production allowed by the *TMF*.



**Figure 2. Profile of new fluid tailings**

- Ten years after the end of mine life Suncor would have 18 Mm<sup>3</sup> of fluid tailings on site that would not be in a RTR state.

[61] Suncor indicated that its profile of new fluid tailings assumed the following:

- The maximum amount of fluid tailings produced in one year would occur in 2023.
- The fluid tailings treatment technologies included in-line flocculation, thin lift drying, and rehandling (DDA1/MD9); PASS technology (DDA3); and in-line flocculation and stacking<sup>1</sup> (DDA2).
- PASS technology for DDA3 would begin in 2018.
- In-line flocculation and stacking for DDA2 would begin in 2019.
- All tailings ponds and deposits would have a small remnant volume of fluid tailings left over because of the physical limitation of removing all fluid tailings from a deposit.

[62] Suncor stated that it was evaluating the viability of DDA2. If Suncor did not proceed with DDA2 it would rely on DDA3 to manage the volumes of fluid tailings otherwise allocated to DDA2.

<sup>1</sup> The term stacking is independent of the use of this term in Suncor's soil salvage and placement plans.

## SOC Filers

[63] No specific concerns regarding Suncor's profile of legacy (equivalent) fluid tailings were raised by SOC filers. OSEC expected that any future changes to RTR criteria do not result in a change to Suncor's profile.

## AER

[64] The AER has determined that

- the peak volume of new fluid tailings provided by Suncor is less than the maximum ten years of full production allowed by the *TMF* and guided by *Directive 085*;
- after 2025, the tailings treatment capacity will exceed the production of new fluid tailings volumes, which is consistent with the *TMF* and *Directive 085* profile guidance;
- at the end of mine life there will be an untreated fluid tailings accumulation of 147 Mm<sup>3</sup>, or about five years of full production, which is consistent with the *TMF* and *Directive 085*; and
- 18 Mm<sup>3</sup> of untreated remnant fluid tailings is forecast to remain ten years after the end of mine life, which does not meet *TMF* or *Directive 085* profile guidance or the *TMF* objective that all fluid tailings will achieve RTR status by 2043.

[65] Based on this, the AER modified Suncor's new tailings profile to require Suncor to achieve zero new fluid tailings volume by 2043.

[66] There are risks that Suncor will not achieve this profile. The ability of Suncor to achieve the profile is dependent on successfully implementing its TMP.

[67] This decision report identifies a number of uncertainties and risks to the plan, such as not meeting RTR criteria, the success of PASS technology, and the construction and operation of DDA2, and identifies the approval conditions that address uncertainties and risks to the TMP.

## Thresholds

### Context

[68] The volume of accumulated fluid tailings is identified as the primary indicator to be used in the *TMF* to manage and decrease liability and environmental risk resulting from the accumulation of fluid tailings on the landscape. Triggers and a limit (collectively referred to as "thresholds") will be set relative to a fluid tailings volume profile generated on a project-specific basis. The triggers and limit will ensure that new fluid tailings are not accumulating beyond a volume or at a rate that precludes operators from meeting the *TMF*'s objective. Until fluid tailings are RTR, they will be considered part of the total fluid tailings volume inventory.



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

### **Profile Deviation Trigger**

- The profile deviation trigger is based on when the fluid tailings volume growth is 20 per cent higher than that in the approved profile. Additional management action is required when the profile deviation trigger is exceeded.
- The *TMF* states the profile deviation trigger would consider a 5-year rolling average to account for year-over-year variability, and that the profile deviation trigger applies to new fluid tailings profiles.

### **Total Volume Trigger**

- Indicates that the volume of fluid tailings has exceeded its approved maximum accumulation and requires additional management action.
- The *TMF* defines the total volume trigger as 100 per cent of the end of mine life target (a volume of fluid tailings that can be managed to a RTR state within 10 years after end of mine life).
- The *TMF* indicates that the total volume trigger can be based on the greater of the maximum approved fluid tailings inventory volume or the end of mine life target.

### **Total Volume Limit**

- A volume of fluid tailings that 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) by ten years after the end of mine life. Therefore, the most severe management responses are initiated if there is an exceedance of this limit.
- The *TMF* defines the total volume limit as 140 per cent of the end of mine life target.
- The *TMF* indicates that the total volume limit can be based on the greater of the maximum approved fluid tailings inventory volume, or the end of mine life target.

### **Decision**

[70] The profile deviation trigger is based on a 5-year rolling average of the annual profile deviation for the new tailings profile.

[71] The total volume trigger is set at 281 Mm<sup>3</sup>.

[72] The total volume limit is set at 393 Mm<sup>3</sup>.

## Suncor

[73] Suncor proposed the following thresholds:

<b>profile deviation trigger</b>	20 per cent based on a five-year rolling average per cent difference between actual and measured fluid tailings inventory
<b>total volume trigger</b>	295 Mm <sup>3</sup>
<b>total volume limit</b>	413 Mm <sup>3</sup>

## SOC Filers

[74] OSEC recommended an alternative profile deviation trigger using an annual calculation and suggested that this threshold be applied to both the growth and decline phases as part of its feedback on draft conditions. OSEC also raised concerns about the management actions and responses that are triggered by threshold exceedances.

## AER

[75] In accordance with the *TMF*, the AER requires that Suncor not exceed the following:

- The profile deviation trigger is a five-year rolling average of the annual profile deviation and is applicable to both the new and legacy profiles.
- The AER considered the proposed profile deviation trigger calculation put forth by OSEC and determined that it did not function for the decline phase of the profile. The approved profile deviation trigger is applicable to the entire profile, including growth and decline phases.
- The total volume trigger is set at 281 Mm<sup>3</sup>. The AER did not accept Suncor's proposed trigger as Suncor's approved fluid tailings volume profile will peak at 281 Mm<sup>3</sup>, not 295 Mm<sup>3</sup>, which is greater than the end of mine life target at 147 Mm<sup>3</sup>.
- The total volume limit is set at 393 Mm<sup>3</sup> (140 per cent of 281 Mm<sup>3</sup>).

[76] If any of the triggers or limits are exceeded, Suncor is required to comply with the management response or action directed by the AER. Management responses and actions and the intent of these are set out in the *TMF* and *Directive 085*. The AER also has a full suite of enforcement and compliance tools available. The AER's *ICAF* and *Manual 013* are applicable to the approvals. In accordance with section 4.2.6 of *Directive 085*, where there are changes to the TMP that affect thresholds or increase risks, an amendment application is required, including effective stakeholder engagement.

## Fluid Tailings Treatment Technology and Research

### Issue

[77] 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.

### General Technology Selection

#### Context

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

[79] Suncor proposed the use of in-line flocculation, thin lift drying and rehandling for DDA1/MD9, the future use of in-line flocculation and stacking for DDA2, and the use of PASS technology in DDA3.

#### Decision

[80] The AER finds that the current use of in-line flocculation, thin lift drying, and rehandling (DDA1/MD9); the future use of in-line flocculation and stacking (DDA2); and the PASS technology (DDA3) has the potential to provide adequate capacity for Suncor to treat all legacy and new fluid tailings before 2043 in accordance with the *TMF*'s objective. However, these technologies are subject to further assessment and research and to future policy.

[81] Suncor must research ways to mitigate the uncertainties within its TMP and provide the AER with the right information at the right time to make key regulatory decisions.

[82] Suncor must provide detailed site-specific implementation plans for its terrestrial, aquatic, and wetland research.

[83] Decisions regarding technology selection for individual deposits are in subsequent sections.

#### Suncor

[84] Suncor identified three options for managing its fluid tailings volumes:

- Reduce fluid tailings generation
- Increase fluid tailings storage capacity
- Increase fluid tailings treatment capacity

[85] As its primary approach to managing fluid tailings volumes, Suncor chose to increase its fluid tailings treatment capacity but stated that it would also evaluate options to reduce fluid tailings

generation. Suncor stated that it would not pursue increased fluid tailings storage capacity because it would only serve to defer the final treatment and reclamation of fluid tailings.

[86] Suncor stated that it would need to almost triple its fluid tailings treatment capacity to meet the *TMF*'s objective.

[87] To meet its need for increased fluid tailings treatment capacity, Suncor considered in-line flocculation, consolidated tailings (CT), and solid-liquid separator technologies.

- Suncor indicated that CT technology was not feasible because of site-specific containment restrictions and construction material availability.
- Suncor stated that solid-liquid separator technology (e.g., centrifuges and thickeners) was unsuitable because of the time required to implement but that solid-liquid separator technology would be evaluated for future dedicated disposal area (DDA) improvements.
- Suncor selected in-line flocculation because of its experience with the technology in DDA1 and the infrastructure was already in place. Suncor also claimed that in-line flocculation resulted in the smallest volume of treated tailings compared to CT and solid-liquid separator technology.

[88] Suncor evaluated the use of in-line flocculation for an in- and out-of-pit deposit. Suncor indicated that an out-of-pit deposit would limit operational flexibility and require

- up to an additional 20 square kilometres of surface disturbance,
- construction of additional deposits,
- extended reclamation timelines and
- costs that are prohibitive and impact the further development of the mineable oil sands resource.

[89] Suncor also evaluated terrestrial and aquatic closure outcomes. Suncor concluded that an in-pit aquatic closure outcome would

- require a smaller footprint,
- open up more area within the project footprint for progressive reclamation,
- require shorter reclamation timelines and have more sustainable costs than the out-of-pit terrestrial or the in-pit terrestrial closure outcomes; and
- effectively manage new and legacy fluid tailings.

[90] Suncor concluded that its PASS technology for DDA3, which uses in-line flocculation and results in an aquatic closure, was the best way to

- achieve the *TMF* objective,

- match tailings production with tailings treatment capacity, and
- capture the benefits of an in-pit aquatic closure outcome.

[91] Suncor concluded that it would treat 757 Mm<sup>3</sup> of fluid tailings through the use of three applications of in-line flocculation technology, in concert with thin lift drying (DDA1/MD9), stacking (DDA2), and PASS technology (DDA3):

- 154 Mm<sup>3</sup> by in-line flocculation, thin lift drying, and rehandling
- 79 Mm<sup>3</sup> by in-line flocculation and stacking
- 524 Mm<sup>3</sup> by PASS technology (in-line flocculation and coagulant addition with an aquatic ecosystem formed at closure)

#### SOC Filers

[92] Concerns and recommendations raised by SOC filers with respect to the technologies proposed by Suncor are discussed in subsequent sections.

[93] McMurray Métis, FMMCA, and ACFN indicated that Suncor should explore alternative tailings treatment methods, with McMurray Métis and FMMCA recommending that Suncor limit the use of undisturbed land.

#### AER

[94] The AER finds that Suncor's approach of increasing fluid tailings treatment capacity while evaluating options to reduce fluid tailings generation is appropriate.

[95] As discussed above, the AER finds that the current use of in-line flocculation, thin lift drying, and rehandling (DDA1/MD9); the future use of in-line flocculation and stacking (DDA2); and the PASS technology (DDA3) has the potential to provide adequate capacity for Suncor to treat all legacy and new fluid tailings before 2043 in accordance with the *TMF*'s objective. However, these technologies are subject to further assessment and research and future policy.

[96] Suncor evaluated a number of technology options to meet its treatment capacity needs. One option considered was CT. The use of CT technology at Suncor's site was previously considered as part of Suncor's 2009 thin lift drying application. At that time, CT technology was not considered viable due to site-specific containment restrictions and construction material availability. No additional information has been provided by Suncor or stakeholders that would cause the AER to revisit this decision.

[97] A second option considered by Suncor was solid-liquid separator technology. The implementation of this technology could take a year or more. At this time, Suncor needs to start depositing in Q2 2018 or Suncor will encounter a limitation with fluid storage capacity on site. Therefore, timing is a constraint. This technology has potential to be used as part of Suncor's tailings management in

the future, and the AER encourages Suncor to continue to evaluate the use of this technology for any improvements to DDA performance.

## Pilots, Prototypes, and Demonstrations

### Context

[98] Innovation is a principle of the *TMF* and *Directive 085*. To facilitate innovation at the Suncor mine operations and to address administrative inconsistencies, the AER has updated the requirements in Suncor's *OSCA* approval to be consistent with the principles of the *TMF* and *Directive 085*, and with the requirements under *EPEA*.

### Decision

[99] Suncor must notify the AER six months in advance of any proposed on-site pilots, prototypes, or demonstrations and may not construct or implement them unless a written approval amendment or authorization is granted.

### Suncor

[100] Suncor continues to research other fluid tailings treatment technologies, including solid-liquid separators and in situ dewatering.

### SOC Filers

[101] No specific concerns around pilots, prototypes, and demonstrations (other than the DPL pilot test) were raised by SOC filers.

### AER

[102] The added requirements in Suncor's approvals are to ensure appropriate oversight. The AER continues to support and acknowledge the importance of technological innovation, understanding, and certainty around fluid tailings treatment options. As highlighted in *Directive 085*, the AER expects Suncor to show commitment to innovation and continuous improvement and share what it learns from ongoing technology development.

## Tailings Research and Implementation Plans

[103] The AER has expectations as to the research conducted and is requiring a series of research plans and research and implementation plans.

[104] The AER expects Suncor to use standard scientific methodology in the design of each research plan submitted, and Suncor is required to provide details that support any of its research, including the

objective, the applicability of that objective in addressing the uncertainties and risks associated with Suncor's TMP, and how the research is building upon existing knowledge.

[105] Proposed research plans should be focused on addressing site-specific uncertainties and be implementable on site in a timely manner to ensure that the *TMF* objective is met, ensure that reclamation timelines are not extended, and assist with regulatory decision making. It is important to understand how Suncor could incorporate the research results into its mining operations. In addition, Suncor should consider the benefits of peer-reviewed research and publication to provide an appropriate level of assurance.

[106] All research plans and research and implementation plans should include the following:

- rationale for proposed monitoring plans that support research;
- a discussion how the selection of performance measures, criteria, and validation methods relate to implementation;
- the applicability and scalability of the research to full implementation;
- a discussion on impact to reclamation outcomes and timing for the site; and
- the changes that would be necessary to the mine design and material requirements to achieve reclamation outcomes.

[107] The AER's review of Suncor's research plans will be informed by the research expectations set out in this decision. If Suncor's research plans do not accord with these expectations, the AER will re-evaluate the regulatory approach.

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

## DDA1/MD9 – Technology Selection

### Context

[109] Suncor is combining in-line flocculation with thin lift drying and rehandling in DDA1/MD9. The fluid tailings are being treated with a flocculent and placed in thin lifts over large, sloped areas for dewatering and atmospheric drying in DDA1. The treated tailings will undergo freezing and thawing according to the seasons. Within 1 to 2 years the treated tailings will be excavated and moved to MD9 for co-disposal with overburden.

### Decision

[110] The AER finds that Suncor's use of in-line flocculation, thin lift drying, and rehandling for DDA1/MD9 is acceptable subject to approval conditions.

[111] Suncor must

- submit a settlement monitoring plan by February 28, 2018, to assure the AER that settlement, an area of concern with MD9 closure, is being monitored;
- submit an evaluation of the volume of treated tailings to be placed in MD9 and its implications (both to MD9 and DDA3) by February 28, 2020;
- submit a plan that updates MD9 fluid tailings management that addresses *Directive 085* requirements, evaluates the performance of past or current tailings deposits where similar tailings treatment technology and reclamation outcomes were proposed, explains how research results were incorporated, and addresses the resolution of uncertainties by September 30, 2023; and
- report annually on research results and technology improvements that support reduced MD9 reclamation timelines to assure the AER and stakeholders that Suncor is focused on accelerated reclamation and closure of MD9.

Suncor

[112] Within the co-disposal area of MD9, settlement of up to 10 to 25 metres was expected to occur over a period of 50 to 100 years following the end of operations. Suncor stated that the uncertainty in the time for MD9 to reach final settlement was because of

- variable material properties of the treated tailings, such as the clay-to-water ratio (CWR);
- variations in treated tailings and overburden material mixing; and
- unknown thickness of nonmixed treated tailings.

[113] Suncor proposed the following mitigation measures and milestones for MD9:

- 2020** Evaluate the treated tailings volume from DDA1 to be deposited in MD9.
- 2022** Commence reclamation of exterior MD9 slopes.
- 2023** Evaluate and provide an update on alternatives to manage settlement and treated tailings properties to reduce the risk to and accelerate the timeframe of reclamation and closure activities.
- 2030** Complete reclamation of exterior slopes and commence reclamation of the co-disposal area.
- 2085** Complete reclamation activities.



[114] Suncor stated that its mitigation measures, along with existing monitoring programs, would provide sufficient data and information to manage environmental risks and uncertain reclamation and closure timing.

#### SOC Filers

[115] No specific concerns with respect to Suncor's selection of in-line flocculation, thin lift drying, and rehandling were raised by SOC filers. However, settlement and reclamation timing of MD9 was discussed during the ERP technical meeting.

[116] OSEC, FMMCA, and McMurray Métis each recommended conditions of approval that focused on shortening reclamation timelines. FMMCA and McMurray Métis stated that the draft conditions on settlement monitoring and research and technology improvement were not forceful enough. OSEC also recommended that Suncor develop metrics and report on the performance of MD9 in designated benchmark years.

#### AER

[117] MD9 was approved in 2008. In-line flocculation and thin lift drying to dewater fluid tailings in DDA1 was approved in 2009 and reached a rate of 15 Mm<sup>3</sup> per year in 2015. Treated tailings placement in MD9 also commenced in 2015.

[118] The AER finds that Suncor's continued use of in-line flocculation, thin lift drying, and rehandling for DDA1/MD9 is acceptable subject to the approval conditions described within this section. These requirements will

- manage the uncertainty associated with settlement and the final volume of the deposited fluid tailings;
- provide the information in a timely manner to update MD9 fluid tailings management; and
- inform future regulatory decisions regarding the reclamation and closure of MD9.

[119] Suncor, the AER, and stakeholders have all identified settlement of the treated tailings in MD9 as a significant risk. Due to the uncertainty in the timing and the amount of settlement, Suncor must submit a settlement monitoring plan by February 28, 2018, and report annually on research results to improve reclamation timelines. Applicable research must investigate acceleration of reclamation timeframes and explore modified placement plans. The AER encourages reclamation activities to occur progressively but does not prescribe reclamation timelines.

[120] Suncor is still evaluating the volume of treated tailings to be stored in MD9. The AER is concerned with the length of time required to reclaim MD9 and meet the *TMF* outcomes of progressive reclamation and minimization of liability. The evaluation of treated tailings to be placed in MD9 by February 28, 2020, and annual reporting on research results and technology improvements are intended to support reduced MD9 reclamation timelines.

[121] Suncor will evaluate and provide an update on alternatives to manage settlement and treated tailings properties to reduce risk to and accelerate the timeframe of reclamation and closure activities in 2023. The AER expects Suncor's update to its plan for MD9 fluid tailings management to explore modified DDA1 operations and placement plans (e.g., increasing the area and decreasing the thickness of treated tailings, layering treated tailings with overburden), show how MD9 could be reclaimed faster, explain how research results have been incorporated, be supported by research and operational data, and address potential operational and environmental issues including the rate of mobility of harmful substances.

## DDA2 – Technology Selection

### Context

[122] DDA2 will be an out-of-pit stacked deposit, where fluid tailings will be treated with a flocculent, placed in thin lifts to dewater and dry and stack, and left in place.

### Decision

[123] The AER finds that Suncor's use of in-line flocculation and stacking for DDA2 is a reasonable approach to manage tailings, subject to the approval conditions described within this section.

[124] Suncor must submit a plan for DDA2 fluid tailings management that addresses *Directive 085* requirements, evaluates the performance of past or current tailings deposits where similar tailings treatment technology and reclamation outcomes were proposed, explains how research results were incorporated, and addresses resolution of uncertainties, by September 30, 2018.

[125] Suncor may only place treated tailings in DDA2 once a written approval amendment or authorization is granted.

### Suncor

[126] Suncor stated that DDA2 would be reclaimed to a terrestrial closure outcome. Treated tailings would be deposited into DDA2 by 2019 and reclamation activity would be complete by 2055.

[127] Suncor noted that DDA2 was not a cost-effective treatment system as it required low rates of production to produce a stackable deposit. Suncor stated that it was actively seeking ways to reduce its reliance on DDA2, including shifting treatment production to DDA3 or implementing the feed fines avoidance initiative.

## SOC Filers

[128] FMMCA indicated that it expected DDA2 to lack the necessary strength through thin lift drying, and ACFN sought clarity between tailings placement in DDA2 and DDA3. No other specific concerns were raised with respect to Suncor's selection of in-line flocculation and stacking.

[129] OSEC, FMMCA, and McMurray Métis all recommended shortened reclamation timelines. OSEC sought clarity on whether Suncor would be allowed to place treated tailings in DDA2 prior to authorization of an updated plan as part of its feedback on draft conditions.

## AER

[130] Suncor has completed field testing for in-line flocculation and stacking, and those results, which have previously been provided to the AER, demonstrate the potential of this treatment technology. The AER finds that Suncor's use of in-line flocculation and stacking for DDA2 is a reasonable approach to manage tailings, subject to the conditions of approval described within this section.

[131] To support the *TMF* and *Directive 085* principles of technological innovation, and to reduce the potential added volume of fluid tailings to DDA3, the AER supports the proposal to place treated tailings in DDA2. If Suncor determines that DDA2 is not to be built, the AER expects Suncor to address the impact to DDA3 storage capacity.

