Kearl Oil Sands Mine: Fluid Tailings Management Report for 2020

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Executive Summary

During 2020, Imperial continued to execute Kearl's *Tailings Management Plan* (TMP), in alignment with Imperial's long-term tailings management objectives:

- minimize long-term environmental effects
- minimize the accumulation of fluid tailings (FT) to ensure timely progress to closure
- maximize water recovery from tailings to minimize fresh water import
- minimize the land footprint required for tailings management and storage

To achieve these objectives, the strategies employed by Kearl continue to be:

- design with the end in mind, to create a sustainable closure landscape
- treat tailings, including flotation tailings (FLT) and fluid fine tailings (FFT), prior to accumulating large volumes of FT deposit treated tailings in their final landscape position to facilitate progressive reclamation
- construct a single external tailings area

In July 2018, Imperial received *Oil Sands Conservation Act* (OSCA Commercial Scheme Approval No. 10829H in response to the OSCA amendment application (number 1872083) submitted as required by Directive 085. This approval provided Imperial with an approved FT profile for Kearl and ready-to-reclaim (RTR) criteria for the East External Tailings Area (EETA).

Imperial's 2020 results included managing its FT inventory below Kearl's approved FT profile with a total 2020 year end estimated FT inventory of 75.0 million cubic metres (Mm^3) versus a profile limit of 130 Mm^3. Kearl's fine tailings treatment performance, lower overall mining and production rates than predicted within the D85 FT profile, and continuous improvement on tailings treatment volumes are all contributing factors to Imperial being 55 Mm^3 below its approved profile.

Overall, the thickened tailings (TT) deposit is currently performing as expected with some variations observed across the deposit. A tailings field investigation was not completed during 2020 due to COVID-19, however available process data and modelling techniques were utilized to provide estimates for normally field measured data.

1.0 Introduction

Imperial Oil Resources Limited (Imperial) operates the Kearl Oil Sands Mine (Kearl) located approximately 70 km north of Fort McMurray and approximately 42 km northeast of Fort MacKay. Imperial has prepared this *Fluid Tailings Annual Management Report* for 2020 in accordance with the requirements of the Alberta Energy Regulator's (AER) *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects* (Directive 085*)* (AER, 2017*)* that requires operators to submit annual management reports in electronic format to the AER by April 30 for the previous year's performance (January to December).

This report summarizes Imperial's 2020 fines treatment and treated tailings performance and fulfils the reporting requirement as stated in Imperial's (OSCA) approval.

The fines treatment process proposed in the TMP has been fully implemented. A brief summary of Imperial's 2020 operations are described in the following paragraphs.

In 2020, FLT and Tailings Solvent Recovery Unit (TSRU) tailings from both Kearl Plants (K1 and K2) continued discharging into the WETA. CST from either plant is discharged in both the WETA and the EETA.

Imperial's primary fines treatment technology is thickening. Thickened tailings (TT) are produced by flocculating FLT and FT in the thickeners and re-flocculating the stream using second chemical injection (secondary chemical treatment) before it is discharged to the TT panel. The thickener overflow water clarity and underflow density were monitored to control TT quality. Thickener operation and the TT deposit generally met expectations. Continuous improvement activities will be undertaken in 2021 to improve equipment reliability and fines treatment performance as described in Table 6-1.

1.1 Temporary Changes to Tailings Field Investigation Program for 2020

Imperial submitted on April 15th, 2020 a request for tailings field investigation program relief for 2020 related to COVID-19 (Appendix C). Imperial proposed for its 2020 tailings compliance report, to rely on process stream data collected from installed online instrumentation and tests on samples from inline sampling points. Imperial further indicated it would utilize this data, along with aerial survey data, available models, previously completed calibration and estimating techniques to determine annual fluid tailings volumes and provide insight into deposit performance and that this information would form the basis of the 2020 tailings compliance reporting due April 30th, 2021.

On May 20th, 2020, the AER announced and published its decision regarding industry relief related to COVID-19 on the AER website and provided Imperial with direction specific to the tailings field investigation program on May 26, 2020 (Appendix D). The AER accepted Imperial's proposed variances to their measurement plans for the 2020 tailings field investigation program.

Table 1-1 summarizes the concordance of OSCA sections to the corresponding sections of this report, and Table 1-2 summarizes the concordance of Directive 085 to the corresponding sections of this report.

Table 1-1: Concordance Table: OSCA Approval Number 10829L

Regulatory Requirements	Section Within Annual Tailings Management Report
29. The Operator shall monitor: *(a) on a quarterly basis, or such other basis as the AER may stipulate in writing, the solids content and sands to fine ratio of the thickened tailings after secondary chemical treatment;* *(b) on an annual basis, or such other basis as the AER may stipulate in writing, the sands to fine ratio, effective stress, deposit consolidation, pore water pressure, and particle size distribution in each treated tailings deposit; and* *(c) any other parameter on the basis as specified in writing by the AER*	Section 4.3 – Quarterly Monitoring

Regulatory Requirements	Section Within Annual Tailings Management Report
30. The Operator shall, in addition to any reporting requirements under Directive 085, provide in the annual fluid tailings management report:	
(a) for each treated tailings deposit, monitoring data including representative cross-sections to illustrate the variation of the following:	Section 4.2 – Treated Tailings Characteristics
i) sands to fine ratio;	Section 1.1
ii) effective stress;	Section 1.1
iii) deposit consolidation;	Section 1.1
iv) pore water pressure;	Section 1.1
v) particle size distribution plot;	Section 1.1
vi) any other parameter considered relevant by the Operator; and	Section 1.1
vii) any other parameter specified by the AER.	
(b) a summary of quarterly monitoring results for the solids content and sands to fine ratio of thickened tailings after secondary chemical treatment;	Section 4.3 – Quarterly Monitoring
(c) the available storage capacity of each tailings deposit or tailings pond that contains water or tailings at the end of the reporting period;	Section 4.2.1 – Storage Capacity
(d) annual storage capacity and volume requirements for the five years following the end of the reporting period; and	Section 4.2.1 – Storage Capacity
(e) description of any implications to the tailings management plan resulting from resource sterilization due to avoidance of the Pleistocene Channel Aquifer, including but not limited to impacts to storage capacity changes	Section 4.2.1 – Storage Capacity

Table 1-2: Concordance Table - Directive 085 Reporting Requirements

Regulatory Requirements	Section Within Annual Tailings Management Report
Include a project site summary of all annual fluid tailings volumes, as per the accounting table in appendix 3.	Section 3.0 – Fluid Tailings Volume Reporting
Show in a figure the approved new and legacy profiles with the actual fluid tailings volume and the three thresholds (profile deviation, total volume, and total volume limit).	Figure 3-1: Fluid Tailings Profile Showing Approved Profile, Triggers and Limits
Describe if and how activities have deviated from the fluid tailings management plan and any modifications made to improve performance.	Section 3.1.2 - Fluid Tailings Profile
Identify the management level (as described in the TMF) that the operation's performance falls within.	Section 3.1.2 - Fluid Tailings Profile
If the operation is deemed level 2 or higher, describe the circumstances that led to the increased fluid accumulation and any actions that are being taken to improve fluid tailings management performance.	Section 3.1.2 - Fluid Tailings Profile
Provide a site-wide water balance or provide the reference to another AER report and location where this information can be obtained.	Section 3.2 – Water Volume, Quality and Site Wide Balance
Provide a water volume (in tabular form) or provide the reference to another AER report and location where this information can be obtained. The table must include, for each treated tailings deposit and fluid tailings pond,	
a) total volume of water at the beginning of the reporting period,	Table 3-5: Volume of Free Water for the 2020 Reporting Period
b) total volume of water at the end of the reporting period,	
c) characterization of the quality of water, and	Table 3-6: Water Quality Testing Key Parameters
d) the volume and quality of water recovered from fluid tailings and runoff from RTR tailings.	Table 3-7: Volume and Quality of Water Recovered from Fluid Tailings

Regulatory Requirements	Section Within Annual Tailings Management Report
Provide information about fines that were not captured, which form fluid tailings, including *a) quantity of fines in the ore processed during the reporting period, and* *b) quantity of fines in fluid tailings.*	Section 3.3.2 – Fines in Ore and Fluid Tailings
Estimate the change in fluid tailings volume inventory as a result of settling and consolidation and provide an explanation if inconsistent with the predictions.	Section 3.1.4 – Fluid Tailings Volume in Each Deposit and Composition
Provide a status map of the current locations and sizes of all fluid tailings ponds and treated deposits for the project.	Section 3.4 – Status Map
Provide tables indicating the volume and composition of each deposit containing fluid tailings (including the volume of fluid tailings, of treated and placed fluid tailings meeting RTR status, and of water).	Section 3.1.4 – Fluid Tailings Volume in Each Deposit
Provide tonnage of ore processed and average composition (bitumen, water, solids) or provide the reference to another AER report and location where this information can be obtained.	Section 3.3.1 – Ore Tonnage and Composition
For each fluid tailings treatment technology, *a) provide volume of fluid tailings treated and where they were placed;* *b) provide chemical and physical properties of the treated fluid tailings and the water recovered from treatment; and* *c) if the technology is not performing as predicted, provide mitigation measures to rectify performance (address any impacts on the deposit performance).*	Section 3.4 – Status Map Figure 3-7: 2020 ETA Status Table 3-9: Tailings Treatment Summary Table 3-11: Properties of the Treated Tailings Section 3.4 – Status Map
Monitoring Reporting Data Requirements	
For each monitoring dataset required in the annual fluid tailings management report, *a) identify any uncertainties and* *b) explain the dataset adequacy.*	Section 4,1: Dataset Accuracy
For each treated tailings deposit and fluid tailings ponds and their surrounding environment provide monitoring results, including the following: *a) a map and tabular data showing the survey locations of tailings deposits;*	Section 1.1
b) representative cross-sections to illustrate the variation of tailings characteristics; *c) for each deposit containing treated and placed fluid tailings,* *i) the measured data on the chosen indicators and confirm performance against the chosen performance criteria;* *ii) for those fluid tailings deposits that have met RTR status, data to support that it is trending appropriately; and* *iii) confirmation that indicator and performance criteria are still appropriate or justify the need to modify them; and* *d) verification that the tailings deposit is meeting the milestones in the fluid tailings management plan.*	Section 1.1 Section 1.1 Section 1.1 Section 1.1 Section 1.1

Regulatory Requirements	Section Within Annual Tailings Management Report
Inadequate Deposit Performance: *If the deposit is under-performing so as to impact the fluid tailings volume accumulation, then* *a) describe the contributing causes to under-performance;* *b) describe mitigation and contingency plans from the fluid tailings management plan that have been implemented to manage performance;* *c) identify any risks that could result from additional fluid fine tailings placement in a deposit;* *d) confirm that the indicators, measures, and performance criteria are still acceptable in light of new factors introduced by the mitigation and contingency plans; and* *e) describe the impacts that tailings performance is having on the mine plan, water management plan, mine reclamation plan, and life-of-mine closure plan.* *f) For tailings previously identified as RTR that are no longer following the trajectory or meeting performance criteria, confirm that the volume has been added to the fluid tailings volume inventory and describe the actions taken to address under-performance.*	Section 5.0 – Deposit Performance
Technology: Continuous Improvement and Development	
To assess continuous improvement and innovation, to confirm that fluid tailings treatment technologies are operating as expected, and confirm that operational issues are being managed, the fluid tailings management report must include the following: *a) Description of the treatment technologies' operation over the reporting period, including issues that were encountered and a summary of continuous improvement activities* *b) Confirmation that technology development was implemented as proposed in the approved fluid tailings management plan by summarizing relevant activities in the reporting year. Confirm that technology development will continue to be implemented as stated in the approved fluid tailings management plan* *c) A technical report, within the constraints of proprietary information, on the progress of any pilots, prototypes, or demonstrations of fluid tailings technologies* *d) An assessment, within the constraints of proprietary information, of performance, successes, challenges, and implications for net environmental effects for all treatment technologies. The assessment may incorporate information references to other required reports, such as the tailings research report and groundwater monitoring report submitted under EPEA*	Section 6.1 - Summary Of Continuous Improvement Activities Section 1.0 - Introduction Section 6.2 – Pilots or Prototypes Section 4.2 – Treated Tailings Characteristics Section 7.0 -Environmental Monitoring Results There have not been any observed implications on net environmental effects.
Environmental Monitoring Results	
To ascertain that environmental benefits and risk trade-offs anticipated by operators for their tailings technology justification continue to be accurate, and to assess operator performance in managing and minimizing environmental effects and implications associated with fluid tailings management activities, the annual management report must provide a summary of the results from environmental performance monitoring reports related to fluid tailings management activities.	Section 7.0 -Environmental Monitoring Results

2.0 Indigenous and Stakeholder Engagement

For more than a decade and a half Imperial has worked closely and collaboratively with the Indigenous groups in the Athabasca region whose traditional territory overlaps with Kearl operations. Imperial's long-standing collaborative relationships with Athabasca Chipewyan First Nation (ACFN), Fort Chipewyan Métis (FCM), Fort McKay First Nation (FMkFN), Fort McKay Métis Nation (FMMN), Fort McMurray 468 First Nation (FMFN 468), McMurray Métis (MM 1935) and Mikisew Cree First Nation (MCFN) are core to Imperial's responsible oil sands development and the operation of Kearl.

