8-A.1: Mine Waste Rock and Tailings Management Plan

ADDENDUM

AGNICO EAGLE

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Plan / Version:	Mine Waste Rock and Tailings Management Plan	Version WT; June 2016
NIRB Requirement:	Project Certificate No. 004	**Condition:** not applicable
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Addendum:		

Section Change	**Specify: Update or New**	**Details**
Appendix 2	New	WT Addendum

AGNICO EAGLE

Meadowbank Division

Mine Waste Rock and Tailings Management Plan – Whale Tail Pit Addendum

JUNE 2016

VERSION WT

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) is proposing to develop the Whale Tail Pit and Haul Road Project (Project), a satellite deposit located on the Amaruq property, to continue mine operations and milling at Meadowbank Mine.

The proposed open pit mine, mined by truck-and-shovel operation, will produce 8.3 million tonnes (Mt) of ore, 46.1 Mt of waste rock, and 5.6 Mt of overburden waste. There are four phases to the development: 1 year of construction, 3 years of mine operations, 8 years of closure, and the post-closure period. According to the Whale Tail Pit Life of Mine (LOM) calculation, the addition of the Whale Tail Pit to the actual Meadowbank LOM (LOM 2015) will generate an addition of approximately 8.3 Mt (dry) of tailings to the Meadowbank Tailings Storage Facility (TSF) for a total of 35.4 Mt.

Project mining facilities include accommodation buildings; two ore stockpiles; one overburden stockpile; one waste rock storage facility (WRSF) area planned to receive waste rock and waste overburden; a water management system that includes collection ponds, water diversion channels, and retention dikes/berms; and a Water Treatment Plant.

One area, located north-west of the open pit, has been identified as the Whale Tail WRSF. Waste rock and overburden will be trucked to the Whale Tail WRSF until the end of mine operations, with distribution according to the operations schedule. Waste rock and overburden will be co-disposed together in one of the two piles constituting the Whale Tail WRSF area. Results of geochemical testing indicate that approximately 73% of the waste rock and overburden produced is potentially acid generating and/or metal leaching. The remaining 27% is non-potentially acid generating and non-metal leaching and can be used as construction material for pads, roads, water management infrastructures, and reclamation. Closure of the Whale Tail WRSF will begin when practical as part of the progressive reclamation program. The Whale Tail WRSF will be covered with non-potentially acid generating and non-metal leaching waste rock to promote freezing as a control strategy against acid generation and migration of contaminants. Thermistors will be installed within the Whale Tail WRSF to monitor permafrost development.

Ore will be stockpiled on the three Ore Stockpiles planned for the Project. Ore is potentially acid generating. The Ore Stockpiles will be reclaimed at the end of the operations.

The Whale Tail WRSF and the Ore Stockpiles were designed to minimize the impact on the environment and to consider geotechnical and geochemical stability. The surface runoff and seepage water from these facilities will be collected in water collection ponds as part of the water management strategy. If water quality does not meet the discharge criteria as per the Water Licence requirement, the collected water will be treated prior to being discharged to the outside environment.

Tailings from the Project will be stored in the Meadowbank TSF, which consists of a North Cell and South Cell located within the basin of the former north-west arm of Second Portage Lake previously dewatered to allow mining in the Portage Pit. To store the full volume of tailings from processing of the Whale Tail Pit ore, Agnico Eagle will maximize storage in South cell through the deposition of approximately 5.3 Mt of tailings, and is proposing to construct internal dike structures to store the remaining 3 Mt within the current footprint of the North Cell.

The tailings deposition plan has been optimized to target tailings deposition in the North Cell TSF during summer, and in the South Cell TSF during winter to reduce the impact of cold climate on the tailings dry density. Tailings deposition within the North Cell raise will continue as a sub-aerially slurry placement, and water from the pond will be reclaimed during operations. The current tailings deposition strategy is to build beaches against the face of the perimeter dikes to eliminate ponding and ultimately produce a tailings surface that directs drainage towards the western abutment of the Stormwater Dike.

The control strategy to minimize water infiltration into the TSF and the migration of constituents out of the facility in closure and post-closure includes freeze control of the tailings through permafrost encapsulation. Consistent with approved interim closure plans for Meadowbank, a minimum of a 2-metre thick cover of non-potentially acid generating rockfill will be placed over the tailings as an insulating convective layer to confine the active layer within relatively inert materials. The final thickness of the rockfill cover layer will be confirmed in the final closure design based on thermal monitoring to be completed during operations.

Pit flooding volumes and sequencing (including Portage, Goose, and Vault pits) updated for the revised mining schedule including Whale Tail Pit are presented in this report. An updated water quality forecasting model is also presented in this report. Based on the modelling results, copper, selenium, and total nitrogen may require removal treatment in order for the pit water quality to meet Canadian Council of Ministers of the Environment criteria prior to dike breaching in 2029.

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Version	Date (YM)	Section	Page	Revision
1	May 2016	ALL	-	
Rev 1	05-04-2016	Tailings Section	-	T Lepine, F Petrucci, R Vanengen
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ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited – Meadowbank Division
ARD	Acid Rock Drainage
CCME	Canadian Council of Ministers of the Environment
FEIS	Final Environmental Impact Statement
IPCC	Intergovernmental Panel on Climate Change
LOM	Life of Mine
ML	Metal Leaching
NML	Non-Metal Leaching
NPAG	Non-Potentially Acid Generating
NWB	Nunavut Water Board
PAG	Potentially Acid Generating
PGA	peak ground acceleration
Project	Whale Tail Pit and Haul Road Project
SWD	Stormwater Dike
TSF	Tailings Storage Facility
WRSF	Waste Rock Storage Facility
WTP	Water Treatment Plant

UNITS

%	percent
°C	degrees Celsius
°C/m	degrees Celsius per metre
g	gram
ha	hectare
km	kilometre(s)
km^2	square kilometre(s)
m	metre
masl	metre above sea level
mm	millimetre
m^3	cubic metre(s)
m^3/hr	cubic metre(s) per hour
Mm^3	million cubic metre(s)
Mt	million tonne(s)
t	tonne
t/day	tonne(s) per day
t/m^3	tonne(s) per cubic metre

SECTION 1 • INTRODUCTION

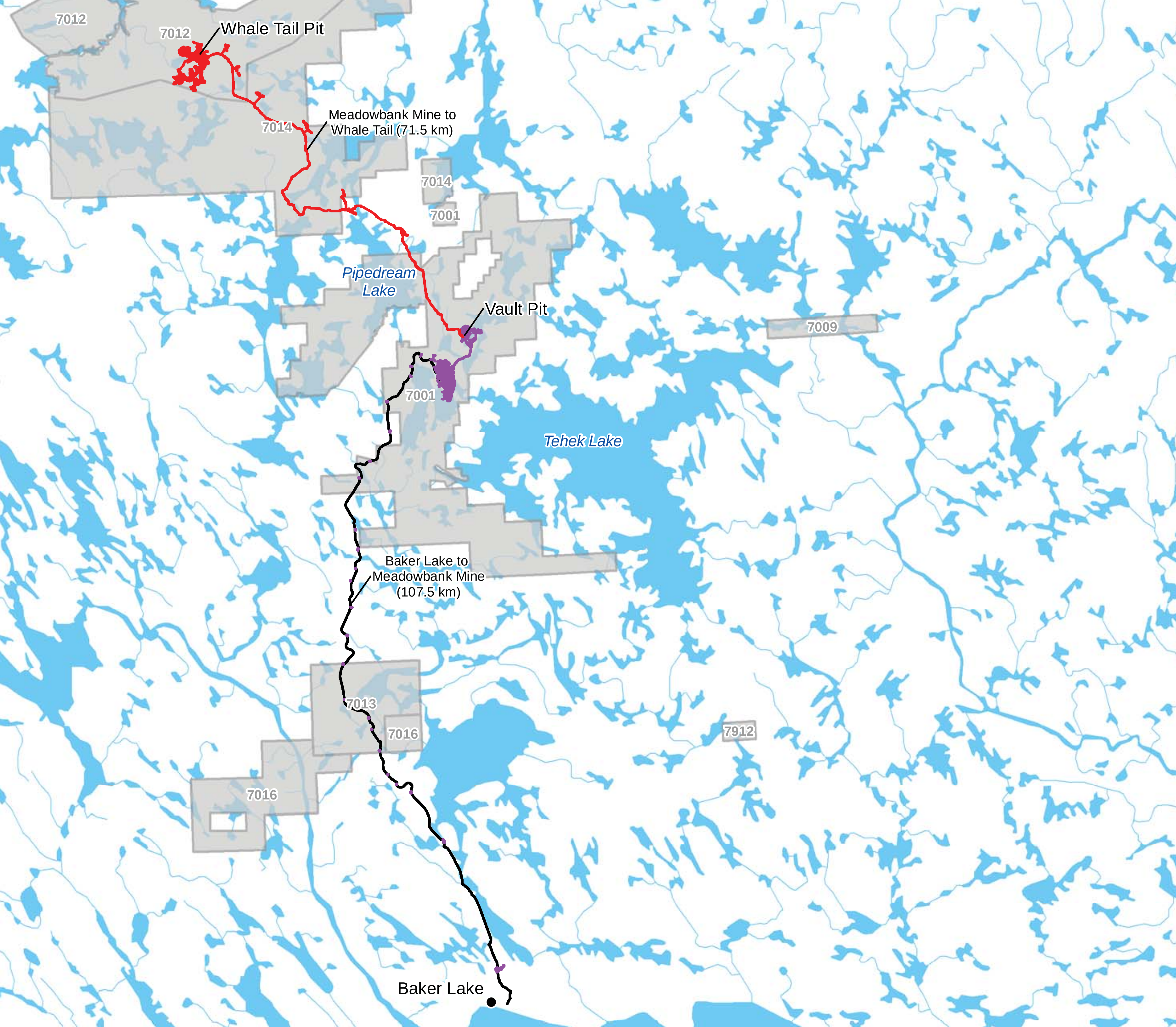
Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) is proposing to develop the Whale Tail Pit and Haul Road Project (Project), a satellite deposit located on the Amaruq property, to continue mine operations and milling at Meadowbank Mine. Agnico Eagle is seeking approval to extend Meadowbank Mine to include development of resources from Whale Tail Pit. Concurrent with the reconsideration of the Project Certificate by the Nunavut Impact Review Board, Agnico Eagle is seeking from the Nunavut Water Board (NWB) an amendment to Meadowbank Mine Type A Water Licence (No. 2AM-MEA1525) to include mining of Whale Tail Pit and construction and operations of associated infrastructure.

The Amaruq property is a 408 square kilometre (km^2) site located on Inuit Owned Land approximately 150 kilometres (km) north of the hamlet of Baker Lake and approximately 50 km northwest of Meadowbank Mine in the Kivalliq Region of Nunavut. The deposit will be mined as an open pit (i.e., Whale Tail Pit), and ore will be hauled to the approved infrastructure at Meadowbank Mine for milling.

The proposed open pit mine, mined by truck-and-shovel operation, will produce 8.3 million tonnes (Mt) of ore, 46.1 Mt of waste rock, and 5.6 Mt of overburden waste. There are four phases to the development: 1 year of construction, 3 years of mine operations, 8 years of closure, and the post-closure period.

The general mine site location for the Project and a site layout plan are shown in Figure 1.1. The mine development will include the following major infrastructure:

- industrial area (camp and garage);
- crusher;
- ore stockpiles;
- rock and overburden storage facilities;
- landfill;
- haul and access roads;
- open pit mine; and
- water dewatering dikes.



MEADOWBANK
CLAIM BOUNDA
WATERCOURSE
WATERBODY

REFERENCE
1. HAUL ROAD OBTAINED
FROM 6103-117-230-200_R
2. CLAIM BOUNDARIES OB
3. WATERCOURSE AND W
NATURAL RESOURCES CA
4. INSET MAP DATA OBTAI
DATUM: NAD 83 CSRS PRO

PROJECT
AGNICO EAGLE
TITLE
LOCA

This document presents the Mine Waste Rock and Tailings Management Plan (the Plan) to support the application to amend the NWB Type A Water Licence to include Whale Tail Pit. Upon approval, this will meet the requirements of the Type A Water Licence Part B General Conditions – Item 13.u. The purpose of the Plan is to provide consolidated information on the management of tailings, ore stockpiled on site, waste rock and overburden, including strategies for runoff and dust control and monitoring programs for the storage facilities. Also included within the Plan, is updated pit flooding volumes, sequencing and water quality estimates (including Portage, Goose, and Vault pits) to account for the revised mining schedule including Whale Tail Pit are presented in this report. It is important to note that as the ore will be transported and processed at Meadowbank Mine, and resulting tailings will be stored within the existing Meadowbank tailings storage facility (TSF) (Figure 1.2).

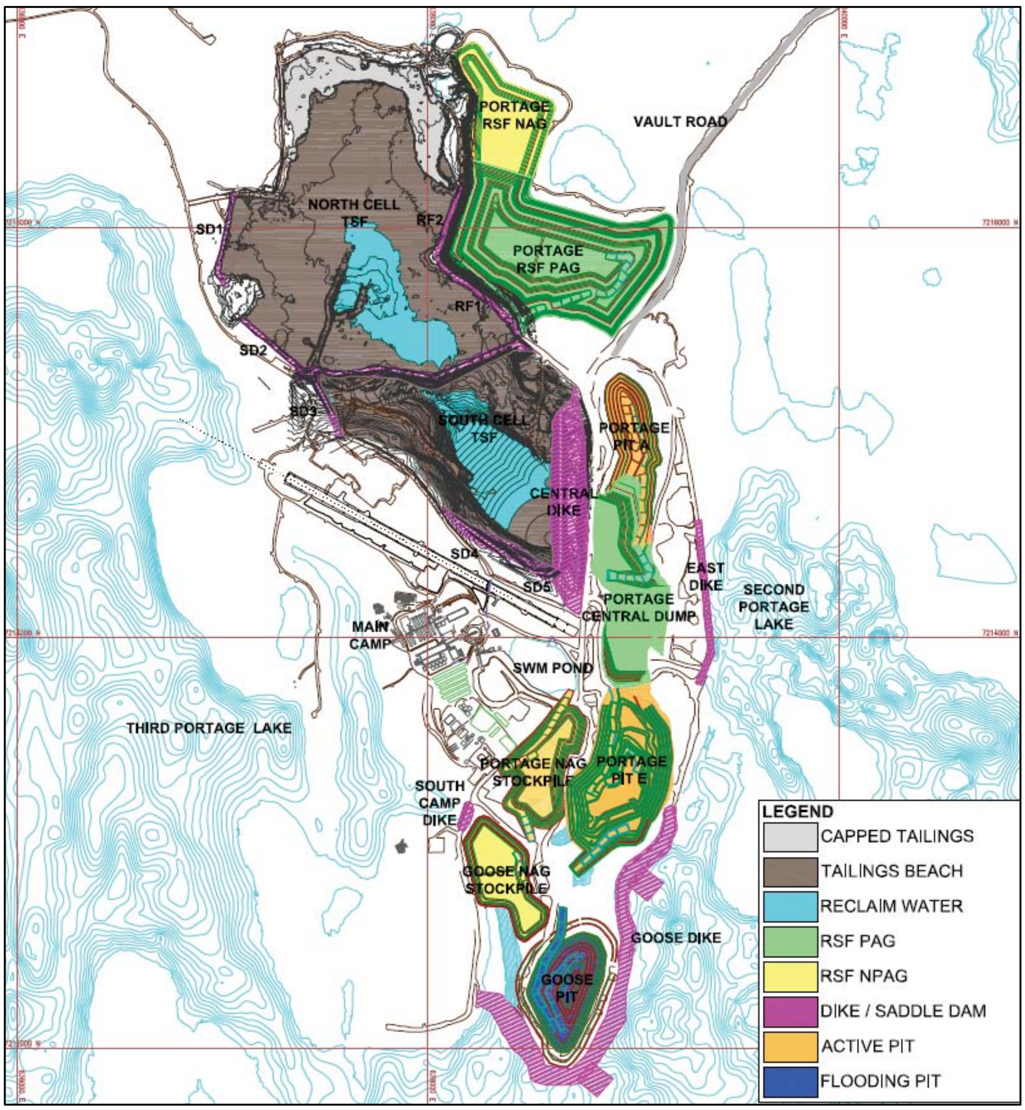


Figure 2.2 Meadowbank Tailings Storage Facility

SECTION 2 • BACKGROUND INFORMATION

2.1 Meadowbank Mine Operations

The Meadowbank Mine consists of various pits (Goose, Portage, Vault, Phaser, and BB Phaser pits), two Waste Rock Storage Facilities (WRSFs) (Portage and Vault), the Meadowbank Mill, Meadowbank camp, and the Meadowbank TSF. Mining of Portage Pit began in early 2010 and operated as a truck-and-shovel open pit operation under the terms established by the Type A Water Licence. As a requirement of the Type A Water Licence, any modifications to the dewatering process, LOM, TSF, and any other aspect associated to the water management at Meadowbank are adhered to and updated in the annual submission of the Meadowbank Water Management Plan and associated water balance. According to the current reserve at Meadowbank, and in the absence of Whale Tail Pit, operations within the approved Meadowbank TSF are scheduled to cease in Q3 2018 with closure and post-closure activities occurring thereafter.

2.2 Whale Tail Pit Mine Operations

The construction phase is anticipated to start in the second quarter of Year -1 (2018) and focus on site preparation and the construction of infrastructure, with the development of a quarry (Quarry 2) located in the open pit to produce construction material. The operations (mining and ore processing) will continue approximately 3 years, from Year 1 (2019) to Year 4 (2022), with a rate of extraction targeted between 9,000 and 12,000 tonnes per day (t/day) of ore at an average stripping ratio of 6,25. Mining activities are expected to end in Year 3 (2021) and ore processing is expected to end during the first quarter of Year 4 (2022). Closure will occur from Year 4 (2022) to Year 11 (2029) after the completion of mining and will include removal of the non-essential site infrastructure and flooding of the mined-out open pit, as well as reestablishment of the natural Whale Tail Lake level. Post-closure and monitoring phases will commence as closure is completed in Year 11 (2029) and will continue until Year 15 (2034) or it is shown that the site and water quality meets regulatory closure objectives. Table 2.1 summarizes the Project timeline and general activities.

Table 2.1 Overview of Timeline and General Activities

Phase	Year	General Activities
Construction	Year -1	• Construct site infrastructure • Develop open pit mine • Stockpile ore
Operations	Year 1 to 3	• Open pit operations • Transport ore to Meadowbank Mine • Stockpile ore • Discharge Tailings in Meadowbank TSF
	Year 4	• Complete transportation of ore to Meadowbank Mine • Complete discharge tailings in Meadowbank TSF
Closure	Year 4 to 11	• Remove non-essential site infrastructure • Flood mined-out open pit • Re-establish natural Whale Tail Lake level
Post-Closure	Year 11 forwards	• Site and surrounding environment monitoring

TSF = Tailings Storage Facility

2.3 Whale Tail Pit Site Layout

Site layouts are presented in Appendix A.

2.4 Climate

Climate characteristics presented herein were extracted from the permitting level engineering report (SNC 2015).

The Project is located in an arid arctic environment that experiences extreme winter conditions, with an annual mean temperature of -11.3 degrees Celsius (°C). The monthly mean temperature ranges from -31.3°C in January to 11.6°C in June, with above-freezing mean temperatures from June to September. The annual mean total precipitation at the Project is 249 millimetres (mm), with 59 percent (%) of precipitation falling as rain, and 41% falling as snow. Mean annual losses were estimated to be 248 mm for lake evaporation, 80 mm for evapotranspiration, and 72 mm for sublimation. Mean annual temperature, precipitation, and losses characteristics are presented in Table 2.2.

Short-duration rainfall events representative of the Project are presented in Table 2.3, based on intensity-duration-frequency curves available from the Baker Lake A meteorological station (Station ID 2300500) operated by the Government of Canada (2015).

Table 2.2 Estimated Mine Site Monthly Mean Climate Characteristics

Month[a]	Mean Air Temperature (°C) [a]	Monthly Precipitation (mm) [a]			Losses [a]		
		Rainfall (mm)	Snowfall Water Equivalent (mm)	Total Precipitation (mm)	Lake Evaporation (mm)	Evapo-transpiration (mm)	Snow Sublimation (mm)
January	-31.3	0	7	7	0	0	9
February	-31.1	0	6	6	0	0	9
March	-26.3	0	9	9	0	0	9
April	-17.0	0	13	13	0	0	9
May	-6.4	5	8	13	0	0	9
June	4.9	18	3	21	9	3	0
July	11.6	39	0	39	99	32	0
August	9.8	42	1	43	100	32	0
September	3.1	35	7	42	40	13	0
October	-6.5	6	22	28	0	0	9
November	-19.3	0	17	17	0	0	9
December	-26.8	0	10	10	0	0	9
Annual	**-11.3**	**146**	**103**	**249**	**248**	**80**	**72**

[a] SNC (2015).

mm = millimetre; °C = degrees Celsius.

Table 2.3 Estimated Mine Site Extreme 24-Hour Rainfall Events

Return Period (Years) [a]	24-hour Precipitation (mm) [a]
2	27
5	40
10	48
25	57
50	67
100	75
1000	101

[a] SNC (2015).

mm = millimetre.

2.5 Climate Change

Climate change information presented herein was extracted from the Final Environmental Impact Statement (FEIS) Amendment, Volume 4, Section 4.2.

The climate in the Arctic is changing faster than at mid-latitudes (IPCC 2014). The most recent set of climate model projections (CMIP5) predict an Arctic-wide year 2100 multi-model mean temperature increase of +13°C in late fall and +5°C in late spring under the Intergovernmental Panel on Climate Change (IPCC)'s "business as usual scenario" (RCP8.5). IPCC climate change mitigation scenario RCP4.5 results in a year 2100 multi-model Arctic wide prediction of +7°C in late fall and +3°C in late spring (Overland et al. 2013). The effects of changes of this magnitude to terrestrial, aquatic and marine ecosystems, and social and economic systems of the Arctic are an active area of research. However, due to the short duration of the proposed Project, climate change related effects to the Project are likely negligible.

2.6 Permafrost

The mine site is located in an area of continuous permafrost, as shown on Figure 2.1. Based on measurements of ground temperatures (Knight Piésold 2015), the depth of permafrost at the mine site is estimated to be in the order of 425 metres (m) outside of the influence of waterbodies. The depth of the permafrost and active layer will vary based on proximity to the lakes, overburden thickness, vegetation, climate conditions, and slope direction. The typical depth of the active layer is 2 m in this region of Canada. The typical permafrost ground temperatures at the depths of zero annual amplitude (typically at the depth of below 15 m) is approximately -8.0 °C in areas away from lakes and streams. The geothermal gradient measured is 0.02 degrees Celsius per metre (°C/m) (Knight Piésold 2015). Late-winter ice thickness on freshwater lakes is approximately 2.0 m. Ice covers usually appear by the end of October and are completely formed in early November. The spring ice melt typically begins in mid-June and is complete by early July.

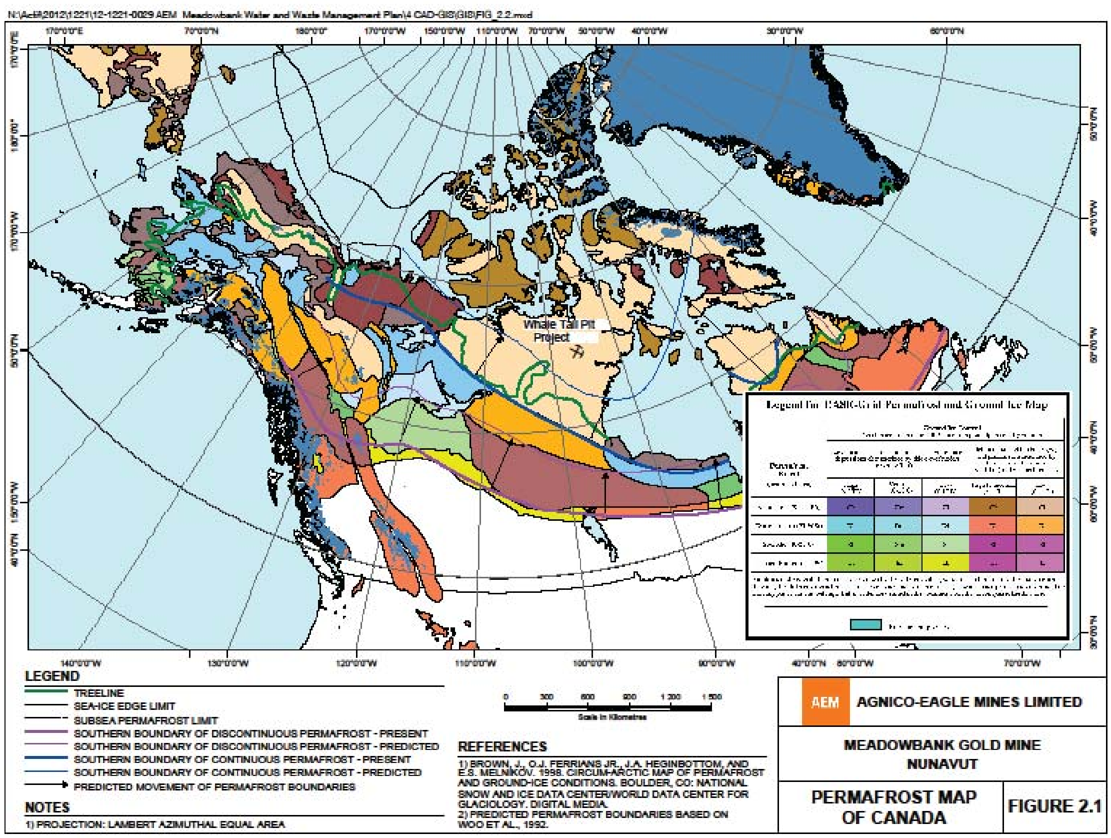


Figure 2.3 Permafrost Map of Canada

2.7 Seismic Zone

The mine site is situated in an area of low seismic risk. The peak ground acceleration (PGA) for the area was estimated using the seismic hazard calculator from the 2010 National Building Code of Canada website (http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/index_2010-eng.php). The estimated PGA is 0.019 grams (g) for a 5% in 50-year probability of exceedance (0.001 per annum or 1 in 1,000 year return) and 0.036 g for a 2% in 50-year probability of exceedance (0.000404 per annum or 1 in 2,475 year return) for the area.

SECTION 3 • WHALE TAIL PIT DEVELOPMENT PLAN

3.1 Whale Tail Pit Life of Mine

Several LOM scenarios were analysed by Agnico Eagle, which ultimately retained the best one based on economic viability of the Project. The chosen scenario is not expected to change significantly from that existing at Meadowbank, and will remain on average 9,000 t/day and up to a peak mill throughput of 12,000 t/day (which is the current rate capacity at Meadowbank Mill). Milling will end as the maximum capacity of the current TSF is reached (8.3 Mt). Table 3.1 summarizes the Whale Tail Pit LOM.

Table 3.1 Projected Whale Tail Pit Mined Tonnages

Year	Period	Ore Mined (t)	Ore Processed in Mill (t)	Production Days
2018		160,020	-	-
2019	Q1	366,229	-	184
	Q2	610,012	-	
	Q3	418,663	821,250	
	Q4	895,072	821,250	
2020	Q1	800,463	821,250	366
	Q2	931,458	821,250	
	Q3	763,882	821,250	
	Q4	856,512	821,250	
2021		2,476,834	3,285,000	365
2022		0	66,644	8
Total		**8,279,144**	**8,279,144**	**923**

t = tonne.

As an extension of the current Meadowbank LOM, the Whale Tale Pit deposition plan is proposed to be a continuation of the current Meadowbank deposition plan according to the Whale Tail Pit production rates and mill feed presented in Table 3.1. Completion of the Meadowbank LOM milling activities will occur in Q3 2018.

The tailings management plan presented in Section 8.5 focuses on the year 2019 to 2022 and presents only the tailings management strategy required for the extension of the Meadowbank actual LOM to accommodate Whale Tail Pit tailings.

3.2 Mine Waste Production Sequence

Two mine waste streams will be produced at Whale Tail Pit, waste rock and overburden. A third mine waste stream, tailings, will be produced at Meadowbank Mine. Approximately 46.1 Mt of waste rock, 5.6 Mt of overburden, and 8.3 Mt of tailings (or mined ore) will be generated by the Project (Tables 3.2 and 3.3).

The term “waste rock” designates all fragmented rock mass that has no economic value and needs to be stored separately. Waste rock is also commonly referred to as “mine rock” in the mining industry. Typically, waste rock is produced during the initial stripping and the subsequent development of open pits and underground workings.

The term “overburden” designates all soils above the bedrock that needs to be stripped at surface prior to developing the open pits. Generally, the overburden at the site consists of a thin layer of organic material overlying a layer of non-cohesive soil with variable amounts of silt, sand, and gravel.

Tailings are the processed material by-product of the gold recovery process and generally comprise water with gravel, sand, silt, and clay sized particles.

Table 3.2 Projected Mined Tonnages and Ore Stockpile Balance (2018 – 2022)

Year	Period	Ore Mined (t)	Waste Rock Excavated (t)	Overburden Excavated (t)	Total Material Excavated (t)	Total Material Excavated (t/day)	Strip ratio	Ore Stockpile Balance (t)
2018	June to Sept.	-	400,782	610,973	1,011,754	8,431	-	-
	Q4	160,020	1,080,812	807,105	2,047,937	22,260	11.80	160,020
	Sub-total	**160,020**	**1,481,594**	**1,418,078**	**3,059,691**	**14,433**	**18.12**	**160,020**
2019	Q1	366,229	1,905,908	820,072	3,092,209	33,980	7.44	526,249
	Q2	610,012	2,299,406	122,351	3,031,769	33,316	3.97	1,136,261
	Q3	418,663	4,307,676	2,350,185	7,076,524	77,764	15.90	733,674
	Q4	895,072	5,284,473	826,373	7,005,917	76,988	6.83	807,495
	Sub-total	**2,289,976**	**13,797,463**	**4,118,981**	**20,206,420**	**55,360**	**7.82**	**807,495**
2020	Q1	800,463	6,111,564	81,160	6,993,187	76,848	7.74	786,709
	Q2	931,458	5,816,680	139	6,748,277	74,157	6.24	896,916
	Q3	763,882	5,120,892	0	5,884,773	64,668	6.70	839,548
	Q4	856,512	4,455,358	0	5,311,869	58,372	5.20	874,809
	Sub-total	**3,352,314**	**21,504,494**	**81,300**	**24,938,107**	**68,324**	**6.44**	**874,809**
2021		**2,476,834**	**9,320,843**	**0**	**11,797,677**	**32,322**	**3.76**	**66,644**
2022		**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total		**8,279,144**	**46,104,394**	**5,618,359**	**60,001,895**		**6.25**	**0**

t = tonne; t/day = tonnes per day.

The proposed usage or destination of the three mine waste materials is presented in Table 3.3. Further details on the management of the mine waste materials are presented in Sections 5, 6, and 8 of this Plan.

The site layouts presented in Appendix A show the evolution of the site in 2018, 2019, 2022, and 2029. Most of the waste rock excavated in 2018 from Quarry 2 will be used for the construction of the water management structures, the infrastructures pads, and the access roads (Table 3.4). During the Year 1 (2019) and the Year 2 (2020), the remaining required facilities for the operations will be completed.

Table 3.3 Summary of Mine Waste Tonnage and Destination

Mine Waste Stream	Estimated Quantities	Waste Destination
Overburden	5.6 Mt	• Temporary storage West of Whale Tail Lake (~ 0.1 Mt for operations) • Co-disposed with waste rock in Whale Tail WRSF
Waste Rock	46.1 Mt	• Construction material • Whale Tail WRSF • Closure and site reclamation
Tailings	8.3 Mt	• As slurry tailings placed in the TSF (Meadowbank Mine)

Mt = million tonnes; TSF = Tailings Storage Facility; WRSF = Waste Rock Storage Facility.

Table 3.4 Projected Waste Rock Tonnages Used for Construction (2018 – 2022)

Year	Period	Waste Rock and Overburden Excavated (t)	Waste Rock Used for Pad Construction (t)	Waste Rock Used for Road Construction (t)	Waste Rock Used for Water Management Structures (t)	Waste Rock and Overburden Stored in Whale Tail WRSF (t)
2018	June to Sept.	1 011 755	356 435	103 658	512 900	38 762
	Q4	1 887 917	150 949	1 364	192 082	1 543 522
	Sub-total	**2 899 672**	**507 384**	**105 022**	**704 982**	**1 582 284**
2019	Q1	2 725 980	0	94 625	154 608	2 476 747
	Q2	2 421 757	143 155	201 321	8 656	2 068 625
	Q3	6 657 861	20 877	0	40 041	6 596 943
	Q4	6 110 846	0	85 722	0	6 025 124
	Sub-total	**17 916 444**	**164 032**	**381 668**	**203 306**	**17 167 439**
2020	Q1	6 192 725	0	0	3 624	6 189 101
	Q2	5 816 820	0	0	0	5 816 820
	Q3	5 120 892	0	0	0	5 120 892
	Q4	4 455 358	0	0	0	4 455 358
	Sub-total	**21 585 794**	**0**	**0**	**3 624**	**21 582 170**
2021		**9 320 843**	**0**	**0**	**0**	**9 320 843**
2022		**0**	**0**	**0**	**0**	**0**
Total		**51 722 752**	**671 416**	**486 689**	**911 912**	**49 652 736**

t = tonne; WRSF = Waste Rock Storage Facility.

Over the LOM, non-potentially acid generating (NPAG)/non-metal leaching (NML) and potentially acid generating (PAG) waste rock will be segregated according to the requirement for construction (see the Operational Acid Rock Drainage (ARD)/ Metal Leaching (ML) Testing and Sampling Plan) and capping of the Whale Tail WRSF (see Section 6).

SECTION 5 • WHALE TAIL PIT OVERBURDEN MATERIALS

A detailed description of soils in the Project footprint is presented in FEIS Volume 5, Section 5.3 - Terrain, Permafrost, and Soils. Soils in the Project footprint are predominantly coarse to moderately coarse-textured glacial till and colluvium with high coarse fragment content commonly overlying bedrock at shallow depths (less than 1 m). Soils are dominated by Cryosols which develop on till dominated landscapes. Saturated soil layers overlying frozen layers have been observed on site. Other soils identified include Brunisols which are most prevalent on glaciofluvial material (e.g., eskers), Gleysols which develop on till in transition areas between upland and depressional landscape positions, and Regosols which are poorly developed soils. Organic Cryosolic soils have been found in wetlands.

Field results suggest that the mineral soils are predominantly acidic to neutral, ranging from pH 5.14 to 6.96, with pH tending to increase with soil depth (FEIS Amendment Volume 5, Appendix 5-A, Appendix E). Due to their mineralogy, the mineral soils in the Project area are increasingly sensitive to adverse effects due to acid deposition with decreasing baseline pH. Soils in the Project footprint are generally not susceptible to compaction. Soils prone to compaction are limited to low-lying, imperfectly and poorly drained areas where the clay content of soils is slightly higher.

Most soils in the Project area are rated as having moderate erosion potential, with the exception of areas with morainal blankets or colluvial deposits on slopes greater than 60%, and areas containing glaciofluvial soils. In areas of gullied or dissected terrain, the erosion potential would increase.

There is a level of uncertainty associated with the location of ice-rich permafrost within the Project footprint as no detailed permafrost studies regarding the thickness of the active layer or the ice content of the soils were completed for this area. It is assumed that ground ice content is between 0 and 10% as suggested by Heginbottom et al. (1995).

A chemical characterization program investigated the geo-environmental properties of surficial overburden and Whale Tail Lake sediments. Static geochemistry tests, mineralogy and kinetic leaching tests were carried out to investigate the reactivity of these materials with respect to their potential to generate ARD and to release metals (metal leaching or ML) to the receiving environment. The surficial overburden, as described in FEIS Amendment Volume 5, Appendix 5-E, is NPAG and has low leachability but the fines portion of the material could be amenable to erosion and transport as suspended solids in contact water.

The overburden expected to be excavated over the LOM is presented in the Table 3.2. According to Meadowbank Mine experience, lakebeds will consist of water saturated and soft soils. The remainder of the overburden materials will consist of till excavated on land. Some of the till or till-like material (approximately 100,000 t) is expected to be used during operations and will be temporarily stockpiled on the Overburden Storage pad (having approximate footprint of

3.2 hectares [ha]) near Whale Tail Dike and where the contact runoff will naturally flow into the Whale Tail Attenuation Pond. The remaining 5.5 Mt of overburden will be piled at the base of the Whale Tail WRSF and surrounded with waste rock in order to stabilize the material (see Figure A.1 in Appendix A). All the overburden stockpiled in the Whale Tail WRSF will be eventually covered with waste rock.

SECTION 6 • WHALE TAIL PIT WASTE ROCK

The location of the Whale Tail WRSF took into consideration the following environmental, social, economic, and technical aspects of waste rock management:

- minimize the overall footprint of the Whale Tail WRSF to the extent practicable while maintaining the short-term and long-term stability of the facilities;
- avoid or minimize impact to adjacent fish bearing lakes;
- minimize the haul distance from the open pit to the Whale Tail WRSF;
- minimize the number of the water catchment areas potentially affected by drainage from the Whale Tail WRSF;
- when feasible, divert upstream clean natural non-contact run-on water away from the Whale Tail WRSF; and
- facilitate the collection and management of the contact water from the Whale Tail WRSF during mine operations to avoid potentially negative impacts on the surrounding environment.

The area selected for the storage of waste rock and overburden materials is shown in Figures A.1 to A.4 of Appendix A. This area has an approximate footprint of 110 ha. Waste rock and overburden from the Whale Tail Pit not used for site development purposes, will be trucked to the Whale Tail WRSF until the end of mine operations.

6.1 Waste Rock Properties

A chemical characterisation program investigated the geo-environmental properties of waste rock and ore at the Project (FEIS Amendment Volume 5, Appendix 5-E). Static geochemistry tests, mineralogy and kinetic leaching tests were carried out to investigate the reactivity of these materials with respect to their potential to generate ARD and to release metals (ML) to the receiving environment.

The Whale Tail deposit mineralization is low sulphur but the sulphur carries arsenic which is enriched in all waste rock types. Arsenic, sulphur, and carbonate-buffering capacity are the parameters of environmental interest present in mining wastes.

Most of the waste rock lithologies to be disturbed by mining are NPAG including: ultramafic, iron formation, mafic volcanic, southern greywacke and intermediate intrusive units. Together, these lithologies comprise approximately 73% of the waste rock (33.6 Mt). These units will not require means to control ARD. Of these, however, 46% (ultramafic and iron formation units) and some of the lake sediments leach arsenic in static and kinetic leaching tests at concentrations that exceed the Meadowbank Mine (Portage) effluent criterion. The mafic volcanic lithology can leach elevated arsenic at the contact with the ultramafic and greywacke units, however the bulk of the samples have low arsenic content and release arsenic at low concentrations. This does not necessarily infer future water quality exceedances at site but contact water will need to be monitored before discharge to the receiving environment.

The southern greywacke, the bulk of the mafic volcanic waste rock units away from the contacts of greywacke and ultramafic rock, and the intermediate intrusive within the open pit are NPAG and have low leachability. These units represent approximately 27% of the waste rock (12.4 Mt), and will not require environmental control in the short or long-term. As such, they are targeted for use as construction materials on site, as cover material for the Whale Tail WRSF and as reclamation material.

The ore and the central greywacke and chert waste rock are PAG. Chert and central greywacke represent 27% of waste rock to be generated by mining (12.4 Mt). They are silicified, have a lower buffering capacity and a higher sulphur content than the southern greywacke and other NPAG waste rock. The PAG waste rock also leaches arsenic but at concentrations that are well below the Portage effluent criterion. Based on results to date, a sulphur content of 0.1 wt% appears to be a suitable cut-off criteria below which chert and greywacke waste rock are NPAG.

Kinetic leaching tests, mineral depletion calculations and consideration of the scale and site differences between laboratory tests and field conditions suggest a time lag to possible ARD development at site of more than a decade. Upper tier ARD materials (high sulphur/low buffering capacity greywacke or chert waste rock) generated acidic drainage earlier but without the benefit of added buffering capacity from mixing with other NPAG rock piles. The delay to onset of ARD from the bulk of PAG waste rock and ore is expected to be substantially longer than the seven years of mine construction, operations, and closure. Accordingly, ARD control mechanisms for PAG materials can be implemented at the end of mining operations.

6.2 Whale Tail Waste Rock Storage Facility Management

Seepage and runoff water from the Whale Tail WRSF will be managed by a combination of water retention dikes and water collection ponds (Whale Tail WRSF Pond and Whale Tail Attenuation Pond). If water quality does not meet discharge criteria, contact water in the water collection ponds will be treated at the Whale Tail WTP prior to discharge to the outside environment.

The Whale Tail WRSF was located considering advantageous topography in the form of a gentle valley presenting one low topographic point near Mammoth Lake where a contact water pond will be built. Only one low topographic point is observed north of the Whale Tail WRSF where potential runoff could escape from the Whale Tail WRSF footprint. As part of the surrounding road, a saddle dam will be constructed at this location to avoid contamination of the sub-watershed located northward of the Whale Tail WRSF.

The construction of Whale Tail WRSF Pond (Whale Tail WRSF Dike) and Whale Tail Attenuation Pond (Whale Tail Dike) are among the most important water management infrastructure for the Project.

These ponds and accompanying dikes will be built as soon as licenses and permits for the Project are approved. The source of construction material for these facilities will be the open pit (Quarry 2) where NPAG and NML rocks are located. The overburden from the quarry will be removed and stockpiled in the Whale Tail WRSF. During the construction, berms and sumps will be built inside the footprint of the Whale Tail WRSF area if required to limit seepage and runoff from overburden and waste rock. As soon as waste rock material will be available from the open pit, the overburden will be surrounded with run of mine material (see Figure A.1 in Appendix A) to control the stability of the pile. If deemed necessary turbidity barriers in Mammoth Lake will also be installed.

During the operations of the mine, seepage and runoff from the Whale Tail WRSF will be captured by the Whale Tail WRSF Pond and pumped to the Whale Tail Attenuation Pond where the contact water will be treated in the Whale Tail WTP prior to discharge to the outside environment.

The Whale Tail WRSF water management infrastructure will remain in place until mine closure activities are completed and monitoring results demonstrate that the contact water quality from the Whale Tail WRSF meets discharge criteria (see Section 10.1).

6.3 Whale Tail Waste Rock Storage Facility Dimensions

The evolution of the Whale Tail WRSF is shown in Figures A.1 to A.4 of Appendix A. At completion, the crest elevation of the Whale Tail WRSF will be approximately at 235 m (maximum height of 80 m; see Figure 6.1) in an environment where the adjacent topography elevation varies between 154 and 170 m.

The Whale Tail WRSF is designed to minimize the impact on the environment and consider both the physical and geochemical stability of the stored waste rock and overburden. The design criteria are presented in FEIS Amendment Volume 2, Appendix 2-J. Final design details for the Whale Tail WRSF will be provided to the regulators for approval at least 60 days prior to construction. The Whale Tail WRSF is designed considering the placement of the waste rock and overburden in layers spread using a dozer to minimize the footprint and the dust. Each bench of 20 m maximum height is going to be composed of 4 layers of 5 m thickness, and where the bench toe will start at a setback distance of 20 m from the crest of the previous bench. The current design and overall sideslope angle of the Whale Tail WRSF will be 2.5V:1V, an angle generally considered stable for such a facility. However, slope stability analyses will be performed during the next engineering phases to determine the final design so that it is consistent with approved Portage and Vault Waste Rock facilities at Meadowbank Mine.

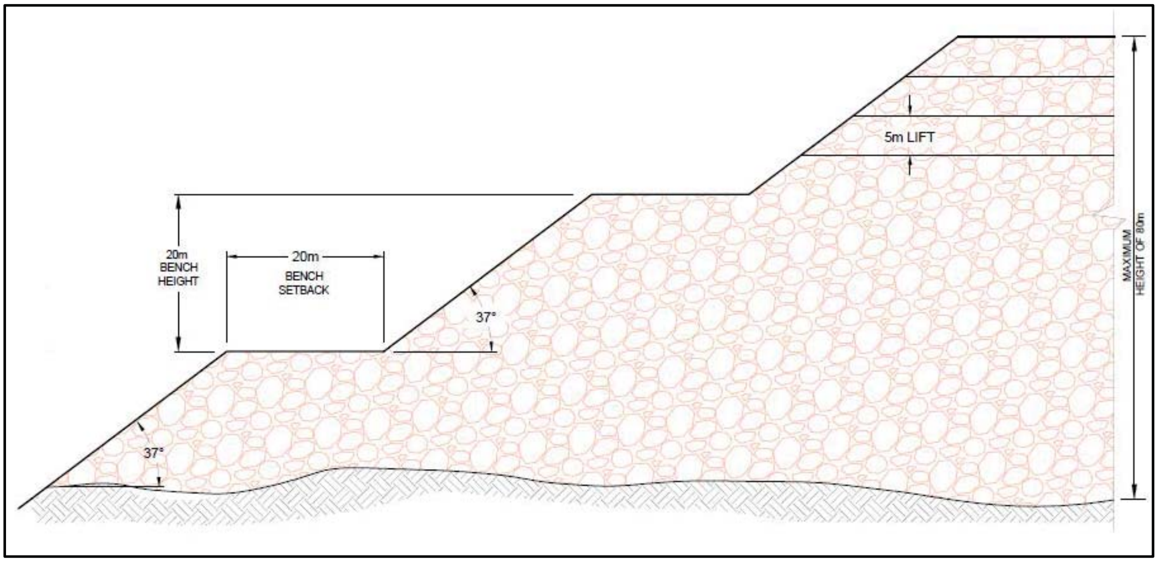


Figure 6.4 Typical Cross Section of the Whale Tail Waste Rock Storage Facility

Source: SNC (2015).

SECTION 7 • WHALE TAIL PIT ORE STOCKPILES

The three areas selected for stockpiling of ore are identified as Ore Stockpile 1, Ore Stockpile 2, and Ore Stockpile 3 on Figure A.2 of Appendix A. These ore stockpile pads have an approximate footprint of 5.7, 5.5, and 6.5 ha, respectively. As presented in Table 3.1, the maximum amount of ore stockpiled on the ore pads is 1,136,261 tonnes (t) in Q2 2019, from there the quantity of ore stockpiled stabilizes and then decreases until the end of operations in Q1 2022. No ore will remain on stockpile pads at the end of operations.

7.1 Ore Properties

A chemical characterization program investigated the geo-environmental properties of waste rock and ore report (FEIS Amendment Volume 5, Appendix 5-E). Static geochemistry tests, mineralogy and kinetic leaching tests were carried out to investigate the reactivity of these materials with respect to their potential to generate ARD and to release metals (ML) to the receiving environment.

The ore is PAG, and is enriched in arsenic, antimony, bismuth, chromium, selenium, silver and to a lesser extent, nickel. Some of the ore samples leached arsenic at concentrations that exceed the Portage effluent criterion in static (shake flask extraction) tests but exceedances were short-lived in the first cycles of kinetic leaching tests. The delay to onset of ARD from ore is expected to be substantially longer than the seven years of mine construction, operations, and closure.

7.2 Ore Stockpile Management

Seepage and runoff water from Ore Stockpiles 1, 2, and 3 will naturally flow to the Whale Tail Attenuation Pond; channels will be constructed if deemed required to direct the seepage and runoff to the pond. If the water quality does not meet discharge criteria, the contact water will be treated at the Whale Tail WTP prior to discharge to the outside environment.

7.3 Ore Stockpile Facility Dimensions

The three ore stockpiles will occupy an area of approximately 17.8 ha. A typical cross section of these facilities is presented in Appendix A (Drawing no. 6108-687-210-001). Currently, Ore Stockpiles 1, 2, and 3 are designed to stack three layers of 5 m maximum thickness for a total height of 15 m. The sideslope angle of these ore stockpiles will be 3V:1V, an angle generally considered stable for such facility. Slope stability analyses will be performed during the next engineering phases and a final design will be presented prior to construction.

SECTION 8 • MEADOWBANK TAILINGS STORAGE FACILITY - TAILINGS MANAGEMENT FOR WHALE TAIL PIT

According to the Whale Tail Pit LOM calculation, the addition of the Whale Tail Pit to the Meadowbank LOM (LOM 2015 – completion Q3 2018) will generate an addition of approximately 8.3 Mt (dry) of tailings to the Meadowbank TSF for a total of 35.4 Mt.

Currently, Meadowbank tailings are stored within the TSF North and South Cells. The TSF includes dikes/dams, and is located within the basin of the former north-west arm of Second Portage Lake which has been dewatered to allow mining in the Portage Pit (refer to Figure 1.2). The TSF North and South cells are separated by the Stormwater Dike. Tailings were deposited into the North Cell from 2010 until November 2014, and again from June to September 2015. The South Cell (former Portage Attenuation Pond) is currently operating and receiving tailings.

According to the approved Meadowbank TSF design and Meadowbank LOM 2015, there remains a capacity of 5.3 Mt in the South Cell after the completion of mining Goose Pit, Portage Pit, Vault Pit, BB Phaser, and Phaser Pit. To provide the additional 3 Mt of capacity required to store Whale Tail Pit tailings, Agnico Eagle is proposing to construct an internal structure raise over the outside perimeter of the existing and frozen North Cell. This concept will increase the tailings beach elevation to a maximum of 153.5 masl in the North Cell.

8.1 Deposition Strategy

Tailings from Whale Tail Pit will be stored within the approved Meadowbank TSF footprint. Agnico Eagle, in collaboration with O'Kane Consulting (O'Kane), developed a rockfill internal structure design for the North Cell TSF to avoid increasing the overall footprint of the existing TSF. The Arctic climate conditions lead Agnico Eagle to implement a specific deposition strategy to optimize placement of tailings and reduce the impact of cold temperature on the tailings dry density. This strategy has been documented in previous tailings management plans and focuses on discharging tailings into the North Cell TSF during summer, and moving to the South Cell TSF during winter.

Since the beginning of operations, Agnico Eagle inferred variations of tailings dry density has ranged from 1.76 tonnes per cubic metre (t/m^3) to 1.08 t/m^3 during summer and winter, respectively. These observations are a direct consequence of ice entrapment occurring within the storage facility. The ice entrapment depends on the temperature and the general TSF geometry at the deposition location, reclaim water volume and sub-aerial beach length. The more the slurry is exposed to cold temperatures during the sub-aerial deposition, the greater the volume of water trapped as ice in the capillary voids of the tailings beach.

Agnico Eagle identified the North Cell TSF as most prone to ice entrapment due to its geometry. Therefore, deposition in the proposed North Cell TSF raise will be conducted from June to September inclusively, for a period of 122 days in an environment free of ice. For the remaining part of the year, the South Cell TSF will be used for tailings deposition as a lower entrapment is forecasted due to smaller sub-aerial beach lengths. This tailings deposition strategy will also promote the building of a tailings beach on all peripheral geotechnical structures per design requirements.

8.2 North Cell Tailings Storage Facility

Figure 8.1 depicts the geometry of the North Cell before resuming the deposition in June 2019. An incline internal structure (see Section 8.4) will surround the North Cell TSF starting at elevation 154 masl at the north end of the cell, and decreasing in elevation until reaching the Stormwater Dike (SWD) at elevation 150 masl. Tailings deposition will be almost exclusively sub-aerial and water ponding against the SWD will be transferred to the South Cell TSF to keep the reclaim water elevation below 148 m to maintain a 2 m freeboard per design requirements. A long subaerial tailings beach will be pushed from the north to the south to promote sheet flow runoff water drainage toward the South Cell at closure. The Meadowbank Review Board encouraged this practice for closure purposes as outlined in the Section 12.2 of the Meadowbank Review Board Report No 17 (MDRB 2015).

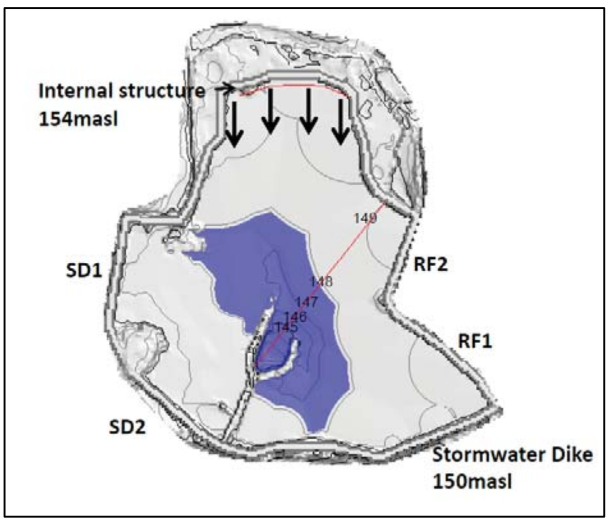


Figure 8.5 North Cell Deposition Strategy

8.3 South Cell Tailings Storage Facility

Figure 8.2 depicts the geometry of the South Cell before resuming deposition in October 2019. All structures (Central Dike, SD3, 4 & 5 and SWD) will be raised at elevation 150 masl. As is currently undertaken at Meadowbank, most of the deposition will occur from the Central Dike to push the reclaim water toward the west end of the TSF. Throughout operations, the reclaim pond will be located in the South Cell TSF and water transfer will be required from the North Cell to South Cell TSF. The reclaim system will be located in the SD3 area. At the end of operations, a long subaerial tailings beach will be built up from Central Dike, which will promote runoff water drainage toward SD3 at closure.

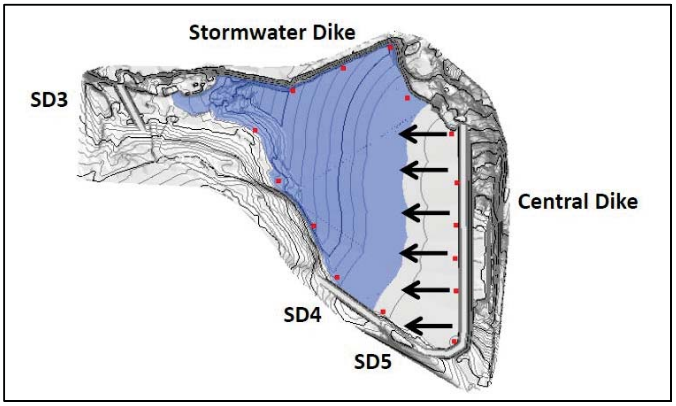


Figure 8.6 South Cell Deposition Strategy

8.4 North Cell Internal Structure

O'Kane were mandated by Agnico Eagle to design the North Cell TSF internal dike structures to provide an additional tailings storage capacity of 3 Mt. The internal structure will consist of NPAG waste rock placed at 1.5H:1V (upstream face) and at 3H:1V (downstream face) along the alignment (see drawings presented in Appendix B). While the technical drawings presented in Appendix B show a 15 m crest width, suitable for 2-way traffic with 50 t haul trucks, the final dike width at the crest will be determined by construction equipment to be used. Numerical modelling of slope stability and seepage were completed assuming a 30 m wide dike. Sensitivity analysis of seepage showed no difference in seepage rates and total volumes between the 15 m and 30 m options. The height of the dike will vary between 2 and 4 m, the higher portion located in the northern section of the TSF.

8.5 Tailings Deposition Planning

8.5.1 Tailings Properties

An updated TSF water balance and tailings deposition plan for the Project was prepared based on tailings properties defined by field measurement during the Meadowbank operations. Table 8.1 presents the parameters used in the model as determined from bi-annual (i.e., twice per year) bathymetric surveys after the summer and winter seasons. Intervening summer and winter values were estimated from the measured values and weighted by month.

The bathymetric surveys of the TSF also provided measurements of sub-aqueous and sub-aerial beach angles. The model used a sub-aerial tailings beach slope of 0.45% and a sub-aqueous tailings beach slope of 2.36% assuming that the Meadowbank in situ measured tailings geotechnical properties will be representative of conditions during deposition of the Whale Tail Pit tailings.

Based on the geochemical testing completed to date, the Whale Tail Pit tailings are expected to be PAG due to their low carbonate-mineral buffering capacity relative to sulphide sulphur content (2.8 wt%). The Whale Tail Pit tailings sample subjected to kinetic testing by humidity cell remained neutral for the 44-week test duration and showed little evidence of active sulphide mineral oxidation. However, mineral depletion calculations on kinetic test results suggest that the buffering capacity will eventually be consumed, after which the tailings may start to oxidize and develop acidic conditions. Therefore, the tailings are anticipated to require oxidation control in the long-term.

Table 8.1 Model Parameters

North Cell Parameters 2019-2021				South Cell Parameters 2019-2020 & 2021			
Month	**Ice Thickness (m)**	**Tailings Dry Density (t/m^3)**	**Ice entrapment (%)**	**Month**	**Ice Thickness (m)**	**Tailings Dry Density (t/m^3)**	**Ice entrapment (%)**
January	1.1	1.08	90%	January	1.1	1.22 - 1.08	50% - 90%
February	1.3	1.08	90%	February	1.3	1.22 - 1.08	50% - 90%
March	1.5	1.08	90%	March	1.5	1.22 - 1.08	50% - 90%
Q1	**1.5**	**1.08**	**90%**	**Q1**	**1.5**	**1.22 - 1.08**	**50% - 90%**
April	1.7	1.08	90%	April	1.7	1.49 - 1.08	50% - 90%
May	0	1.32	60%	May	0	1.49 - 1.32	40% - 60%
June	0	1.56	30%	June	0	1.49 - 1.56	30%
Q2	**0**	**1.32**	**60%**	**Q2**	**0**	**1.49 - 1.32**	**40% - 60%**
July	0	1.56	30%	July	0	1.76 - 1.56	30%
August	0	1.56	30%	August	0	1.76 - 1.56	30%
September	0	1.56	30%	September	0	1.76 - 1.56	30%
Q3	**0**	**1.56**	**30%**	**Q3**	**0**	**1.76 - 1.56**	**30%**
October	0.2	1.32	75%	October	0.2	1.31 - 1.32	40% - 75%
November	0.5	1.08	80%	November	0.5	1.31 - 1.08	50% - 80%
December	0.8	1.08	90%	December	0.8	1.31 - 1.08	50% - 90%
Q4	**0.8**	**1.16**	**82%**	**Q4**	**0.8**	**1.31 - 1.16**	**47% - 82%**
Average	-	**1.28**	**65%**	**Average**	**-**	**1.44 - 1.28**	**42% - 65%**

m = metre; t/m^3 = tonnes per cubic metre; % = percent.

8.5.2 Deposition Strategy

End of pipe tailings deposition will be used in North and South Cell TSF during the Whale Tail Pit mining. The deposition may be optimized by incorporating a spigoting system to the deposition process at the north end of the North Cell TSF.

8.5.3 Tailings Deposition Plan

Please refer to Appendix C for the detailed Whale Tail Pit Tailings Deposition Plan.

8.5.4 Tailings Storage Capacity

Table 8.2 and Figure 8.3 summarize the tailing tonnages to be deposited in each cell with time.

Table 8.2 Tailings Storage Facility Tailings Tonnage Profile

Time	North Cell (t)	South Cell (t)	Total (t)
2019	821,250	821,250	1,642,500
2020	1,091,992	2,193,008	3,285,000
2021	1,098,000	2,187,000	3,285,000
2022	0	66,644	66,644
Total	**3,011,242**	**5,267,902**	**8,279,144**

t = tonne.

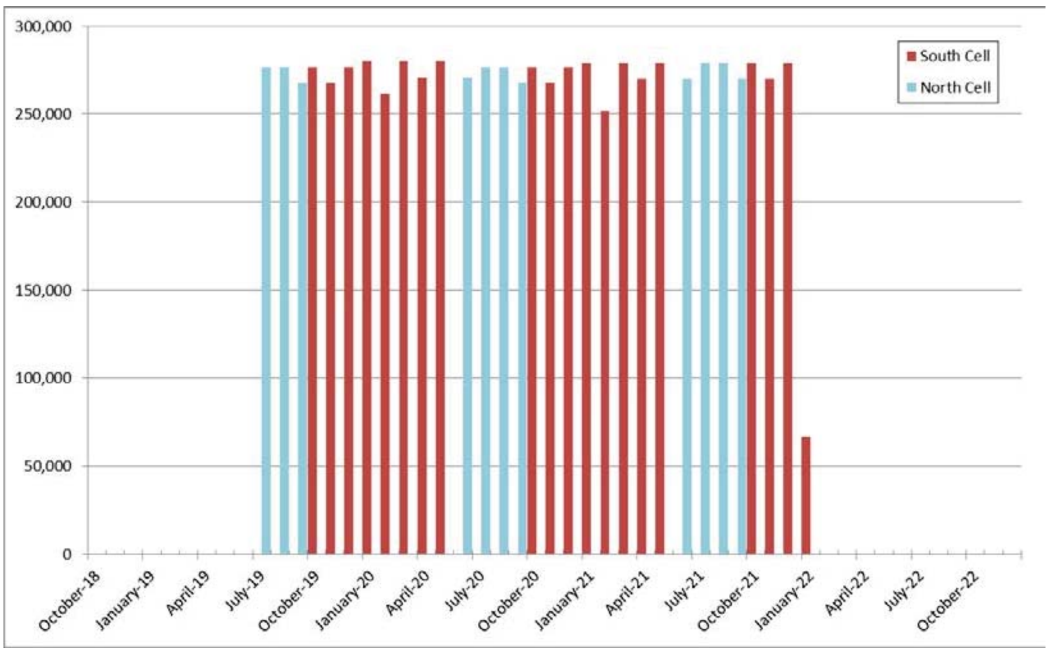


Figure 8.7 Tailings Tonnage Stored in Each Cell with Time

Assuming a tailings dry density of 1.28 t/m^3, the South Cell will have a remaining storage capacity of 1.9 Mt after completion of Whale Tail Pit operations. This provides additional storage contingency should tailing properties differ from that modelled. Figure 8.4 presents the layout of the TSF once deposition is completed.

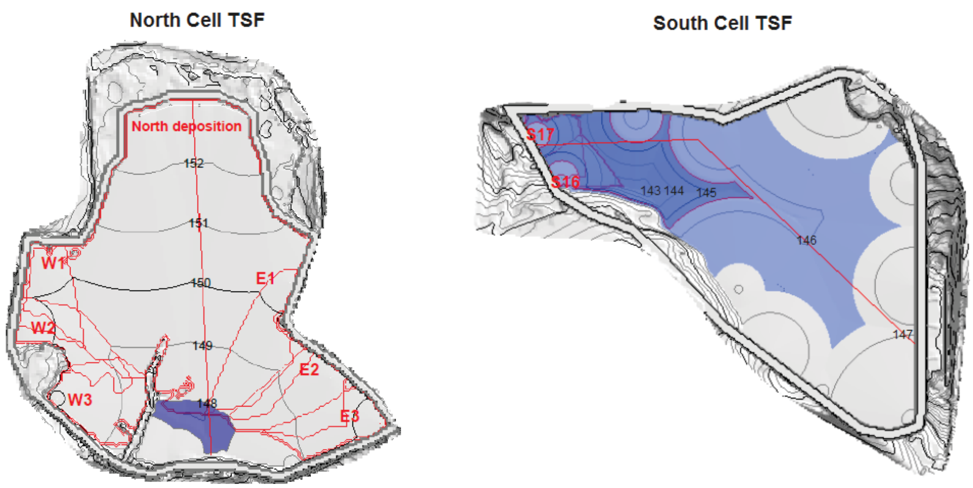


Figure 8.8 Tailings Storage Facility Layout after Deposition Completed

8.6 Meadowbank Mine Water Management Strategy during Whale Tail Pit Operations and for Progressive Closure of Goose, Portage, and Vault Pits

At Meadowbank, four major sources of inflow water are considered in the site water management system on site: freshwater pumped from Third Portage Lake, natural pit groundwater inflow, seepage inflow from the East Dike and runoff water. This water is utilized and removed from the catchment areas by the following means: WTP effluent from the Vault Attenuation Pond, water trapped in the capillary voids of the tailings fraction at the TSF, East Dike seepage discharge into Second Portage Lake and water trapped within the in-pit central waste rock storage area voids.

An updated Meadowbank Mine Water Balance incorporating the Project is presented in Appendix D, and the related flowcharts are provided in Appendix E. The updated model does not include inflows from the Interception Sump, Waste Dump Extension Pond, or ST-16 to the TSF. It is expected that water running through the diversion ditch to the Interception Sump during the Project LOM will be suitable for direct discharge to the environment, while inflows to the TSF from the Waste Dump Extension Pond and ST-16 will be relatively minor and therefore have negligible influence on eth water balance. The following sections provide further details on the Meadowbank Mine water management strategy during the Project.