[132] Additional technical information is necessary to support the viability of DDA2. Therefore, the AER requires Suncor to update the plan for DDA2 by September 30, 2018, to prepare for placement of fluid tailings in DDA2 in 2019. That plan is to address *Directive 085* requirements, evaluate the performance of past or current tailings deposits where similar tailings treatment technology and reclamation outcomes were proposed, explain how research results were incorporated, and address resolution of uncertainties.

## DDA3 – PASS Technology – Technology Selection

### Context

[133] Suncor proposes to use PASS technology in DDA3 to treat 70 per cent of its tailings. Phase 1 of the PASS technology adds a coagulant and a flocculent to fluid tailings, which are then placed in DDA3. After all treated tailings have been placed, Suncor proposes to cap DDA3 with water in phase 2 to form an aquatic closure landscape. Phase 3 is controlled water flow through and water return and phase 4 is water return under natural flow and pit lake development.

[134] There are various risks and uncertainties associated with PASS technology. If research demonstrates that it is successful at the scale of DDA3, PASS technology may provide an aquatic closure outcome. It is unknown at this time if the proposed aquatic closure will align with future GoA policy as policy work is ongoing.

## Decision

[135] The AER finds that Suncor's use of Phase 1 of Suncor's PASS technology for DDA3 is a reasonable approach to manage tailings, subject to the approval conditions described within this section.

[136] Suncor must

- submit an annual assessment of PASS technology operational performance, DDA3 deposit performance and research results associated with DDA3 as a part of *Directive 085* reporting;
- submit an updated DPL pilot test research plan, with sufficient detail to allow the AER to assess the objectives and milestones of the research and its applicability to DDA3, by November 30, 2017;
- submit research and implementation plan for DDA3 as a self-sustaining locally common boreal forest lake ecosystem by September 30, 2018;
- submit tailings and pit lake research results, conclusions, and status annually; and
- submit a proposal for final closure of DDA3 in 2023, 10 years before the end of mine life.

[137] Given the uncertainties of aquatic closure, Suncor is not authorized to place any water, including industrial wastewater, above treated or untreated tailings for the purpose of creating an aquatic closure landscape, or to conduct phases 2, 3, or 4 of the PASS technology.

## Suncor

[138] Suncor proposed to develop a new tailings deposit, DDA3, and use the PASS technology to treat 70 per cent of its fluid tailings.

[139] Suncor stated that DDA3 and the PASS technology would operate in four phases:

- Phase 1: dewatering and treatment of fluid tailings – 2018 to 2043.
- Phase 2: placement of a water cap – 2043 to 2053.
- Phase 3: controlled water flow through and water return – 2053 to 2063.
- Phase 4: water return under natural flow and pit lake development – 2063 onwards.

[140] Phase 1 of the PASS technology adds a coagulant and a flocculent to fluid tailings, which are then placed in DDA3. After all treated tailings have been placed, DDA3 would be capped with water in phase 2 to form an aquatic closure landscape.

[141] Suncor provided objectives for each phase. Phase 1 objectives include the following:

- Achieve volume reduction to meet containment objectives.
- Achieve a CWR of greater than or equal to 0.5 annual average.
- Reduce amount of water expressed from treated fluid tailings in phases 2 to 4.

- Reduce mobility of constituents of potential concern (COPCs) to improve the quality of expressed pore water, specifically hydrocarbon mobility, ultrafine mineral mobility, naphthenic acid mobility, and other COPC (e.g., select metal) mobility.

[142] Based on its laboratory test results, Suncor indicated that with the PASS technology

- the mobility of bitumen, ultrafine minerals, COPCs, and other material will be reduced;
- deposit stability would be sufficient for aquatic closure;
- select metals would precipitate and be sequestered in the deposit; and
- the improvement in the quality of expressed water from treated tailings increased the likelihood of rapidly establishing a fresh water lake ecosystem.

[143] Suncor stated that its test results provided it with confidence that the PASS technology would perform as claimed and would meet reclamation and closure outcomes for an aquatic landscape. Suncor acknowledged that there are still areas of uncertainty, including lake dynamics associated with scaling up to a full size lake and its understanding of risk posed by light hydrocarbons.

[144] Suncor plans to conduct an aquatic closure research program, which includes a 15-year field trial DPL pilot test beginning in 2017 to address uncertainties and validate assumptions for the PASS process and aquatic closure.

[145] Suncor provided information on risks associated with the PASS process, water quality associated with DDA3 and Upper Pit Lake, and reclamation of DDA3. Suncor concluded that risks were either low, unlikely to occur, or could be adequately managed. Suncor identified that results from its aquatic closure research program, including the DPL pilot test, was a key mitigation to manage the risks.

#### SOC Filers

[146] McMurray Métis, FMMCA, ACFN, and OSEC all expressed concerns with DDA3 and aquatic closure, including climate change implications, knowledge about the ultimate success of a pit lake as a healthy ecosystem, toxicity, a lack of demonstrated success of PASS technology, and unclear mitigation triggers. The potential of aquatic closure of DDA3 using PASS technology was acknowledged by ERP technical meeting participants, however concerns were also raised including

- the need for additional documentation and assessments
- approval of an end pit lake being premature
- the need for a terrestrial closure alternative

[147] ACFN, FMMCA, and McMurray Métis each recommended content that they would like to see addressed as part of Suncor's research, and OSEC submitted that the AER or Alberta Environment and

Parks (AEP) must explicitly define the characteristics of a boreal lake ecosystem in northern Alberta as part of their feedback on draft conditions.

[148] FMMCA, McMurray Métis, ACFN, and OSEC also expressed concern in their SOC's, ERP, and feedback on draft conditions about engagement around DDA3 research and monitoring plans. Engagement is discussed in a dedicated section.

[149] OSEC, FMMCA, and McMurray Métis also recommended that reclamation timelines be shortened.

#### AER

[150] The AER finds that Suncor's use of Phase 1 of Suncor's PASS technology for DDA3 is a reasonable approach to manage tailings, subject to the conditions of approval described within this section.

[151] The AER recognizes the potential benefits of PASS technology if successful at the scale of DDA3. PASS technology may provide increased tailings treatment rates and land footprint efficiency and may enable benefits of an aquatic closure outcome, including the sequestration of fines and improvement in lake performance.

[152] PASS technology performance is uncertain. Performance assumptions have not been verified at the scale and complexity of DDA3. Lab data provided by Suncor supporting use of PASS technology are not conclusive. For example, there can be a varying degree of immobilization of ultra-fines, bitumen, and other potentially harmful substances; this variability could result in technology performance objectives not being met.

[153] The AER has identified PASS uncertainties as a high risk and therefore requires proactive regulatory oversight and has included approval conditions to manage the risk. *Directive 085* requires operators to report on technology and deposit performance annually. Suncor must include the following as part of its annual assessment of PASS technology and DDA3 performance:

- adequate information to understand the relationship between PASS technology performance and deposit performance (e.g., RTR criteria), including the number of days the technology was not operating as intended, a description of why the technology was not operating as intended, and the variation of properties of the treated tailings and released water;
- ultra-fines, bitumen and other hydrocarbon, and other potentially harmful substances, in the characterization of water recovered from treated tailings and runoff from RTR tailings;

- adequate information to evaluate whether or not the PASS technology phase objectives that are identified in the applications are being met; and
- consolidation of treated tailings within DDA3.

[154] There are long-term performance risks and uncertainties with PASS technology and the performance of DDA3 as an aquatic closure ecosystem. Though Suncor is undertaking research as part of its aquatic closure research program to address uncertainties, validate assumptions, and mitigate risk, Suncor's end of mine life is quickly approaching. The AER plans to decide in 2023 on the final closure of DDA3, whether it will be aquatic or terrestrial. Therefore, timeliness of research to resolve uncertainties is critical.

[155] Suncor has indicated that it plans to mitigate uncertainties associated with DDA3 and its new PASS technology through its DPL pilot test with a proposed length of 15 years. While Suncor has provided a high-level DPL pilot test research plan, the level of detail is not sufficient for the AER to fully understand which uncertainties Suncor is trying to resolve, what performance measures will be used to determine success, and if the material to be placed in the DPL is representative of the material to be placed in DDA3. Suncor must update its DPL for the AER to fully understand what uncertainties Suncor is trying to resolve. The updated DPL pilot test research plan will include general research plan expectations as described in the section "Tailings Research and Implementation Plan," and therefore Suncor is required to identify what performance measures it will use to determine success and to provide rationale for its monitoring plans that support the DPL pilot test research.

[156] The DPL pilot test has limitations (e.g., wave action, littoral zones), therefore additional long-term research is required to resolve uncertainties that the AER cannot wait until 2033 to resolve. Therefore, Suncor must have a research plan and the implementation plan for the aquatic closure of DDA3, which is intended to ensure that adequate information is available for decision making in 2023. This is ten years before end of mine life. This is a critical deadline as it should provide enough time for Suncor to adjust their TMP to meet any applicable policy if water-capped tailings and pit lakes are restricted by any applicable policy in effect at that time.

[157] The AER expects that the proposed research plans provide scientific information that will allow the AER to evaluate if the proposed research is representative of the DDA3 deposit. To enhance the scientific rigour of the research, Suncor should also address the potential for a control area or cell to validate its research hypotheses against. The updated plan should also include

- initial characterization of fluid tailings and pore water prior to treatment;
- source of fluid tailings;
- a rationale why the fluid tailings to be deposited are representative of the fluid tailings to be placed in DDA3;

- tailings treatment to be employed before and after placement;
- description of how tailings will be placed in deposit;
- source, volume, and characterization of all water to be placed in the DPL;
- a rationale as to why water used to create the cover is representative of the proposed water cover for DDA3;
- initial water cover depth to tailings deposition depth ratio;
- lake functions and factors to be considered in lake design; and
- confirmation of physical, chemical, and biological processes models to be developed, which may include
  - water flux and expressed water characterization,
  - generation of greenhouse gases, and
  - reswelling or resuspension of tailings.

[158] In addition, froth treatment tailings could have a detrimental impact on the success of a treated tailings deposit and should be included in the long-term research. Suncor stated that it does not intend to place froth treatment tailings into DDA3, but there are uncertainties associated with froth treatment tailings as described in this decision report. It is unclear if the DPL pilot test will be testing the impact of treated froth treatment tailings. If tailings are to be placed in the DPL pilot test that have properties of froth treatment tailings, Suncor should provide an explanation of how influences from the addition of these tailings would be isolated to ensure research results are applicable to DDA3.

[159] In addition, as part of the monitoring plans that support long-term and DPL pilot test research, Suncor should describe the following:

- deposit performance measurements;
- biological, physical, and chemical measurements of water and tailings sediment quality;
- fluxes between tailings and water; and
- biological, physical, and chemical reduction of organics and inorganics.

[160] The DPL pilot test is critical to the success of Suncor's TMP. This will assist in determining outstanding issues that may need to be addressed through other research projects.

[161] The approval prohibitions concerning the placement of water and the conduct of the latter phases of the PASS technology reflect the current uncertainties respecting the manner or type of the closure landscape.



## DDA3 – Terrestrial Closure Option – Technology Selection/Research

### Context

[162] It is unknown at this time if the proposed aquatic closure for DDA3 will proceed. Therefore, there are two possible closure outcomes for DDA3: terrestrial or aquatic.

### Decision

[163] Suncor must

- submit a research and implementation plan in 2018 that supports a self-sustaining locally common boreal forest ecosystem with a terrestrial closure for DDA3;
- submit an interim report on its terrestrial closure research and implementation plan in 2020;
- submit an updated DDA3 tailings treatment and target ecosites development plan, which includes the proposed closure approach, in 2023; and
- report on its terrestrial research results in its annual fluid tailings management report.

### Suncor

[164] Suncor provided an in-pit terrestrial closure option for DDA3. Suncor did not recommend this option because it estimated that DDA3 would be subject to a large degree of settlement over a long period of time, 120 to 150 years or more.

[165] Suncor identified 2023 as the next milestone that substantial new technical information on terrestrial closure will be available from six years of terrestrial programs and five years of PASS technology operations.

[166] Suncor stated that a final decision on the aquatic and terrestrial closure options could be made as late as 2039, allowing four years to complete treated tailings placement in DDA3. Suncor stated that the decision point would have no impact on closure timelines because neither option could be pursued until treated tailings placement was complete.

[167] Suncor stated it was committed to developing a program to address uncertainties for terrestrial closure of DDA3.

[168] Suncor proposed the following milestones:

- Develop a program for terrestrial closure by June 30, 2017.
- Execute the program between 2017 and 2023.
- Assess terrestrial and aquatic closure viability in 2023, 2029, and 2033.

## SOC Filers

[169] McMurray Métis, FMMCA, ACFN, and OSEC expressed concerns with respect to DDA3 and aquatic closure and identified a need for a terrestrial alternative. ACFN recommended modified wording, and FMMCA, McMurray Métis, and OSEC recommended alternative submission timing for the terrestrial implementation plan as part of their feedback on draft conditions. OSEC also proposed a terrestrial reclamation of DDA3 by 2063, annual report content, and public disclosure of costs for all deposits as part of its feedback on draft conditions.

[170] Concerns were also expressed by FMMCA, McMurray Métis, ACFN, and OSEC in SOC's, the ERP, and feedback on draft conditions regarding engagement around DDA3 research and monitoring plans.

## AER

[171] Suncor's proposed schedule does not address the time sensitivity of examining the feasibility of a terrestrial reclamation outcome. As a consequence, Suncor must complete its research to ensure it can fully support its closure proposal in 2023.

[172] Suncor plans to start depositing treated tailings into DDA3 by 2018, and Suncor proposes to continue to do so until 2039 when Suncor states that a final decision on closure will be made. This 2039 date may effectively preclude any possibility of a terrestrial closure outcome due to settlement time, cost, or material availability.

[173] A final decision on the closure option must be made well in advance of 2039 to assure that a terrestrial closure outcome is possible. Suncor must submit a series of plans and reports in 2018, 2020, and 2023. The submissions include an updated DDA3 tailings treatment and target ecosites development plan, which will include the proposed closure approach in 2023, and an annual report on its progress and results.

## Storage

### Context

[174] Site-wide fluid storage space is needed to adequately contain and manage fluid tailings, treated tailings, and water.

### Decision

[175] Suncor must report annually on the available storage capacity of each deposit or pond that contains water or tailings, and to estimate storage capacity and volume requirements for the subsequent five years.

[176] In addition, other approval conditions will help to address the uncertainties associated with Suncor's assumptions regarding storage, including DDA3 performance and DDA2 development. For example, the AER expects Suncor to incorporate PASS technology and DDA3 deposit performance and DDA3 aquatic closure research to verify if DDA3 has sufficient capacity to support the aquatic closure as part of its 2023 submission.

#### Suncor

[177] Suncor indicated there could be short-term storage constraints if DDA3 was not available in Q2 2018. It stated that it could mitigate these short-term storage constraints by changing to a mining sequence that accelerates Millennium Mine pit and reduces high-fines ore from the North Steepbank Mine.

[178] Suncor stated that the storage capacity of DDA3 was based on the dewatering performance achieved in DDA1. Suncor indicated that reduction in dewatering would increase the volume of treated fluid tailings in DDA3.

[179] Suncor indicated fluid tailings from Pond 1A, Pond 2/3, Pond 6, Pond 7, Pond 8B, and STP will be transferred to the DDAs, including DDA3.

[180] Suncor is evaluating options to reduce the reclamation timing for MD9. One of these options includes reducing the volume of fluid tailings treated by DDA1 by depositing them in DDA3. This means Suncor may need to increase the planned storage volume of DDA3.

[181] Suncor also stated that it was actively seeking ways to reduce its reliance on DDA2, including shifting treatment to DDA3. Suncor indicated that there were a number of options it could employ to increase the fluid tailings storage capacity in DDA3 and still achieve a viable aquatic closure.

#### SOC Filers

[182] No SOC filers raised concerns with respect to storage.

#### AER

[183] Suncor's site-wide fluid storage needs are uncertain and therefore require proactive regulatory oversight. The AER also finds that site-wide fluid storage is a risk to Suncor achieving its fluid tailings profile. Lack of fluid storage capacity can significantly impact the ability of Suncor to achieve its TMP.

[184] Suncor has identified short-term storage constraints that require the immediate construction and operation of DDA3.

[185] There are a number of other uncertainties that may result in DDA3 needing to store additional tailings, including PASS technology performance and tailings transfer from other tailings deposits. As

well, there are a number of unknowns associated with aquatic closure, including the depth of water cover to ensure a viable lake. Other concerns with aquatic closure are discussed elsewhere in the report.

[186] The need for water storage can result in water being stored in ponds or treated tailings deposits, resulting in a delay in reclamation that could cause Suncor to miss milestones described in its TMP. This could lead to failing to meet the *TMF* outcomes of progressive reclamation and minimization of liabilities.

[187] The *TMF* indicates water management is subject to further policy direction from AEP. Suncor's water management is dependent on these policies, which may introduce additional requirements that have consequences for site-wide storage requirements.

## Ready to Reclaim

### Issue

[188] Fluid tailings are considered RTR when they have been processed with an accepted technology, placed in their final landscape position, and meet performance (RTR) criteria.

[189] RTR criteria supports the objective of reclaiming oil sands mining projects to a self-sustaining boreal forest ecosystem that is (1) integrated with the surrounding area and (2) consistent with the values and objectives identified in local, subregional, and regional plans.

[190] RTR criteria are used to track the performance of a tailings deposit towards its ability to meet predicted reclamation and closure outcomes, in the time predicted. Consequently, RTR criteria are critical to evaluate trends and performance management. 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.

[191] The *TMF* and *Directive 085* provide the flexibility for operators to develop RTR criteria that are suitable to the type of tailings, technology, and deposit. *Directive 085* provides guidance on RTR criteria and requires operators to include information that supports the assessment of RTR criteria.

[192] RTR is a new concept and the criteria proposed by Suncor may or may not adequately track the performance of a tailings deposit as expected, especially for DDA3 (which is using a new tailings treatment technology). Improvements to RTR criteria will likely be required. The AER also expects that research and monitoring could result in new or modified RTR criteria. Suncor's approval is conditioned to allow for improvements to RTR criteria, which will be identified in the AER's annual tailings report.

[193] In accordance with *Directive 085*, where treated tailings are meeting their RTR criteria, they can be removed from the fluid tailings inventory because they are on a trajectory to meeting long-term reclamation outcomes. Treated tailings will require ongoing monitoring to confirm they are still on the RTR trajectory and meeting trajectory milestones. In circumstances where RTR criteria are no longer met or there is a deviation from the expected trajectory, Suncor must identify the volume not meeting the RTR criteria and the degree of nonperformance.

## RTR Criteria – Measurement and Averaging

### Context

[194] Each treated tailings deposit will have approved indicators that must be measured to determine if the RTR criteria has been achieved. *Directive 085* requires operators to submit a measurement system plan six months from the date of an approved TMP.

### Decision

[195] Details on RTR criteria measurement must be included in Suncor's measurement system plan, (appendix 3). The measurement system plan must include

- definitions of parameters for fluid tailings and RTR criteria measurements;
- reference to standards and procedures used to measure fluid tailings and treated tailings and RTR criteria;
- an explanation of and justification for measurement procedures that are unique to Suncor and its plan;
- evidence that the plan will address the measurement outcomes as per section 6 of *Directive 085*;
- an explanation of how each of the deposit's RTR criteria will be measured, calculated, and reported;
- a description of the deposit sampling, measurement, and survey program; and
- justification of how measurement, sampling, and spacing intervals will
  - show the variation of the deposit properties,
  - verify that the tailings deposit is achieving RTR criteria, and
  - identify if any material in the deposit is not achieving RTR criteria.

[196] The measurement plan must also describe how Suncor will measure the volume of treated tailings that do not meet RTR criteria and that must be returned to the inventory.

[197] Suncor must measure the volume of treated tailings that meets the RTR criteria based on deposit sampling; treated tailings can only be removed from the fluid tailings inventory if the RTR criteria are

achieved. Suncor cannot use an annual average CWR for the entire deposit (e.g., claiming that 100 per cent of the deposit meets the RTR criteria by calculating the average CWR for the entire deposit).

[198] An annual average for total suspended solids (TSS) is acceptable.

#### Suncor

[199] Suncor proposed the following RTR criteria would be measured on an annual average:

- CWR greater than 0.5 24 hours after placement annual average (DDA1).
- CWR greater than or equal to 0.5 deposit average (DDA3).
- TSS less than or equal to 500 parts per million (ppm) annual average (DDA3).

[200] Suncor proposed using annual averages in part because of variability in the treatment process and in the material produced. Suncor claimed this approach aligned with *Directive 085* (which would have Suncor report on an average, not an instantaneous, target) and that it reduces the likelihood of having treated fluid tailings coming on and off the profile.

[201] Suncor stated that a detailed measurement plan for DDA3 was being developed and would be provided after approval of its applications, as required by *Directive 085*.

[202] Suncor did not propose measurement or estimation methodologies associated with its proposed RTR criteria nor did they explain how the volume of fluid tailings to be returned to the fluid tailings inventory would be determined where subobjective 1 or subobjective 2 RTR criteria were not met.

#### SOC Filers

[203] OSEC recommended inclusions for Suncor's measurement plan, such as measurement locations, frequency, and methods, as part of its feedback on draft conditions.