Supported by Imperial's Indigenous Relations Guiding Principles and Guidelines (Appendix A) and underpinned by comprehensive long-term agreements with each of the Indigenous groups identified above, Imperial's approach is one of early and ongoing engagement. This approach enables Imperial to understand potential impacts on Imperial's neighbours' Indigenous harvesting and treaty rights, to develop appropriate mitigations, and to steward Kearl's performance in areas of environmental interests. Imperial does this through open dialogue and transparent sharing of information to provide common understanding and develop the best outcomes for all parties involved. In addition to Imperial's engagement on a technical level, Imperial's regular engagement with the community members strengthens Imperial's relationship and enables Imperial to share information about Imperial's projects and operations and learn specifically from their view as traditional knowledge holders and land users. Imperial also works closely with each of the Indigenous groups' business arm to strategically plan contracting opportunities as well as business capability development plans. Overarching direction is provided through joint leadership committees Imperial has with each of the local Indigenous groups to ensure that Imperial's work is focused on priority areas of interest and achieving the objectives we have established together. Through this multi-faceted and multi-layered approach, Imperial has developed strong relationships with the local Indigenous groups based on a foundation and ongoing demonstration of shared commitment, mutual respect and trust.

Due to COVID-19 restrictions, Imperial hosted a virtual tailings forum over 2 half days in November 2020 to discuss Kearl's Tailings Management, including the Annual Fluid Tailings Management Report for 2019, with all seven Athabasca Indigenous groups, including their technical consultants. Imperial and Indigenous groups collaboratively developed the agenda for the forum to include details on the 2019 tailings management performance, groundwater monitoring and RTR sub objective 2, the water balance, TSRU tailings, Internal Tailings Area 1, tailings treatment studies and tailings research as well a presentation by communities and their technical consultants. The agenda and attendee list for the annual forum are provided for reference in Appendix B. Imperial's long-term agreements with each of the Indigenous groups include confidentiality agreements which allow both Imperial and the communities to have much more in-depth sharing and meaningful conversations; in respect of these agreements, Imperial has elected to not provide copies of the materials shared by Imperial or the communities for the forum. Imperial provided capacity funding to allow technical consultants to review the Kearl Fluid Tailings Management Report for 2019, prepare a technical review of the material, review the responses to the technical review prepared by Imperial and participate in the annual forum, to ensure that the Indigenous communities could engage meaningfully in the forum. Technical representatives included:

- John Errington, John C. Errington and Associates Ltd. (mine operations support, representing FMFN 468, FMMN, FMkFN, FCM, ACFN and MCFN);
- Jim Blum, JGBlum Consulting Ltd (tailings support, representing FMFN 468, FMMN, FMkFN, FCM, ACFN and MCFN);
- Kelly Finigan, Lagimodiere Finigan Inc. (water and risk analysis support, representing FMFN 468, FMMN, FMkFN, FCM, ACFN and MCFN)
- Lisa Schaldemose, Schaldemose & Associates Inc. (project and technical support, representing FMFN 468, FMMN, FMkFN, FCM, ACFN and MCFN);
- Megan Thompson, Management and Solutions in Environmental Science (water support, representing FMFN 468, FMMN, FMkFN, FCM, ACFN and MCFN);
- Gillian Donald, Donald Functional & Applied Ecology Inc. (project and technical support, representing McMurray Métis);

- Mandy Olsgard, Tox Solutions (toxicology technical support, representing FMFN 468, FMMN, FMkFN, FCM, ACFN and MCFN);
- Shanti Berryman, Integral Ecology (closure and reclamation support, representing FMFN 468, FMMN, FMkFN, FCM, ACFN and MCFN);
- Kevan Berg, Integral Ecology (closure and reclamation support, representing FMFN 468, FMMN, FMkFN, FCM, ACFN and MCFN);
- Jenna Dunlop, Endeavour Scientific Inc. (project support, representing FMFN 468, FMMN, FMkFN, FCM, ACFN and MCFN).

Each of these technical representatives submitted a memo prior to the forum, with questions and suggestions on the Kearl Fluid Tailings Management Report for 2019 and Kearl Tailings Management Plan in general. A summary of the key feedback topics include:

- Treated tailings characteristics, sampling, and modelling;
- Fines avoidance;
- Ready to reclaim criteria and sampling results to assess achievement;
- Closure landscape, use of end pit lakes, alternatives to water capped tailings, and reclamation plan;
- Implications of treated fine tailings on reclamation;
- Water volume, quality and site wide balance;
- Dyke embankment integrity of external tailings area;
- Thickener performance, fines and FT growth;
- Pilot technologies;
- Environmental monitoring and effects – surface and groundwater quality, receptors, thresholds/control objectives, RTR subobjective 2, seepage modeling, seepage interception system;
- Tailings reclamation research;
- Risk management;
- Opportunities for Indigenous engagement on COSIA research projects.

Imperial reviewed the technical memos, provided written responses in advance of the Forum and leveraged the technical memos to cater presentation material (collaboratively identified topics) to focus the forum on areas of interest and importance for the Indigenous groups. This included discussing groundwater monitoring and RTR sub objective 2, the water balance, TSRU tailings, Internal Tailings Area 1, tailings treatment studies and tailings research as well a presentation by communities and their technical consultants. At the conclusion of the forum, both Imperial and Indigenous communities agreed that the event was a positive and collaborative experience. Indigenous community representatives and their consultants expressed gratitude for the opportunity to carry out a detailed and technical conversation on topics not strictly within the scope of the D085 report and the receptive nature of Imperial's representatives throughout those discussions. Multiple communities indicated in follow-up conversations that Imperial is industry leading in the Tailings forum space. Imperial also received positive feedback about the collaborative method by which forum topics were chosen, which allowed focus on topics and issues of priority to stakeholders.

Subsequent to the annual forum, Imperial has continued to look for opportunities to address and incorporate feedback. Key examples include:

- Kearl Environmental Stewardship Presentation: In June 2020, Imperial delivered an environmental stewardship presentation to review the 2019 environmental monitoring results for Kearl. The presentation was delivered through a joint virtual meeting (established as part of Imperial's long-term agreements) with the seven Indigenous communities. Presentation materials included discussion of tailings management and performance, including topics related to surface water, groundwater and seepage monitoring, again based on feedback provided by the communities at the Tailings Forum and in the associated technical reviews. Imperial will continue to use this annual environmental stewardship presentation to discuss environmental monitoring and performance with Indigenous groups.

- In addition to the annual Tailings Forum and engagement with community technical representatives, Imperial recognizes the need to meet with community members directly to discuss tailings topics and research. In Q1 2021, Imperial held a Community Advisory Group (CAG) meeting with ACFN to discuss tailings. Topics included a general overview to tailings at Kearl as well as a review of the Imperial Kearl In-line Flocculation study underway. The intent of meeting at the CAGs in addition to the tailings forum and technical reviews is to engage a variety of representatives from communities so that information can be shared broadly and feedback can be received from as many areas of the community as possible.
- Kearl Life of Mine Closure Plan (LMCP): In 2020, Imperial initiated a series of LCMP engagement workshops to work collaboratively with Indigenous groups and their technical representatives on the LMCP, which describes the closure landscape, reclamation plans, timing for tailings placement and use of end pit lakes. The feedback received from the communities in the technical memos and Tailings Forum were further used to inform the discussion topics at these workshops. The third of three workshops occurred in Q1 2021, with follow-up data to be provided to communities. Imperial and Indigenous groups continue to identify opportunities for feedback on the LCMP prior to submission, currently anticipated in June 2021.
- Kearl Tailings Management Plan: Similarly, Imperial intends to work collaboratively with Indigenous groups on the TMP. Imperial and Indigenous groups are in the early stages of planning consultation activities to identify community feedback for incorporation into the TMP update, due December 2021, prior to submission.
- Indigenous involvement in COSIA research projects has been identified as a focus area for Imperial. Imperial will continue to look for opportunities to engage stakeholders in research projects as well as sharing results and data with communities when possible. Imperial intends to identify those COSIA Projects led by Imperial where Indigenous groups can be involved directly. Imperial continues to look for opportunities for communities to influence research program design, including seeking input on plant species selection for a thickened tailings reclamation study in Q4 2020.

Imperial will continue to use regular committee meetings, monitoring tours, environmental stewardship presentation, tailings forum, and review of regulatory plans to engage with Indigenous communities and develop solutions to tailings management collaboratively.

Imperial has proposed to again host an annual Tailings forum to discuss tailings management activities at Kearl with all the Indigenous groups jointly. Through regular engagement, Imperial and the Indigenous groups have agreed to schedule the tailings forum in the fall of 2021, prior to the submission of the TMP. A key focus of the upcoming forum will be discussion of Imperial's TMP update, due in December 2021. Discussion and feedback from the forum will drive the development of Imperial's 2021 TMP update.

3.0 Fluid Tailings Volume Reporting

As per the FT volume reporting requirements outlined in Section 6.2 of Directive 085, Imperial is required to submit FT management details including an accounting table as per Appendix 3 of Directive 085. The 2020 Annual Report presents the data collected, results obtained and the analysis performed regarding Imperial's FT inventory and management.

3.1 Fluid Tailings Volume and Profile

3.1.1 Accounting Table

As per *Decision 20180716A: Imperial Oil Resources Limited; Application for Kearl Mine's Tailings Management Plan*, Imperial does not have any legacy FT and as such all FT are considered to be new FT at Kearl. Therefore, throughout this report any references to FT inventory and FT profile means new FT inventory and new FT profile, respectively. Table 3-1 provides a detailed accounting table (as per Directive 085) of annual FT volumes. It can be seen that Imperial's FT inventory is below the approved FT profile.

Table 3-1: Accounting Table

Year		Previous Year New FT Inventory (Mm^3)	Previous Year Legacy FT Inventory (Mm^3)	FT Inventory (Mm^3)	Change in New FT Inventory (Mm^3)	Change in Legacy FT Inventory (Mm^3)	New FT Inventory (Mm^3)	Legacy FT Inventory (Mm^3)	Approved Profile New FT Inventory (Mm^3)	Approved Profile Legacy FT Inventory (Mm^3)	New FT Rolling Profile Deviation (%)	Legacy FT Rolling Profile Deviation (%)
2014	0.0	0	0.0	4.7	0	0.0	4.7	0.0	5.0	0.0	-	-
2015	1.0	4.7	0.0	13.6	8.9	0.0	13.6	0.0	20.0	0.0	-32%	n/a
2016	2.0	13.6	0.0	24.1	10.5	0.0	24.1	0.0	46.0	0.0	-40%	n/a
2017	3.0	24.1	0.0	41.0	16.9	0.0	41.0	0.0	66.0	0.0	-39%	n/a
2018	4.0	41.0	0.0	50.1	9.1	0.0	50.1	0.0	87.0	0.0	-40%	n/a
2019	5.0	50.1	0.0	62.1	12.0	0.0	62.1	0.0	113.0	0.0	-41%**	n/a
2020	6.0	62.1	0.0	75.0*	12.9*	0.0	75.0*	0.0	130.0	0.0	-43%*	n/a
2021	7.0		0.0			0.0		0.0	147.0	0.0		
2022	8.0		0.0			0.0		0.0	159.0	0.0		
2023	9.0		0.0			0.0		0.0	170.0	0.0		
2024	10.0		0.0			0.0		0.0	177.0	0.0		
2025	11.0		0.0			0.0		0.0	180.0	0.0		

* Estimated due to COVID-19 waiver for 2020 tailings field investigation program

** 2019 rolling profile deviation was calculated using only a 4 year rolling average (2016 to 2019 only) in 2019 Annual Report. This has been corrected for 2019 using a 5 year rolling average which includes 2015.