8.6.1 Freshwater from Third Portage Lake

Freshwater from Third Portage Lake is pumped utilizing a freshwater barge to service the camp, mill, maintenance shop, and all other freshwater users at Meadowbank. The amount pumped from the barge is tracked and reported in the water balance and as a requirement of the Type A Water Licence. The two main consumers of freshwater are the mill and the camp.

The freshwater going to the mill is used in the milling process and will be discharged with the tailings as a slurry. Once in the TSF, the total water volume is comprised of 40% free reclaim water (recycled back to the mill as process water), 30% entrapped within the capillary void space of the tailings, and a further 30% entrapped within the TSF as ice (60% total entrapped in TSF). The water entrapment within the TSF represents annual averages as the ice entrapment during the summer months would fall to zero, while in winter months it could reach close to 90% (according to the 2014-2015 North Cell bathymetric analysis). Please refer to Table 8.1 for detailed information on expected water entrapment throughout TSF operation.

The freshwater used in the camp includes laundry facilities, cleaning, cooking and drinking water consumption. The majority of the camp freshwater is returned as sewage treatment effluent to the Stormwater Management Pond which ultimately gets transferred to the active TSF (currently the South Cell), and later in the mine closure period to Portage Pit during the reflooding operation.

The total expected freshwater utilization planned for 2019 to mine closure varies from 50 to 250 cubic metres per hour (m^3/hr) during mill operation, and drops to 4 m^3/hr during closure. Table 8.3 and Figure 8.5 summarize water consumption with time. The variation seen in the freshwater consumption during mill operation is calculated to prevent a water deficit in the TSF while allowing for adequate reclaim volumes at the mill.

Table 8.3 Yearly Water Consumption Summary

Time	Freshwater flow (m^3/hr)	Total Freshwater (m^3)	Reclaim Water Flow (m^3/hr)	Total Reclaim Water (m^3)	Total Water Flow (m^3/h)
2019	32	282,635	138	1,214,399	170
2020	108	944,640	228	1,998,953	335
2021	123	1,072,800	212	1,862,750	335
2022	25	218,064	7	63,321	32
2023-2029	4	34,675	0	0	4

m^3/hr = cubic metres per hour; m^3 = cubic metres.

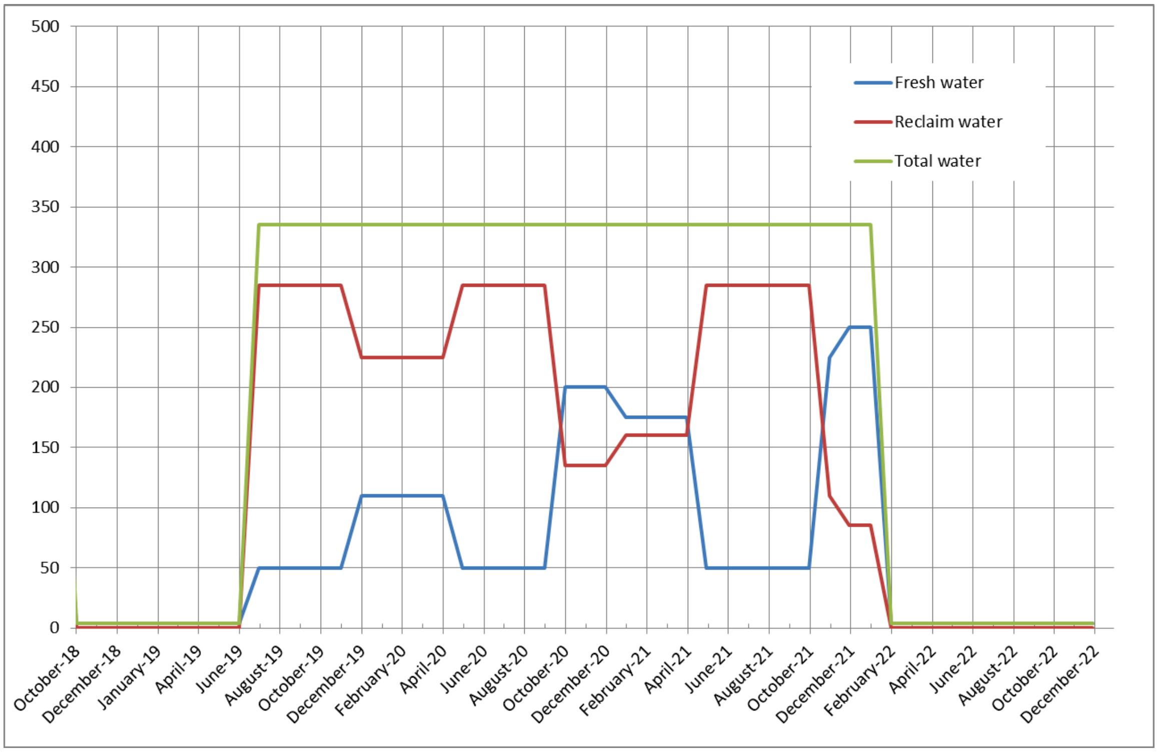


Figure 8.9 Flow to the Mill

8.6.2 Reclaim Tailings Water

Reclaim tailings water represents the water reclaimed from the TSF to feed the mill during operations. The pumping system is a mobile pumphouse mounted on skids which retreats on a road as the water level rises in the South Cell TSF. The suction line is laid down at the bottom of the pond and is extended as needed when the pump moves. A summary of the reclaim water that will be sent to the mill on an annual basis during the Project is presented in Table 8.3.

Figure 8.6 illustrates the water management in the North Cell TSF until the end of its operation in 2022. The reclaim pumping system installed in the South Cell will continue to supply the mill with reclaim water. Water transfers are required from the North Cell to South Cell TSF to maintain a reclaim water elevation in the North Cell below 148 m (i.e., to maintain a 2.0 m freeboard), and to continue providing the mill with the required volume of reclaim water.

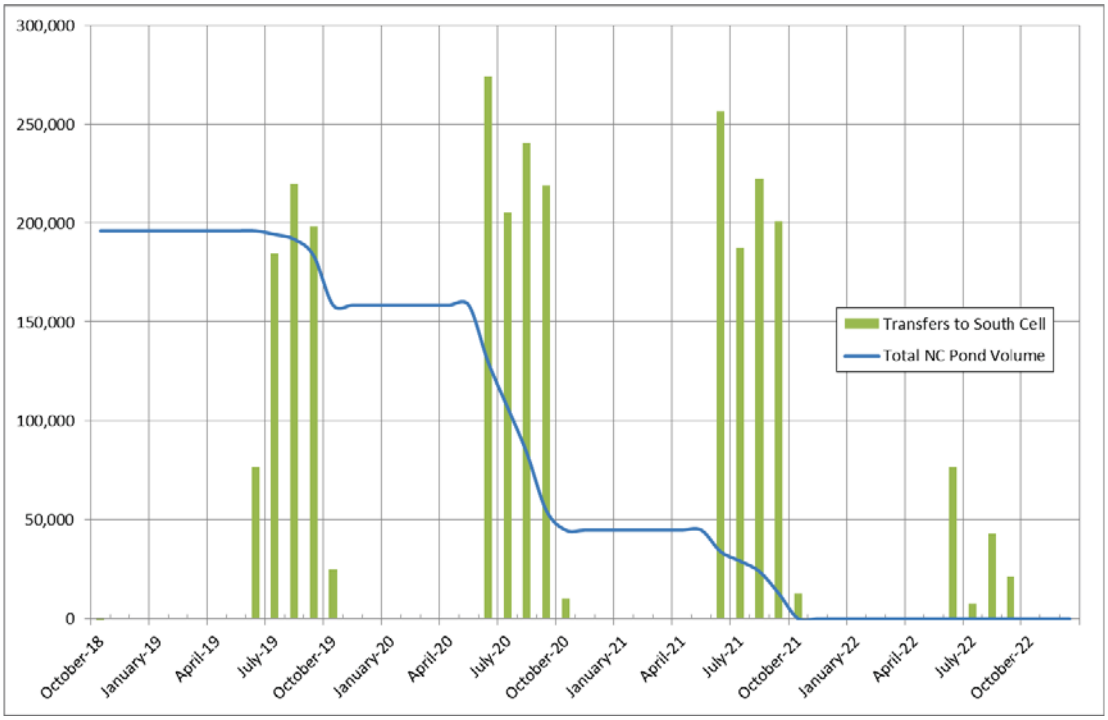


Figure 8.6 North Cell TSF – Reclaim Water Volume and Transfer

The South Cell TSF water management is consistent with that of the North Cell. Figure 8.7 shows the projected water volume in the South Cell from 2019 through to mine closure in 2022 and the water transfers required to maintain the optimal reclaim water volume for operations.

After the summer 2019, the reclaim water volume in the South Cell will decrease slowly until deposition is complete. Some water will need to be transferred to the Portage Pit at the end of the deposition (cessation of mill operation) to properly dewater the tailings pond prior to executing capping activities. The treatment requirements of the reclaim water will be determined as per TSF Expansion Water Quality Analysis Phase 1 (SNC 2016, found in Appendix F) and will be evaluated as per Type A Water Licence conditions.

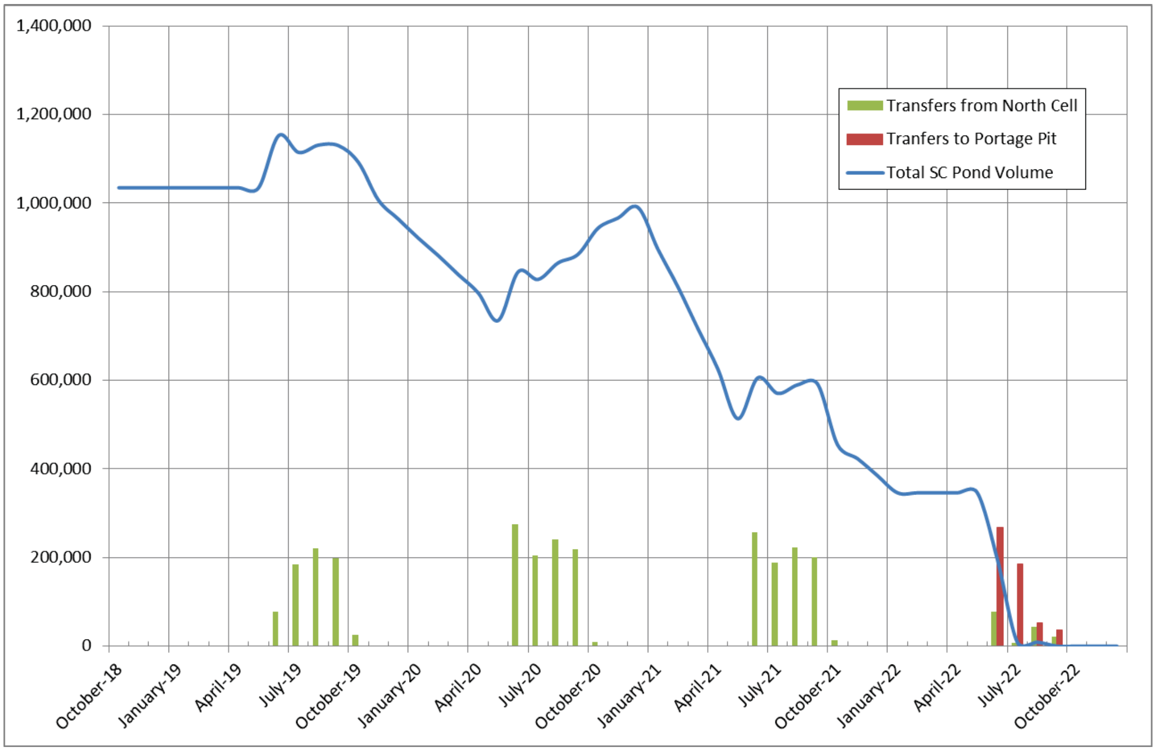


Figure 8.10 South Tailings Storage Facility - Reclaim Water Volume, Elevation, and Transfer

8.6.3 Water Transfers

Water transfers from various locations around the site are required to reduce freshwater consumption, optimize basin storage, optimize the water balance and prevent receiving environment impacts.

8.6.3.1 Tailings Storage Facility Water Transfers

Water transfers within the TSF and to the Portage Pit are required throughout the Project LOM to optimize the tailings deposition sequence, maintain an adequate reclaim pond (operating volume, dike structure protection and water quality), minimize freshwater consumption, and to ensure the closure of each TSF cell (Table 8.4). All these transfers will be documented overtime in order to improve accuracy of the water balance and maintain adequate TSF reclaim pond levels with time.

Table 8.4 Tailings Storage Facility Water Transfers

Year	North Cell to South Cell (m³)	SMP to South Cell (m³)	SMP to Portage Pit (m³)	South Cell to Portage Pit (m³)
2019	703,953	34,675		
2020	948,751	34,675		
2021	880,009	34,675		
2022	148,451		34,675	540,163
2023	181,187		34,675	281,082

m^3 = cubic metres; SMP = Stormwater Management Pond.

8.6.3.2 Stormwater Management Pond

The Stormwater Management Pond (Tear Drop Pond) is a small shallow, fishless, water body that can be seen in Figure 1.2 adjacent to Portage Pit. Treated sewage effluent is discharged to this lake before being transferred to the Portage Pit during operations. These transfers ensure there is always capacity in the pond to contain freshet water from its catchment area, as well as the onsite Sewage Treatment Plant effluent. The pond water is transferred two times or more per year during the warmer months: typically, once in the spring and once in the fall. The total flow volume to be transferred during the Project LOM is forecasted at 34,675 cubic metres (m^3).

8.7 Progressive Closure – Goose, Portage, and Vault Pit Reflooding

As per the recommendations and requirements concerning water use in the NWB Water Licence No. 2AM-MEA1525, the Meadowbank Water Management Plan will be updated on an annual basis and will continue to include a pit flooding strategy. The following is provided as an interim update considering the addition of the Project. The first phase of the Portage, Goose, and Vault pit reflooding sequence is currently planned to be completed by the end of summer 2025. Refer to Table 8.5 for the proposed reflooding sequence per year for all pits.

Table 8.5 Pit Flooding Profile

Pit Flooding Profile								
Year	Volumes pumped from Third Portage Lake			Volumes pumped from Wally Lake				Total flooding water (m³)
	To Portage Pit (m³)	To Goose Pit (m³)	From Third Portage Lake (m³)	To Vault Pit (m³)	To Vault Attenuation Pond (m³)	To Phaser Pit (m³)	From Wally Lake (m²)	
2018	0	3,182,704	3,182,704	0	0	0	0	3,182,704
2019	4,520,000	0	4,520,000	4,182,604	0	0	4,182,604	8,702,604
2020	4,520,000	0	4,520,000	4,182,604	0	0	4,182,604	8,702,604
2021	4,520,000	0	4,520,000	4,182,604	0	0	4,182,604	8,702,604
2022	4,520,000	0	4,520,000	4,182,604	0	0	4,182,604	8,702,604
2023	4,520,000	0	4,520,000	4,182,604	0	0	4,182,604	8,702,604
2024	4,520,000	0	4,520,000	4,182,604	0	0	4,182,604	8,702,604
2025	4,059,356	0	4,059,356	2,955,472	314,194	0	3,269,666	7,329,022
Total	**31,179,356**	**3,182,704**	**34,362,060**	**28,051,096**	**314,194**	**0**	**28,365,290**	**62,727,350**

m^3 = cubic metres.

8.7.1 Goose Pit Flooding

The volumes of water needed for Portage and Goose pit reflooding, which is part of the overall approved Meadowbank interim closure plan (Golder 2014), is dependent on the water elevation of Third Portage Lake. The Goose Dike can only be breached when the level of the flooded pits reaches the same elevation as Third Portage Lake and pit water quality meets Type A Water Licence conditions. According to Third Portage Lake elevation data from 2013 to 2015 this elevation is approximately 133.6 masl (Figure 8.8).

To obtain a water elevation of 133.6 m in the Portage and Goose pits, a total of 45 Million cubic metres (Mm^3) of water will be required in the Portage area. Of this amount, 34.3 Mm^3 will originate from Third Portage Lake, and the 10.7 Mm^3 balance will be made up from the natural pit water inflows including runoff and precipitation combined with reclaim water.

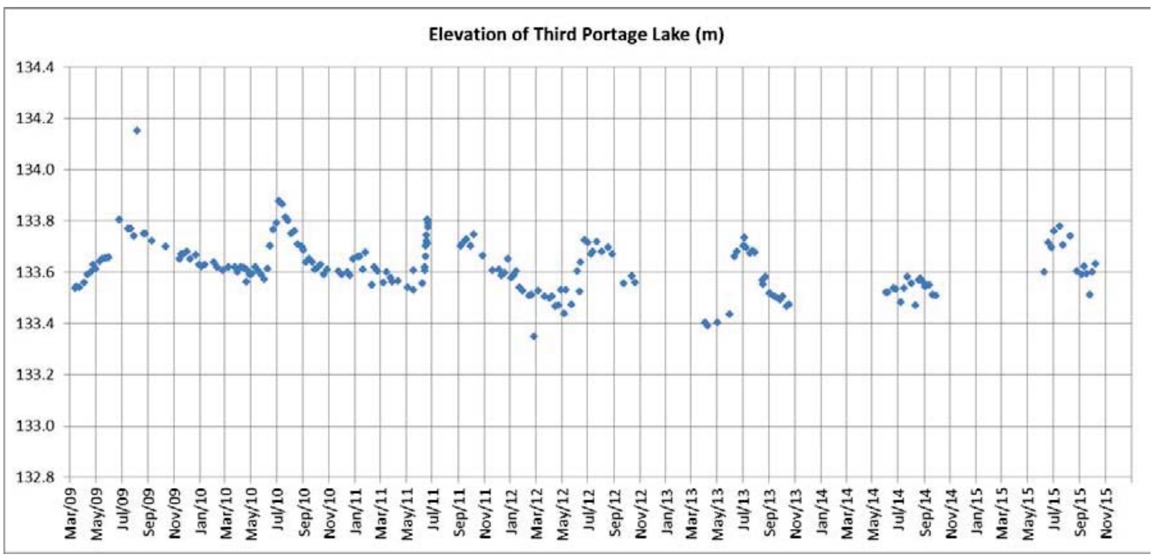


Figure 8.11 Distribution of Third Portage Lake Elevation Surveyed Data

Figure 8.9 depicts the Goose Pit flooding curve. Goose Pit flooding started in 2015 by allowing the annual inflow volume (runoff, groundwater, and precipitation) of 383,800 m^3 to remain within the pit. In the summer 2018, transfers from Third Portage Lake to Goose Pit are planned to commence, and will end in September 2018, after which natural pit inflows will continue. Once elevation 131.0 masl is reached, the Goose water will join the Portage Pit water to form one water body. This is planned by September 2025, and the pit lake water level is expected to reach the Third Portage Lake elevation in 2029. If water quality meets all closure criteria, including Canadian Council of Ministers of the Environment (CCME) guidelines and site specific criteria, the Goose dike will be breached. Refer to Section 10.3 and Appendix F for details on the pit water quality forecast model.

When interpreting Figure 8.9, it should be noted that it appears that Goose Pit never reaches 133.6 masl; however, Goose Pit volumes between 131 masl and 133.6 masl are included as part of Portage flooding volumes (Section 8.7.2 and Figure 8.10).

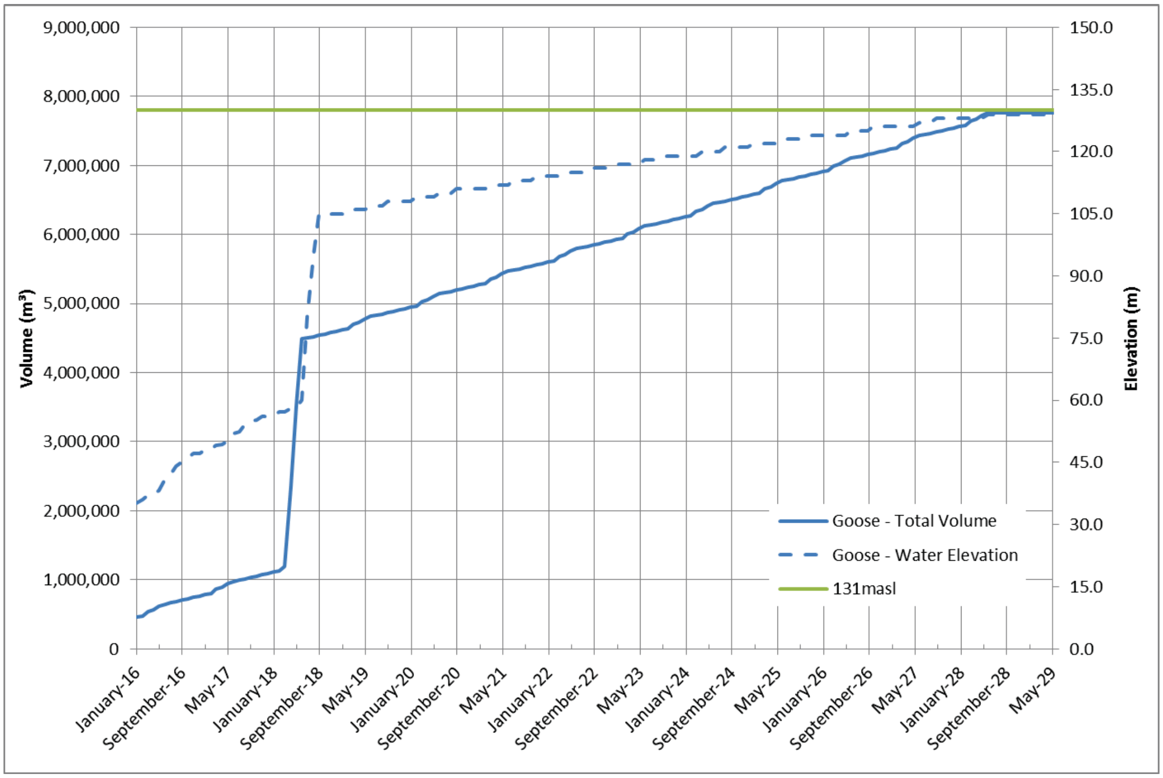


Figure 8.12 Goose Pit Flooding

8.7.2 Portage Pit Flooding

Portage Pit reflooding will begin in 2019 with a annual 4.52 Mm³ transfer from Third Portage Lake to the Portage Pit. In 2025, an additional 4.06 Mm³ will be required to complete the total active flooding to elevation 131 masl. From this point, runoff water and other pit inflows will be used to complete flooding of both the Portage and Goose pits until elevation 133.6 masl is reached at the end of 2028 (Figure 8.10).

Again, as mentionned above, the portion of Goose Pit between 131 masl and 133.6 masl elevation is included in the Portage Pit volumes.

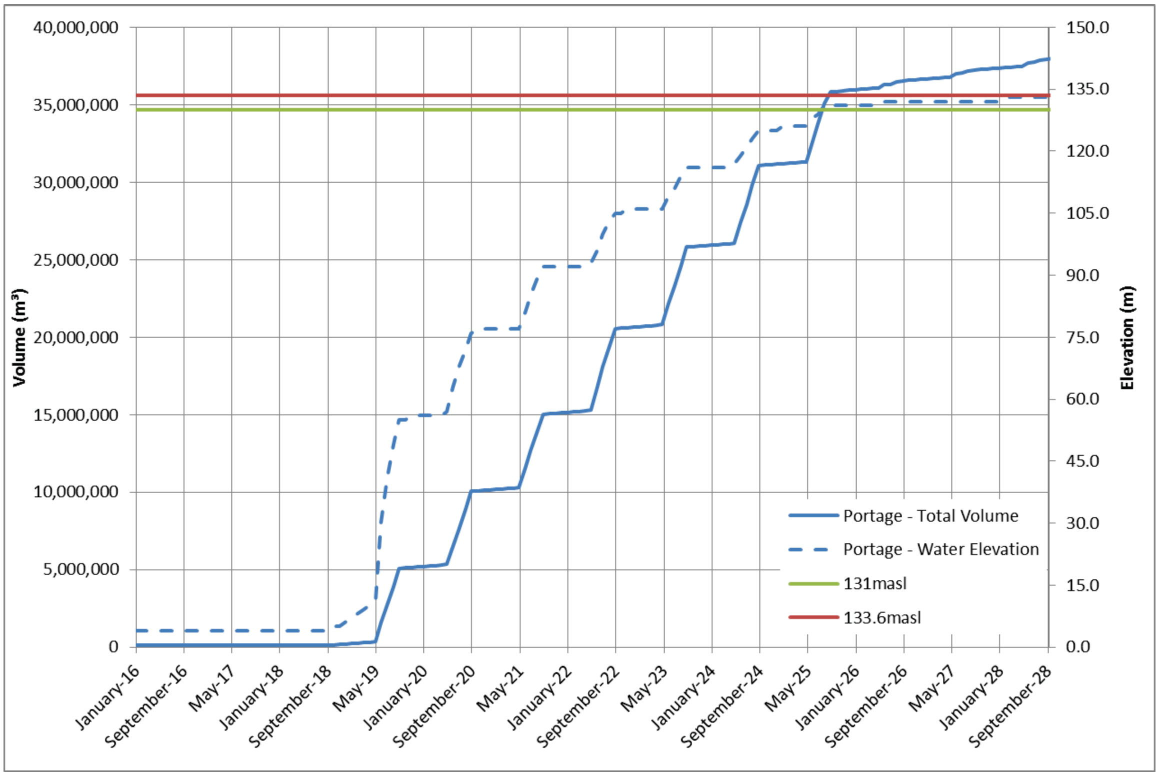


Figure 8.13 Portage Pit Flooding

8.7.3 Vault Pit Flooding

The Vault Pit area is composed of many basins in the former lake and different pit elevations that are all linked together. The flooding of Vault and Phaser (once fully authorized) is more complex and requires water transfers from basin to basin. Reflooding of the Vault area from Wally Lake will commence in 2019 and will continue until the end of summer 2024 at an annual rate of 4,182,604m^3, and finally 2,955,472 m^3 in 2025. From 2025 to 2029 natural inflows of approximatively 500,000 m³ per year from freshet, precipitation and groundwater will then allow Vault Pit lake to reach 139.9 masl (natural Wally Lake water level) (Figure 8.11). At this point, the Vault dike will be breached provided the water meets CCME criteria and/or site specific criteria for parameters not included in the CCME guidelines. Refer to Table 8.5 for the yearly cumulative volumes required to complete the flooding process as well as the resulting pit elevation. Refer to Section 10.3 of this present report for the pit water quality forecast model.

Phaser Pit and Lake are planned to be flooded exclusively from catchment run off until approximately 2025. At this point, the Phaser and Vault areas will combine, and flooding will continue as describe above for the Vault area until a target elevation of 139.9 masl (i.e., the Wally Lake elevation) is reached in 2027.

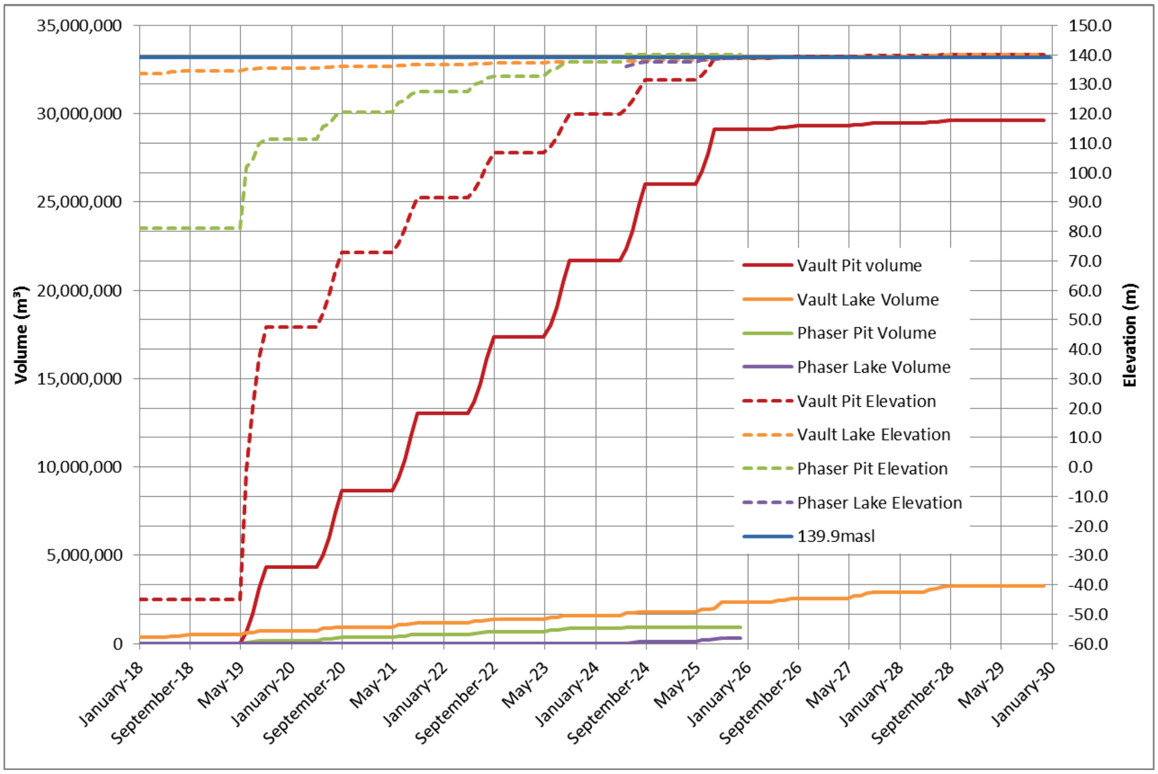


Figure 8.14 Vault Pit Flooding

8.8 Water Management Structure Inspections

As per the recommendations and requirements outlined in the document *Water Licence: 2AM-MEA1525 Reasons for Decision Including Record of Proceedings* from the NWB, and as per Water Licence 2AM-MEA1525 (Part E, Condition 10), Agnico Eagle will conduct weekly inspections of all water management structures during periods of flow. Records of the inspections will be available for review by an Inspector upon request.

SECTION 9 • CONTROL STRATEGIES FOR ACID ROCK DRAINAGE IN COLD REGIONS

The generation of metal leachate in acidic drainage is a concern for mining projects. In evaluating the potential control strategies for the disposal of the mine waste for the Whale Tail Pit, consideration was given to strategies that are effective in cold regions. A discussion of the alternative control strategies considered is summarized below.

Common control strategies for the prevention or reduction of acid mine drainage in cold regions are:

1. Control of acid generating reactions;
2. Control of migration of contaminants; and
3. Collection and treatment.

In assessing the overall control strategies for the Project, emphasis has been placed on methods that satisfy (1) and (2) in the above list, which then has an impact on (3) by potentially reducing the requirements for these activities. Table 9.1 presents various acid mine drainage control strategies.

Table 9.1 Acid Mine Drainage Control Strategies of the Arctic

Strategy	Description
Freeze Controlled	Requires considerable volumes of non-acid waste rock for insulation protection. Better understanding of air and water transport through waste rock required for reliable design.
Climate Controlled	Requires control of convective air flow through waste rock, infiltration control with modest measures and temperature controls. Better understanding of waste rock air, water, and heat transport for reliable design.
Engineered Cover	Special consideration for freeze-thaw effects. Availability and cost of cover materials are major impediments.
Subaqueous Disposal	Very difficult to dispose of waste rock beneath winter ice.
Collection and Treatment	Costly to maintain at remote locations Long-term maintenance cost.

Source: Dawson and Morin (1996).

The Whale Tail Pit site is located within the zone of continuous permafrost, and has a mean annual air temperature of about -11.3°C. Based on thermal data collected during baseline studies, the mine area is underlain by permafrost to the depth of 425 m below the ground surface. In developing this Plan, freeze control and climate control strategies have been adopted.

Freeze control strategies rely on the immobilization of pore fluids to control acid mine drainage reactions, and the potential migration of contaminated pore water outside of the storage facility. The climate conditions in the project area are amenable to freeze control strategies, and hence should be taken advantage of. In addition to immobilization of pore fluids, permafrost can reduce the hydraulic conductivity of materials by several orders of magnitude. Consequently, freeze control strategies are effective methods for reducing the migration of contaminants through materials.

According to Dawson and Morin (1996), freeze control strategies can only be effective if sufficient quantities of NPAG waste rock are available for use as a cover and insulation protection.

Climate control strategies rely on cold temperatures to reduce the rate at which oxidation occurs. The low net precipitation in permafrost regions limits infiltration of water into waste rock and tailings disposal areas. Consequently, the climate of the Whale Tail Pit will act as a natural control to reduce the production of acid mine drainage and metal leachate. Climate control strategies are best applied to materials placed at a low moisture content to reduce the need for additional controls on seepage and infiltration. This strategy is considered to be effective for waste rock in arid climate such as the one of project.

Meadowbank Mine uses the climate control strategy for the reclamation of the WRSF and TSF. Research activities are ongoing about the behaviour and the performance of the proposed cover systems for Meadowbank Mine with the participation of the Université du Québec en Abitibi-Témiscamingue: Research Institute Mines and Environment since 2014. Experience and knowledge acquired at Meadowbank Mine regarding the design and the monitoring of the cover system will be applied to the Whale Tail Pit scenario.

SECTION 10 • MONITORING AND CLOSURE

10.1 Whale Tail Waste Rock Storage Facility

Progressive reclamation includes closure activities that take place prior to permanent closure in areas or at facilities that are no longer actively required for current or future mining operations. Reclamation activities can be done during operations with the available equipment and resources to reduce future reclamation costs, minimize the duration of environmental exposure, and enhance environmental protection. Progressive reclamation may shorten the time for achieving reclamation objectives and may provide valuable experience on the effectiveness of certain measures that might be implemented during permanent closure. The Whale Tail WRSF will be operated to facilitate progressive reclamation; detailed mine closure and reclamation activities are provided in the Whale Tail Interim Closure and Reclamation Plan.

Monitoring will be carried out during all stages of the mine life to demonstrate geotechnical stability and the safe environmental performance of the facilities. If any non-compliant conditions are identified, then maintenance and planning for corrective measures will be completed in a timely manner to ensure successful completion of the Whale Tail Interim Closure and Reclamation Plan.

Mine closure and the reclamation of the Whale Tail WRSF will use currently accepted management practices and appropriate mine closure techniques that will comply with accepted protocols and standards.

Geochemical testing indicates that approximately 27% of the total amount of waste rock produced during the Project is NPAG and NML (FEIS Amendment Volume 5, Appendix 5-E). The remaining 73% of waste rock shows PAG and/or ML behaviour; therefore, means to limit oxidation and water infiltration need to be put in place. A closure cover system will be added on the top of the Whale Tail WRSF. The design proposed is the same as that at Meadowbank Mine for the Portage WRSF, i.e. the addition of 2 to 4 m of NPAG and NML waste rock as a final surface cover. The intent of the cover is to contain the yearly active layer inside the thickness of the cover and maintain a temperature below 0°C for the underlying rock. The objective of the cover is the control of acid generating reactions and migration of contaminants.

The segregation of the PAG/NPAG and ML/NML waste rock will occur during operations (see the Operational ARD-ML Sampling and Testing Plan), as will the progressive placement of the final cover on the WRSF slopes. The covering of the top of the Whale Tail WRSF will be completed during the closure period using of the stockpiled NPAG and NML waste rock. It is anticipated that the native lichen community will naturally re-vegetate the surface of the Whale Tail WRSF over time.

The contact water management system for the Whale Tail WRSF (WRSF Dike and WRSF Pond) will remain in place until mine closure activities are completed and monitoring results demonstrate that water quality conditions from the Whale Tail WRSF are acceptable for discharge with no further treatment required. Once water quality meets the discharge criteria established through the water licensing process, the contact water management system will be decommissioned to allow the surface runoff and seepage water from the Whale Tail WRSF to naturally flow to the outside environment. Water quality predictions for Whale Tail Pit are provided in Volume 6, Appendix 6-H of the FEIS.

10.2 Ore Stockpiles

Ore Stockpiles 1, 2, and 3 will used over the operations to stockpile ore and will be freed during Q1 2022. During the following summer, if metal contamination of ore pads is measured, the pad section targeted by the contamination will be excavated and placed in the Whale Tail WRSF before its final covering with NPAG waste rock. If deemed required, the Ore Stockpiles 1, 2, and 3 will be covered with NPAG waste rock or soils. In the event of a short-term temporary closure, the water and dust management strategies for the ore stockpiles will be kept the same as used during active mine operations. In the event of a long-term temporary closure, surface water control structures will be maintained as required. Further details on mine site closure and reclamation, including the ore stockpiles, can be found in the Interim Closure and Reclamation Plan.

10.3 Portage and Goose Pit Water Quality Forecast for Closure Including Whale Tail Pit Operations

An updated water quality forecast report including Whale Tail Pit operations was prepared by SNC Lavalin (SNC 2016 and found in Appendix F). The purpose of the updated modelling was to identify through a mass balance approach the contaminants of concern during the pit flooding process and determine if water treatment will be required on site for closure activities when comparing the final contaminant levels to the CCME guidelines and/or site specific criteria for parameters that are not included in the CCME guidelines. The water quality forecast will be updated on an annual basis as new monitoring data is added at the site. Forecasted model values from prior years will be compared with the actual sample results from the following years for model calibration purposes.

Using Whale Tail Pit tailings geochemistry data, SNC (2016) identified three contaminants of concern that could impact end pit water quality and therefore require treatment: copper, selenium and total nitrogen. These contaminants originate from the TSF reclaim water transferred to the pits in 2022 as outlined in Section 8.7. As the afore mentioned parameters may be of concern prior to dike breaching, treatment options for their removal during or after the pit flooding process will need to be examined and will be assessed in greater detail during the preparation of the final closure and reclamation plan to be submitted one year prior to the end of operations.

10.4 Monitoring of Freezeback

10.4.1 Whale Tail Waste Rock Storage Facility

To observe the freezeback of Whale Tail WRSF, a series of subsurface thermistors will be installed at strategic locations. The purpose of the thermistors is to monitor the temperature within the facility as freezing progresses. The thermistors will be monitored regularly throughout the operational period as well as during closure and post-closure according to Part I Item 9 of the Type A Water Licence. The results will be used to evaluate the predicted thermal response of the facility, and will allow for revision of the thickness of the final cover if required.

10.4.2 Meadowbank Mine Tailings Storage Facility

During the development and mining of the Meadowbank Mine deposits, an adaptive management plan was implemented with respect to monitoring of the TSF. A number of test pads have been developed to assess various TSF cover designs, and to determine the most appropriate for the actual site conditions. A similar approach was used previously at the Nanisivik Mine. In collaboration with the Université du Québec en Abitibi-Témiscamingue: Research Institute Mines and Environment, four tests pads have been constructed on the TSF North Cell since 2014. The monitoring program for the TSF will provide the data required to validate the predictions of freezeback within the tailings. If it is determined by monitoring during operations that the tailings are freezing at lower rates than predicted, then mitigation procedures would be implemented. However, results to date indicate that the tailings in the North Cell are freezing as predicted. Once capping on the tailings with NPAG is completed, a specific monitoring program will be implemented to ensure the closure strategy documented in Golder (2014) is adhered to.

10.5 Operational Monitoring of Tailings Seepage

Routine inspections and thermal data is monitored to evaluate seepage from the TSF Central Dike, Saddle / Coffer Dam, and Rockfill perimeter containment foundations in accordance with the TSF Operation, Maintenance, and Surveillance plan. In addition visual inspections are performed regularly, and a yearly geotechnical inspection is undertaken by a third party contractor.

If monitoring indicates flow rates and water qualities are of concern, then mitigation measures would be undertaken. Collection of any seep water and pumping it back into the TSF will be required. The potential mitigation action will be dependent on observed flow rates and water quality data.

If, during monitoring, it is found that the freezeback of the dike and tailings deposit are occurring at a rate less than predicted, then enhancement by artificial freezing methods (i.e., thermosyphons) may be considered.

Monitoring activities and mitigations will be further detailed in the updated Tailings Storage Facilities Operation, Maintenance, and Surveillance Plan, which will be updated prior to the use of the TSF for Whale Tail Pit tailings storage.

SECTION 11 • REFERENCES

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APPENDIX A • DRAWINGS

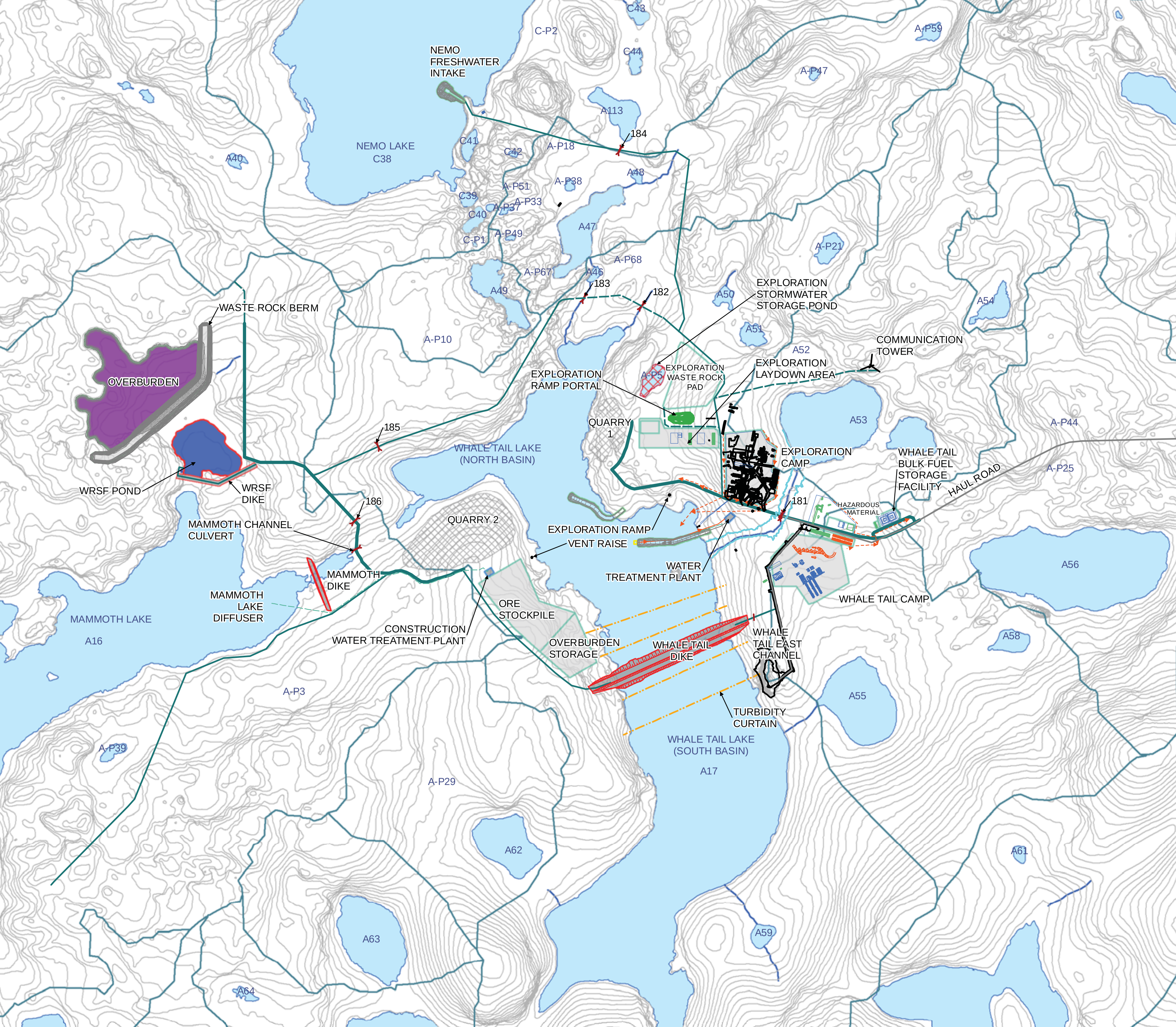
Figure A.1 **Yearly Site Layout Plan (Year -1: 2018)**

Figure A.2 **Yearly Site Layout Plan (Year 1: 2019)**

Figure A.3 **Yearly Site Layout Plan (Year 4: 2022)**

Figure A.4 **Yearly Site Layout Plan (Year 11: 2029)**

Drawing 6108-687-210-001 **Ore Stockpiles 1, 2, 3**



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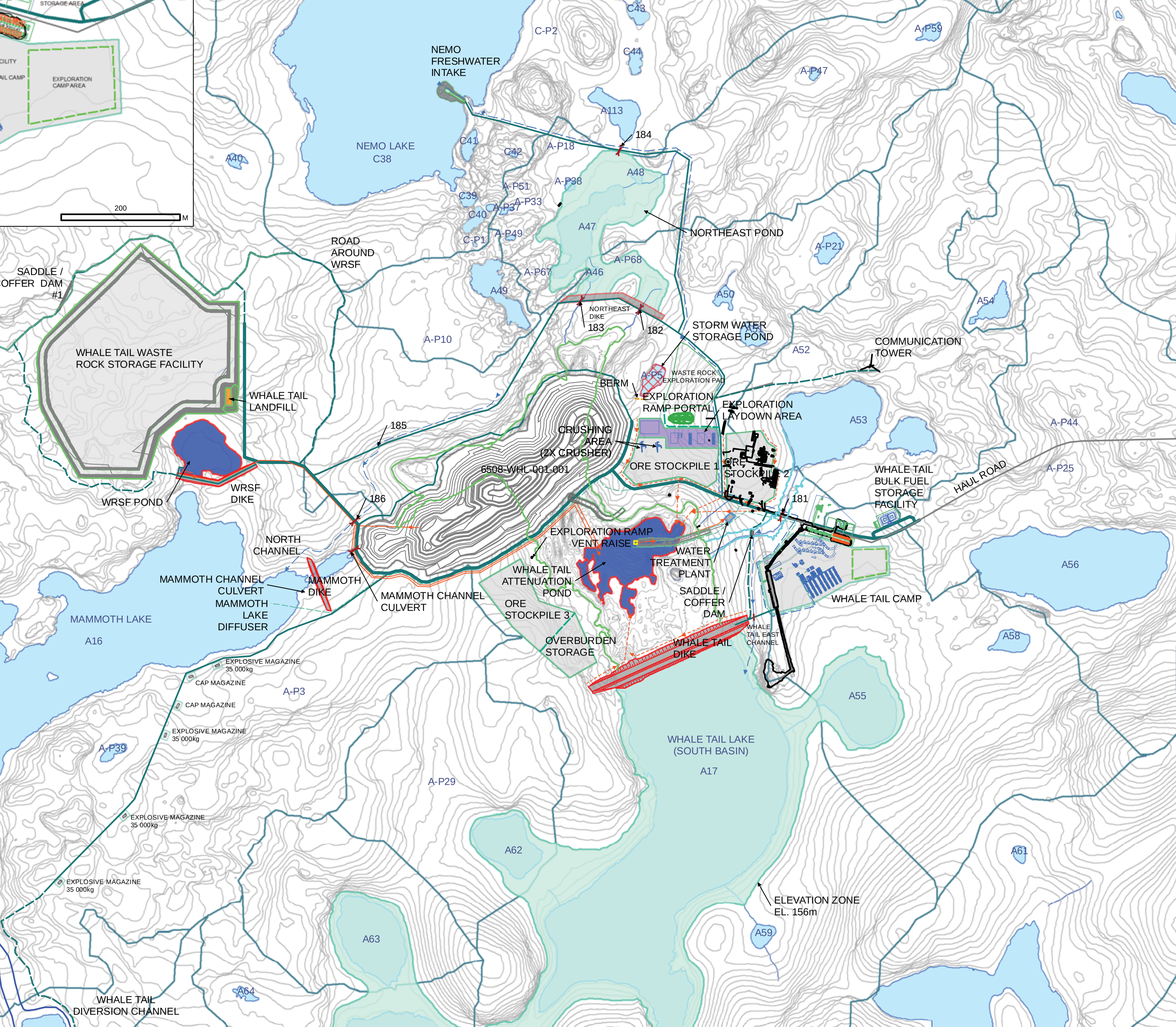

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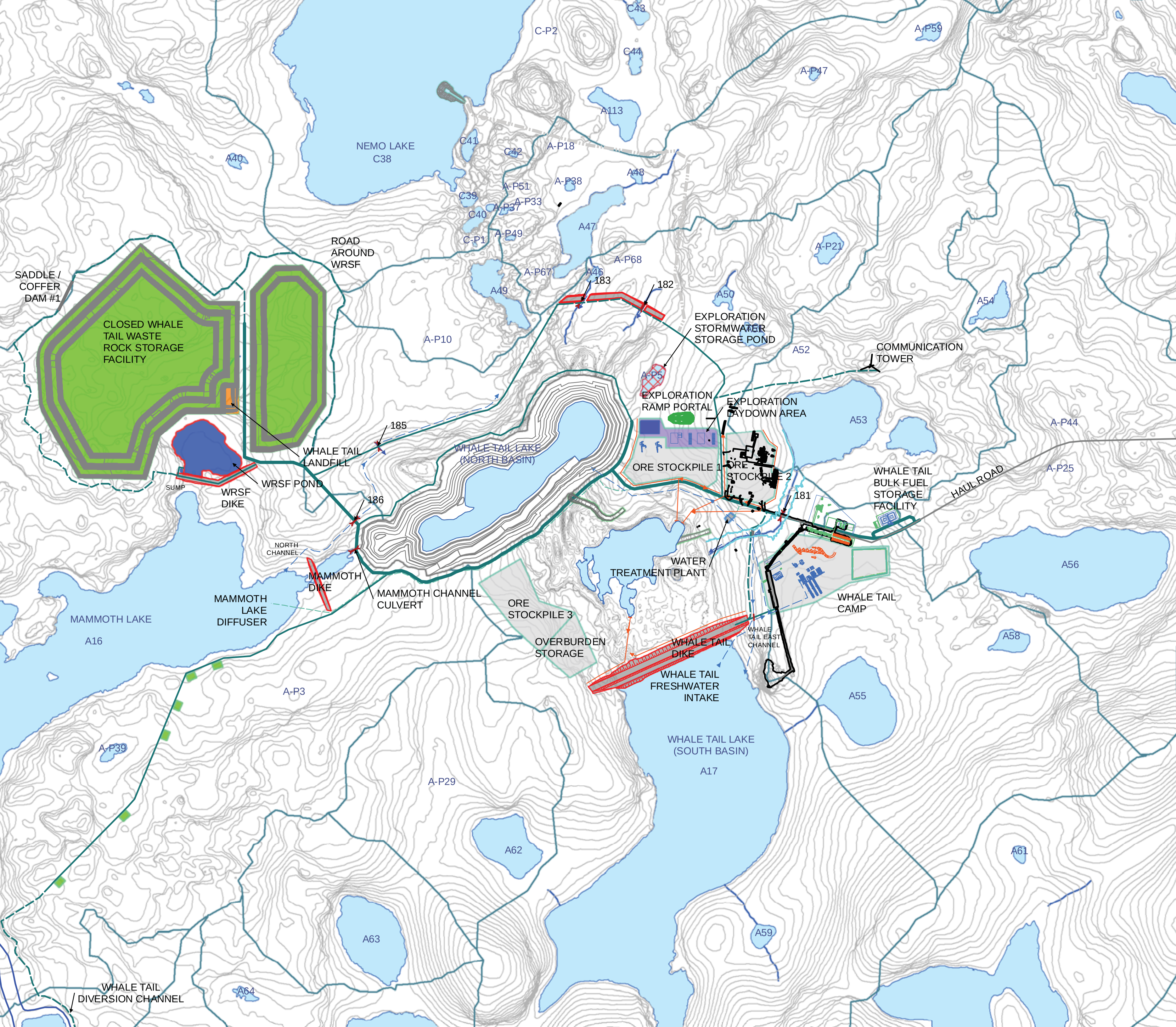

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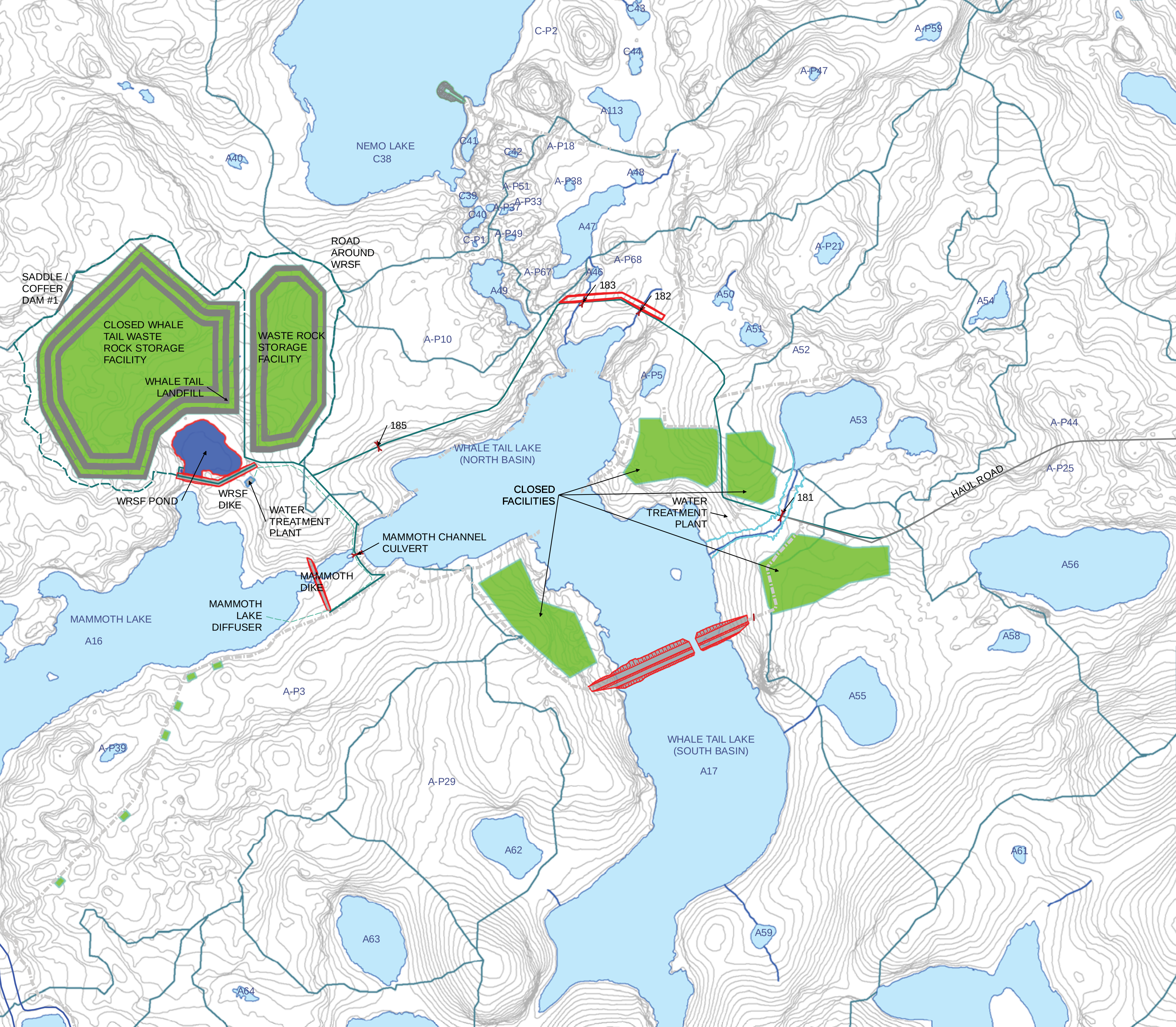

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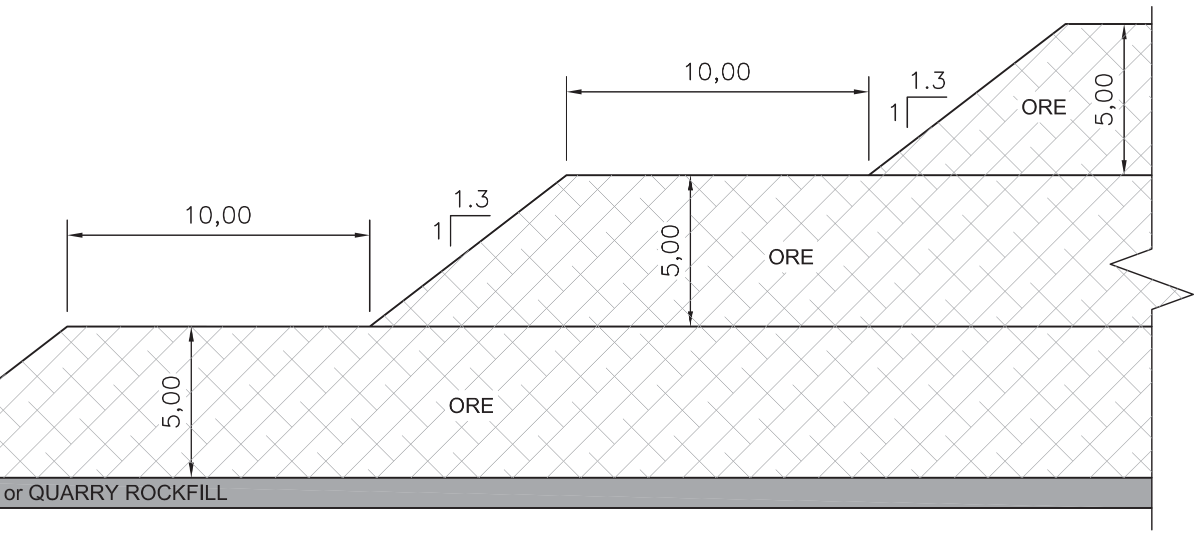

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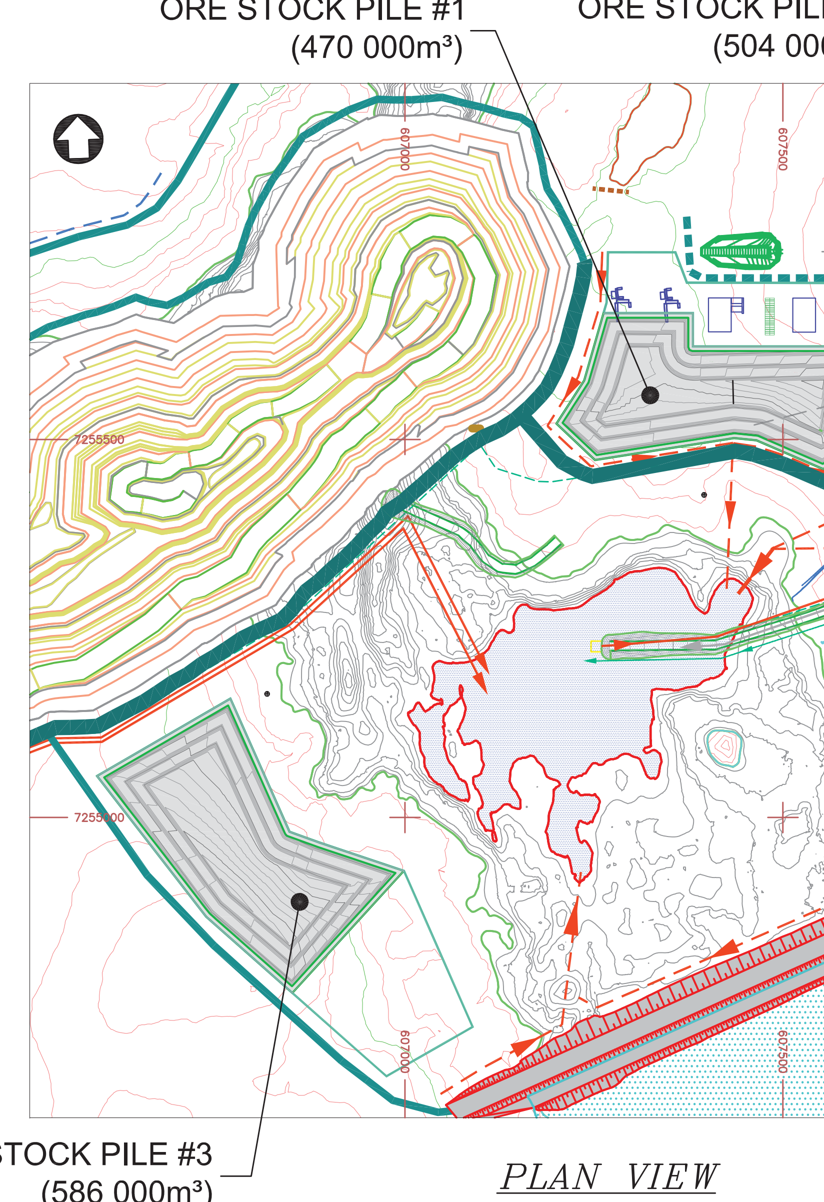

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APPROUVÉ PAR / APPROVED BY	S. OUELLET		2016–05–03
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APPENDIX B • TFSE INTERNAL STRUCTURES DESIGN

Meadowbank North Cell TSF Expansion -Design of Internal Structures

March 11, 2016

AGNICO EAGLE

O'Kane Consultants

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Meadowbank North Cell TSF Expansion -Design of Internal Structures

948/2-01

March 2016

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[illegible]-[illegible] Rockfill Dike Sections 6-7

1 INTRODUCTION

Agnico Eagle Mines Ltd. (AEM) owns and operates the Meadowbank Mine located in the Kivalliq region of Nunavut, about 110 kilometres by road north of Baker Lake. Mine commissioning and first gold production from the Portage open pit began in early 2010. The Meadowbank site is located in a region of continuous permafrost where the average daily temperature is about -12°C.

Based on potential additional tailings storage capacity required at Meadowbank, AEM evaluated options to optimize disposal of tailings in the North Cell TSF to accommodate additional tailings storage requirements for Whale Tail Pit within the current footprint of the approved Tailings Storage Facility. This report considers the addition of internal dike structures placed on the frozen beach tailings in the North Cell in support of an amendment to the approved North Cell Tailings Storage Facility. AEM contracted O'Kane Consultants Inc. (OKC) to design the internal structures based on the design parameters used for designing the North Cell TSF cover system and landform.

1.1 Project Objectives and Scope

The objectives of the project are to design internal dike structures to provide additional tailings storage capacity in the North Cell TSF using the design parameters developed for the North Cell cover system and landform design and ensuring that the designed final landform is still practicable (hillslope grades, channel grades, and outlet locations).

The scope of the project involved

- Review of existing design information of various existing tailings retaining structures;
- Review of basis for expansion and assess the structure dimensions;
- Conceptual design of internal structures;
- Numerical analysis to inform on designs, which included;
    - Slope stability,
    - Consolidation, and
    - Seepage;
- Final design of internal structures; and
- Compilation of final report, including design drawings.

Note that the design drawings are prepared with objective of allowing Agnico to develop costs for the expansion to the extent that approval can be evaluated. From a typical project flow perspective, the drawings are suitable for regulatory purposes and for concurrent feasibility studies.

1.2 Report Organization

For reference, this report has been sub-divided into the following sections:

- Section 1 - Introduction
- Section 2—Conceptual Design
- Section 3—Numerical Analyses
- Section 4—Final Design

2 CONCEPTUAL DESIGN

Based on current tailings production, AEM is looking at potential options to augment the capacity of the North Cell TSF (NC). After a review of several options, AEM decided to further explore the option of raising the North Cell to accommodate additional tailings. To accomplish this, dikes will be built along the North Cell perimeter road, which will form a perimeter for most of the North Cell TSF with the exception of above the Storm Water Dike (SWD). The dike will be placed as an offset on the tailings beach. The beach is expected to be frozen. Sufficient space will be available on the downstream side of the dike to allow for the construction of seepage water collection ditches. The seepage analysis conducted as part of this project estimates that seepage will be limited in volume and in time, as well as being manageable with minimal pumping required.

Based on the tailings production, including the Whale Tail Pit project, this report conservatively assumes 9000 tonnes per day will be deposited in the North Cell TSF over a 92 to 122-day operating season, from June to October. Deposition is planned to take place over three annual seasons from 2019 to 2021 for a total of over 3M tonnes of additional tailings deposited within the North Cell TSF. The remaining 5.3 M tonnes of storage required for the Whale Tail Pit operations will be placed in the approved South Cell Tailings Storage Facility (see Figure 2.1 - TSF site layout).