#### AER

[204] The use of an annual average CWR does not provide sufficient information to identify variations in tailings characteristics across a deposit and therefore limits the ability to assess risks and liabilities for underperforming treated tailings and the effect on a deposit's performance towards reclamation outcomes. A deposit may show excellent performance on average while a significant portion of the tailings deposit is underperforming, compromising the ability to reclaim either to a terrestrial or aquatic outcome. The averaging process obscures understanding of the deposit volumes that have been treated unsuccessfully or are failing to improve as expected.

[205] Representative sampling of a tailings deposit is challenging, and Suncor may use some form of spatial statistics or averaging to determine the volume not meeting the performance criteria and the degree

of underperformance. Suncor is expected to describe and justify how the frequency and spatial extent of monitoring and the statistical methods applied will minimize the margin of error.

[206] Based on the AER's current understanding, the AER expects that the measured TSS in the water expressed from tailings will be monitored at a frequency that supports the use of an annual average TSS. Further, TSS will be measured in the water expressed from tailings, not within the deposit. The TSS data will be provided to the AER under *Directive 085* reporting requirements, and the AER will determine if data variability requires increased monitoring and reporting frequencies.

## Subobjective 1 RTR Criteria – DDA1/MD9

### Context

[207] *Directive 085* allows for fluid tailings treated with certain technologies to be placed in a temporary location and still be able to meet RTR status. *Directive 085* requires that RTR performance criteria be developed for the interim placement location, as well as for the final placement location.

[208] Suncor is combining in-line flocculation with thin lift drying and rehandling in DDA1/MD9. The fluid tailings are being treated with a flocculent and placed in thin lifts over large, sloped areas for dewatering and atmospheric drying in DDA1. The treated tailings will undergo freezing and thawing according to the seasons. Within 1 to 2 years the treated tailings will be excavated and moved to MD9 for co-disposal with overburden. DDA1 is therefore a temporary location, while MD9 is the final placement location as all tailings treated and placed in DDA1 are re-handled and moved to MD9.

### Decision

[209] The AER accepts Suncor's data showing that a CWR greater than or equal to 0.5 measured 24 hours after placement in DDA1 is an acceptable subobjective 1 RTR criterion, subject to the approval conditions described in this section.

[210] Suncor must

- achieve CWR greater than or equal to 0.5 measured 24 hours after placement in DDA 1 for subobjective 1 RTR criteria;
- provide proposed RTR criteria for MD9 by September 30, 2020; and
- submit a settlement monitoring plan for MD9 by December 31, 2018.

[211] Suncor must not use any modified RTR criteria for MD9 unless it has written authorization or an approval amendment. In the absence of RTR criteria for MD9, no treated fluid tailings in DDA1 may be removed from the fluid tailings inventory.

## Suncor

[212] Suncor identified terrestrial closure outcomes for DDA1 and MD9. Suncor stated that terrestrial closure was driven by the dewatering and settlement remaining, strength, and the hydraulic conductivity of the treated tailings. Suncor provided information that showed a relationship between CWR and strength, and CWR and hydraulic conductivity, based on data from DDA1.

[213] Suncor acknowledges that the data sets have variable water chemistry, flocculent type, flocculent dosage (including untreated), clay composition, bitumen content, and other parameters due to the variability in the tailings deposits, DDA systems, and treatment conditions. Suncor stated that the relationships between CWR and strength and CWR and hydraulic conductivity both have wide variance at low CWR for strength and hydraulic conductivity.

[214] DDA1 requires quick dewatering so that thin lift drying can begin. CWR is currently used by Suncor as process control for dewatering of fluid tailings, and it governs future dewatering behaviour of the deposit. Suncor stated that CWR is a direct measure of the parameter that best determines the dewatering of fluid tailings.

[215] Suncor proposed a CWR greater than 0.5 measured 24 hours after placement as a subobjective 1 RTR criterion for DDA1 because it demonstrates that initial dewatering has occurred. Suncor stated that CWR measured or correlated to dewatering and settlement remaining, strength, and the hydraulic conductivity of the treated tailings and provided performance data that supported this assertion.

[216] Suncor provided a performance measure of 1 to 3 metres of settlement remaining in the co-disposal area before permanent reclamation activities can begin, but it also indicated it could not currently provide the trajectory between DDA1 RTR criteria and this performance measure. Suncor stated that more information would be available in 2020 and 2023 and that it intended to make the connection between DDA1 RTR criteria and the performance measure.

[217] Suncor did not provide RTR criteria for MD9, but indicated that it will measure and monitor MD9 through its life and that settlement will be reported on through *Directive 085*.

## SOC Filers

[218] FMMCA raised concerns about RTR criteria for DDA1/MD9. RTR criteria for DDA1/MD9 were discussed at the ERP technical meeting, with concerns focused on settlement and reclamation timing of MD9.

[219] OSEC recommended RTR criteria for MD9 and suggested that Suncor be required to develop a performance plan for MD9 that defined metrics around what constituted success in benchmark years as part of its feedback on draft conditions.



## AER

[220] The AER accepts Suncor's data showing that a CWR greater than or equal to 0.5 measured 24 hours after placement in DDA1 is an acceptable subobjective 1 RTR criterion, given that dewatering is the purpose of this deposit's performance.

[221] Although RTR criteria are not intended to track fluid tailings treatment technology performance, treatment technology can be a justifiable starting point for a deposit's trajectory.

[222] In reaching this decision, the AER also considered the following:

- Although CWR's relationship with strength and hydraulic conductivity is complex, the relationships developed by Suncor considered a sufficiently wide range of coparameters (e.g., water chemistry, flocculent type).
- The AER expects that Suncor will continue to validate the relationships provided.
- Although CWR is a nonstandardized measure and susceptible to sampling and analysis errors, the measurement system plan will provide information on how Suncor is minimizing the margin of error.

[223] *Directive 085* requires RTR criteria for both the interim (DDA1) and final (MD9) placement locations.

[224] Suncor did not provide RTR criteria for MD9. Suncor did indicate that the last point on its deposit trajectory was 1 to 3 metres of settlement and that additional work would be done to define the trajectory with more information available in 2020 and 2023.

[225] As discussed in the section "DDA1/MD9 – Technology Selection," Suncor will provide a settlement monitoring plan for MD9 by the end of 2018.

[226] Suncor also stated that it will measure and monitor MD9 settlement and provide this information through the annual fluid tailings management report. Therefore, the AER is confident that it will have information on the short-term performance of MD9 until RTR criteria can be provided.

## Subobjective 1 RTR Criteria – DDA2

### Context

[227] DDA2 uses a stacked treated tailings structure using the same treatment technology as DDA1. The treated tailings will not be dried and moved, but rather the treated tailings will be reclaimed in place to form a terrestrial landscape.

### Decision

[228] No RTR criteria are set for DDA2 at this time.

[229] Suncor must submit a plan that updates DDA2 fluid tailings management and includes RTR criteria by September 30, 2018.

[230] Suncor is not permitted to deposit in DDA2 until that plan is authorized or an approval amendment is granted.

#### Suncor

[231] Suncor proposed a CWR greater than or equal to 0.5 at 24 hours, measured on an annual average basis, as a subobjective 1 RTR criterion for DDA2. Suncor noted that the criterion was the same as that proposed for DDA1, reasoning that the technologies employed at DDA1 and DDA2 were similar.

#### SOC Filers

[232] FMMCA expressed concern that RTR criteria were not provided for DDA2. Since that time, Suncor proposed RTR criteria for DDA2. OSEC recommended RTR criteria for DDA2 and said the DDA2 plan needed to include RTR criteria; FMMCA and McMurray Métis indicated the DDA2 plan needed to reduce the time between achieving RTR status and reclamation activity commencement as part of their feedback on draft conditions.

#### AER

[233] Suncor did not provide evidence that it could place treated tailings in a stacked deposit and create a terrestrial landscape within a reasonable time. Suncor did not adequately demonstrate that the subobjective 1 RTR criterion for DDA1 ( $CWR \geq 0.5$  at 24 hours, annual average) was appropriate for DDA2. While the technologies at DDA1 and DDA2 are similar, the deposition method and targeted final ecosites are not the same. Consequently, the AER does not accept Suncor's proposed RTR criterion for DDA2.

[234] No RTR criteria are set for DDA2 at this time.

#### Subobjective 1 RTR Criteria – DDA3

#### Context

[235] Suncor proposed to develop a new tailings deposit, DDA3, and use the PASS technology to treat 70 per cent of its fluid tailings. A decision on the closure outcome for DDA3 needs to occur in 2023.

#### Decision

[236] The AER approves the following subobjective 1 RTR criteria:

- $CWR \geq 0.5$ , based on deposit sampling expressed water from DDA3 treated tailings
- annual average TSS  $\leq 500$  parts per million

[237] To address the uncertainty and risk associated with PASS technology objectives and the terrestrial closure outcome, Suncor must

- propose additional subobjective 1 RTR criteria for DDA3 that incorporate results from research, the DPL pilot test and DDA3 monitoring to provide assurance that immobilization is occurring as predicted by September 30, 2019.
- propose additional subobjective 1 RTR criteria for DDA3 that show improved deposit performance prior to the 2023 decision point related to terrestrial closure or aquatic closure of DDA3 by September 30, 2019.

Suncor

[238] Suncor proposed a CWR greater than or equal to 0.5 annual average, as subobjective 1 RTR criterion for DDA3.

[239] Suncor justified the proposed RTR criterion by asserting that CWR measures the treatment of fluid tailings, proper flocculation, and the amount of dewatering. Suncor stated that dewatering rates for DDA3 were based on DDA1 operations and development work on the PASS process. Suncor also stated that it has used CWR measures for the last 20 years to understand and manage fluid tailings and found that a CWR of greater than or equal to 0.5 indicates that tailings have been properly flocculated, thereby beginning the trajectory to reclamation.

[240] Suncor also indicated that a CWR greater than or equal to 0.5 was also tied to the DDA3 aquatic outcome and the PASS technology phase 1 objectives for volume reduction and reducing the amount of water expressed from treated tailings in phases 2 through 4.

[241] Suncor justified using an annual average versus a 24-hour average by stating that the PASS process is designed to promote dewatering less rapidly than for in-line flocculation and thin lift drying in DDA1 and to allow for treated tailings to flow out over the deposit area.

[242] Suncor also proposed TSS of less than or equal to 500 parts per million (ppm) annual average as a RTR criterion for DDA3.

[243] Suncor justified the use of TSS because it measures the PASS technology phase 1 objectives for reduced mobility of bitumen, COPCs, and ultrafine minerals in the deposit and provides information on expressed water quality. Suncor also indicated that TSS is a common method used in many industries to measure water quality and is a controlling factor in recycle water quality for operations. Suncor provided PASS technology data that included TSS assessment.

[244] Suncor also indicated that TSS is important to developing an aquatic closure outcome for DDA3 in PASS technology phases 2 and 3 because clear water permits the penetration of light that helps

establish early microbiological activity and algae communities that play a role in reducing residual dissolved organics in the water forming the water cap.

[245] Suncor indicated that TSS is valid as both a subobjective 1 and subobjective 2 criteria because reduced mobility of bitumen, ultrafine minerals, and COPCs indicate that the physical properties of the deposit are on a trajectory to support future stages of reclamation and that there is reduced mobility of COPCs in the deposit and potential for impacts to the surrounding environment.

[246] Suncor indicated that the proposed RTR criteria are independent of closure outcomes.

#### SOC Filers

[247] FMMCA and McMurray Métis expressed concern that RTR criteria was not provided for DDA3 in its SOC. Since that time, Suncor proposed RTR criteria for DDA3. RTR criteria for DDA3 were discussed at the ERP technical meeting. OSEC, FMMCA, and McMurray Métis recommended RTR criteria DDA3 as part of their feedback on draft conditions. OSEC also requested that the AER prescribe more ambitious RTR criteria and provide clear expectations for what are appropriate RTR criteria for DDA3.

#### AER

[248] Suncor drew its rationale for the RTR criterion of CWR from data from DDA1 operations and PASS technology testing.

[249] CWR is intended to measure the treatment of fluid tailings, proper flocculation, and dewatering. Subobjective 1 RTR criteria are not intended to track fluid tailings treatment technology performance but to ensure that the deposit's physical properties are on a trajectory to support future stages of activity. RTR criteria associated with fluid tailings treatment technology performance can be a justifiable starting point for a deposit's RTR criteria, but a trajectory to closure also needs to be reflected in RTR criteria.

[250] Suncor submitted that a CWR greater than or equal to 0.5 was also tied to the DDA3 aquatic outcome and achieving the PASS technology phase 1 objectives for volume reduction and reducing the amount of water expressed from treated tailings in phase 2 through 4.

[251] Given that dewatering is critical for deposit performance independent of closure outcomes and that a CWR of greater than or equal to 0.5 demonstrates that initial dewatering has occurred, Suncor's proposed RTR criterion is an acceptable starting point for DDA3's RTR criteria.

[252] However, CWR greater than or equal to 0.5 does not demonstrate that the deposit's physical properties are progressing along an appropriate trajectory to support future stages of activity for the two possible closure outcomes.

[253] With respect to Suncor's terrestrial closure of DDA3, it will be subject to a large degree of settlement. Suncor indicated that CWR greater than or equal to 0.5 is correlated to settlement. However, Suncor did not provide information on how CWR greater than or equal to 0.5 demonstrates how the risks associated with settlement is being managed or how the deposit will support reclamation activities in the future.

[254] With respect to Suncor's aquatic closure of DDA3, dewatering does support Suncor's objective for volume reduction and reducing the amount of water expressed from treated tailings in phases 2 through 4. However, CWR of greater than or equal to 0.5 on its own does not demonstrate this progression over time.

[255] Therefore, Suncor is required to propose additional subobjective 1 RTR criteria for DDA3 that shows improved deposit performance prior to the 2023 decision point related to terrestrial closure or aquatic closure of DDA3 by September 30, 2019.

[256] Suncor drew its rationale for this criterion of TSS based on from PASS technology testing.

[257] Given that TSS is a common water quality measure that can demonstrate the mobility of bitumen, ultrafine minerals, and COPCs, and light penetration is critical for an aquatic closure outcome, Suncor's proposed RTR criterion of TSS of less than or equal to 500 ppm is acceptable for DDA3.

[258] However, some lab data show that under certain conditions, even when the criterion of TSS of 500 ppm is met, some substances (e.g., bitumen, hydrocarbons, potentially some select metals) may continue to be mobilized with the water expressed from treated tailings. Therefore, TSS may not correlate to a specific amount or rate of reduced mobility of bitumen, ultrafine minerals, or COPCs. Suncor is required to propose additional subobjective 1 RTR criteria for DDA3 that incorporates results from research, the DPL pilot test and DDA3 monitoring to provide assurance that immobilization is occurring as predicted by September 30, 2019.

[259] Further, the AER expects that the research and implementation plan for aquatic closure will address the duration of immobilization of COPCs, and for terrestrial closure, will address settlement. The indicators, measures, and proposed RTR criteria will also be the subject of ongoing research and implementation plans and will be important as part of Suncor's future RTR criteria proposals and the AER's future decision on DDA3's closure proposal.

## Subobjective 1 RTR Criteria – Pond 5

### Context

[260] Pond 5 is a legacy CT pond. Pond 5 contains about 18 Mm<sup>3</sup> of CT which requires remediation because of poor performance. Remediation includes coke capping and vertical strip drains (VSDs). Pond 5 is no longer active and is to be reclaimed to a terrestrial landform with a lake feature.

## Decision

[261] Suncor's proposed subobjective 1 RTR criterion of coke capping and VSD installation mitigation completion is acceptable.

[262] Suncor must

- confirm the Pond 5 monitoring plan by October 31, 2017;
- report on the settlement, strength gain, and water release and that the rate of Pond 5 settlement will support reclamation milestones, including commencement of reclamation before May 1, 2024 and achievement of targeted final landforms for Pond 5, in its annual fluid tailings management report;
- complete Pond 5 coke capping and VSD installation mitigation to achieve subobjective 1 RTR status by December 31, 2019; and
- commence Pond 5 reclamation by May 1, 2024.

## Suncor

[263] Suncor stated that Pond 5 would achieve RTR status after mitigation was complete in 2019. Suncor also identified settlement, strength, and water release as measures for stability.

[264] Suncor stated that Pond 5 reclamation activities could commence once settlement in cell 9 reached 1087 feet in 2023 or 2024. Cell 9 was chosen to measure settlement because it was the location with the deepest volume of fluid tailings under an overlying cap and the location where the most settlement was likely to occur.

## SOC Filers

[265] ACFN and FMMCA raised concerns with Pond 5 RTR criteria, focusing on settlement, closure drainage, and post-reclamation settlement mitigation. OSEC recommended RTR criteria for Pond 5, including elevation, and identified the need for a Pond 5 plan similar to that for Pond 6 and 7 as part of its feedback on draft conditions. ACFN recommended modified wording to the draft conditions, and FMMCA and McMurray Métis recommended end land-use planning collaboration as part of their feedback on draft conditions.

## AER

[266] Suncor has been monitoring the settlement and strength gain of Pond 5 since 2009. The monitoring data show that dewatering is occurring and that the deposit is gaining strength. The measured data fit well with Suncor's settlement model forecast.

[267] Suncor's proposed subobjective 1 RTR criterion of coke capping and VSD installation mitigation completion is acceptable given Suncor's monitoring of settlement, strength gain, and dewatering and its specific settlement model forecast, settlement data, and settlement predictions. Suncor must continue the

Pond 5 monitoring program to ensure mitigations are performing and that risks to reclamation are effectively managed.

[268] In the absence of an RTR trajectory that demonstrates progression over time, and as per *Directive 085*, the AER is setting approvals conditions for Pond 5 milestones, including the achievement of RTR status and the commencement of reclamation activities.

## Subobjective 1 RTR Criteria – Pond 6

### Context

[269] Pond 6 is a legacy CT pond. Pond 6 contains some 35 Mm<sup>3</sup> of legacy fluid tailings which requires remediation because of poor performance. Pond 6 is no longer active and is to be reclaimed to a terrestrial landform with a lake feature.

### Decision

[270] Suncor's proposed subobjective 1 RTR criterion of mitigation completion is acceptable.

[271] Suncor must

- Submit a plan by September 30, 2019, that updates Pond 6 fluid tailings management to ensure RTR status will be achieved no later than December 31, 2028.
- Achieve RTR status for Pond 6 by December 31, 2028, five years before the end of mine life.

### Suncor

[272] Suncor plans to remove up to 13 Mm<sup>3</sup> of fluid tailings from Pond 6 for treatment elsewhere. The remaining 22 Mm<sup>3</sup> will be mitigated in place.

[273] Suncor stated that

- 13 Mm<sup>3</sup> of fluid tailings would be removed between 2019 and 2021,
- surface preparation would occur between 2022 and 2023,
- 22 Mm<sup>3</sup> would be mitigated in place between 2023 and 2027, and
- the deposit would achieve RTR status by 2028.

[274] For Pond 6, Suncor plans to use similar mitigation as Pond 5 (i.e., coke capping and VSDs) and expects to achieve similar results. Suncor indicated that detailed engineering would progress over the next several years.

[275] Suncor stated that it would update Pond 6 mitigation and RTR criteria in 2019.

## SOC Filers

[276] ACFN and FMMCA raised concerns with Pond 6 RTR criteria. OSEC recommended RTR criteria for Pond 6, including elevation, and identified the need for the Pond 6 plan to include RTR criteria as part of their feedback on draft conditions. ACFN recommended modified wording to the draft conditions, and FMMCA and McMurray Métis recommended end land-use planning collaboration as part of their feedback on draft conditions.

## AER

[277] Suncor provided sufficient information to demonstrate that using the same mitigation and the same RTR criteria for Pond 6 as it did for Pond 5 might be appropriate. Suncor is evaluating options for Pond 6, therefore it will provide a plan that updates its TMP by September 30, 2019, that ensures RTR status is achieved by the end of 2028. This management plan is required to confirm Pond 6 management, RTR criteria, milestones, mitigation measures, and the monitoring plan.

[278] In the absence of an RTR trajectory that demonstrates progression over time, and as per *Directive 085*, the AER is setting approvals conditions for Pond 6 milestones, including the achievement of RTR status. The AER has not set conditions for the commencement of reclamation activities in absence of a plan for Pond 6 fluid tailings management.

## Subobjective 1 RTR Criteria – Pond 7

### Context

[279] Pond 7 contains a legacy fluid tailings inventory of 69 Mm<sup>3</sup> and will continue to be active and receive fluid tailings until 2023.

### Decision

[280] Suncor's proposed subobjective 1 RTR criterion of mitigation completion is acceptable.

[281] Suncor must

- submit a plan by September 30, 2024, for Pond 7 fluid tailings management to ensure RTR status will be achieved no later than December 31, 2033, and
- achieve RTR status for Pond 7 by December 31, 2033.

### Suncor

[282] After 2023, Suncor plans to

- remove about 106 Mm<sup>3</sup> fluid tailings for treatment in DDA3 starting in 2025,



- perform sand infilling trials in 2026 and 2027 (previous sand infilling trials were completed for Pond 1),
- backfill with sand starting in 2028,
- remediate about 41 Mm<sup>3</sup> in place from 2028 to 2033, and
- achieve RTR status by 2033.

[283] Suncor expected that the approach it used for Pond 5 mitigation would also work for Pond 7 mitigation.