The FT inventory for 2020 was estimated using Imperial's tailings model. In the absence of actual field data, to better estimate FT inventory, this tailings model was updated with reconciled data from Bilmat (a mass balance and reconciliation tool used by the plant), S-23 reports data and process stream data collected from online instrumentations. Imperial is taking a conservative approach and is not reporting any new ready-to-reclaim (RTR) volumes for 2020 since solid content of the TT deposit was not measured in 2020. During 2020, Imperial continued its fines treatment plan through KFTT and other supplemental fines treatment trials. It is expected that year end FT inventory would have been lower in 2020, than what is reported in Table 3.1 above, if pond investigation was completed and volumes meeting RTR criteria removed from the FT inventory. Imperial will adjust this estimated 2020 FT inventory as necessary after the next pond investigation and TT sampling program and will report in a subsequent D085 Annual Report.

3.1.2 Fluid Tailings Profile

Figure 3-1 shows the approved FT profile with estimated FT inventory volumes and threshold limits plotted. This demonstrates that Imperial's FT inventory is currently below the AER approved FT profile and thresholds. The primary reasons for having lower cumulative FT inventory are: KFTT performance, lower than estimated mining and production rates versus original D85 FT profile. Kearl's cumulative ore production from 2015 through 2020 was approximately 6% less than what was originally forecasted in the 2016 TMP.

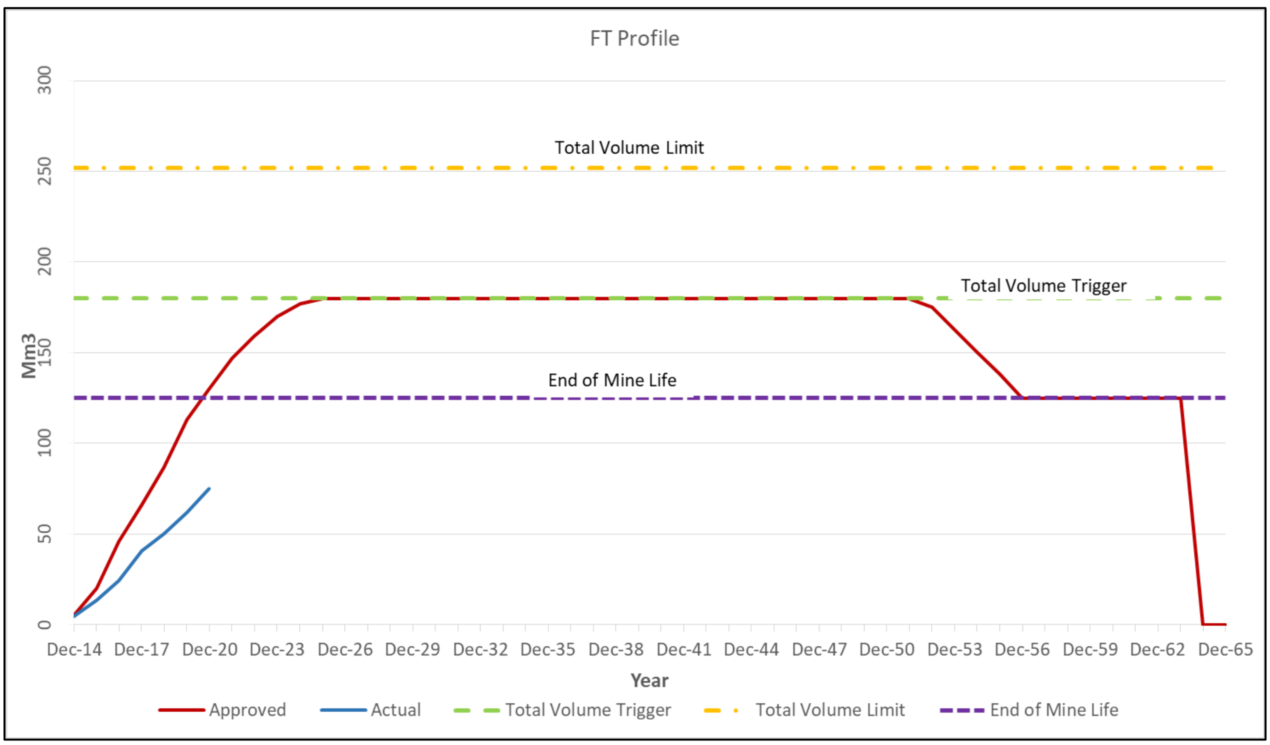

Figure 3-1: Fluid Tailings Profile Showing Approved Profile, Triggers and Limits

In addition to lower than estimated mining tonnage (since 2014), Kearl's tailings treatment process has produced tailings that have predominantly met the current sub objective 1 RTR criteria (additional details in Section 4.3). Ongoing performance evaluation and continuous improvements of the overall fines treatment system is focused on demonstrating sustained performance over a wider operational envelope. Further details on the challenges experienced, work completed and current planned improvements can be found in the Section 6.1.

Kearl's performance falls within management level 1, as defined by the TMF, as its FT inventory was below the approved FT profile.

3.1.3 RTR Criteria

FT are considered RTR when "they have been processed with an accepted technology, placed in their final landscape position, and meet performance criteria" (AER, 2017). According to Commercial Scheme Approval No. 10829L, Imperial is currently required to meet the following RTR criteria for the EETA TT deposits (AER, 2018):

- 65% solids content by weight, based on deposit sampling, within one year of treated FT placement for the EETA TT deposit (subobjective 1)
- Groundwater is monitored in accordance with the *Environmental Protection and Enhancement Act* (EPEA) approval (subobjective 2)

Groundwater was monitored, managed and reported as required by EPEA Approval No. 46586-00-00, as amended, during 2020. Details are added in the section 'Environmental Monitoring Results' (Section 7.0). Should specific issues regarding Imperial's EPEA groundwater monitoring program be identified, Imperial's understanding is that they will be addressed in the AER review of the Annual Groundwater Monitoring Report. Therefore, all tailings material that has been treated and placed in the EETA is deemed to have met RTR subobjective 2 criteria.

Throughout the remainder of this report, treated tailings referred to as having met RTR criteria also means material having met RTR subobjective 1 criteria, and material not meeting RTR criteria refers to material that hasn't been proven to have met RTR subobjective 1 criteria.

3.1.4 Fluid Tailings Volume in Each Deposit

Table 3-2 shows estimated FT inventory at the end of the reporting period, while Table 3-3 provides estimated thickened tailings volume and material that has met the RTR criteria.

Table 3-2: FT Inventory

Pond	FT Inventory (Mm^3)	Water Inventory (Mm^3)
West ETA (WETA)	62.1	23.8
East ETA (EETA)	3.0	2.1
TT Panel	9.9*	0.9
Total	75	26.8

*In the absence of a tailings field investigation program on the TT deposit in 2020, all TT produced in 2020 was considered to be FT. The total FT volume was estimated from tailings model as explained in Section 3.1.1 above.

Table 3-3: Thickened Tailings Volume

Pond	Volume of TT (Mm^3)	Volume of TT determined to be RTR (Mm^3)	FT Inventory (Mm3)
TT Panel*	19	9.1	9.9

*TT volume, and FT volume in TT deposit was estimated from previous year's data and aerial surveys. This volume may be adjusted if required after the next tailings field investigation program. 'Volume of TT determined to be RTR' considered unchanged from what was reported in the 2019 Annual Report.

A cross section of the TT panels, based on an aerial survey is shown in Figure 3-2

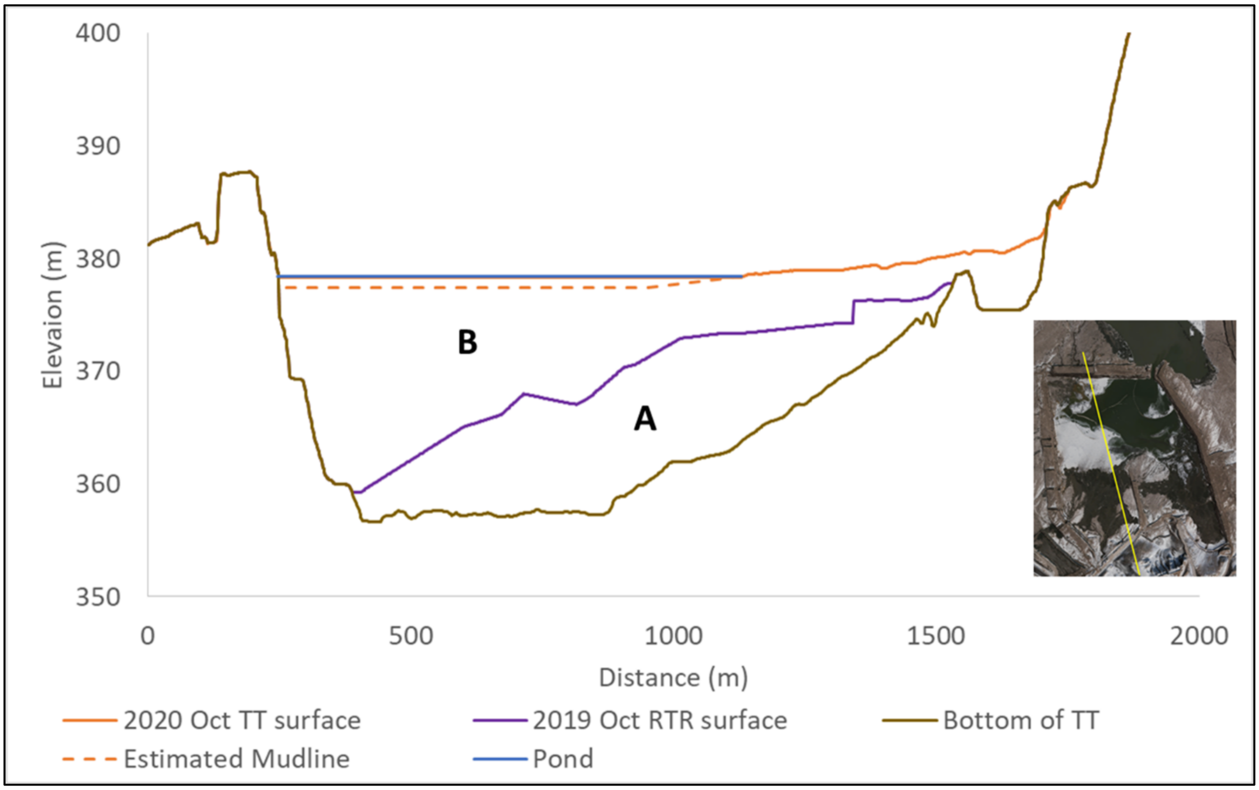

Figure 3-2: Estimated RTR volume and FT volume in TT deposit

Surfaces generated using 2020 satellite survey and 2019 deposit surveillance data to estimate the total TT volume and RTR volume. Figure 3-2 breaks down the TT deposit into two zones. The volume of zone "A" was the previously determined RTR volume based on 2019 pond investigation data. It was assumed that this volume of material would remain as RTR satisfied material for 2020 year as well. The volume of zone "B" was consisted of the non-RTR volume carried forward from 2019, estimated TT volume deposited in 2020, and 2020 inter layered CST volume. Even though part of the TT deposited in 2020 potentially turned into RTR material, in the absence of in-situ tests or TT sample data, all TT produced in 2020 was considered non-RTR in this estimation. Hence, taking a conservative approach, the total 2020 non-RTR volume was estimated subtracting estimated CST volume from zone "B". Imperial will adjust this estimated non-RTR volume as necessary after the next pond investigation and TT sampling program and will report in a subsequent D085 Annual Report.

3.2 Water Volume, Quality and Site Wide Balance

Figure 3-3 shows a simplified diagram of the site wide water balance while Table 3-4 shows an estimated site-wide water balance for Kearl.