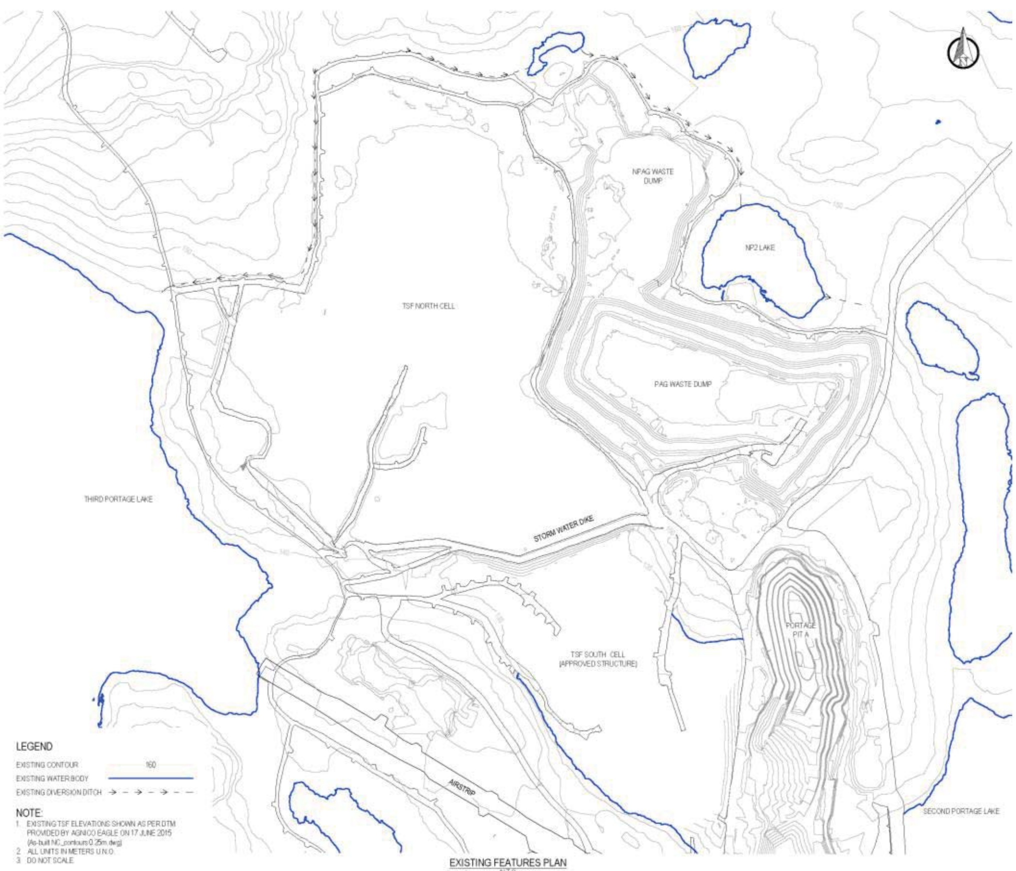


Figure 2.1: TSF Site Layout

Based on the additional space requirement in the North Cell, the present concept of the dike is one of an incline structure with minimal elevation to 152 m at its highest point along the northern portion of the TSF. It is intended to build the dike during the winter months over the frozen tailings and the previously placed 2015 capping in areas where this structure is present. The TSF closure cover system, consisting of a thermal layer of 2 to 4 m of non-acid generating (NAG) waste rock, will eventually be placed over the tailings to construct the final landform.

The rockfill dike will consist of non-potentially acid generating (NPAG) waste rock placed at angle of repose (upstream face) and at 3H:1V (downstream face) along the alignment presented in Technical Drawing 948-2-002. Note that the existing road embankment is built with a 1.3H:1V outer slope. The conceptual model assumes that this slope angle will not meet the long-term (closure) stability criteria, and therefore a reduction in this angle is required for the existing dike (to 3H:1V). On this basis, the slope for the new dike is proposed to also be set at 3H:1V.

The dike width at the crest is to be determined by construction equipment to be used. Technical drawings presented here show a 15m crest width, suitable for 2-way traffic with 50 t haul trucks. Numerical modelling of slope stability and seepage were done with a 30m wide dike. Sensitivity analysis of seepage showed no difference in seepage rates and total volumes between the 15 m and 30 m options. The height of the dike will vary between 2m and 4m, the higher portion located in the northern section of the TSF.

3 NUMERICAL ANALYSES

As part of the design process, it was necessary to ensure that the dikes would be safe and stable over the long-term as well as to account for seepage collection systems that may be required. Numerical analyses were completed to ensure that the dike design accounted for geotechnical slope stability and the quantity of potential seepage through the dike. Consolidation of tailings underneath the dike was also considered. Seven (7) typical cross-sections were developed for numerical modelling of slope stability and seepage. Each cross-section represents an area of the rockfill dike around the TSF, incorporating the specific infrastructure and foundation details (Figure 3.1).

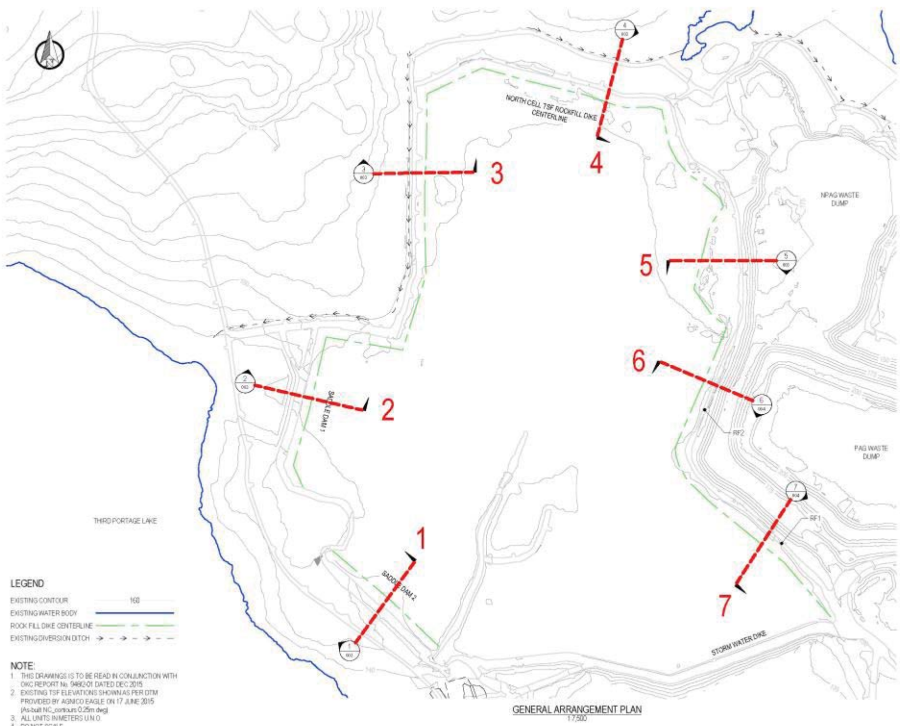


Figure 3.1: Plan view of Meadowbank North Cell TSF with slope stability and seepage analysis cross section locations.

3.1 Slope Stability Analyses

The purpose of this analysis is to evaluate the overall stability of the TSF, as well as the effects of dike location on TSF stability.

This section provides the design basis information, modelling methodology, summary of modelling scenarios, and summary of model results. Appendix B provides a summary of material properties, and all slip plane profiles.

3.1.1 Design Basis

The design basis set the following general criteria to be maintained.

- Meet or exceed required factors of safety (FS).
- Accommodate additional tailings.
- Feasibility of the construction approach (based on cost and effort).
- When the dike is used as a haul road, mine health and safety regulations, NWT/Nunavut will be followed.
- CDA 207 Dam Safety Guidelines will be followed.
- Maintain adequate setback to facilitate other works

Calculated FS values will then be compared to the minimum required values (i.e. the slope stability criteria). The minimum FS values are summarized in Table 3.1.

Table 3.1: Summary of minimum factor of safety values utilized for slope stability criteria

Condition	FS Value	Basis for FS Value
End of Construction	1.3	During or immediately after construction
Operations	1.5	Steady seepage with maximum tailings deposit
Closure	1.5	Long term seepage with the cover system
Pseudo static	1.0	Earthquake loading

3.1.2 Modelling Methodology

The commercial software SLOPE/W was used to conduct two-dimensional (2D) limit equilibrium analyses using the Morgenstern-Price method for static loading with a circular slip surface. In stability analyses, trial failure surfaces were defined with 'entry and exit' parameters, resulting in a range of possible locations within which the most critical potential failure surface may be found. The SLOPE/W program incorporates a search routine to locate those failure surfaces with the least factor of safety (FS) within the defined search limits. Calculated FS values were then compared to the minimum required values (slope stability criteria). Figure 3.2 presents a typical cross-section developed for the slope stability analysis. All cross-sections developed are available in Appendix B.

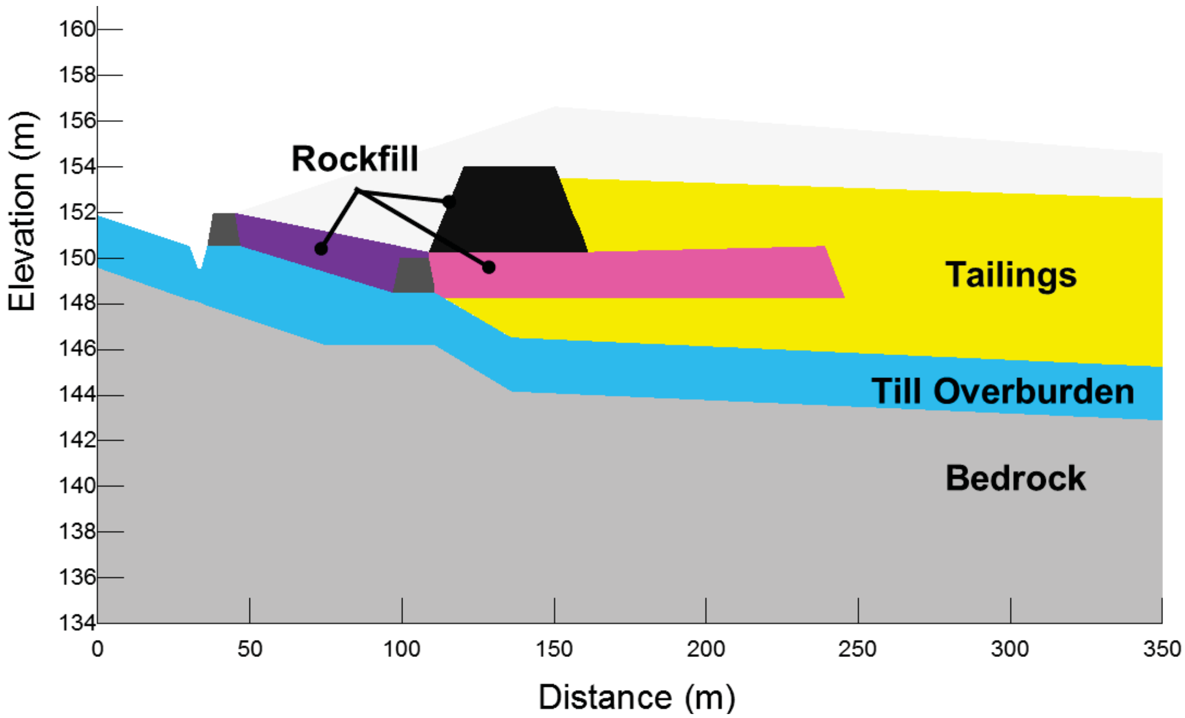


Figure 3.2: Typical cross section (Cross-Section 4) developed for slope stability analysis

3.1.3 Modelling Scenarios

Four scenarios were considered:

1) End of Construction – rockfill extension dike in place but tailings placement has yet to commence.
2) Operation – All tailings placed within the TSF.
3) Closure – Cover system placed over entire TSF.
4) Seismic Loading - a horizontal acceleration coefficient of 0.06 is applied to the scenario that has the lowest FS obtained from above three static case analyses.

For all scenarios, unfrozen materials were simulated as fully saturated with a maximum pore-water pressure of 20 kPa. Frozen materials were simulated with a -1 m pressure head. The rockfill extension dike in scenario 1 and any material within 2 m (the minimum TSF cover) of the surface were simulated as unfrozen.

3.1.4 Results

Table 3.2 provides a summary of the results for all four scenarios for each of the seven cross-sections.

Additional sensitivity analyses were completed using cross-sections 2 and 4 (Table 3.3). The angle of internal friction (phi) was reduced from 45° to 40° and 35°. Select models were also completed with the maximum pore-water pressure decreased to 10 kPa; results for these scenarios are in brackets in Table 3.3.

3.2 Seepage Analyses

Seepage analyses are required to address the potential for seepage through the rockfill extension dike. The main objective of the seepage modelling is to estimate seepage volumes through the rockfill dike, design appropriate seepage collection infrastructure as required, evaluate the need for a low permeability component on the internal slope of the rockfill extension dike, and evaluate if the width of the rockfill extension dike can be reduced.

Seepage modelling is completed assuming no permafrost formation within the rockfill as a “worst-case” scenario, defining the conservative seepage range through the extension dike. Thermal modelling undertaken as part of the North Cell TSF Cover System Design (OKC 948-01-02) shows that the permafrost active layer reaches 2 m depth for the warmest years of a 100-year climate database, taking into account climate change conditions. Assuming that the rockfill dike is constructed during the winter months and is 4 m thick where seepage is most important, the thawing front would not reach the base of the rockfill dike and the 2015 capping material will remain frozen. The conditions set out for the analysis where the rockfill dike is assumed unfrozen in its entirety, including a portion of the 2015 capping, are therefore considered conservative.

Table 3.2: Summary of slope stability analysis results.

Cross Section	Scenario	FS	Slip Surface
1	End of Construction	1.6	Up-stream (U/S), along the rockfill dike slope
	Operation	1.6	Down-stream (D/S), along the rockfill dike slope
	Closure	3.1	Through the cover, rockfill dike, and saddle dam
	Seismic Loading	1.3	D/S, along the rockfill dike slope
2	End of Construction	1.5	U/S, through the rockfill dike and tailings
	Operation	2.0	D/S, through the rockfill dike and saddle dam
	Closure	2.1	Through the cover, rockfill dike, and saddle dam
	Seismic Loading	1.3	U/S, through the rockfill dike and tailings
3	End of Construction	2.4	D/S, through the rockfill dike, 2015 capping
	Operation	1.7	D/S, along the rockfill dike slope
	Closure	2.0	Through the cover, NC road, 2015 capping and overburden
	Seismic Loading	1.4	Along the rockfill dike slope
4	End of Construction	2.4	D/S, through the rockfill dike,2015 capping, and overburden
	Operation	1.9	D/S, along the rockfill dike slope
	Closure	2.5	Through the cover, 2016 capping and overburden
	Seismic Loading	1.5	D/S, along the rockfill dike slope
5	End of Construction	2.7	U/S, through the rockfill dike and 2015 capping
	Operation	1.7	D/S, along the rockfill dike slope
	Closure		Not analyzed*
	Seismic Loading	1.4	Along the rockfill dike slope
6	End of Construction	1.7	U/S, through rockfill dike and tailings
	Operation	1.7	Along the rockfill dike slope
	Closure		Not analyzed*
	Seismic Loading	1.6	U/S, through the rockfill dike and tailings
7	End of Construction	1.6	U/S, through the rockfill dike and tailings
	Operation	1.6	U/S, through the rockfill dike and tailings
	Closure		Not analyzed*
	Seismic Loading	1.2	U/S, through the rockfill dike and tailings

*Failure cannot occur due to rock storage facility sitting outside of the dike.

Table 3.3: Sensitivity analysis results

Cross□ Se□tion	**S□enario**	**FS**			**Sli□ Surfa□e**
		□□i□□□□	□□□	□□□	
2	End of Construction	1.4	1.4	1.5	U/S, through the rockfill dike and tailings
	Operation	1.5	1.7	2.0	D/S, through the rockfill dike and saddle dam
	Closure	1.5	1.8	2.1	Through the cover, rockfill dike, and saddle dam
	Seismic Loading	1.1	1.2	1.3	Through the rockfill dike and saddle dam
4	End of Construction	2.2	2.2	2.4	D/S, along the rockfill dike slope
	Operation	1.3	1,6	1.9	Through the cover, 2016 capping and overburden
	Closure	2.3	2.4	2.5	D/S, along the rockfill dike slope
	Seismic Loading	1.1	1.3	1.5	D/S, along the rockfill dike slope

Completing the seepage simulations required definition of the following model inputs:

- geometry for each typical cross-section;
- material properties;
- surface boundary condition;
- lower boundary condition;
- external edge boundary condition; and,
- internal edge boundary condition.

Each of these inputs are described in Appendix C with results summarized below. The cross section locations are shown in Figure 3.1. The geometry for all cross sections are provided in Appendix C. The geometry for cross section 4, which showed the maximum seepage rates, is provided in Figure 3.3.

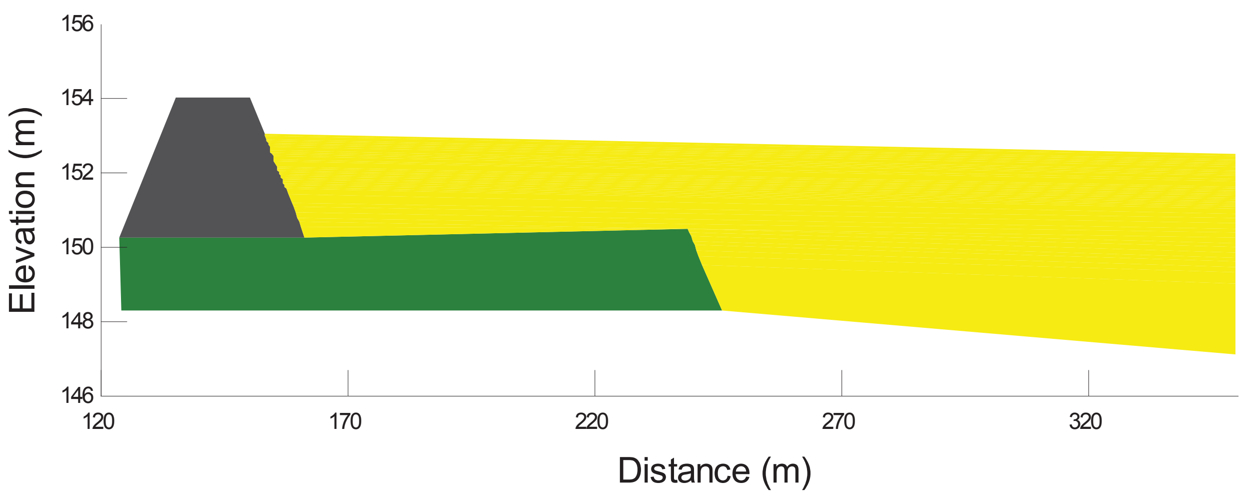


Figure 3.3: Cross-section 4 geometry at the end of deposition

3.2.1 Results

3.2.1.1 Transient Simulations

The results of the transient seepage analysis are summarized in Table 3.4. Cross-sections 1 and 7 resulted in negligible seepage; hence, no results are provided. Note that the "affected dike length" is estimated based on OKC's assumption that the rockfill dike will be built at the outer edge of the 2015 cover system placement. However, the annual tailings thickness were estimated assuming the extension dike is along the interior edge of the 2015 cover system as provided by AEM. This adds additional conservatism to the results as the dike length will either be shorter (if placed on the interior edge) or the tailings thickness will be reduced (if the dike is placed on the exterior edge of the 2015 cover system). The results are also conservative because the weekly amount of tailings are simulated as being placed, fully saturated, all at once rather than distributed throughout the week as in reality.

Table 3.4: Summary of transient seepage results for each deposition season.

Summer	Cross-Section	Maximum Seepage Velocity (m/s)	Maximum Seepage Rate (m^3/day/m)	Seepage per Length of Dike (m^3/m)	Affected Dike Length (m)	Maximum Daily Seepage Volume (m^3/day)	Total Season Seepage Volume (m^3)
2019	3	9.3E-07	0.03	1.7	724	22	1,227
	4	8.8E-06	0.5	12.3	681	341	8,358
	Total					*363*	*9,585*
2020	3	1.0E-05	0.07	2.5	724	51	1,779
	4	2.2E-05	0.15	3.3	681	102	2,266
	5	1.0E-06	0.01	0.6	559	6	312
	Total					*159*	*4,357*
2021	2	2.2E-06	0.03	2.4	851	26	2,070
	3	1.6E-05	0.03	2.5	724	22	1,811
	4	3.5E-05	0.24	6.4	681	163	4,339
	5	2.0E-06	0.09	6.8	559	50	3,776
	6	9.3E-07	0.01	0.1	480	5	39
	Total					*266*	*12,035*
2022	2	3.8E-06	0.12	2	851	102	1,702
(no cover system in place)	3	2.3E-05	0.16	2.6	724	116	1,882
	4	2.6E-06	0.23	4	681	157	2,724
	5	1.1E-05	0.12	1.3	559	67	727
	6	5.8E-06	0.10	0.7	480	48	336
	Total					*490*	*7,371*

Transient simulations were completed with the dike width at its crest at 30 m as well as with the width reduced to 15 m. Both scenarios resulted in similar results; hence, overall dike width does not influence anticipated seepage rates, which is a function of the assumed conditions, as well as the properties of the materials modelled. 15 m was determined as the minimum width to accommodate 2-way traffic with 50-ton haul trucks.

Simulation of cross-section 4 was completed with a filter layer along the interior slope of the extension dike. This model showed that the presence of a filter layer does not influence seepage rates unless the k_{sat} of the filter layer is lower than the k_{sat} of the tailings.

3.2.1.2 Steady-State Simulations

A steady-state simulation was completed for the end of each deposition season for each cross-section using anticipated maximum seepage during that season to determine: the absolute maximum seepage rate and velocity; and, the maximum distance from the dike that tailings could still contribute to the seepage rate. The results are provided in Table 3.5. These values are highly conservative as the entire tailings mass, and the flow path through the extension dike, are assumed to be fully saturated and to remain so throughout the simulation. In reality, there would likely be some storage capacity available within the tailings and/or dike thus reducing the seepage rate. If the system was fully saturated as simulated, this condition would quickly dissipate.

Table 3.5: Summary of steady-state seepage results for the end of each deposition season.

Summer	Cross Section	Maximum Seepage Velocity (m/s)	Maximum Seepage Rate (m^3/day/m)	Affected Dike Length (m)	Maximum Daily Seepage Volume (m^3/day)	Maximum Contributing Distance from Dike (m)
2019	3	1.3E-03	51	724	36,924	47
	4	1.8E-03	66	681	44,946	95
2019 (rockfill below tailings not included)	3	1.3E-03	9	724	6,516	3
	4	2.6E-03	18	681	12,258	3
2020	3	3.3E-03	45	724	32,580	8
	4	3.3E-03	50	681	34,050	8
	5	1.5E-03	22	559	12,298	74
2021	2	1.7E-03	73	851	62,123	8
	3	3.4E-03	76	724	55,024	25
	4	3.3E-03	109	681	74,229	10
	5	2.0E-03	49	559	27,391	80
	6	2.0E-03	16	480	7,680	50

Figures for all the cross-sections for each season are provided in Appendix C. Cross-section 4 (Figure 3.4 to Figure 3.7) is anticipated to have the highest seepage volume. The steady-state models show that the 2015 capping cover system rockfill layer under the tailings and dike provides a conduit for flow during the 2019 season, which allows for tailings pore-water much further away from the dike to influence seepage rates through the dike. Seepage rates and contributing distances are substantially reduced when the rockfill layer is not included in the simulation (Figure 3.5). In order to reduce seepage rates under the rockfill dike, the rockfill dike should be constructed during the winter months to ensure permafrost aggradation within the 2015 capping and the dike material. This is to ensure permafrost formation under and within the dike and to reduce the active layer to the dike itself during the deposition season, thus reducing the “conduit” effect in the rockfill material under the dike.

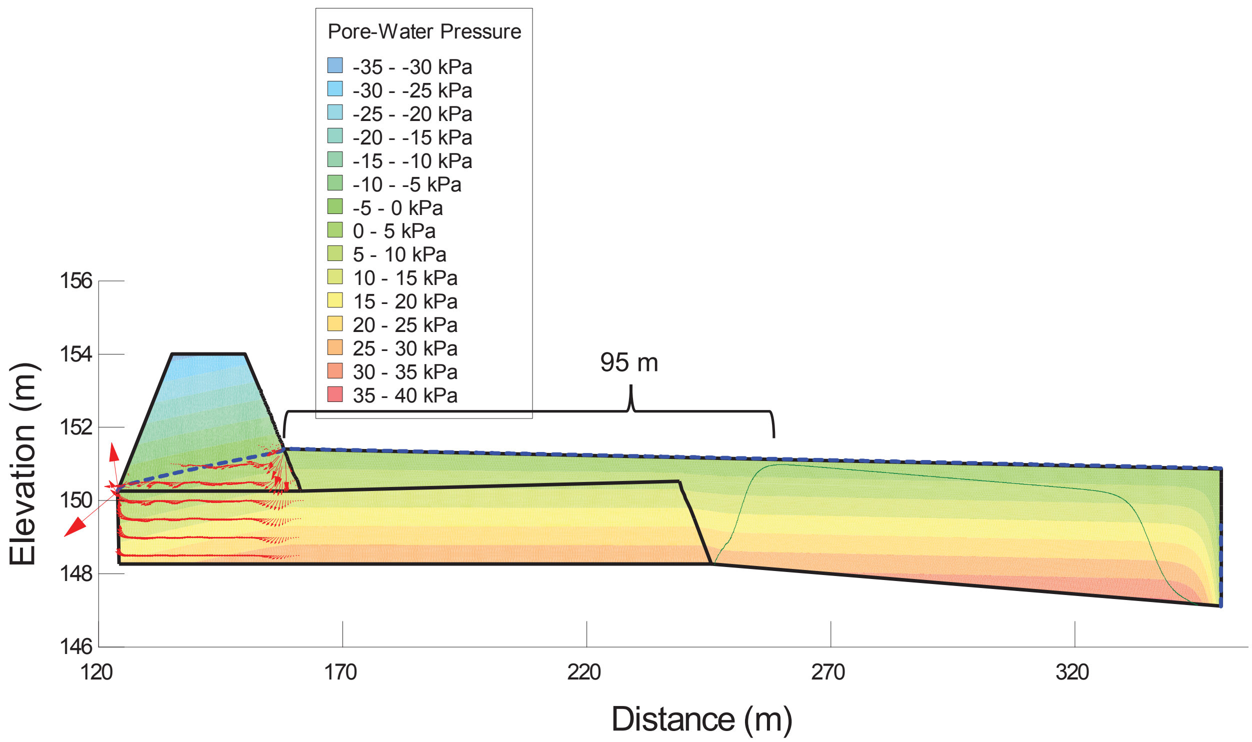


Figure 3.4: Steady-state pore-water pressure, flow paths and flow vectors for section 4 at end of 2019.

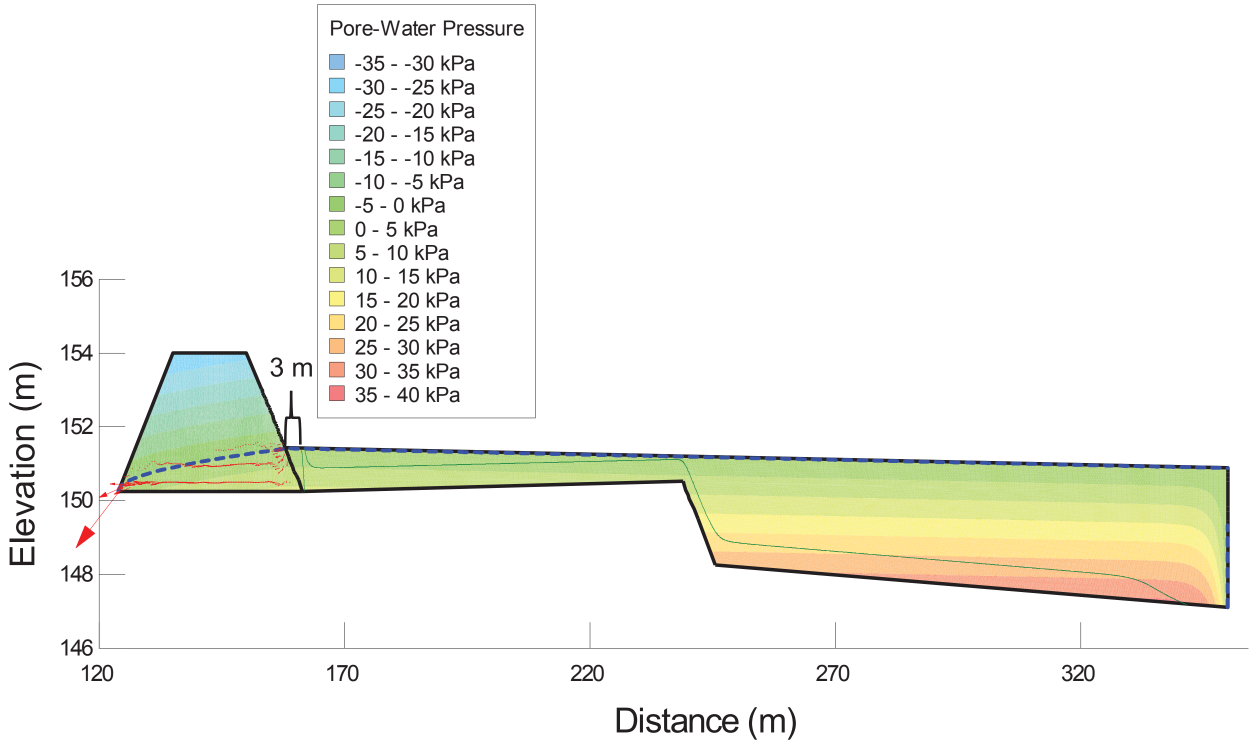


Figure 3.5: Steady-state pore-water pressure, flow paths and flow vectors for section 4 at end of 2019 when rockfill layer below tailings and dike not included.

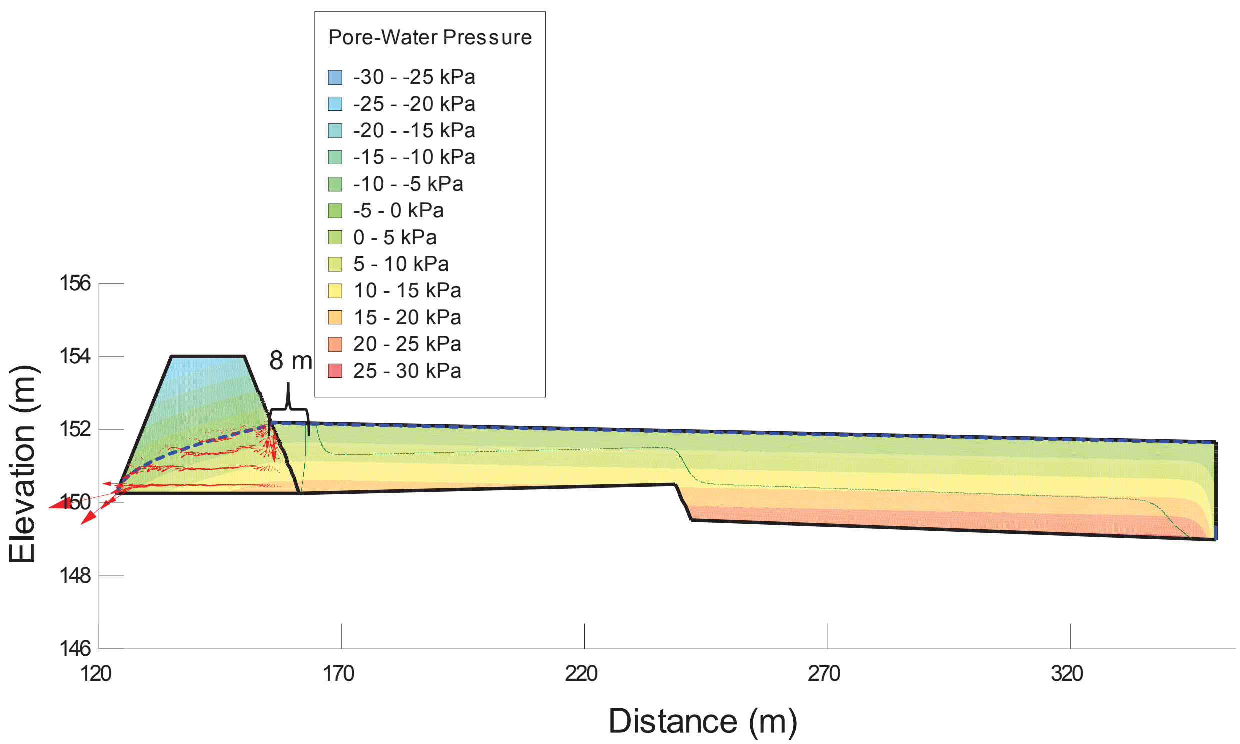


Figure 3.6: Steady-state pore-water pressure, flow paths and flow vectors for section 4 at end of 2020

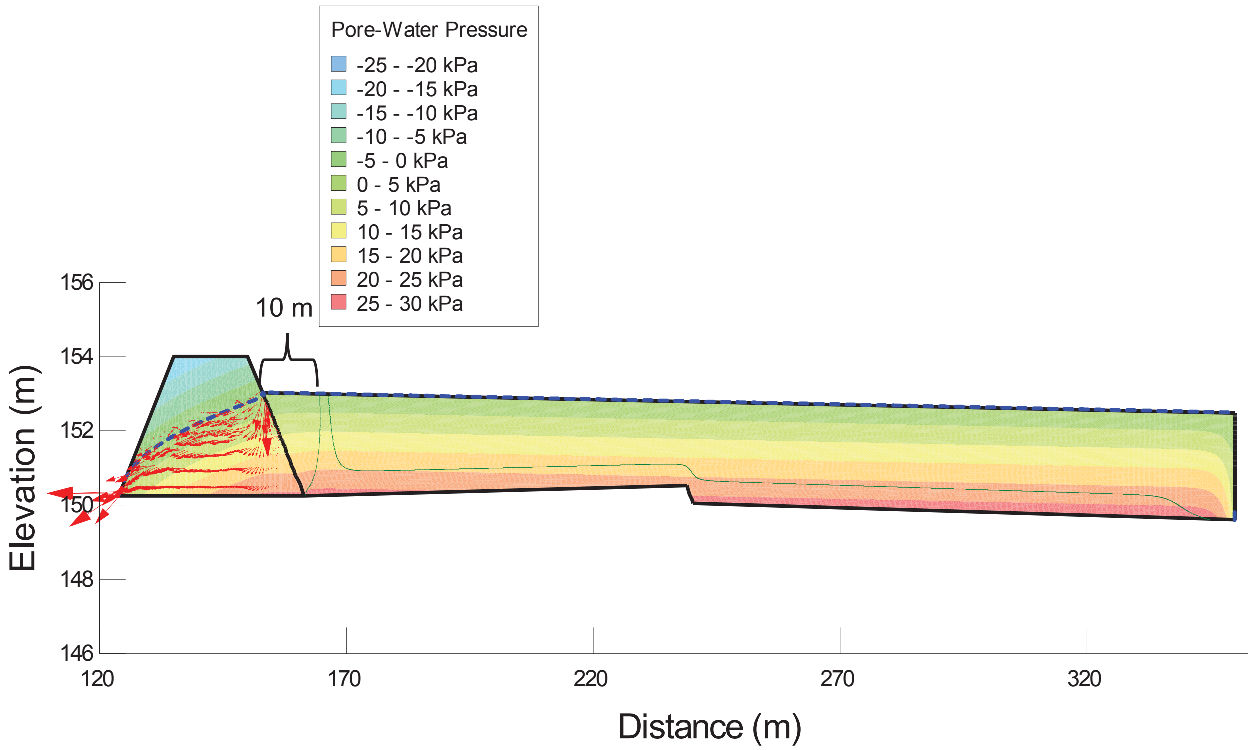


Figure 3.7: Steady-state pore-water pressure, flow paths and flow vectors for section 4 at end of 2021

It can be argued that a potential concern is fines within the tailings migrating into the extension dike via the seepage flow. It is the opinion of OKC that this "washing" of fines from the tailings will be minimal and will not influence performance of the extension dikes for the following reasons.

- The maximum seepage velocities provided in this report are very conservative, and, in the case of the maximum seepage velocities presented in Table 3.5, represent the absolute maximum seepage velocities if the full volume of annual tailings was placed, saturated and without permafrost, against the extension walls at one time. Although not as extreme as the steady-state simulations, the transient maximum seepage rates are also highly conservative as the weekly material placement is simulated as placed all at once and not distributed throughout the week as in reality.

- The maximum seepage velocities will quickly dissipate as the tailings drain; quickly losing its ability to keep particles in suspension.

- Preferential flow paths will change year-to-year due to the development of permafrost within the tailings and extension dike.

- Any initial movement of sediments will clog flow paths within the extension dike, quickly limiting flow and reducing the washing of fines from the tailings.

3.3 Climate Change Considerations

As part of the North Cell TSF Cover System Design (OKC 948-01-02), OKC considered climate change scenarios for the thermal analysis of the proposed cover system. Results from the thermal analysis were then used as inputs for the seepage analysis discussed in the previous section.

As part of the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (AR5), the IPCC adopted new Representative Concentration Pathways (RCPs) to replace the previous emission scenarios of the Special Report on Emission Scenarios (SRES). The two middle class scenarios: RCP4.5 and RCP6 scenarios were chosen as the most appropriate climate change scenarios for the site. RCP6 represents non-climate policy scenarios. The RCP6 scenario is more equivalent to most predictions of emissions by 2100 in the case that no climate action is taken (van Vuuren et al. 2011).

The first of the two proposed scenarios, RCP4.5, is comparable to many scenarios that include some form of climate policy. This scenario still allows for increases in emissions while also implementing a climate policy. The policy most followed by the world's countries is outlined by the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC has the goal of stabilizing GHG emissions to a level that would prevent serious human-caused climate change. In addition to the UNFCCC, the Kyoto Protocol is the main international agreement that limits countries GHG emissions with the aim of an overall decrease. The Kyoto Protocol came into effect in 2005 and expired at the end of 2012. While several large polluters (USA and Canada included) did not sign or ratify the treaty, or did and later withdrew, others, like the European Union, are on track to achieve their reduction targets (EEA 2010). In 2013, an agreement was reached that all states of the UNFCCC would work to reduce their emissions as soon as possible. A new climate framework is to be negotiated in 2015, indicating a willingness to work toward a policy of reduced emissions. The second proposed scenario, RCP6 is a stabilization scenario where total radiative forcing stabilizes after 2100 at 6 W/m^2. This scenario would still require implementation of a range of technologies and strategies to reduce GHG emissions.

3.4 Consolidation Analyses

A one-dimensional (1-D) consolidation analysis was conducted to assess the potential for overall tailings settlement due to the additional loading from the placement of the rockfill dike. The specific purpose of this analysis was to estimate settlement of the tailings mass that would be caused by permafrost degradation due to seepage beneath the dike during operations. The analysis looked to evaluate whether the predicted long-term settlement could affect the overall integrity of the rockfill dike. It is assumed that the internal structure will remain frozen or partially frozen once operations have ceased and the tailings are capped.

Essential criteria for ensuring long-term stability due to dike construction are:

1) Absolute magnitude of potential settlement;
2) Time dependent consolidation rates; and
3) Magnitude of secondary settlement to ensure long-term stability.

An analytical approach was selected for the 1-D tailings consolidation analysis. Material properties (e.g. unit weight) of the tailings and reclamation cover materials were the same assumptions used for the consolidation analysis provided for the cover and landform design (OKC Report 948/1-02), and were used to calculate initial and final vertical effective stresses in the tailings mass. The tailings ultimate settlement due to consolidation was then determined based on the calculated vertical effective stresses. A tailings mass thickness of 2 m was used in the analysis, which is consistent with the thawed depth of tailings used in other analyses; not taking into account cover system placement in order to develop a conservative case.

Tailings consolidation, for the purposes of this report, is referred to as tailings volume change (settlement) at the end of tailings deposition. External loading from dike material placement is a key factor leading to tailings consolidation settlement.

The results indicate that a 2 m thick mass of tailings would consolidate to a 90% degree of consolidation in approximately 10 days. During this time, primary consolidation of the tailings would be approaching completion with a final change in height of approximately 0.29 m. Long-term consolidation, also known as creep, then commences. A secondary settlement of approximately <1 cm was calculated over a period of 100 years following completion of primary consolidation. However, it is anticipated that the tailings beneath the rockfill dike will re-freeze and therefore long-term consolidation is unlikely to occur.

The consolidation analysis is considered to be highly conservative. The conservatism in this analysis is due to:

- The assumption of 2 m of thawed tailings beneath the rockfill dike;
- The assumption that the 2 m of thawed tailings would also be at a saturation of 100%; and
- The assumption that 2 m of thawed tailings would exist instantaneously and allow primary consolidation to occur all at once.

The predicted consolidation is therefore considered to be somewhere between the minimum value of <1cm for the secondary consolidation rate (and frozen tailings) and the 0.29 m maximum value (for the 2 m of thawed tailings). If thawing due to seepage beneath the rockfill dike does occur, it is most likely to occur within the rockfill itself, rather than through the tailings. Therefore, both the thaw depth, and the fully saturated condition make this assessment highly conservative. Seepage will occur within the year of tailings placement or shortly after, so any thaw consolidation that might occur would occur over short timeframes, to enable modification to the dike elevation, if required.

4 FINAL DESIGN

The rockfill dike design was developed from the conceptual design along with completed numerical modelling to ensure the adequacy of the design meets the design and operational objectives of the infrastructure. Technical drawings were developed showing the main elements of the rockfill dike as well as its position within the North Cell TSF. Drawings are presented in Appendix A and are listed in below.

Table 4.1: Technical drawings list and description.

Drawing Number	Drawing Title	Description
948/2-001	Existing Feature Plans	Plan view of the greater area surrounding the North Cell TSF
948/2-002	Rockfill Dike Alignment Layout Plan	Plan view of the North Cell TSF, showing the alignment of the rockfill dike and set out data
948/2-003	Rockfill Dike, Sections 1-5	Typical cross-sections of the rockfill dike for Sections 1 &2, 3&4, and 5.
948/2-004	Rockfill Dike, Sections 6-7	Typical cross-section of the rockfill dike for Sections 6 & 7, and details of the filter layer

4.1 Rockfill Dike Cross-Section

The rockfill dike is constructed of NPAG material placed by haul truck and dozer. It is not designed to be a water retaining structure and numerical modelling shows that seepage reporting to the downstream side of the dike is manageable as part of regular operations. The height of the dike is limited to 4 m for its highest portions (cross-sections 3, 4 and 5 on DRG 948-2-002) and to 2 m for the remaining sections. It is suggested to limit lift height to 1m during construction to avoid particle segregation during placement and promote traffic compaction. This will further limit potential seepage during operational tailings deposition,

The rockfill dike is designed with 15 m crest width to allow for 2-way traffic with 50-ton haul trucks. If larger construction equipment was to be used, the rockfill dike may be built wider to accommodate the equipment. Seepage modelling was done on both the 15 m and 30 m dike width for cross-section 4, showing that overall width had little to no influence on the seepage rates reporting on the downstream side of the dike.

4.1.1 Filter Layer

Drawing 948-2-004 shows preliminary detail of the filter layer to be placed on the upstream side of the rockfill dike prior to tailings deposition. The overall width of this filter layer is in addition to the rockfill dike crest width. The filter layer consists of 0-6” granular fill against the NPAG rockfill dike, with 0-3/4” granular fill on either side of a non-woven geotextile. The purpose of the 0-3/4” granular material and geotextile is to prevent tailings material from migrating through the coarser rockfill of the dike. The

0-6” material is a transition material to prevent the finer granular material from migrating towards the rockfill. Should the stated layer widths prove challenging to implement, these can be increased as required. Anchoring of the geotextile layer will be dependent on the chosen manufacturer specifications for installation.

4.2 Rockfill Dike Alignment

The alignment presented in DRG 948-2-002 is based on a set offset from known infrastructure on the perimeter of the North Cell TSF. The offset is based on the edge of the roadway to the centre line of a 15 m wide rockfill dike. If AEM was to choose to build a wider dike to accommodate construction equipment, this additional width should be expanded on the upstream side in order to maintain the offset.

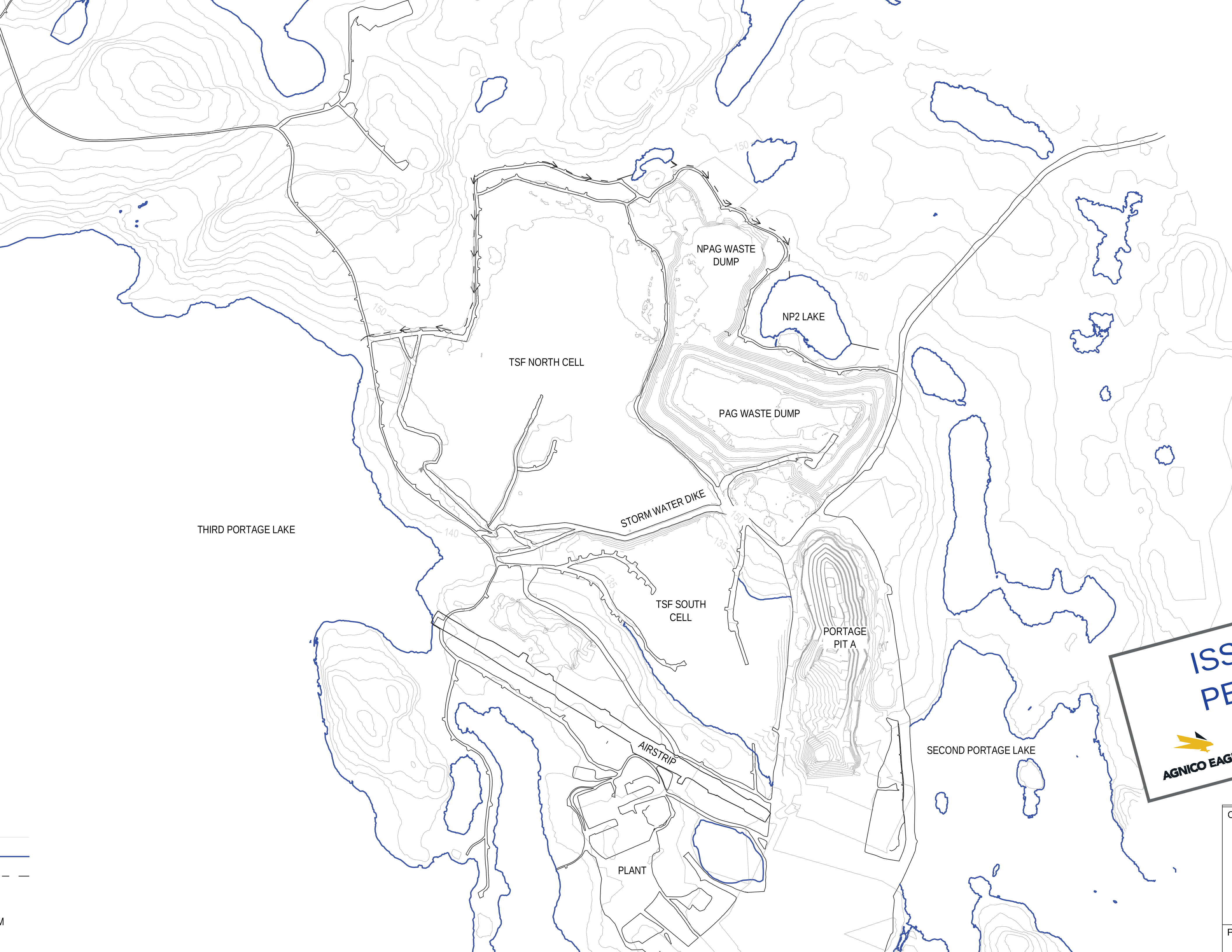
Some sections of the rockfill dike are to be built directly over the tailings beach (cross-sections 1, 2, 6 and 7) while the remainder will be built over the previously placed capping material; refer to DRG 948-2-003 and 948-2-004 for typical cross-sections.

4.2.1 Seepage Management Infrastructure

Numerical modelling developed for the project shows that seepage from the rockfill dike are limited both in volume and time. Conservative modelling suggests that most seepage occurs early following deposition and tails off when deposition stops. As deemed necessary, AEM will construct a collection ditch on the downstream side of the rockfill dike, 5 m from the toe of the dike. As survey data is conflicting for the areas close to the perimeter of the TSF, it is suggested that low-points along the collection ditch be identified during construction and collection sump positioned in these areas. The maximum daily seepage rate expected for the rockfill dike is 341 m^3 for the portion of the dike relating to cross-section 4 (dike length of 681 m). As such, pumping capacity of 15 m^3/hr (70 gpm, 250 L/min) is sufficient to manage seepage volumes for that section of dike. As deposition of tailings will take place over a limited section of the dike at any one time, seepage is expected to be limited in extent.

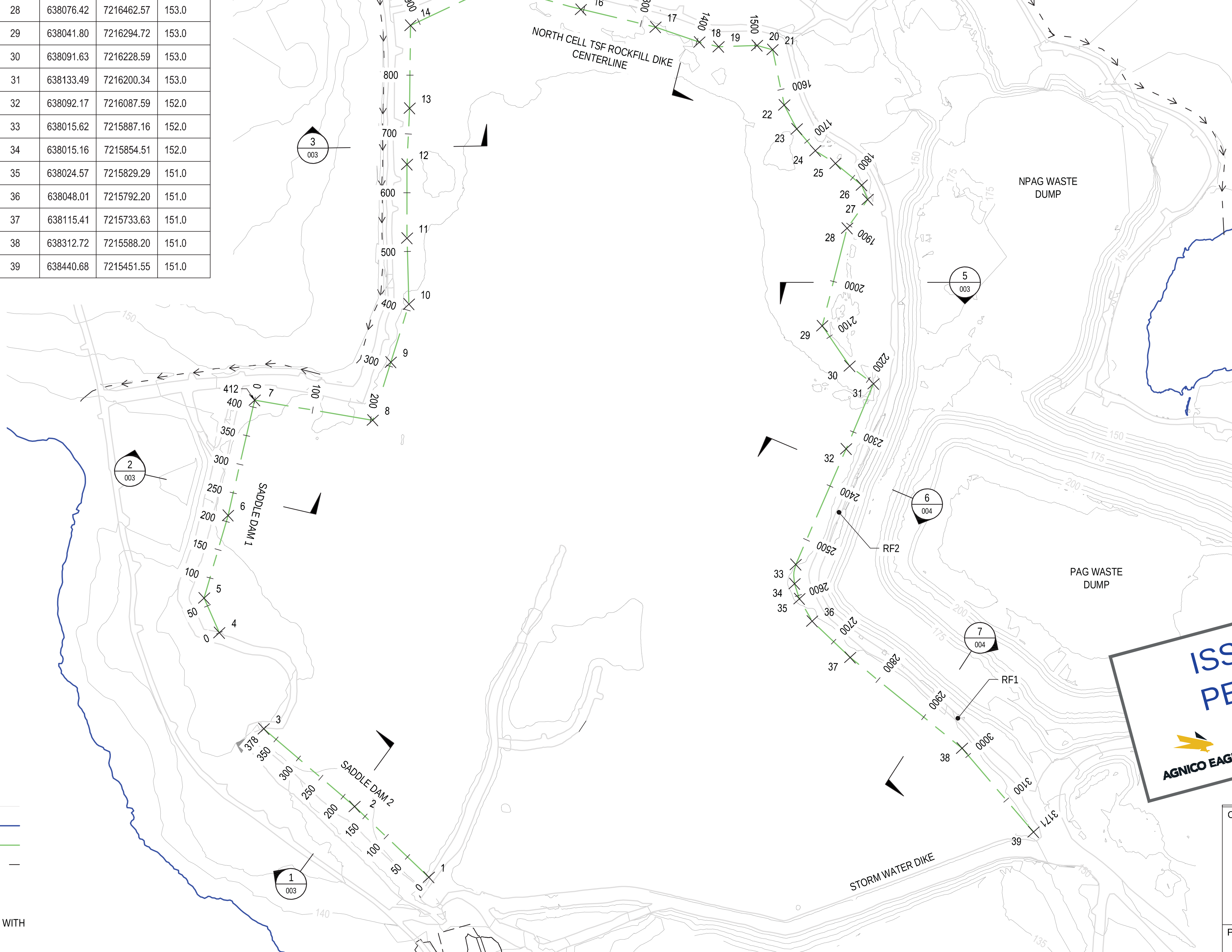
Appendix [illegible]

Drawings



NPAG WASTE DUMP
NP2 LAKE
TSF NORTH CELL
PAG WASTE DUMP
STORM WATER DIKE
THIRD PORTAGE LAKE
TSF SOUTH CELL
PORTAGE PIT A
SECOND PORTAGE LAKE
AIRSTRIP
PLANT
AGNICO EAG
175
150
140
135

28	638076.42	7216462.57	153.0
29	638041.80	7216294.72	153.0
30	638091.63	7216228.59	153.0
31	638133.49	7216200.34	153.0
32	638092.17	7216087.59	152.0
33	638015.62	7215887.16	152.0
34	638015.16	7215854.51	152.0
35	638024.57	7215829.29	151.0
36	638048.01	7215792.20	151.0
37	638115.41	7215733.63	151.0
38	638312.72	7215588.20	151.0
39	638440.68	7215451.55	151.0



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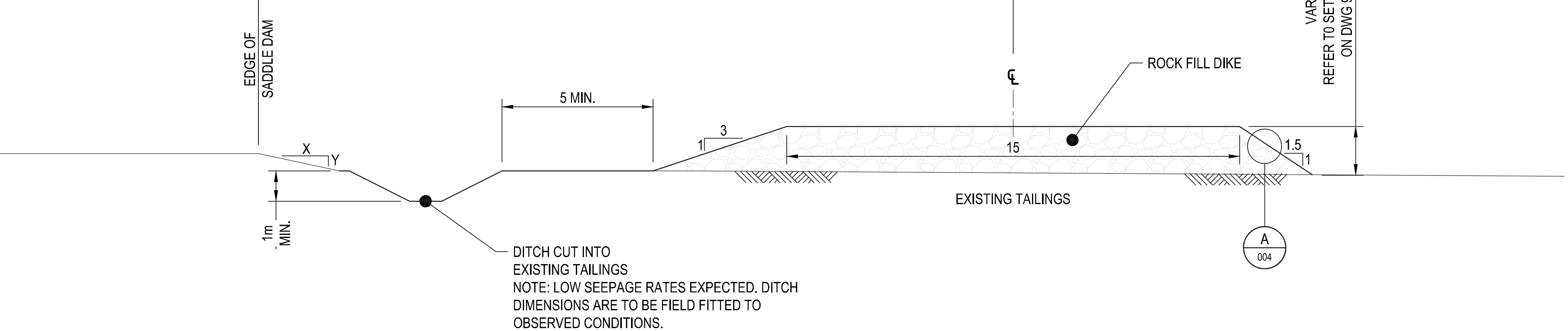

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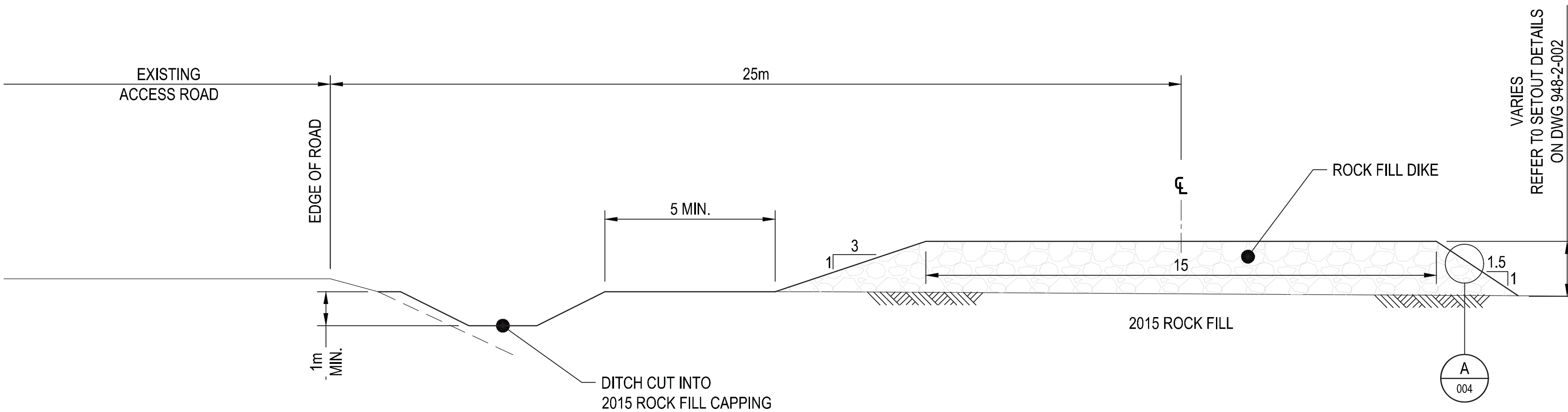

SECTION 3 & 4
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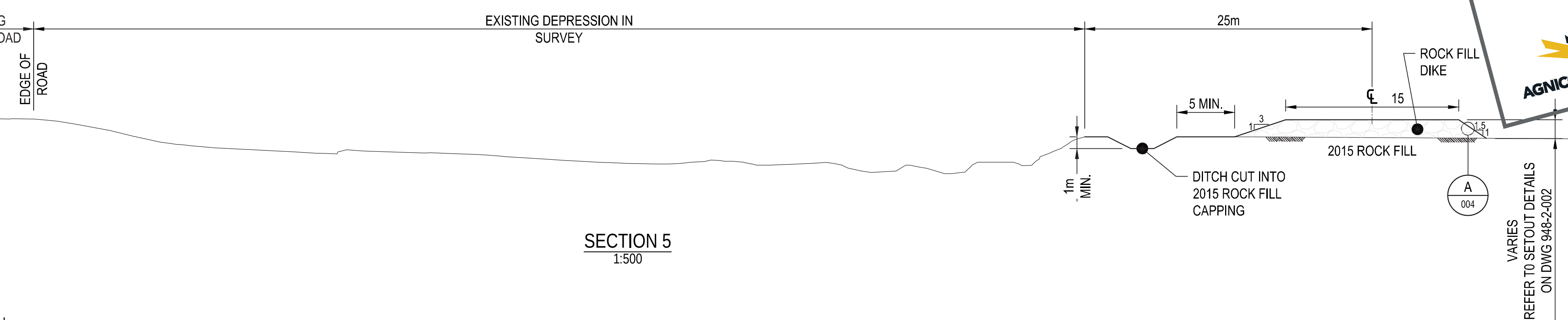

SECTION 5
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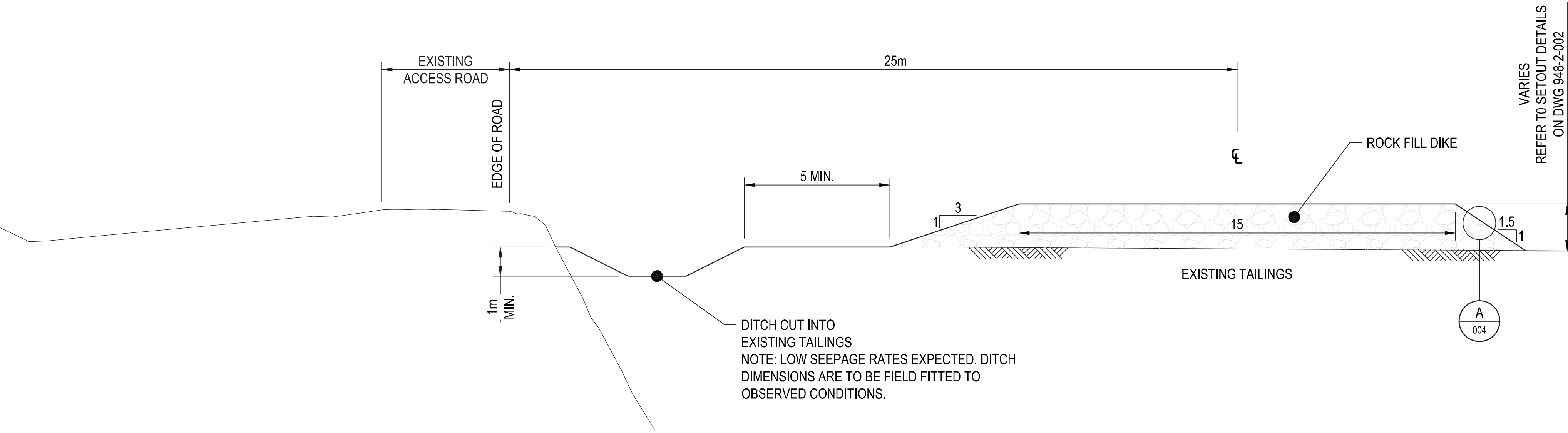

SECTION 6 & 7
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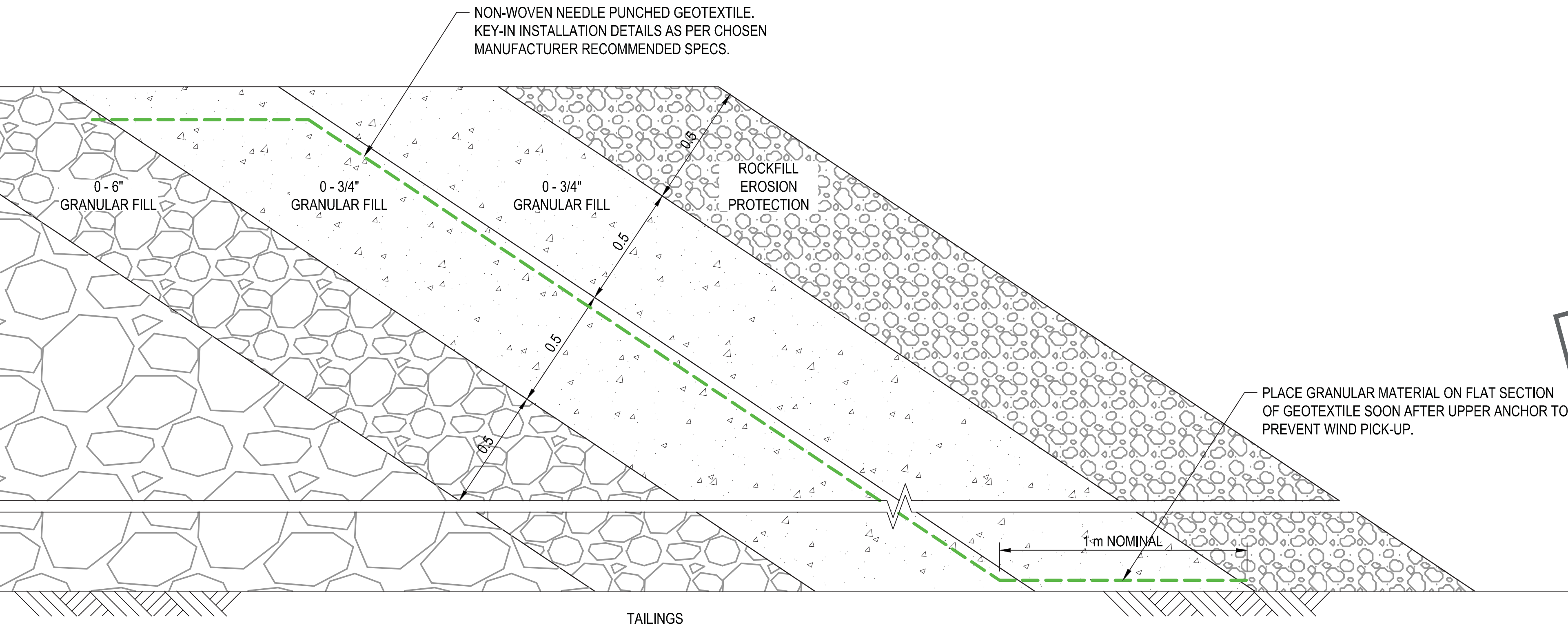

DETAIL A
1:20

Appendix B

Slope Stability Modelling-Detailed Results

O'Kane Consultants
Integrated Mine Waste Management and Closure Services
Specialists in Geochemistry and Unsaturated Zone Hydrology

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Interoffice Memorandum

To: Bonnie Dobchuk – Senior Geoenvironmental Engineer, O'Kane Consultants

From: Jason Song, Geoscientist P.Eng.

Cc: Philippe Garneau

Our ref: 948/2

Date: January 15, 2016

Re: **Meadowbank North TSF Extension - Results for Slope Stability Analysis**

O'Kane Consultants Inc. (OKC) was retained by Agnico Eagle Mines Ltd. (AEM) for design work to support evaluation and optimization of the current Meadowbank Tailings Storage Facility (TSF). A key component of this work is slope stability analysis of the rockfill extension dike, which will form a perimeter for most of the TSF North Cell with the exception of above the Storm Water Dike (SWD). The purpose of this analysis is to check the overall stability of the TSF as well as the effects of dyke location on the TSF stability. The body of this document provides the modelling methodology, summary of material properties, modelling cross-sections and scenarios, slope stability criteria, and summary of model results. The appendix provides all slip plane profiles.