[284] Suncor stated that it would update Pond 7 mitigation and RTR criteria in 2028.

#### SOC Filers

[285] ACFN and FMMCA raised concerns with Pond 7 RTR criteria in their SOC. OSEC recommended RTR criteria for Pond 6, including elevation, and identified the need for the Pond 7 plan to include RTR criteria as part of their feedback on draft conditions. ACFN recommended modified wording to the draft conditions and FMMCA and McMurray Métis recommended end land-use planning collaboration as part of their feedback on draft conditions.

#### AER

[286] Suncor identified that it could use the same mitigation and the same RTR criteria for Pond 7 as it did for Pond 5. However, sand infilling was not part of the mitigation used at Pond 5, and Suncor plans to mitigate in place 41 Mm<sup>3</sup> of fluid tailings, a significantly greater volume than that proposed for Pond 5.

[287] Although Suncor used sand infilling for Pond 1 mitigation and reclamation activities, Suncor did not provide sufficient information to show that sand infilling would be an effective mitigation for Pond 7.

[288] Suncor is required to submit a plan that updates Pond 7 fluid tailings management by September 30, 2024 because this is the year prior to fluid tailings removal. This management plan is required to confirm Pond 7 management, RTR criteria, milestones, mitigation measures, monitoring plan, and provide an explanation of how what has been learned from Pond 1, Pond 5, Pond 6 has been incorporated into Pond 7 management, and the type of and placement schedule for capping materials.

[289] In the absence of an RTR trajectory that demonstrates progression over time, and as per *Directive 085*, the AER is setting approvals conditions for Pond 7 milestones, including the achievement of RTR status. The AER has not set conditions for the commencement of reclamation activities in absence of a plan for Pond 7 fluid tailings management.

## Subobjective 2 RTR Criteria for all Deposits

### Context

[290] Subobjective 2 focuses on circumstances where the operator may propose management strategies, design features, or mitigation measures for risks associated with the specific nature of the deposit or its surrounding environment that could impact reclamation—for example, design features that control specific water movement such as drainage control systems.

### Decision

[291] Suncor must meet the following subobjective 2 RTR criteria:

- The closed-circuit water management system is operating as designed.
- Groundwater is monitored as required by *EPEA* approval 94-02-00, as amended or renewed.

### Suncor

[292] Suncor summarized the risks for each tailings pond and DDA with respect to groundwater, surface water bodies, seepage, stability, and erosion. In addition to the subobjective 1 RTR criteria identified and based upon on its summary of risk, Suncor proposed the following subobjective 2 RTR criteria:

- The closed-circuit water management system, where required by *EPEA* 94-02-00 seepage controls, are operating as designed.
- The observation and monitoring of groundwater until water quality is sufficient such that each deposit does not need to be monitored and reported through the [groundwater monitoring program] pursuant to *EPEA* approval 94-02.

[293] Suncor indicated that the closed-circuit water management system met the intent of subobjective 2 RTR criteria because it managed drainage and collected seepage from the tailings deposits.

[294] Suncor stated that monitoring groundwater quality through the groundwater monitoring program (GMP) meets the intent of subobjective 2 RTR criteria because it provides direct information regarding the potential impacts water expressed from each deposit could have on the surrounding environment.

[295] Suncor stated that its GMP is used to monitor groundwater interaction of the deposits through all stages of operation and reclamation. Suncor stated that its approved GMP is used to monitor potential seepage of process-affected groundwater, describes the methodologies employed to indicate the migration of contaminants and trends in contaminant concentrations, describes appropriate actions to be taken if groundwater quality issues are triggered, and describes follow-up activities that will be implemented. Groundwater monitoring results and their analysis, as well as results from follow-up and mitigation activities, is reported under *EPEA* 94-02-00.

[296] Suncor identified that reporting pursuant to *EPEA* approval 94-02-00, as amended, includes the ability to make recommendations for changes to the GMP to make it more effective.

[297] For DDA3, Suncor also proposed TSS of less than or equal to 500 ppm annual average as a subobjective 2 RTR criterion for DDA3 for aquatic closure because TSS indicates that bitumen, ultrafine minerals, and other COPC mobility has been reduced, and TSS is a recognized measure of water quality.

#### SOC Filers

[298] FMMCA indicated that groundwater needed to be monitored to confirm RTR criteria and expectations. Seepage concerns were also expressed in ACFN, FMMCA, and McMurray Métis's SOC's. OSEC did not support water management system or groundwater monitoring as part of Suncor's RTR criteria in their feedback on draft conditions.

#### AER

[299] Regarding surface water and seepage, Suncor's proposal aligns with *Directive 085* subobjective 2 RTR criteria requirements because the closed-circuit water management system mitigates the deposit-specific risks associated with drainage and seepage for DDA1/MD9, DDA2, DDA3, Pond 5, Pond 6, and Pond 7 throughout operations.

[300] Regarding groundwater, Suncor's proposal aligns with *Directive 085* subobjective 2 RTR criteria because the groundwater monitoring program provides information regarding potential impacts of water expressed from each deposit. This information can be used to ensure that the deposit's effects on the surrounding environment will not compromise the ability to reclaim to a locally common, diverse, and self-sustaining ecosystem or meet regional groundwater criteria. Suncor must supplement its existing groundwater monitoring programs. Suncor is also required to ensure there is alignment between the groundwater monitoring programs and RTR measurement.

[301] Additional information on groundwater protection is in the section "Groundwater."

#### RTR Criteria for Remnant Fluid Tailings

##### Context

[302] Suncor stated that all tailings ponds and deposits would have a small volume of fluid tailings left behind (remnant fluid tailings) because of the physical limitation of removing *all* fluid tailings from a pond or a deposit.

## Decision

[303] Suncor must submit proposed RTR criteria for its remnant fluid tailings by September 30, 2022. As part of its proposed RTR criteria, Suncor must provide an explanation of how what it learned from Pond 1 has been incorporated.

[304] Suncor is not permitted to remove remnant fluid tailings from its legacy (equivalent) or new fluid tailings inventory until such time as the proposed RTR criteria are authorized or an approval amendment is granted.

[305] Further, the AER expects Suncor to address remnant tailings in its terrestrial and wetlands research and report on research results in its tailings research report required under its *EPEA* approval. This must include design and methodologies regarding the ability to manage and cap remnant tailings and provide acceptable distribution of terrestrial ecosystems and wetland types.

## Suncor

[306] Suncor indicated that there would be 36 Mm<sup>3</sup> of remnant fluid tailings distributed over ten deposits, and that 18 Mm<sup>3</sup> of the remnant fluid tailings would be managed in the landscape and left untreated ten years after the end of mine life.

[307] Suncor stated that the remnant fluid tailings volumes would be managed through reclamation and closure activities on a case-by-case basis using freeze/thaw, by mixing the tailings with sand or overburden material, or by incorporating a coke cap on the deposits with or without VSDs.

[308] Suncor concluded that the presence of remnant fluid tailings would not prevent the development of a sustainable ecosystem but that it would take time for soil placement and revegetation to occur. Suncor noted that its experience with Pond 1 supported its claims and that additional experience would be gained from the management of Pond 8B.

## SOC Filers

[309] No specific concerns with respect to remnant tailings were raised in SOC's or as part of ERP technical meeting. OSEC identified a need to engage collaboratively on RTR criteria for remnant tailings as part of its feedback on draft conditions.

## AER

[310] The presence of remnant fluid tailings without RTR criteria does not comply with the objective of the *TMF* which states that all fluid tailings must be in a ready-to-reclaim state within 10 years after the end of mine life.

[311] The AER recognizes that it is not technically feasible to remove all fluid tailings from a pond or deposit. The remaining volume will be dependent on the pond or deposit, and the volume will need to be managed to ensure the reclamation outcomes can be achieved.

[312] Suncor did not provide evidence, including any evidence based on its Pond 1 experience, to support its claim that a sustainable ecosystem could be developed in the presence of remnant fluid tailings. Suncor also did not address the environmental and reclamation risks and uncertainties that the presence of remnant tailings will present.

## Environmental Effects and Implications

### Issue

[313] The *TMF* 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.

[314] However, 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. Applications will identify the nature, location, and magnitude of environmental effects and the understanding of their environmental and reclamation implications.

[315] For currently 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.

[316] The TMPs must align with existing provincial and federal policies, legislation, regulations, strategies, frameworks, requirements, and stated desired outcomes for the region.

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

### Air

#### Decision

[318] No air emissions limits in the *EPEA* approval are being amended as a result of the applications.

[319] There is also ongoing work concerning the AER's September 2016 report *Recurrent Human Health Complaints Technical Information Synthesis Fort McKay Area* that may result in modified or new conditions related to odours and emissions.

#### Suncor

[320] Suncor concluded that the MOA and the TMP would not have any material change to previously assessed air and odour emissions.

#### SOC Filers

[321] No SOC filers raised concerns with respect to air or odour emissions. Emissions were briefly noted during the ERP, but no recommendations were provided.

#### AER

[322] No material changes to previously assessed air and odour emissions were identified and Suncor did not request any changes to air emission limits in the *EPEA* approval.

#### Dust

##### Decision

[323] Suncor must develop a site-wide dust management plan to manage risks associated with dust generation from tailings and must submit this plan to the AER, in alignment with newer mineable oil sands operations, by December 31, 2019.

[324] This plan must include all locations, which may include reclaimed areas, impacted by dust.

#### Suncor

[325] Suncor acknowledges that current thin lift drying at DDA1, coke capping on Pond 5, future stacking at DDA2, and the proposed coke capping on Pond 6 and Pond 7 could generate dust.

#### SOC Filers

[326] No specific concerns with respect to dust were raised in SOC's or as part of the ERP technical meeting. FMMCA and McMurray Métis recommended details be added to the dust management plan for dust monitoring and contingency plans for reclaimed areas as part of their feedback on draft conditions.

#### AER

[327] Dust can be generated through Suncor's use of thin lift drying at DDA1, coke capping on Pond 5, future stacking at DDA2, and the proposed coke capping on Pond 6 and Pond 7. Suncor does not currently have a site-wide dust management plan.

## Groundwater

### Decision

[328] Suncor is required to update its groundwater monitoring program to include the construction and operation of DDA3 by December 31, 2017.

### Suncor

[329] Suncor stated that its groundwater monitoring program is used to monitor groundwater interaction of the deposits through all stages of operation and reclamation until water quality is such that each deposit does not need to be monitored and managed. Suncor indicated that its approved GMP is used to monitor potential seepage of process-affected groundwater, describes the methodologies employed to indicate the migration of contaminants and trends in contaminant concentrations, describes appropriate actions to be taken if groundwater quality issues are triggered, and describes follow-up activities that will be implemented. Groundwater monitoring results and their analysis, as well as results from follow-up and mitigation activities, are reported under *EPEA* approval 94-02-00.

[330] Suncor stated that its existing *EPEA* approval conditions include the ability to make recommendations for changes to the groundwater monitoring program to make it more effective.

### SOC Filers

[331] FMMCA indicated that groundwater needed to be monitored to confirm RTR criteria and expectations. Seepage concerns were also expressed in ACFN, FMMCA, and McMurray Métis's SOC's. ACFN requested additional guidance and requirements to ensure that the groundwater monitoring program was effective in its feedback to draft conditions. FMMCA and McMurray Métis also requested enhanced engagement, including documentation and capacity funding, with respect to groundwater monitoring programs as part of their feedback on draft conditions.

### AER

[332] Subject to the modifications to DDA2, MD9, and DDA3 discussed below, the AER finds that there are no changes arising from Suncor's TMP that are expected to change previously assessed impacts to surface water or groundwater quality.

[333] During mine operations and through its closure and reclamation phases, Suncor will continue to employ ground and surface water control measures and the closed-circuit system to manage the environmental risks and effects; meet its existing *EPEA* approval limits, monitoring, and reporting requirements for industrial wastewater and groundwater; and report on water recovered from treated tailings and runoff from RTR tailings in accordance with *Directive 085*.

[334] Suncor is constructing and operating a new tailings deposit, DDA3. The current GMP does not address the construction and operation of DDA3. Therefore, Suncor must update its GMP to include the construction and operation of DDA3 by the end of 2017.

[335] Suncor's groundwater monitoring program previously authorized under condition 3.11.4 for MD9 and DDA2 on August 20, 2014, is now authorized under a revised condition within the approval.

## Wetlands

### Decision

[336] Suncor is required to provide the following:

- a research plan that evaluates the viability of wetlands and shallow lakes on Pond 5, Pond 6, and Pond 7 in 2018;
- as part of its life of mine closure plan, a summary ecosite table that includes an acceptable distribution of reclaimed wetland types and ecosite phases that support a range of land uses;
- as part of its pit lake research, biotic, physical, and chemical performance measures or criteria for the quality of water discharged from the pit lake and to the receiving wetland or aquatic ecosystem;
- a map showing the spatial extent and distribution of wetlands, including reclaimed, treatment, and opportunistic wetlands, in its 2017 life of mine closure plan; and
- in subsequent life of mine closure plans, report on the updated distribution and spatial extent of opportunistic wetlands as they appear on the reclaimed landscape.

### Suncor

[337] Suncor stated that settlement would continue after reclamation activities commence in Ponds 5, 6, and 7, all of which are intended to have terrestrial closure outcomes (with aquatic features), and MD9, which is also subject to a terrestrial closure outcome. As a result of settlement, wetlands may form opportunistically in depressions within the reclaimed landscape. Suncor cannot at this time identify where and when these wetlands could form. Suncor stated that it has been evaluating and creating wetlands as part of its research and development programs and that it plans to update the AER as work progresses.

[338] Suncor indicated that the initial water quality associated with the placement of the coke cap and hydraulic sand cap on Ponds 5, 6, and 7 will be similar to process-affected water. Suncor advised that the shallow lakes on these ponds are expected to receive water from tailings sand caps and provided models for the water to be released from these shallow lakes.

[339] Suncor provided a conceptual closure plan that included a marsh between the Upper Pit Lake (DDA3) and the Millennium End Pit Lake. Suncor stated the marsh would receive water from the Upper



Pit Lake. Suncor identified four COPCs associated with Upper Pit Lake, including hydrocarbons, select metals, naphthenic acids, and salts. Suncor stated that the quality of water flowing from the Upper Pit Lake to the marsh would not affect the viability of the marsh. Suncor further noted that

- small quantities of tailings water would be released into the Upper Pit Lake from the treated tailings deposited below the water cap,
- residual industrial wastewater would no longer be added to the lake, and
- water added to the lake would be closure drainage water from the surrounding watershed and river water.

#### SOC Filers

[340] McMurray Métis asked to be involved in the development of reclamation plans and compensation plans for the permanent loss of wetlands. ACFN recommended modified wording to the draft conditions and sought clarity on the term “acceptable distribution.” FMMCA and McMurray Métis recommended collaboration on the research and implementation plans for DDA3 and end land-use planning as part of their feedback on draft conditions.

#### AER

[341] Settlement is expected to occur in tailings deposits, including Ponds 5, 6, 7, and MD9. The extent of settlement that occurs in these ponds will affect the features of the shallow lakes and wetlands identified on these tailings deposits.

[342] Suncor included estimates for the length of time that water quality may be affected by the quality of the tailings sand cap (and associated water content) for the wetlands and shallow lakes in Ponds 5, 6, and 7. However, Suncor did not provide information about the longer-term risks to shallow lake and wetlands reclamation outcomes and their uses presented by the chemical attributes of tailings sand and water from tailings sand placement.

[343] Suncor must conduct this research to provide the AER with the information in order for the AER to make future regulatory decisions regarding the reclamation and closure of Ponds 5, 6, and 7. Therefore, Suncor must submit a research plan that evaluates the viability of wetlands and shallow lakes on these ponds in 2018, one year before completing mitigation activities in Pond 5. The results will inform the design and material requirements and milestones to be employed in the mitigation and reclamation plans for these ponds.

[344] Further, settlement in tailings deposits will create low-lying areas or depressions where water will collect, potentially creating opportunistic wetlands. Because the extent of future settlement is currently unknown, the final size of an opportunistic wetland cannot be determined without further settlement modelling.

[345] There is a possibility that future settlement could result in wetlands that exceed the two metre depth limit for wetlands, creating shallow, small lakes on the landscape. Wetlands that develop opportunistically or into shallow, small lakes may result in adverse effects, such as erosion or closure drainage impacts, that may compromise the terrestrial closure outcomes or create challenges for Suncor in meeting their acceptable distribution of upland ecosite phases and wetland types on the post-disturbance landscape.

[346] Also, the presence of hydrocarbons, select metals, naphthenic acids, and salts may increase the proportion and distribution of treatment wetlands with salt-tolerant boreal wetland species. Salt-affected marsh wetlands are a rare feature in the locally common, boreal forest ecosystem. As Suncor did not identify design controls or identify the number or extent of wetlands that will be targeted to receive water from placed tailings sand caps, there may be a greater number of salt-affected marsh wetlands that could create challenges for Suncor in meeting their acceptable distribution of locally common reclaimed wetland types on the post-disturbance landscape.

[347] Suncor must provide an updated ecosites table that includes an acceptable distribution of wetland types and ecosite phases that support a range of land uses as part of the life of mine closure plan.

[348] Wetlands may also form from the unexpected expression of tailings water or of water from capping materials used on a tailings deposit in an unexpected location, which the AER considers unacceptable. Suncor's tailings and reclamation research must determine how it will identify whether wetlands are the result of water collection rather than the expression of tailings water or water from capping material.

[349] Suncor did not provide data to support its claims that the quality of the water discharged from the Upper Pit Lake into the marsh would not affect the viability of the marsh and subsequently Millennium End Pit Lake. Suncor is required, as part of its pit lake research, to assess the physical, chemical, and biological performance measures or criteria for the quality of water discharged from the pit lake and to the receiving wetland or aquatic ecosystem.

[350] Suncor is not authorized to engage in activities relating to the construction of the marsh between Upper Pit Lake and Millennium End Pit Lake, except for the purposes of research, or as authorized by the AER.

## Water Quality and Water Release in Upper Pit Lake and Millennium End Pit Lake

### Decision

[351] Suncor is not permitted to conduct phase 2, 3, or 4 activities of the PASS technology in DDA3 (which Suncor intends to become Upper Pit Lake). Suncor will continue to assess its Upper Pit Lake model and report on its research to address risks associated with pit lakes, including water quality.

[352] Suncor is also not authorized to release any substance, including water, from Upper Pit Lake or Millennium End Pit Lake. Further, before releasing any water from Upper Pit Lake to Millennium End Pit Lake, Suncor must obtain authorization from the AER.

[353] GoA policy on pit lakes and water management is expected, and the AER notes that Suncor's predicted release scenarios in its application may not align with future policy.

#### Suncor

[354] Suncor provided a water quality assessment for the Upper Pit Lake (DDA3) and Millennium End Pit Lake. The water quality assessment included site-specific water chemistry, the PASS process, and the operational phases of DDA3. The water quality assessment focused on total dissolved solids, labile and refractory naphthenic acids, and acute and chronic toxicity. The model predictions were screened against chronic effects benchmarks for total dissolved solids and naphthenic acids and water quality guidelines for toxicity. Suncor concluded that the Upper Pit Lake and Millennium End Pit Lake are expected to eventually be viable and support aquatic life.

[355] Suncor stated that it will continue to assess its Upper Pit Lake model and that a detailed water quality assessment would be provided to the AER.

[356] Suncor did not request approval to release water from Upper Pit Lake or Millennium End Pit Lake as part of the applications.

#### SOC Filers

[357] ACFN, FMMCA, McMurray Métis, and OSEC expressed concerns in their SOC's about water quality and either explicitly or implicitly with respect to water release.

#### AER

[358] Suncor concluded that the Upper Pit Lake (DDA3) and Millennium End Pit Lake are expected to eventually be viable and support aquatic life based on the chronic effects benchmarks or the Canadian Council of Ministers of the Environment (CCME) *Canadian Water Quality Guidelines for Aquatic Life* as water quality criteria. Upper Pit Lake and Millennium End Pit Lake need to become self-sustaining, locally common lake aquatic ecosystems—not just be viable and support aquatic life. Further, the GoA has not accepted the use of chronic effects benchmarks or the CCME *Canadian Water Quality Guidelines for Aquatic Life* as water quality criteria.

[359] The AER recognizes that Suncor will continue to update its water quality assessments, and expects that Suncor will modify these assessments in accordance with future GoA direction.

[360] The AER recognizes that Suncor has not requested approval to release water as part of the applications and that policy on pit lakes and water management is expected.

## Chemical Use

### Decision

[361] Suncor is authorized to use liquid aluminum sulphate, as identified in the applications, and anionic polyacrylamide as previously approved for DDA1.

### Suncor

[362] Suncor provided materials specifications for liquid aluminum sulphate (alum); it indicated that it would use alum as its coagulant in PASS technology and an anionic polyacrylamide as its polymer in PASS technology and in DDA1.

[363] Suncor studied gypsum, alum, ferric sulphate, sulphuric acid, and slaked lime and concluded that alum had the best overall reduction in the mobility of TSS, bitumen, select metals, and naphthenic acids.

[364] Suncor stated that anionic polyacrylamide was selected for PASS technology because it is the same type of flocculent currently used in DDA1. Suncor noted that different types of flocculent would be evaluated in the future.

[365] Suncor identified that risks associated with alum and anionic polyacrylamide were low, provided rationale for its conclusion, and identified mitigation measures. Suncor stated that a potential mitigation where the DPL performance is not as planned could be to change treatment chemistry or introduce an additional additive.