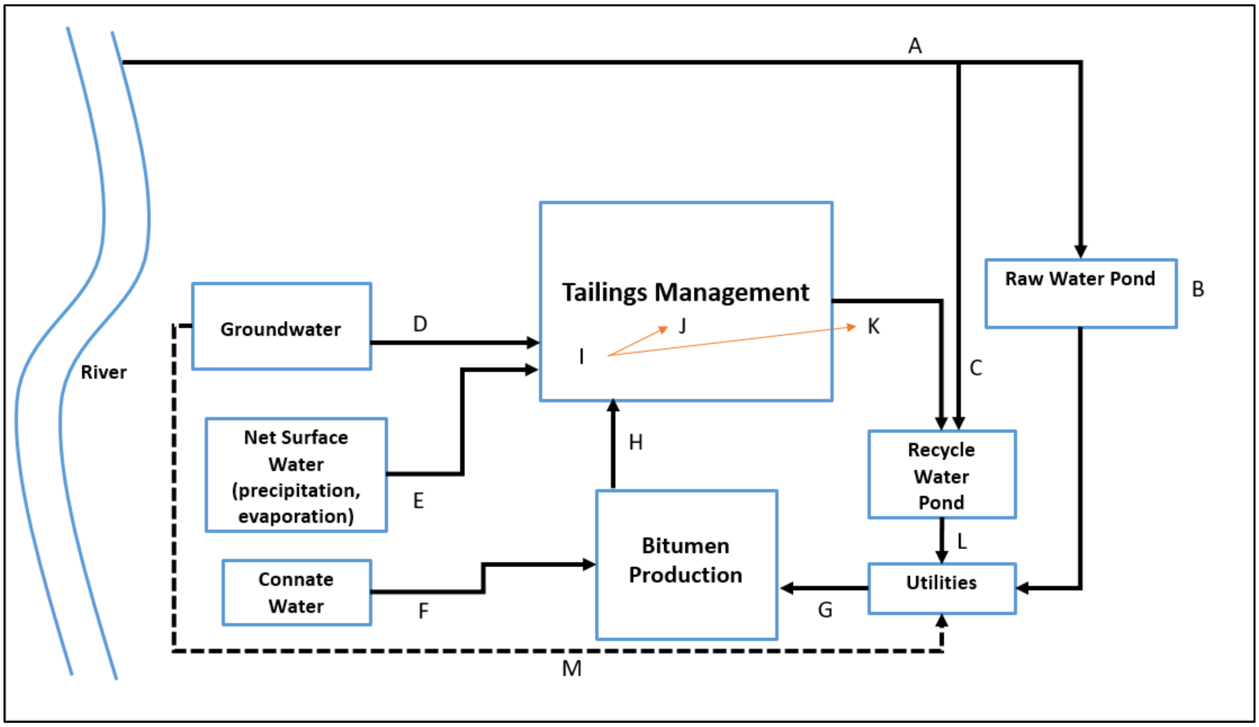

Figure 3-3: Site Wide Water Balance Schematic

Table 3-4: Estimated Site-Wide Water Balance Table for 2020 Reporting Period

	Activity	Mm^3
A)	River water taken from the Athabasca River to Raw and Recycle Water Pond	15.1
B)	River Water to Raw Water Pond and to Utilities	4.1
C)	River Water to Recycle Water Pond	11.2
D)	Overburden, Basal, and Devonian groundwater to Tailings Management	2.9
E)	Surface Water Runoff (net precipitation including rain, snow, and evaporation) to Tailings Management	20.8
F)	Connate Water from within ore body to Bitumen Production	5.5
G)	Utilities to Bitumen Production	152.1
H)	Bitumen production to Tailings Management	157.6
I)	Water to Tailings Management	181.3
J)	Storage in Tailings Management	44.6
K)	Tailings Management to Recycle Water Pond	136.7
L)	Recycle Water to Bitumen Production via Utilities (heat added)	147.9
M)	Basal Well Groundwater to Bitumen Production via Utilities (heat added)	0.0

The total volume of free water for each treated tailings deposit and FT pond at the beginning and end of the 2020 reporting period is shown in Table 3-5. Free water is defined in this case as water volume in the pond between mudline and water top.

Table 3-5: Volume of Free Water for the 2020 Reporting Period

Volume of Free Water (Mm^3)		
Pond	**Start of 2020**	**End of 2020**
WETA	20.1	23.8
EETA + TT Panel	2.3	3.0
Total	22.7	26.8

*EETA pond and TT Panel pond were merged in 2020

The characterization of the quality of the water is shown in Table 3-6. One sample was collected from the centre dyke in May 2020. Water sampled in the WETA is typically neutral pH and, low in nutrients.

The majority of polycyclic aromatic hydrocarbons are usually measured below the detection limit and where detections are present, they are in low concentrations.

Table 3-6: Water Quality Testing Key Parameters

Key Parameters	Annual Average
Dissolved Chloride mg/L	29
Dissolved Sulphate mg/L	290
Total dissolved solids (measured) mg/L	710
Dissolved Calcium mg/L	39
Dissolved Magnesium mg/L	16
Dissolved Potassium mg/L	10
Dissolved Sodium mg/L	180
PH	8.3
Bicarbonate mg/L	260
Carbonate mg/L	<1.0
Total suspended solids mg/L	17

mg/L - milligrams per litre

The estimated volume and quality of water recovered from treated tailings are shown in Table 3-7. A minor increase in overflow water volume from 2019 to 2020 was noted and could be attributed to mainly to increased Fluid Tailings (FT) equipment reliability and uptime. Solids content results met expectations demonstrating adequate quality of recovered water.

Table 3-7: Volume and Quality of Water Recovered from Treated Tailings

Water Recovered	Volume (Mm^3)	Solids Content (%)
Thickener overflow*	33.1	<1.0%
TT deposit**	5.5	<1.0%

*Volume of Thickener overflow water is based on flow data. Solids content of overflow water is obtained from samples from the stream analyzed at the Kearl laboratory

** Volume of TT deposit water derived based off mass balances (inflow less water remaining within panels)

3.3 Ore Processed

3.3.1 Ore Tonnage and Composition

Table 3-8 shows the 2020 total tonnage of ore processed and its average composition.

Table 3-8: Ore Processed in 2020

Year	Ore Tonnage (Mt)	Bitumen (%)	Water (%)	Solids (%)
2020	130.9	11.8	4.2	84.0

3.3.2 Fines in Ore and Fluid Tailings

Over 2020, Kearl processed approximately 18.8 Mt of fines within the ore. Since its start up, the total (cumulative to date) fines estimated to be in FT is approximately 32.1 Mt (representing the 75.0 Mm^3 of FT identified in Table 3-2).

The estimated net generation of FT of 12.9 Mm^3 in 2020 reflects approximately 6.3 Mt equivalent fines.

3.4 Status Map

The External Tailings Area (ETA) status at the end of 2020 is shown in Figure 3-4 on top of an aerial photo taken in September 2020 . The blue outline shows the estimated extents of the pond at the end of the year. The red outline shows the boundary of the ETA. The white outline shows the estimated extents of TT placed inside the panels.

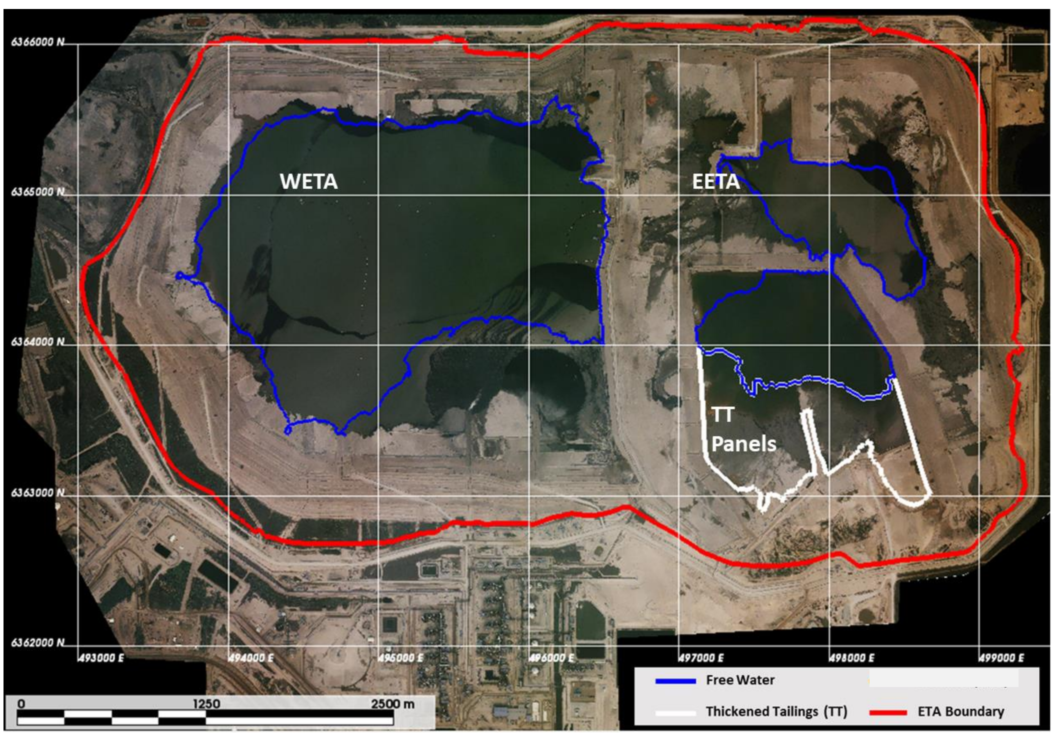

Figure 3-4: 2020 ETA Status

A summary of the tailings treatment during 2020 is shown in Tables 3-9 and Table 3-10. The volume of thickener feed is split between FLT and FT. The thickener underflow (TT) after passing through second chemical system was placed in the EETA. The volumes are based on flows measured in the streams feeding and leaving the thickener.

Table 3-9: Thickener Feed

Tailings Treatment Slurry (Mm^3)	
FLT	25.7
FT (WETA barge)	4.8

Table 3-10: Thickener Underflow

Tailings Treatment Slurry (Mm^3)	
TT	13.2

Total volumes treated in 2020 were marginally lower than 2019. Factors include extended plant shutdowns, as well as one-off equipment issues leading to downtime of a thickener in the Q1-Q2 periods.

Based on process surveillance, the thickeners originally produced underflow in the lower than expected range of 40-50% solids content (SC) during the first half of 2020. This was mainly due to lower solids loading rates from the FLT feeds fed by the Kearl K1 and K2 plants. It was rectified in the second half of 2020, which reflected in the results as displayed in Table 4-3.

The annual average SC is shown in Table 3-11. It’s important to note that the secondary chemical injection system results in further dewatering once deposited into the TT panels.

Table 3-11: Properties of the Treated Tailings

	Solids Content (%)	
Solids Content (%)	Expected Properties	Actual Properties
Thickener Underflow	40%-50%	Avg. 36%
Thickener Overflow	<1%	<1%

Thickener overflow solid content results (%) in 2020 were within the expected properties range. Thickener underflow solid content results were however slightly under target (~36% vs. 40%). The latter was due to a combination of running at lower U/F densities to manage thickener bed levels and mechanical equipment challenges as well as maintaining stable operations with a lower than expected solids loading rate from the primacy separation cells. Though thickener underflow densities were below expected properties, the performance of samples taken after secondary chemical injection continued mostly to demonstrate expected overall thickener and system performance.

4.0 Monitoring Reporting Data

4.1 Dataset Accuracy

As explained previously, tailings field investigation program was not conducted during 2020 due to COVID-19 public health emergency. Therefore FT inventory and RTR volume were estimated from satellite surveys, thickener underflow process data and previously estimated deposit properties.

4.2 Treated Tailings Characteristics

Treated tailings characteristics are usually estimated from in-situ tests and measured properties of TT samples taken during the tailings field investigation program. This year the main characteristics of treated tailings were measured using process samples. Process monitoring summary is provided in the Section 4.3. A comprehensive characterisation of the deposit, including the TT produced in 2020 will be provided in next year's report.

4.2.1 Storage Capacity

Available storage capacity of each tailings deposit or tailings pond that contains water or tailings at the end of the 2020 reporting period is shown in Table 4-1. At the end of 2020, WETA freeboard was limited by low spot on the north part of the Center Dyke. This low area was filled in (poured with sand) in early February 2021 and increased storage capacity to approximately 6 Mm^3. In 2020, because of some operational issues, it required longer than usual time period to complete dyke construction and hence some areas of the dyke remain lower than planned in elevation. Low spots on the dyke cause lower storage capacities due to freeboard restrictions, however, freeboard and storage capacity requirements were in full compliance throughout 2020.

The EETA and the TT panel ponds merged in 2020. The TT panel causeways no longer restrict the EETA fluid storage capacity with respect to freeboard restrictions as they did prior to 2020. Only the EETA perimeter dyke and the Center Dyke freeboard limit controls fluid storage capacities in the EETA as of 2020.