Modelling Methodology

The commercial software SLOPE/W[1] was used to conduct two-dimensional (2D) limit equilibrium analyses using the Morgenstern-Price method for static loading with a circular slip surface. In stability analyses, trial failure surfaces were defined with 'entry and exit' parameters, resulting in a range of possible locations within which the most critical potential failure surface may be found. The SLOPE/W program incorporates a search routine to locate those failure surfaces with the least factor of safety (FS) within the defined search limits.

Summary of Material Properties

Table 1 provides a summary of the material properties used to simulate each component within each of the seven cross-sections.

[1] GEO-SLOPE International Ltd., 2014. Stability Modelling with VADOSE/W. June 2015 Edition. Calgary, Alberta, Canada.

Table 1□Summary of Material Properties

Name in Cross-Section	Material	Unit Weight (kN/m³)	Friction Angle	Cohesion (kPa)	Notes	Colour in Profiles
Cover System	Cover Material	21.0	□2°	0	Estimated	
Tailings	Tailings	18.0	2□°	0	Golder	
Rockfill Dike	Rockfill	22.2	45°	0	Golder	
Road / NC Road	Rockfill	22.2	45°	0	Golder	
Compacted Till	Compacted Till	21.0	□2°	0	Estimated	
Overburden	Overburden	18.0	22°	0	Estimated	
Saddle Dam	Rockfill	22.2	45°	0	Estimated	
LLDPE	Geomembrane	9.0	2□°	0	Estimated	
Fine Filter	Rockfill	22.2	45°	0	Golder	
Coarse Filter	Rockfill	22.2	45°	0	Golder	
Rockfill Storage Facility	Rockfill	22.2	45°	0	Estimated	
2015 Capping	Rockfill	22.2	45°	0	Estimated	
2016 Capping	Rockfill	22.2	45°	0	Estimated	
Bedrock	Bedrock	N/A	N/A	N/A	Impenetrable	

In addition, the internal friction angle of the rockfill was reduced from 45° to 40° and □5° to analyze dike's slope stability sensitivity. The friction angles of other material did not change in the sensitivity analyses.

Modelling Cross-Sections

Seven cross-sections were modelled with slope stability (Figure 1). These sections were chosen along the dike perimeter and were considered representatives of all various dike segments.

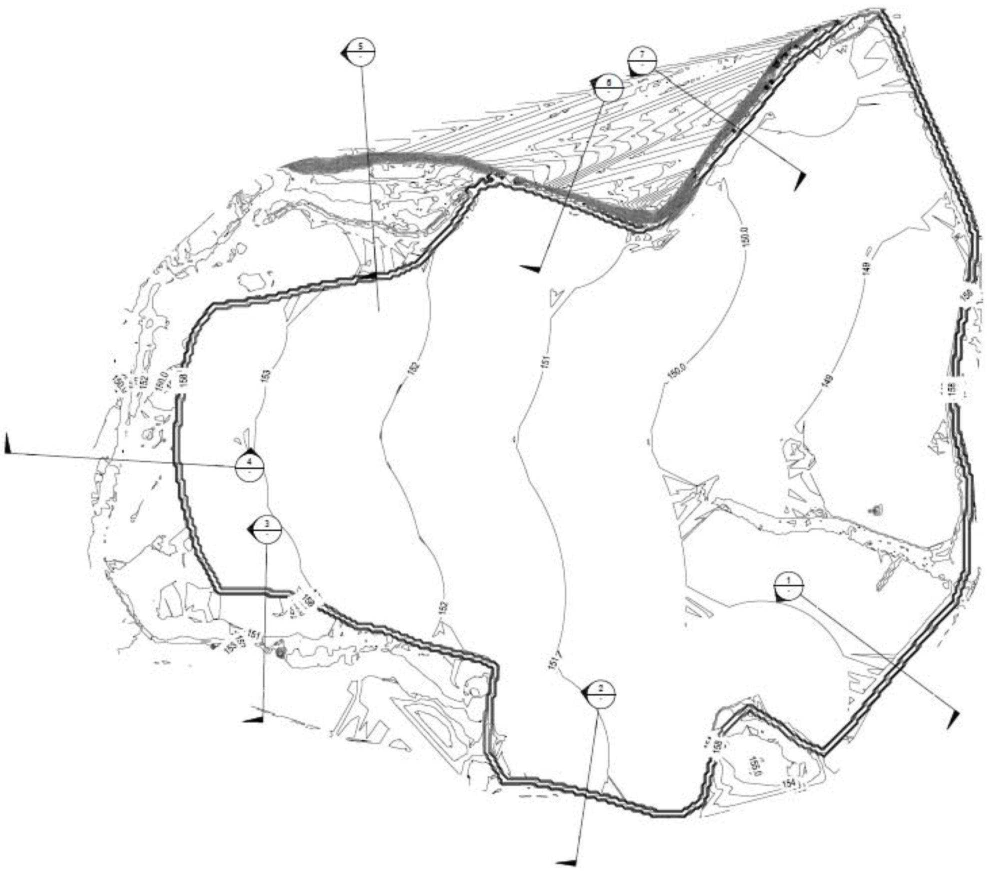

Figure 1 Locations of cross-sections for slope stability analyses for North Cell.

Dike's heights were variable, determined from the planned tailings maximum elevation that was supplied by AEM. A freeboard of approximately 0.5 m was added to the tailings maximum elevation. The maximum dike's height was 4 m. During the slope stability modelling, the dike's width was set as 30 m and the dike's slope angle was set as □□1V.

Modelling Scenarios

Four scenarios were considered:

1) End of Construction – rockfill extension dike in place but tailings placement has yet to commence.
2) Operation – All tailings placed within the TSF.
3) Closure – Cover system placed over entire TSF.
4) Seismic Loading - a horizontal acceleration coefficient of 0.06 is applied to the scenario that has the lowest FS obtained from above three static case analyses.

For all scenarios, unfrozen materials were simulated as fully saturated with a maximum pore-water pressure of 20 kPa. Frozen materials were simulated with a -1 m pressure head. Material within 2 m of the surface were simulated as unfrozen. Figures 1 – □ shows pore-water pressures simulated for scenarios 1) to □), respectively. □ere Section 1 is illustrated as an example. Similar pore-water pressures were applied to other sections. The seismic loading analysis has the same pore-water pressure profile as its corresponding static case analysis. The blue dotted lines indicate zero pore-water pressure.

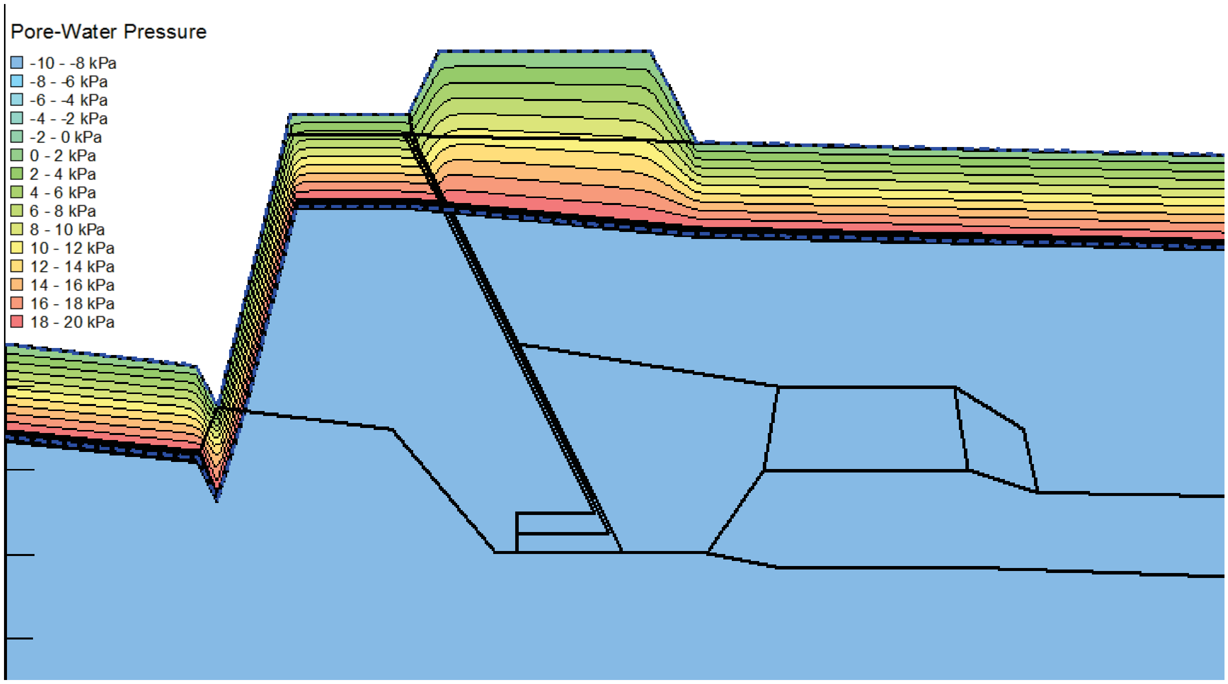

Figure 2 Pore-water pressure at the end of dike construction for Section 1.

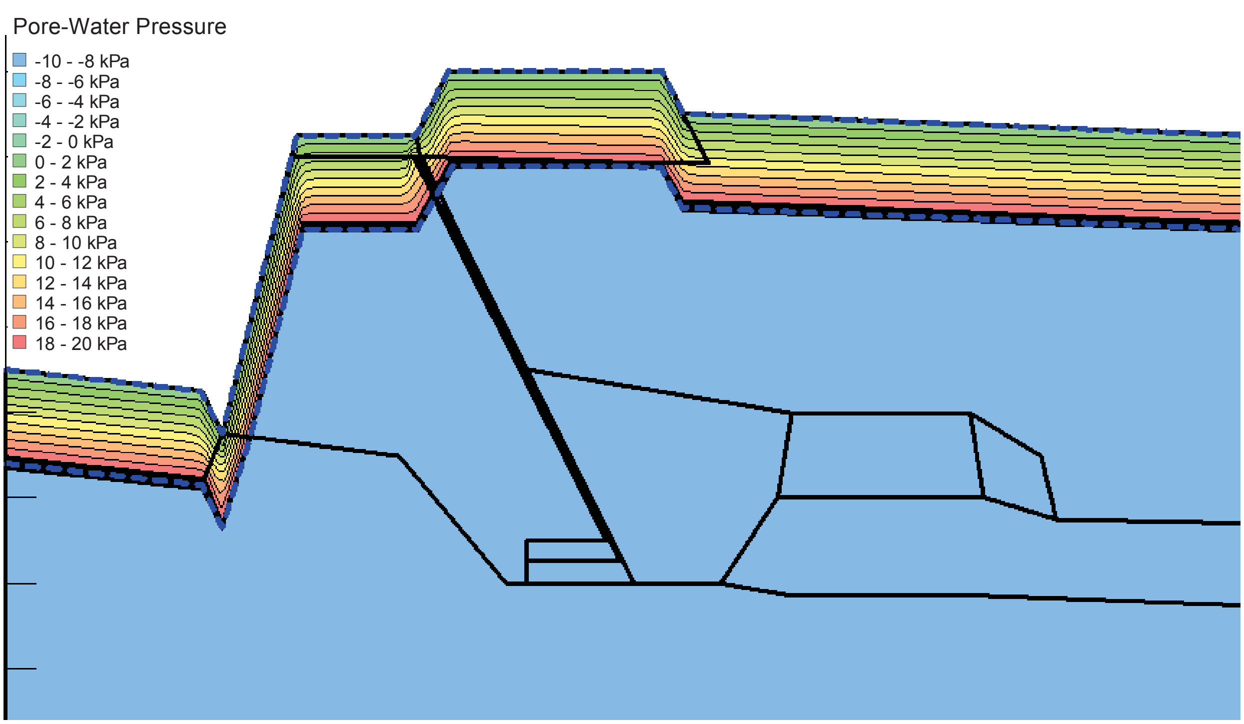

Figure □ Pore-water pressure for the Operation scenario for Section 1.

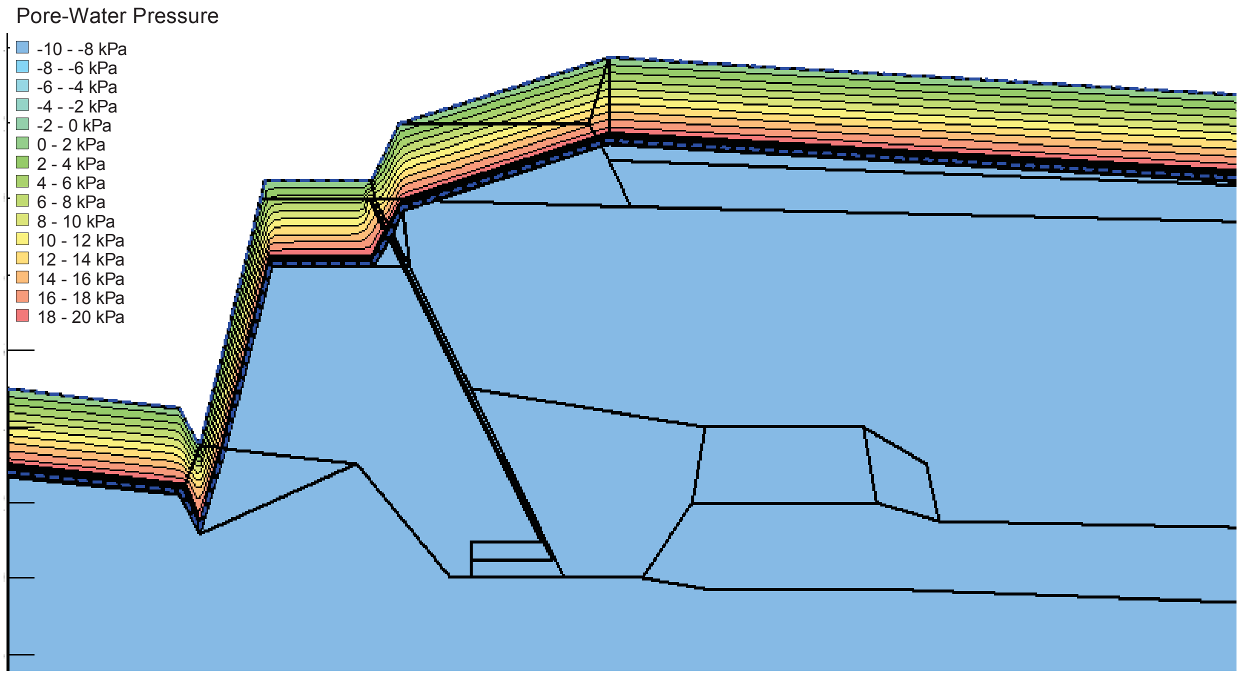

Figure 4 Pore-water pressure for the Closure scenario for Section 1.

Slope Stability Criteria

Calculated FS values from the SLOPE/W program will be compared to the minimum required values (i.e. the slope stability criteria). The minimum FS values are summarized in Table 2.

Table 2 Summary of minimum factor of safety values utilized for slope stability criteria

Condition	FS Value	Basis for FS Value
End of Construction	1.□	During or immediately after dike's construction
Operation	1.5	With maximum tailings deposition
Closure	1.5	After cover system placement
Pseudo static	1.0	Seismic loading

Results

Table □ provides a summary of the results for all four scenarios for each of the seven cross-sections. The slip surfaces and factors of safety are presented in the appendix of this memorandum.

Table □□Summary of slope stability analysis results

Cross-Section	Scenario	FS	Slip Surface
1	End of Construction	1.6	Up-stream (U/S), along the rockfill dike slope
	Operation	1.6	Down-stream (D/S), along the rockfill dike slope
	Closure	□.1	Through the cover, rockfill dike, and saddle dam
	Seismic Loading	1.□	D/S, along the rockfill dike slope
2	End of Construction	1.5	U/S, through the rockfill dike and tailings
	Operation	2.0	D/S, through the rockfill dike and saddle dam
	Closure	2.1	Through the cover, rockfill dike, and saddle dam
	Seismic Loading	1.□	U/S, through the rockfill dike and tailings
□	End of Construction	2.4	D/S, through the rockfill dike, 2015 capping
	Operation	1.□	D/S, along the rickfill dike slope
	Closure	2.0	Through the cover, NC road, 2015 capping and overburden
	Seismic Loading	1.4	Along the rockfill dike slope
4	End of Construction	2.4	D/S, through the rockfill dike,2015 capping, and overburden
	Operation	1.9	D/S, along the rockfill dike slope
	Closure	2.5	Through the cover, 2016 capping and overburden
	Seismic Loading	1.5	D/S, along the rockfill dike slope
5	End of Construction	2.□	U/S, through the rockfill dike and 2015 capping
	Operation	1.□	D/S, along the rockfill dike slope
	Closure		Not analyzed□
	Seismic Loading	1.4	Along the rockfill dike slope
6	End of Construction	1.□	U/S, through rockfill dike and tailings
	Operation	1.□	Along the rockfill dike slope
	Closure		Not analyzed□
	Seismic Loading	1.6	U/S, through the rockfill dike and tailings
□	End of Construction	1.6	U/S, through the rockfill dike and tailings
	Operation	1.6	U/S, through the rockfill dike and tailings
	Closure		Not analyzed□
	Seismic Loading	1.2	U/S, through the rockfill dike and tailings

□Failure cannot occur due to rock storage facility sitting outside of the dike.

The results presented in Table □ indicate that modelled FS values satisfied the dike's slope stability criteria. It should be noted that the dike width (dike's crest width) was set as 30 m in these slope stability analyses. When the seepage modelling was completed in a later time, it was found that the dike's width can be reduced to 15 m and had no significant impact on seepage value. It is anticipated that the FS values will not change substantially when the dike width changes from □0 m to 15 m if the slope angle of the dike maintains. However, it is considered prudent to re-visit slope stability analysis when the dike's width and location is finalized.

Sensitivity analyses were completed using cross-sections 2 and 4. Results for these scenarios are in brackets in Table 4.

Table 4□Factor of safety values from sensitivity analysis

Cross-Section	Scenario	FS			Slip Surface
		Phi□□□□	□□□	□□□	
2	End of Construction	1.4	1.4	1.5	□/S, through the rockfill dike and tailings
	Operation	1.5	1.□	2.0	D/S, through the rockfill dike and saddle dam
	Closure	1.5	1.8	2.1	Through the cover, rockfill dike, and saddle dam
	Seismic Loading	1.1	1.2	1.□	Through the rockfill dike and saddle dam
4	End of Construction	2.2	2.2	2.4	D/S, along the rockfill dike slope
	Operation	1.□	1.6	1.9	D/S, along the rockfill dike slope
	Closure	2.□	2.4	2.5	Through the cover, 2016 capping and overburden
	Seismic Loading	1.1	1.□	1.5	D/S, along the rockfill dike slope

Sensitivity analyses indicate that FS values can satisfy the slope stability criteria when the friction angle (phi) of the rockfill material was reduced to □5° except for a lightly lower FS (1.□) than the criterion (1.5) for Section 4 Operation scenario.

Closure

We trust information provided in this memorandum is satisfactory for your requirements. Please do not hesitate to contact me at (40□) 215-□8□4 or □song□okc-sk.com should you have any questions or comments.

Appendix

Slip Plane Profiles

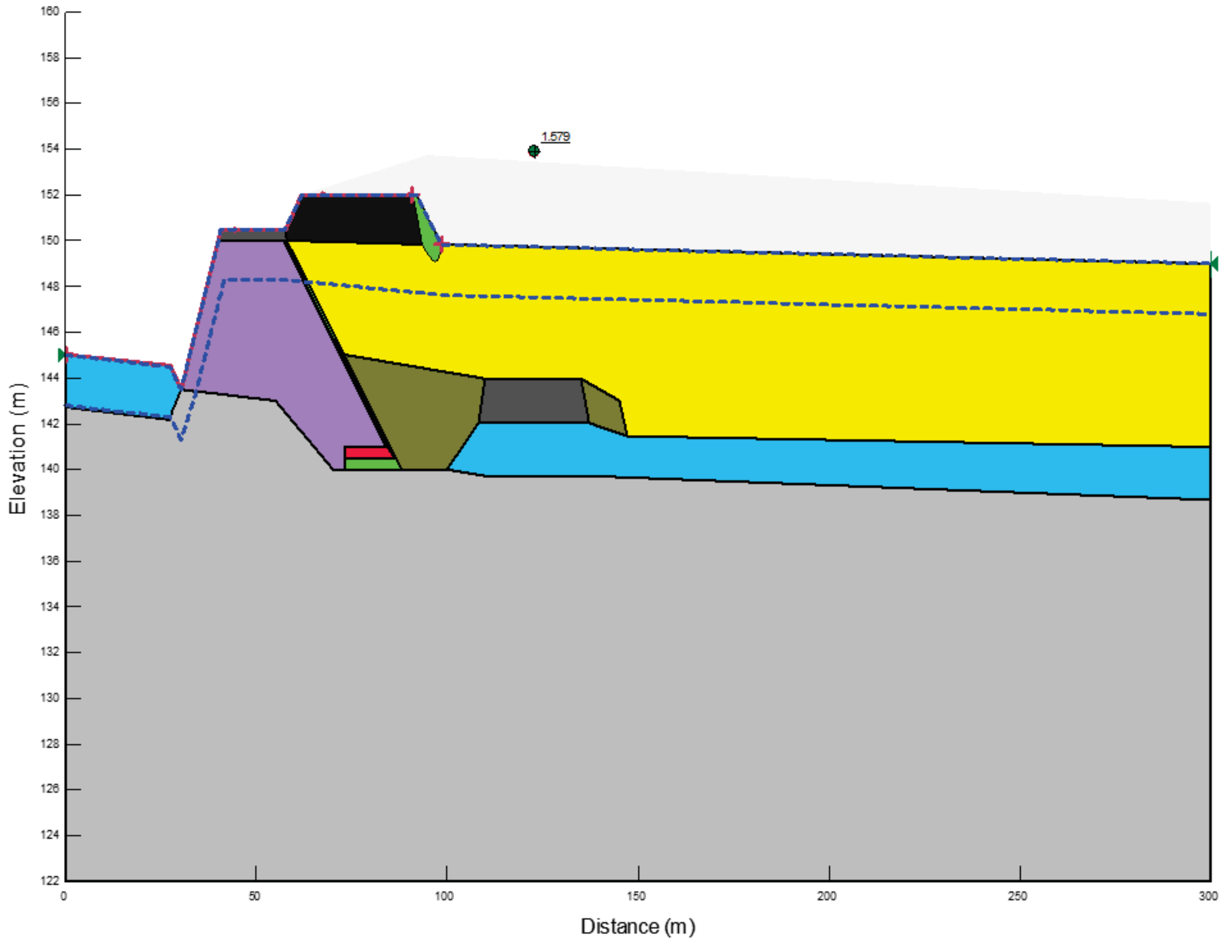

Figure 5□ Cross-Section 1 – End of Construction

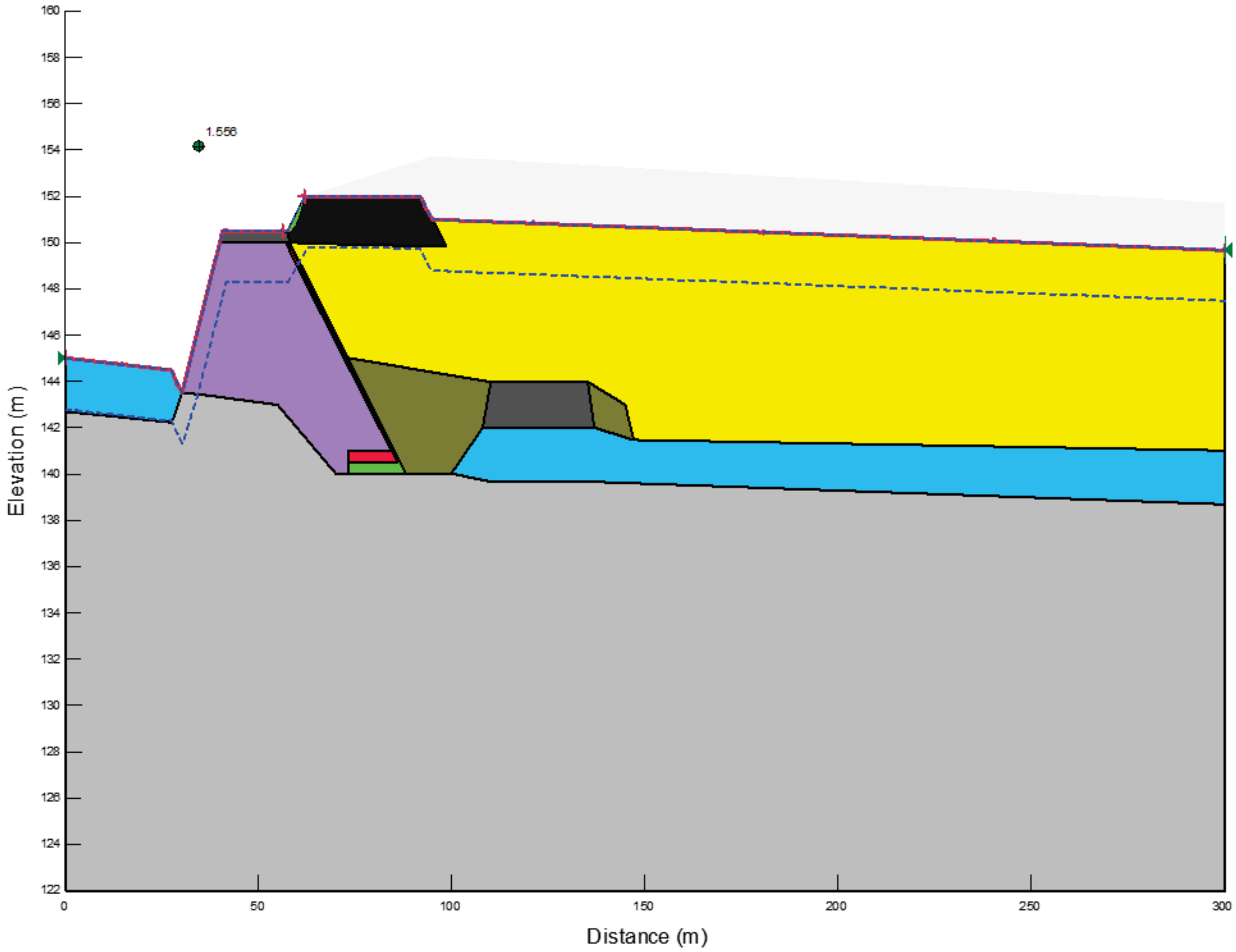

Figure 6	Cross-Section 1 – Operation

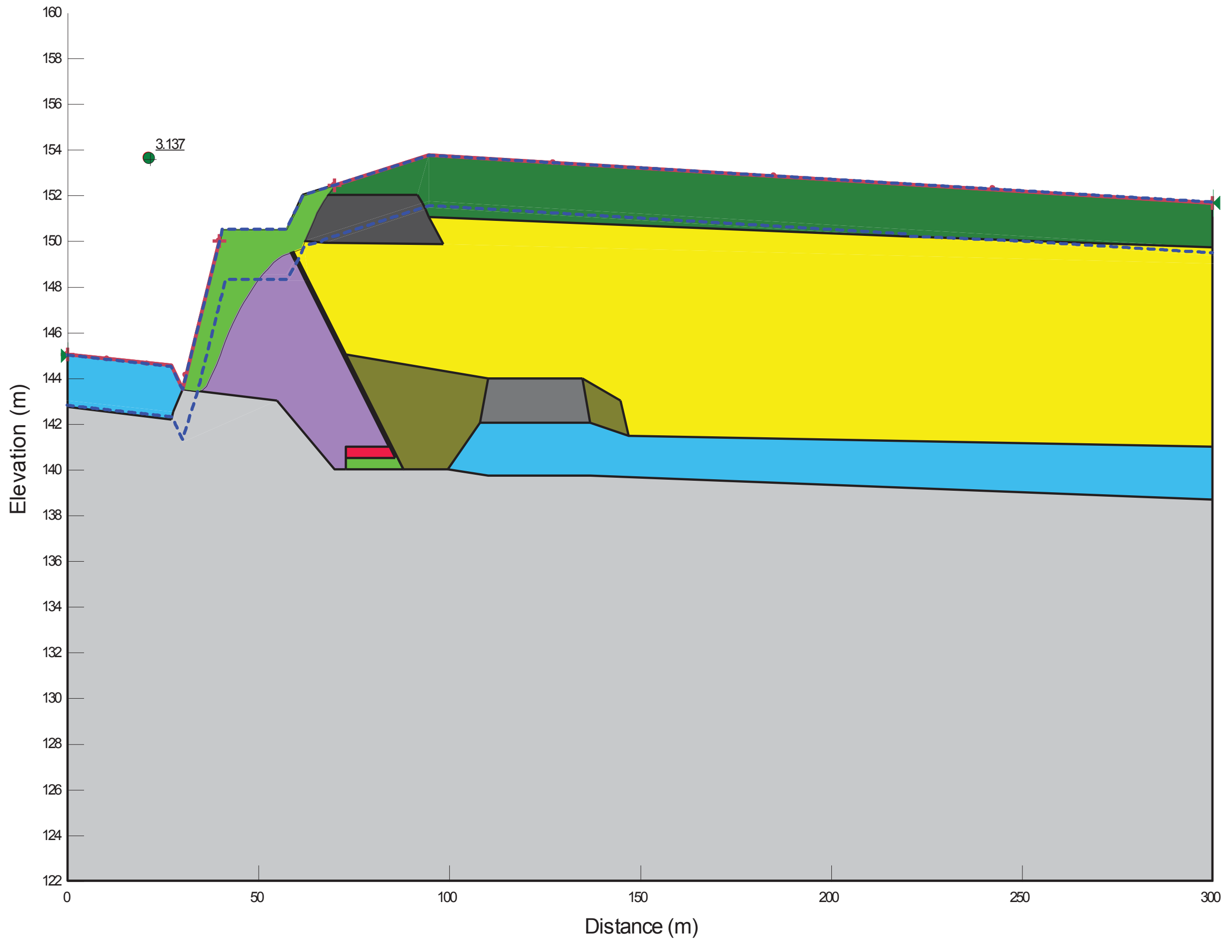

Figure 7: Cross-Section 1 - Closure

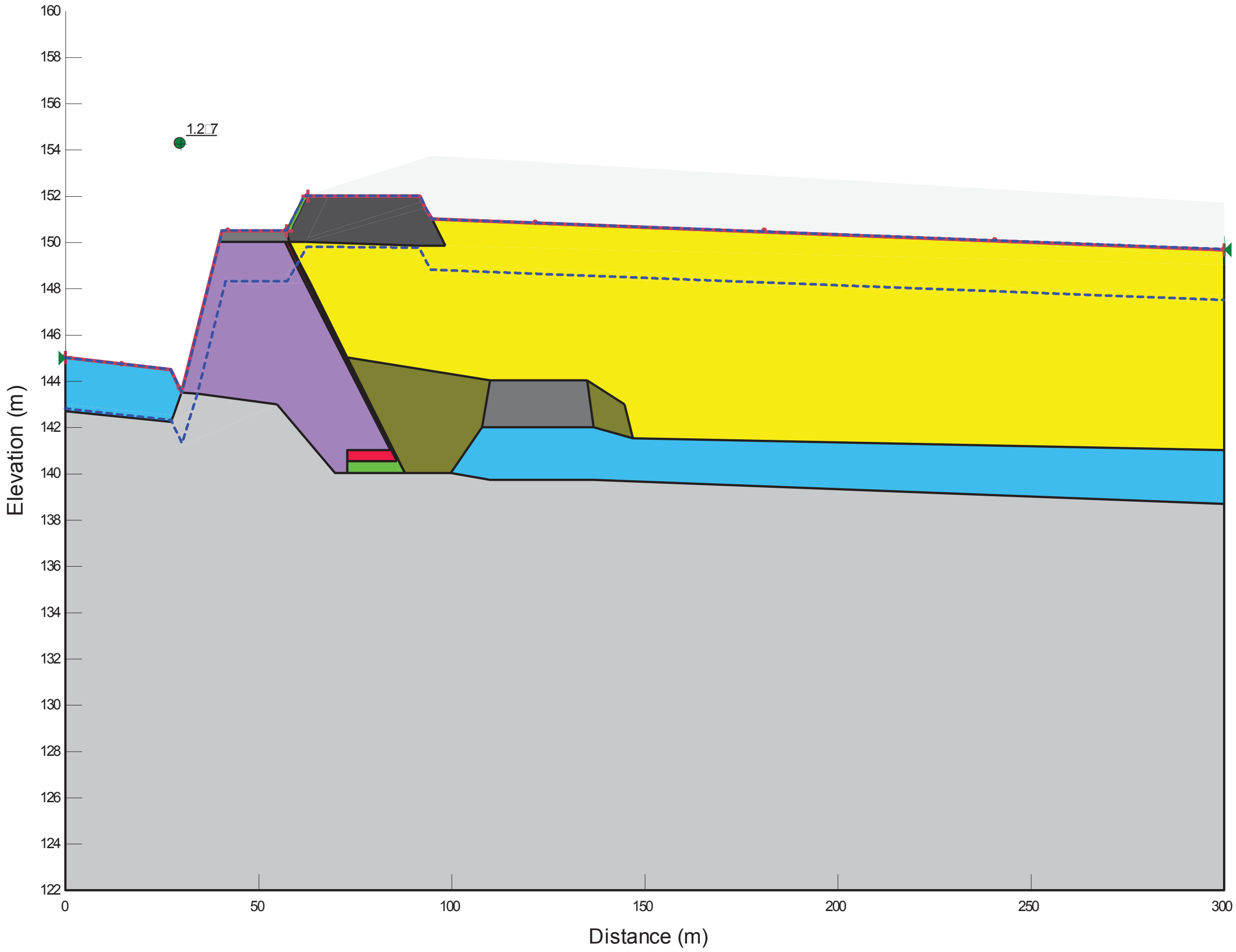

Figure 8: Section 1 – Seismic loading applied to “End of Construction” scenario

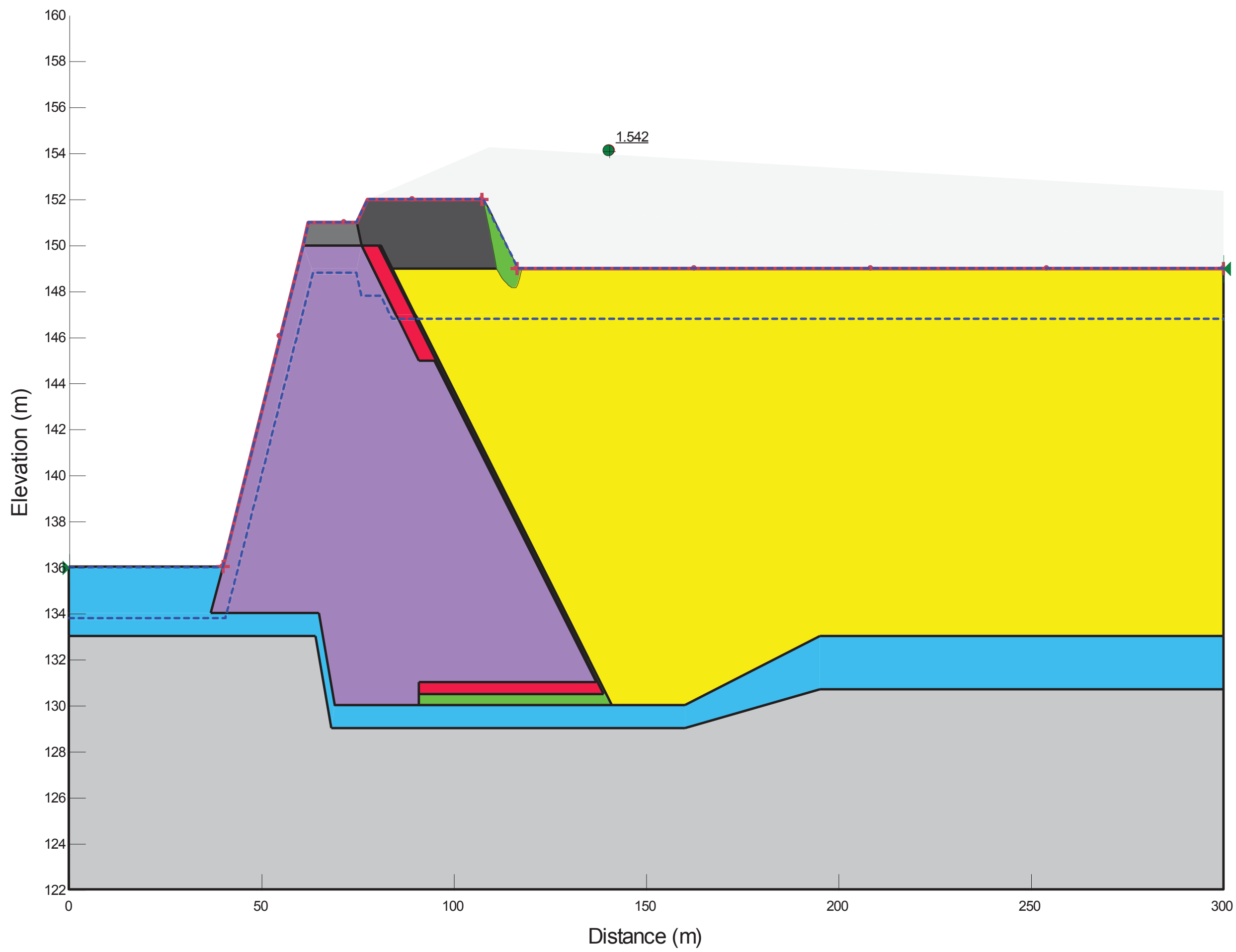

Figure □: Cross-Section 2 – End of Construction

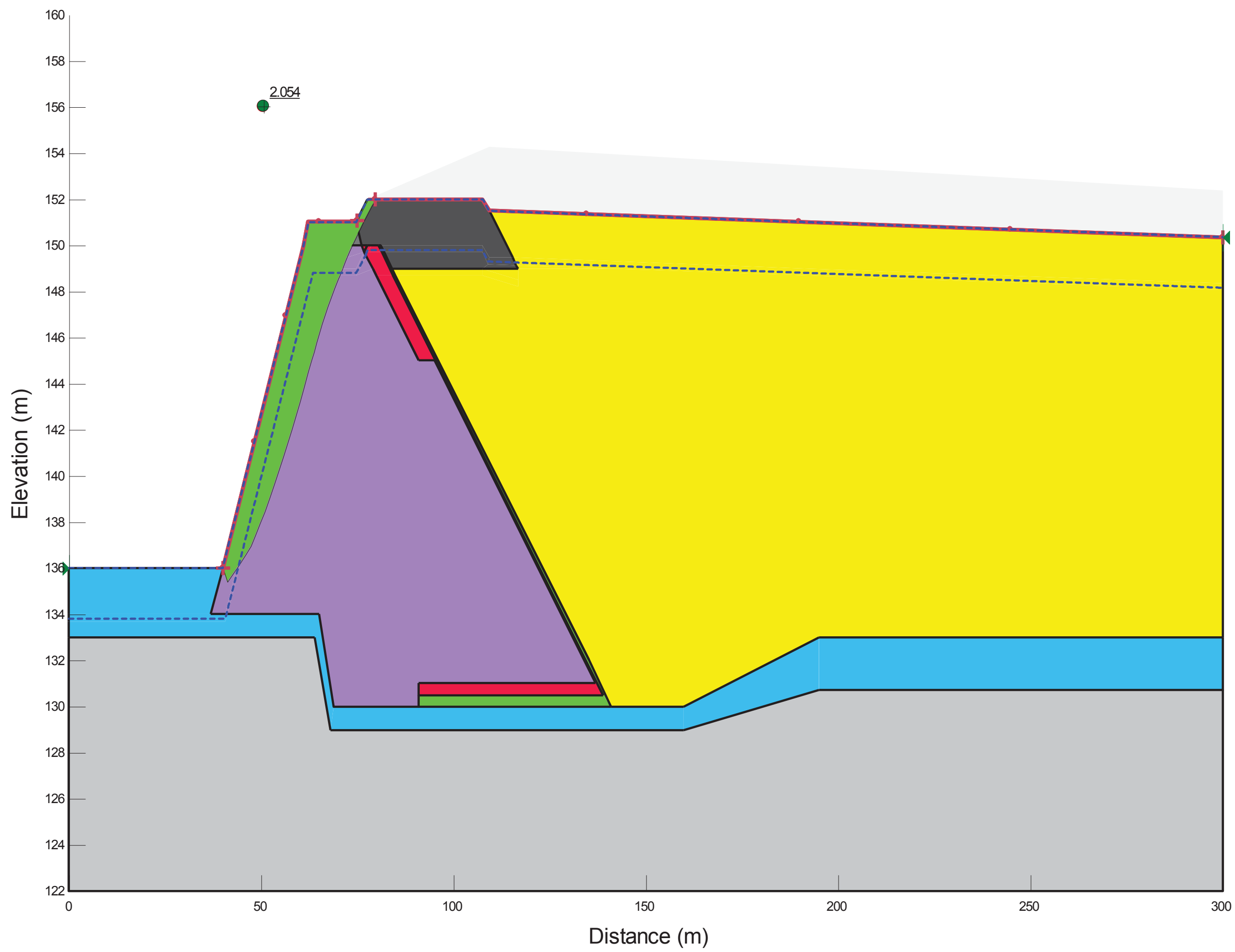

Figure 10: Cross-Section 2 – Operation

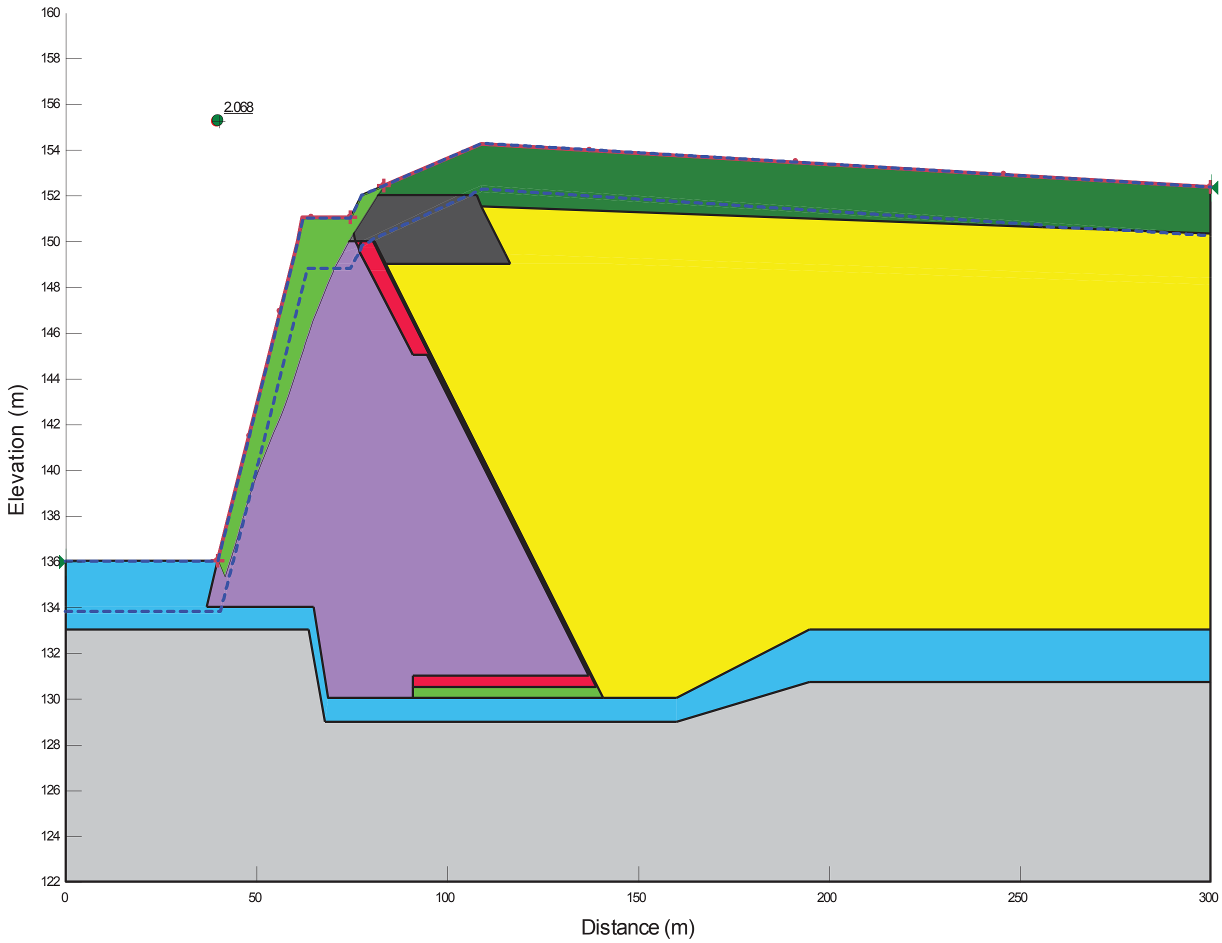

Figure 11: Cross-Section 2 – Closure

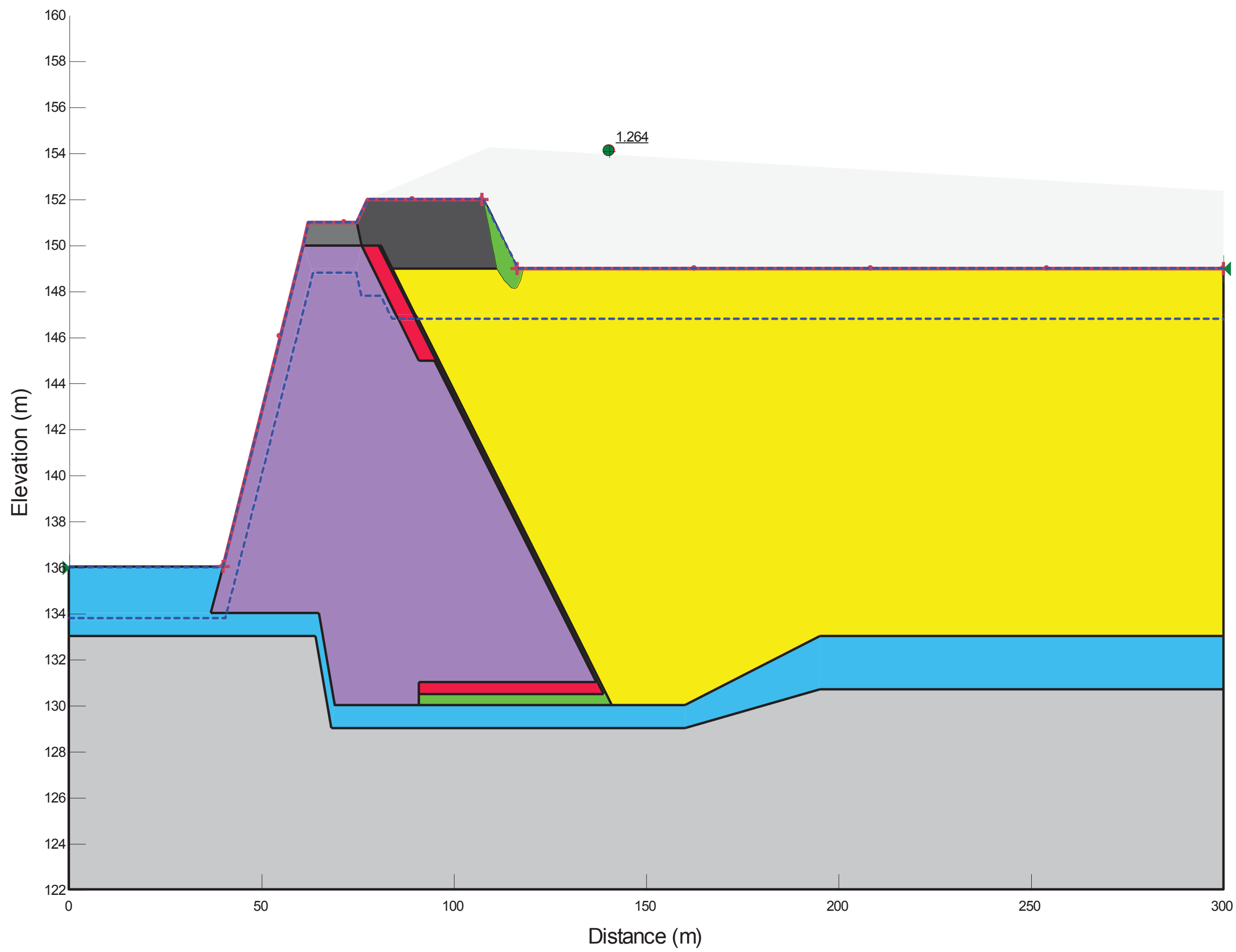

Figure 12: Cross-Section 2 – Seismic loading applied to “End of Construction” scenario