### SOC Filers

[366] McMurray Métis raised concerns with the use of polymer in DDA3. No other specific concerns with respect to chemical use were raised in the SOC's, as part of ERP, or in the feedback on draft conditions.

### AER

[367] Alum has been used to treat lakes for phosphorous with no adverse effects under controlled circumstances. Materials treated with alum have been disposed of in both aquatic and terrestrial environments under controlled circumstances, and the risks associated with those materials and doses have been studied. Suncor provided short-term results from its water column toxicity tests completed to date.

[368] Suncor did not provide material specifications for anionic polyacrylamide that will be used in its PASS technology but did indicate that it is the same type of flocculent currently used in DDA1. The AER authorized the use of this chemical in 2009. However, the use of this chemical was assessed for a terrestrial reclamation outcome and not an aquatic closure outcome.

[369] The chemicals identified for use for in-line flocculation (e.g., anionic polyacrylamide) technologies have been used in controlled circumstances without adverse effect, but the AER has insufficient information about the long-term environmental and reclamation risks and uncertainties associated with the behaviour and effects of the chemicals and resulting treated tailings. This information is particularly relevant for aquatic and terrestrial closure option decisions in 2023, so Suncor's research and implementation plans and the DPL pilot test are expected to address the long-term behaviour and effects of chemicals for DDA3 in its DDA3 tailings treatment and target ecosite options development plan in 2023.

[370] Suncor may propose to change or introduce additional chemicals in the future. In that case, Suncor must notify the AER of any proposed change in chemical use for treating tailings, which may require written authorization or approval amendment.

## Climate Change Scenarios

### Decision

[371] Suncor must

- address hydrological sustainability as part of its aquatic research and implementation plan for DDA3 and,
- as part of its tailings research report required under its *EPEA* approval, include
  - research design and methodologies regarding the ability to provide a sustainable boreal forest lake ecosystem under climate change scenarios, and
  - hydrology models for the creation of sustainable pit lakes that store froth treatment, untreated, treated or covered tailings and that are capable of use for a range of future climate change scenarios, including worst-case scenarios.

### Suncor

[372] Suncor acknowledged that climate change could pose a risk to the long-term viability of Upper Pit Lake.

[373] Suncor used a hydrological model to determine if the watershed could support Upper Pit Lake given a range of climate change scenarios, and Suncor predicted that Upper Pit Lake would be sustainable under these scenarios. Suncor indicated that under a 9:1 ratio of watershed to lake area, it is probable that Upper Pit Lake would be sustainable.

[374] Suncor noted that if future climate conditions were drier, the viability of Upper Pit Lake could be compromised. Suncor provided several mitigations to manage this risk, including

- changing the outlet elevation of the lake (–10 to +3 m range),
- changing the littoral zone elevation, and
- modifying the closure landscape and drainage for more or less water supply to the Upper Pit Lake.

#### SOC Filers

[375] McMurray Métis raised concerns with climate change impacts on current water balance projections. No other specific concerns with respect to climate change scenarios were raised in the SOC's, as part of ERP, or in the feedback on draft conditions.

#### AER

[376] The AER finds that the placement of treated tailings in a boreal forest lake ecosystem requires a robust assessment and design to assure that it is sustainable over time. The AER expects evaluation of the sustainability of the Upper Pit Lake and Millennium Pit Lake system in a climate scenario representative of the average expected change in regional temperature and precipitation at the end of the 21st century under representative concentration pathways (RCP) 8.5 emissions scenario (see Intergovernmental Panel on Climate Change, <http://www.ipcc.ch>).

#### Commercial Forest Viability

##### Decision

[377] Suncor must provide in its annual reclamation progress tracking report any updates to predicted volumes of tailings sands required based on research results.

[378] As part of Suncor's life of mine closure plan, it must provide an acceptable distribution of ecosite phases that supports a range of land uses, including commercial forestry.

##### Suncor

[379] Suncor stated that the majority of the reclamation planned within the MOA application area would have an end land-use target of commercial forestry, with an overlapping capability to provide wildlife habitat and traditional use opportunities.

[380] Suncor indicated that ecosite "d" has an end land use of commercial forestry. Suncor stated that there are three cover designs that include tailings sands and that have a target of ecosite "d." Suncor anticipated that the three cover designs would develop mesic soil moisture conditions based on progress at Wapisiw Lookout, topography leading to water-receiving conditions, high clay content in the tailings sand retaining water, and thick reclamation material.

## SOC Filers

[381] No specific concerns with respect to commercial forestry viability were raised in the SOC's, as part of ERP, or in the feedback on draft conditions.

## AER

[382] There are remaining risks and uncertainties, which may create challenges for Suncor in meeting their acceptable distribution of commercial forests on the post-disturbance landscape, and need to be actively monitored and reported on.

[383] Commercial forestry on sites with a tailings substrate or tailings sands cap may not be achievable because

- tailings sand has a low water holding capacity and this limits the retention of water and nutrients on reclaimed sites;
- ecosites over tailings sands with limited upper surface soil and subsoil will likely default to drier ecosites, such as ecosite "b" or "a," which are not viable as commercial forestry sites; and,
- due to unknown rates of settlement, wetlands may develop on tailings deposits, and wetlands cannot sustain commercial forests.

[384] It is also unknown if Suncor can achieve ecosite "d" because of the following:

- maturity of Wapisiw Lookout site,
- uncertainty in how the topography and hydrology will support the proposed ecosites,
- inadequate evidence to support Suncor's claim regarding tailings sand clay content and water retention,
- uncertainty in how the soil wetness and water retention of the reclamation profile (cap and reclamation material) can support the proposed ecosites, and
- uncertainty in the tailings sand capping depth and reclamation material capping depth.

[385] In light of these uncertainties, Suncor must update predicted volumes of tailings sands required as part of its annual reclamation progress report and provide an acceptable distribution of ecosite phases that supports a range of land uses, including commercial forestry, as part of its life of mine closure plan.

[386] Suncor currently must report annually on its reclamation progress and every three years on its research to address risks associated with tailings and reclamation as part of its *EPEA* approval. Suncor is expected, in its next reports, to provide information that demonstrates that it can achieve ecosite "d," including Wapisiw Lookout progress; clarity on topography, hydrology, soil wetness and water retention, and capping depths; and evidence that supports its claims that clay content in tailings sand cap support water retention.

## Froth Treatment Tailings

### Decision

[387] Suncor is only permitted to place treated froth treatment tailings in Pond 2/3.

[388] Suncor is required to report every three years on its research to address risks associated with tailings and reclamation as part of its current *EPEA* approval. This research includes risks and uncertainties associated with the management of froth treatment tailings in and the closure of Pond 2/3.

[389] Verification that froth treatment tailings and substances within froth treatment tailings that may pose environmental risk are effectively contained within Pond 3 and in Pond 2/3 must be included in Suncor's measurement system plan. This plan must be submitted within six months from the date of this decision. The plan must verify that the historical measurement plan has been effective in controlling the movement of substances from froth treatment tailings through fluid tailings transfers from Pond 2/3 and provide an understanding of

- the range of elevated substances in froth treatment tailings that pose risks to reclamation,
- substance selection (e.g., substances that pose risks to reclamation and those that support confirmation of froth treatment tailings presence in Pond 2), and
- measurement locations, frequency, and methodology.

### Suncor

[390] Suncor indicated that froth treatment tailings have elevated light hydrocarbons, bitumen, diluent, and sulphur compounds.

[391] Suncor stated that there were no changes to its previously approved froth treatment tailings management. Suncor would continue to place froth treatment tailings in Pond 2/3 in the Pond 3 side. Fluid tailings from Pond 2 side of Pond 2/3 would be transferred to Pond 7 at the end of mine life. Fluid tailings from Pond 7 would be transferred to DDA3 at the end of mine life.

[392] Suncor stated that froth treatment tailings were not planned to be deposited directly into DDA3. Suncor would confirm that Pond 7 fluid tailings have the appropriate characteristics of hydrocarbon for DDA3 closure outcomes and apply mitigation if required.

### SOC Filers

[393] ACFN wanted additional monitoring, reporting, and enforcement around froth treatment tailings in its feedback on draft conditions.



AER

[394] Froth treatment tailings pose unique risks and uncertainties to reclamation outcomes for different terrestrial ecosites and wetland types and require additional measures to identify the location where these risks are to be managed. Suncor is only permitted to place treated froth treatment tailings in Pond 2/3.

[395] Froth treatment tailings make up about ten per cent of the overall tailings volume and may contain residual bitumen, diluent, and other substances that can result in increased risks to the environment. Fluid tailings that have been in contact with froth treatment tailings may also contain diluted concentrations of substances that increase environmental risk.

[396] Suncor identified controls to prevent or minimize the opportunity for froth treatment tailings to move from Pond 2/3 to Pond 7 to DDA3. Suncor did not substantiate that its operational controls or measurement were sufficient to prevent or detect the presence of froth treatment tailings or the presence of substances within froth treatment tailings that may pose an elevated environmental risk in Pond 2, in the fluid tailings being transferred from Pond 2 to Pond 7, or in the fluid tailings being transferred from Pond 7 to DDA3.

## Other Technical Issues

### Soil Depth Reduction

Decision

[397] Suncor is not authorized to reduce soil placement depth.

Suncor

[398] Suncor sought approval to reduce its soil placement depth over the MOA area, proposing to place adequate depth of material to separate cover soils from substrates of marginal soil quality.

SOC Filers

[399] No specific concerns with respect to soil depth reduction were raised in the SOC's, as part of ERP, or in the feedback on draft conditions.

AER

[400] A reduction in soil placement depth is not required for Suncor to implement its TMP.

## Capping Material, Suitability, Depth Requirements, and Availability

### Decision

[401] Suncor must, as part of its life of mine closure plan, provide capping material balances and, as part of its mine reclamation plan, provide rationale for how it defined tailings deposit capping requirements.

### Suncor

[402] Suncor proposed to cap its treated fluid tailings and stated that capping was directly related to making the deposit ready for reclamation and future stages of activity. Suncor provided the purpose and depth of capping material required for each deposit.

[403] Suncor indicated that all areas with fluid tailings, other tailings streams, mine dumps, and sand dumps would be capped with one metre or more of either tailings sand or suitable overburden as required under *EPEA* approval 94-02-00. Suncor categorized sand capping as a reclamation activity, with the purpose of protecting the rooting zone above the tailings substrate. Suncor planned to place an adequate depth of material to separate cover soils from substrates of marginal soil quality.

### SOC Filers

[404] No specific concerns with respect to capping material suitability, depth requirements, or availability were raised in the SOC's, as part of ERP, or in the feedback on draft conditions.

### AER

[405] Suncor's current *EPEA* approval condition requiring one metre of suitable capping material is for the purpose of rooting-zone protection and does not consider other objectives of placing capping material on tailings deposits such as geotechnical stability and settlement, management and control of water expressed from treated tailings, or drainage. The AER is amending Suncor's *EPEA* approval to ensure clarity on the purpose of the one-metre cap and modifying the types of material that need capping based on Suncor's applications (e.g., treated tailings).

[406] The tailings and reclamation research in Suncor's *EPEA* approval is required to determine the factors for suitability of capping materials and the depth of capping materials to meet these additional objectives for tailings deposits and ponds. The AER is updating the tailings research conditions to ensure that all required objectives for capping inform the research for the depth required and suitability of the materials required for capping tailings.

[407] Although the purpose and depth of capping material was provided as part of Suncor's TMP, the material availability must continue to be assessed to ensure that the risk of unavailable material is managed.

## Dam Decommissioning

### Decision

[408] Suncor must submit a plan for decommissioning the dams associated with its tailings ponds and deposits, including the following:

- Tar Island Dyke, Pond 1, and Pond 5 by October 31, 2018 (these ponds have been or are being capped and reclaimed at this time);
- Pond 6 by October 31, 2022, to allow capping mitigation in 2023;
- Pond 1A, Pond 2/3, Pond 7, and Pond 8A by October 31, 2028, which is five years before end of mine life; and
- STP and DDA3 by October 31, 2033.

### Suncor

[409] Dam decommissioning information is not a requirement of *Directive 085*, and therefore Suncor did not provide information on dam decommissioning.

### SOC Filers

[410] ACFN expressed concern about the integrity of dams and noted that it was pleased to see requirements for plans for decommissioning of dams in its feedback on draft conditions.

### AER

[411] Suncor has a number of dams associated with its tailings ponds and deposits. These dams may not be decommissioned if the tailings ponds and deposits still contain treated or untreated tailings, even if those tailings have achieved RTR status. Additional plans are required.

## Extended Use of Pond 1A and Pond 2/3

### Context

[412] *Directive 085* contemplates continued operation of a plant at the mine/project site after end of mine life. In these cases, the AER will consider the justification for the continued operation of the plant and the need for the associated infrastructure.

### Decision

[413] Suncor must provide a plan for the extended use of Pond 1A and Pond 2/3, including a revised TMP, by September 30, 2023.

[414] The extended use of Pond 1A and Pond 2/3 is not approved.

#### Suncor

[415] Suncor stated that Pond 1A and Pond 2/3 would continue to operate after the end of mine life to support closure activities and ongoing upgrading and utilities operations.

#### SOC Filers

[416] No specific concerns with respect to the extended use of Pond 1A or Pond 2/3 were raised in the SOC's, as part of ERP, or in the feedback on draft conditions.

#### AER

[417] There is insufficient information in this application to justify the continued operation of these ponds after end of mine life.

#### Pit Walls

##### Decision

[418] Suncor must submit a report containing a detailed geotechnical stability evaluation for any final pit wall. The report must be submitted six months before mining a final pit wall.

#### Suncor

[419] Suncor plans to mine along the final pit wall through to the end of mine life in 2033.

#### SOC Filers

[420] No specific concerns with respect to pit wall stability were raised in the SOC's, as part of ERP, or in the feedback on draft conditions.

#### AER

[421] Final pit-wall stability is important because any instability in pit walls directly affects mining operations and final closure design. *Draft Directive 023* provides pit wall design requirements.

### Conclusion

[422] Suncor's Oil Sands Base Plant is nearing end of mine life (2033). The AER must have the appropriate assurances that Suncor's fluid tailings will meet *TMF* outcomes on time. Therefore, Suncor must submit appropriate and timely information. These approvals reflect a risk-based approach tailored to project-specific considerations. The AER has added research, monitoring, evaluation, and reporting requirements and expectations to meet the requirements of the *TMF* and *Directive 085*.

[423] The approvals also require Suncor to propose the final closure outcome for DDA3 by 2023. This should provide sufficient time to adjust Suncor's TMP if water-capped tailings and pit lakes are restricted by government policy or research and monitoring results.

[424] In alignment with the enhanced transparency and increased role of stakeholders introduced by the *TMF* and *Directive 085*, the AER expanded the involvement of stakeholders in the review of Suncor's TMP by hosting an ERP technical meeting, circulating draft approvals, and providing for robust engagement on the issues. That transparency continues through the approval conditions.

[425] The approvals take a balanced approach to the continued involvement of stakeholders. The approvals require Suncor to engage with stakeholders about tailings management, including holding an annual forum and annually reporting on their engagement efforts to the AER. The approvals also provide Suncor with the flexibility in who it engages with and how it undertakes its engagement activities. The AER requires that Suncor will engage with its stakeholders on the matters governed by these approvals.

Dated in Calgary, Alberta, on October 25, 2017.

**Alberta Energy Regulator**

*<original signed by>*

Paul Ferensowicz

Senior Advisor

Corporate Planning & Enterprise Projects



## **Appendix 1      Approvals**





MADE at the City of Calgary in the Province of Alberta, on  <original dated>	<original signed>  ALBERTA ENERGY REGULATOR
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IN THE MATTER of a scheme of Suncor Energy Inc. (hereinafter called “the Operator”) for the recovery of oil sands and production of oil sands products from the Athabasca Wabiskaw-McMurray Oil Sands Deposit in the Mildred Lake Area, as outlined in Appendix A to this approval (Scheme).

WHEREAS the Operator has applied to the Alberta Energy Regulator to amend the approval for the Scheme under the *Oil Sands Conservation Act* (hereinafter called “the Scheme Approval”) in respect of the Operator’s Tailings Management Plan; and

WHEREAS the Alberta Energy Regulator is confining substantive changes in this Scheme Approval No. 8535N to those arising from the Operator’s Tailings Management Plan applications;

WHEREAS the Alberta Energy Regulator 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* in Scheme Approval No. 8535N.

THEREFORE, the Alberta Energy Regulator (hereinafter called "The AER"), pursuant to the *Oil Sands Conservation Act*, being chapter 0-7 of the Statutes of Alberta, 2000, hereby orders as follows:

1.
  - (a) The Operator’s Scheme for the recovery of oil sands in the area shown on the attachment hereto marked Appendix A to this approval, and production of oil sands products from the processing of recovered oil sands or crude bitumen from other sources, as such scheme is described in Applications No. 167, 1641, 3438, 6628, 8461, 780318, 850870, 851047, 880875, 900282, 920863, 931233, 940874, 941091, 951265, 960369, 960439, 980197, Proceeding No. 990401, and Applications No. 1298119, 1325847, 1403323, 1391211, 1391212, 1565025, 1600800, 1617414, 1626039, 1626702, 1645272, 1623214, 1686327, 1754895, 1801043, 1857270, 1857274, and 1890348 is approved subject to the *Oil Sands Conservation Act*, the *Oil Sands Conservation Rules* and the terms of the clauses set out in this approval.
  - (b) Subclause (a) does not preclude alterations in design or equipment, provided the AER is satisfied the alterations are compatible with the outline of the Scheme, meet the operating criteria in the approval, are made for the better operation of the Scheme and do not result in unacceptable adverse impacts.
2. The Operator shall carry out its operations in such a way as to maximize conservation of energy resources and, under normal operating conditions on a calendar year basis, meet the following operating criteria:

- (a) diluent loss will not exceed 4.0 volumes of diluent per 1000 volumes of bitumen production;
  - (b) no untreated upgrader waste water shall be released to any tailings pond or treated tailings area; and
  - (c) no untreated froth treatment tailings shall be released to any tailings pond or treated tailings area.
- 3. On or before February 28, 2000 and every 2 years thereafter or such time that the AER may stipulate, the Operator shall submit a report to the AER for its review describing the performance of the mine, the extraction and the upgrading facilities which shall include as a minimum:
  - (a) a discussion of the historical energy efficiency for the previous two calendar years,
  - (b) the results of any studies undertaken to identify opportunities for improved energy efficiency,
  - (c) a description of any modifications made to improve energy efficiency, and
  - (d) a comparison of the energy efficiencies with those of similar industrial operations.
- 4. The Operator shall submit to the AER, five years prior to the end of the Millennium Mine life, for approval:
  - (a) A detailed report that assesses the geotechnical requirements and establishes the minimum required pillar width and the associated resources sterilization, specific to the requirements for (i) Mine Dump 2 (MD2) Expansion geotechnical stability (the “stability pillar”); and (ii) seepage prevention (the “seepage pillar”) between the Millennium Pit Lake and MD2;
  - (b) In the instance that the stability pillar is larger than the seepage pillar, Suncor will re-handle the MD2 Expansion waste required to recover the resource in the section of the stability pillar that is larger than that of the seepage pillar;
  - (c) In the instance that the seepage pillar is larger than the stability pillar, Suncor will justify the size of the seepage pillar by providing an economic analysis that compares the seepage pillar size versus a smaller pillar size that incorporates seepage mitigation measures. The cost associated with the re-handling of the MD2 Expansion waste required for the smaller pillar will not be used in the economic analysis.
- 5. The Operator shall re-handle the portions of Pond 8b and dedicated disposal areas as required to accommodate recovery of the underlying mineable oil sands as defined in *Directive 082: Operating Criteria - Resource Recovery Requirements for Oil Sands Mine and Processing Plant Operations*.
- 6. Two years prior to the relocation of the Millennium Extraction Plant or construction of additional extraction facilities on the east side of the Athabasca River, the Operator shall submit an assessment of the resulting impacts on resource recovery, environment, mine, and extraction operations for AER approval.