Short and mid-range range tailings planning continuously monitors freeboard in both the WETA and the EETA and plans dyke and beach construction schedule to maintain freeboard requirements, and thus, ensures maintaining sufficient storage capacity requirements.

Table 4-1: 2020 Year End Available Storage Capacity

Pond	Storage Capacity (Mm^3)
WETA	3.3
EETA + TT Panel	7.7

FT annual storage capacity and volume requirements forecast for the five years following the end of the 2020 reporting period are shown in Table 4-2. These all reflect the end of reporting period (December 31) volumes, identifying the FT storage capacity that is planned to be created and how much FT storage will be required as per the current plan. Along with ETA, storage forecast in Table 4-2 from the year 2023 to 2025 also includes Inpit Tailings Area 1 (ITA1) storage. Tailings deposition, upon AER approval, is planned to begin in the ITA1 starting in 2023.

Table 4-2: 5 Year Annual Fluid Storage Capacity and Fluid Volume Storage Requirement Forecast

Pond	2021		2022		2023		2024		2025	
	Storage Capacity (Mm^3)	Storage Requirement (Mm^3)	Storage Capacity (Mm^3)	Storage Requirement (Mm^3)	Storage Capacity (Mm^3)	Storage Requirement (Mm^3)	Storage Capacity (Mm^3)	Storage Requirement (Mm^3)	Storage Capacity (Mm^3)	Storage Requirement (Mm^3)
WETA	105.4	88.8	111.1	94.4	115.4	101.4	113.5	109.0	112.5	107.4
EETA + TT Panels	16.1	4.9	13.9	3.5	13.5	2.4	9.5	3.3	8.1	2.2
ITA1					49.6	10.0	40.4	10.0	34.0	10.0

In accordance with the Tailings Management Framework and Directive 085, Imperial submitted a TMP on November 1, 2016. This plan was aligned with the approved Pleistocene Channel Aquifer (PCA) offset scenario for areas A/B/C, where the resource is sterilized within and up to a 50 m offset from the PCA edge. It also included sterilization of areas D/E on the basis that leaving the ore in-situ within and up to a 50 m offset from the PCA edge was considered to be the most likely path forward. The ore that is proposed to be sterilized within areas D/E is of average fines content, therefore no impact to the FT generation rate in this area of the mine is anticipated.

The proposed sterilization of ore to keep all infrastructure within Kearl's existing regulatory approval boundaries was not included in the 2016 Directive 085 TMP. This volume and area is a small increase from that proposed within PCA areas D/E. Also, given that the ore in this area is of average fines content, no impact to the FT generation rate is anticipated. The sterilization of this ore will accelerate the availability of in-pit tailings area 2, which improves the robustness of the TMP.

4.3 Quarterly Monitoring

Table 4-3 shows the average quarterly TT solids content and SFR from process samples after the secondary chemical injection point.

Table 4-3: Quarterly Monitoring Results for Solids Content and SFR

Months	Initial (%)	24 hours (%)	7 days (%)	SFR
Jan - Mar	34%	47%	51%	1.15
April - June	37%	46%	49%	1.17
July - Sep	42%	53%	57%	2.21
Oct - Dec	42%	51%	57%	1.33

TT solids content, for the first half of 2020, was initially averaging approximately 36%, which increased to approximately 50% after seven days. First half of 2020 only produced approximately 40% of 2020's TT production. Whereas majority of the TT (approximately 60%) was produced in the second half of 2020 with higher initial TT solids content averaging around 42%, which increased to approximately 57% after seven days.

In summary, thickener overflow solid content results (%) in 2020 were within the expected properties range. Thickener underflow solid content results were however slightly under target (~36% vs. 40%). The latter was mainly due to lower solids loading rates from FLT. This makes it more difficult to achieve the targeted density. However performance in the second half of 2020 validated expected overall thickener and system performance. The performance of the overall system shall further be confirmed with the next annual sampling campaign and in-situ data collection and can be reported in the following annual report.

5.0 Deposit Performance

During 2020, Imperial relied on process sampling to evaluate TT characteristics. As illustrated in Section 4.3, primary KPIs (solids content, SFR etc.) of treated tailings were measured from process data. The 7-day average solids content was above 50% as shown in Table 4-3 above, indicating that material is capable of achieving RTR criteria within the deposit. Therefore, the deposit is expected to perform similar to previous years. A more detailed analysis on deposit performance will be provided upon next annual sampling campaign and in-situ data collection and can be reported in next year's report.

6.0 Technology: Continuous Improvement and Development

6.1 Summary of Continuous Improvement Activities

Over the 2020 reporting period, issues encountered related to operation of the treatment facility at Kearl are summarized in Table 6-1. Challenges were primarily physical availability of specific pieces of equipment, winter operation, and other operational challenges related to commissioning and start-up.

Thickener operation and the TT deposit generally met expectations; thickener underflow achieved required density and fines loss to the thickener overflow was lower than expected.

Table 6-1: Treatment Technologies' Operations During 2020

Operational Challenges	Continuous Improvement Activities
Bitumen plugging of FT pumps reducing availability of FT feed to the thickeners	• Bitumen plugging was less of a challenge in 2020 with installation of alternative style FT Pumps, though plugging with debris (wood, rope, etc.) has emerged as a challenge. Modified screens are to be tested through 2021 to optimize management of both bitumen and debris.
Multiple challenges related to the location and design of the pipeline feeding FT from the WETA to the thickeners	• FT line and power/communications were relocated outside the active tailings beach in 2020. This has resolved operational challenges experienced in the past.
Physical availability of the underflow system challenged by pump and piping challenges	• Accelerated wear of underflow pumps no longer an operational challenge. • Material and thickness of underflow piping partially upgraded in 2019, remainder in 2021. • Frequent underflow pump packing failures emerged as a challenge in 2020 – trialing modified gland water control scheme.
Vibrations in the second chemical injection system resulting in downtime	• Installation of new pipe supports completed in Q1 and surge tank installation completed in Q4. These activities are expected to resolve this issue.
Passing valves leading to isolation challenges and frozen lines	• Several valve replacements/upgrades completed in 2020 – evaluation and identification of further improvements underway in 2021. • Additional instrumentation for temperature monitoring to be installed in 2021.
Design challenges with the new Bitumen Separation Tank – Sand accumulation and sacrificial anodes releasing and damaging downstream pumps	• Tank continues to operate normally with no issues. Evaluating the need to potentially clean and inspect the tank in 2022.
Poor drainage between Centre Dyke and the TT panels, resulting in saturated loose and potentially liquefiable material	• Evaluation into the elimination of the West Divider causeway to allow for longer beaches and co-deposition/inter-layering of CST and TT, potentially allowing for more effective drainage pathways around and within the TT panels. • Should improve consolidation and overall deposit performance through improved drainage and loading of the deposit with CST sand.
Simultaneous failures of Overflow Water Pumps	• Pump maintenance strategy modified to prevent future simultaneous failures and pump upgrades planned to increase pump run life and reduce time to repair.
FFT material behaviour – potential coning	• Continuous troubleshooting through modification of pump and TRS caisson depths as well as pump operating modes. • Seeking external support to better understand coning challenges and options to mitigate.

6.2 Pilots or Prototypes

Imperial Oil submitted the following new or extension applications in 2020 to carry out pilots:

- Inline Flocculation On-Site Tailings Pilot Update – Phase 1 (amended)
- Inline Flocculation On-site Fluid Tailings Pilot Phase 3 (ILF Phase 3)
- Inline Flocculation On-site Fluid Tailings Pilot Phase 4 (ILF Phase 4)
- Enhanced Beach Fines Capture Field Pilot
- Alternative Flocculant Field Trial (amended)

In addition to the above pilots, a follow up investigation of the deposition area from the 2019 Inline Flocculation On-site Fluid Tailings Pilot Phase 2 (ILF Phase 2) was carried out in 2020.

These pilots allow for continuous improvement and operational learnings on the existing Kearl Fluid Tailings Treatment (KFTT) and development of supplemental treatment options. The following provides an overview of the pilots carried out by Imperial Oil in 2020.

6.2.1 Inline Flocculation Onsite Fluid Tailings Pilot Phase 1

Imperial requested authorization from the Alberta Energy Regulator (AER) on August 3, 2018 and received approval to carry out a field pilot called Inline Flocculation Onsite Tailings Pilot Phase 1 on September 7, 2018 with an update approval on September 10, 2019 and an extension approval on May 11 2020. The pilot focused on conducting inline flocculation (ILF) of FT and evaluating performances of ILF treated FT deposit at a field scale.

The ILF technology has been used in the oil sands industry since 2008. The ILF treatment of FT was identified as an opportunity to continue to treat fines to increase overall fines treatment when the primary fines treatment facility (thickener) is not operational or when there is excess FT available from the West External Tailings Area (WETA) FT reclaim barge.

The long term objective of evaluating ILF is eventually to co-deposit/interlayer ILF treated FT with relatively high sands to fines ratio (SFR) thickened tailings (TT) and / or coarse sand tailings (CST) within the TT deposition area. The co-deposition/interlayering of ILF and TT is expected to follow a similar trajectory of solids content increase as TT, thereby meeting the D085 Ready to Reclaim (RTR) requirements. The ILF Phase 1 pilot is the first step in evaluating the ILF treated FT material properties deposited at a field scale i.e. at field scale flows with the TT pipeline routing.

The treatment consists of minimum modifications as it leverages existing infrastructure of the primary treatment process, KFTT, in particular the excess capacity of the WETA FT barge i.e. during thickener downtime. In addition, the ILF process does not introduce any new chemicals. ILF will be using the same approved flocculant used in the secondary chemical treatment process of KFTT (currently anionic polyacrylamide polymer FLOPAM™ A-3338 or SNF FLOPAM NRG 5320).

The ILF Phase 1 pilot was conducted during the latter part of the plant annual maintenance period in 2020. FT was extracted from the WETA tailings pond using the FT barge and directly pumped to inline polymer injection location. After polymer injection, ILF treated FT is sent to the deposition area in East External Tailings Area (EETA).

A surveillance plan was developed to monitor the key performance indicators (KPIs) of the process during the pilot and leveraged readily available inline instrumentation for the process key performance indicators and the deposit key performance indicators were evaluated by insitu testing and field sampling methods combined with laboratory testing of the samples.

The pilot area was aerially surveyed after construction and prior to tailings deposition. The approximate thickness of the deposit was evaluated by comparing the two surveyed surfaces (prior to and after the pour).

The key process indicators that were monitored during the commissioning and operation include:

- FT solids rate, flowrate and density;
- Capillary suction time of treated FT;
- Yield stress measurement of treated FT; and
- Net water release.

A field investigation was carried out about 3 months after deposition to measure the deposit thickness, insitu shear strength, insitu permeability and obtain samples for material characterization. The samples collected during the site investigation program were sent to external labs and the following characterization tests were conducted: Sand to fine ration (SFR), clay content, solids content and undrained shear strength were conducted on select samples.

The field pilot resulted in approximately 40 m by 40 m surface area and about 2 m thickness ILF treated FT deposit. Initially, deposit performance was visually monitored. Figure 6-1 shows the deposit appearance and dewatering progress of the deposit with time.

Figure 6-1: Deposit appearance up to three months of deposition

In summary, the ILF field pilot demonstrated that FT reclaim barge pumps and booster pumps in the thickened tailings pumping system are capable of supplying the required density and flow rate of FT for ILF treatment. Pumps in the flocculant injection system were also capable of injecting required flocculant dosage for optimum flocculation. The control system of the primary treatment facility was successfully used to supply FT feed for ILF operation.

The results of the field pilot deposit surveillance demonstrated better than expected performance from ILF treated FT material compared to lab estimates. Co-deposition/interlayering of ILF product with relatively high SFR / low clay, thickened tailings and/or coarse sand tailings may further improve overall deposit performance.

The ILF treatment of FT is an excellent opportunity to use excess capacity of the current treatment system to increase overall treatment capacity. This increase of fines treatment will help Imperial to achieve fines neutral target at expected time frame.

6.2.2 Inline Flocculation Onsite Fluid Tailings Pilot Phase 2

Imperial requested authorization from the Alberta Energy Regulator (AER) on April 7, 2019 and received approval to carry out a field pilot called Inline Flocculation Onsite Tailings Pilot Phase 2 on April 15, 2019.

The ILF Phase 2 field pilot focused on evaluating an enhanced inline flocculation (EILF) treatment using a three chemical treatment (flocculant, colloidal silica and coagulant) compared to a single flocculant treatment (typical of inline flocculation (ILF)).