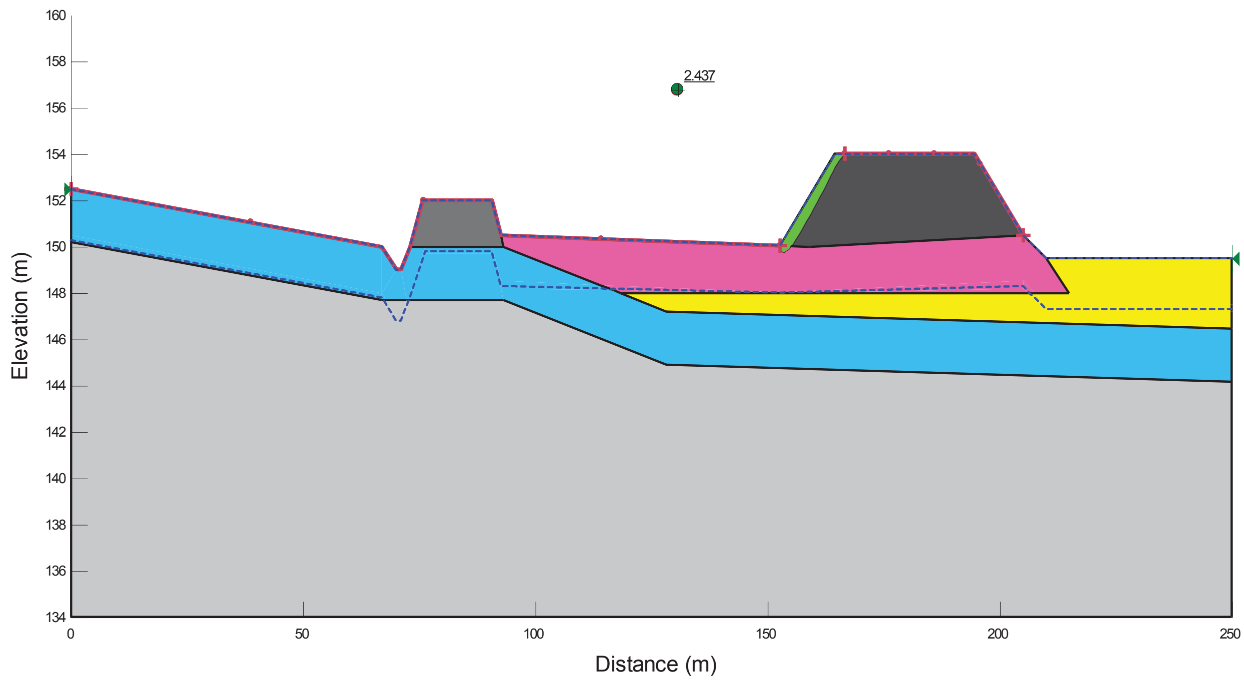

Figure 13: Cross-Section 3 – End of Construction

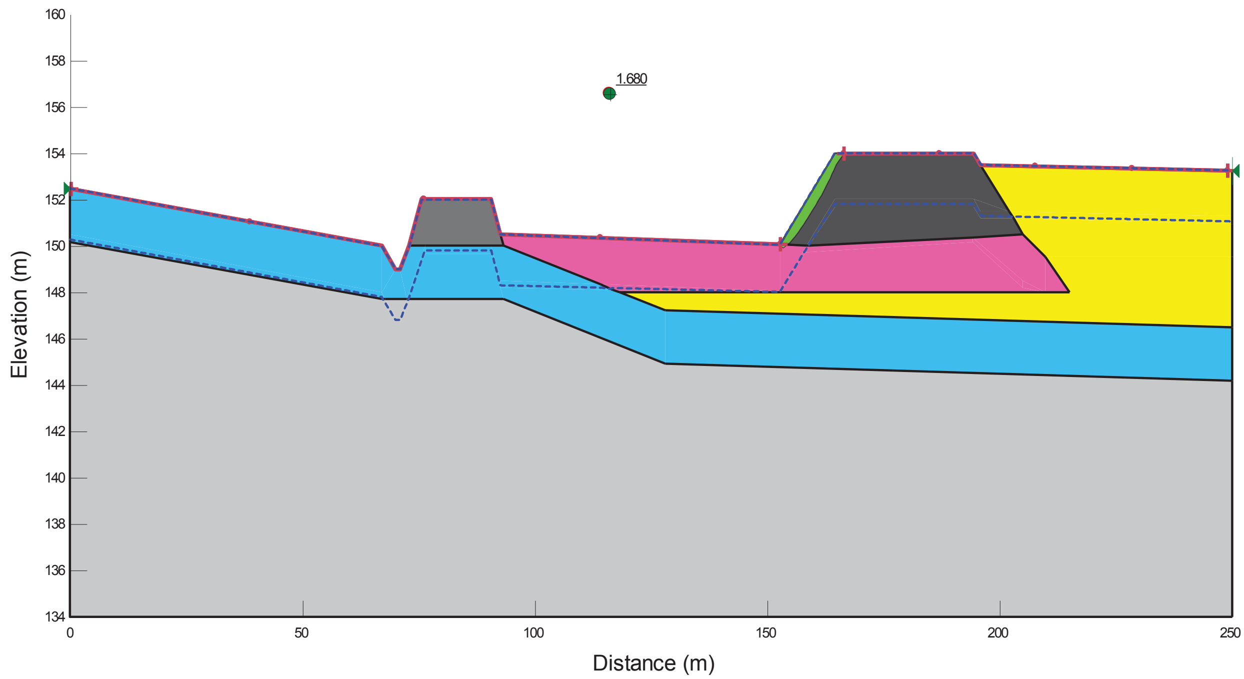

Figure 14: Cross-Section 3 - Operation

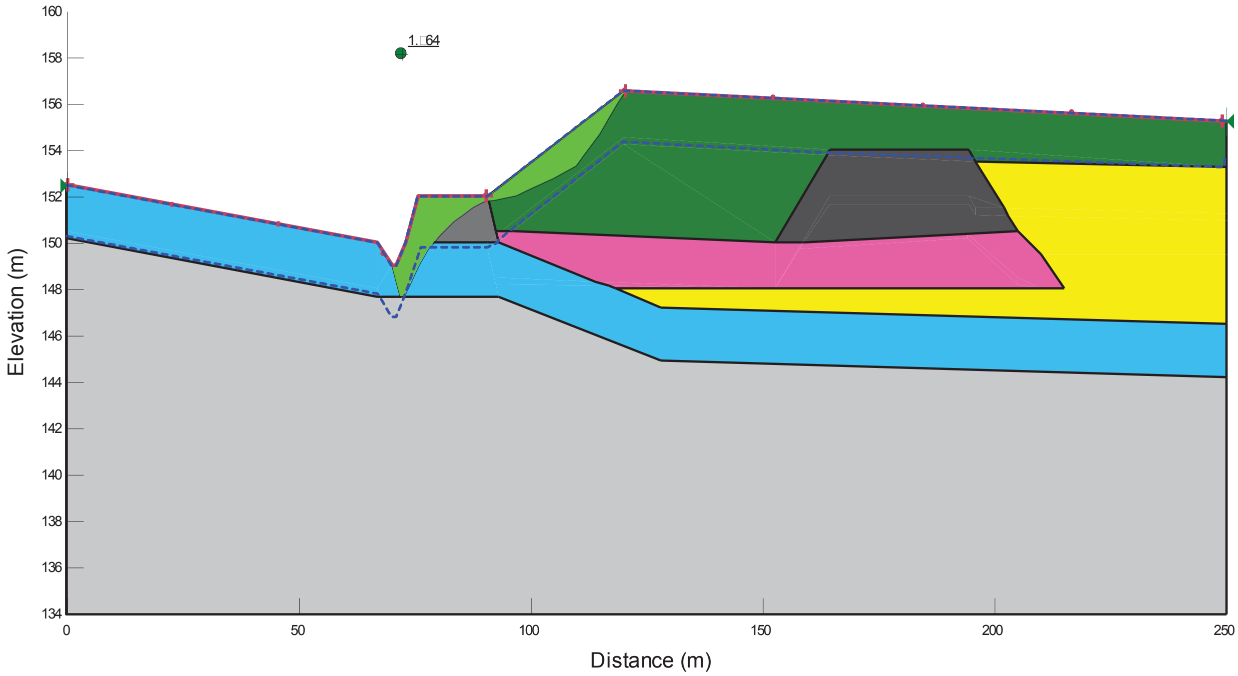

Figure 15: Cross-Section 3 – Closure

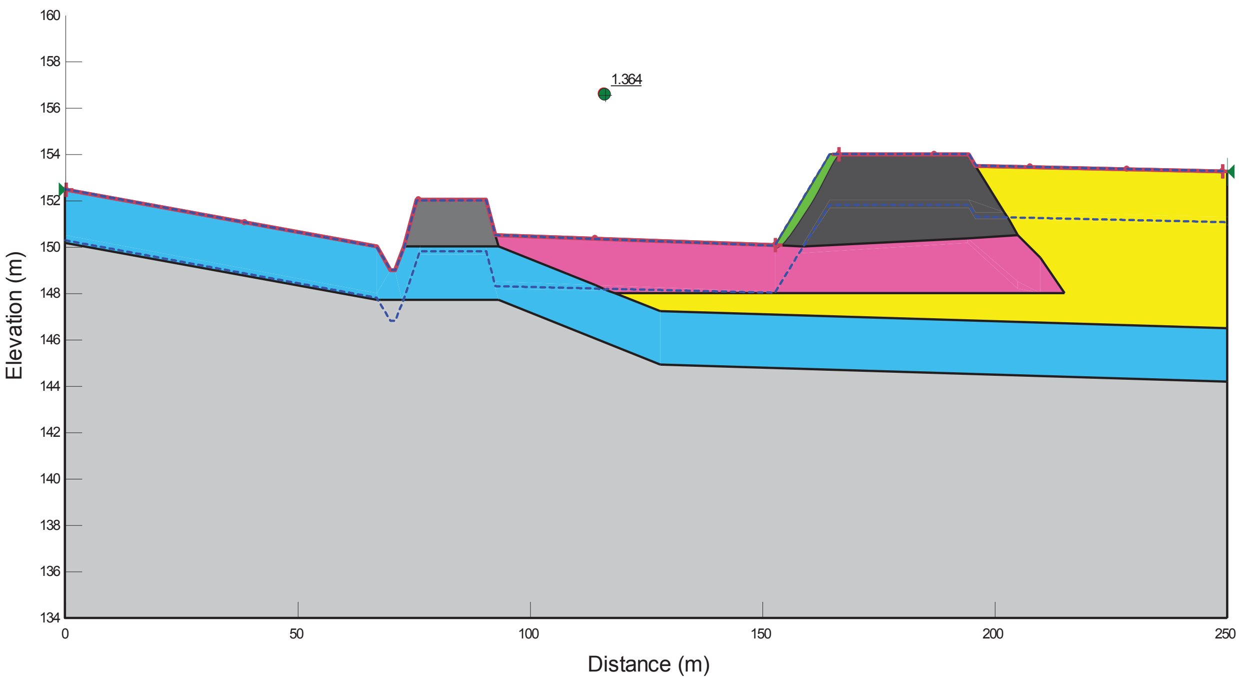

Figure 16: Cross-Section 3 – Seismic loading applied to “Operation” scenario

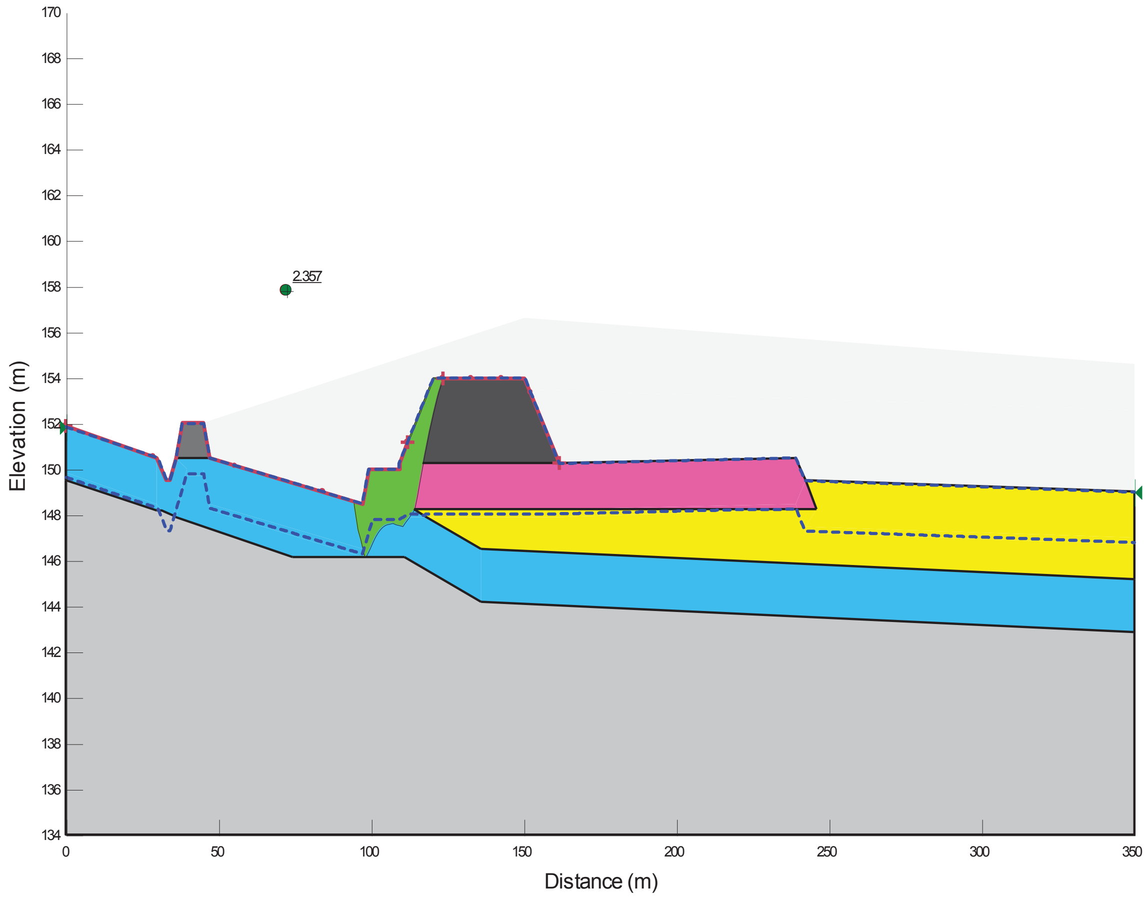

Figure 17: Cross-Section 4 – End of Construction

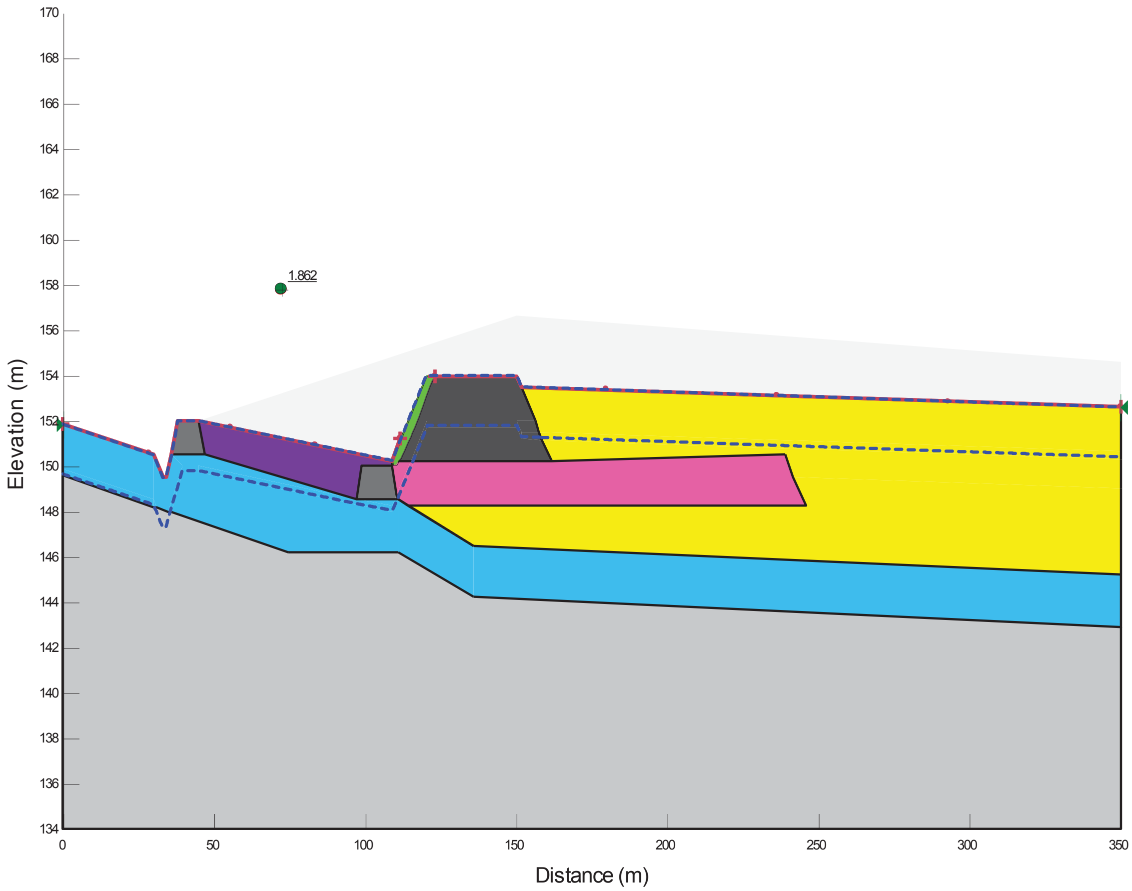

Figure 18: Cross-Section 4 – Operation

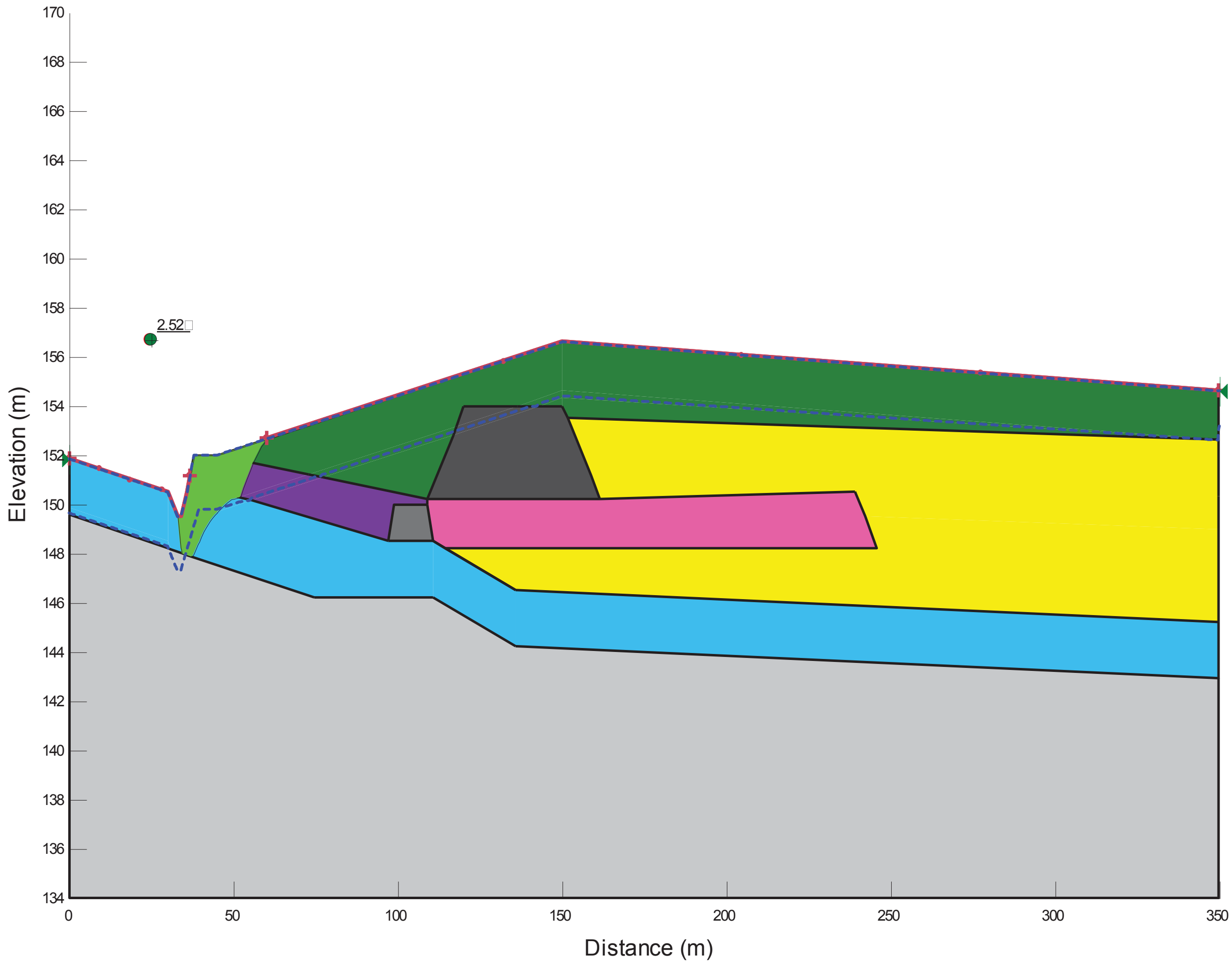

Figure 1□: Cross-Section 4 – Closure

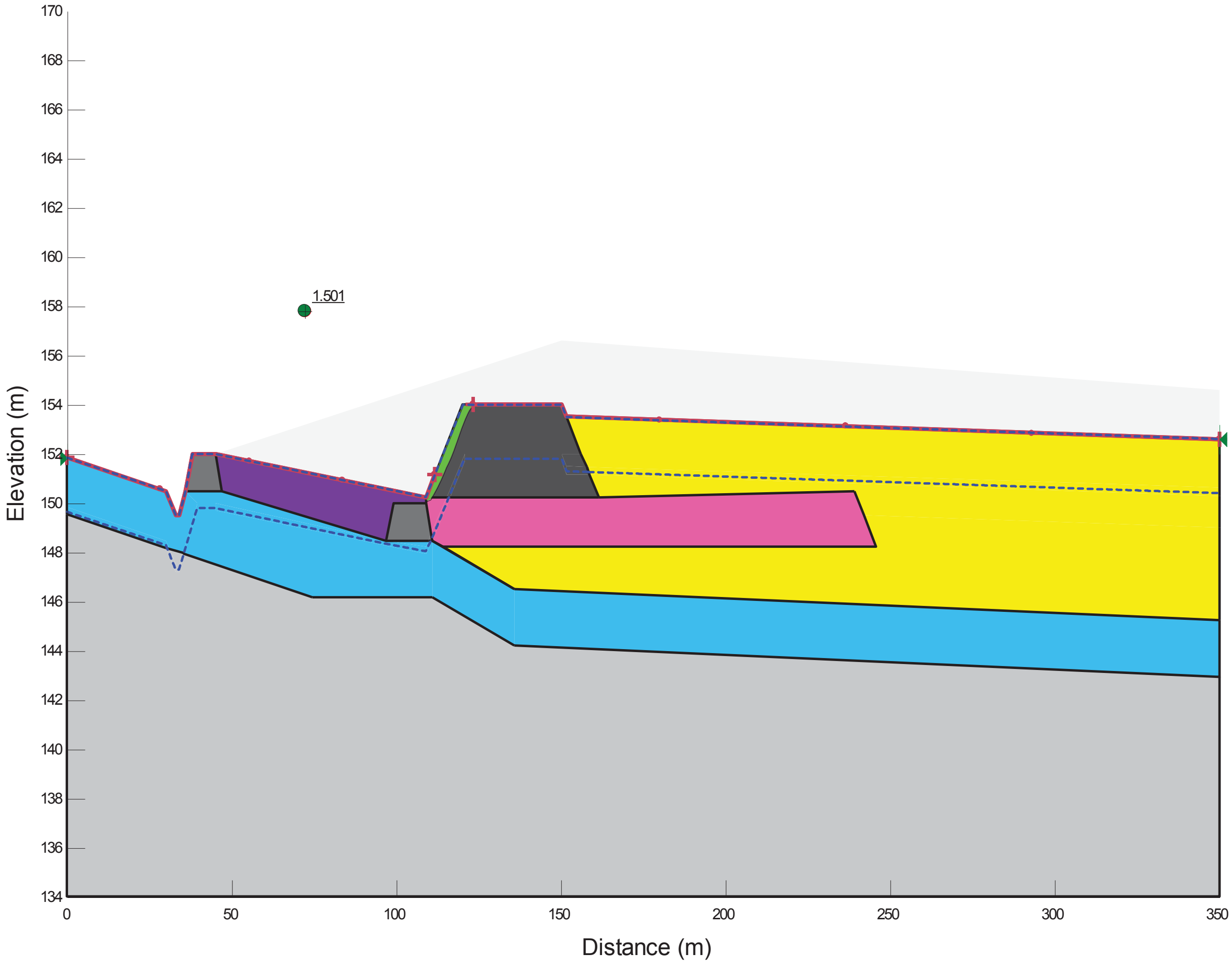

Figure 20: Cross-Section 4 – Seismic loading applied to “Operation” scenario

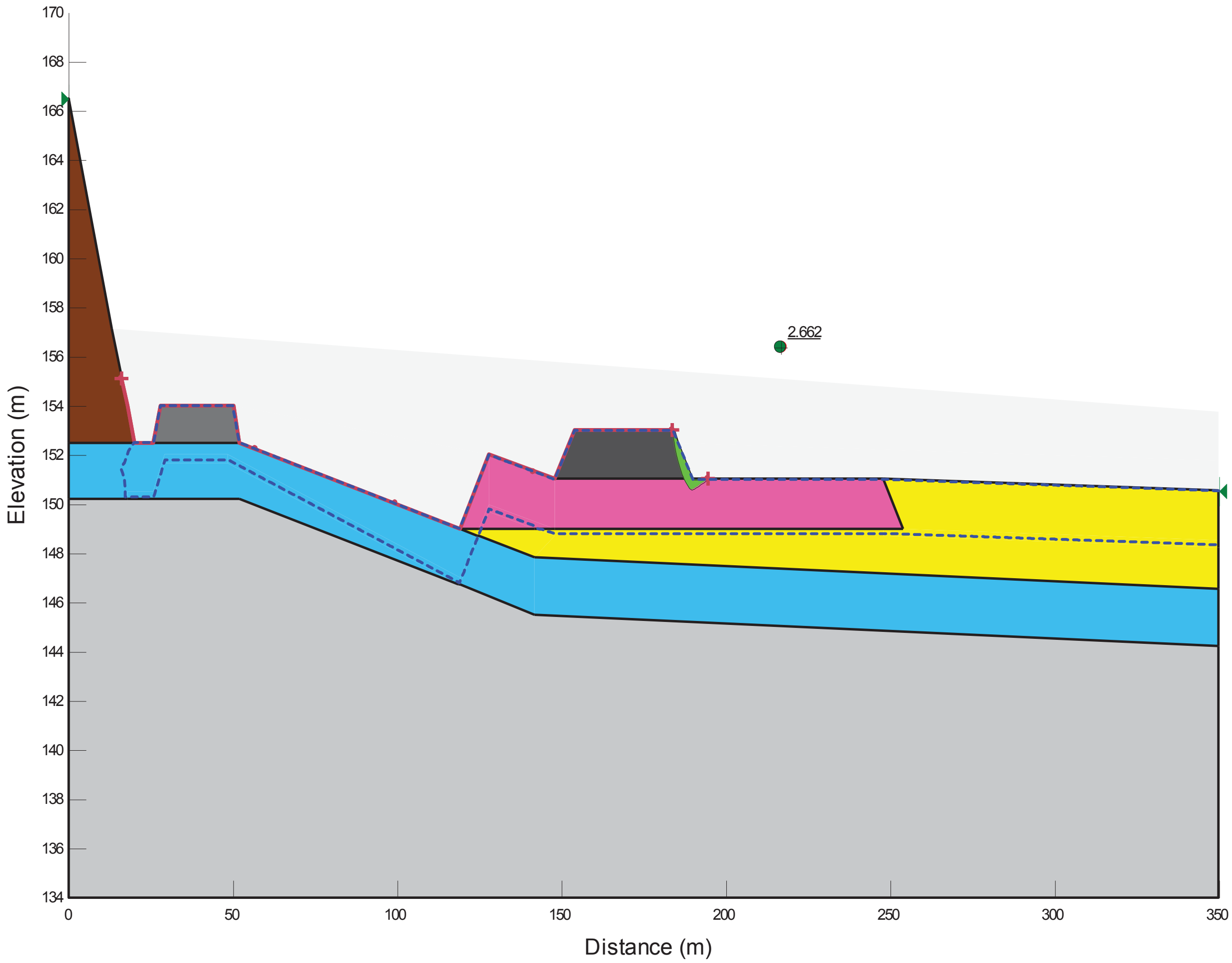

Figure 21: Cross-Section 5 – End of Construction

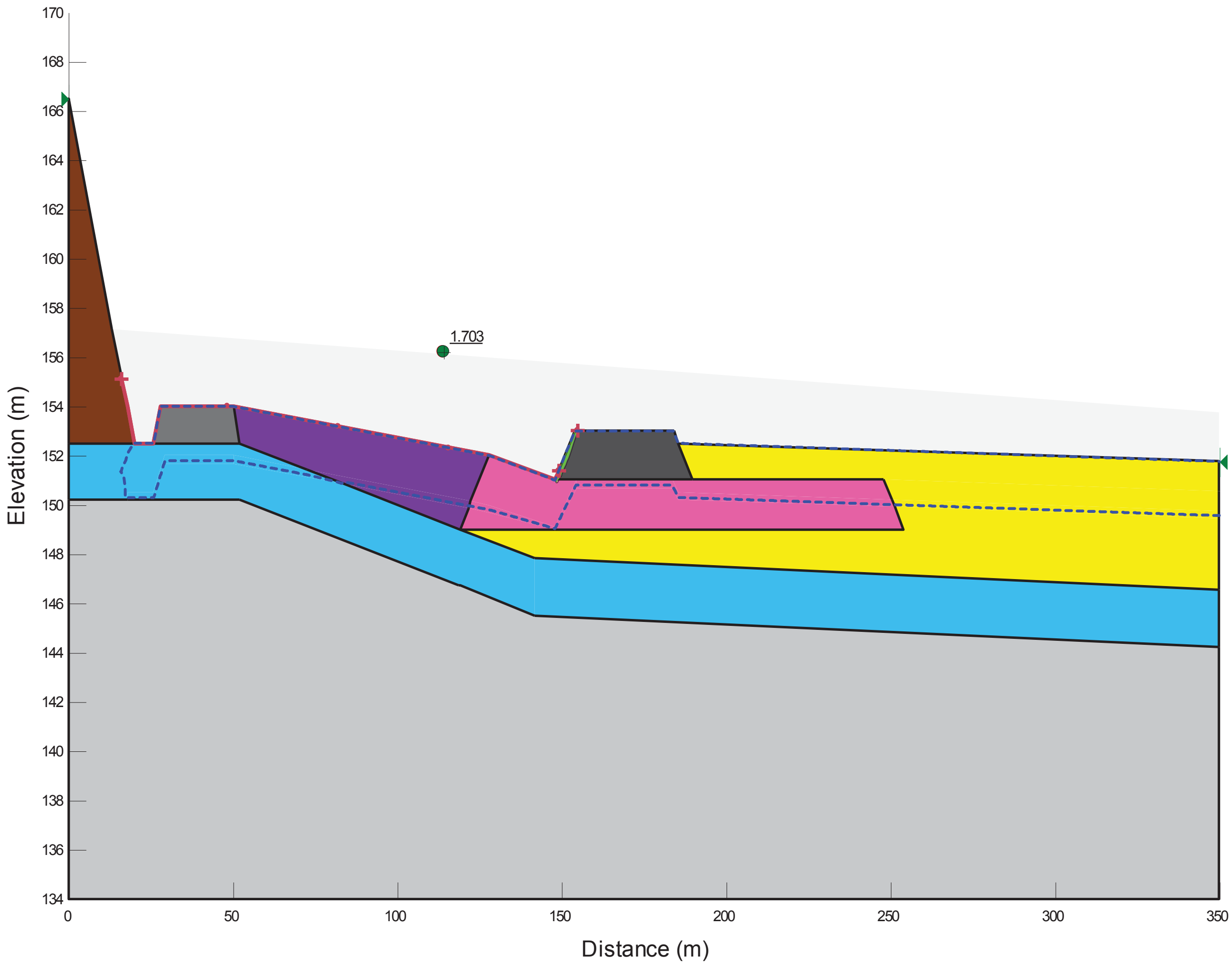

Figure 22: Cross-Section 5 – Operation

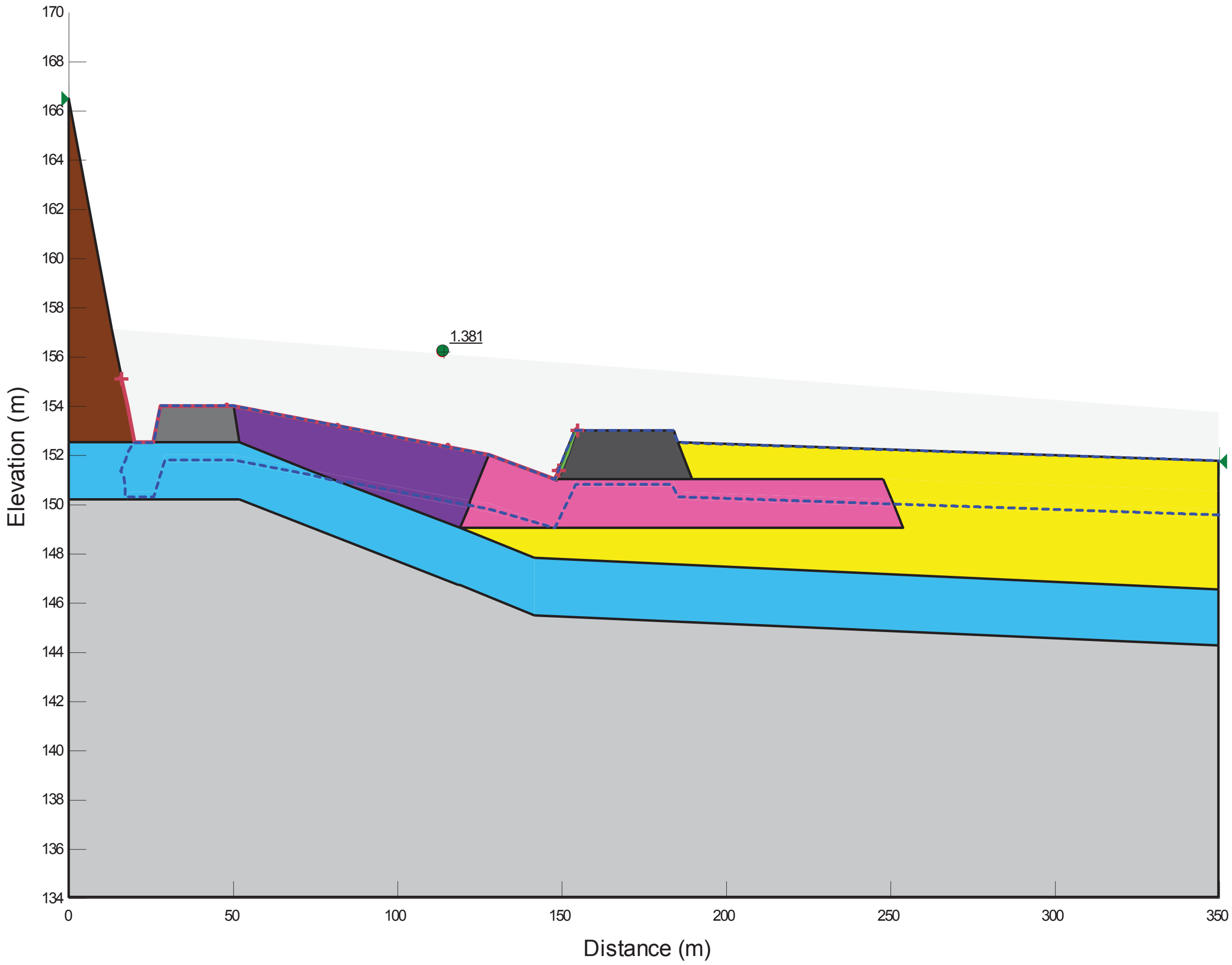

Figure 23: Cross-Section 5 – Seismic loading applied to “Operation” scenario

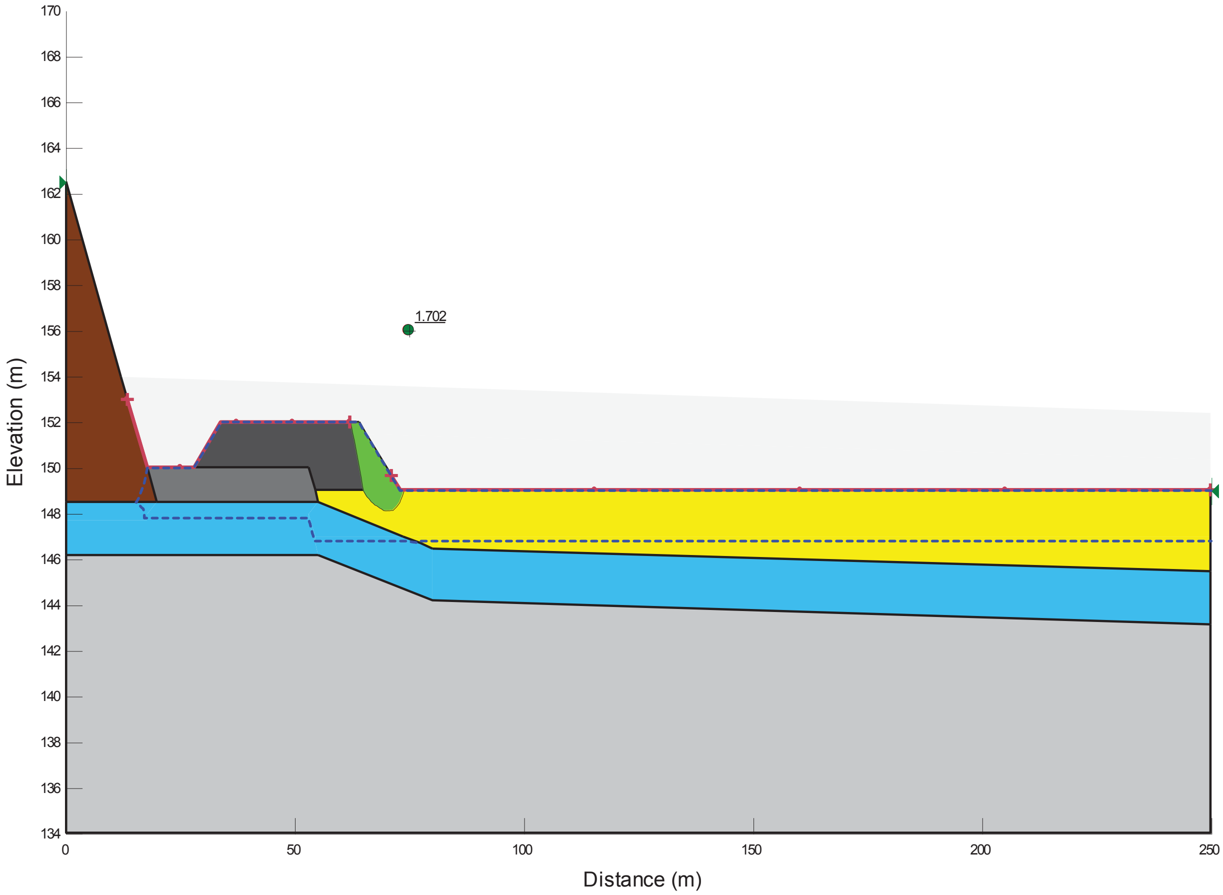

Figure 24: Cross-Section 6 – End of Construction

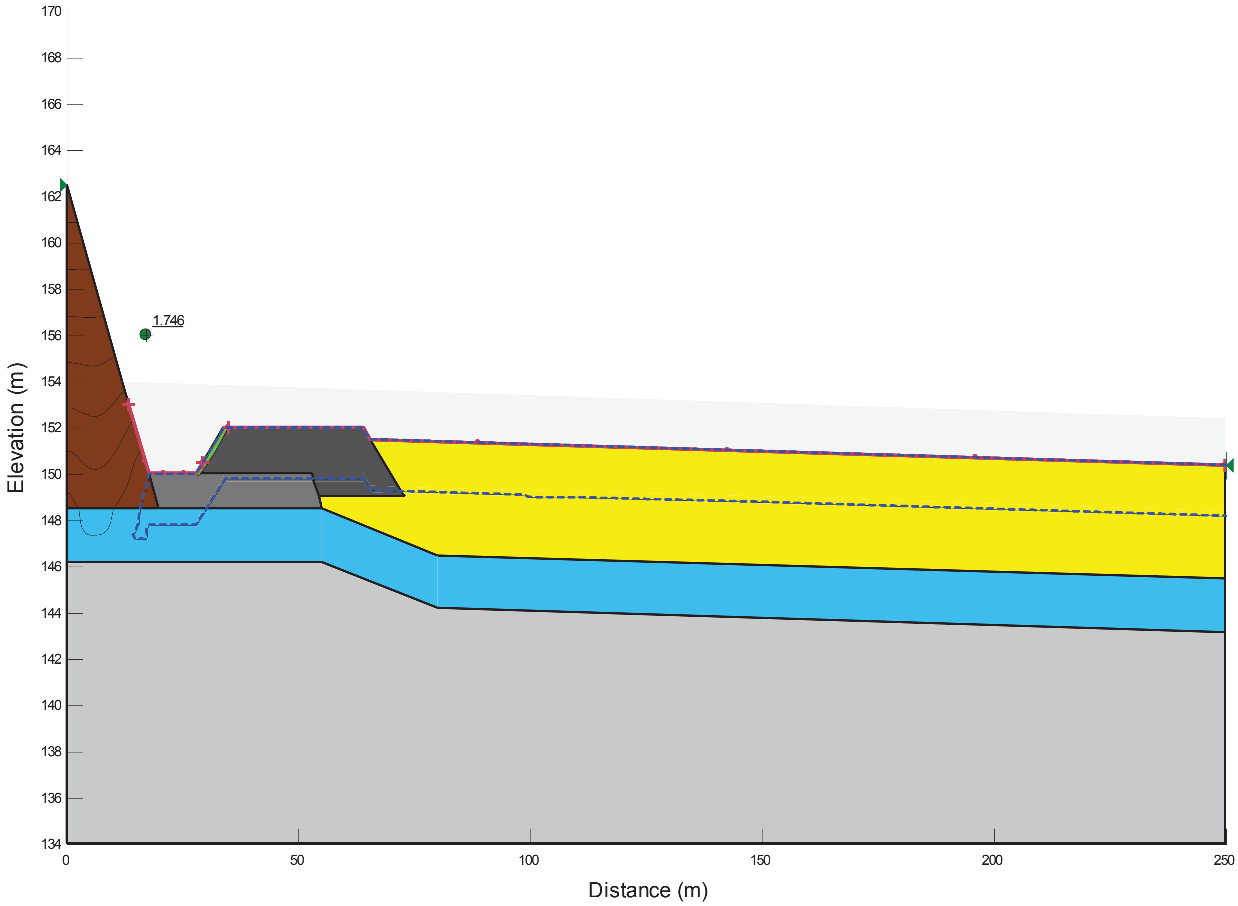

Figure 25: Cross-Section 6 – Operation

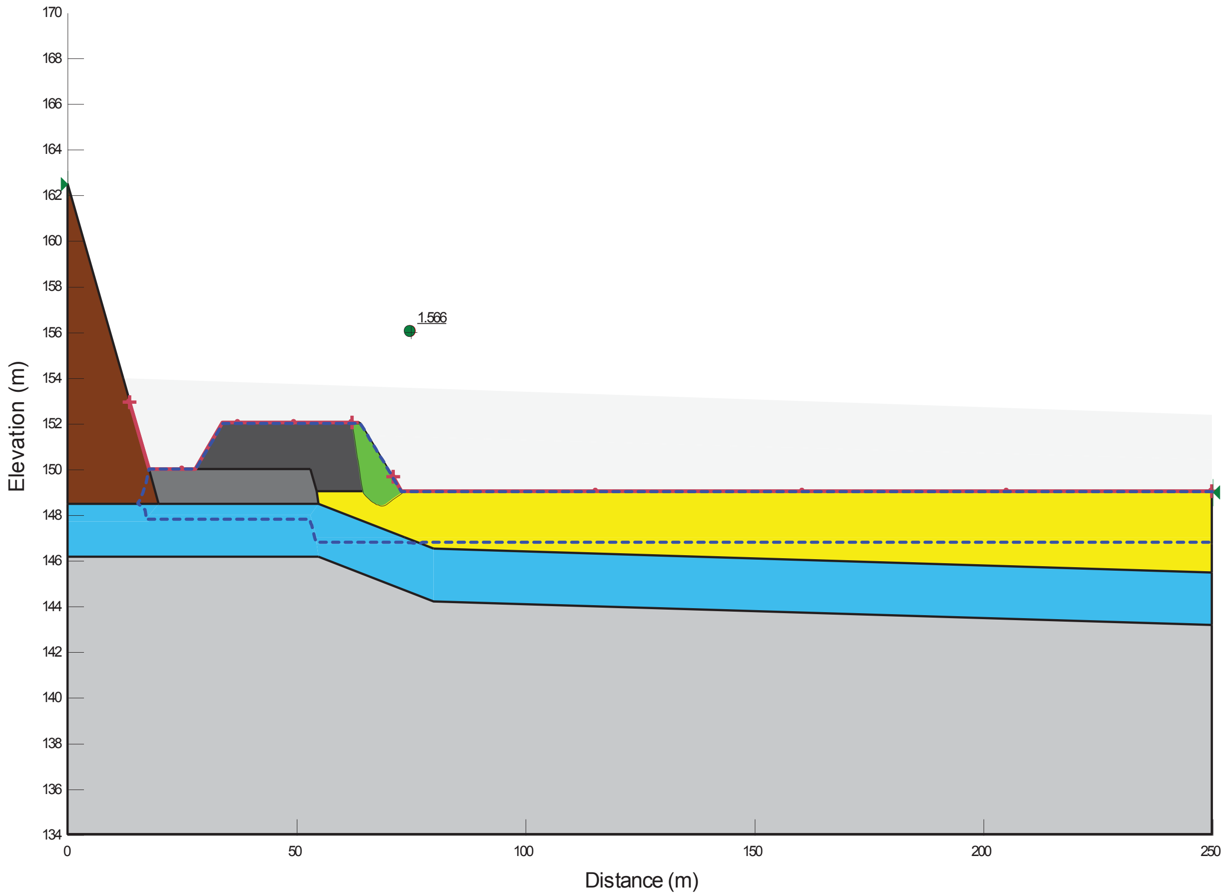

Figure 26: Cross-Section 6 – Seismic loading applied to “End of Construction” scenario

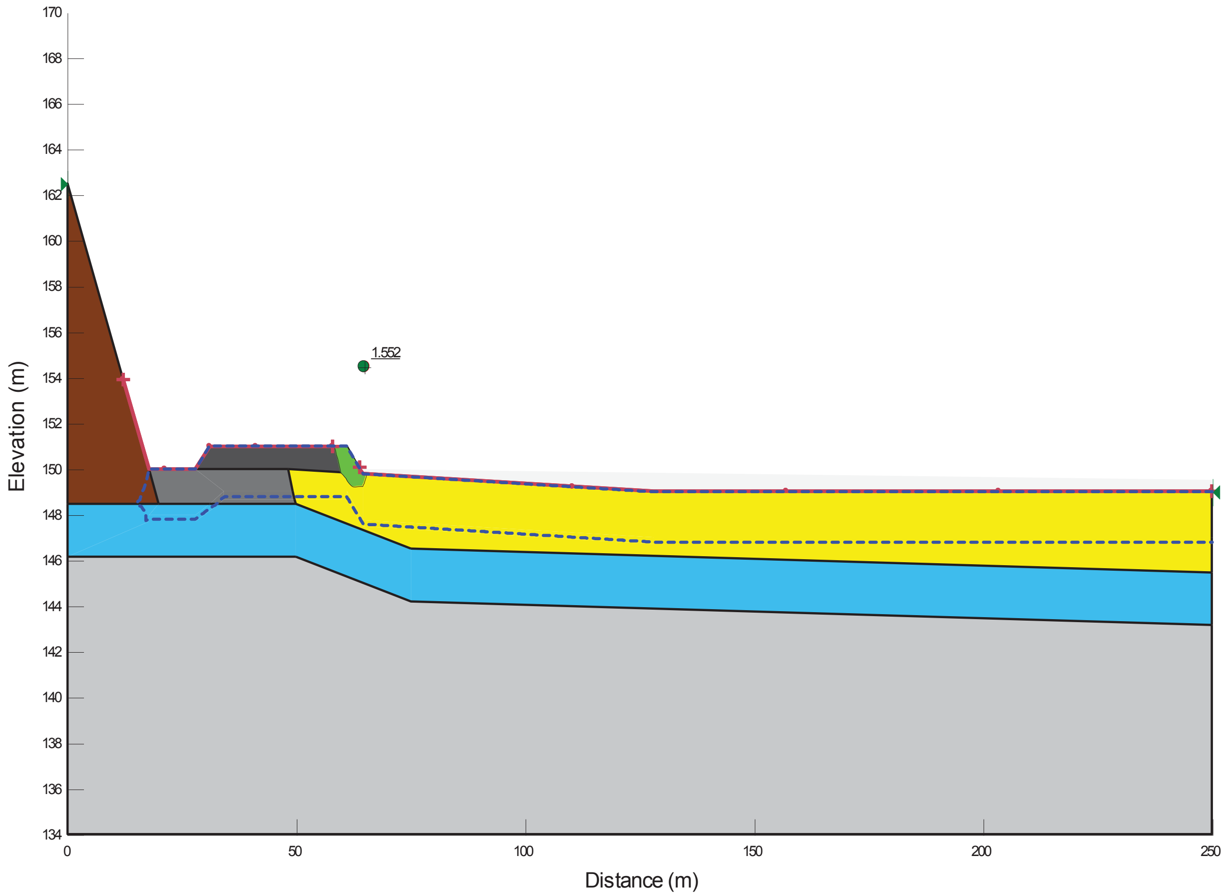

Figure 27: Cross-Section 7 – End of Construction

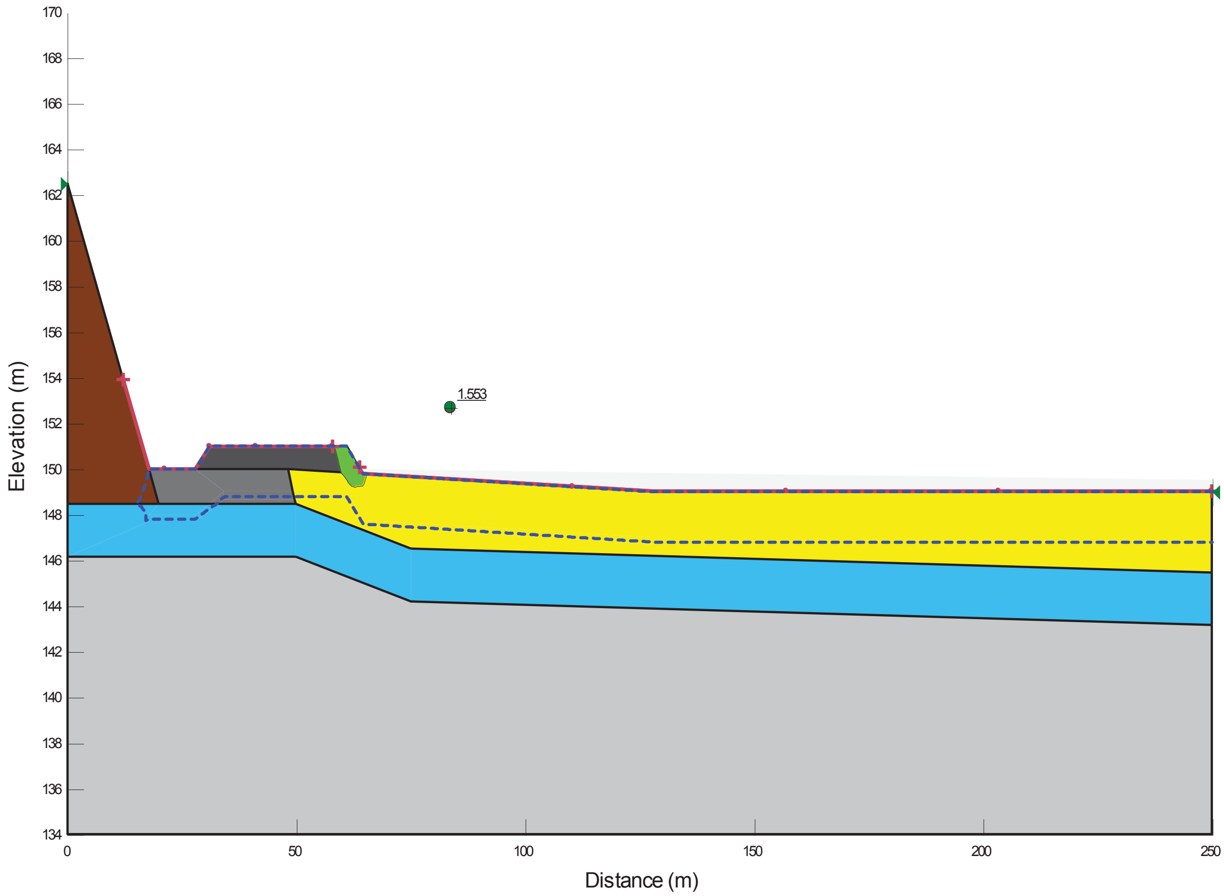

Figure 28: Cross-Section 7 – Operation

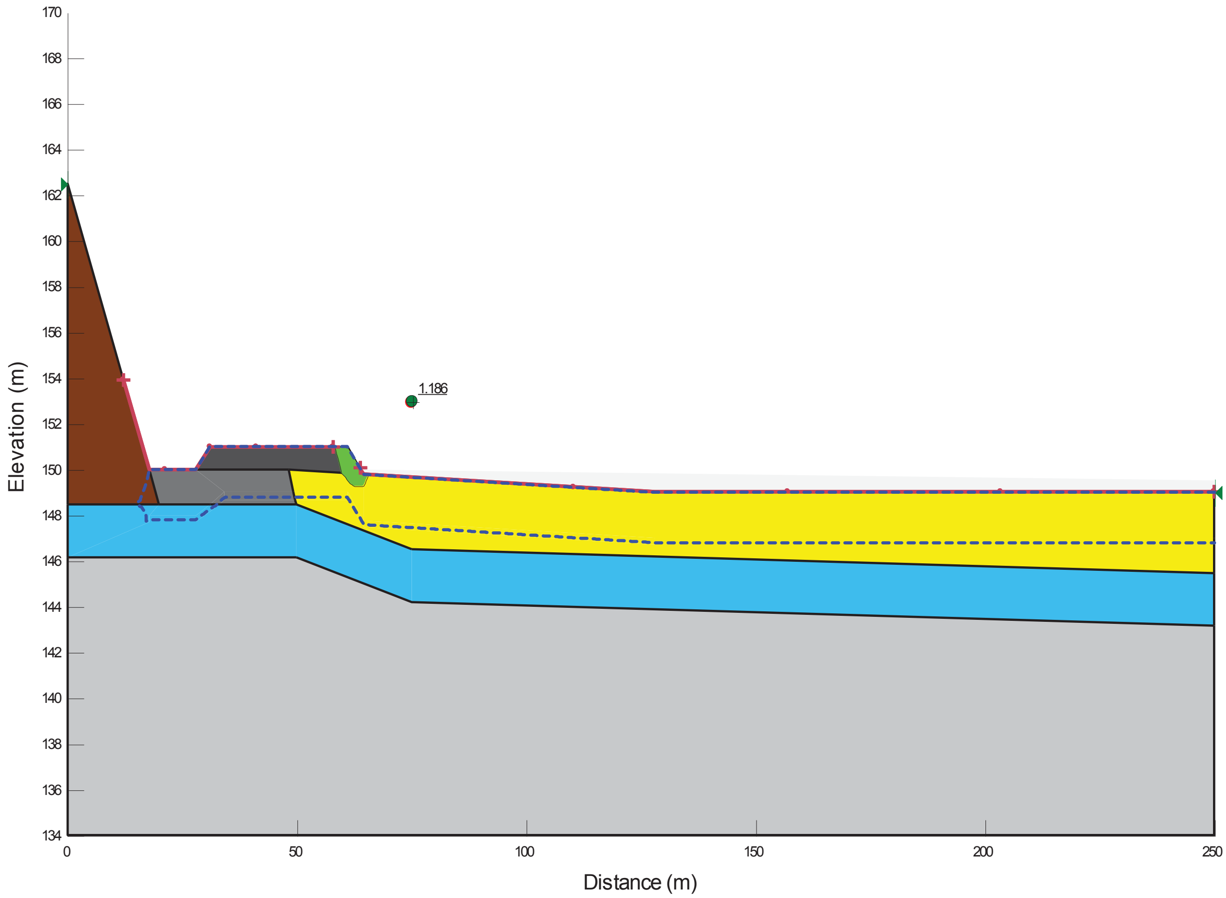

Figure 2□: Cross-Section 7 – Seismic loading applied to "End of Construction" scenario

O'Kane Consultants
Integrated Mine Waste Management and Closure Services
Specialists in Geochemistry and Unsaturated Zone Hydrology

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Interoffice Memorandum

To: Lonnie Dobchuk – Senior Geoenvironmental Engineer, O'Kane Consultants

From: Robert Shurniak, Geotechnical Engineer

Cc: Philippe Garneau – O'Kane Consultants

Our ref: □48/2

Date: March 17, 2016

Re: [illegible]

O'Kane Consultants Inc. (OKC) was retained by Agnico Eagle Mines Ltd. (AEM) for design work to support evaluation and optimization of the current Meadowbank Tailings Storage Facility (TSF). During the design process it was recommended that numerical analysis be completed to address the potential for seepage through the rockfill extension dike, which will form a perimeter for most of the North Cell TSF with the exception of above the Storm Water Dike (SWD). The main objective of this seepage modelling is to estimate seepage volumes through the rockfill dike, design appropriate seepage collection infrastructure as required, evaluate the need for a low permeability component on the internal slope of the rockfill extension dike, and evaluate if the width of the rockfill extension dike can be reduced. Up to this point, OKC had assumed that the permafrost would not degrade within the dike so that no seepage would flow through the rockfill extension dike. For the current exercise, seepage modelling will be completed assuming no permafrost formation within the rockfill as a "worst-case" scenario, defining the other "end-member" of the seepage range through the extension dike. As this modelling is completed, the results are provided to AEM for review to determine if information is sufficient to determine the requirement for seepage collection infrastructure or a HDPE liner; or if additional simulations of conditions between the two end-members are required.

Completing the simulations required definition of the following model inputs:

- geometry for each typical cross-section;
- material properties;
- surface boundary condition;
- lower boundary condition;
- external edge boundary condition; and,
- internal edge boundary condition.

Each of these inputs and the seepage results are described in the following sections.

□□□□□

□ □□□ □□□

Seven cross-sections of the rockfill extension dike were developed for the slope stability numerical analysis portion of this pro□ect (Figure 1). The locations of these cross-sections are shown in Figure 1. All seven cross-sections were simulated as part of the seepage analysis. The slope stability cross-sections were adapted for the seepage models in two ways:

1) The bedrock, till overburden and fro□en tailings layers were not simulated as seepage into these regions is assumed to be negligible. Also, having no downward seepage aligns with the “worst-case” scenario by promoting seepage through the rockfill extension dike.

2) Additional internal regions were added so that the tailings placement could be staggered, simulating actual placement throughout the summer. This was achieved by estimating the lift thickness placed weekly during the three summer deposition periods.

All the cross-sections are provided in the appendix of this report.

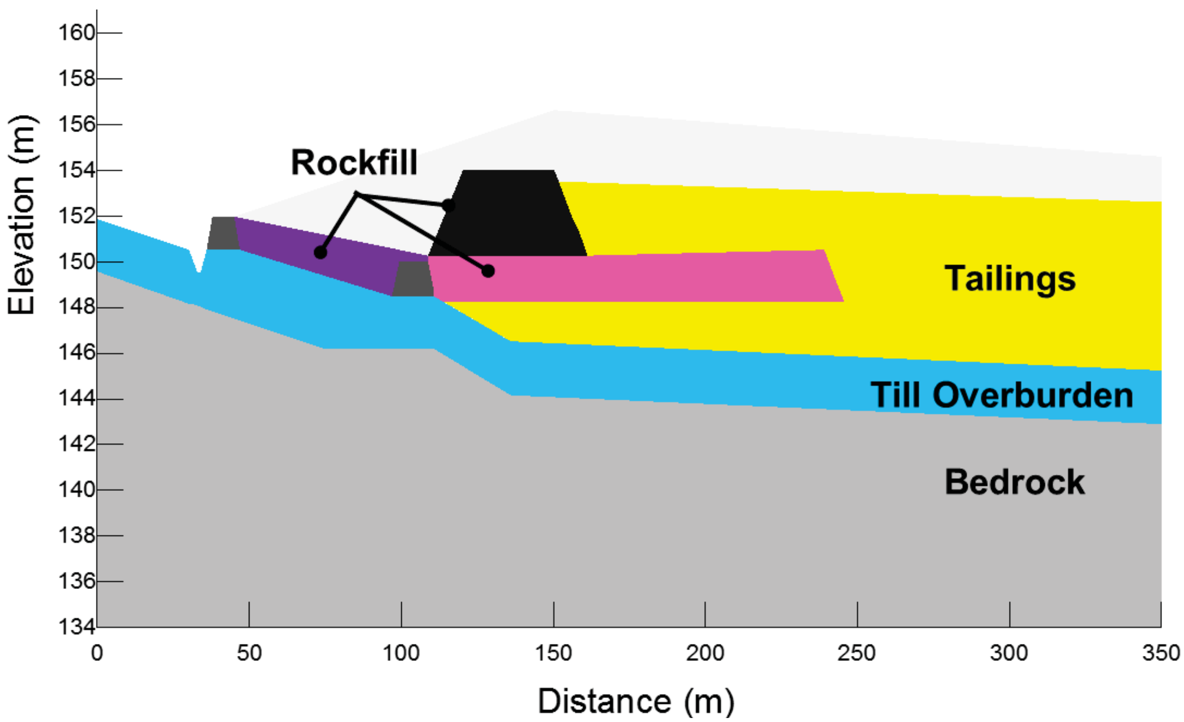

Figure 1: Typical cross section (Cross-Section 4) developed for slope stability analysis

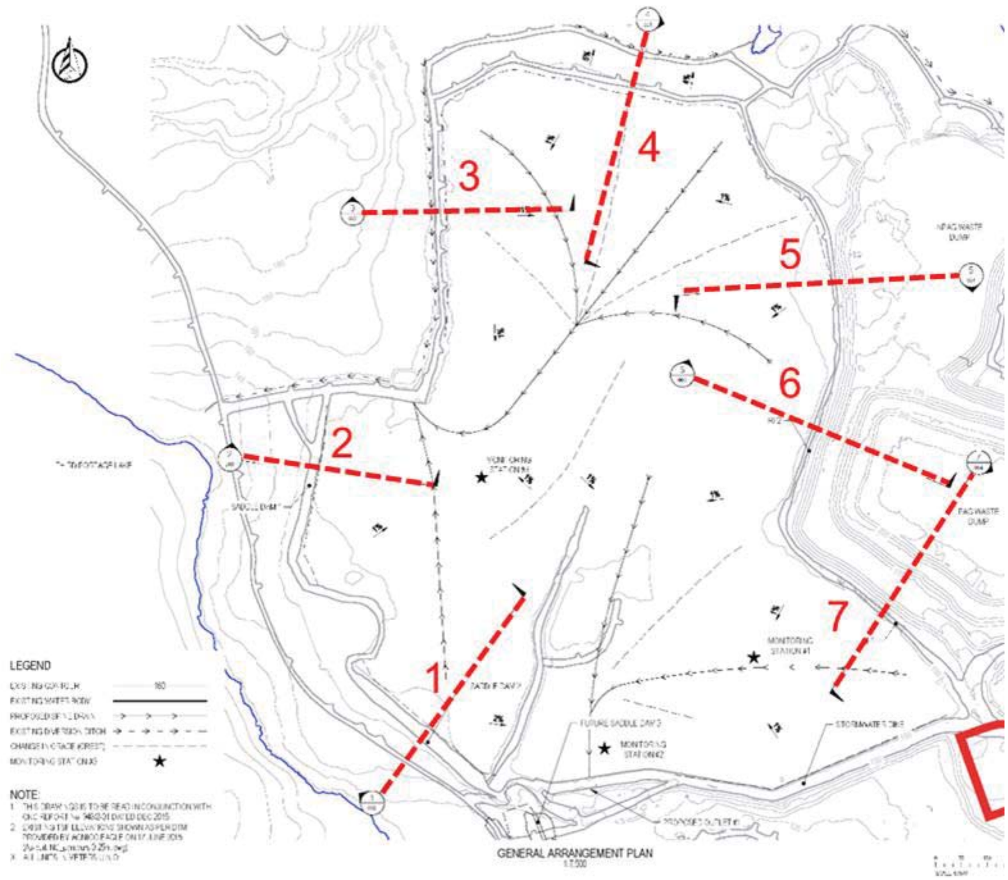

Figure 2: Plan view of Meadowbank TSF with slope stability and seepage analysis cross section locations.

[illegible]

Seepage modelling requires definition of a water retention curve (WRC) and hydraulic conductivity function (k-function) for each material simulated. For examining seepage through the rockfill extension dike, two materials need to be defined: tailings and rockfill. It is assumed that the bedrock and till overburden layers are within the permafrost zone, and therefore essentially impermeable.

Figures 3 and 4 provide the WRCs and k-functions estimated to represent the two materials. These estimates were used for the cover system design modelling previously completed by OKC for AEM, and are based on previous work completed by Golder Associates Ltd. Particle size distribution (PSD) data is compared to material in the SoilVision database with similar PSDs and known material properties. The ‘rockfill’ estimates are based on previous estimates made for NPAG material for the cover system.

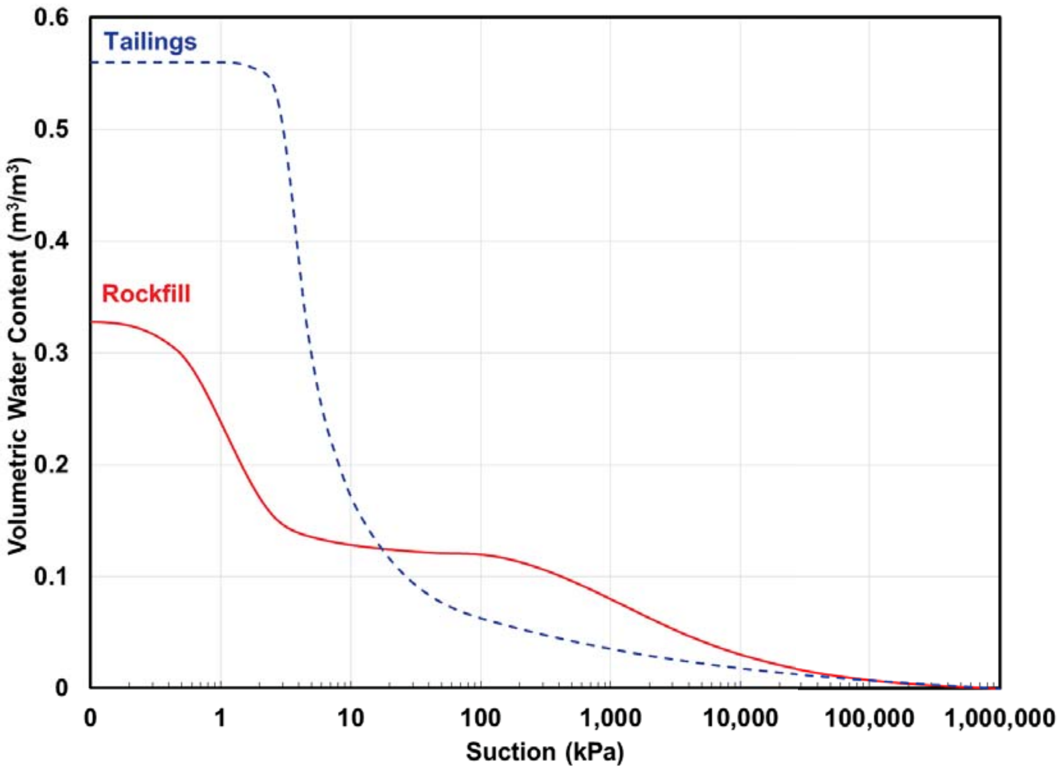

Figure 3: □ater retention curves proposed to simulate Meadowbank materials.

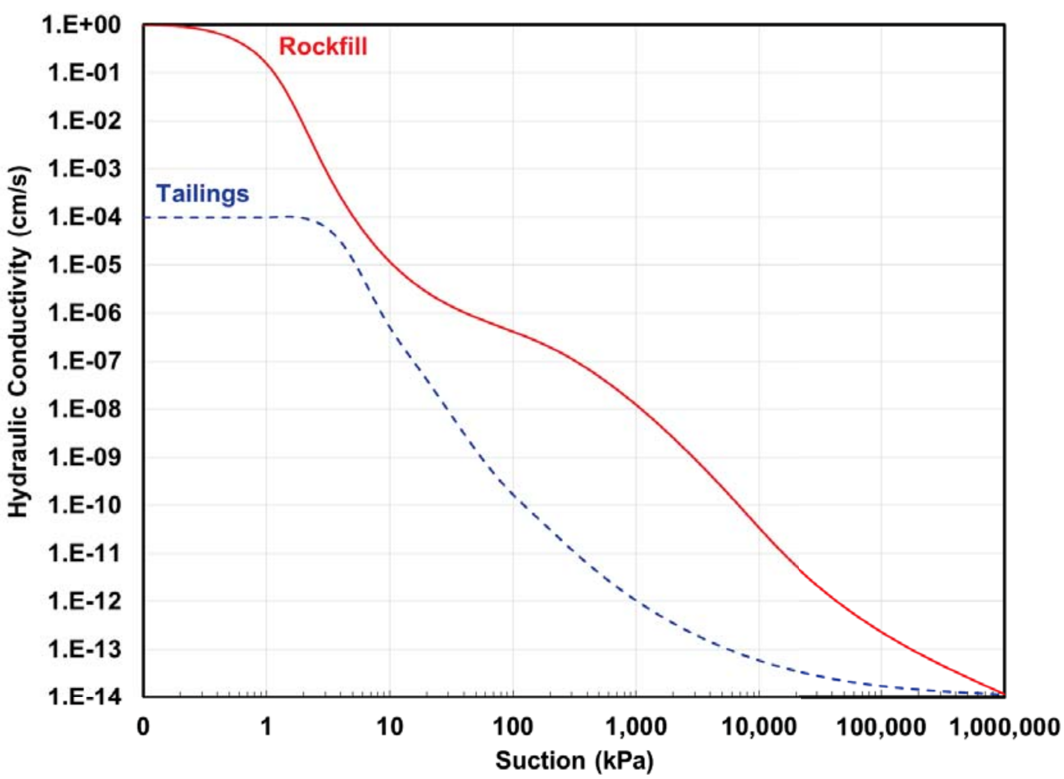

Figure 4: □ydraulic conductivity functions proposed to simulate Meadowbank materials.

[illegible]

The surface boundary condition is mainly governed by climate—specifically, precipitation and evaporative energy. There is the potential for rainfall during tailings deposition to negate the benefits of evaporation. Hence, the worst-case from a seepage point of view is to not include a surface flux attributable to climate. This means water is only added in the model by the deposition of tailings and removed either by lateral seepage downslope towards the pond or through the rockfill extension dike.

[illegible]

The lower boundary is assumed to be a no flow boundary due to the presence of permafrost. If seepage was allowed from the lower boundary it would reduce the potential for seepage through the rockfill extension dike. Therefore, the current concept does not necessitate simulating a permeable lower boundary.

The lower boundary is moved upward at the end of each season to maintain the estimated maximum 2 m active layer.

[illegible]

The external edge of the rockfill extension dike (i.e. the edge exposed to the atmosphere) is simulated as a potential seepage face to allow water to drain though the dike.

[illegible]

The internal edge of the simulated cross-section(s) (i.e. the edge within the TSF) was simulated as a potential seepage face placed far enough away from the extension dike so as to not influence seepage through the dike.

[illegible]

[illegible]

The results of the transient seepage analysis are summarized in Table 1. Cross-sections 1 and 7 resulted in negligible seepage; hence, no results are provided. Note that the "affected dike length" is estimated based on OKC's assumption that the rockfill dike will be built at the outer edge of the 2015 cover system placement. However, the annual tailings thickness were estimated assuming the extension dike is along the interior edge of the 2015 cover system as provided by AEM. This adds additional conservatism to the results as the dike length will either be shorter (if placed on the interior edge) or the tailings thickness will be reduced (if the dike is placed on the exterior edge of the 2015 cover system).

Table 1: Summary of transient seepage results for each deposition season

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
201[illegible]	3	[illegible].3E-07	0.03	1.7	724	22	1,227
	4	8.8E-06	0.5	12.3	681	341	8,358
	Total					*363*	*9,585*
2020	3	1.0E-05	0.07	2.5	724	51	1,77[illegible]
	4	2.2E-05	0.15	3.3	681	102	2,266
	5	1.0E-06	0.01	0.6	55[illegible]	6	312
	Total					*159*	*4,357*
2021	2	2.2E-06	0.03	2.4	851	26	2,070
	3	1.6E-05	0.03	2.5	724	22	1,811
	4	3.5E-05	0.24	6.4	681	163	4,33[illegible]
	5	2.0E-06	0.0[illegible]	6.8	55[illegible]	50	3,776
	6	[illegible].3E-07	0.01	0.1	480	5	3[illegible]
	Total					*266*	*12,035*
2022 (no cover system in place)	2	3.8E-06	0.12	2	851	102	1,702
	3	2.3E-05	0.16	2.6	724	116	1,882
	4	2.6E-06	0.23	4	681	157	2,724
	5	1.1E-05	0.12	1.3	559	67	727
	6	5.8E-06	0.10	0.7	480	48	336
	Total					*490*	*7,371*

Transient simulations were completed with the dike width at its crest at 30 m as well as with the width reduced to 15 m. Both scenarios resulted in similar results; hence, overall dike width does not influence anticipated seepage rates. 15 m was determined as the minimum width to accommodate 2-way traffic with 50-ton haul trucks.

Simulation of cross-section 4 was completed with a filter layer along the interior slope of the extension dike. This model showed that the presence of a filter layer does not influence seepage rates unless the k_{sat} of the filter layer is lower than the k_{sat} of the tailings.

Steady-State Simulations

A steady-state simulation was completed for the end of each deposition season for each cross-section using anticipated maximum seepage during that season to determine the absolute maximum seepage rate and velocity; and, the maximum distance from the dike that tailings could still contribute to the seepage rate. The results are provided in Table 2. These values are highly conservative as the entire tailings mass, and the flow path through the extension dike, are assumed to be fully saturated and to remain so throughout the simulation. In reality, there would likely be some storage capacity available within the tailings and/or dike thus reducing the seepage rate. If the system was fully saturated as simulated, this condition would quickly dissipate.

Table 2: Summary of steady-state seepage results for the end each deposition season

Summer	Cross-Section	Maximum Seepage Velocity (m/s)	Maximum Seepage Rate (m^3/day/m)	Affected Dike Length (m)	Maximum Daily Seepage Volume (m3/day)	Maximum Contributing Distance from Dike (m)
2019	3	1.3E-03	51	724	36,924	47
	4	1.8E-03	66	681	44,946	95
2019 (rockfill below tailings not included)	3	1.3E-03	9	724	6,516	3
	4	2.6E-03	18	681	12,258	3
2020	3	3.3E-03	45	724	32,580	8
	4	3.3E-03	50	681	34,050	8
	5	1.5E-03	22	559	12,298	74
2021	2	1.7E-03	73	851	62,123	8
	3	3.4E-03	76	724	55,024	25
	4	3.3E-03	109	681	74,229	10
	5	2.0E-03	49	559	27,391	80
	6	2.0E-03	16	480	7,680	50

Figures for all the cross-sections for each season are provided in the appendix. Cross-section 4 (Figures 15 to 18) is anticipated to have the highest seepage volume. The steady-state models show that the 2015 cover system rockfill layer under the tailings and dike provides a conduit for flow during the 2019 season, which allows for tailings water much further away from the dike to influence seepage rates through the dike. Seepage rates and contributing distances are substantially reduced when the rockfill layer is not included in the simulation (Figure 16). In order to reduce seepage rates under the rockfill dike, a winter season should pass between construction of the dike and tailings deposition in that area. This is to ensure permafrost formation under and within the dike and to reduce the active layer to the dike itself during the deposition season, thus reducing the "conduit" effect in the rockfill material under the dike.

Consolidation Analysis

The tailings consolidation analysis aims at determining the consolidation process at the north cell of the TSF that may occur beneath the rockfill dyke. Settlement rates of fine tailings have to be distinguished between primary and secondary (long-term) consolidation portions. Essential criteria for both stabilization of tailings due to covering and ensuring long-term stability due to decommissioning are:

1. Absolute magnitude of settlement;
2. Time dependent consolidation rates; and
3. Magnitude of secondary settlement to ensure long-term stability of the rockfill dykes.

Objectives and Scope

A one-dimensional (1-D) consolidation analysis was conducted to assess the potential for overall tailings settlement due to the additional loading from the placement of the rockfill dyke. The specific purpose of this analysis was to estimate long-term settlement of the tailings mass, and evaluate whether the predicted long-term settlement could affect the overall integrity of the rockfill dykes.

An analytical approach was selected for the 1-D tailings consolidation analysis. Material properties (e.g. unit weight) of the tailings and dyke construction materials (i.e. waste rock) were estimated based on material characterization work completed from previous studies provided by AEM, and were used to calculate initial and final vertical effective stresses in the tailings mass. The tailings ultimate settlement due to consolidation was then determined based on the calculated vertical effective stresses. A tailings mass thickness of 2 m was used in the analysis, which represents the tailings thickness at the location where the rockfill dyke will be placed, or in the case of thicker tailings zone, the maximum potential depth the tailings may thaw.

Tailings consolidation for the purposes of this report is referred to as tailings volume change (settlement). External loading from rockfill dyke placement is a key factor leading to tailings consolidation settlement.

Methods of Analysis

Figure 5 illustrates the loading conditions. The scenario simulates tailings consolidation when a 4 m rockfill dyke is placed on top of the tailings mass.

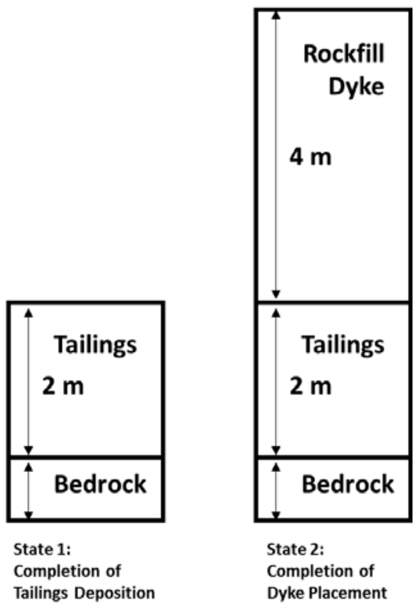

Figure 5: Tailings consolidation analysis scenario

Consolidation analyses are based on changes of effective stress in the tailings. Equation 1 and 3 were used to calculate the primary consolidation and secondary compression of the tailings mass, respectively. Initial and final effective stresses were calculated based on the tailings initial and final state.