7. The Operator shall submit to the AER every two years or such time that the AER may stipulate, starting on February 28, 2001, a report on the progress made in utilizing low engine NOx emission technology to reconfigure its mine fleet.
8. The Operator shall cease bitumen production from the Base Plant Primary Extraction Facility (Plant 3) on or before December 31, 2019, or such later date as the AER may determine.
9. The Operator shall submit for AER approval the detailed geotechnical designs for the External Overburden Disposal structure and the In-pit Overburden Disposal structure along the Steepbank River for the North Steepbank Mine Extension at least six months prior to field preparation in these areas.
10. The Operator shall submit for AER approval a finalized plan for mining at the lease boundary between the North Steepbank Mine Extension and Lease 29 five years prior to mining at this lease boundary.
11. In accordance with s. 8.3.1 of Draft Directive 023, as amended, at least six months prior to mining any final pit wall, the Operator shall submit to the AER for approval, a report containing a detailed geotechnical stability evaluation for the final pit wall the Operator proposes to mine.
12. The Operator shall provide an annual update of its efforts to coordinate mine planning and closure with other operators in terms of landform design, drainage and material balances as part of its annual mine plan submission beginning in September 2007.
13. The Operator shall submit for AER approval a coke conservation plan one year prior to placing coke in-pit in the North Steepbank Mine Extension.
14. The Operator shall submit detailed designs for Sand Dump 10 at least six months prior to containment of any water or deposition of tailings sand.
15. The Operator shall provide a schedule of Plant 3 throughput rates for the upcoming year in its annual mine plan submitted to the AER on or before September 30 of every year.
16. The Operator shall provide in its Annual Report of Mining Operations submitted to the AER on or before February 28 of every year:
  - (a) A monthly summary of throughput rates and bitumen recovery for Plant 3 and Plant 300 separately for the previous calendar year; and
  - (b) A monthly summary demonstrating that Plant 3 operation was required for sand capping of Pond 5 and 6.
17. The Operator shall apply for AER approval should it plan to operate Plant 3 continuously for more than 14 days for reasons other than producing sand for the capping of Pond 5 and Pond 6.
18. The Operator shall provide a detailed instrumentation plan to the AER one month prior to the commencement of active dumping at the EWD site.
19. The Operator shall achieve the
  - (a) new fluid tailings inventory profile specified in Appendix B, Table 1 and Figure 1; and

- (b) legacy fluid tailings inventory profile specified in Appendix B, Table 2 and Figure 2.
- 20. The Operator shall not exceed
  - (a) for the new fluid tailings inventory profile, any of the profile deviation trigger, total volume trigger or total volume limit specified in Appendix B, Table 3.
  - (b) for the legacy fluid tailings inventory profile, the profile deviation trigger specified in Appendix B, Table 4.
- 21. If any limit or trigger in clause 20 is exceeded, the Operator shall comply with the management response or action directed by the AER.
- 22. Subject to clause 23, the Operator shall achieve the ready to reclaim criteria as set out in Appendix C.
- 23.
  - (a) If, at any time, the AER is not satisfied with the ready to reclaim criteria, 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 any modifications to the ready to reclaim criteria authorized by the AER, the Operator shall:
    - (i) address the requirements in *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, as amended (hereinafter called *Directive 085*);
    - (ii) demonstrate that the proposed modifications to the ready to reclaim criteria do not result in changes to any of the ready to reclaim trajectory, reclamation outcomes and 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 modified ready to reclaim criteria unless
    - (i) the Operator has provided the information required by subclause 23(b) to the satisfaction of the AER; and
    - (ii) the AER has revised Appendix C to allow the modified ready to reclaim criteria.
- 24. The Operator shall provide by September 30, 2019, or such other date as the AER may stipulate in writing, proposed ready to reclaim criteria for DDA3.
- 25. The submission in clause 24 shall:
  - (a) incorporate the results from the Demonstration Pit Lake Pilot Test pursuant to EPEA Approval No. 94-02-00, as amended or renewed (hereinafter called the “EPEA Approval”), and DDA3 monitoring results; and
  - (b) include proposed subobjective 1 criteria that will demonstrate improved deposit performance prior to 2023.
- 26. The Operator shall not use any modified ready to reclaim criteria for DDA3 unless
  - (a) the Operator has provided the information required by subclause 23(b) to the satisfaction of the AER; and

- (b) the AER has revised Appendix C to allow the modified ready to reclaim criteria.
- 27. The Operator shall provide by September 30, 2020, or such other date as the AER may stipulate in writing, proposed ready to reclaim criteria for MD9.
- 28. The submission in clause 27 shall include the information as required by subclause 23(b).
- 29. The Operator shall not use any modified ready to reclaim criteria unless
  - (a) The Operator has provided the information required by subclause 23(b) to the satisfaction of the AER; and
  - (b) The AER has revised Appendix C to allow the modified ready to reclaim criteria.
- 30. The Operator shall provide by September 30, 2022, or such other date as the AER may stipulate in writing, proposed ready to reclaim criteria for remnant fluid tailings.
- 31. The submission in clause 30 shall include
  - (a) The information as required by subclause 23(b); and
  - (b) An explanation of how learnings from managing Pond 1 remnant volumes have been incorporated.
- 32. The Operator shall not remove treated tailings in DDA1 or remnant fluid tailings from the fluid tailings inventory unless the AER has revised Appendix C to allow the modified ready to reclaim criteria.
- 33. The Operator shall only place treated tailings in
  - (a) DDA1, MD9 and DDA3; and
  - (b) DDA2, provided written authorization or approval amendment for the plan required in clause 41 has been granted by the AER.
- 34. The Operator shall
  - (a) confirm the monitoring plan for Pond 5 by November 30, 2017, or such other date as the AER may stipulate in writing;
  - (b) complete coke capping and vertical strip drain installation in Pond 5 by December 31, 2019; and
  - (c) commence reclamation of Pond 5 prior to May 1, 2024.
- 35. The Operator shall achieve ready to reclaim status for Pond 6 by December 31, 2028.
- 36. The Operator shall submit, by September 30, 2019, or such other date as the AER may stipulate in writing, a plan that updates Pond 6 fluid tailings management.
- 37. The plan in clause 36 shall include:
  - (a) A description of the removal and treatment of fluid tailings, including the following:
    - (i) Rationale for the volume of fluid tailings to be removed;
    - (ii) Rationale for the placement location of the removed fluid tailings; and
    - (iii) Chemical and physical properties of the fluid tailings to be removed;
  - (b) Updated ready to reclaim criteria in accordance with clause 23;

- (c) An analysis of any implications to the fluid tailings profiles identified in clause 19;
  - (d) Key activities and milestones necessary to achieve ready to reclaim status no later than December 31, 2028;
  - (e) A description of proposed mitigation measures for the remaining fluid tailings, including
    - (i) An explanation of how Pond 5 mitigation measures and results have been incorporated in the proposed mitigation measures;
    - (ii) An explanation for how research results in the EPEA Approval have been incorporated in the proposed mitigation measures;
    - (iii) An analysis of any implications to the targeted final landforms and targeted range of ecosites;
    - (iv) Identification of the nature and magnitude of the uncertainties with Pond 6's ability to achieve ready to reclaim status by December 31, 2028, and achieve the targeted final landforms and targeted range of ecosites;
    - (v) Identification of, with supporting justification for, mitigation measures to address uncertainties identified in 37(e)(iv);
    - (vi) Identification of, with supporting justification for, triggers to initiate the mitigation measures identified in 37(e)(v);
  - (f) A monitoring plan addressing settlement, strength and dewatering; and
  - (g) Any other information the AER may require.
38. The Operator shall achieve ready to reclaim status for Pond 7 by December 31, 2033.
39. The Operator shall submit, by September 30, 2024, or such other date as the AER may stipulate in writing, a plan that updates Pond 7 fluid tailings management.
40. The plan in clause 39 shall include:
- (a) The requirements in subclause 37(a)–(c), (e) and (f);
  - (b) An explanation of how learnings from managing Pond 1, Pond 5 and Pond 6 have been incorporated in the plan;
  - (c) The type of proposed capping material(s) and placement schedule, including an analysis supporting the schedule, suitable capping material availability and volume requirements;
  - (d) Key activities and milestones necessary to achieve ready to reclaim status no later than December 31, 2033; and
  - (e) Any other information the AER may require.
41. The Operator shall provide by September 30, 2018, or such other date as the AER may stipulate in writing, a plan that updates DDA2 fluid tailings management.
42. The plan in clause 41 shall:
- (a) address the application requirements specified in *Directive 085*;
  - (b) evaluate the performance of past or current tailings deposits where similar tailings treatment technology and reclamation outcomes were proposed;
  - (c) explain how research results required by the reclamation outcomes in the EPEA Approval have been incorporated;
  - (d) mitigate uncertainties associated with the tailings treatment technology, tailings deposit performance and ready to reclaim trajectory; and
  - (e) provide any other information the AER may require.
43. The Operator shall submit for MD9

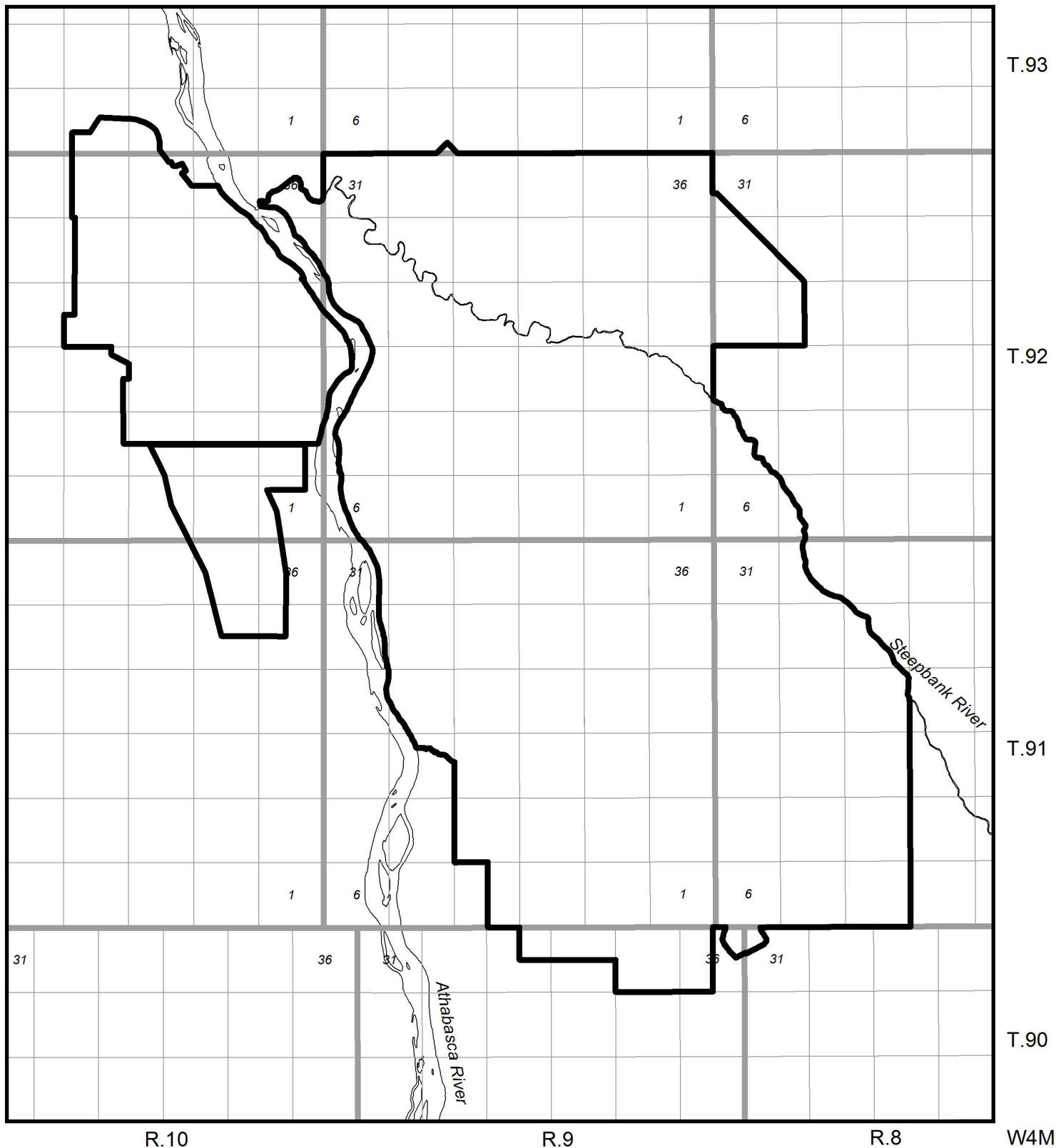
- (a) By February 28, 2018, a settlement monitoring plan;
  - (b) By February 28, 2020, an evaluation of
    - (i) the volume of treated tailings that will be placed in MD9; and
    - (ii) the implications of the volume of treated tailings placed in MD9; and
  - (c) By September 30, 2023, a plan that updates MD9 tailings management,
- or such other date as the AER may stipulate in writing.
44. The plan in subclause 43(c) shall:
- (a) address the application requirements specified in *Directive 085*;
  - (b) evaluate the performance of past or current tailings deposits where similar tailings treatment technology and reclamation outcomes were proposed;
  - (c) explain how research results required by and reclamation outcomes in the EPEA Approval have been incorporated;
  - (d) mitigate uncertainties associated with the tailings treatment technology, tailings deposit performance and ready to reclaim trajectory; and
  - (e) provide any other information the AER may require.
45. The Operator shall, in addition to any reporting required by *Directive 085*, provide in the annual fluid tailings management report:
- (a) The available storage capacity of each tailings deposit or pond that contains water or tailings at the end of the reporting period;
  - (b) Annual storage capacity and volume requirements for the five years following the end of the reporting period;
  - (c) An assessment of PASS technology operation for the reporting period, including
    - (i) the number of days the technology was not operating as intended;
    - (ii) a description of why the technology was not operating as intended; and
    - (iii) the variation of properties of the treated tailings and the released water ;
    - (iv) the characterization of water recovered from treated tailings and runoff from ready to reclaim tailings required by *Directive 085*, including bitumen, hydrocarbons and ultrafines;
    - (v) an evaluation of whether or not the treatment performance met the objectives stated in Application No. 1890348;
    - (vi) an assessment of consolidation, based on sampling and drilling data, of treated tailings within DDA3; and
    - (vii) any other information the AER may require.
  - (d) A summary of research results and technology improvements supporting reduced Mine Dump 9 (MD9) reclamation timelines;
  - (e) Report on Pond 5 settlement, strength and dewatering; and
  - (f) Confirm the rate of Pond 5 settlement will support proposed commencement of reclamation prior to May 1, 2024 and will support the achievement of targeted final landforms,
- unless otherwise specified in writing by the AER.
46. The Operator shall provide by September 30, 2023, or such other date as the AER may stipulate in writing, a plan for
- (a) extended use; and
  - (b) updates to tailings management for Ponds 1A and 2/3.
47. The plan in clause 46 shall:

- (a) address the application requirements specified in *Directive 085*;
  - (b) identify the volume of recycle water and containment required for continued operation past end-of-mine life;
  - (c) provide an assessment of alternatives considered for extraction and upgrading processes;
  - (d) assess the composition and the chemical and physical properties of the tailings in Pond 1A and Pond 2/3;
  - (e) identify the purpose and duration of Pond 1A and Pond 2/3 extended use;
  - (f) describe the activities and milestones from end of mine life to closure of Pond 1A and Pond 2/3;
  - (g) assess the material required and available to reclaim Pond 1A and Pond 2/3;
  - (h) identify the nature and magnitude of the uncertainties with and the mitigation measures for
    - (i) extended use of Pond 1A and Pond 2/3; and
    - (ii) reclamation and closure of Pond 1A and Pond 2/3;
  - (i) provide a Pond 1A and Pond 2/3 monitoring plan for deposit stability, settlement, water quality, and tailings sediment;
  - (j) assess the liability management associated with Pond 1A and Pond 2/3 extended use; and
  - (k) provide any other information the AER may require.
48. The Operator shall not implement the plan for extended use of Pond 1A and Pond 2/3 unless written authorization or approval amendment is granted by the AER.
49. The Operator shall place froth treatment tailings only in Pond 2/3.
50. The Operator shall not implement any individual plan in clauses 36, 39, 41, 43(a), 43(c) and 46(b) unless written authorization or approval amendment for that plan is granted by the AER.
51. The Operator shall not place any water, which includes industrial wastewater, above treated or untreated tailings for the purpose of creating an aquatic closure landscape, except as authorized under the EPEA Approval.
52. The Operator shall not conduct phase 2, 3 and 4 activities in DDA3 identified in Application No. 1890348 unless an approval amendment is granted by the AER.
53. The Operator shall not release any substance to the surrounding environment except as authorized under the EPEA Approval.
54. 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.
55. The Operator shall engage with stakeholders and Indigenous communities on the activities undertaken under this Approval in respect of tailings management.



56. The Operator shall conduct an annual forum with stakeholders and Indigenous communities on tailings management.
57. The Operator shall report in the annual fluid tailings management report engagement efforts undertaken in the reporting period.
58. The report in clause 57 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 the 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.
59. The Operator 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 a pit lakes; and
  - (c) reclamation criteria.
60. 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.
61. AER Approval No. 8535, 8535A, 8535B, 8535C, 8535D, 8535E, 8535F, 8535G, 8535H, 8535I, 8535J, 8535K, 8535L and 8535M are hereby repealed, rescinded, and replaced with the AER Approval No. 8535N.

END OF DOCUMENT



# **SUNCOR OIL SANDS PROJECT** **APPENDIX A TO APPROVAL NO. 8535N**

## **Legend**

**OSCA Approval Area**

0 1 2 4 6 8 Kilometers

The AER does not warrant the accuracy or completeness of the information contained in this map and is not responsible for any errors or omissions in its content and accepts no liability for the use of this information.

Base Data Provided by Spatial Data Warehouse Ltd., 2003

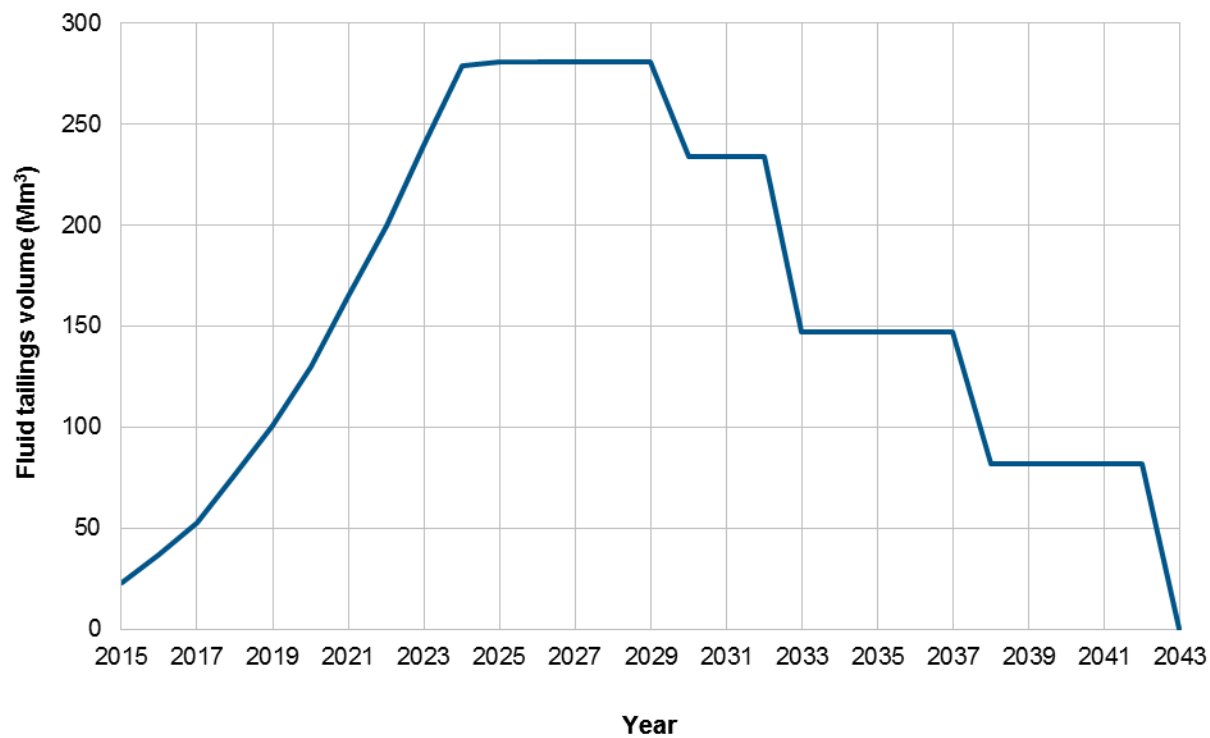
**SUNCOR ENERGY INC.**
**APPENDIX B TO APPROVAL NO. 8535N**
**Table 1. Profile for New Fluid Tailings**

<b>Year</b>	<b>Approved Profile New FT Inventory (million cubic metres)</b>
2015	23
2016	37
2017	53
2018	76
2019	101
2020	130
2021	165
2022	200
2023	240
2024	279
2025	281
2026	281
2027	281
2028	281
2029	281
2030	234
2031	234
2032	234
2033	147
2034	147
2035	147
2036	147
2037	147
2038	82
2039	82
2040	82
2041	82
2042	82
2043	0 <sup>a</sup>

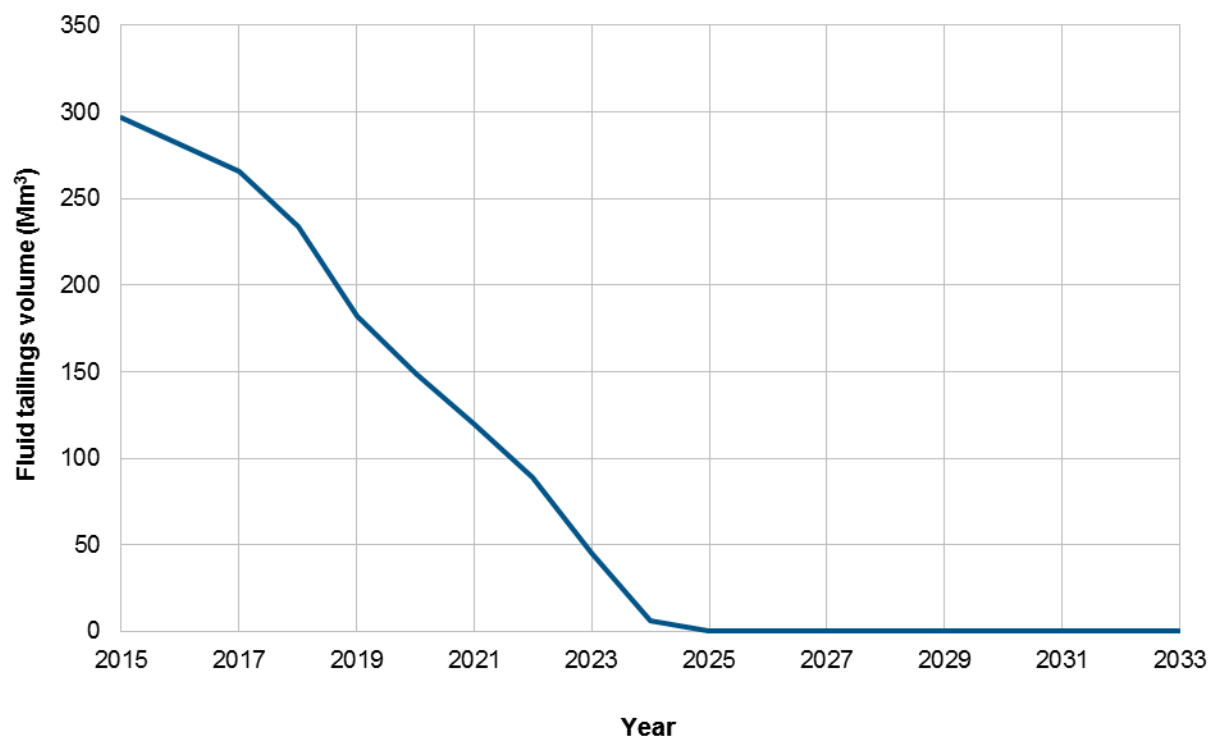
<sup>a</sup>In accordance with the TMF, the AER requires the Operator have 0 Mm<sup>3</sup> of new fluid tailings 10 years after end of mine life.