Two cells were setup for the pilot in 2019 to compare performance of tailings treated with single polymer with tailings treated with the EILF treatment. Tailings deposition in the cells were completed in October 2019 with a field investigation completed 10 day after. A summary was provided on the objectives and plan for ILF Phase 2 pilot in the 2019 Tailings Annual Management Report. The main activities that have been conducted since the last update are summarized below.

The pilot location allowed for monitoring to continue after the initial field pilot since the area will not be covered by tailings for many years. An aerial survey with photograph was conducted one year after deposition as shown in Figure 6-2.

Figure 6-2. Aerial photo taken 1 year after completion of the pour

The second site investigation was completed one year after deposition and conducted after the thaw season in 2020. Core sampling and in-situ shear strength testing (BCPT and VST) was completed. Continuous data monitoring from the two cells using the in-situ instrumentation was collected throughout the first year after deposition. Analysis of the results from the second field investigation and continuous monitoring data are in progress.

A water modeling study was completed to assess the effect of the enhanced treatment chemistry on the chemistry of the pond water. Water characterization was evaluated on samples of the release water collected during the pilot for both cells. The results of the water chemistry analysis tests was utilized in water modelling software and mass balancing to assess the impact on pond water chemistry.

The case study used in the model considered 2Mt of fines to be treated using the enhanced treatment. The water chemistry analysis of the samples from each cell were used as the input to the model. The model showed the release water from the treated FT via the enhanced treatment chemistry does no change the pond water chemistry significantly. It was also shown that the treatment does not increase the ionic (monovalent and divalent) concentration to levels that negatively impacts the extraction.

6.2.3 Inline Flocculation Onsite Fluid Tailings Pilot Phase 3

Imperial requested authorization from Alberta Energy Regulator (AER) on 15 May 2020 and received approval to carry out a field pilot called Inline Flocculation Onsite Tailings Pilot Phase 3 (ILF Phase 3) on June 2, 2020.

The ILF Phase 3 field pilot focuses on evaluating inline flocculation treatment on the fluid tailings (FT) dredged from the East External Tailings Area (EETA) pond.

The pilot leverages existing infrastructure to inline flocculate FT from the EETA pond using the approved polyacrylamide (PAM) polymer(s). However, the ILF Phase 3 field pilot is decoupled from the existing thickening treatment since the setup relies on a separate FT pipeline from the existing EETA pond dredge and a separate polymer pipeline from the secondary injection rather than through the existing TT pipelines. The dredge would target FT at certain depths and location in the EETA pond such that the dredged material would have a similar sand to fines ration (SFR) and clay content compared to thickened tailings (TT) and therefore the treated material would behave similar to TT.

The deposit location proposed for the ILF Phase 3 field pilot is within the EETA in the southeast corner of the TT deposition area. The field pilot is approved from June 2020 to September 2021, however the pilot was not able to be started in 2020 as originally planned due to the impact to site operations from COVID-19 pandemic public health emergency. Therefore, the pilot is planned to commence this year with completion in September 2021 followed by a field investigation in October 2021. Additional details will be provided in the subsequent Tailings Annual Management Report.

6.2.4 Inline Flocculation Onsite Fluid Tailings Pilot Phase 4

Imperial requested authorization from the Alberta Energy Regulator (AER) on June 12, 2020 and received approval to carry out a field pilot called Inline Flocculation Onsite Tailings Pilot Phase 4 on June 29th, 2020.

The Phase 4 pilot builds on the results of the previous phases to understand operational challenges and evaluate deposition strategies that would results in additional fines capture. The pilot evaluated the potential to treat FT from the WETA pond with enhanced ILF (three chemical treatment consisting of flocculant, colloidal silica and coagulant; same enhanced chemistry evaluated in ILF Phase 2) and co-deposit with CST. The treated FT was co-deposited with CST to evaluate different discharge methods to promote beach fines capture i.e. multiple discharge compared to single discharge. The deposit location for the Phase 4 ILF field pilot was within the ETA between the East Causeway and the East Perimeter Dyke, outside of the structural zone. A high level summary of the discharge methods for the pilot is provided in Figure 6-3.

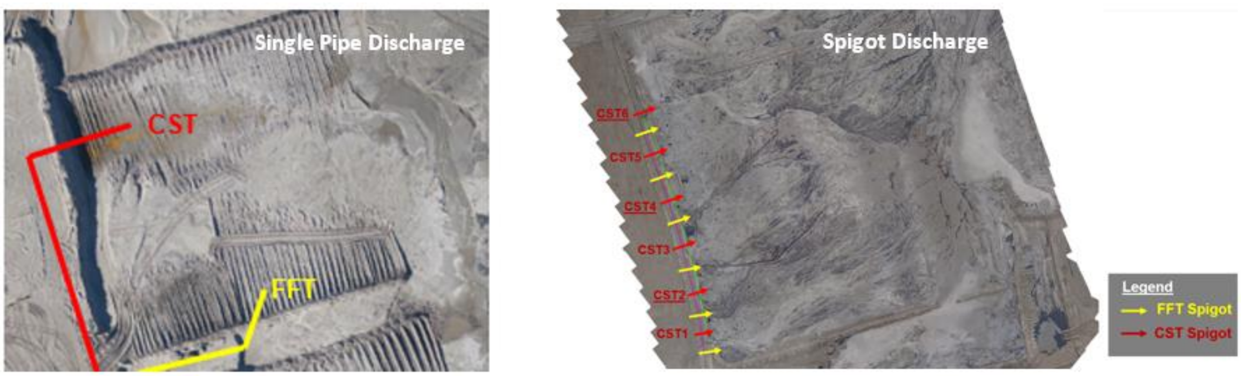

Figure 6-3. Discharge methods and set-up plan for ILF Phase 4

The Phase 4 field pilot was carried out from July to November 2020, which included construction, commissioning, treated FT and CST deposition in two cells, decommissioning and field investigation. In this pilot, FT was extracted from the tailings pond using the existing FT barge. FT was then be sent to the existing secondary chemical addition process for flocculation. The flocculant was the polyacrylamide (PAM) polymer for the existing approved thickening treatment, (SNF FLOPAM NRG 5320 (NRG)). The FT treated with PAM polymer was then treated with colloidal silica and coagulant, just after the secondary chemical injection location, which completed the enhanced ILF three chemical treatment.

The treated FT was deposited in two cells that have been designed for this pilot via two discharge methods: spigots and single pipe discharge. The same discharge method was considered for Coarse Sands tailings (CST) deposition in each cell, i.e. spigots and single pipe discharge method. The duration and interval of FT and CST deposition was designed to achieve the target sand-to-fines ratio of 3 to 5 that would maximize fines capture.

A surveillance plan was developed to monitor the key performance indicators (KPIs) of the process during the pilot and leveraged readily available inline instrumentation for the process key performance indicators and the deposit key performance indicators were evaluated by insitu testing and field sampling methods combined with laboratory testing of the samples. Visual and videographic or photographic monitoring was also be carried out during deposition.

Both test cells were aerially surveyed after construction and prior to tailings deposition to ensure the base slope met the design requirements. Another aerial survey was conducted a few days after completion of the tailings pour in each test cell. The approximate thickness of the deposit was evaluated by comparing the two surveyed surfaces (prior to and after the pour).

The key process indicators that were monitored during the commissioning and operation include:

- FT solids rate, flowrate and density;
- Capillary suction time of treated FT;
- Yield stress measurement of treated FT; and
- Net water release.

A field investigation was carried out about two weeks after deposition to measure the deposit thickness, insitu shear strength, insitu permeability and obtain samples for material characterization. The samples collected during the site investigation program were sent to external labs and the following characterization tests were conducted: Water and solids content, Dean-Stark (bitumen, water, minerals content), and Laser particle size distribution (PSD); MBI (Methylene Blue Index), Atterberg Limits, and Specific gravity were also conducted on select samples.

Analysis of the deposit behavior based on insitu tests and laboratory results on deposit and release water samples is still in progress to evaluate the commercial application of the treatment and the deposition strategy.

6.2.5 Enhanced Beach Fines Capture

Imperial requested authorization from the AER on February 18, 2020 and received approval to carry out a field pilot called Enhanced Beach Fines Capture (EBFC) on February 20, 2020.

The pilot focused on evaluating the reduction in generation of FT by increasing beach fines capture through the injection of carbon dioxide (CO_2) into the coarse sand tailings (CST) stream. Laboratory tests (bench scale) results indicated fines were retained on the CST beaches by adding CO_2 to CST and rheology was impacted (shorter ad steeper beaches) as shown in Figure 6-4.

Therefore, the objectives of the pilot were to evaluate the changes in fines content and fines capture of the beaches formed as a result of CO_2 treatment, and also to understand the potential impact on geotechnical characteristics and behavior of the deposit. For this purpose, a deposition area within one of the existing internal dykes at East External Tailings Area (EETA) was considered to deposit both untreated CST and CO_2-treated CST streams. The streams were used to build two cells and adjacent beaches typical of hydraulic upstream construction such that dozers are used to construct compact cells and beaches are not track packed. The deposit location for the pilot is outside of the TT deposition area and perimeter dyke structural zones in the EETA. The pilot leveraged the existing facilities to transport CST from the injection location to the deposit location. A CO_2 injection skid was installed to inject the CO_2 into the pipeline that transports CST to the EETA.

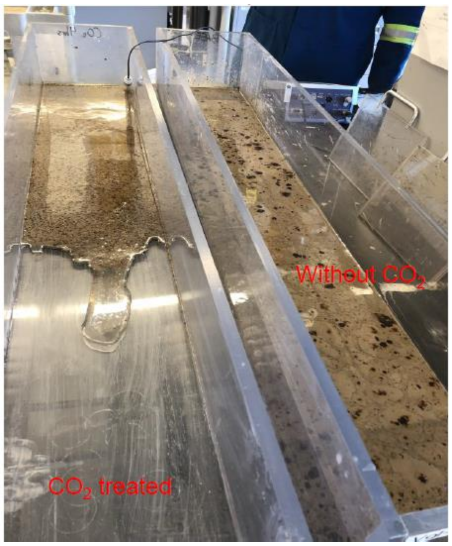

Figure 6-4: Bench scale flume test results of CST with and without CO2 addition.

Deposition started in September 2020 and was completed in November 2020. A site investigation program, including in-situ tests and sample collection for laboratory analysis, was conducted in December. The original scope of the pilot was only partially completed due to seasonal and operational complexities. The cells were constructed at sufficient thickness to allow for geotechnical and fines content assessment. However, the beaches were insufficiently thick to allow for a geotechnical assessment to be completed.

The laboratory testing and data analysis are in progress. Additional details will be provided in the subsequent Annual Tailings Management report.

6.2.6 Alternative Flocculant Field Trial

Imperial requested authorization from the AER on April 29, 2019 and received approval to carry out a field pilot called Alternative Flocculant Field pilot on May 15, 2019. An extension was requested on January 17, 2020 followed by an approval on January 21, 2020. The pilot evaluated the use of flocculant, SNF FLOPAM NRG 5320 (NRG) as an alternative to the SNF FLOPAM A3332 (A3332) flocculant for the thickener and SNF FLOPAM A3338 (A3338) for the secondary injection. All three of these flocculants are anionic polyacrylamide (PAM) polymers. The alternative flocculant, NRG, was developed by chemical manufacturer and supplier, SNF, specifically for Kearl's fine treatment and is based on the operating envelope for both the thickener flocculant and the secondary injection flocculant.

Based on the results of the pilot data collected at the time, commercial authorization was requested from the AER on October 27, 2020 and approval was received on November 10, 2020. The pilot continued until December 1, 2020 as per the existing pilot approval. Final pilot data is currently under review. The interim results used to support the commercial application for NRG are discussed below.

NRG behaved similarly to A3332 and A3338 given the laboratory test results, and performance data collected as part of the pilot. Data collected during existing routine surveillance activities for key performance process indicators confirms laboratory test results that NRG exhibits dose equivalent dewatering performance to A3332 and A3338.

In particular, the 7-day solids content results of the pilot at the time of the commercial application, shown in Figure 6-5, were compared to operational results from fines treatment using A3332 and A3338 flocculants, at comparable operating conditions and for similar material properties (usually FFT ratio is proportional to material properties such as SFR, clay content). Data from both flocculants are in the target seven days solids content for translating to 65% solids content within one year of deposition. For comparison, the average seven days solids content for a FFT ratio between 0.2 and 0.35 is 55 %wt with a standard deviation of 4 %wt for NRG and 59 %wt with a standard deviation of 3 %wt for fines treatment with A3332 and A3338. The average for NRG is lower than the average for A3332 and A3338 treatment, however, the NRG results fall within the existing operating range based on A3332 and A3338 dewatering performance. In addition, given the feed variability and estimated accuracy for testing, sampling and subsampling, the dewatering performance for NRG is considered similar to the dewatering performance for A3332 and A3338.