Primary consolidation is the change in volume of tailings caused by the expulsion of water from the voids and the transfer of load from excess pore water pressure to the soil particles following dyke placement (□ardari 2010). The equation below was used to determine the primary consolidation of the tailings mass following placement of a 4 m rockfill dyke overlying the tailings mass (Table 3 and 4 summarize the inputs).

$$(\delta_c)_{Primary} = \frac{C_c}{1+e_0} H \log\left(\frac{\sigma'=f}{\sigma'=0}\right) \qquad (1)$$

where:

- (δ_c) : is the settlement due to consolidation
- c_c : is the compression index,
- e_o : is the initial void ratio,
- H : is the thickness of tailings material (m),
- σ_f' : is the final vertical effective stress (kPa), and
- σ_o' : is the initial vertical effective stress (kPa).

It was assumed that the tailings were normally consolidated and the compressibility is defined by the compression index, Cc. The Rendon-Herrero (1983) method was applied to determine the compression index (Equation 2).

$$C_c = 0.141 G_s^{1.2} \left(\frac{1+e_0}{G_s}\right)^{2.38} \qquad (2)$$

Table 3 Key inputs for the tailings consolidation analysis

Property	Rockfill Dyke	Tailings
Dry Density (t/m^3)	2.15	1.31
Specific Gravity	3.2	3
Unit Weight (kN/m^3)	24.27	18.36
Void Ratio	0.49	1.29
Porosity	32.8	56.3
Saturation	1	1
Hydraulic Conductivity (cm/s)	[illegible]	5.00E-07
Thickness (m)	4	2

Table 4 Key parameters for the tailings consolidation analysis

Parameter	Value
Compression Index (Cc)	0.2771
Secondary compression Index (Cα)	0.00160
Coefficient of volume compressibility (mv)	0.00175
Coefficient of consolidation (Cv)	1.55E-05
Time factor for 90% degree of consolidation (Tv)	0.848

Analytical Results

The modelled relationship, Equation 1, showed that a primary consolidation of approximately 0.19 m is achieved following construction of a 4 m rockfill dyke. Figure 6 presents the relationship between the change in primary consolidation and cover thickness.

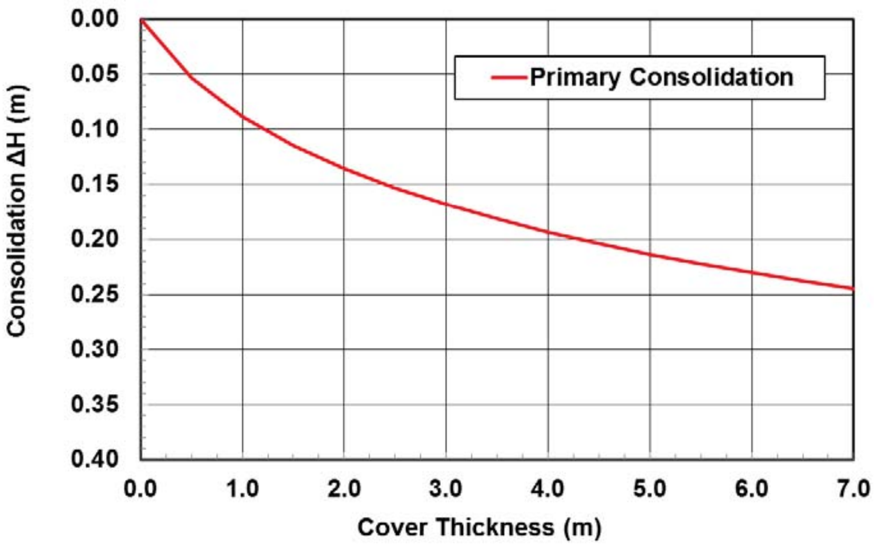

Figure 6: Primary consolidation vs. cover thickness

The results indicate that a 2 m thick mass of tailings would consolidate to a 90% degree of consolidation in approximately 10 days. During this time, primary consolidation of the tailings would be approaching completion with a final change in height of approximately 0.4 m. Long-term consolidation, also known as creep then commences. A secondary settlement of approximately 0.5 cm was calculated over a period of 100 years following completion of primary consolidation. Figure 7 presents the time-dependent long-term consolidation which occurred over a long period of time in response to the placement of the cover system.

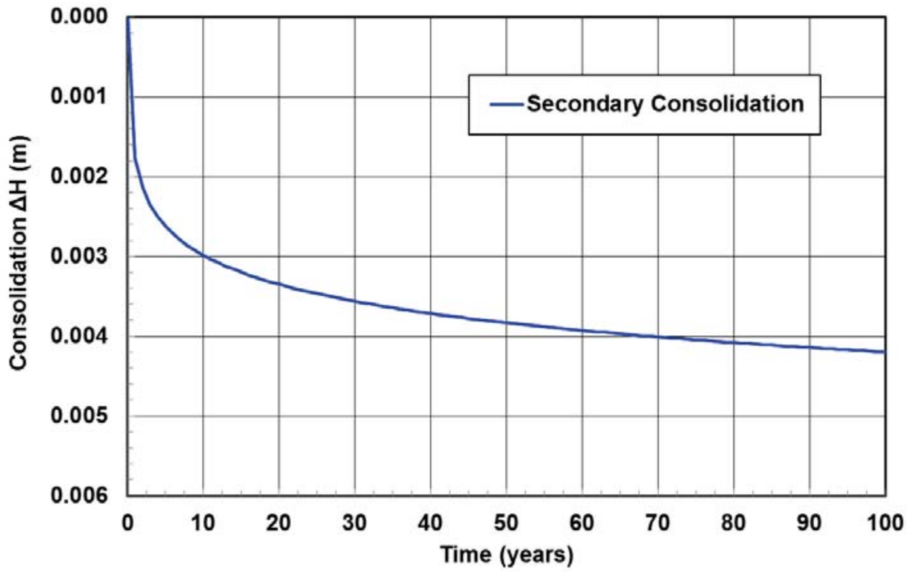

Figure 7□□Tailings secondary consolidation model □settlement rate prediction for 100 years□

Key Findings

Key findings from the tailings consolidation analysis are as follows:

1. In general, the tailings ultimate settlement for the Northern Cell TSF tailings beneath the rockfill dykes is approximately 0.[illegible]m.
2. It is considered highly unlikely that the tailings underlying the rockfill dyke will thaw, and if some thaw occurs it will be substantially less than [illegible]m into the underlying tailings.

Closure

We trust information provided in this memorandum is satisfactory for your requirements. Please do not hesitate to contact me at [illegible] or rshurniak@okc-sk.com should you have any questions or comments.

□□□endi□

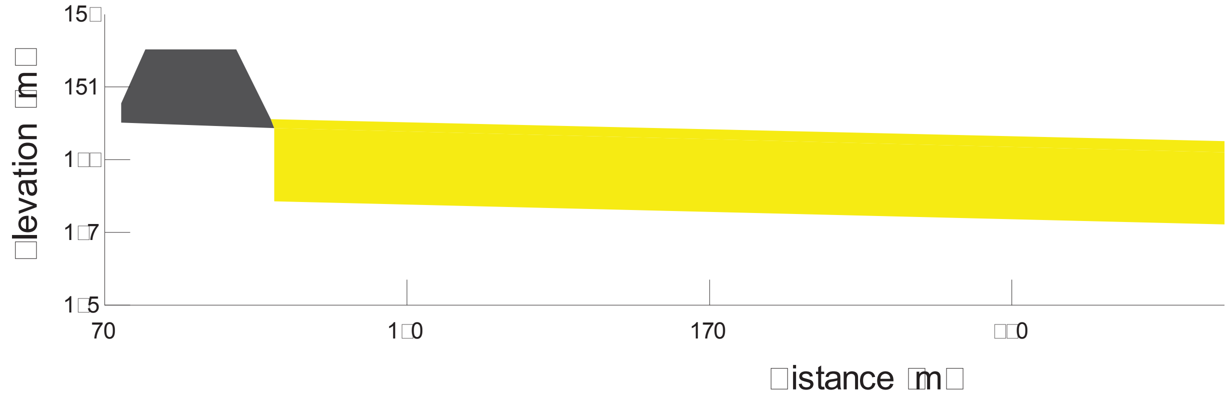

Figure 5□ □ross-section 1 geometry at the end of deposition.

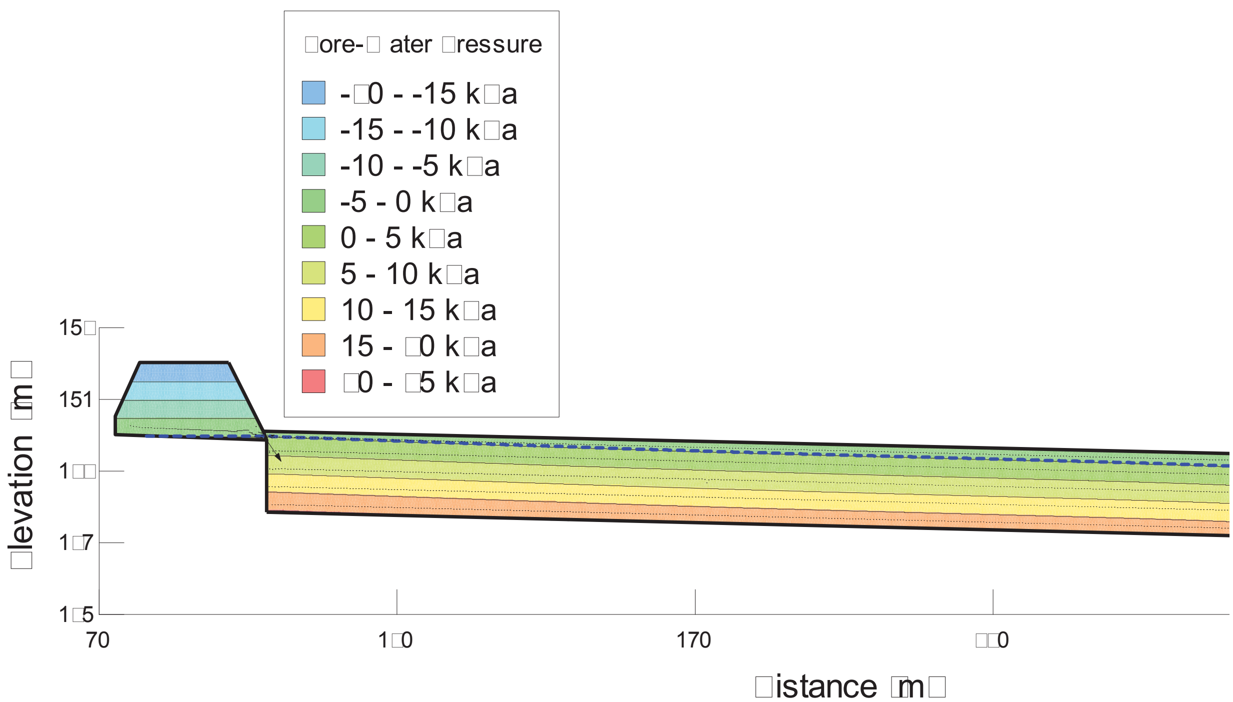

Figure □□ □ross-section 1 pore-water pressure, and flow vectors at end of □0□1. □o flow into the dike.

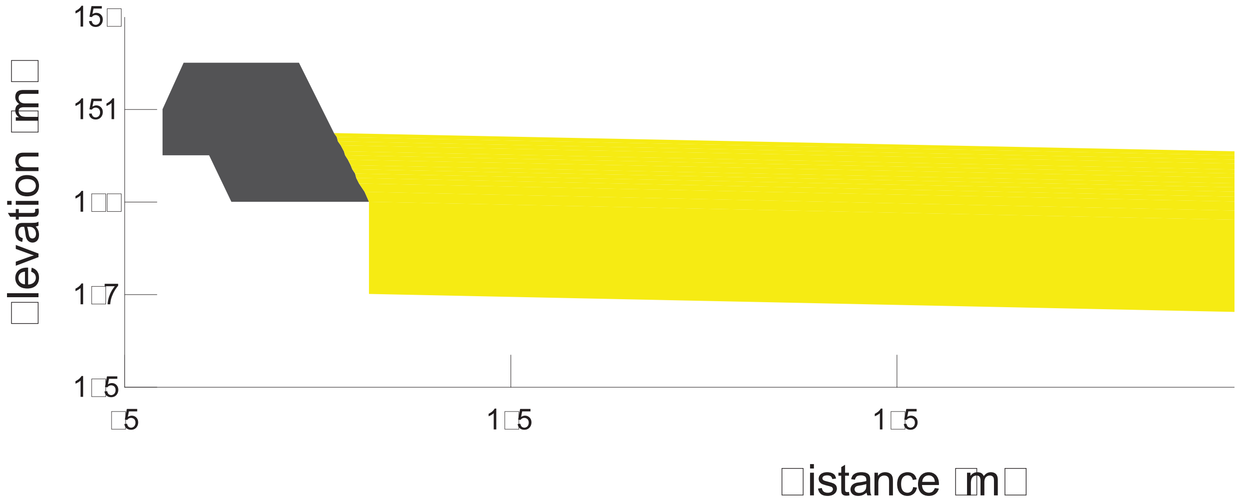

Figure 7□ □ross-section □ geometry at the end of deposition

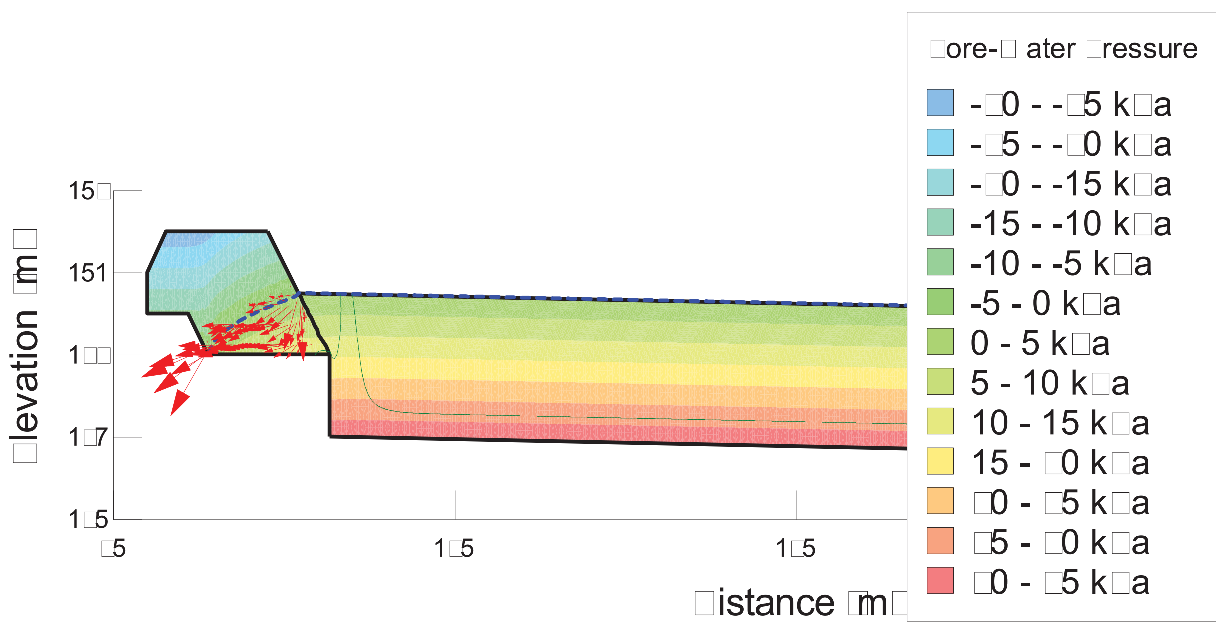

Figure □□ □teady-state pore-water pressure, flow paths and flow vectors for section □ at end of □0□1

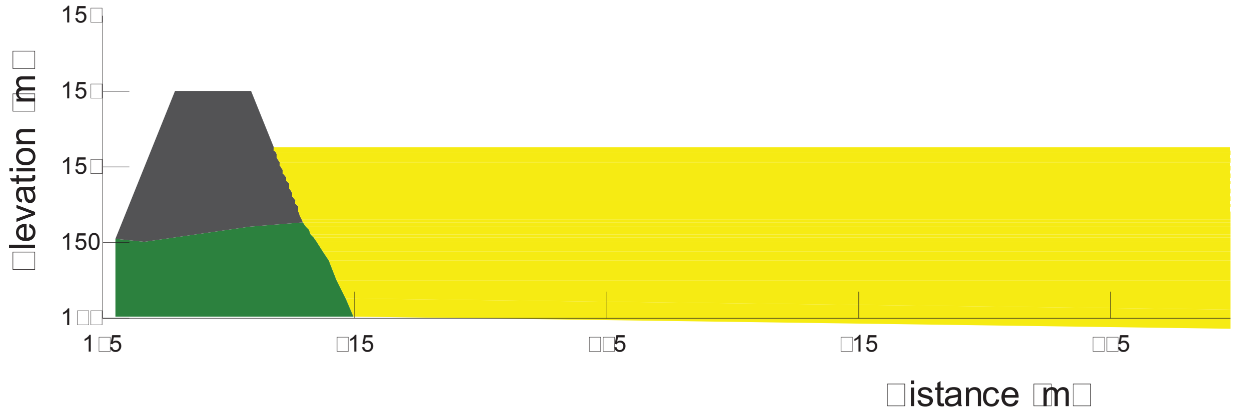

Figure □□ □ross-section □geometry at the end of deposition

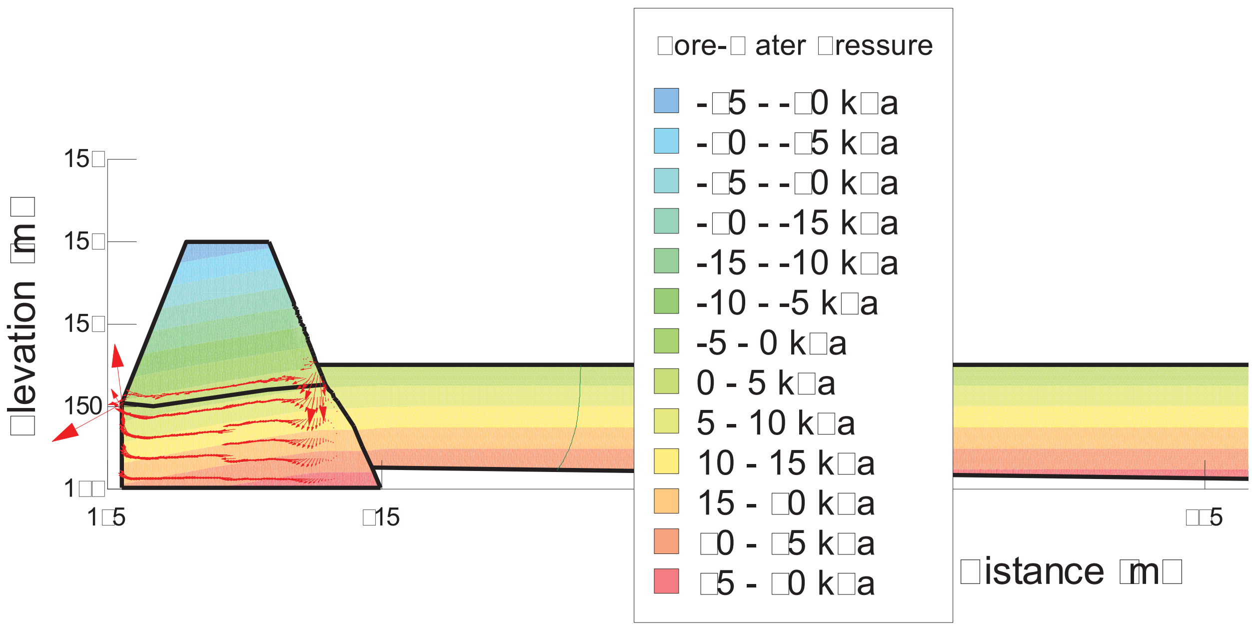

Figure 10□ □teady-state pore-water pressure, flow paths and flow vectors for section □at end of □01□

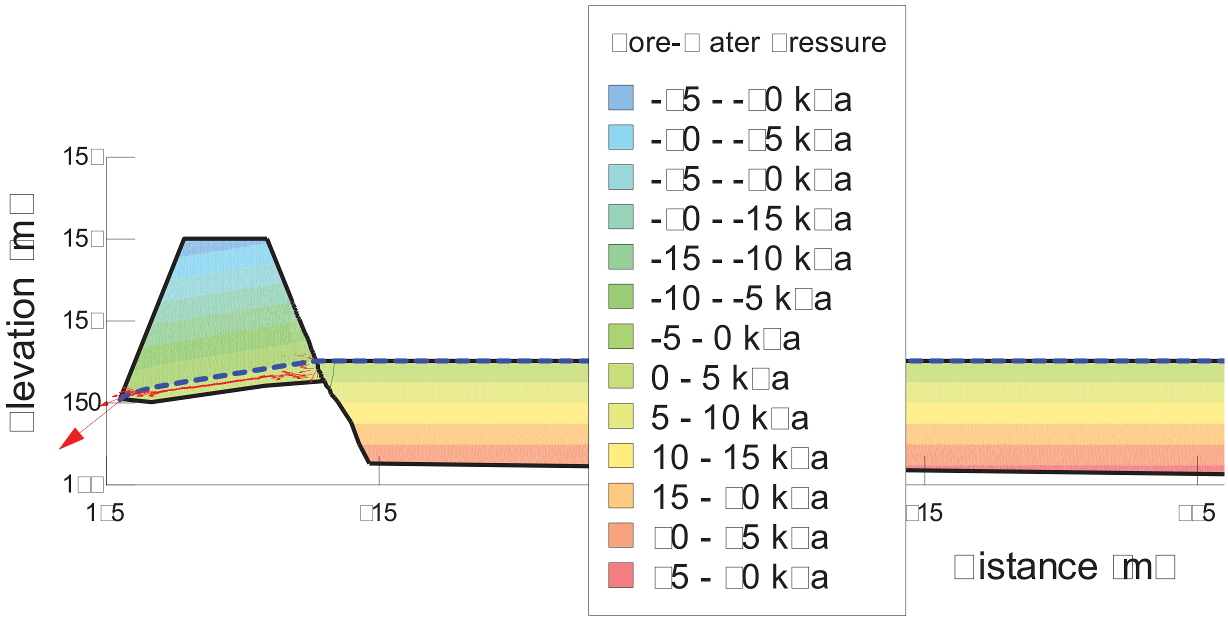

Figure 11□ □teady-state pore-water pressure, flow paths and flow vectors for section □ at end of □01□ when rockfill layer □elow tailings and dike not included

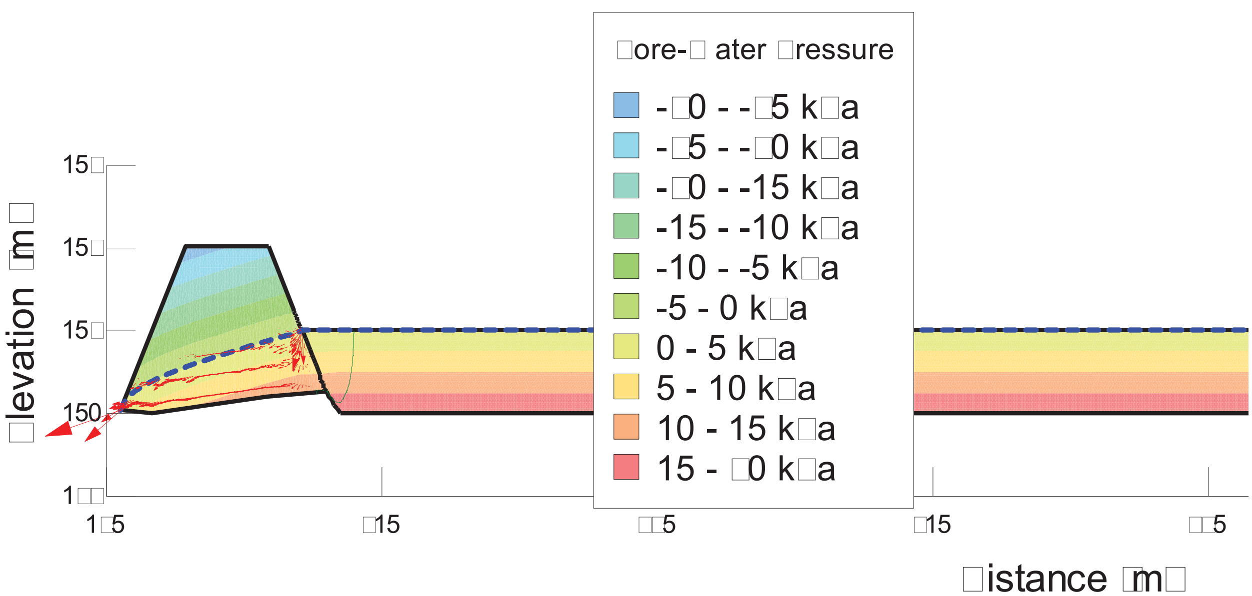

Figure 1□□ □teady-state pore-water pressure, flow paths and flow vectors for section □ at end of □0□0

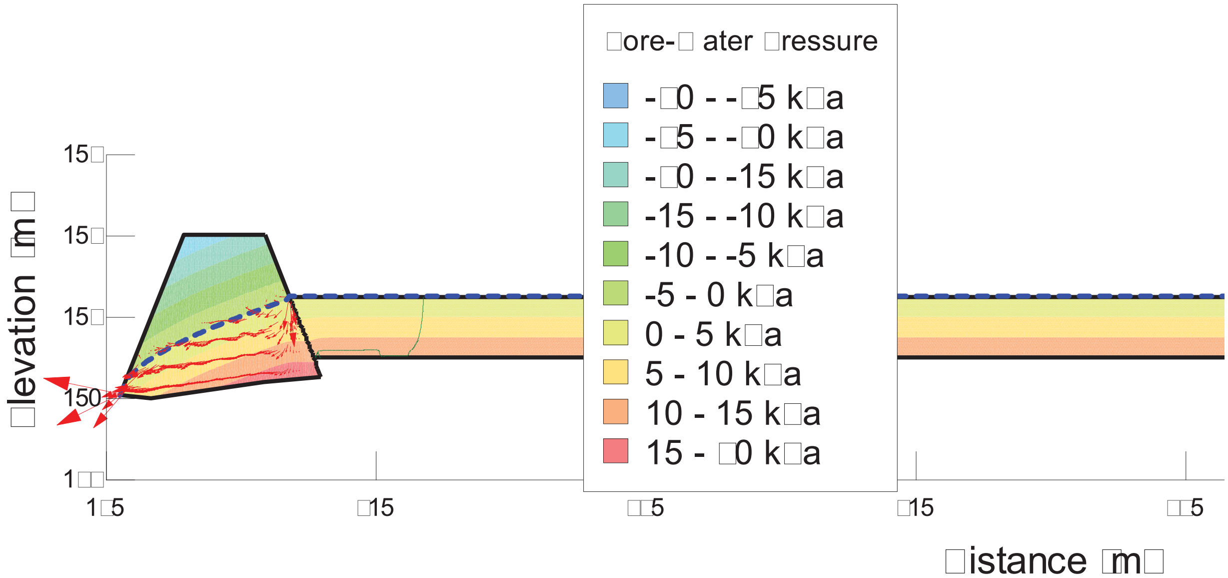

Figure 1□□ □teady-state pore-water pressure, flow paths and flow vectors for section □ at end of □0□1

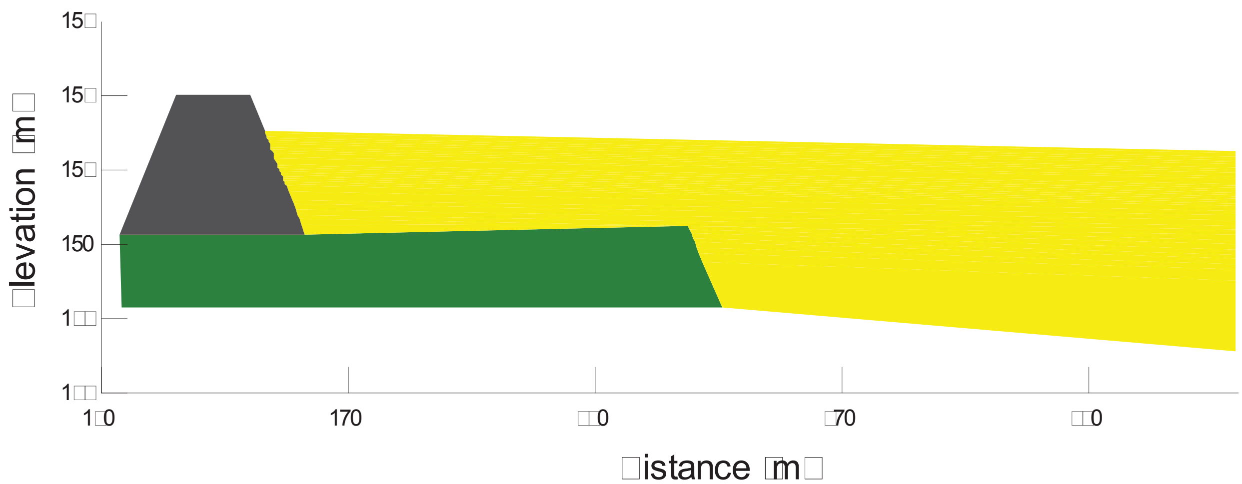

Figure 1□□ □ross-section □ geometry at the end of deposition

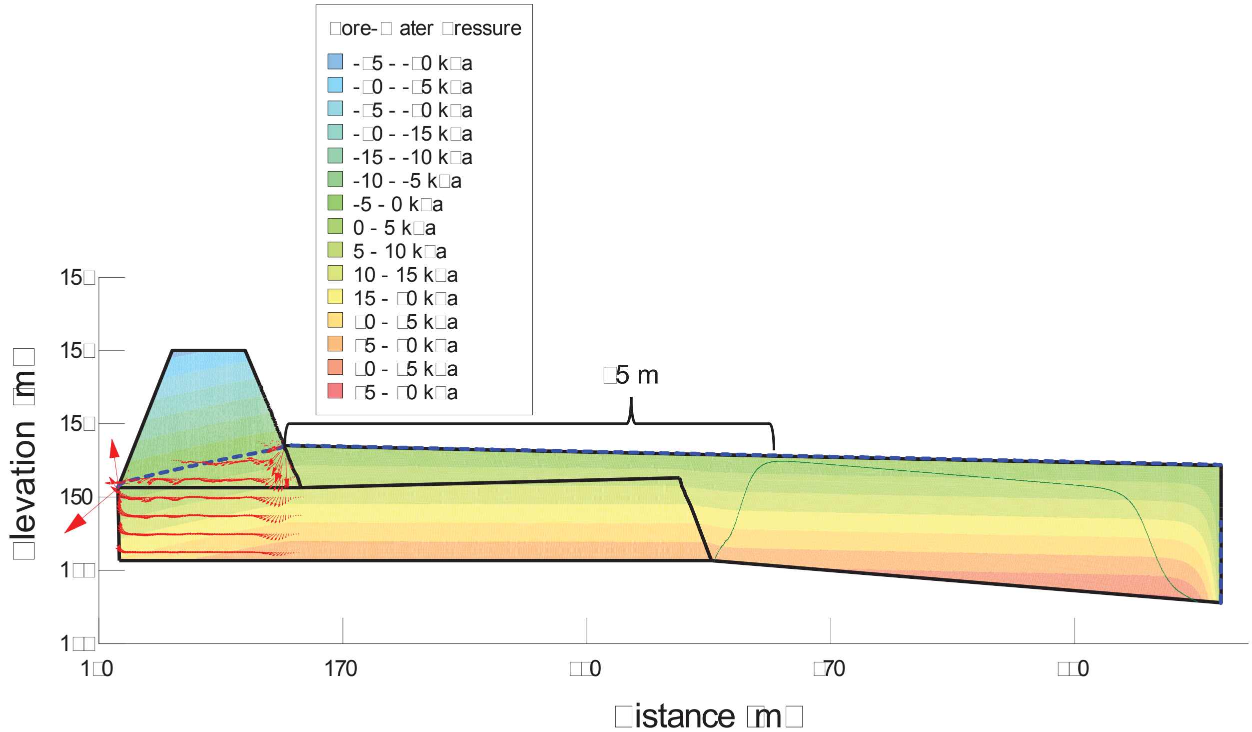

Figure 15□ □teady-state pore-water pressure, flow paths and flow vectors for section □ at end of □01□

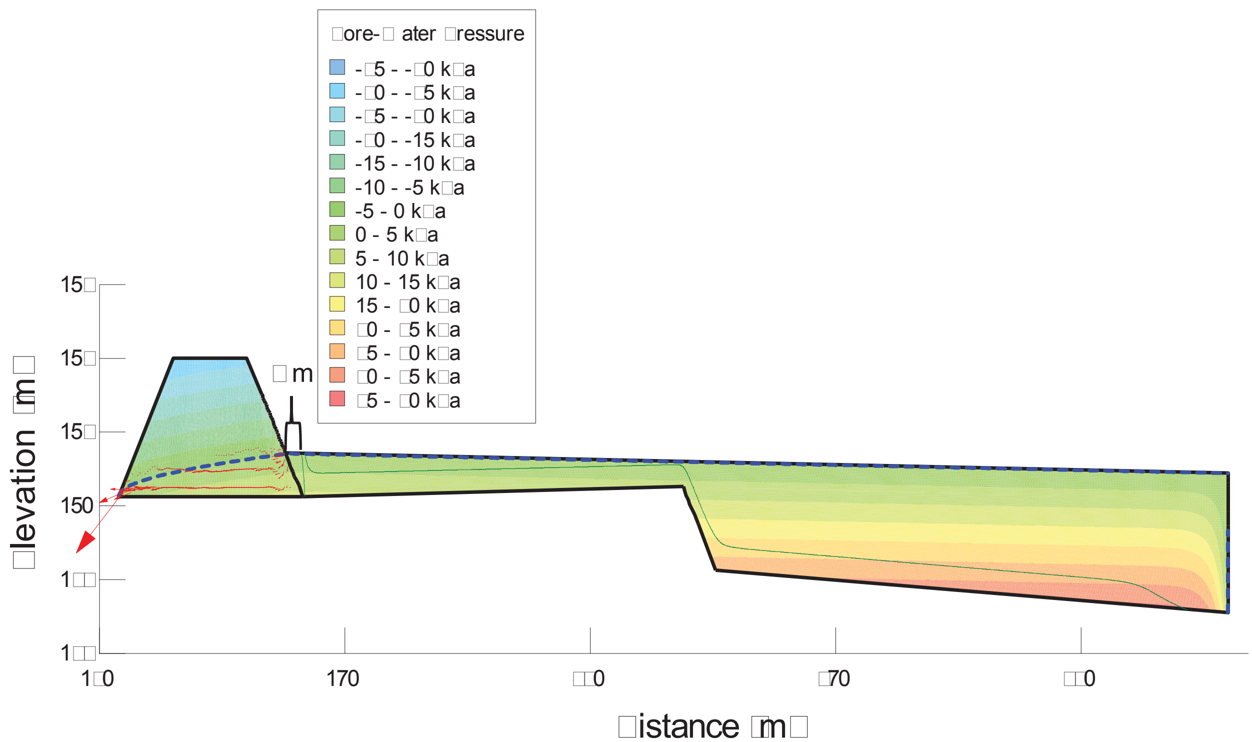

Figure 1□□ □teady-state pore-water pressure, flow paths and flow vectors for section □ at end of □01□ when rockfill layer □elow tailings and dike not included.

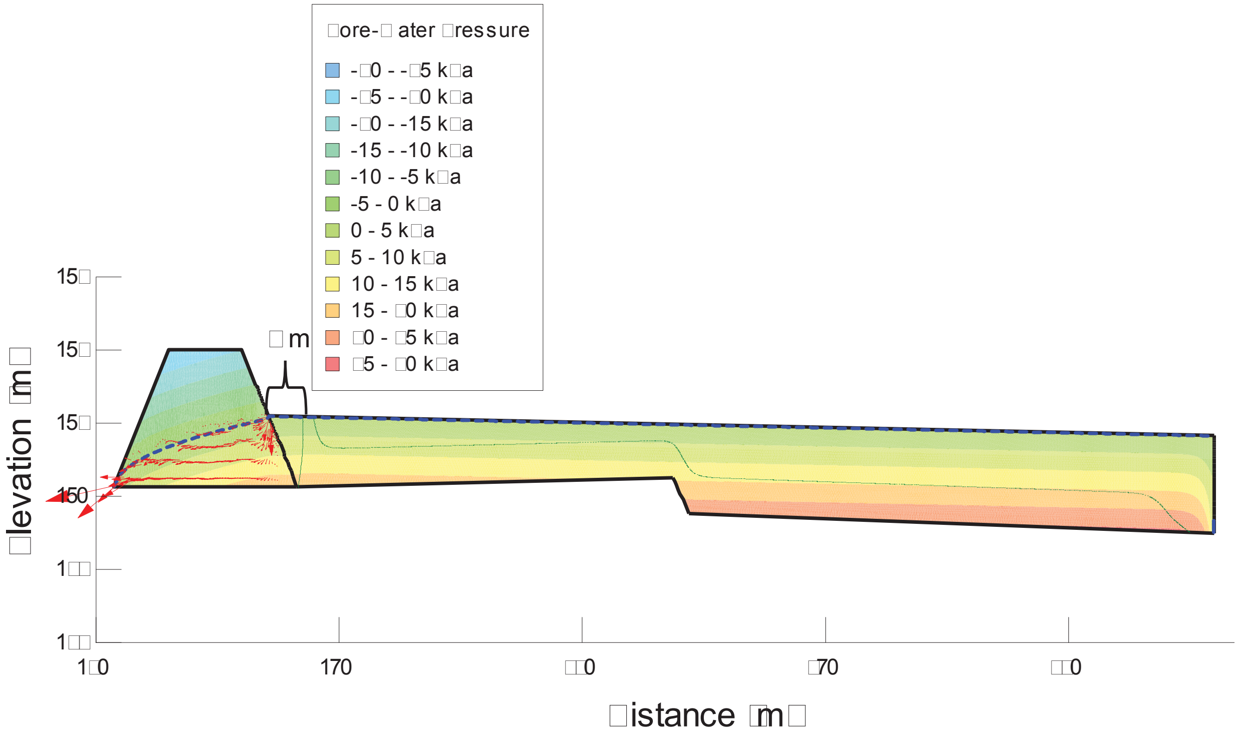

Figure 17□ □teady-state pore-water pressure, flow paths and flow vectors for section □ at end of □0□0

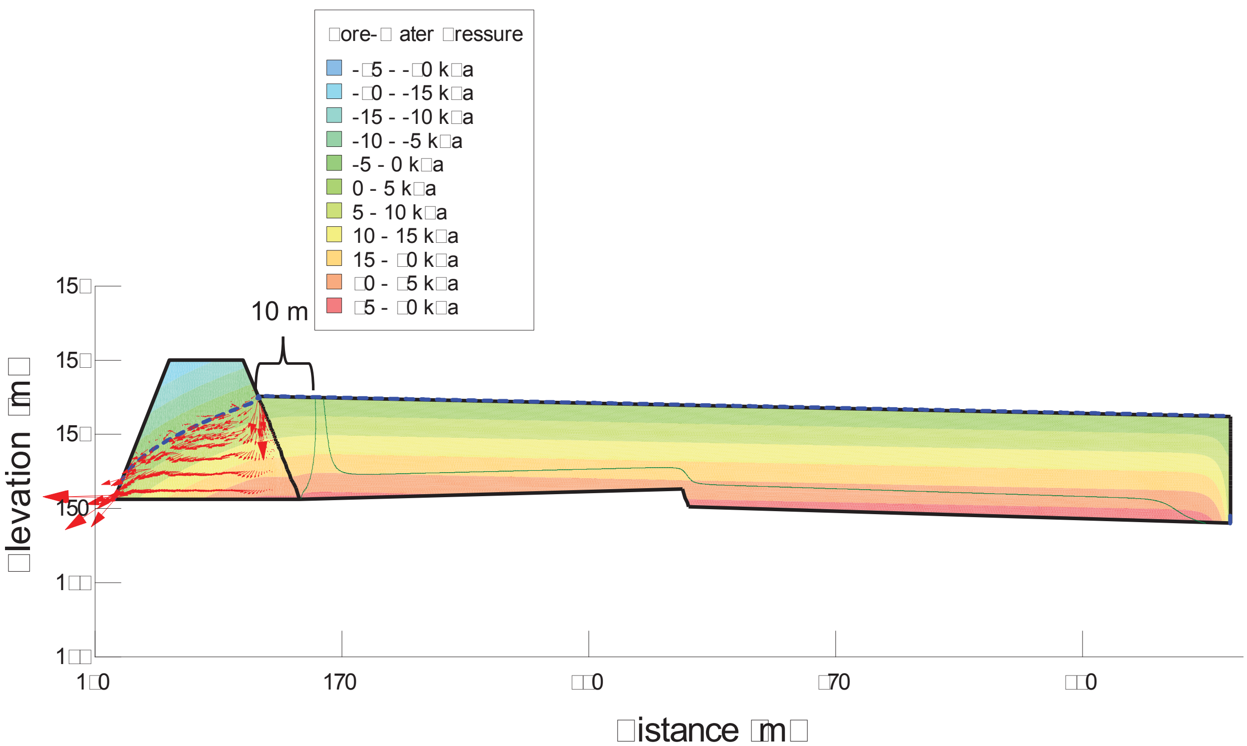

Figure 1□□ □teady-state pore-water pressure, flow paths and flow vectors for section □ at end of □0□1

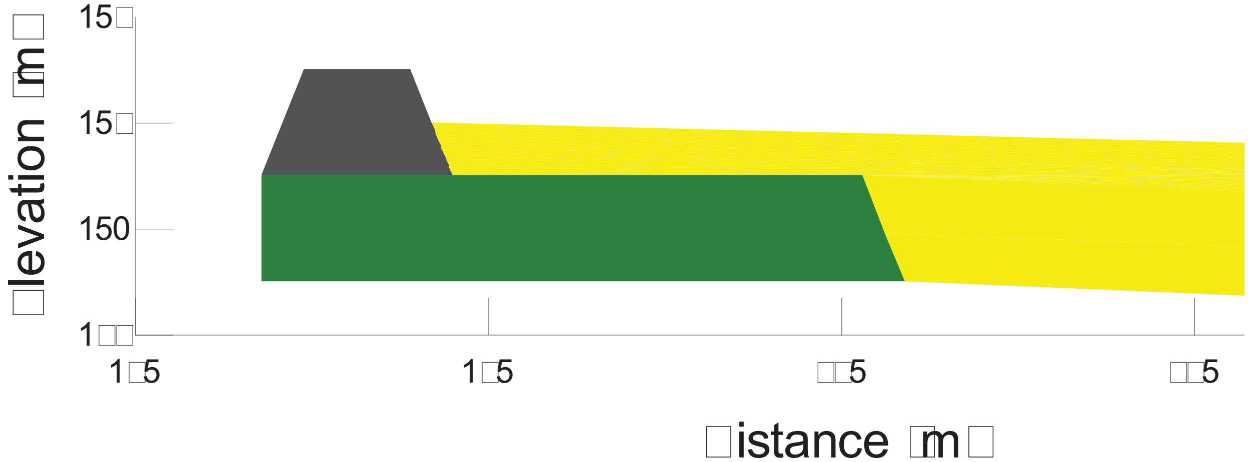

Figure 1□□ □ross-section 5 geometry at the end of deposition

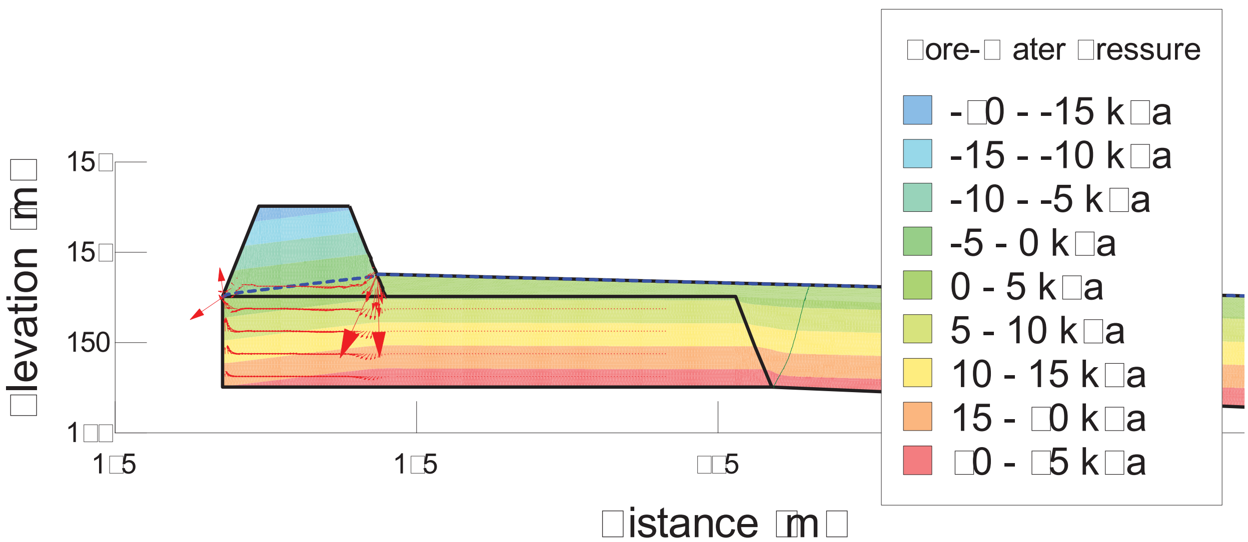

Figure □0□ □teady-state pore-water pressure, flow paths and flow vectors for section 5 at end of □0□0

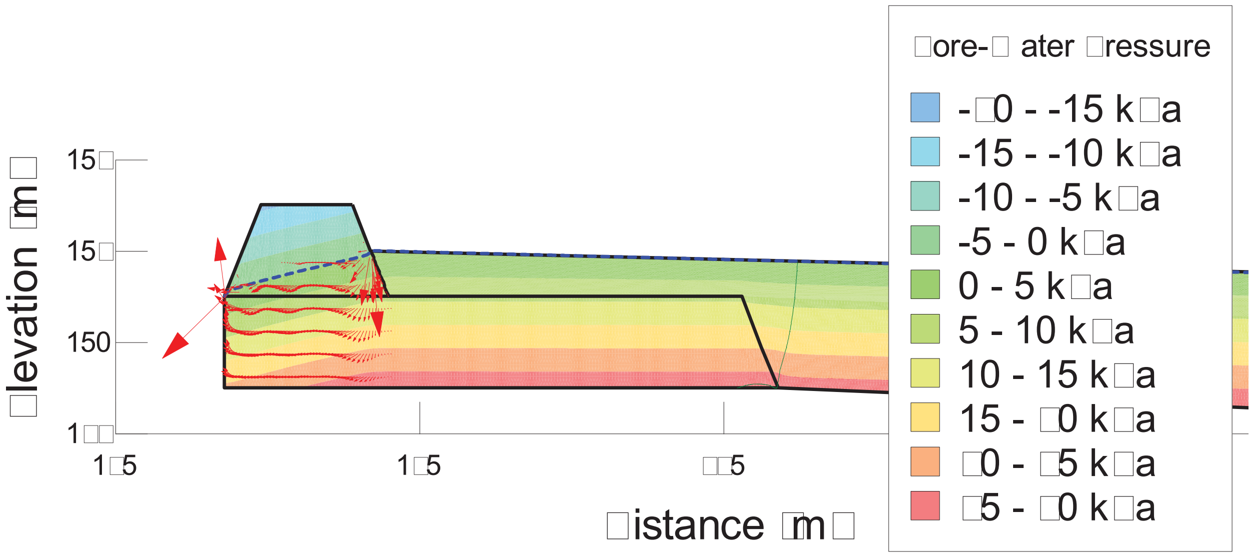

Figure □1□ □teady-state pore-water pressure, flow paths and flow vectors for section 5 at end of □0□1

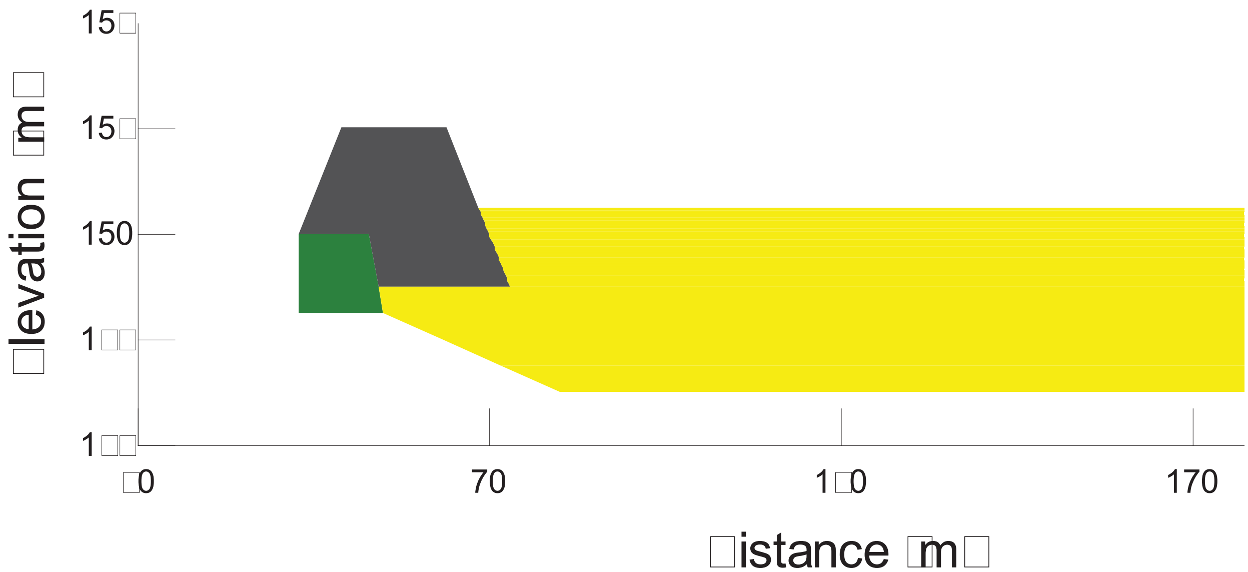

Figure □□□ □ross-section □geometry at the end of deposition

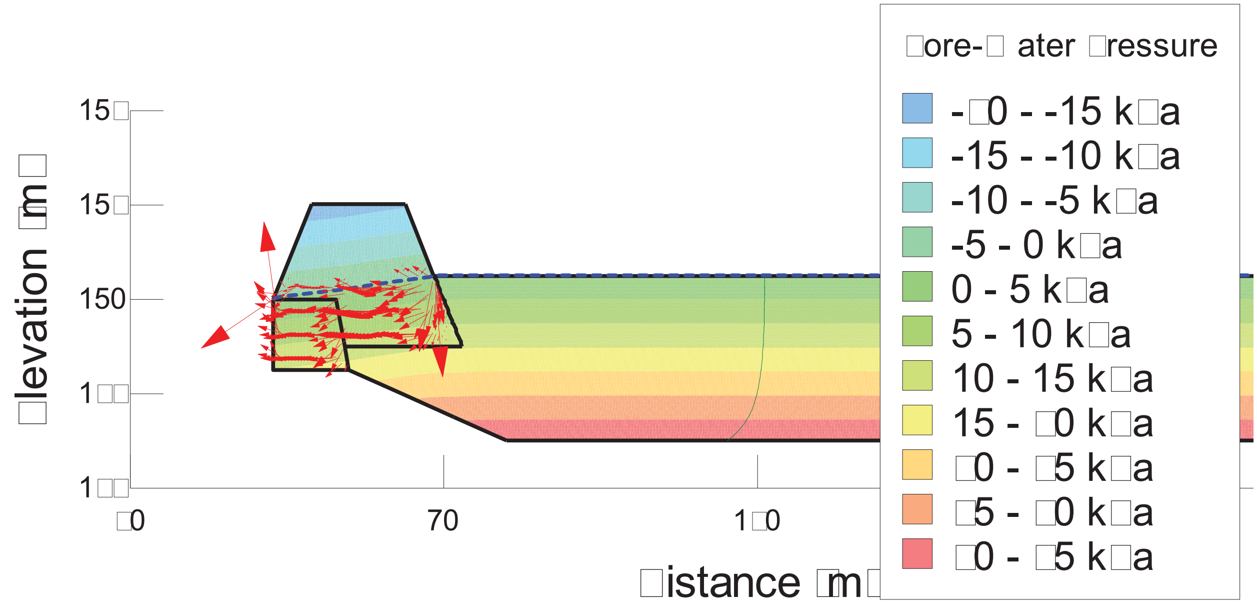

Figure □□□ □teady-state pore-water pressure, flow paths and flow vectors for section □ at end of □0□1

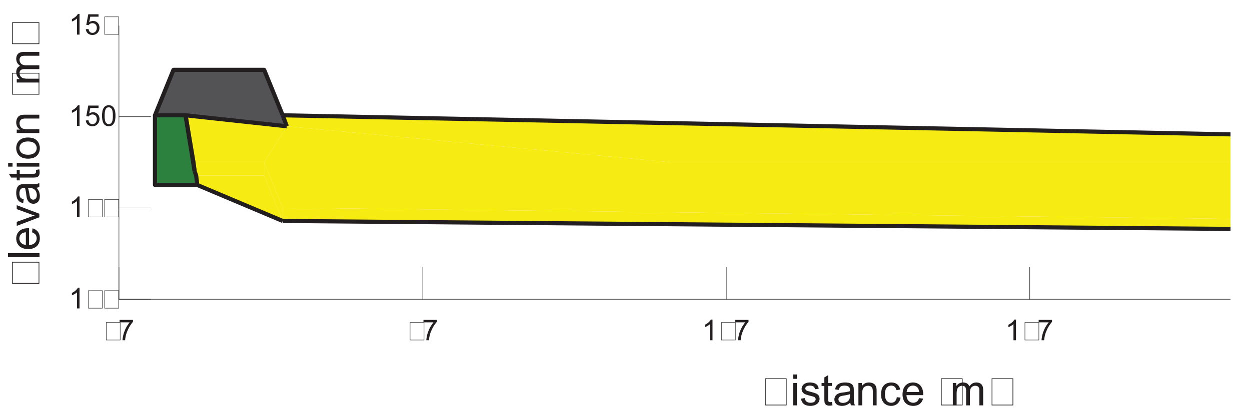

Figure □□□ □ross-section 7 geometry at the end of deposition

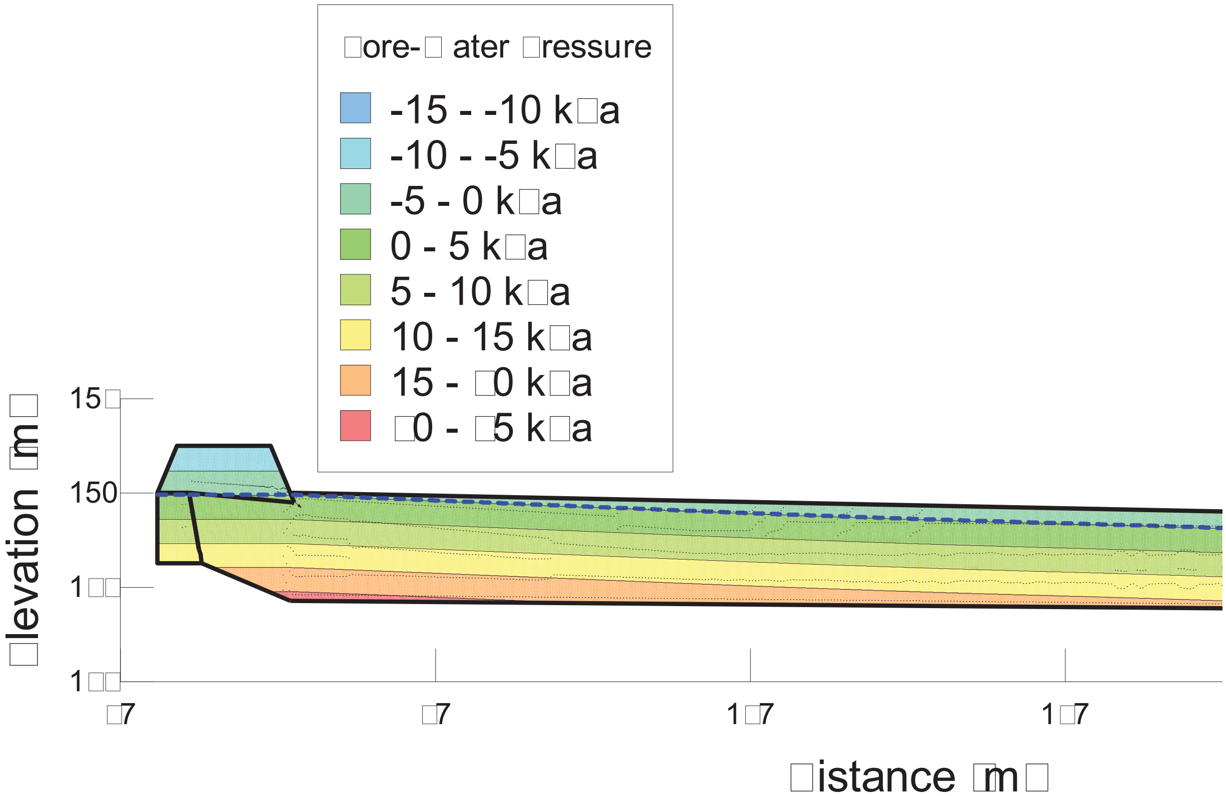

Figure □5□ □ross-section 7 pore-water pressure, and flow vectors at end of □0□1. □o flow into the dike

O'Kane Consultants

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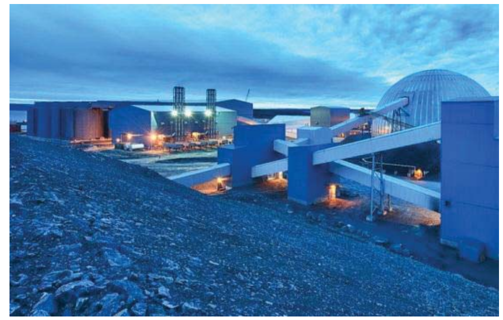
APPENDIX C • WHALE TAIL PIT TAILINGS DEPOSITION PLAN

AGNICO EAGLE



Introduction

Following the revision of the Whale Tail Pit LOM, AEM reviewed the global tailings deposition plan required to store 8,279,144 tons of tailings in the Meadowbank TSF.

Parameters

The model inputs are to one measured with the North Cell bathymetry analysis presented during the MDRB meeting #17:

- Sub aerial tailings slope set at 0.45%;
- Sub aqueous tailings slope set at 2.36%;

Tailings dry density & ice entrapment are presented on next slide.

Assumptions

- Using *Water balance – Whale Tail Pit LOM*
- Starting surfaces:
  - North Cell: October 2015 from *"15 - October 2015 NC backward analysis"* *(actual deposition)*
  - South Cell: December 2017 from *"13 – Integrated deposition plan + August 2015"* *(actual budget)*
- NC suction location for NC to SC transfers is mobile in time to match the pond's dynamic geometry ;
- Maximum of 122days of deposition considered in the NC (summer period).

Model parameters

AEM observed an higher tailings dry density than expected in the South Cell during winter 2014-2015. Following the analysis of the parameter completed this fall, adjustment on the tailings dry density in time was done. This new model represents the evolution of this parameter in function of the tailings pond configuration.

Month	North Cell Parameters 2019-2021		
	Ice Thickness (m)	Tailings Dry Density (t/m^3)	Ice entrapment (%)
January	1.1	1.08	90%
February	1.3	1.08	90%
March	1.5	1.08	90%
Q1	**1.5**	**1.08**	**90%**
April	1.7	1.08	90%
May	0	1.32	60%
June	0	1.56	30%
Q2	**0**	**1.32**	**60%**
July	0	1.56	30%
August	0	1.56	30%
September	0	1.56	30%
Q3	**0**	**1.56**	**30%**
October	0.2	1.32	75%
November	0.5	1.08	80%
December	0.8	1.08	90%
Q4	**0.8**	**1.16**	**82%**
Average	-	**1.28**	**65%**

Month	South Cell Parameters 2019-2020 & 2021		
	Ice Thickness (m)	Tailings Dry Density (t/m^3)	Ice entrapment (%)
January	1.1	1.22 - 1.08	50% - 90%
February	1.3	1.22 - 1.08	50% - 90%
March	1.5	1.22 - 1.08	50% - 90%
Q1	**1.5**	**1.22 - 1.08**	**50% - 90%**
April	1.7	1.49 - 1.08	50% - 90%
May	0	1.49 - 1.32	40% - 60%
June	0	1.49 - 1.56	30%
Q2	**0**	**1.49 - 1.32**	**40% - 60%**
July	0	1.76 - 1.56	30%
August	0	1.76 - 1.56	30%
September	0	1.76 - 1.56	30%
Q3	**0**	**1.76 - 1.56**	**30%**
October	0.2	1.31 - 1.32	40% - 75%
November	0.5	1.31 - 1.08	50% - 80%
December	0.8	1.31 - 1.08	50% - 90%
Q4	**0.8**	**1.31 - 1.16**	**47% - 82%**
Average	-	**1.44 - 1.28**	**42% - 65%**

↗ 2019-2020 ↖ 2021

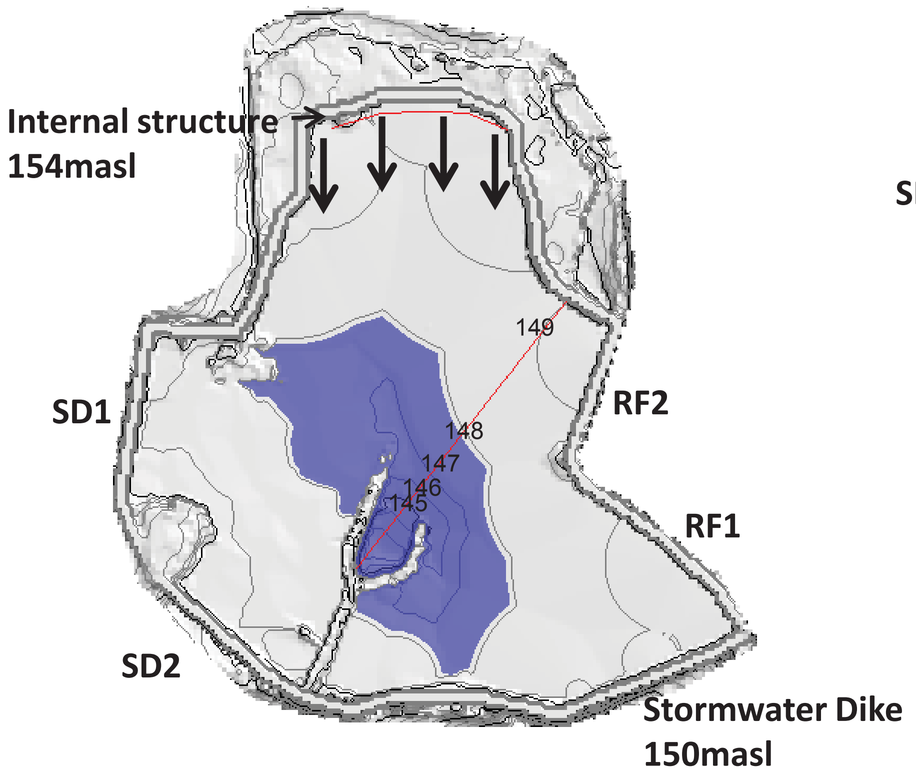
□epos□t□o□ strate□□

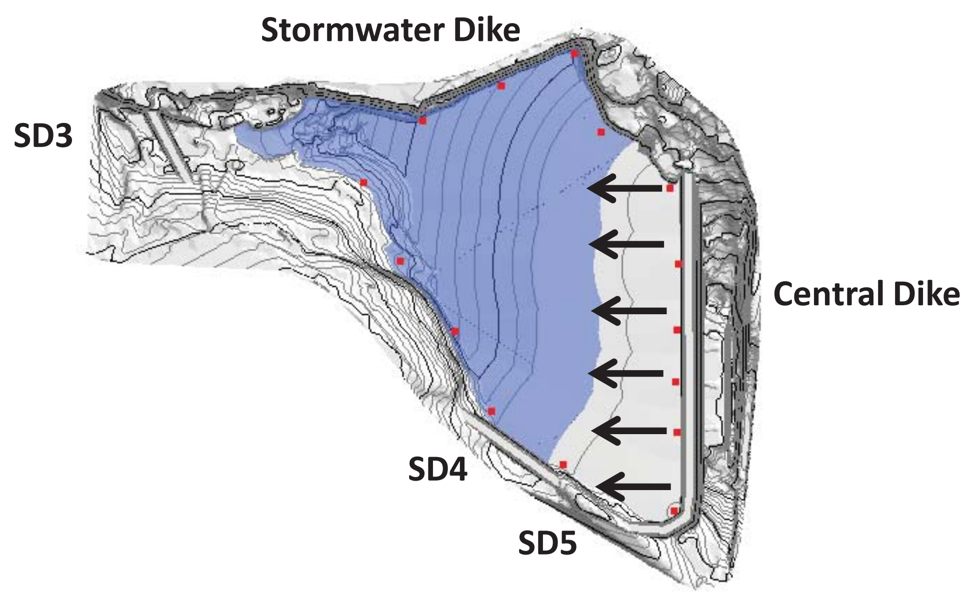
North Cell TSF

The figure below on the left depicts the geometry of the North Cell before resuming the deposition in June 2019 . An incline internal structure will surround the North Cell TSF starting at elevation 154m at the north end of the cell and will decrease in elevation until reaching the SWD at elevation 150m. Most of the deposition will occurred from the north end identified by a red line on the picture below.