**Table 2. Profile for Legacy Fluid Tailings Profile**

<b>Year</b>	<b>Approved Profile Legacy FT Inventory (million cubic metres)</b>
2015	297
2016	281
2017	266
2018	234
2019	182
2020	149
2021	120
2022	89
2023	45
2024	6
2025	0
2026	0
2027	0
2028	0
2029	0
2030	0
2031	0
2032	0
2033	0



**Figure 1. Profile for New Fluid Tailings**



**Figure 2. Profile for Legacy Fluid Tailings**

**Table 3. Thresholds for Profile for New Fluid Tailings**

Threshold Type	Trigger or Limit	Calculation Factors
Profile Deviation Trigger	20 per cent	$\text{annual deviation percent}_{\text{year}} = \frac{\text{New FT Inventory}_{\text{year}} - \text{Approved Profile New FT Inventory}_{\text{year}}}{\text{Approved Profile New FT Inventory}_{\text{year}}}$ $\text{profile deviation trigger}_{\text{year}} = \frac{\sum_{i=\text{year}-5}^{\text{year}} (\text{annual deviation percent}_i)}{\text{Count}(\text{annual deviation percent}_i: \text{annual deviation percent}_{i-5})}$
Total Volume Trigger	281.0 million cubic metres	n/a
Total Volume Limit	393.4 million cubic metres	n/a

**Table 4. Thresholds for Profile for Legacy Fluid Tailings**

Threshold Type	Trigger or Limit	Calculation Factors
Profile Deviation Trigger	20 per cent	$\text{annual deviation percent}_{\text{year}} = \frac{\text{Legacy FT Inventory}_{\text{year}} - \text{Approved Profile Legacy FT Inventory}_{\text{year}}}{\text{Approved Profile Legacy FT Inventory}_{\text{year}}}$ $\text{profile deviation trigger}_{\text{year}} = \frac{\sum_{i=\text{year}-5}^{\text{year}} (\text{annual deviation percent}_i)}{\text{Count}(\text{annual deviation percent}_i: \text{annual deviation percent}_{i-5})}$

**SUNCOR ENERGY INC.**
**APPENDIX C TO APPROVAL NO. 8535N**
**Table 1. RTR criteria for Suncor Pond 5, Pond 6, Pond 7, DDA1-MD9, and DDA3**

<b>Deposit</b>	<b>Subobjective</b>	<b>RTR criteria</b>
Pond 5	Subobjective 1	capping with coke and vertical strip drains (VSDs) installation is complete in 2019
	Subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed.  Groundwater is monitored as required by <i>Environmental Protection and Enhancement Act (EPEA)</i> Approval No. 94-02-00, as amended or renewed
Pond 6	Subobjective 1	Pond 6 mitigation is complete by December 31, 2028
	Subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed.  Groundwater is monitored as required by <i>Environmental Protection and Enhancement Act (EPEA)</i> Approval No. 94-02-00, as amended or renewed
Pond 7	Subobjective 1	Pond 7 mitigation is complete by December 31, 2033
	Subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed.  Groundwater is monitored as required by <i>Environmental Protection and Enhancement Act (EPEA)</i> Approval No. 94-02-00, as amended or renewed
DDA1-MD9	Subobjective 1	Clay to water ratio > 0.5 in DDA1 based on deposit sampling
	Subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed.  Groundwater is monitored as required by <i>Environmental Protection and Enhancement Act (EPEA)</i> Approval No. 94-02-00, as amended or renewed
DDA3	Subobjective 1	Clay to water ratio $\geq 0.5$ based on deposit sampling  Expressed water from DDA3 treated tailings annual average total suspended solids $\leq 500$ parts per million
	Subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed.  Groundwater is monitored as required by <i>Environmental Protection and Enhancement Act (EPEA)</i> Approval No. 94-02-00, as amended or renewed



# AMENDING APPROVAL

## ALBERTA ENERGY REGULATOR

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

APPROVAL NO.: 94-02-18 .....

APPLICATION NO.: 075-94 .....

EFFECTIVE DATE: <original dated> .....

EXPIRY DATE: August 12, 2018 .....

APPROVAL HOLDER: Suncor Energy Inc. ....

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 Suncor Energy Inc. Oil Sands Processing Plant and Mine

is amended as per the attached terms and conditions.

<original signed by>

---

Paul Ferensowicz  
Alberta Energy Regulator

<original dated>

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## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

*Environmental Protection and Enhancement Act* Approval No. 94-02-00 is hereby further amended as follows:

1. Subsection 1.1.2 (x) is deleted and substituted with the following:

(x) "Director" means an authorized employee of the Alberta Energy Regulator.

2. Subsection 1.1.2 (w.1) is deleted and substituted with the following:

(w.1) "Dedicated Disposal Area 1 (DDA1)" means a DDA location including DDA1 (East) and DDA1 (8A), where fluid tailings are mixed with a polymer and deposited in thin lifts where water is recycled, and thereafter the resulting tailings deposit, after further drying, is transferred to Mine Dump 9 (MD9).

(w.2) "Dedicated Disposal Area 2 (DDA2)" means a stackable treated tailings deposit located south of MD9 and west of MD9 South.

(w.3) "Dedicated Disposal Area 3 (DDA3)" means an in-pit dedicated disposal area located in the Millennium pit between SD8 and SD9.

3. Subsections 1.1.2 (dd) and (bbbbb) are deleted and substituted with the following:

(dd) "East Bank Plant Site" means that part of the plant located on the east side of the Athabasca River, which is equivalent to East Bank Development Area (EBDA).

(bbbbb) "West Bank Plant Site" means that part of the plant located on the west side of the Athabasca River, which is equivalent to West Bank Development Area (WBDA).

4. Subsections 1.1.2 (aa.1), (pppp.1) are deleted.

5. Subsection 1.1.2 (iii.1) is added after 1.1.2 (iii):

(iii.1) "Millennium End Pit Lake" means an in-pit waterbody that will receive inflows from the East Bank Plant Site designed to discharge directly to the Athabasca River.

6. Subsection 1.1.2 (vvvv.1) is added after 1.1.2 (vvvv):

(vvvv.1) "Upper Pit Lake" means an in-pit waterbody resulting from the placement of a water cover on DDA3 that will receive inflows from the East Bank Plant Site, and is designed to discharge to the Millennium End Pit Lake.

7. Section 3.11 is deleted and substituted with the following:

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

### **SECTION 3.11: MINE DUMP 9 AMENDMENT AND DEDICATED DISPOSAL AREA 2 (DDA2) Expansion**

3.11.1 The approval holder shall construct:

- (a) Mine Dump 9 (MD9) as described in applications No. 064-94 and 071- 94, unless otherwise authorized in writing by the Director; and
- (b) DDA2 as described in applications No. 064-94 and 071-94 upon complying with *Oil Sands Conservation Act* Approval No. 8535N, as amended ("the OSCA Approval").

3.11.2 The approval holder shall not implement the plans for either DDA2 or MD9 required by the OSCA Approval, unless:

- (a) the approval holder has provided the information required by the OSCA Approval; and
- (b) an approval amendment or written authorization is granted by the AER.

3.11.3 The approval holder shall commence construction of DDA2 and associated facilities by December 31, 2019, unless otherwise authorized in writing by the Director.

8. The following is added after section 3.12:

### **SECTION 3.13: DDA3**

#### **DDA3 Treated Tailings Containment**

3.13.1 The approval holder shall construct DDA3 and associated facilities, as described in application No. 075-94 and OSCA applications 1857274 and 1890348, unless otherwise authorized in writing by the Director.

3.13.2 The approval holder shall commence construction of DDA3 and associated facilities by December 31, 2018, unless otherwise authorized in writing by the Director.

### **SECTION 3.14: POND 5, POND 6 and POND 7**

3.14.1 The approval holder shall:

- (a) complete coke capping and vertical strip drain installation of Pond 5 by December 31, 2019; and
- (b) commence reclamation of Pond 5 prior to May 1, 2024.

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

3.14.2 The approval holder shall not implement the mitigation plans for Pond 6 or Pond 7 required by the OSCA Approval, unless

- (a) the approval holder has provided the information required by the OSCA Approval; and
- (b) an approval amendment or written authorization is granted by the AER.

9. The following is added after subsection 4.1.74:

### **Dust Management**

4.1.75 The approval holder shall submit a Dust Management Plan to the satisfaction of the Director on or before December 31, 2019, unless otherwise authorized in writing by the AER.

4.1.76 The Dust Management Plan referred to in subsection 4.1.75 shall include, at a minimum, all of the following:

- (a) a discussion on existing dust control practices and their effectiveness;
- (b) list of all dust exposure areas or locations of concern;
- (c) list of all dust generation activities of concern;
- (d) list of all dust suppressants applied;
- (e) measures to control and mitigate dust from the locations referred to in subsection 4.1.76 (b);
- (f) measures to control and mitigate dust from the activities identified in subsection 4.1.76 (c);
- (g) dust monitoring; and
- (h) contingency plans to respond to dust issues from operations;

unless otherwise authorized in writing by the AER.

4.1.77 The approval holder shall implement the Dust Management Plan referred to in subsection 4.1.75 as authorized in writing by the AER.

4.1.78 The approval holder shall not apply dust suppressant or any other chemicals for the purpose of dust management on the roads or lands, unless otherwise authorized in writing by the AER.

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

10. Subsection 4.2.1 is deleted and substituted with the following:

- 4.2.1 The approval holder shall not release any substance to the surrounding environment, except as authorized under this approval.

11. The following section is added after Section 4.4:

### **SECTION 4.5: DEDICATED DISPOSAL AREAS - OPERATION, CLOSURE, MONITORING AND REPORTING**

4.5.1 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 056-94; and
- (b) the coagulant identified in application 075-94;

unless otherwise authorized in writing by the Director.

4.5.2 The approval holder shall only place treated tailings in:

- (a) DDA1, MD9 and DDA3;
- (b) DDA2, provided written authorization or approval amendment for the plan as required by the OSCA Approval has been granted by the AER.

4.5.3 The approval holder shall not place any water, which includes industrial wastewater, above treated or untreated tailings for the purpose of creating an aquatic closure landscape, except in accordance with any research plans authorized under Section 4.7 of this approval.

4.5.4 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.

4.5.5 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;

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

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

### **DDA3 OPERATION**

- 4.5.6 The approval holder shall conduct fluid tailings treatment and operate DDA3 as described in application No. 075-94 and related OSCA applications 1857274 and 1890348.
- 4.5.7 The approval holder shall not conduct phase 2, 3, and 4 activities in DDA3 identified in Application No. 1890348 in DDA3, unless an approval amendment is granted by the Director.

### **PIT LAKES WATER RETURN**

- 4.5.8 The approval holder shall obtain written authorization from the Director prior to the commencement of any water release from Upper Pit Lake to Millennium Pit Lake.

12. The following subsection is added after subsection 4.6.14:

- 4.6.15 The approval holder shall submit an updated Groundwater Monitoring Program proposal to the Director, unless otherwise authorized in writing by the Director, for the following:
  - (a) MD9 and DDA2 that includes the supplemental hydrogeological characterization to the Director on or before December 31, 2017; and
  - (b) DDA3 to monitor potential seepage of process-affected groundwater on or before December 31, 2017.
- 4.6.16 The approval holder shall ensure the measurement system plan developed as required by Directive 085: Fluid Tailings Management for Oil Sands Mining Projects, as amended, aligns with the Groundwater Monitoring Program authorized under this approval.
- 4.6.17 If any proposal referred to in subsection 4.6.15 is found deficient by the Director, the approval holder shall correct all deficiencies by the date specified in writing by the Director.
- 4.6.18 The approval holder shall implement the Groundwater Monitoring Program in subsection 4.6.15 as authorized in writing by the Director.

13. The following section is added after Section 4.6:

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

### **SECTION 4.7: TAILINGS RESEARCH and/or IMPLEMENTATION PLANS**

#### **GENERAL**

4.7.1 All research plans in this approval shall include the following, at a minimum:

- (a) an explanation of and rationale for:
  - (i) the research objectives,
  - (ii) the hypotheses to be tested,
  - (iii) the models to be developed,
  - (iv) the experimental controls,
  - (v) key performance measures and criteria,
  - (vi) the applicability of each objective to addressing the risks and uncertainties identified in 6.1.60.2, 6.1.61 and 6.1.63,
  - (vii) the applicability of each objective to achieving reclamation outcomes consistent with requirements in PART 6 of this approval,
  - (viii) the incorporation of existing research results to date (both general and site specific) into the research plan,
  - (ix) detailed discussion of the design and methodology for the research, model or technique,
  - (x) research monitoring plans and methodologies, and
  - (xi) the approach to incorporating research results into site specific implementation designs and plans;
- (b) identification of milestones that will ensure that results can be incorporated into milestones identified in the OSCA Approval and this approval, including:
  - (i) a rationale for the sequence of research,
  - (ii) timing of initiation and completion of research, and
  - (iii) key activities;

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

- (c) proposed schedule for research results and data submission, with a mechanism to track progress over time; and
  - (d) any other information requested in writing by the Director.
- 4.7.2 If any plan in this section is found deficient by the Director, the approval holder shall correct all deficiencies by the date specified in writing by the Director.
- 4.7.3 The approval holder shall implement the research plans in this section as authorized in writing by the Director.
- 4.7.4 The approval holder shall only implement corrective measures or research design changes for any research required by this approval as authorized in writing by the Director.
- 4.7.5 The approval holder shall not implement any implementation plan unless written authorization or approval amendment for that plan is granted by the Director.

### **POND 5, POND 6, and POND 7**

- 4.7.6 The approval holder shall submit a Wetland and Shallow Lake Viability research plan for Pond 5, Pond 6, and Pond 7 to the Director by June 30, 2018, unless otherwise authorized in writing by the Director.
- 4.7.7 The research plan referred to in subsection 4.7.6 shall include the following, at a minimum:
- (a) the information required by subsection 4.7.1;
  - (b) a discussion of the proposed target landforms, targeted range of ecosites and their targeted distribution and spatial extents for Pond 5, Pond 6 and Pond 7;
  - (c) justification of the required activities, materials and timelines to achieve reclamation outcomes and milestones required by the OSCA Approval for Ponds 5, 6 and 7; and
  - (d) any other information requested in writing by the Director.

### **DEMONSTRATION PIT LAKE PILOT TEST**

- 4.7.8 The approval holder shall submit an updated Demonstration Pit Lake Pilot Test research plan on or before November 30, 2017, unless otherwise authorized in writing by the Director.
- 4.7.9 The plan referred to in subsection 4.7.8 shall include, at a minimum, the following:



## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

- (a) the information required by subsection 4.7.1;
- (b) research design and methodology details for the tailings treatment process , treatment process chemicals, the lake functions, and the resulting implications for boreal forest lake ecosystems, including;
  - (i) confirmation of the research objectives, risks or uncertainties, and physical, chemical, and biological processes and models to be developed,
  - (ii) demonstration pit lake design details,
  - (iii) characterization and volume assessments of the water and tailings, and
  - (iv) discussion and rationale for proposed research monitoring plans and methodologies;
- (c) test and identify the constraints or limitations that the water quality of a lake may have on establishing self-sustaining locally common lake aquatic ecosystems, or its use; and
- (d) any other information requested in writing by the Director.

### **DDA3 Terrestrial Research and Implementation Plan**

4.7.10 The approval holder shall submit a Terrestrial Research and Implementation Plan to the Director by September 30, 2018, unless otherwise authorized in writing by the Director.

4.7.11 The plan referred to in subsection 4.7.10 shall include, at a minimum, the following:

- (a) the information required by subsection 4.7.1;
- (b) a description of how the plan would result in a self-sustaining locally common boreal forest ecosystem with an acceptable distribution of terrestrial and wetland habitats for DDA3;
- (c) a description of the technology used to treat the fluid tailings;
- (d) the justification for the proposed design and implementation priorities, milestones and plans to be submitted in accordance with subsection 4.7.17;
- (e) an analysis of any implications to the fluid tailings profiles identified in the OSCA Approval and reclamation milestones for DDA3; and

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

- (f) any other information requested in writing by the Director.
- 4.7.12 The approval holder shall submit an interim report on the plan to the Director by September 30, 2020.
- 4.7.13 The interim report referred to in subsection 4.7.12 shall include, at a minimum, the following:
  - (a) the information required by subsection 4.7.1;
  - (b) the results of the research described in subsection 4.7.10;
  - (c) the results of any other relevant research;
  - (d) identification of any remaining uncertainties and an explanation, justification and timelines for how the uncertainties will be addressed; and
  - (e) any other information requested in writing by the Director.
- 4.7.14 If the interim report referred to in subsection 4.7.12 is found deficient by the Director, the approval holder shall correct all deficiencies identified by the date specified in writing by the Director.

### **DDA3 Aquatic Research and Implementation Plan**

- 4.7.15 The approval holder shall submit a DDA3 Aquatic Research and Implementation Plan to the Director by September 30, 2018, unless otherwise authorized in writing by the Director.
- 4.7.16 The plan referred to in subsection 4.7.15 shall include, at a minimum, the following:
  - (a) the information required by subsection 4.7.1;
  - (b) a description of how the plan would result in a self-sustaining locally common boreal forest lake ecosystem for DDA3;
  - (c) a description of the technology used to treat the fluid tailings;
  - (d) the justification for the proposed design and implementation priorities, milestones and plans to be submitted in accordance with subsection 4.7.17;
  - (e) detailed design considerations including lake size, littoral zone features, shoreline and erosion protection features, and outlet design features;

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

- (f) hydrological sustainability assessment for the lake and thickness of water cover under both current and for a range of future climate change scenarios based upon proposed drainage and catchment areas;
- (g) detailed design considerations for froth treatment tailings, treated or capped tailings storage and treatment capacities and efficiencies under different flow scenarios and seasonal variation;
- (h) the tested range of pit lake capabilities to identify and assess the constraints and limitations of pit lakes;
- (i) an analysis of any implications to the fluid tailings profiles identified in the OSCA Approval and reclamation milestones for DDA3; and
- (j) any other information requested in writing by the Director.

### **DDA3 Tailings Treatment and Target Ecosite Development Plan**

4.7.17 The approval holder shall submit an updated DDA3 Tailings Treatment and Target Ecosite Development Plan to the Director by September 30, 2023.

4.7.18 The plan referred to in subsection 4.7.17 shall include, at a minimum, the following:

- (a) description of the management of volume of fluid tailings to be placed in DDA3;
- (b) results from the DDA3 research and implementation design and planning;
- (c) explanation of how tailings management has been adapted based on learnings from DDA3 and DPL operation and research to date;
- (d) proposal for the final closure and reclamation of DDA3 with supporting justification and implementation design and plan;
- (e) justification of the required activities, materials and timelines to achieve reclamation outcomes and milestones for the proposed final closure and reclamation landscape;
- (f) update the information set out in Sections 4.4 to 4.8 of *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, as amended;
- (g) an assessment of the cost to complete the tailings management work from now until reclamation is complete;

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

- (h) explanation of outstanding risks and uncertainties, and their nature and magnitude;
- (i) explanation and justification for how risks and uncertainties will be addressed;
- (j) assessment of cost to implement mitigation options; and
- (k) any other information requested in writing by the Director.

### **Reporting on Tailings Research Plans**

4.7.19 The approval holder shall submit research reports in the annual tailings performance report for the research plans required by this section to the Director on or before April 30 of every year, unless otherwise authorized by the Director.