The chemical dosage range for NRG at the time of the commercial application was comparable to the operating dosage range for both A3338 and A3332 under normal operating conditions at the field scale. Therefore, NRG exhibits dose equivalent dewatering performance to A3332 and A3338 based on the data collected during the pilot and the laboratory test results.

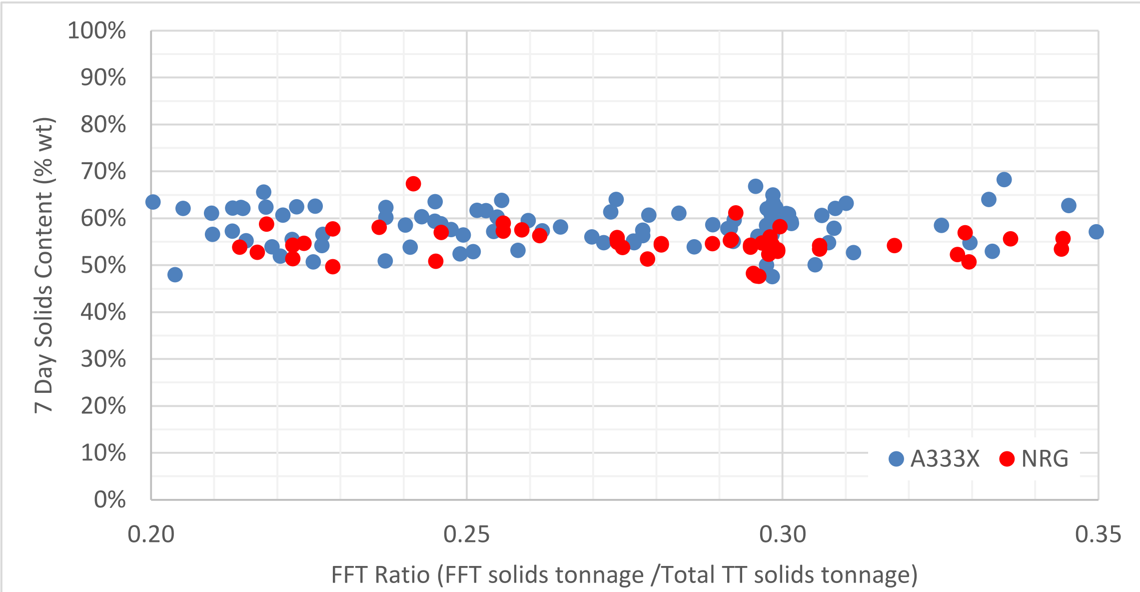

Figure 6-5: Seven days Solids Content (%wt) for NRG Treatment Compared to A3332 and A3338 Treatment for Normal Operating Conditions.

7.0 Environmental Monitoring Results

As per Appendix C to Approval No. 10829M, Imperial's RTR Subobjective 2 criteria is 'groundwater is monitored in accordance with the Environmental Protection and Enhancement Act (EPEA) Approval No. 46586-00-00, as amended or renewed'.

Imperial uses the following to determine if treated fluid tailings material is achieving sub objective 2 RTR status:

1. Groundwater, during the reporting year, is monitored in accordance with the Environmental Protection and Enhancement Act (EPEA) Approval No. 46586-00-00, as amended or renewed.
2. The results of the groundwater monitoring program was reported in accordance with the Environmental Protection and Enhancement Act (EPEA) Approval No. 46586-00-00, as amended or renewed.

If both these conditions are met, all treated fluid tailings material will be deemed to have achieved sub objective 2 RTR status. Groundwater at Kearl continued to be monitored as required by EPEA Approval No. 46586-01-00, as amended, in 2020. Results of the groundwater monitoring program was reported in accordance with the Environmental Protection and Enhancement Act (EPEA) Approval No. 46586-00-00, as amended or renewed. Imperial considers the deposits are meeting RTR criteria with respect to the 2020 groundwater conditions.

Surface water runoff and seepage through the perimeter dykes of the ETA was managed through a closed-circuit system. Runoff from the ETA was collected in toe ditches and collection ponds and was returned to the West ETA for use in the plant.

Groundwater at Kearl continues to be monitored and reported under the Kearl Groundwater Monitoring Plan (GMP) as required by EPEA Approval No. 46586-01-00, as amended.

The Groundwater Monitoring Plan (GMP) details all groundwater monitoring programs across the Site. The intent of the GMP is to facilitate the understanding of potential effects of oil sands mining, bitumen extraction, and associated operations (including tailings management activities) on local groundwater quality and down-gradient receptors. Groundwater management and monitoring falls four programs:

- Regulatory Groundwater Monitoring
- Basal and Devonian Depressurization
- Lined Pond Monitoring and Response; and
- External Tailings Area Seepage Interception System Monitoring and Response

Groundwater monitoring is conducted on an annual / semi-annual basis (program dependent). New monitoring wells are typically sampled for a baseline analytical suite and once sufficient baseline data is collected, monitoring suites are refined to indicate a potentially significant change in groundwater chemistry (also known as key indicator parameters (KIPs)).

Groundwater monitoring was carried out on a semi-annual basis in 2020 for the Seepage Interception System (SIS) installed along the north and east perimeter of the ETA.

The groundwater elevations in the monitoring network have increased since the operation of the ETA. The groundwater elevations north of the WETA appear to be increasing at a faster rate compared to those north and east of the EETA. The noted increasing groundwater elevations are due to active works in this area, including loading of material to build berms and the filling of the WETA.

Groundwater concentrations from the External Tailings Area (ETA) Seepage Interception System (SIS) monitoring program were compared to control objectives (CO) (site-specific thresholds). Control objective (CO) exceedances and trends of key indicator parameters (KIPs) (used as primary indicators of changes to groundwater quality) were interpreted as 1) natural variation; 2) potential hydrogeochemical reactions; or 3) potential early arrival of process affected water (PAW).

Increasing sulphate trends continued to be reported at KHY14_006 and KHY14_008 that are interpreted to be caused by hydrogeochemical reactions (sulphide mineral oxidation and/or gypsum dissolution). No other KIPs indicated trends or CO exceedances at these locations.

The potential early arrival of process affected water is being investigated as part of the EPEA Groundwater Monitoring Plan based on the 2020 monitoring program. KIP concentration trends determined to be likely caused by the potential early arrival of PAW seepage were recorded at six monitoring wells (KH11-179, KH13-008, KH13-014, KHY14_018, KHY14_023 and KHY14_036), located north and downgradient of the WETA, as reported as part of the EPEA Groundwater Monitoring Plan.

Visual and statistical trends in chloride, sodium, sulphate, TDS, EC and/or boron may be indicating the early arrival of PAW seepage at KHY14_018, KHY_023 and KH13-008. All KIP concentrations at these wells were within their respective COs.

Emerging visual trends in chloride, sodium, sulphate, TDS and EC at KH13-014 may be indicating the early arrival of PAW; however, further confirmation sampling is required.

Upward trends of chloride, sodium, sulphate, boron and TDS were interpreted to be a result of both seepage of PAW and hydrogeochemical reactions at KH11-179. Increasing trends in sulphate and TDS suggested hydrogeochemical processes were occurring at this location beginning in 2018. Elevated concentrations of chloride, sodium and boron were recorded in 2020, suggesting the arrival of PAW, in addition to the hydrogeochemical processes.

The only CO exceedance reported in 2020 was naphthenic acid concentrations at KHY14_036. An upward trend of boron has also been observed. Visual trends in sodium and total ammonia (as N) concentrations were also noted. It is anticipated that more conservative KIPs (i.e. chloride) would arrive prior to less mobile naphthenic acids; therefore, more data are needed to evaluate if PAW seepage is the source of the changing chemistry at this location.

As part of Kearl Groundwater Monitoring Plan (GMP), as required by EPEA Approval No. 46586-01-00, in order to verify the potential emergence of PAW seepage from the WETA and to allow for timely response, all wells with suspected PAW seepage will be monitored at an increased frequency with delineation and mitigation planning currently underway. The ETA SIS pumping wells were not activated for capture of PAW in 2020 as KIP concentrations that indicated potential arrival of PAW remained below the respective COs except for naphthenic acids at KHY14_036 which requires further investigation as noted above.

8.0 Acronyms

Acronym	Definition
AER	Alberta Energy Regulator
BAW	beach above water
BBW	beach below water
COSIA	Canadian Oil Sands Innovation Alliance
CST	coarse sand tailings
Directive 85	*Directive 085 Fluid Tailings Management for Oil Sands Mining Projects.*
EETA	East External Tailings Area
ETA	External Tailings Area
EPEA	*Environmental Protection and Enhancement Act*
FFT	fluid fine tailings
FLT	flotation tailings
FT	fluid tailings
ILF	inline flocculation
Imperial	Imperial Oil Resources Limited
K1	Kearl Plant 1
K1	Kearl Plant 2
Kearl	Kearl Oil Sands Mine
KFTT	Kearl fine tailings treatment
kPa	Kilopascal
MCFN	Mikisew Cree First Nation
m	Metres
Mm^3	million cubic metres
Mt	million tonnes
OSCA	*Oil Sands Conservation Act*
PCA	Pleistocene Channel Aquifer
PSD	particle size distribution
RTR	ready-to-reclaim
SFR	sand to fines ratio
SIS	Seepage Interception System
TDS	total dissolved solids
TMP	Tailings Management Plan
transition	transition zone
TRS	tailings recovery system
TSRU	tailings solvent recovery unit
TT	thickened tailings
WETA	West External Tailings Area

9.0 References

Alberta Energy Regulator (AER). 2017. *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*. October 2017:

https://www.aer.ca/documents/directives/Directive085.pdf

AER. 2018. *Decision 20180716A: Imperial Oil Resources Limited; Application for Kearl Mine's Tailings Management Plan.* https://www.aer.ca/documents/decisions/2018/20180716A.pdf

Appendix A Indigenous Relations Guiding Principles and Guidelines

Indigenous relations

Guiding principles and guidelines

Many of Imperial's operations and development opportunities are located within indigenous communities or on their traditional lands. Imperial supports communities in areas where it explores, develops and operates, and strives to establish meaningful relationships built on mutual trust and respect.

Principles

Imperial conducts its business in a manner that respects the land, environment, rights and cultures of indigenous communities, in accordance with the laws of Canada and corporate policies and guidelines that underlie the company 's commitment to ethics, equity, environment and safety.

Imperial engages indigenous communities and their representatives in open and forthright consultation. We seek to understand indigenous perspectives on issues of mutual interest and to deal constructively with differing views.

Imperial supports recruitment and development programs that enable indigenous people to meet the company 's employment requirements and business needs.

Imperial fosters the development of indigenous businesses in ways that provide benefits to the company and to indigenous communities.

Imperial creates meaningful relationships with indigenous peoples by supporting programs that build capacity through leadership development and community initiatives.

Imperial expects its contactors to conduct their business in accordance with these principles and guidelines.

WP02246 17 06

Indigenous relations guidelines

Consultation

Imperial maintains ongoing dialogue with indigenous leaders, community members and their representatives by:

- Respecting the legal rights of indigenous people and adhering to government requirements.
- Ensuring timely discussions when activities have the potential to impact the community.
- Supporting the identification of specific infringements on traditional uses and rights in order to minimize or mitigate impacts.
- Treating all parties fairly.
- Respecting traditional practices, decision-making processes, cultural activities and language.
- Coordinating with Crown consultation.

Workforce development

In accordance with Imperial's equal employment opportunity policy, the company's goal is to achieve a workforce that is representative of the available qualified indigenous peoples in the labour market. To this end, Imperial focuses on:

- Developing and supporting educational programs and recruiting practices that facilitate employment of qualified indigenous people.
- Establishing internal training and development programs that enhance retention of indigenous staff.
- Addressing workplace barriers that may exist.
- Supporting indigenous staff and promoting a culturally inclusive workplace.