South Cell TSF

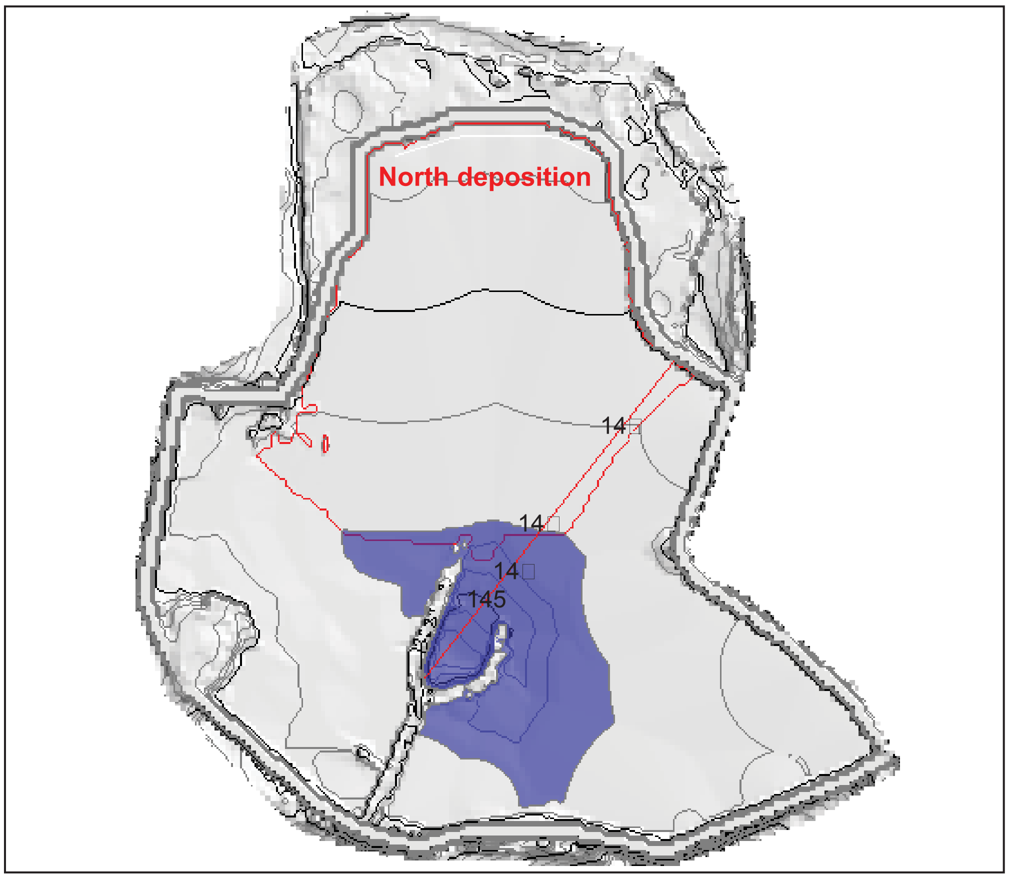
The figure below on the right depicts the geometry of the North Cell before resuming the deposition in October 2019. All structure (Central Dike, SD3, 4 & 5 and Stormwater Dike) will be at elevation 150m. Most of the deposition will occurred from the Central Dike in order to reclaim water from the west end of the TSF.





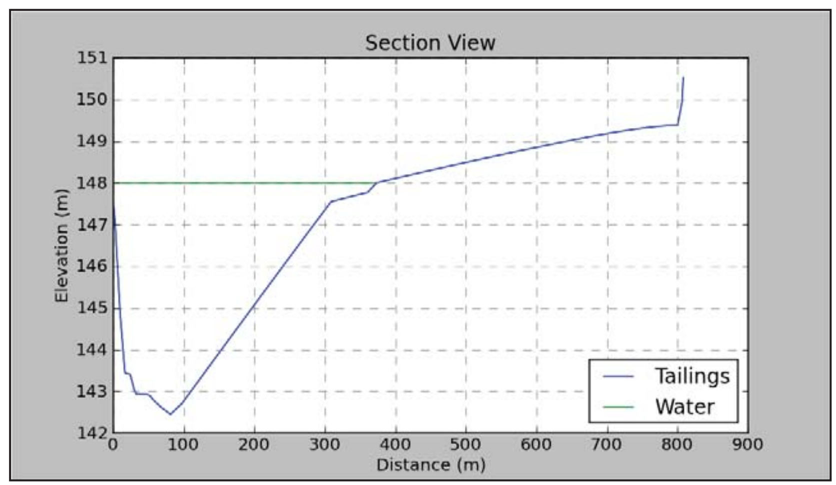
South Cell TSF deposition plan
2019 Q3

Duration	Deposition Point	Tonnes	Elevation (m)
□□	□ □□□	□□□454	151□4



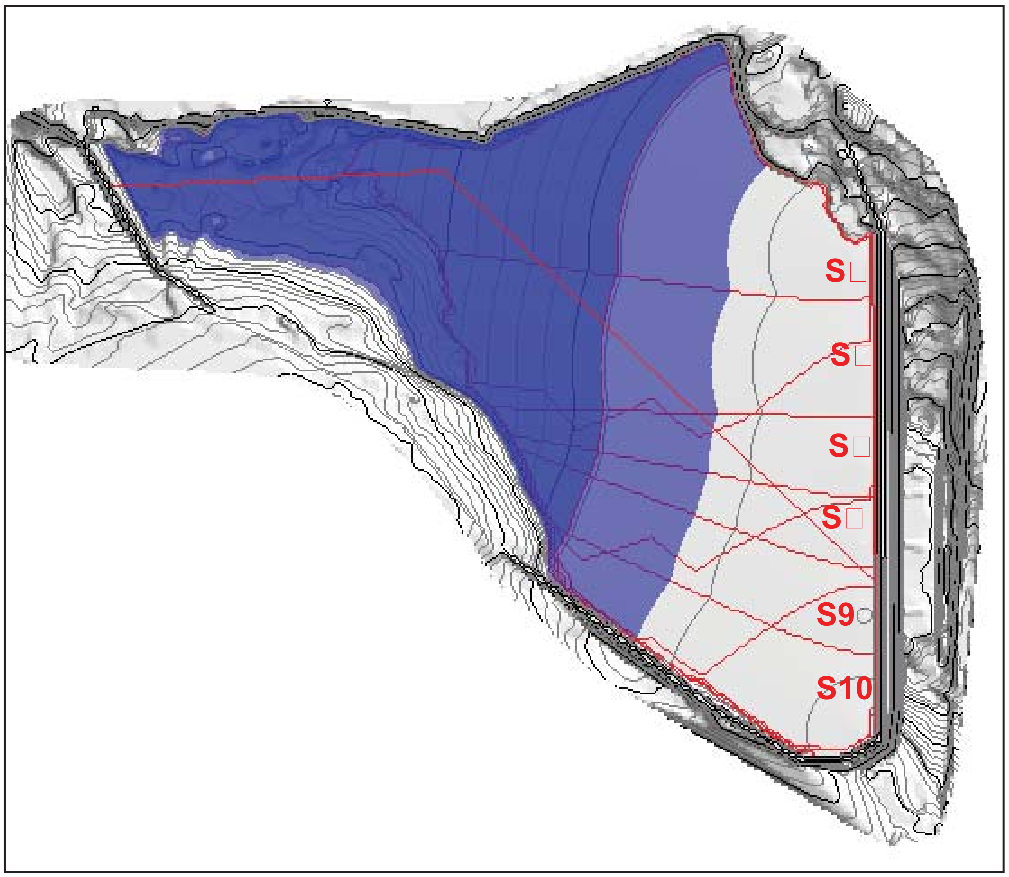
MODEL INPUT	
Pond Volume (m)	□1 □□4□
Ice thickness (m)	□
Tonnes (t)	□□1 □5□

MODEL OUTPUT	
Total water volume (m³)	1 □□44□
Free water volume (m³)	1 □□44□
Ice volume (m³)	□
Pond elevation (m)	14□□□□
Free water elevation (m)	14□□□□
Pond bottom elevation (m)	14□4□□
Ice ratio (%)	□□
Ice entrampment (%)	□□□
Transfer (m³)	5□□5□□ □□ □□□□□1 □□□□□



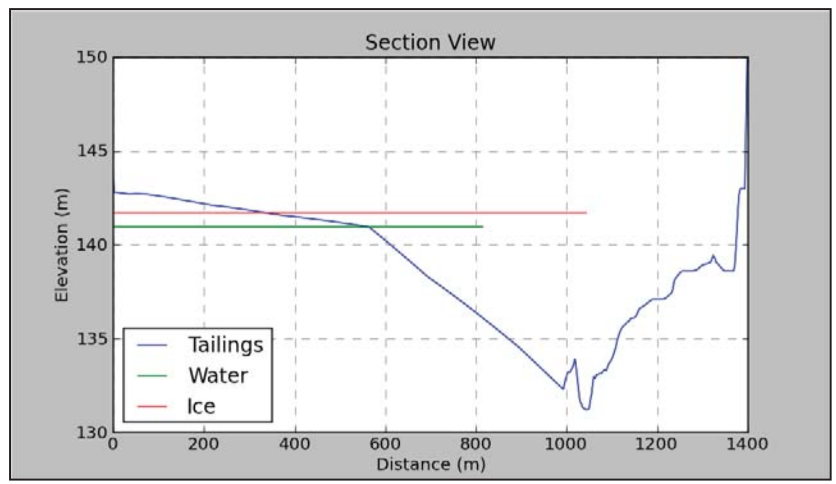
South Cell TSF deposition plan 2019 Q[illegible]

Duration	Deposition Point	Tonnes	Elevation (m)
4[illegible]	[illegible]5	41[illegible]	14[illegible]5[illegible]
1[illegible]	[illegible]	1[illegible]51	14[illegible]
1[illegible]	[illegible]	[illegible]	14[illegible]
[illegible]	[illegible]	[illegible]1[illegible]5	14[illegible]
[illegible]	[illegible]	5[illegible]1	14[illegible]5[illegible]
[illegible]	[illegible]1[illegible]	[illegible]1	14[illegible]



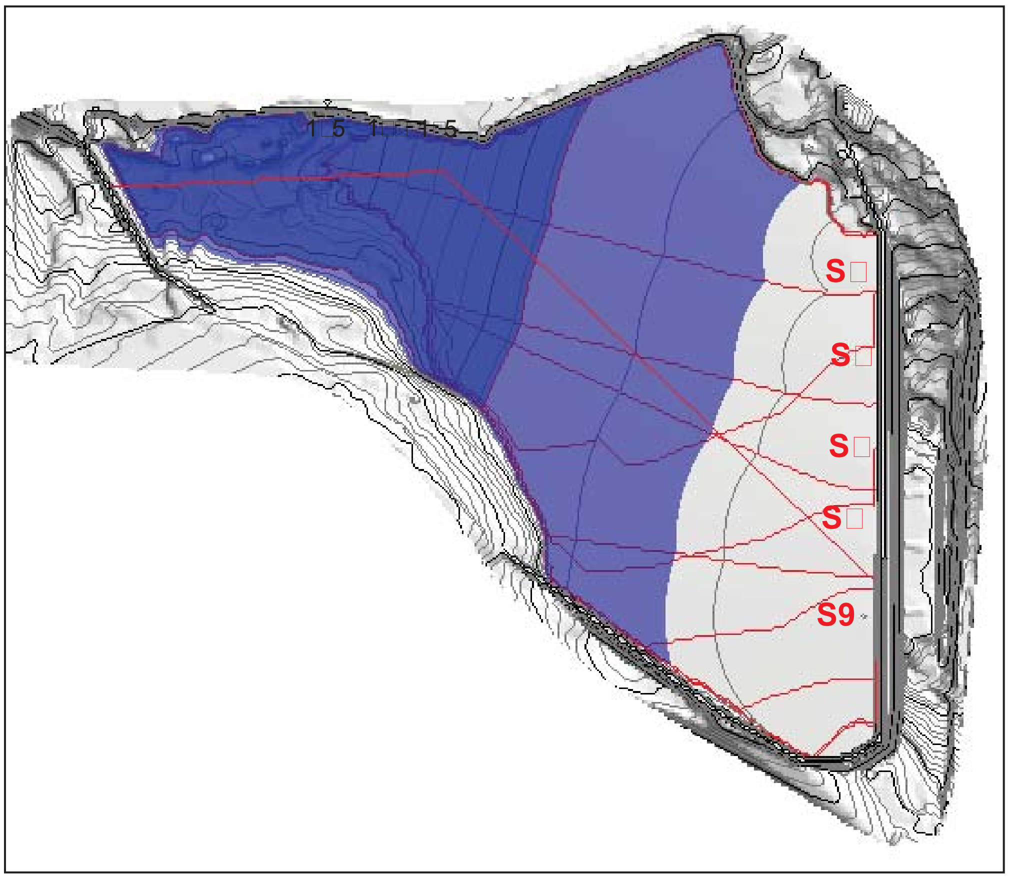
MODEL INPUT	
Pond Volume (m3)	[illegible]15[illegible]
Ice thickness (m)	[illegible]
Tonnes (t)	[illegible]1[illegible]5[illegible]

MODEL OUTPUT	
Total water volume (m³)	[illegible]55[illegible]
Free water volume (m³)	[illegible]15[illegible]1[illegible]
Ice volume (m³)	[illegible]55
Pond elevation (m)	141[illegible]
Free water elevation (m)	14[illegible]4
Pond bottom elevation (m)	1[illegible]1[illegible]
Ice ratio (%)	[illegible]5[illegible]
Ice entrampment (%)	4[illegible]
Transfer (m³)	[illegible]



South Cell TSF deposition plan
2020 Q1

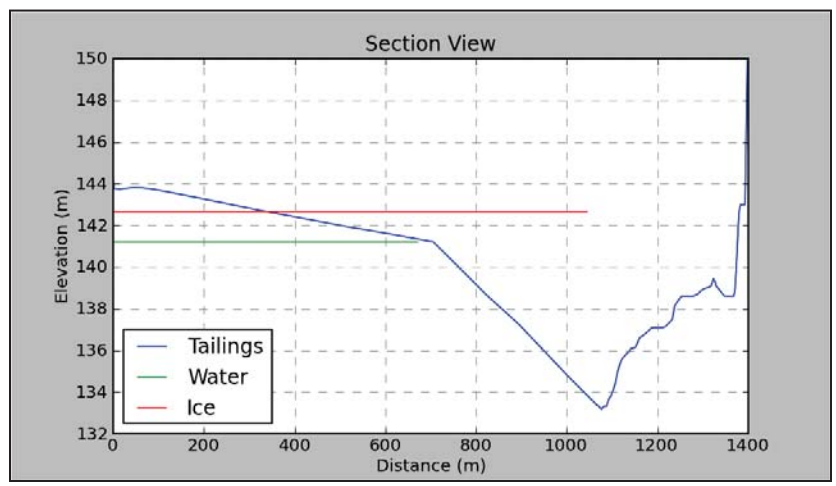
Duration	Deposition Point	Tonnes	Elevation (m)
5□	□5	45□□1□	14□□□□
□□	□□	1□1□1□□	14□□5□□
1□	□□	□□5□4	14□□□□
□	□□	□□451	14□□45
□	□□	□□1□□	144□1□



Operation risk – Effect of slurry channel
Beach length: 624m
Tailings volume above water: 315,002m³

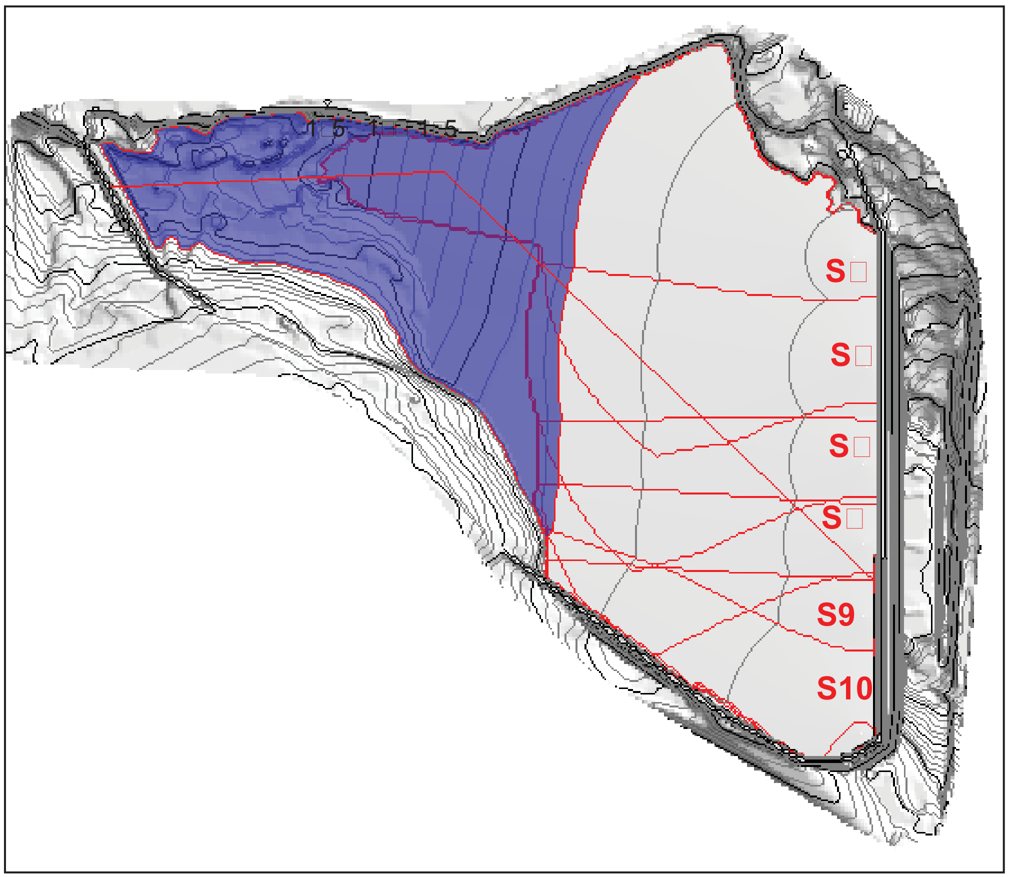
MODEL INPUT	
Pond Volume (m3)	4□□□□□
Ice thickness (m)	1□5
Tonnes (t)	□□1□□5□

MODEL OUTPUT	
Total water volume (m³)	□□□□□□
Free water volume (m³)	4□□□□□
Ice volume (m³)	4□□□□□
Pond elevation (m)	14□□□□
Free water elevation (m)	141□□□5
Pond bottom elevation (m)	1□□□□□
Ice ratio (%)	4□□
Ice entrampment (%)	5□□
Transfer (m³)	□



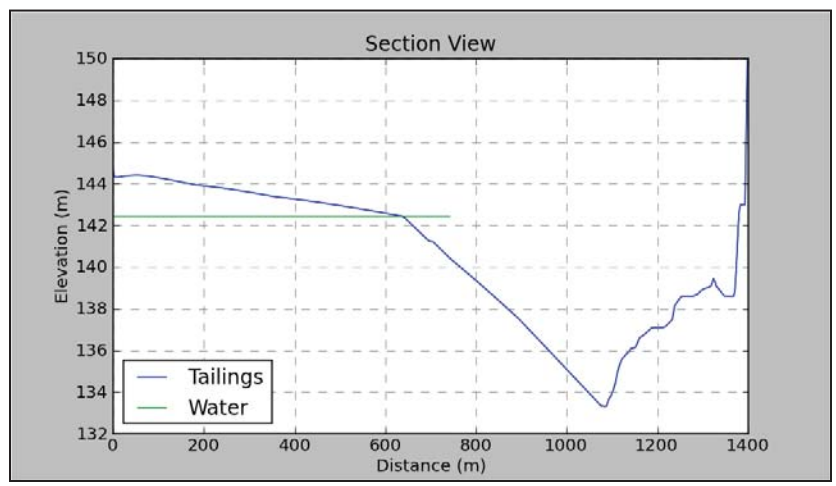
South Cell TSF deposition plan
2020 □pril□□ a□

Duration	Deposition Point	Tonnes	Elevation (m)
□□	□5	□□1□5□□	144□□□□
1□	□□	1□□□□□1	144□5□□
□	□□	54□□15	144□5□5
5	□□	45□□□□	144□544
4	□□	□□□□1□	144□5□□
4	□1□	□□□□1□	144□□□□



MODEL INPUT	
Pond Volume (m3)	□□□□□□□
Ice thickness (m)	□
Tonnes (t)	55□5□□

MODEL OUTPUT	
Total water volume (m³)	□□□□□□□
Free water volume (m³)	□□□□□□□
Ice volume (m³)	□
Pond elevation (m)	14□4□□
Free water elevation (m)	14□4□□
Pond bottom elevation (m)	1□□15□
Ice ratio (%)	□□
Ice entrampment (%)	45□
Transfer (m³)	□

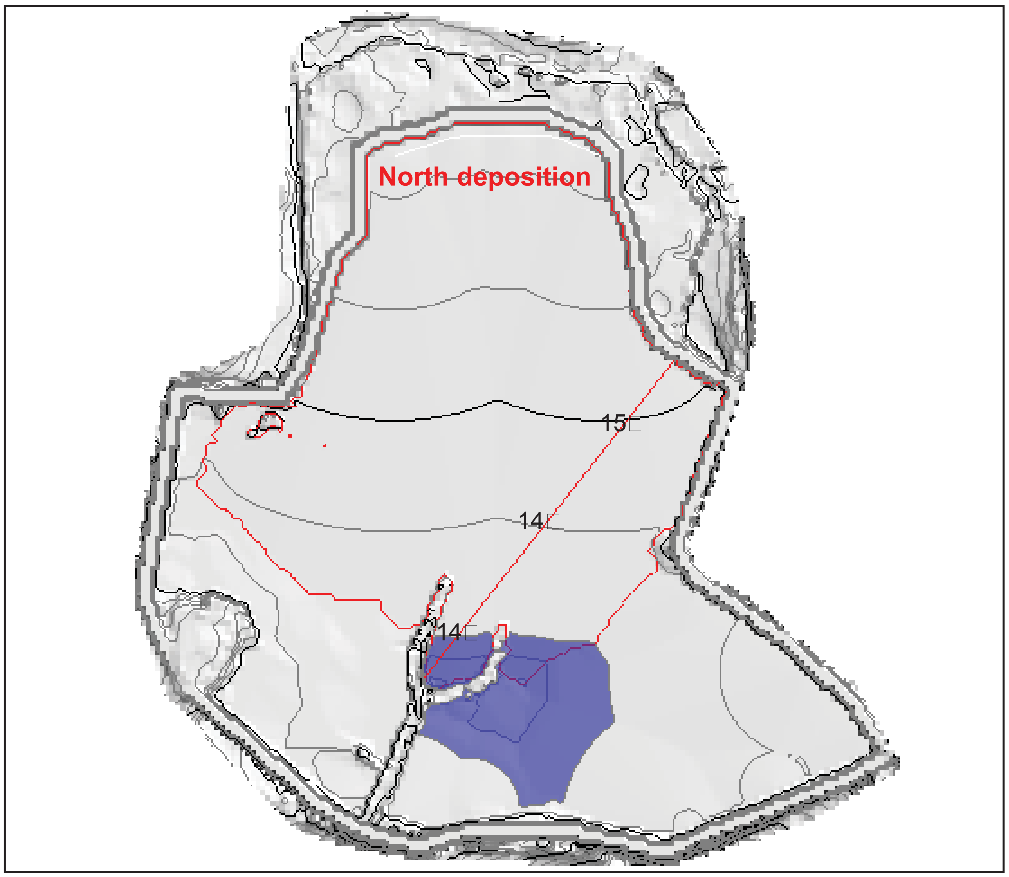


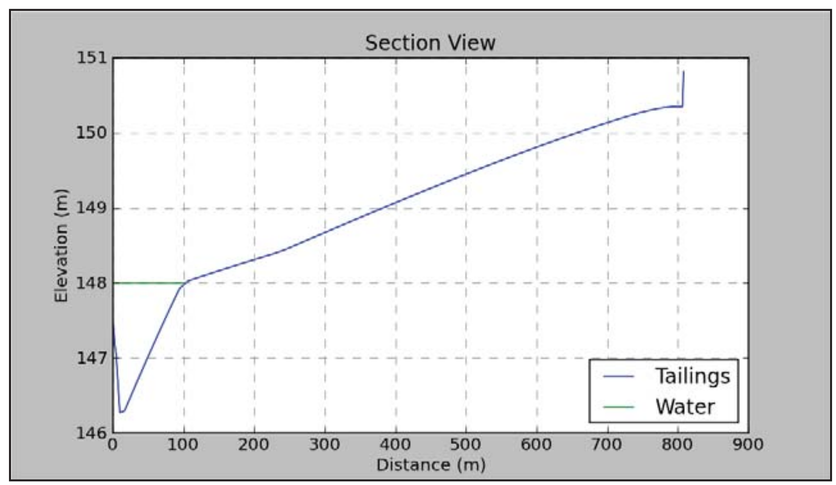
South Cell TSF deposition plan
2020 □une □ Q3

Duration	Deposition Point	Tonnes	Elevation (m)
1□□	□ □□□	1□□□□□□□	15□□1□5

MODEL INPUT	
Pond Volume (m)	□45□1□□
Ice thickness (m)	□
Tonnes (t)	1□□□1□□□□

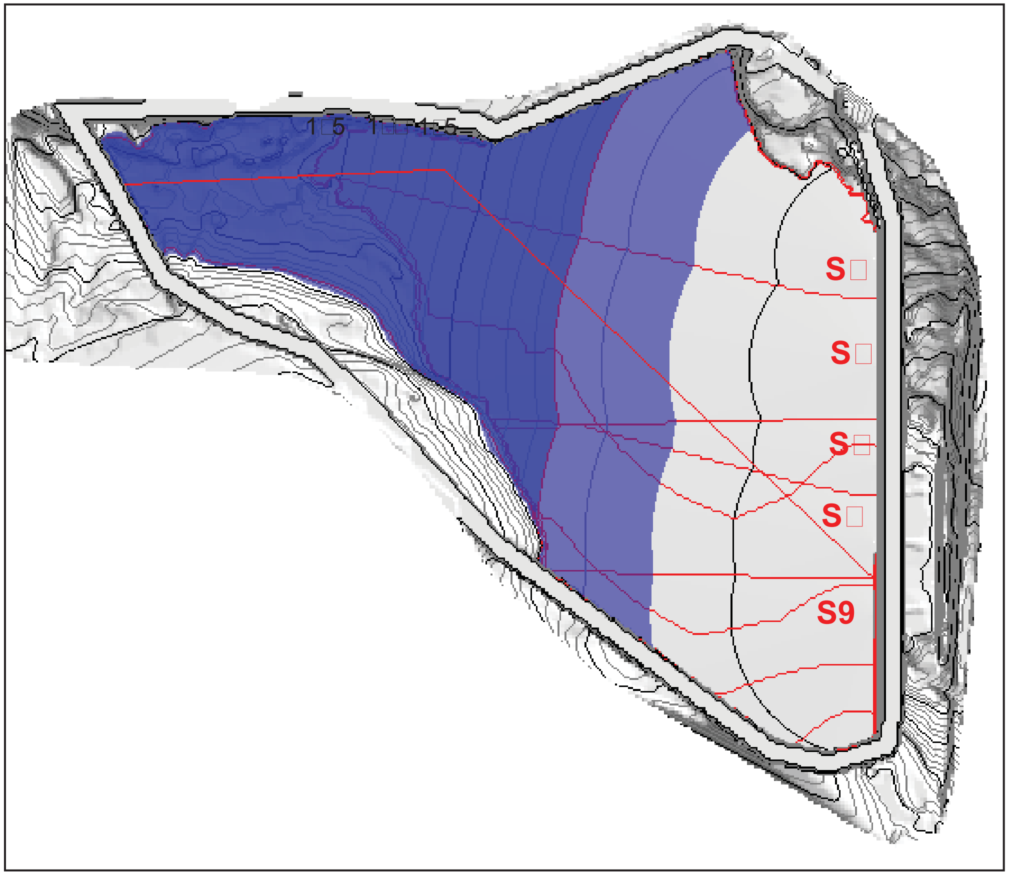
MODEL OUTPUT	
Total water volume (m³)	54□□□□
Free water volume (m³)	54□□□□
Ice volume (m³)	□
Pond elevation (m)	14□□□□□
Free water elevation (m)	14□□□□□
Pond bottom elevation (m)	145□□□5
Ice ratio (%)	□□
Ice entrampment (%)	□□□
Transfer (m³)	□□□□□1 □□ □□□□□1 □□□5 □5□





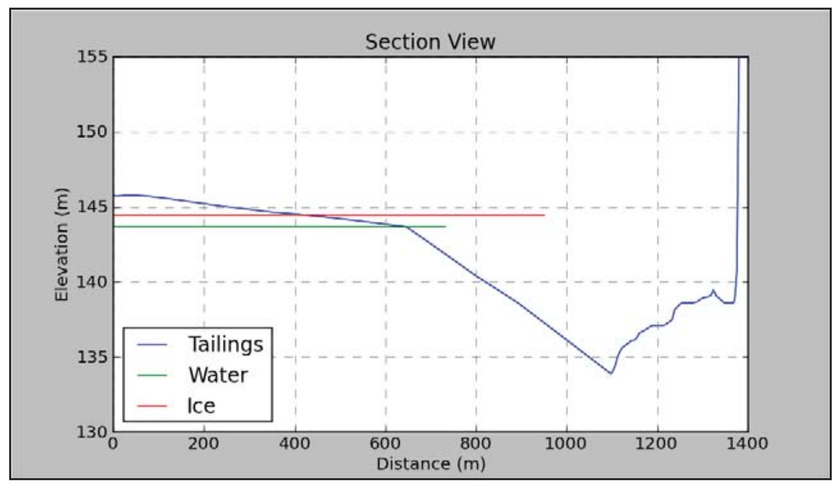
South Cell TSF deposition plan
2020 Q□

Duration	Deposition Point	Tonnes	Elevation (m)
45	□5	4□□□□□□	145□□□
□□	□□	□□□□□□□	145□□□□
1□	□□	□□□□4□	145□□45
□	□□	□1□4□□	145□□5□
□	□□	□□□□□5	145□□□□



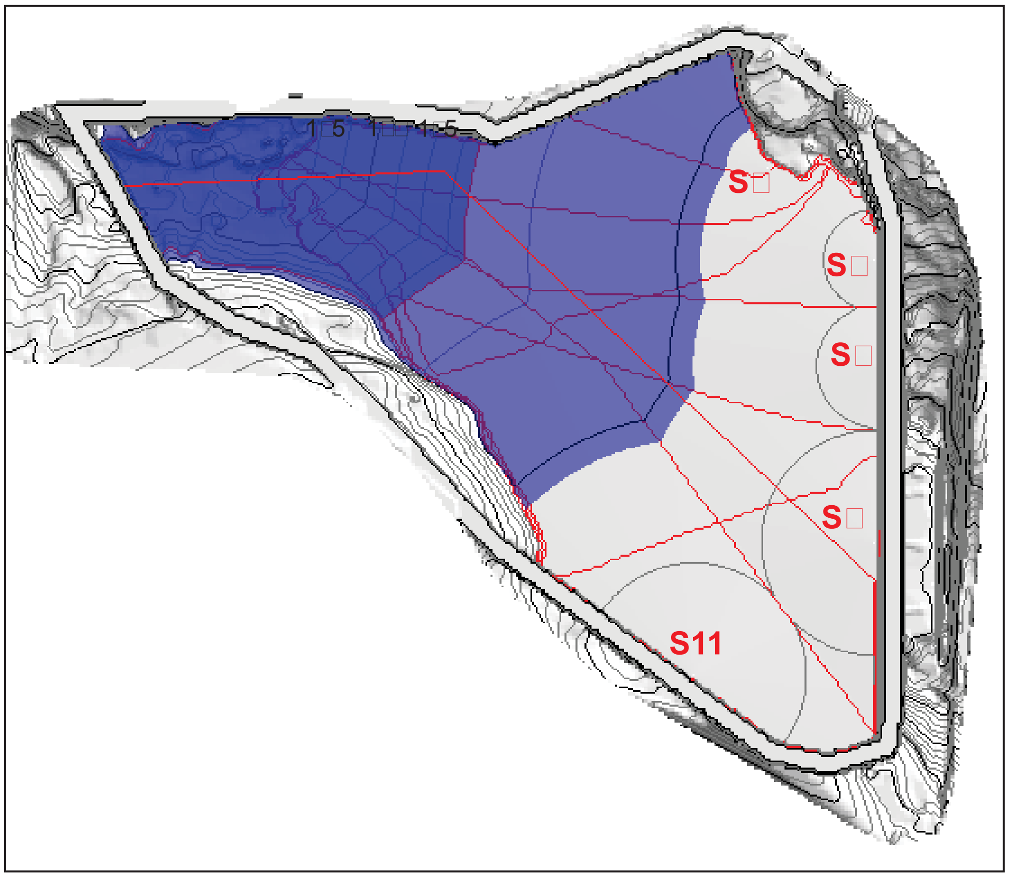
MODEL INPUT	
Pond Volume (m3)	□□1□□4□
Ice thickness (m)	□□
Tonnes (t)	□□1□□5□

MODEL OUTPUT	
Total water volume (m³)	□□1□□4□
Free water volume (m³)	□5□□□1□
Ice volume (m³)	□□□□□□□
Pond elevation (m)	144□454
Free water elevation (m)	14□□□□1
Pond bottom elevation (m)	1□□□□□5
Ice ratio (%)	□□□
Ice entrampment (%)	4□□
Transfer (m³)	□



South Cell TSF deposition plan
2021 Q1

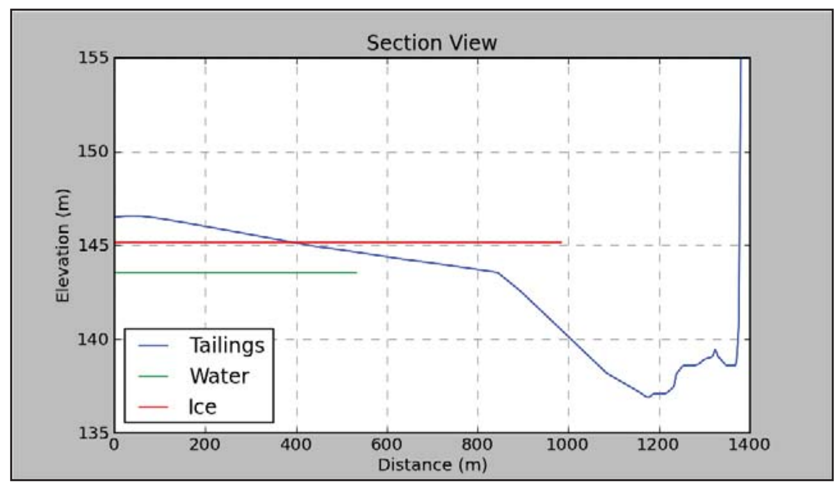
Duration	Deposition Point	Tonnes	Elevation (m)
[illegible]	[illegible]4	[illegible]4[illegible]5[illegible]4	145[illegible]44[illegible]
[illegible]	[illegible]	[illegible]5[illegible]1[illegible]	14[illegible]411
15	[illegible]	1[illegible]	14[illegible]
15	[illegible]11	1[illegible]	14[illegible]
5	[illegible]5	44[illegible]4	14[illegible]41



Operation risk – Effect of slurry channel
Beach length: 500m
Tailings volume above water: **384,741m³**
<u>Tailings volume may fill up the reclaim pond.</u>

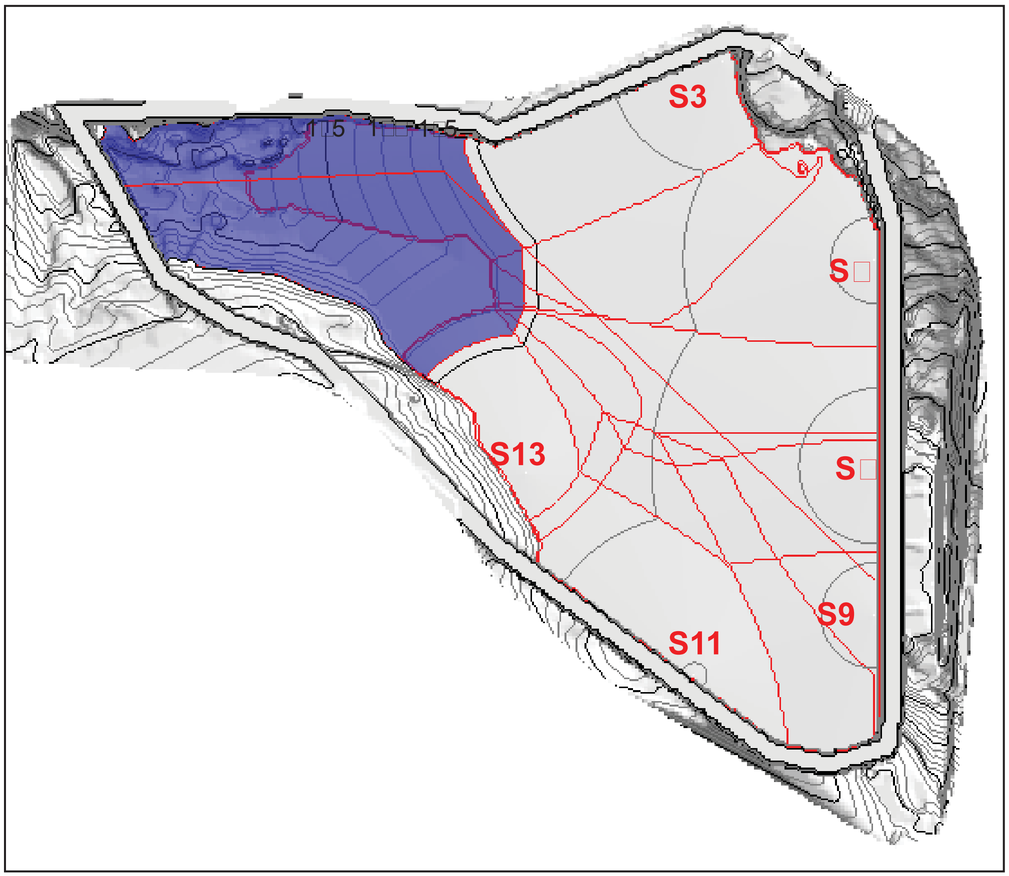
MODEL INPUT	
Pond Volume (m3)	[illegible]
Ice thickness (m)	1[illegible]5
Tonnes (t)	[illegible]1[illegible]

MODEL OUTPUT	
Total water volume (m³)	[illegible]
Free water volume (m³)	3[illegible]3
Ice volume (m³)	[illegible]4[illegible]
Pond elevation (m)	145[illegible]1[illegible]5
Free water elevation (m)	14[illegible]55[illegible]
Pond bottom elevation (m)	1[illegible]5[illegible]
Ice ratio (%)	4[illegible]
Ice entrampment (%)	[illegible]
Transfer (m³)	[illegible]



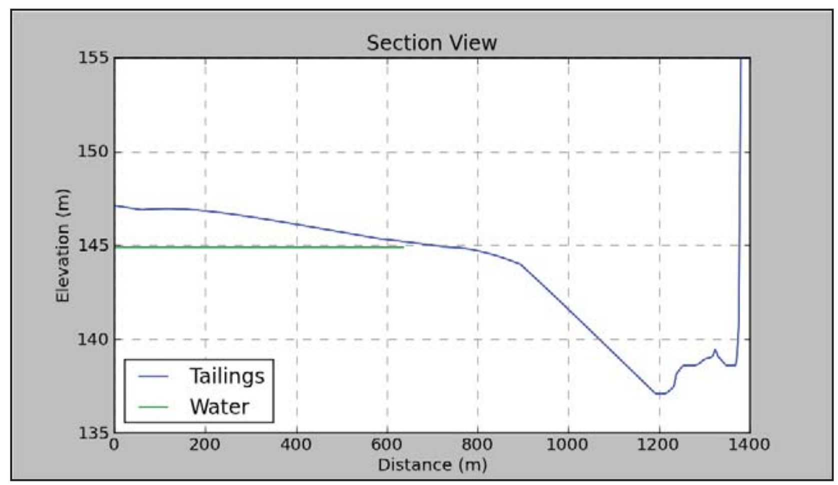
South Cell TSF deposition plan
2021 □pril□□ a□

Duration	Deposition Point	Tonnes	Elevation (m)
□□	□□	□□□□□1	14□□5□
5	□1□	45□□□	145□5□
15	□5	1□5□□1	14□□□1
5	□11	45□□□	14□□□□
5	□□	45□□□	14□□55
□	□□	□□□□□	14□5□□



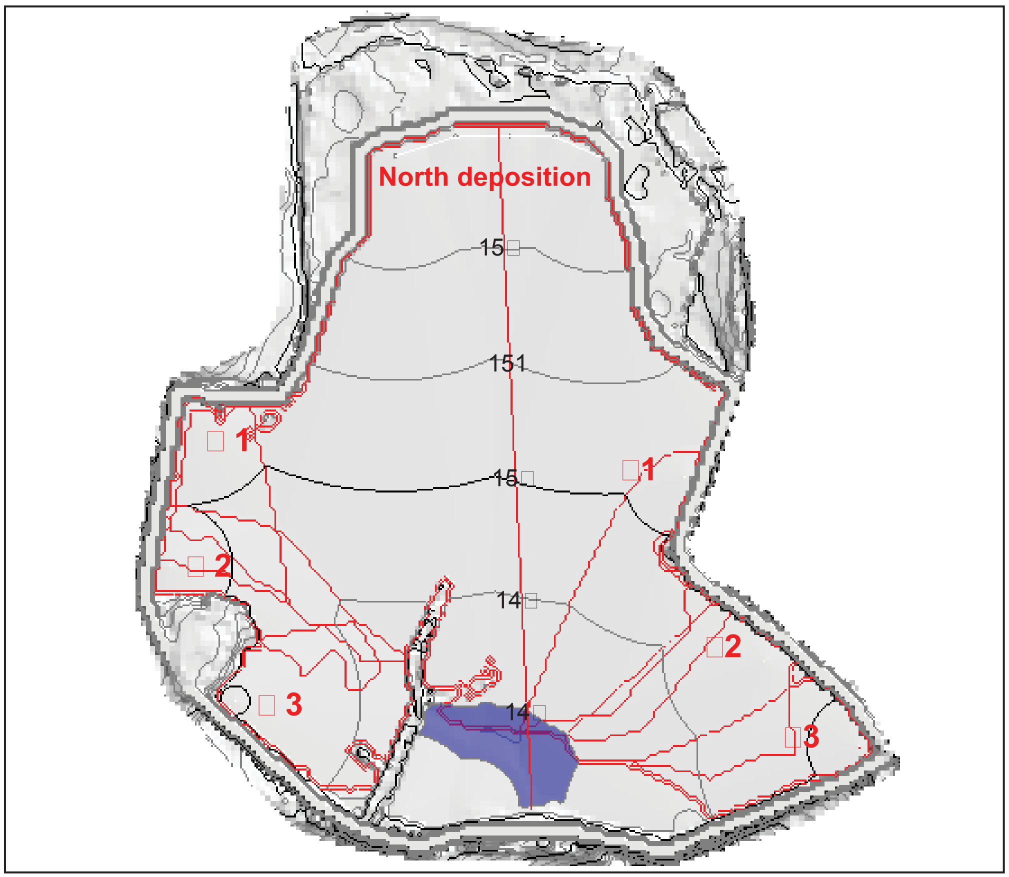
MODEL INPUT	
Pond Volume (m3)	5□4□4□4
Ice thickness (m)	□
Tonnes (t)	54□□□□

MODEL OUTPUT	
Total water volume (m³)	5□□□1□
Free water volume (m³)	5□□□1□
Ice volume (m³)	□
Pond elevation (m)	144□□□
Free water elevation (m)	144□□□
Pond bottom elevation (m)	1□□1□□
Ice ratio (%)	□□
Ice entrampment (%)	□5□
Transfer (m³)	□



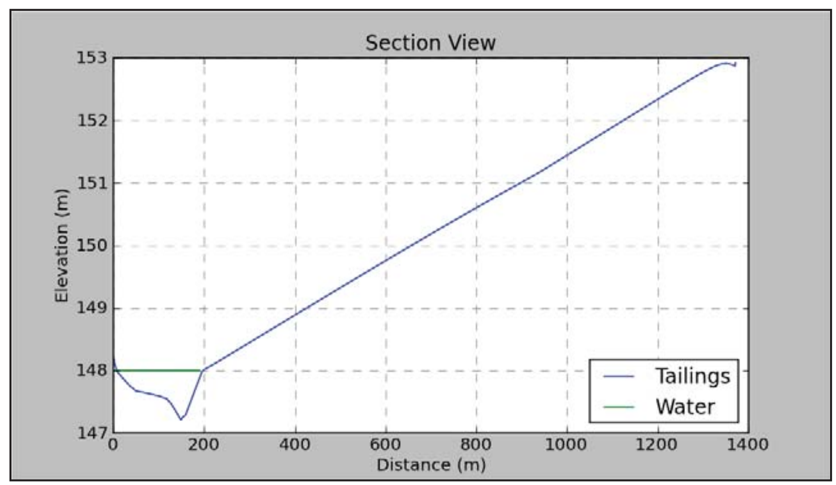
South Cell TSF deposition plan
2021 □une □ Q3

Duration	Deposition Point	Tonnes	Elevation (m)
□□	□ □□□	□□□□□□□	15□□□
5	□ 1	45□□□	15□□□4
5	□ □	45□□□	15□5□□
5	□ □	45□□□	15□1□□
5	□1	45□□□	15□55□
5	□□	45□□□	15□44□
5	□□	45□□□	14□□15



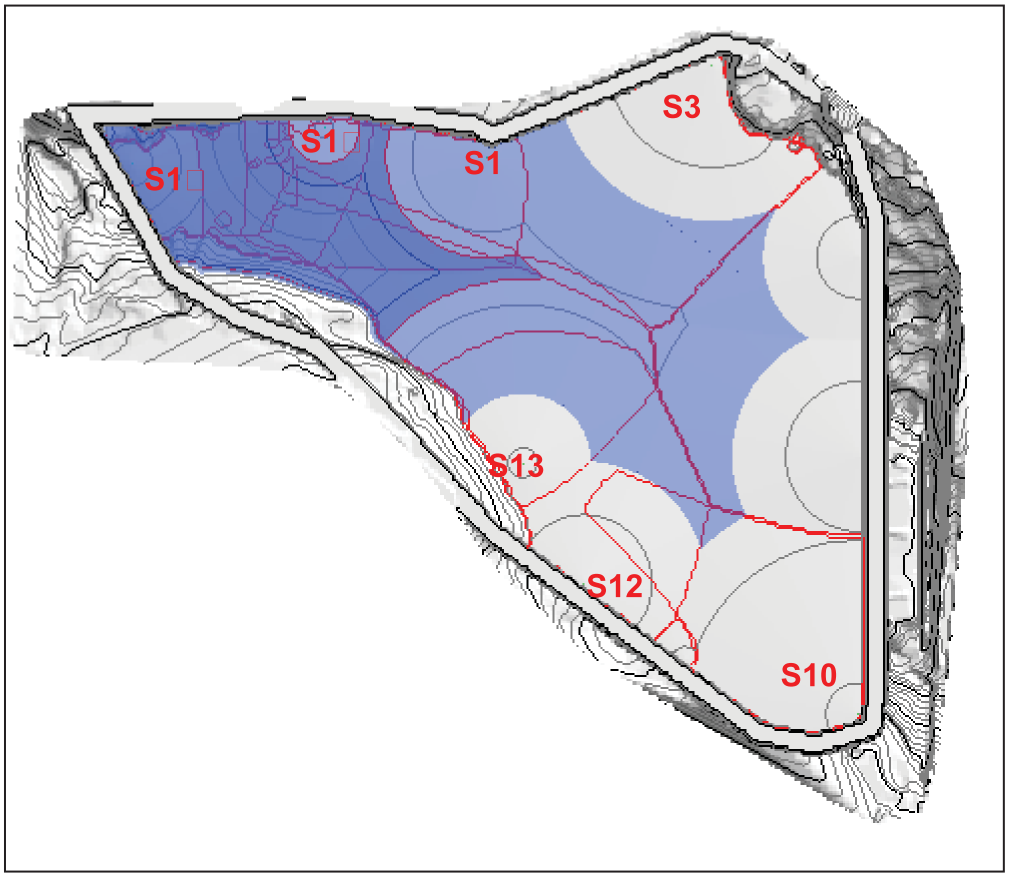
MODEL INPUT	
Pond Volume (m)	□□1 55□
Ice thickness (m)	□
Tonnes (t)	1□□□□□□

MODEL OUTPUT	
Total water volume (m³)	1□□□5
Free water volume (m³)	1□□□5
Ice volume (m³)	□
Pond elevation (m)	14□□□□
Free water elevation (m)	14□□□□
Pond bottom elevation (m)	14□□□□
Ice ratio (%)	□□
Ice entrampment (%)	□□□
Transfer (m³)	□1□□□□



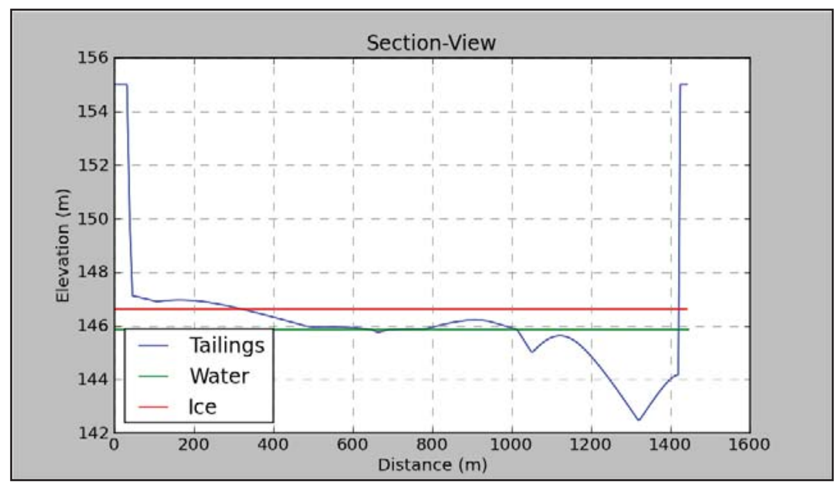
South Cell TSF deposition plan
2021 Q□

Duration	Deposition Point	Tonnes	Elevation (m)
5	□1□	45□□41	14□□□1□
1□	□1□	11□□1□□	14□□□□5
11	□1□	□□□□□□	14□□□□□
1□	□1□	1□□□□□□	14□□□□□
1□	□□	1□□□14□	14□□1□□
1□	□1	1□□□14□	14□□□□□
15	□1□	1□5□1□□	14□□5□□



MODEL INPUT	
Pond Volume (m3)	□□5□□15
Ice thickness (m)	□□□□
Tonnes (t)	□□□□□□□

MODEL OUTPUT	
Total water volume (m³)	□□5□□15
Free water volume (m³)	□□□□4□□
Ice volume (m³)	14□□□□□
Pond elevation (m)	14□□5□□
Free water elevation (m)	145□□□□
Pond bottom elevation (m)	1□□□□□1
Ice ratio (%)	□□□
Ice entrampment (%)	□□□
Transfer (m³)	□

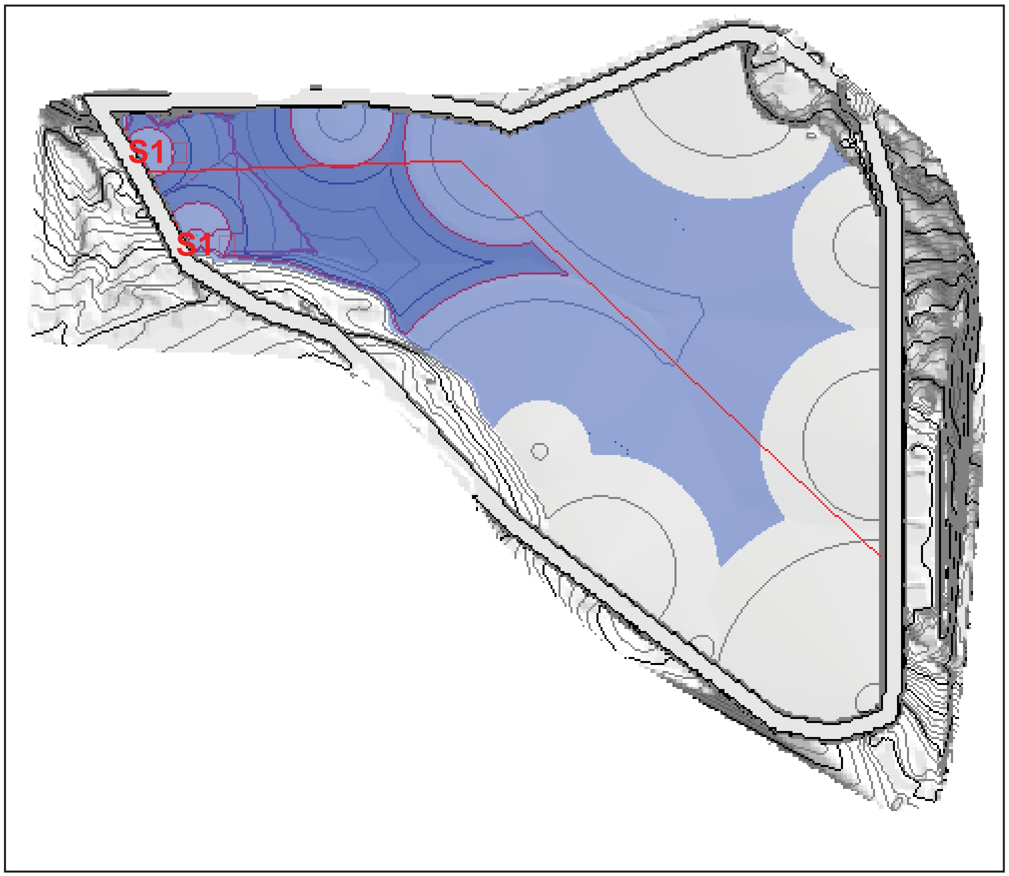


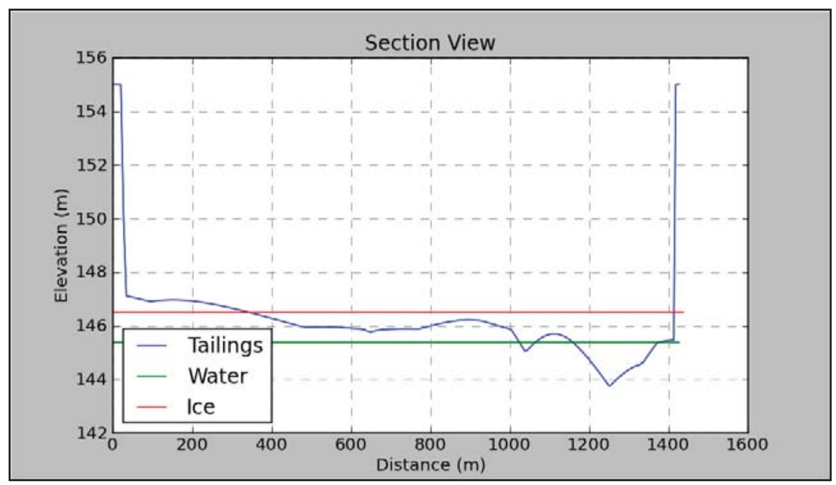
South Cell TSF deposition plan
2022 □anuar□

Duration	Deposition Point	Tonnes	Elevation (m)
15	□1□	□□□1□	145□1
1□	□1□	□4□□□	14□□□

MODEL INPUT	
Pond Volume (m3)	□□□1□□
Ice thickness (m)	1□1□
Tonnes (t)	□□□44

MODEL OUTPUT	
Total water volume (m³)	□□□1□□
Free water volume (m³)	1□□□□□
Ice volume (m³)	□□□□1□
Pond elevation (m)	14□□□□
Free water elevation (m)	145□□□
Pond bottom elevation (m)	14□4□□
Ice ratio (%)	□□□
Ice entrampment (%)	□□□
Transfer (m³)	□





□esults

Tonnage profile

Table below summarizes the tonnage store in each cells in time.

Time	North Cell (t)	South Cell (t)	Total (t)
2019	821,250	821,250	1,642,500
2020	1,091,992	2,193,008	3,285,000
2021	1,098,000	2,187,000	3,285,000
2022	0	66,644	66,644
Total	**3,011,242**	**5,267,902**	**8,279,144**

Remaining capacity

Assuming a tailings dry density of 1.28 t/m^3, the South Cell still have a capacity of 1,9Mt. AEM consider that the North Cell is full as the final surface is ideal to minimize capping requirement for closure of the tailings pond.

Dikes elevation	Remaining capacity
North Cell (154m)	0 t
South Cell (150m)	1,900,376 t

No contingency is applied on the remaining capacity presented is this table.

□nal□sis

Operational risk

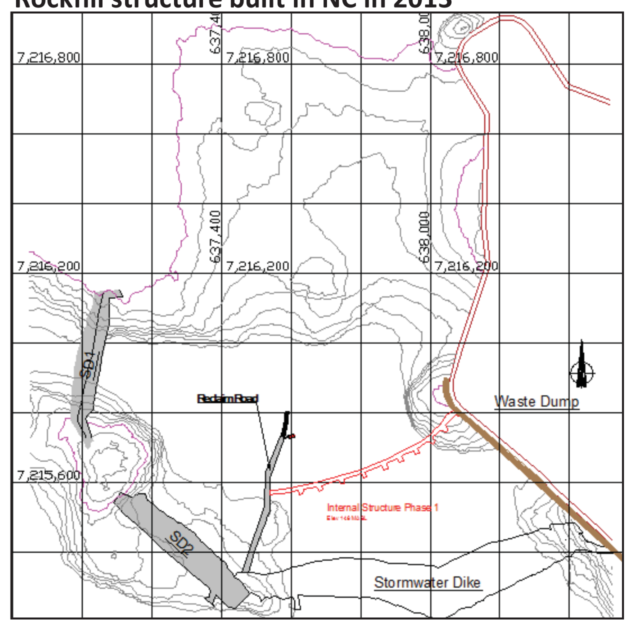
Deposition in the South Cell will only be performed during winter time as the operation of the North Cell Internal Structure concept requires summer deposition. Base on field observation, slurry discharge over frozen tailings beach habitually channel through the tailings pond instead of beaching in front of the dike. Tons discharged above reclaim water elevation may lead to the bottom of the pond and compromise reclaim water availability in the mill as observed during the winter 2013 in Meadowbank. This event caused a reduction of the storage capacity and compromise mill operation. The 2021-Q1 will be the most critical month.

Mitigation

AEM developed an in-house expertise in tailings deposition modeling to forecast these kind of events. To solve this problem in 2013, AEM built rockfill structures inside the tailings pond to prevent the slurry to reach the reclaim water pumping system and higher freshwater consumption was required to operate the mill.