4.7.20 The tailings research plan reports shall include the following information, at a minimum:

- (a) a summary of the research programs and research plans conducted to date, that includes the following:
  - (i) an analysis of the monitoring and research results including successes and failures,
  - (ii) how corrective measures were identified and implemented for research monitoring and data collection;
- (b) an interpretation of the research conclusions, including:
  - (i) a description of the progress towards completing outstanding research objectives, or developing models,
  - (ii) identification of any emerging issues affecting the ability to achieve research objectives in accordance with the schedule and timelines for resolving the emerging issues,
  - (iii) identification of any new uncertainties and timelines for resolving the new uncertainties,
  - (iv) a description and assessment of potential impacts to research objectives and timelines from emerging issues and uncertainties,
  - (v) identification of any resolved uncertainties and new learnings, and

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- (vi) how the data or techniques trialed will be used in future operations and reclamation;
- (c) any proposed changes to the research design, methodologies or milestones for existing projects;
- (d) any proposed changes to the research design, methodologies or milestones for subsequent or related research projects; and
- (e) any other information requested in writing by the Director.

4.7.21 If any tailings research plan report is found deficient by the Director, the approval holder shall correct all deficiencies identified by the date specified in writing by the Director.

14. The following is added to subsection 6.1.5:

6.1.5.1 The approval holder shall submit plans for the decommissioning of each of the dams associated with the following infrastructure by the date specified to the Director, unless otherwise authorized in writing by the Director:

- (a) Tar Island Dyke, Pond 1 and Pond 5 by October 31, 2018;
- (b) Pond 6 by October 31, 2022;
- (c) Pond 1A, Pond 2/3, Pond 4, Pond 7 and Pond 8B by October 31, 2028; and
- (d) STP and DDA3 by October 31, 2033.

6.1.5.2 If any plan referred to in subsection 6.1.5.1 is found deficient by the AER, the approval holder shall correct all deficiencies identified by the date specified in writing by the AER.

6.1.5.3 The approval holder shall not implement any plan referred to in subsection 6.1.5.1 unless written authorization or approval amendment for that plan is granted by the Director.

15. Subsection 6.1.12 (r) is deleted and the following is substituted:

- (r) criteria used for landform design;
- (s) landform grading and topography;
- (t) a rationale for defining capping requirements for tailings deposits, based on the Tailings Research Report referred to in subsection 6.1.60;

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- (u) reclamation material salvage, stockpiling, and placement, with consideration of the target ecosites and adaptive incorporation of the *Best Management Practices for Conservation of Reclamation Materials in the Mineable Oil Sands Region of Alberta*, Alberta Environment and Water, 2012, as amended;
- (v) detail the reclamation materials balance specific to the ten year period of the plan and reflective of the life of mine closure reclamation requirements, including soil quality; and
- (w) any other information requested in writing by the Director.

16. The following is added after subsection 6.1.15 (f):

- (g) 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;
- (h) 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;
- (i) be consistent with *Lower Athabasca Region Tailings Management Framework for the Mineable Athabasca Oil Sands*, Government of Alberta, March 2015, as amended, and Directive 085 Fluid Tailings Management for Oil Sands Mining Projects, Alberta Energy Regulator, July 2016, as amended;
- (j) provide an acceptable distribution of:
  - (i) ecosite phases that are consistent with subsection 6.1.99, and
  - (ii) wetland types that are consistent with subsection 6.1.99 and provides an acceptable spatial extent of reclaimed and treatment wetlands; and
- (k) provide the material balances for the capping material referred to in subsection 6.1.35 to meet mine closure requirements for both terrestrial and wetland reclamation.

17. Subsection 6.1.35 is deleted and substituted with the following:

6.1.35 Prior to placement of reclamation material in accordance with subsection 6.1.28 through 6.1.34, the approval holder shall provide rooting-zone protection by capping the following materials and locations with a minimum average depth of 1.0 m of

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

suitable overburden or tailings sand which meets the chemical criteria for suitable overburden:

- (a) impervious conditions such as lean oilsand or rock;
- (b) reject from the oil sands conditioning and transport system;
- (c) the following types of tailings as described in the application:
  - (i) consolidated tailings,
  - (ii) treated tailings,
  - (iii) froth treatment tailings, and
  - (iv) tailings in South Tailings Pond;
- (d) Clearwater overburden;
- (e) coke;
- (f) the processing plant areas; and
- (g) landfills.

18. Subsections 6.1.59 to 6.1.63 are deleted and substituted with the following:

### **RESEARCH, MONITORING AND REPORTING**

#### **TAILINGS**

- 6.1.59 The approval holder shall support and participate in regional tailings research, including the development of performance criteria and targets, to the satisfaction of the Director.
- 6.1.60 The approval holder shall submit a Tailings Environmental and Reclamation Research Report to the Director starting April 30, 2018, and every three years thereafter, unless otherwise authorized in writing by the Director.
  - 6.1.60.1 The Tailings Environmental and Reclamation Research Report referred to in subsection 6.1.60 shall report on the environmental aspects of tailings research and development with specific reference to the tailings technology used by the approval holder and include:

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

- (a) The information required in subsection 4.7.20, which may reference other tailings research reports submitted to the Director; and
- (b) planned tailings research and development activities for the next five year period.

6.1.60.2 The report referred to in subsection 6.1.60 shall include research that addresses all of the following, at a minimum:

- (a) an analysis of the risk to reclamation presented by the chemical attributes of tailings sand, with specific attention to:
  - (i) substance identification, along with any environmental quality guidelines for soil, groundwater and surface water;
  - (ii) substance load,
  - (iii) influence of fines content on physical or chemical risks,
  - (iv) proposed placement depth and location relative to reclamation materials, and
  - (v) terrestrial versus aquatic outcomes (including wetlands);
- (b) forest ecosystem research:
  - (i) time required for tailings to consolidate to a trafficable surface,
  - (ii) capping objectives in addition to rooting-zone protection for tailings deposits,
  - (iii) suitable capping materials and depth of reclamation materials required to cover tailings deposits,
  - (iv) stability of reclaimed tailings surfaces over time,
  - (v) characterization of tailings release water and any treatment required,
  - (vi) movement of salts from tailings release water during deposition or seepage and its impact on plant development due to the uptake of organic compounds, heavy metals and salts from tailings release water,
  - (vii) techniques required to isolate tailings waters from terrestrial lands, such that terrestrial and aquatic vegetation can develop into healthy,



## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

self-sustaining ecosystems, consistent with Table 6.2-A and Table 6.2-B,

- (viii) identification of local native vegetation species suitable for reestablishment on terrestrial lands affected by tailings waters, and
- (ix) seepage of tailings (and placed coversoil, subsoil, overburden, or other capping materials) release water into groundwater or surface water, including:
  - (A) expected volumes of water entering the groundwater regimes,
  - (B) flow regimes of the groundwater,
  - (C) impacts of affected groundwater, and
  - (D) any proposed mitigation that may be implemented;
- (c) wetland and shallow lake ecosystem research:
  - (i) hydrologic models to create treatment wetlands or other wetland types associated with tailings in the reclaimed landscape,
  - (ii) rationale for suitable capping materials and depth of reclamation materials required to cover tailings deposits,
  - (iii) stability of reclaimed tailings surfaces over time, and the implications to the size and type of ecosystems for different deposit designs,
  - (iv) capping objectives in addition to rooting-zone protection for tailings deposits,
  - (v) chemical characterization (composition, concentration, toxicity) and rate of pore water release and surface runoff from tailings deposits,
  - (vi) environmental fate, including degradation rates of potentially toxic components in tailings release waters,
  - (vii) environmental fate of potentially toxic constituents (e.g. residual hydrocarbons, organic acids, and heavy metals) in tailings streams that have been identified for eventual emplacement in a wetland or water capped environment,
  - (viii) impact of tailings release waters on aquatic ecosystems, including the impact on sediments,

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- (ix) identification of suitable soils, site preparation and soil placement for wetlands constructed on tailings deposits or those affected by tailings water inflows,
  - (x) wetland revegetation,
  - (xi) seepage of tailings (and placed coversoil, subsoil, overburden or other capping material) release water into groundwater or surface water,
  - (xii) validation of expected scenarios with field-collected data that describes hydrology and water quality of tailings seepage within the receiving environment, and
  - (xiii) ascertain whether wetlands on dedicated disposal areas are the result of water collection in low lying areas rather than unexpected water expression from tailings deposits or capping materials;
- (d) for human health risk assessment:
- (i) an assessment of human receptor exposure to industrial wastewaters and tailings material stored at the plant site, as well as the impacts from reclamation activities,
  - (ii) the chemicals to be evaluated in the human health risk assessment shall include, but not limited to:
    - (A) dust (PM<sub>2.5</sub>),
    - (B) salts,
    - (C) naphthenic acids (acid extractable organics),
    - (D) chemicals in the treated tailings and the associated pore water, expressed water or throughflow,
    - (E) reduced sulphur compounds, and
    - (F) naturally occurring radioactive material;
- (e) for long-term chemistry and mineralogy:
- (i) assessment of the long-term chemistry and mineralogy of tailings including the buffering capacity of the untreated and treated tailings and froth treatment tailings from various sources and associated pore water, expressed water, or throughflow in tailings deposits, and

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changes in their chemical and mineralogical composition under varying reduction-oxidation conditions,

- (ii) detailed examination of the biogeochemical processes and probable geochemical end points of processes occurring within the products resulting from the untreated, treated and froth treatment tailings process, with specific attention to reduction-oxidation processes under water saturated and unsaturated conditions,
  - (iii) a description of a water monitoring program that includes mass balance, sampling procedures, sampling frequency and chemical composition analysis of the water within and resulting from the bitumen extraction process,
  - (iv) detailed evaluation of concentrations of chemicals authorized for use under subsection 4.5.1 in consolidated or treated tailings and the associated pore water, expressed water, or throughflow,
  - (v) investigation of long term stability, physical and chemical, of materials added to tailings, such as coagulants and flocculants, and their influence on geotechnical stability and water holding capacity of treated tailings, and
  - (vi) examination of whether the monitoring and research results alter the conclusions put forth in the application No. 056-94 with respect to ecological or human health effects; and
- (f) any other information requested in writing by the Director.

### **PIT LAKES**

6.1.61 The approval holder shall support and participate in regional pit lake research and applied research initiatives, including research concerning storing froth treatment tailings untreated, treated or covered tailings within a lake and the development of performance criteria and targets, to the satisfaction of the Director that:

- (a) examines the
  - (i) feasibility and capability of pit lakes, and
  - (ii) the viability of pit lakes storing fluid, treated, or covered tailings

as self-sustaining boreal forest lake ecosystems and resolves uncertainties about the effects of lake design features, and physical, chemical and biological processes on the environmental and human health;

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- (b) confirms or contradicts the predicted behavior and resolves uncertainties about the behavior of tailings within a pit lake;
- (c) determines the short term and long term environmental and human health effects from:
  - (i) storing froth treatment tailings, untreated, treated, or covered tailings within a lake,
  - (ii) storing process affected waters within a lake,
  - (iii) receiving surface water runoff and groundwater from deposits and reclaimed areas, and
  - (iv) water released from the lake to various expected receiving environments;
- (d) tests and confirms the appropriateness of response variables to be measured to demonstrate the viability of pit lakes and pit lakes storing froth treatment tailings, untreated, treated, or covered tailings, including measures of:
  - (i) tailings characteristics and performance,
  - (ii) lake sustainability (water quality and quantity),
  - (iii) sediment quality,
  - (iv) littoral zone function,
  - (v) ecological function,
  - (vi) traditional use,
  - (vii) human and ecological health, and
  - (viii) biodiversity; and
- (e) explores the full capabilities to identify the design requirements and constraints and limitations of pit lakes to meet reclamation outcomes, to store tailings, and to allow for unlimited types of uses of the lake.

6.1.62 The approval holder shall submit a Pit Lake Research Report to the Director starting April 30, 2018, and every three years thereafter, unless otherwise authorized in writing by the Director.

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

- 6.1.63 The report referred to in subsection 6.1.62 shall include research with specific reference to the tailings technology used by approval holder that addresses, at a minimum, all of the following:
- (a) the information required by subsection 4.7.20 addressing the results of the research described in subsection 6.1.60.2, and 6.1.63 (d) which may reference other tailings research reports submitted to the Director;
  - (b) an interpretation of the conclusions for:
    - (i) feasibility and capability of pit lakes,
    - (ii) the viability of pit lakes storing fluid, treated, or covered tailings, and
    - (iii) key performance measures and indicators for each stage of lake development;
  - (c) planned tailings research and development activities for the next five year period;
  - (d) detailed discussion of the research design and methodology for the research, which shall:
    - (i) demonstrate that the proposed research is capable of validating the design and performance expectations for the commercial scale pit lake or the lake storing froth treatment tailings, untreated, treated, or covered tailings proposed by the approval holder,
    - (ii) Identify and validate the design, operation and performance assumptions for each type of lake and stage of lake development and an estimate of timelines for each stage of lake development,
    - (iii) Identify and assess the adequacy of proposed research to resolve risks and uncertainties for pit lakes and lakes storing froth treatment tailings, untreated, treated, or covered tailings, including at a minimum:
      - (A) the ability to provide a sustainable boreal forest lake ecosystem under a range of future climate change scenarios,
      - (B) the ability to achieve ancillary functions (e.g. shoreline protection and flood buffering),
      - (C) lake design features,

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- (D) physical and chemical functions for lake types and their potential to maintain and enhance biodiversity, such as mixing and redox potential,
- (E) geotechnical stability, and
- (F) any other uncertainties identified by the Director,
- (iv) identify the constraints or limitations that water quality of a lake may have on establishing self-sustaining locally common lake aquatic ecosystems and its use,
- (v) identify research for each type of lake, to address the following:
  - (A) the treatment capacity and efficiency of the pit lake to maintain suitable water and sediment quality,
  - (B) 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 6.1.60.2,
  - (C) physical, chemical and biological performance measures and criteria for water quality release,
  - (D) best practices for design, site preparation and suitable materials for the littoral zone,
  - (E) seepage of lake water and mobility of substances of concern in groundwater,
  - (F) how wetlands, riparian habitat and littoral zone create continuity between the reclaimed landscape and the lakes,
  - (G) watershed hydrologic connections and associated closure goals and targets for fish and fish habitat,
  - (H) the effect of potential elevated contaminant influences on fish ecology, health, palatability and consumption safety,
  - (I) the effects of long-term shoreline regression and related effects on littoral zone, adjacent wetlands, landforms, water budget and solute mass balances (especially in relation to evaporation);

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

- (e) Proposed assessment of the use of pit lakes to store froth treatment tailings, untreated, treated or covered tailings which shall address the following:
  - (i) the time required for tailings to achieve maximum consolidation to achieve a consistent rate of pore water expression,
  - (ii) the functions the lake is intended to perform when storing froth treatment tailings, untreated, treated or covered tailings, and the key factors contributing to the adequacy of those functions,
  - (iii) treatment capacity and efficiency required for the pit lakes that store froth treatment tailings, untreated, treated or covered tailings to maintain suitable water and sediment quality,
  - (iv) hydrological models for the creation of sustainable pit lakes that store froth treatment tailings, untreated, treated or covered tailings, which are capable of use for a range of future climate change scenarios, and
  - (v) the risks and uncertainties associated with the design and performance assumptions for each stage of lake development and type of lake; and
- (f) any other information requested in writing by the Director.

19. The following is added after subsection 6.1.97 (r):

- (s) a summary of the actual placement depths of overburden or tailings sand placed over materials and locations referred to in subsection 6.1.35;
- (t) for suitable overburden;
  - (i) the salvage volume, and
  - (ii) the volume of salvaged material directly placed and assigned to stockpile;
- (u) the volume of tailings sand which meets the chemical criteria for suitable overburden and is available as capping material for the materials and locations referred to in subsection 6.1.35;
- (v) any updates to the predicted volume of tailings sand required to cap the materials and locations referred to in subsection 6.1.35, based on the Tailings Research Report referred to in subsection 6.1.60; and
- (w) any other information requested in writing by the Director.

## **TERMS AND CONDITIONS ATTACHED TO APPROVAL**

*<original signed by>*

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Paul Ferensowicz  
Alberta Energy Regulator

*<original dated>*

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## **Appendix 2      Submissions and Deposit Milestones Timeline**



Submissions and Deposit Milestones Timeline

		DDA3 commences  <i>EPEA approval renewal</i>	DDA2 commences									end of mine life
Month	2017	2018	2019	2020		2022	2023	2024		2028		2033
February		MD9 settlement monitoring plan		MD9 evaluation								
April		Measurement system plan submission										
		Tailings Environmental and Reclamation Research Report and Pit Lake Research Report (and every three years thereafter)										
May								Commence Pond 5 reclamation				
June		Submit Wetland and Shallow Lake Viability research plan for Ponds 5, 6, and 7										
September		Plan updating DDA2 fluid tailings management	Propose additional RTR criteria for DDA3	Propose RTR criteria for MD9		Propose RTR criteria for remnant fluid tailings	Plan updating MD9 fluid tailings management	Plan updating Pond 7 fluid tailings management				
		Terrestrial and Aquatic Research and Implementation Plans for DDA3	Plan updating Pond 6 fluid tailings management	Interim report on terrestrial Research and Implementation Plan for DDA3			Plan updating Pond 1A and Pond 2/3 fluid tailings management and for extended use of Pond 1A and Pond 2/3  Updated DDA3 Tailings Treatment and Target Ecosite Development Plan					
October		Plans for the decommissioning of each of the dams associated with Tar Island Dyke, Pond 1 and Pond 5				Plan for the decommissioning of each of the dams associated with Pond 6				Plans for the decommissioning of each of the dams associated with Pond 1A, Pond 2/3, Pond 4, Pond 7, and Pond 8B		Plans for the decommissioning of each of the dams associated with STP and DDA3 plan for decommissioning dam
November	Confirm Pond 5 monitoring plan											
	Updated Demonstration Pit Lake Pilot Test research plan											
December	Groundwater Monitoring Program proposal		Submit Dust Management Plan  Complete Pond 5 coke capping and vertical strip drain installation complete (i.e., achieve RTR status)							Pond 6 achieves RTR status		Pond 7 achieves RTR status



## **Appendix 3      Measurement System Plan Requirements Letter**



<original dated>

by email only

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Jason Heisler, Manager EH&S, Regulatory Approvals, Oil Sands

**Suncor Energy Inc.**

P.O. Box 2844 150 6<sup>th</sup> Avenue SW

Calgary, AB T2P 3E3

E-mail: [jheisler@suncor.com](mailto:jheisler@suncor.com)

**Suncor Energy Inc.**

***Oil Sands Conservation Act Approval No. 8535N***

**Measurement System Plan Requirements**

Dear Mr. Heisler:

In accordance with *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, the Alberta Energy Regulatory (AER) requires Suncor to submit by April 27, 2018, or on such other date stipulated by the AER, a measurement plan for fluid tailings, treated tailings volumes and ready to reclaim (RTR) criteria (subobjective 1 and subobjective 2 in Appendix C) in Approval No. 8535N.

The measurement plan must include the following:

- Key definition of parameters for fluid tailings and RTR criteria measurements.
- Reference of standards and procedures used to measure fluid tailings, treated tailings, and RTR criteria.
- An explanation of and justification for measurement procedures that are unique to Suncor and its plan.
- Evidence that the plan will address the measurement outcomes as per section 5 of *Directive 085*, as amended.
- An explanation of how each of the tailings deposit's RTR criteria will be measured, calculated and reported.
- A description of the tailings deposit survey program.

- Justification of how measurement, sampling, and spacing intervals will show the variation of the deposit properties, verify that the tailings deposit is achieving RTR criteria and
- Identify if any material in the deposit is not achieving RTR criteria.

As per condition 49 of Approval No. 8535N, Suncor may place froth treatment tailings only in Pond 2/3. To ensure froth treatment tailings are only placed in Pond 2/3, the measurement plan must also include identification of substances of concern from froth treatment tailings, and measurement locations and measurement methodology for the substances of concern.

Where measurement plans exist for either subobjective, Suncor may incorporate references to other plans, such as the groundwater monitoring program. If you have any questions regarding this correspondence, please contact Tara Wang at (403) 297-8547 or [tara.wang@aer.ca](mailto:tara.wang@aer.ca).

Regards,

*<original signed by>*

Paul Ferensowicz

PF/smtw

cc: [SMcArthur@suncor.com](mailto:SMcArthur@suncor.com)      [KBisgrove@suncor.com](mailto:KBisgrove@suncor.com)  
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## **Appendix 4      Groundwater Monitoring Program Written Authorization Letter**



<original dated>

by email only

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E-mail: [jheisler@suncor.com](mailto:jheisler@suncor.com)

**Suncor Energy Inc.**

**EPEA Approval No. 94-02-00, as amended**

**MD9 and DDA2 Groundwater Monitoring Program**

Dear Mr. Heisler:

This letter confirms that the written authorization required under subsection 4.6.15 of *EPEA* Approval No. 94-02-00, as amended, for the MD9 and DDA2 Groundwater Monitoring Program, which was issued on August 20, 2014, remains valid. No further authorization is required unless there are any changes in footprint or activity in those areas

Should you have any questions, please contact Eva Kilinska at (780) 642-9229 or [Eva.Kilinska@aer.ca](mailto:Eva.Kilinska@aer.ca).

Regards,

<original signed by>

Paul Ferensowicz

PF/tk

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## Appendix 5 Suncor Site Map