Business development

Imperial recognizes that indigenous communities may be interested in maximizing the economic benefits of development on their lands. The company fosters the development of indigenous businesses in ways that benefit the company and the community by:

- Using indigenous suppliers of goods and services that are competitive and meet Imperial's safety, technical and quality standards and timing needs.
- Providing information and training on Imperial's procurement processes, safety standards and expectations of business conduct.
- Developing local indigenous content plans, which address employment of indigenous people alongside the amount of work subcontracted to indigenous businesses, as a factor in evaluating and awarding contracts.

Community relations

Imperial builds meaningful relationships with indigenous communities in areas where it explores, develops and operates by:

- Working collaboratively in the design and implementation of programs that build capacity through leadership development and community initiatives.
- Participating in community events.

Appendix B Agenda and Attendee list for the 2020 Annual Forum

Kearl Tailings Management Forum

Meeting Agenda

Date	November 25, 2020 1:00 – 5:00pm	**Location**	Zoom

AGENDA	
Purpose: Through constructive and transparent dialogue we aim to build an understanding of Imperial's Kearl tailings management plan, its performance, research undertaken and Imperial's approach to the 2020 tailings management plan development. Through this forum we will facilitate opportunity for open discussion and feedback to gain greater understanding by all parties and to identify concerns and potential mitigations.	
Topic	**Time**
Welcome and Introductions Opening Remarks	1:00 – 1:30 pm
Directive 085	1:30 – 2:30 pm
Break	2:30 – 2:40 pm
Groundwater • Overview of groundwater monitoring program • Subobjective 2	2:40 – 3:50 pm
Break	3:50 – 4:05 pm
Water Balance	4:05 – 4:45 pm
Closing Discussion	4:45 – 5:00 pm

Date	November 26, 2020 1:00 – 5:00pm	**Location**	Zoom

AGENDA

Purpose: Through constructive and transparent dialogue we aim to build an understanding of Imperial's Kearl tailings management plan, its performance, research undertaken and Imperial's approach to the 2020 tailings management plan development. Through this forum we will facilitate opportunity for open discussion and feedback to gain greater understanding by all parties and to identify concerns and potential mitigations.

Topic	**Time**
Opening Remarks	1:00 – 1:10 pm
TSRU Tailings/ Internal Tailings Areas	1:30 – 2:30 pm
Break	2:30 – 2:40 pm
Community Presentation	2:40 – 3:35 pm
Tailings Treatment Studies	3:35 – 4:50 pm
Closing Discussion	4:50 – 5:00 pm

Attendees	**Organization**
Meghan Dalrymple	Athabasca Chipewyan First Nation
Cathleen O'Brien	Athabasca Chipewyan First Nation
Kim Dertien	Fort Chipewyan Métis
Ryan Abel	Fort McKay First Nation
Bori Arrobo	Fort McKay First Nation
Benjamin Sey	MCFN
Petrina Fudge	Fort McMurray 468 First Nation
Harry Cheecham	Fort McMurray 468 First Nation
Sanil Sivarajan	Fort McKay Métis Nation
Margaret Luker	Fort McKay Métis Nation
Dan Stuckless	Fort McKay Métis Nation
Michaela Loutitt	McMurray Métis
Russell Noseworthy	McMurray Métis
Jenna Dunlop	Endeavour Scientific Inc.
Shanti Berryman	Integral Ecology
Kevan Berg	Integral Ecology
Megan Thompson	Thompson Aquatic

John Errington	John C. Errington and Associates Ltd
Jim Blum	JGBlum Consulting Ltd
Kelly Finigan	Lagimodiere Finigan Inc.
Lisa Schaldemose	Schaldemose & Associates Inc.
Gillian Donald	Donald Functional & Applied Ecology Inc.
Mandy Olsgard	Tox Solutions
Rhiannon Davies	Imperial
Alexandra Patrick	Imperial
Rita Karrel	Imperial
Gordon Wong	Imperial
Jennifer Haverhals	Imperial
Freda Pittman	Imperial
Sidantha Weerakone	Imperial
Jenna Schellen	Imperial
Mikayla Lee	Imperial
Jeff Strashok	Imperial
Autumn Essington	Imperial
Asfaw Bekele	Imperial
Reza Moussavi	Imperial
Christopher Lin	Imperial
Anu Saini	Imperial
Scott Cebula	Imperial
Manoj Biswas	Imperial
Atoosa Zahabi	Imperial
Paul Cavanagh	Imperial
Jay Li	Imperial
Paul Cavanagh	Imperial
Rosalyn Campbell	Imperial
Ashley Wiebe	Imperial
Robert Mahood	Imperial

Appendix C Imperial Oil Resources Limited – Kearl Oil Sands Mine Request for waiver to 2020 Tailings Field Investigation Progarm

Imperial | Kearl

Greg Forgeron
Kearl Operations Integrity Manager
587 476 2410
greg.s.forgeron@esso.ca

15 April 2020

BY EMAIL TO: paul.aguas@aer.ca

Paul Aguas
Manager, Mining Authorizations, Oil Sands East
Alberta Energy Regulator
Suite 1000, 250-5th St. SW
Calgary, AB T2P 0R4

Dear Mr. Aguas,

Re: Imperial Oil Resources Limited – Kearl Oil Sands Mine
Request for waiver to 2020 Tailings Field Investigation Program
Directive 085
OSCA Approval No. 10829L

Imperial Oil Resources Limited (Imperial) is requesting a waiver from the AER for all tailings field investigation work related to *Directive 085*, including those requirements in *OSCA Approval No. 10829L* or committed to in the *Kearl Directive 085 Measurement System Plan*, in 2020 that is completed using a third party contractor. This waiver is being requested to support our efforts in limiting the spread of COVID-19 and to protect the health and safety of workers; in addition this waiver would support economic relief and recovery in the current economic environment.

Imperial, along with other Oil Sands Operators, have eliminated (where possible) and minimized in-person interactions at their facilities. The focus is on critical activities required to maintain the safe operation of essential services and protect the health and safety of workers. Completion of tailings field investigation work involves bringing non-essential workers to operating sites, adding risk to the operation.

Imperial, along with all other Oil Sands Operators, utilizes the same third party contractor to complete the tailings investigation field work associated with the Fluid Tailings Management Report Requirements in section 6.2 of *Directive 085*, along with the related requirements in individual scheme approvals (in Imperial's case OSCA Approval No. 10829L, clause 30). In order for every Operator to complete their required tailings field investigations, these programs need to be coordinated and take the entire open water field season (Spring, Summer, Fall) to complete. This type of field work presents safety and technical challenges in the late fall, once temperatures are consistently below freezing where ice starts to form on the ponds and tailings start to freeze for the winter. For this reason, the current travel and social distancing restrictions, which could continue into the summer months, may reduce the overall amount of field work that can be completed by our third party contractor for all Oil Sands Operators.

In addition, once field work is completed, samples are sent for analysis and the availability of lab resources may also be affected due to the current public health emergency related to COVID-19.

Specifically, Imperial is requesting relief from collecting measured field data to support reported numbers related to the following requirements:

- *Directive 085*, *Section 6.2*:
    - annual fluid tailings volumes, as per the accounting table in appendix 3
    - change in fluid tailings volume inventory as a result of settling and consolidation
    - the volume and composition of each deposit containing fluid tailings (including the volume of fluid tailings, of treated and placed fluid tailings meeting RTR status, and of water)
    - chemical and physical properties of the treated fluid tailings and the water recovered from treatment
    - *Monitoring Reporting Data Requirements* (including representative cross-sections to illustrate the variation of tailings characteristics, the measured data on the chosen indicators and confirm performance against the chosen performance criteria; for those fluid tailings deposits that have met RTR status, data to support that it is trending appropriately)
- *OSCA Approval No. 10829L, clause 30*,
    - (a) for each treated tailings deposit, monitoring data including representative cross-sections to illustrate the variation of the following:
        - i) sands to fine ratio;
        - ii) effective stress;
        - iii) deposit consolidation;
        - iv) pore water pressure;
        - v) particle size distribution plot;
        - vi) any other parameter considered relevant by the Operator; and
        - vii) any other parameter specified by the AER.
- Field measurement methods described in *Kearl Directive 085 Measurement System Plan*
    - *2.0 Determination of Fluid Tailings* (use of CT09TM, cone penetration tests, ball penetration tests, vane shear tests)
    - *3.0 Key Measurement Methods and Parameters*
        - *3.1 Deposit Measurements (*volumetric surveys, measurement of pond bottom, measurement of mudline, measurement of water cap and water volume, material properties, fluid sampler and procedures, sonic sampler, Sharky sampler, gamma and gamma ball CPT, vane shear testing)
        - *3.2 Laboratory Tests* (bitumen, mineral and water; particle size distribution; methylene blue index test; water chemistry testing)
- Authorized Tailings Field Pilots
    - Inline Flocculation On-Site Tailings Pilot – Phase 2: The post-trial monitoring as part of the 2020 annual ETA monitoring program for the following parameters: insitu shear strength, solids content and SFR.
    - Tailings Pilot - Enhanced Beach Fines Capture by CO2 Injection into CST line: tailings deposit parameters including insitu fines content, solids content, SFR, density, shear strength, and porewater pressure dissipation (in areas that require an amphibious rig for access)

Imperial is proposing that for the 2020 Annual Kearl D085 Tailings Management Report, it relies on process stream data that is collected from installed online instrumentation and from tests on samples collected by site employees from available inline sampling points. This data, along with aerial survey data, available models, previously completed calibration and estimating techniques could be used to determine annual fluid tailings volumes and provide insight into deposit performance.

The collection (or absence) of tailings pond and deposit measurements in itself does not impact health, safety nor increase environmental impacts or environmental risk. Kearl's fluid tailings inventory is currently more than 40% below its fluid tailings profile, meaning that there is no risk of Kearl exceeding its fluid tailings profile in 2020, even if no fluid tailings generated in 2020 were assumed to be ready-to-reclaim.

In the event that Imperial is able to complete some tailings field data collection in 2020, even in the event of receiving a full waiver, this data will be reported to the AER and provided in the 2020 Annual Tailings Management Report.

Imperial would be more than willing to meet with the AER to further discuss this waiver request. If additional information is required, please contact Jennifer Haverhals, Senior Environment and Regulatory Advisor, at (587) 476-2555 or jennifer.r.haverhals@esso.ca.

Sincerely,

Greg Forgeron
Kearl Operations Integrity Manager

Cc: Eric Chiu, AER
industry.relief@aer.ca
Scott Cebula, Imperial
Greg Forgeron, Imperial

Appendix D Imperial Oil Resource Ltd. – Kearl Mine Covid -19 Relief Request – Tailings Field Investigation Program Variance

Alberta Energy Regulator

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

www.aer.ca

May 26, 2020

By e-mail only

Jennifer R Haverhals

Senior Regulatory Advisor
505 Quarry Park Blvd SE,
P.O. Box 2480, Stn. M, Calgary, AB,
T2P 3M9

E-mail: jennifer.r.haverhals@esso.ca

IMPERIAL OIL RESOURCE LTD. – KEARL MINE
COVID -19 RELIEF REQUEST – TAILINGS FIELD INVESTIGATION PROGRAM VARIANCE

Dear Ms. Haverhals,

The Alberta Energy Regulator (AER) has reviewed Imperial Oil Resource Ltd.'s (Imperial's) request for COVID-19 relief submitted on April 15th and the follow up request on May 21st. The AER understands Imperial is requesting relief from collecting measured field data to support reported numbers related to the following requirements:

- *Directive 085*, Section 6.2;
- Oil Sands Conservation Act Approval No. 10829L, clause 30;
- Field measurement methods described in Kearl *Directive 085* Measurement System Plan; and
- Authorized Tailings Field Pilots.

The AER announced an industry relief and published its decision on May 20th, 2020 on the AER website. As a result of the announced, the AER provides the following direction:

- The AER understands, Imperial proposes for its 2020 tailings compliance report, to rely on process stream data collected from installed online instrumentation and tests on samples from inline sampling points. Imperial will utilize this data, along with aerial survey data, available models, previously completed calibration and estimating techniques to determine annual fluid tailings volumes and provide insight into deposit performance. This information will form the basis of the 2020 tailings compliance reporting due **April 30th, 2021**. The AER also understands, in the event that Imperial is able to complete tailings field data collection in 2020, it will report this data to the AER in its 2020 tailings compliance report. As a result, the AER accepts Imperial's proposed variances to their measurement plans for the 2020 tailings field investigation program.

If you have any questions or concerns, contact me at 403-297-2269 or Paul.Aguas@aer.ca

Sincerely,

Paul Aguas,
Manager of Oil Sands East, Regulatory Applications

cc: Eric Chiu, AER