Slurry channel observed in NC in Nov 2014

Rockfill structure built in NC in 2013



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WORLD GOLD COUNCIL

APPENDIX D • MEADOWBANK MINE WATER BALANCE

the mill (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	76,665	184,536	219,698	198,074	24,987	0	0
	0	0	0	0	0	0	-1,855	-2,475	-8,268	-25,000	0	0
e (m^3)	196,038	196,038	196,038	196,038	196,038	196,038	194,183	191,708	183,440	158,440	158,440	158,440
rtage Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	40,982	-10,260	8,951	5,933	-22	0	0
th Cell (m^3)	0	0	0	0	0	76,665	184,536	219,698	198,074	24,987	0	0
gs slurry (m^3)	0	0	0	0	0	0	0	0	0	149,469	120,178	124,475
	0	0	0	0	0	117,646	174,276	228,648	204,007	174,434	120,178	124,475
the mill (m^3)	0	0	0	0	0	0	212,121	212,121	205,278	212,121	205,278	167,481
e Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	212,121	212,121	205,278	212,121	205,278	167,481
	0	0	0	0	0	117,646	-37,845	16,527	-1,271	-37,687	-85,100	-43,006
e (m^3)	1,034,718	1,034,718	1,034,718	1,034,718	1,034,718	1,152,364	1,114,519	1,131,046	1,129,775	1,092,089	1,006,989	963,982
	0	0	0	0	0	0	3,597	2,712	2,383	2,740	1,928	2,574
3)	0	0	0	0	0	0	212,121	212,121	205,278	212,121	205,278	167,481
Third Portage Lake (m^3)	2,945	2,660	2,945	2,850	2,945	2,850	37,200	37,200	36,000	37,200	36,000	81,840
	2,945	2,660	2,945	2,850	2,945	2,850	252,918	252,033	243,662	252,060	243,206	251,894
mp purposes (m^3)	2,945	2,660	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
	0	0	0	0	0	0	249,973	249,088	240,812	249,115	240,356	248,949
	2,945	2,660	2,945	2,850	2,945	2,850	252,918	252,033	243,662	252,060	243,206	251,894
	0	0	0	0	0	0	0	0	0	0	0	0
ng rate (m^3/hr)	0	0	0	0	0	0	285	285	285	285	285	225
rate (m^3/hr)	4	4	4	4	4	4	50	50	50	50	50	110
	0	0	0	0	0	0	249,973	249,088	240,812	249,115	240,356	248,949
on (1=100% SC, 0=100% NC)	1.000	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000	1.000	1.000	1.000
/ice entrampment (%)	90%	90%	90%	90%	60%	30%	30%	30%	30%	75%	80%	90%
ice entrampment (%)	50%	50%	50%	50%	40%	30%	30%	30%	30%	40%	50%	50%
ned to the NC pond (m^3)	0	0	0	0	0	0	174,981	174,361	168,568	0	0	0
ned to the SC pond (m^3)	0	0	0	0	0	0	0	0	0	149,469	120,178	124,475

	Year 2019												A
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	31	28	31	30	31	30	31	31	30	31	30	31	
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131	
th Cell (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	
rd Portage Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131	
uation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131	
e (m^3)	4,561,026	4,580,339	4,599,470	4,618,601	4,637,914	4,698,630	4,728,872	4,778,169	4,811,434	4,830,565	4,849,878	4,869,009	
	0	0	0	0	0	78,539	20,985	56,628	26,694	0	0	0	
th Cell (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	
m Tear Drop Lake (m^3)	0	0	0	0	23,085	0	0	0	11,590	0	0	0	
rd Portage Lake (m^3)	0	0	0	0	0	1,130,000	1,130,000	1,130,000	1,130,000	0	0	0	
e (m^3)	30,000	30,000	30,000	30,000	30,000	0	0	0	0	30,000	30,000	30,000	
	30,000	30,000	30,000	30,000	53,085	1,208,539	1,150,985	1,186,628	1,168,284	30,000	30,000	30,000	
uation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	
	30,000	30,000	30,000	30,000	53,085	1,208,539	1,150,985	1,186,628	1,168,284	30,000	30,000	30,000	
e (m^3)	221,074	251,074	281,074	311,074	364,159	1,572,698	2,723,683	3,910,311	5,078,595	5,108,595	5,138,595	5,168,595	
nd													
	0	0	0	0	0	118,708	6,053	60,667	30,672	0	0	0	
ult Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	
aser Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	118,708	6,053	60,667	30,672	0	0	0	
ally Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	118,708	6,053	60,667	30,672	0	0	0	
e (m^3)	691,172	691,172	691,172	691,172	691,172	809,880	815,933	876,600	907,272	907,272	907,272	907,272	
	0	0	0	0	0	66,526	17,775	47,967	22,611	0	0	0	
lly Lake (m^3)	0	0	0	0	0	603,783	1,006,306	1,360,338	1,212,177	0	0	0	
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0	
Attenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0	
e (m^3)	0	0	0	0	0	670,309	1,694,391	3,102,695	4,337,484	4,337,484	4,337,484	4,337,484	

o the mill (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	274,240	205,275	240,437	218,813	9,987	0	0	9
	0	0	0	0	0	-28,799	-22,594	-23,214	-29,007	-10,000	0	0	-
me (m3)	158,440	158,440	158,440	158,440	158,440	129,641	107,048	83,834	54,827	44,827	44,827	44,827	
ortage Pit (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	40,982	-10,260	8,951	5,933	-22	0	0	
orth Cell (m3)	0	0	0	0	0	274,240	205,275	240,437	218,813	9,987	0	0	9
ngs slurry (m3)	124,559	117,242	124,643	120,690	149,638	0	0	0	0	149,469	120,178	124,475	1,
	124,559	117,242	124,643	120,690	149,638	315,221	195,015	249,387	224,746	159,434	120,178	124,475	2,
o the mill (m3)	167,481	156,675	167,481	162,078	212,121	205,278	212,121	212,121	205,278	100,521	97,278	100,521	1,
age Pit (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
	167,481	156,675	167,481	162,078	212,121	205,278	212,121	212,121	205,278	100,521	97,278	100,521	1,
	-42,922	-39,433	-42,838	-41,389	-62,482	109,943	-17,106	37,266	19,468	58,913	22,900	23,954	
me (m3)	921,060	881,627	838,789	797,401	734,918	844,861	827,756	865,022	884,490	943,403	966,303	990,257	
	2,742	4,004	2,910	2,951	3,021	2,680	3,597	2,712	2,383	2,740	1,928	2,574	
m3)	167,481	156,675	167,481	162,078	212,121	205,278	212,121	212,121	205,278	100,521	97,278	100,521	1,
n Third Portage Lake (m3)	81,840	76,560	81,840	79,200	37,200	36,000	37,200	37,200	36,000	148,800	144,000	148,800	9
	252,062	237,240	252,230	244,229	252,342	243,958	252,918	252,033	243,662	252,060	243,206	251,894	2,
camp purposes (m3)	2,945	2,755	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945	
)	249,117	234,485	249,285	241,379	249,397	241,108	249,973	249,088	240,812	249,115	240,356	248,949	2,
	252,062	237,240	252,230	244,229	252,342	243,958	252,918	252,033	243,662	252,060	243,206	251,894	2,
	0	0	0	0	0	0	0	0	0	0	0	0	
ping rate (m3/hr)	225	225	225	225	285	285	285	285	285	135	135	135	
g rate (m3/hr)	110	110	110	110	50	50	50	50	50	200	200	200	
)	249,117	234,485	249,285	241,379	249,397	241,108	249,973	249,088	240,812	249,115	240,356	248,949	2,
ation (1=100% SC, 0=100% NC)	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	
er/ice entrapment (%)	90%	90%	90%	90%	60%	30%	30%	30%	30%	75%	80%	90%	
r/ice entrapment (%)	50%	50%	50%	50%	40%	30%	30%	30%	30%	40%	50%	50%	
urned to the NC pond (m3)	0	0	0	0	0	168,776	174,981	174,361	168,568	0	0	0	6
urned to the SC pond (m3)	124,559	117,242	124,643	120,690	149,638	0	0	0	0	149,469	120,178	124,475	1,

	Year 2020												ANN
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	31	28	31	30	31	30	31	31	30	31	30	31	
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131	3
outh Cell (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
hird Portage Lake (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131	3
nuation Pond (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131	3
me (m3)	4,888,140	4,907,453	4,926,584	4,945,715	4,965,028	5,025,744	5,055,986	5,105,283	5,138,548	5,157,679	5,176,992	5,196,123	
	0	0	0	0	0	78,539	20,985	56,628	26,694	0	0	0	1
outh Cell (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
rom Tear Drop Lake (m3)	0	0	0	0	23,085	0	0	0	11,590	0	0	0	
hird Portage Lake (m3)	0	0	0	0	0	1,130,000	1,130,000	1,130,000	1,130,000	0	0	0	4,
ge (m3)	30,000	30,000	30,000	30,000	30,000	0	0	0	0	30,000	30,000	30,000	2
	30,000	30,000	30,000	30,000	53,085	1,208,539	1,150,985	1,186,628	1,168,284	30,000	30,000	30,000	4,
nuation Pond (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	
	30,000	30,000	30,000	30,000	53,085	1,208,539	1,150,985	1,186,628	1,168,284	30,000	30,000	30,000	4,
me (m3)	5,198,595	5,228,595	5,258,595	5,288,595	5,341,680	6,550,218	7,701,203	8,887,831	10,056,115	10,086,115	10,116,115	10,146,115	
ond													
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0	3
ault Pit (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
haser Pit (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0	3
Wally Lake (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0	
me (m3)	907,272	907,272	907,272	907,272	907,272	1,091,249	1,114,354	1,221,706	1,274,416	1,274,416	1,274,416	1,274,416	
	0	0	0	0	0	66,526	17,775	47,967	22,611	0	0	0	1
Vally Lake (m3)	0	0	0	0	0	603,783	1,006,306	1,360,338	1,212,177	0	0	0	4,
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0	4,
t Attenuation Pond (m3)	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0	4,
me (m3)	4,337,484	4,337,484	4,337,484	4,337,484	4,337,484	5,007,793	6,031,874	7,440,179	8,674,967	8,674,967	8,674,967	8,674,967	
cluding Phaser Lake)													
	0	0	0	0	0	73,652	19,679	53,105	25,033	0	0	0	1
	0	0	0	0	0	73,652	19,679	53,105	25,033	0	0	0	

o the mill (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	256,371	187,406	222,568	200,944	12,721	0	0
	0	0	0	0	0	-10,935	-4,704	-5,329	-11,124	-12,734	0	0
me (m^3)	44,827	44,827	44,827	44,827	44,827	33,892	29,188	23,859	12,734	0	0	0
ortage Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	40,982	-10,260	8,951	5,933	-22	0	0
orth Cell (m^3)	0	0	0	0	0	256,371	187,406	222,568	200,944	12,721	0	0
ings slurry (m^3)	24,911	22,639	24,928	24,137	99,756	0	0	0	0	62,284	48,074	24,897
	24,911	22,639	24,928	24,137	99,756	297,352	177,146	231,518	206,877	74,983	48,074	24,897
o the mill (m^3)	119,121	107,593	119,121	115,278	212,121	205,278	212,121	212,121	205,278	212,121	79,278	63,321
age Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	119,121	107,593	119,121	115,278	212,121	205,278	212,121	212,121	205,278	212,121	79,278	63,321
	-94,210	-84,954	-94,193	-91,141	-112,365	92,074	-34,975	19,397	1,599	-137,137	-31,204	-38,424
me (m^3)	896,047	811,093	716,900	625,759	513,394	605,468	570,494	589,891	591,490	454,352	423,149	384,725
	2,734	3,856	2,902	2,943	3,013	2,673	3,627	2,734	2,403	2,762	1,944	2,595
m3)	119,121	107,593	119,121	115,278	212,121	205,278	212,121	212,121	205,278	212,121	79,278	63,321
n Third Portage Lake (m^3)	130,200	117,600	130,200	126,000	37,200	36,000	37,200	37,200	36,000	37,200	162,000	186,000
	252,055	229,048	252,222	244,221	252,334	243,951	252,948	252,055	243,681	252,083	243,222	251,915
camp purposes (m^3)	2,945	2,660	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
3)	249,110	226,388	249,277	241,371	249,389	241,101	250,003	249,110	240,831	249,138	240,372	248,970
	252,055	229,048	252,222	244,221	252,334	243,951	252,948	252,055	243,681	252,083	243,222	251,915
	0	0	0	0	0	0	0	0	0	0	0	0
ping rate (m^3/hr)	160	160	160	160	285	285	285	285	285	285	110	85
g rate (m^3/hr)	175	175	175	175	50	50	50	50	50	50	225	250
3)	249,110	226,388	249,277	241,371	249,389	241,101	250,003	249,110	240,831	249,138	240,372	248,970
ation (1=100% SC, 0=100% NC)	1.000	1.000	1.000	1.000	1.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000
er/ice entrampment (%)	90%	90%	90%	90%	60%	30%	30%	30%	30%	75%	80%	90%
er/ice entrampment (%)	90%	90%	90%	90%	60%	30%	30%	30%	30%	75%	80%	90%
urned to the NC pond (m^3)	0	0	0	0	0	168,771	175,002	174,377	168,582	0	0	0
urned to the SC pond (m^3)	24,911	22,639	24,928	24,137	99,756	0	0	0	0	62,284	48,074	24,897

	Year 2021											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	31	28	31	30	31	30	31	31	30	31	30	31
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
outh Cell (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
hird Portage Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
enuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
me (m^3)	5,215,254	5,234,567	5,253,698	5,272,829	5,292,142	5,352,858	5,383,100	5,432,397	5,465,662	5,484,793	5,504,106	5,523,237
	0	0	0	0	0	78,539	20,985	56,628	26,694	0	0	0
C (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
rom Tear Drop Lake (m^3)	0	0	0	0	23,085	0	0	0	11,590	0	0	0
hird Portage Lake (m^3)	0	0	0	0	0	1,130,000	1,130,000	1,130,000	1,130,000	0	0	0
ge (m^3)	30,000	30,000	30,000	30,000	30,000	0	0	0	0	30,000	30,000	30,000
	30,000	30,000	30,000	30,000	53,085	1,208,539	1,150,985	1,186,628	1,168,284	30,000	30,000	30,000
enuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	30,000	30,000	30,000	30,000	53,085	1,208,539	1,150,985	1,186,628	1,168,284	30,000	30,000	30,000
me (m^3)	10,176,115	10,206,115	10,236,115	10,266,115	10,319,200	11,527,739	12,678,724	13,865,352	15,033,636	15,063,636	15,093,636	15,123,636
Pond												
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
Vault Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
Phaser Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
Wally Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
me (m^3)	1,274,416	1,274,416	1,274,416	1,274,416	1,274,416	1,458,393	1,481,498	1,588,850	1,641,559	1,641,559	1,641,559	1,641,559
	0	0	0	0	0	66,526	17,775	47,967	22,611	0	0	0
Vally Lake (m^3)	0	0	0	0	0	603,783	1,006,306	1,360,338	1,212,177	0	0	0
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0
lt Attenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0
me (m^3)	8,674,967	8,674,967	8,674,967	8,674,967	8,674,967	9,345,276	10,369,358	11,777,662	13,012,451	13,012,451	13,012,451	13,012,451

o the mill (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	76,665	7,700	42,862	21,238	-13	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
me (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
ortage Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	40,982	-10,260	8,951	5,933	0	0	0
orth Cell (m^3)	0	0	0	0	0	76,665	7,700	42,862	21,238	-13	0	0
ings slurry (m^3)	24,703	0	0	0	0	0	0	0	0	0	0	0
	24,703	0	0	0	0	117,646	-2,560	51,812	27,171	-13	0	0
o the mill (m^3)	63,321	0	0	0	0	0	0	0	0	0	0	0
age Pit (m^3)	0	0	0	0	0	267,646	184,637	51,812	36,068	0	0	0
	63,321	0	0	0	0	267,646	184,637	51,812	36,068	0	0	0
	-38,618	0	0	0	0	-150,000	-187,197	0	-8,897	-13	0	0
me (m^3)	346,107	346,107	346,107	346,107	346,107	196,107	8,910	8,910	13	0	0	0
	653	0	0	0	0	0	0	0	0	0	0	0
m3)	63,321	0	0	0	0	0	0	0	0	0	0	0
n Third Portage Lake (m^3)	186,000	2,688	2,976	2,880	2,976	2,880	2,976	2,976	2,880	2,976	2,880	2,976
	249,974	2,688	2,976	2,880	2,976	2,880	2,976	2,976	2,880	2,976	2,880	2,976
camp purposes (m^3)	2,945	2,688	2,976	2,880	2,976	2,880	2,976	2,976	2,880	2,976	2,880	2,976
3)	247,029	0	0	0	0	0	0	0	0	0	0	0
	249,974	2,688	2,976	2,880	2,976	2,880	2,976	2,976	2,880	2,976	2,880	2,976
	0	0	0	0	0	0	0	0	0	0	0	0
ping rate (m^3/hr)	85	0	0	0	0	0	0	0	0	0	0	0
g rate (m^3/hr)	250	4	4	4	4	4	4	4	4	4	4	4
3)	247,029	0	0	0	0	0	0	0	0	0	0	0
ation (1=100% SC, 0=100% NC)	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
er/ice entrampment (%)	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
er/ice entrampment (%)	90%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
urned to the NC pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
urned to the SC pond (m^3)	24,703	0	0	0	0	0	0	0	0	0	0	0

	Year 2022											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	31	28	31	30	31	30	31	31	30	31	30	31
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
outh Cell (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
hird Portage Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
enuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
me (m^3)	5,542,368	5,561,681	5,580,812	5,599,943	5,619,256	5,679,972	5,710,214	5,759,511	5,792,776	5,811,907	5,831,220	5,850,351
	0	0	0	0	0	78,539	20,985	56,628	26,694	0	0	0
C (m^3)	0	0	0	0	0	267,646	184,637	51,812	36,068	0	0	0
rom Tear Drop Lake (m^3)	0	0	0	0	23,085	0	0	0	11,590	0	0	0
hird Portage Lake (m^3)	0	0	0	0	0	1,130,000	1,130,000	1,130,000	1,130,000	0	0	0
ge (m^3)	30,000	30,000	30,000	30,000	30,000	0	0	0	0	30,000	30,000	30,000
	30,000	30,000	30,000	30,000	53,085	1,476,185	1,335,622	1,238,440	1,204,352	30,000	30,000	30,000
enuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	30,000	30,000	30,000	30,000	53,085	1,476,185	1,335,622	1,238,440	1,204,352	30,000	30,000	30,000
me (m^3)	15,153,636	15,183,636	15,213,636	15,243,636	15,296,721	16,772,905	18,108,527	19,346,967	20,551,319	20,581,319	20,611,319	20,641,319
Pond												
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
ault Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
haser Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
ally Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
Wally Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
me (m^3)	1,641,559	1,641,559	1,641,559	1,641,559	1,641,559	1,825,537	1,848,642	1,955,993	2,008,703	2,008,703	2,008,703	2,008,703
	0	0	0	0	0	66,526	17,775	47,967	22,611	0	0	0
ally Lake (m^3)	0	0	0	0	0	603,783	1,006,306	1,360,338	1,212,177	0	0	0
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0
lt Attenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0
me (m^3)	13,012,451	13,012,451	13,012,451	13,012,451	13,012,451	13,682,760	14,706,841	16,115,146	17,349,934	17,349,934	17,349,934	17,349,934
cluding Phaser Lake)												

r to the mill (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
)	0	0	0	0	0	77,826	20,794	56,114	26,452	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
lume (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	42,909	11,465	30,938	14,584	0	0	0
North Cell (m^3)	0	0	0	0	0	77,826	20,794	56,114	26,452	0	0	0
	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
r to the mill (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
rtage Pit (m^3)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
lume (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
)	0	0	0	0	0	0	0	0	0	0	0	0
r (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
om Third Portage Lake (m^3)	2,945	2,660	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
	2,945	2,660	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
r camp purposes (m^3)	2,945	2,660	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
m^3)	0	0	0	0	0	0	0	0	0	0	0	0
)	2,945	2,660	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
	0	0	0	0	0	0	0	0	0	0	0	0
mping rate (m^3/hr)	0	0	0	0	0	0	0	0	0	0	0	0
ing rate (m^3/hr)	4	4	4	4	4	4	4	4	4	4	4	4
e												
m^3)	0	0	0	0	0	0	0	0	0	0	0	0
/ice entrampment (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ntrapment losses (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
eturned to the pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0

	Year 2023											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	31	28	31	30	31	30	31	31	30	31	30	31
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
South Cell (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
Third Portage Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
tenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
)	0	0	0	0	0	0	0	0	0	0	0	0
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
lume (m^3)	5,869,482	5,888,795	5,907,926	5,927,057	5,946,370	6,007,086	6,037,328	6,086,625	6,119,890	6,139,021	6,158,334	6,177,465
	0	0	0	0	0	78,539	20,985	56,628	26,694	0	0	0
SC (m^3)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
r from Tear Drop Lake (m^3)	0	0	0	0	23,085	0	0	0	11,590	0	0	0
Third Portage Lake (m^3)	0	0	0	0	0	1,130,000	1,130,000	1,130,000	1,130,000	0	0	0
page (m^3)	30,000	30,000	30,000	30,000	30,000	0	0	0	0	30,000	30,000	30,000
	30,000	30,000	30,000	30,000	53,085	1,329,274	1,183,244	1,273,681	1,209,320	30,000	30,000	30,000
tenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
)	0	0	0	0	0	0	0	0	0	0	0	0
	30,000	30,000	30,000	30,000	53,085	1,329,274	1,183,244	1,273,681	1,209,320	30,000	30,000	30,000
lume (m^3)	20,671,319	20,701,319	20,731,319	20,761,319	20,814,404	22,143,678	23,326,922	24,600,602	25,809,922	25,839,922	25,869,922	25,899,922
n Pond												
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
Vault Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
Phaser Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
Wally Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
o Wally Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
lume (m^3)	2,008,703	2,008,703	2,008,703	2,008,703	2,008,703	2,192,681	2,215,786	2,323,137	2,375,847	2,375,847	2,375,847	2,375,847
	0	0	0	0	0	66,526	17,775	47,967	22,611	0	0	0
Wally Lake (m^3)	0	0	0	0	0	603,783	1,006,306	1,360,338	1,212,177	0	0	0
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0
ult Attenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0
lume (m^3)	17,349,934	17,349,934	17,349,934	17,349,934	17,349,934	18,020,243	19,044,325	20,452,629	21,687,418	21,687,418	21,687,418	21,687,418
including Phaser Lake)												
	0	0	0	0	0	73,652	19,679	53,105	25,033	0	0	0

n^3)	0	0	0	0	0	77,826	20,794	56,114	26,452	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
olume (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	42,909	11,465	30,938	14,584	0	0	0
n North Cell (m^3)	0	0	0	0	0	77,826	20,794	56,114	26,452	0	0	0
)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
er to the mill (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
ortage Pit (m^3)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
n^3)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
olume (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
n^3)	0	0	0	0	0	0	0	0	0	0	0	0
er (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
rom Third Portage Lake (m^3)	2,945	2,755	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
)	2,945	2,755	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
or camp purposes (m^3)	2,945	2,755	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
(m^3)	0	0	0	0	0	0	0	0	0	0	0	0
n^3)	2,945	2,755	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
	0	0	0	0	0	0	0	0	0	0	0	0
umping rate (m^3/hr)	0	0	0	0	0	0	0	0	0	0	0	0
ping rate (m^3/hr)	4	4	4	4	4	4	4	4	4	4	4	4
ce												
(m^3)	0	0	0	0	0	0	0	0	0	0	0	0
er/ice entrapment (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
entrapment losses (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
returned to the pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0

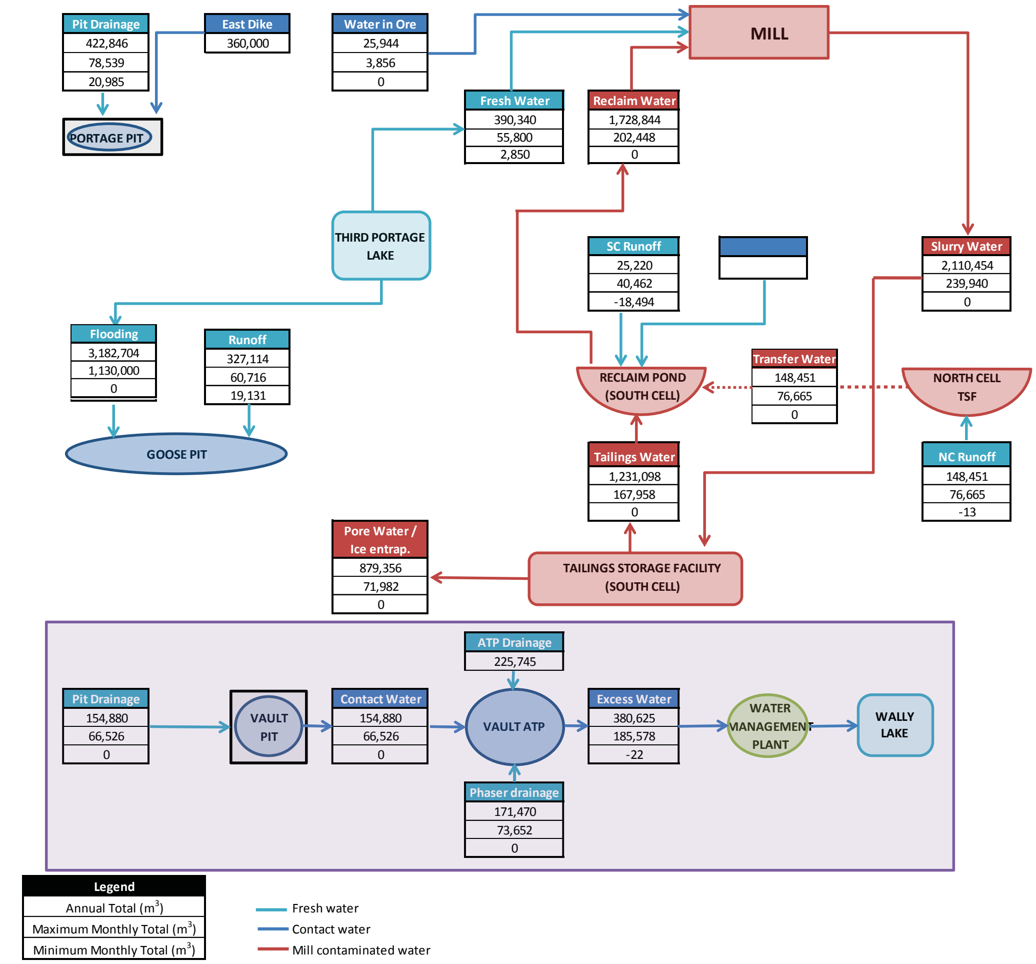
	Year 2024											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
	31	**28**	**31**	**30**	**31**	**30**	**31**	**31**	**30**	**31**	**30**	**31**
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
n South Cell (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
n Third Portage Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
)	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
ttenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
n^3)	0	0	0	0	0	0	0	0	0	0	0	0
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
olume (m^3)	6,196,596	6,215,909	6,235,040	6,254,171	6,273,484	6,334,200	6,364,442	6,413,739	6,447,004	6,466,135	6,485,448	6,504,579
	0	0	0	0	0	78,539	20,985	56,628	26,694	0	0	0
n SC (m^3)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
er from Tear Drop Lake (m^3)	0	0	0	0	23,085	0	0	11,590	0	0	0	0
n Third Portage Lake (m^3)	0	0	0	0	0	1,130,000	1,130,000	1,130,000	1,130,000	0	0	0
epage (m^3)	30,000	30,000	30,000	30,000	30,000	0	0	0	0	30,000	30,000	30,000
)	30,000	30,000	30,000	30,000	53,085	1,329,274	1,183,244	1,285,271	1,197,730	30,000	30,000	30,000
ttenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
n^3)	0	0	0	0	0	0	0	0	0	0	0	0
	30,000	30,000	30,000	30,000	53,085	1,329,274	1,183,244	1,285,271	1,197,730	30,000	30,000	30,000
olume (m^3)	25,929,922	25,959,922	25,989,922	26,019,922	26,073,007	27,402,280	28,585,524	29,870,795	31,068,524	31,098,524	31,128,524	31,158,524
on Pond												
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
n Vault Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
n Phaser Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
n Wally Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
)	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
to Wally Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
n^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
olume (m^3)	2,375,847	2,375,847	2,375,847	2,375,847	2,375,847	2,559,824	2,582,929	2,690,281	2,742,991	2,742,991	2,742,991	2,742,991
	0	0	0	0	0	66,526	17,775	47,967	22,611	0	0	0
n Wally Lake (m^3)	0	0	0	0	0	603,783	1,006,306	1,360,338	1,212,177	0	0	0
)	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0
Vault Attenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
n^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	670,309	1,024,081	1,408,305	1,234,788	0	0	0
olume (m^3)	21,687,418	21,687,418	21,687,418	21,687,418	21,687,418	22,357,727	23,381,808	24,790,113	26,024,901	26,024,901	26,024,901	26,024,901
(including Phaser Lake)												
	0	0	0	0	0	73,652	19,679	53,105	25,033	0	0	0
)	0	0	0	0	0	73,652	19,679	53,105	25,033	0	0	0
Vault Attenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
n^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	73,652	19,679	53,105	25,033	0	0	0
olume (m^3)	857,347	857,347	857,347	857,347	857,347	931,000	950,679	1,003,784	1,028,817	1,028,817	1,028,817	1,028,817

er to the mill (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m^3)	0	0	0	0	0	77,826	20,794	56,114	26,452	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
Volume (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	42,909	11,465	30,938	14,584	0	0	0
m North Cell (m^3)	0	0	0	0	0	77,826	20,794	56,114	26,452	0	0	0
)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
er to the mill (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
Portage Pit (m^3)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
m^3)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0
Volume (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m^3)	0	0	0	0	0	0	0	0	0	0	0	0
er (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
from Third Portage Lake (m^3)	2,945	2,660	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
)	2,945	2,660	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
for camp purposes (m^3)	2,945	2,660	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
(m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m^3)	2,945	2,660	2,945	2,850	2,945	2,850	2,945	2,945	2,850	2,945	2,850	2,945
	0	0	0	0	0	0	0	0	0	0	0	0
umping rate (m^3/hr)	0	0	0	0	0	0	0	0	0	0	0	0
ping rate (m^3/hr)	4	4	4	4	4	4	4	4	4	4	4	4
ce												
(m^3)	0	0	0	0	0	0	0	0	0	0	0	0
er/ice entrapment (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
entrapment losses (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
returned to the pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0

	Year 2025											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	31	28	31	30	31	30	31	31	30	31	30	31
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
m South Cell (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m Third Portage Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
)	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
Attenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	19,131	19,313	19,131	19,131	19,313	60,716	30,242	49,297	33,265	19,131	19,313	19,131
Volume (m^3)	6,523,710	6,543,023	6,562,154	6,581,285	6,600,598	6,661,314	6,691,556	6,740,853	6,774,118	6,793,249	6,812,562	6,831,693
	0	0	0	0	0	78,539	20,985	56,628	26,694	0	0	0
m SC (m^3)	0	0	0	0	0	120,735	32,259	87,052	41,036	0	0	0
er from Tear Drop Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m Third Portage Lake (m^3)	0	0	0	0	0	1,130,000	1,130,000	1,130,000	669,356	0	0	0
epage (m^3)	30,000	30,000	30,000	30,000	30,000	0	0	0	0	30,000	30,000	30,000
)	30,000	30,000	30,000	30,000	30,000	1,329,274	1,183,244	1,273,681	737,086	30,000	30,000	30,000
Attenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	30,000	30,000	30,000	30,000	30,000	1,329,274	1,183,244	1,273,681	737,086	30,000	30,000	30,000
Volume (m^3)	31,188,524	31,218,524	31,248,524	31,278,524	31,308,524	32,637,798	33,821,042	35,094,722	35,831,808	35,861,808	35,891,808	35,921,808
on Pond												
	0	0	0	0	0	183,978	23,105	107,352	52,710	0	0	0
m Vault Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m Phaser Pit (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m Wally Lake (m^3)	0	0	0	0	0	0	0	0	314,194	0	0	0
)	0	0	0	0	0	183,978	23,105	107,352	366,904	0	0	0
to Wally Lake (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	183,978	23,105	107,352	366,904	0	0	0
Volume (m^3)	2,742,991	2,742,991	2,742,991	2,742,991	2,742,991	2,926,968	2,950,073	3,057,425	3,424,329	3,424,328	3,424,328	3,424,328
	0	0	0	0	0	66,526	17,775	47,967	22,611	0	0	0
m Wally Lake (m^3)	0	0	0	0	0	603,783	1,006,306	1,345,383	0	0	0	0
)	0	0	0	0	0	670,309	1,024,081	1,393,350	22,611	0	0	0
Vault Attenuation Pond (m^3)	0	0	0	0	0	0	0	0	0	0	0	0
m^3)	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	670,309	1,024,081	1,393,350	22,611	0	0	0
Volume (m^3)	26,024,901	26,024,901	26,024,901	26,024,901	26,024,901	26,695,210	27,719,292	29,112,641	29,135,253	29,135,253	29,135,253	29,135,253
(including Phaser Lake)												
	0	0	0	0	0	73,652	19,679	53,105	25,033	0	0	0
)	0	0	0	0	0	73,652	19,679	53,105	25,033	0	0	0

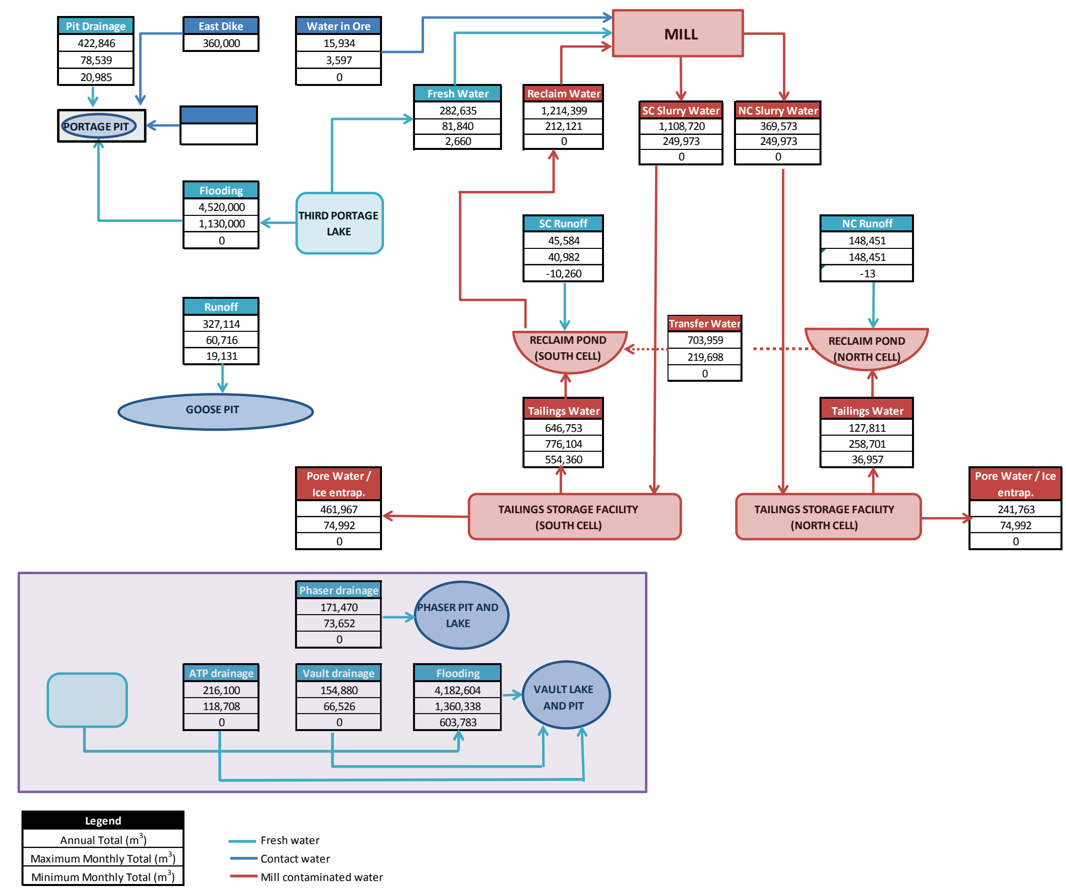
APPENDIX E – FLOW CHARTS

2018



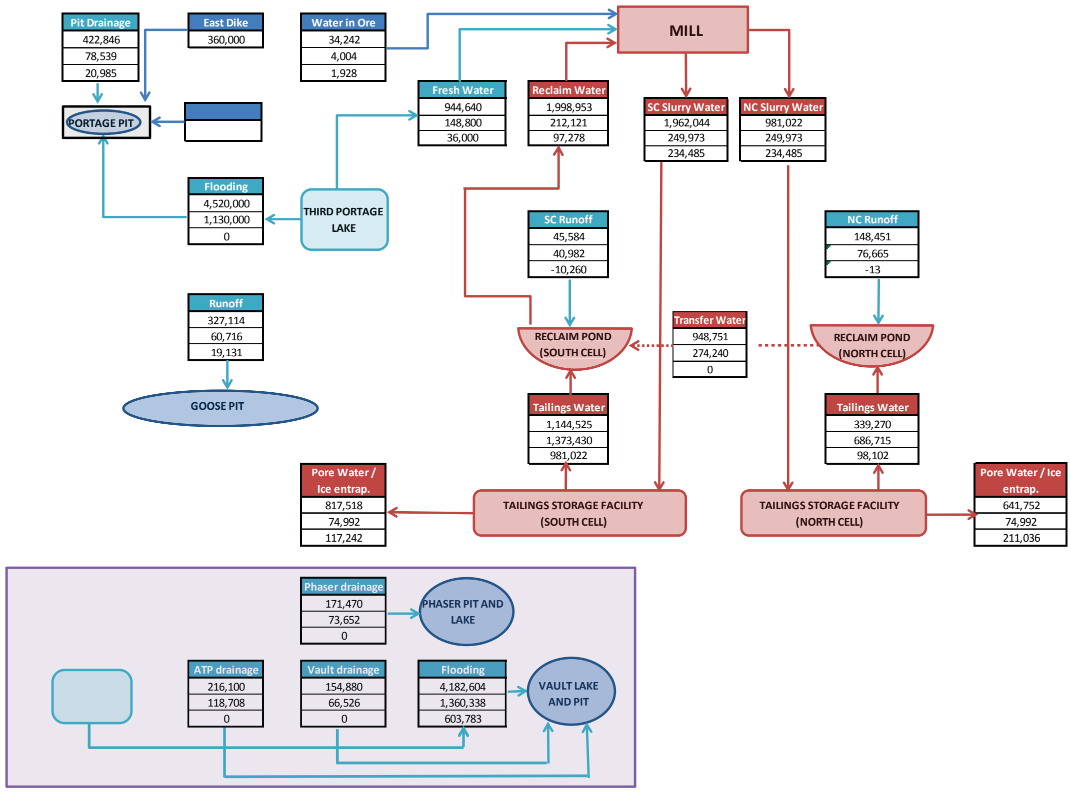
*Small water transfers are not shown on this drawing, refer to water balance tables for detailed water movement.

2019



*Small water transfers are not shown on this drawing, refer to water balance tables for detailed water movement.

2020

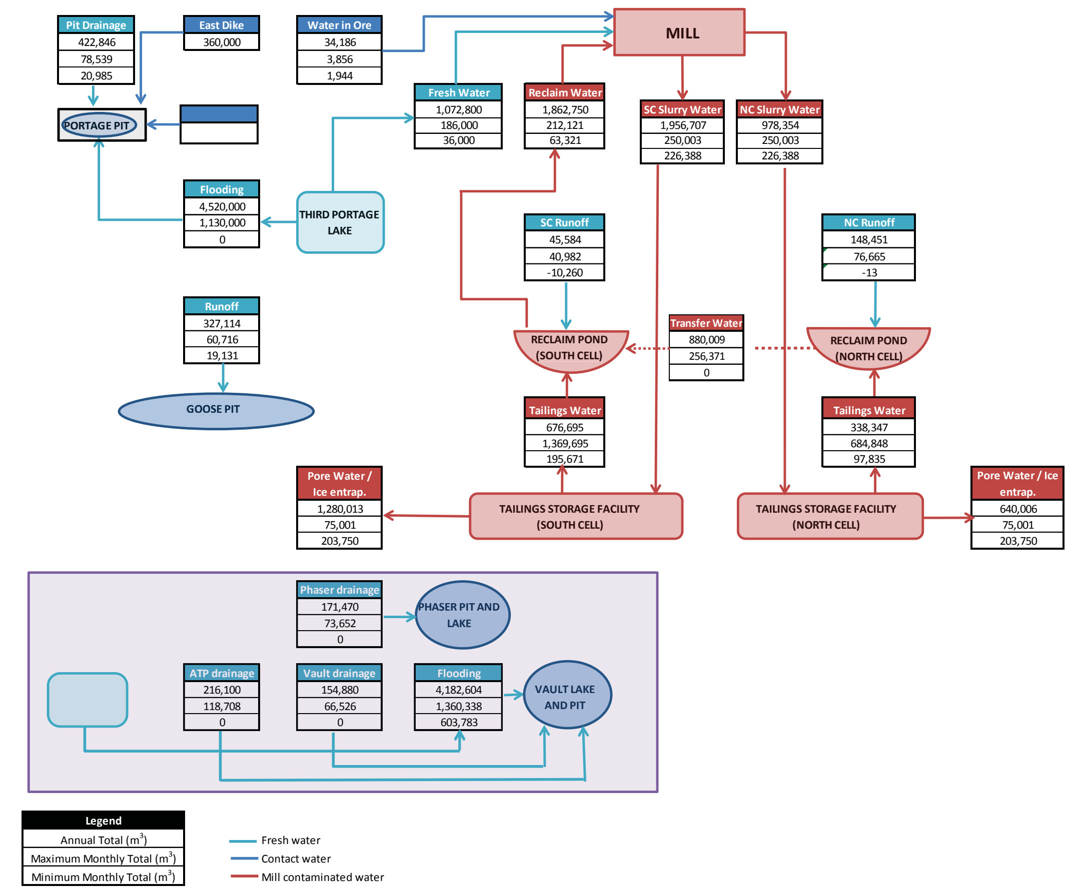


Legend
Annual Total (m³)
Maximum Monthly Total (m³)
Minimum Monthly Total (m³)

Fresh water
Contact water
Mill contaminated water

*Small water transfers are not shown on this drawing, refer to water balance tables for detailed water movement.

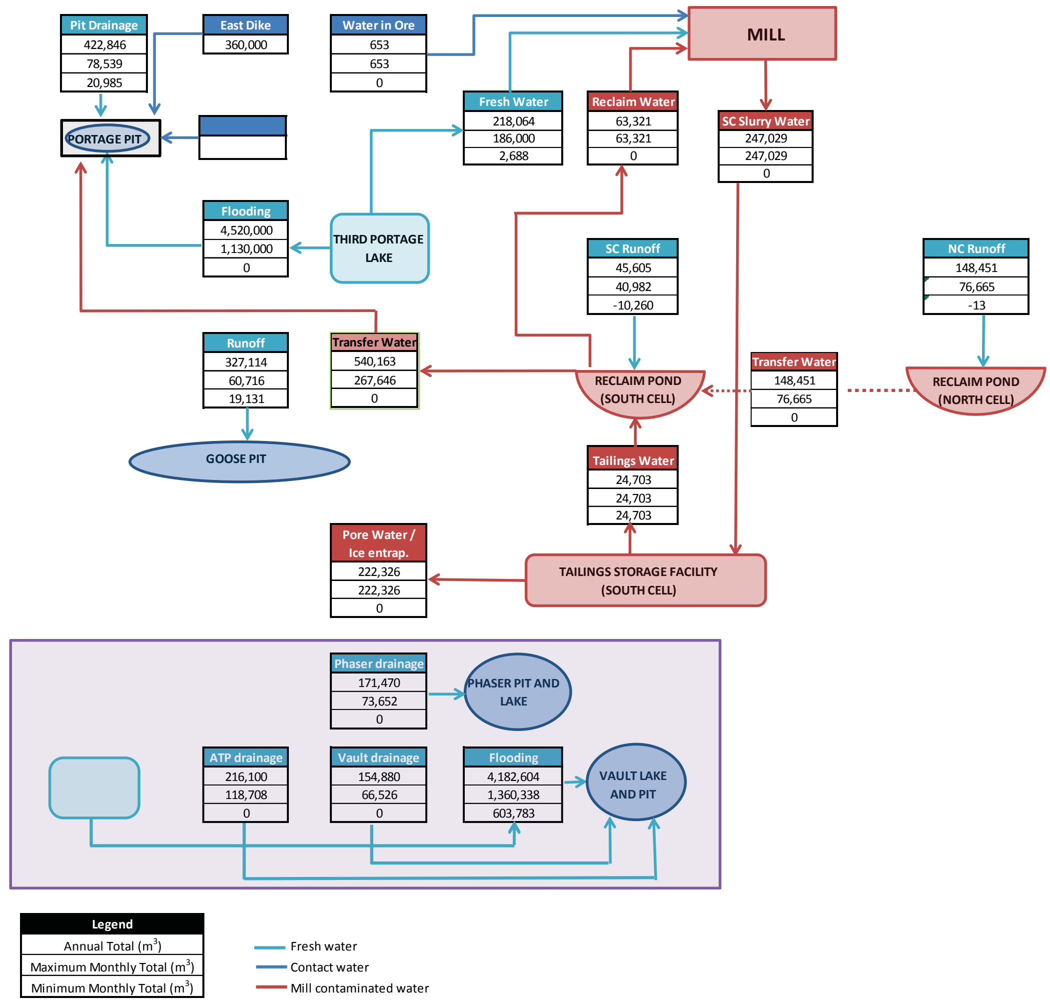
2021



*Small water transfers are not shown on this drawing, refer to water balance tables for detailed water movement.

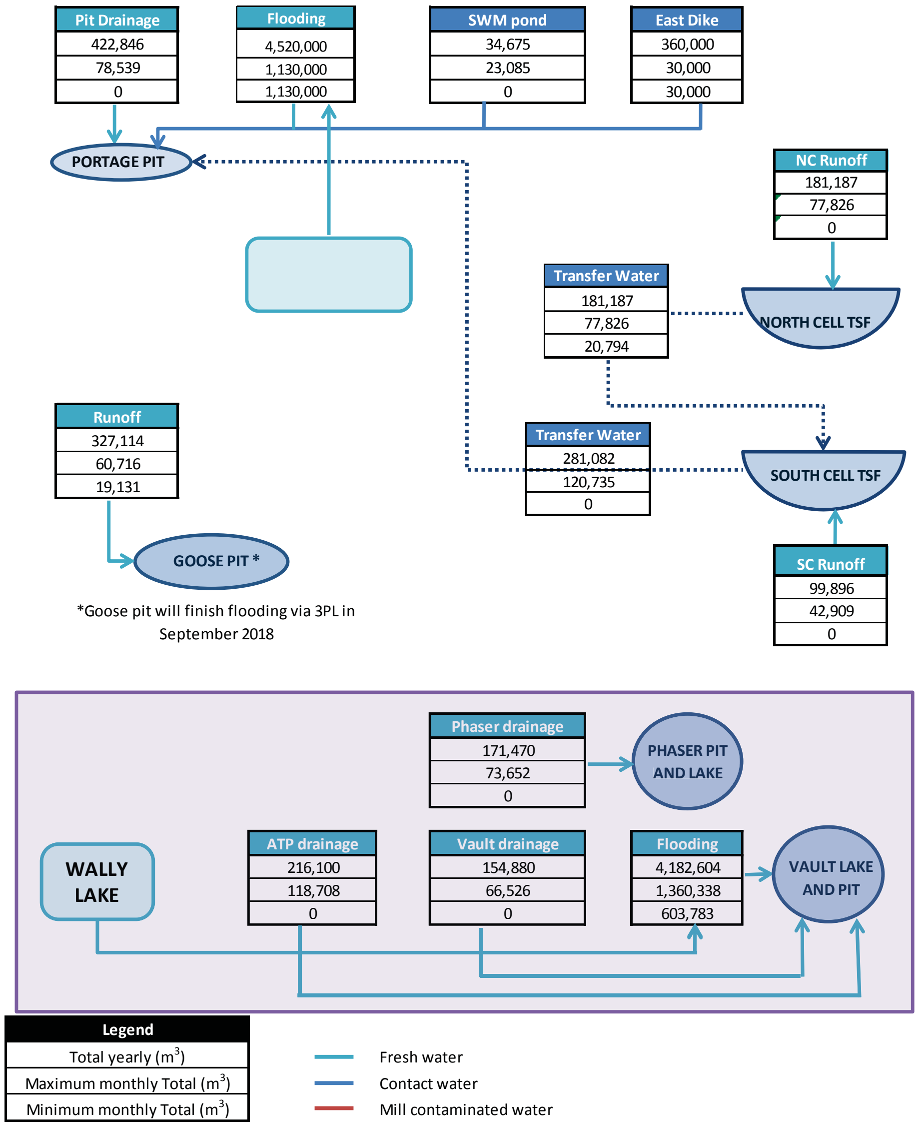
AGNICO EAGLE

2022

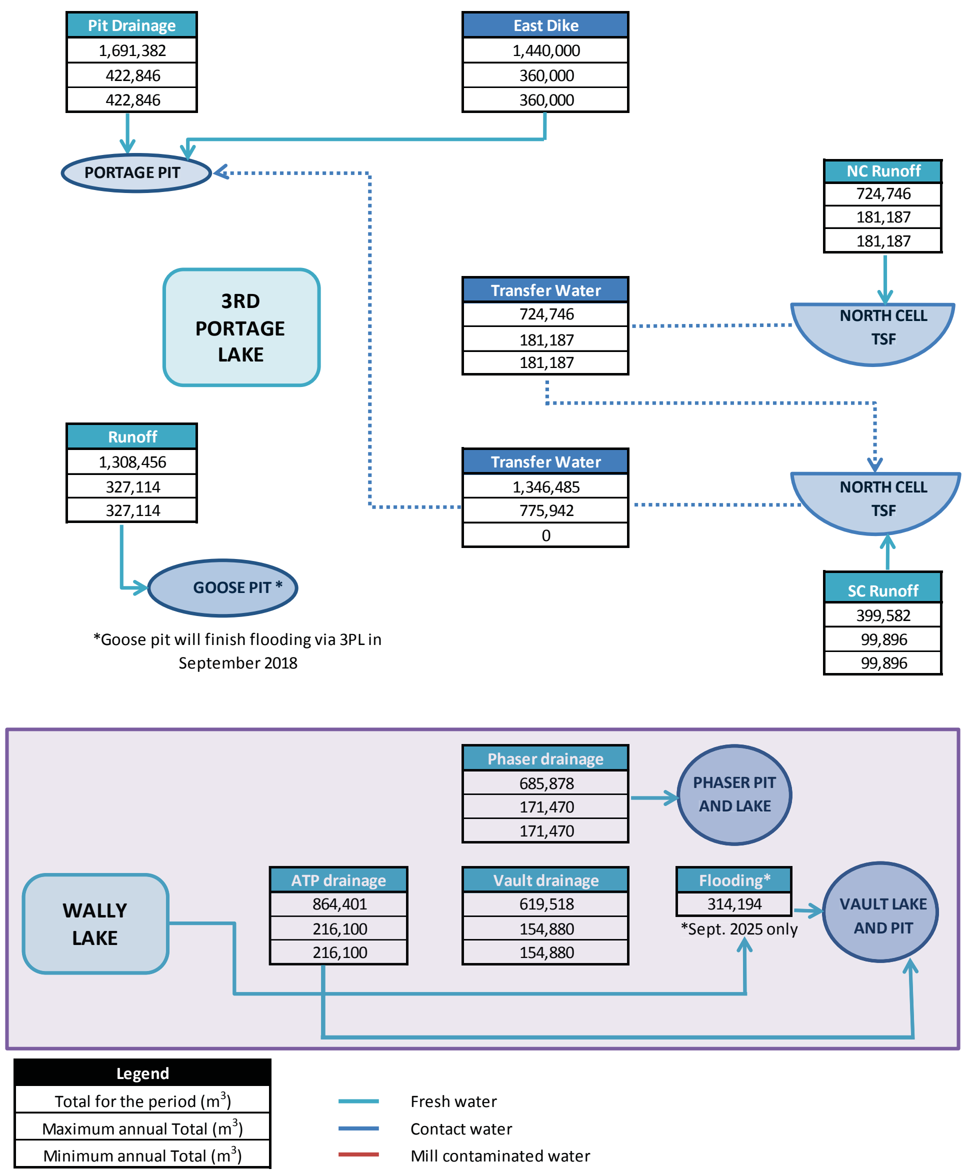


*Small water transfers are not shown on this drawing, refer to water balance tables for detailed water movement.

2023-2024


Pit Drainage
422,846
78,539
0
Flooding
4,520,000
1,130,000
1,130,000
SWM pond
34,675
23,085
0
East Dike
360,000
30,000
30,000
PORTAGE PIT
NC Runoff
181,187
77,826
0
Transfer Water
181,187
77,826
20,794
NORTH CELL TSF
Runoff
327,114
60,716
19,131
Transfer Water
281,082
120,735
0
SOUTH CELL TSF
GOOSE PIT *
SC Runoff
99,896
42,909
0
*Goose pit will finish flooding via 3PL in September 2018
Phaser drainage
171,470
73,652
0
PHASER PIT AND LAKE
WALLY LAKE
ATP drainage
216,100
118,708
0
Vault drainage
154,880
66,526
0
Flooding
4,182,604
1,360,338
603,783
VAULT LAKE AND PIT
Legend
Total yearly (m3)
Maximum monthly Total (m3)
Minimum monthly Total (m3)
Fresh water
Contact water
Mill contaminated water

2025-2028


Pit Drainage
1,691,382
422,846
422,846
East Dike
1,440,000
360,000
360,000
PORTAGE PIT
NC Runoff
724,746
181,187
181,187
3RD PORTAGE LAKE
Transfer Water
724,746
181,187
181,187
NORTH CELL TSF
Runoff
1,308,456
327,114
327,114
Transfer Water
1,346,485
775,942
0
NORTH CELL TSF
GOOSE PIT *
SC Runoff
399,582
99,896
99,896
*Goose pit will finish flooding via 3PL in September 2018
Phaser drainage
685,878
171,470
171,470
PHASER PIT AND LAKE
WALLY LAKE
ATP drainage
864,401
216,100
216,100
Vault drainage
619,518
154,880
154,880
Flooding*
314,194
*Sept. 2025 only
VAULT LAKE AND PIT
Legend
Total for the period (m3)
Maximum annual Total (m3)
Minimum annual Total (m3)
Fresh water
Contact water
Mill contaminated water

APPENDIX F • TAILINGS STORAGE FACILITY EXPANSION PROJECT PHASE 1- WATER QUALITY ASSESSMENT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Montreal, March 11th, 2016

Mr□Michel □roleau
Agnico Eagle Mines Limited
Mea□o□ban□Division
□a□er □a□e, □unavut, Cana□a
□0C 0□0

Subject: Tailin□s Stora□e Facilit□ □□pansion Pro□ect Phase 1 - Water Qualit□ □ssessment Technical □eport
□ur □ile□630□0□-0000-40□□-0001-01

Dear Mr□□roleau,

We are please□ to submit the revision 01 o□the report mentione□ above□

Do not hesitate to communicate □ith the un□ersi□ne□ shoul□ □ou have □urther questions re□ar□in□ the content o□this report□

□e□ar□s,

SNC LAVALIN INC.

□nh-□on□ □□u□en, □n□□
Pro□ect Mana□er
Sustaining Capital Works
Mining and Metallurgy

□enevieve □eau□oin-□ebeu□, □n□□
Water Treatment Specialist
Sustaining Capital Works
Mining and Metallurgy

□□□□

LIST OF REVISIONS

Revision				Revised pages	Remarks
#	Prep.	App.	Date		
PA	GBL	ALN	2015-12-14	All	For internal review
PB	GBL	ALN	2015-12-15	All	For Client review
00	GBL	ALN	2015-12-22	All	For Client review
01	GBL	ALN	2016-03-11	All	For use

NOTICE TO READER

This document contains the expression of the professional opinion of SNC-Lavalin Inc. (“SNC-Lavalin”) as to the matters set out herein, using its professional judgment and reasonable care. It is to be read in the context of the agreement dated June 19, 2015 (the “Agreement”) between SNC-Lavalin and Agnico Eagle Mine (the “Client”) and the methodology, procedures and techniques used, SNC-Lavalin’s assumptions, and the circumstances and constraints under which its mandate was performed. This document is written solely for the purpose stated in the Agreement, and for the sole and exclusive benefit of the Client, whose remedies are limited to those set out in the Agreement. This document is meant to be read as a whole, and sections or parts thereof should thus not be read or relied upon out of context.

SNC-Lavalin has, in preparing estimates, as the case may be, followed accepted methodology and procedures, and exercised due care consistent with the intended level of accuracy, using its professional judgment and reasonable care, and is thus of the opinion that there is a high probability that actual values will be consistent with the estimate(s). Unless expressly stated otherwise, assumptions, data and information supplied by, or gathered from other sources (including the Client, other consultants, testing laboratories and equipment suppliers, etc.) upon which SNC-Lavalin’s opinion as set out herein are based have not been verified by SNC-Lavalin; SNC-Lavalin makes no representation as to its accuracy and disclaims all liability with respect thereto.

To the extent permitted by law, SNC-Lavalin disclaims any liability to the Client and to third parties in respect of the publication, reference, quoting, or distribution of this report or any of its contents to and reliance thereon by any third party.

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1.0 INTRODUCTION

1.1 Context

Agnico Eagle Mines Limited, Meadowbank □ivision (AEM) is proposing to develop □hale Tail Pit, a satellite deposit on the Amaruq property, as a continuation of mine operations and milling at the Meadowbank Mine. The Amaruq Exploration property is a 40□km□site located on Inuit □wned Land, approximately 150 km north of the □amlet of Baker Lake and approximately 50 km northwest of the Meadowbank Mine in the □ivalliq region of Nunavut.

AEM is looking to extend the life of the mine by constructing and operating □hale Tail Pit and processing the ore at the Meadowbank Mine Site. The additional tailings generated from the □hale Tail Pit operation will be deposited in the existing TSF (North Cell and South Cell).

1.2 Mandate

SNC-Lavalin (SLI) was mandated by AEM to perform a preliminary assessment of the water quality forecast in the Goose and Portage pits at closure based on the water balance developed by AEM that incorporates the additional tailings from □hale Tail Pit deposited in the existing TSF (North and South Cells).

1.3 Study Objectives

The objectives of this report are the following□

- Review the water qualities and water balance models provided by AEM;
- Update the water quality forecasting model accordingly;
- Analy□e the results for the parameters of concern supported by graphs prepared by SLI;
- Review the results at closure with the use of geochemical tools like the software program P□REE□C (USGS 2013);
- Identify different treatment options that could be implemented depending on the water quality at closure;
- Produce a Technical Report presenting findings and our interpretation.

2.0 WATER MANAGEMENT PLAN STUDIED

AEM developed a tailings deposition plan to manage the additional tailings from □hale Tail Pit within the existing North and South Cell Tailings Storage Facility (TSF). As part of this study, AEM developed a water management plan (□MP) that incorporates the □hale Tail Pit development project. Table 2-1 summari□es the preliminary schedule used for the □MP that incorporates the □hale Tail Pit development project.

Ta□□e □□□□S□□ed□□e o□□ ater □anagement P□ases □or t□e TSFE P□ase □Pro□e□t

	TSFE P□ASE □□□□□□TPD FRO□ □□ALE TAIL PIT □Nov. □□□□□ode□□	
ACTIVIT□□	**Start Date**	**End Date**
Pits □ining and Pro□essing at □i□□		
Portage Pit	Jan.2010	Sept. 201□
Pit A (North)	Jan. 2010	Sept. 201□
Pit B, C, □ (Central)	Jan. 2010	Apr. 2013
Pit E (South)	Jan. 2010	July 2016
Goose	Apr. 2012	□ct. 2015
□ault	Jan. 2014	Sept. 201□
Phaser (including potentially BB Phaser)	July 2017	Sept. 201□
□hale Tail	July 2019	Jan. 2022
Tai□ings Storage Fa□i□it□ Operations		
North Cell TSF	Jan. 2010	□ct. 2015
North Cell TSF with □hale Tail Tailings	July 2019	Sept. 2021
South Cell TSF	□ec. 2014	Sept. 201□
South Cell TSF with □hale Tail Tailings	□ct. 2019	Jan. 2022
Ro□k Storage Fa□i□it□		
Portage RSF	Jan. 2009	March 2023
□ault RSF	Jan. 2014	□ct. 201□

[1] Periods are given from the beginning of the starting month to the end of the ending month.

	TSFE P□ASE □ □ □□□□ TPD FRO□ □ □ALE TAIL PIT □Nov. □□□□ □ode□□	
ACTIVIT□[□]	Start Date	End Date
Atten□ation Re□aim Ponds □ ater □anagement		
Attenuation Pond (South Cell)[2]	Jan. 2009	Nov. 2014
Attenuation Pond (□ault Lake)	July 2014	Sept. 201□
Ot□er A□tivities		
□ewatering of □ault	June 2013	June 2014
□ewatering of Phaser Lake	Sept. 2016	□ct. 2016
Flooding of Portage Pit with 3PL water	Jun. 2019	Sep. 2025
Flooding of Goose Island Pit with 3PL water	Jun. 201□	Aug. 201□
Flooding of □ault Pit	Mar. 201□	□ct. 2023
Flooding of Phaser Pit	June 201□	□ct. 2023
Flooding Period Completed	NA	□ec. 202□
Breaching of dykes	2029, only if water criteria are met	

[2] After Nov. 2014, the Reclaim Pond is relocated in the South Cell TSF and the Attenuation Pond is combined with the Reclaim Pond. After this date, there is no Attenuation Pond.

3.0 WATER QUALITY ASSESSMENT

3.1 Mass Balance Model

3.1.1 Description

The updated water quality mass balance model used during this study was developed to help forecast trends in water quality in the Portage Area of Meadowbank for different parameters of interest from September 2014 to mine closure in 2029. The model forecasts the approximate concentrations in the North and South Cells and in the pits on a monthly time step, until 2029. This model was initially developed for the "*Water Quality Forecast for 2012-2025*" study in March 2012 based on the water balance, and is updated once a year using the updated water balance developed by AEM. It was updated for the last time in January 2015 for the following mandate: "*Meadowbank Water Quality Forecasting Update Based on the 2014 Water Management Plan*".

The water quality forecast model has the following characteristics:

- The model uses a flow and mass balance approach to forecast the concentration of different parameters in the water column;
- The model uses the monthly Reclaim Ponds surface areas defined by the deposition and closure plan;
- Dissolved concentration values are used in the model. The model assumes that the solid fraction in the water column will filter out in the tailings and/or settle out in the TSF;
- Conservation of mass is assumed for all parameters except for cyanide;
- Cyanide volatilization in the summer months is modeled;
- The main contaminant load reporting to the TSF Reclaim Ponds is from the mill effluent.

The forecasting of dissolved metals, nitrate and cyanide concentrations in the North and South Cell TSF Reclaim Ponds is based on a mass balance around the ponds performed on a monthly basis. The initial concentration in the Reclaim Ponds is based on the value forecasted in the previous month. The concentration of contaminant in the mill effluent is assumed to be constant from month to month, considering that the tailing water undergoes a cyanide destruction step that operates at an alkaline pH. Under such treatment conditions, the total cyanide concentration will be reduced and any dissolved metals present will precipitate out of solution as a metal hydroxide. For simplification purposes, the nitrate concentration in the mill effluent is assumed to be constant. Figure 3-1 schematically summarizes the mass balance approach used to forecast these parameters in the TSF Reclaim Ponds.

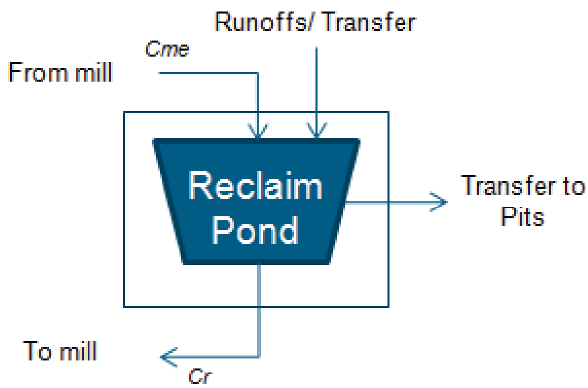


Figure 3-1 Mass Balance for dissolved metals, nitrate and cyanide

For the forecasting of sulphates, chlorides and ammonia concentrations in the TSF Reclaim Ponds, the assessment considers a water/mass balance on a monthly basis around the mill and the Reclaim Ponds. Based on existing water quality data, these parameters have been shown to accumulate over time in the TSF Reclaim Ponds since they are not removed at the cyanide destruction step. Sulphate is generated from the oxidation of the sulfide present in the ore, while ammonia is generated from the hydrolysis of cyanate (i.e. end product of the cyanide destruction system). Chlorides are present in the salt added seasonally for deicing. The contaminant load for these parameters is added to the mill effluent on a monthly basis and accumulates over time. For simplification purposes, no nitrification of ammonia is assumed to occur in the TSF Reclaim Ponds during the summer months. Figure 3-2 schematically summarizes the mass balance approach used to forecast these parameters.

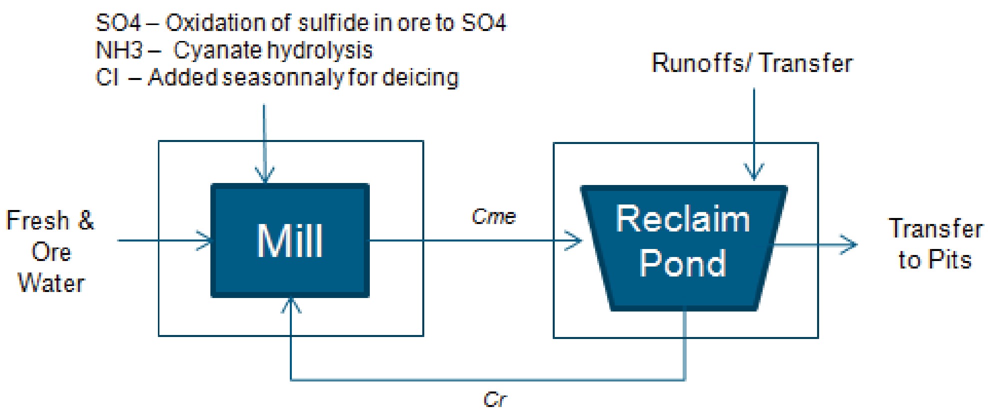


Figure [illegible] Mass balance for sulphate, chlorides and ammonia

3.1.2 Assumptions

In addition to the assumptions presented in Section 3.1.1, the following assumptions were used in the development of the mass balance model of Meadowbank:

- In order to simplify the model, the North and South Cell TSF Reclaim Ponds and the Portage and Goose pits are assumed to be **completely mixed systems**;
- The tailings in the TSF are assumed not to undergo significant amounts of sulphide oxidation. Refer to Section 3.1.4 for further discussion on this topic;
- The pH in the TSF Reclaim Ponds is, on average, [illegible] during the summer months, and, on average, 7.9 for the first half of the year (January to July 2014).
- In order to simplify the mass balance model, the parameters of interest are assumed to be inert; they do not degrade or react with other elements in the system, with the exception of cyanide.
- Cyanide:

  For cyanide, it is assumed that the mill effluent meets AEM's CN-WAD operational target of 16.3 mg/L at all times, based on the latest mill effluent sample.

  The total cyanide in the TSF Reclaim Ponds is comprised of free cyanide and metal-cyanide complexes (weak and strong metal cyanide complexes). As per discussions with AEM, most of the iron- and metal-cyanide complexes are precipitated in the mill. However, since the reaction is not complete or perfect, some dissolved iron- and metal-cyanide complexes are expected to remain in the mill effluent. Therefore it was assumed that 10% of the total cyanide concentration was bound as strong iron-cyanide complexes, and that another 10% of the total cyanide concentration was present as weak metal-cyanide complexes (cyanide bound with copper, zinc, and nickel). The remainder is present as free cyanide (i.e. HCN and CN^-). This agrees with values observed at other gold mine tailings sites (Simovic, 1984). These same proportions are assumed to apply to cyanide at the mill effluent.

For this model, natural cyanide degradation is only considered for the summer months.

- For this analysis, it is assumed that no treatment will take place at the North and South Cell TSF Reclaim Ponds, nor at the Portage and Goose pits.

3.1.3 Updates and Modifications to the Model

The following updates and modifications were carried out on the water quality forecast model in order to properly represent the particularities of the new closure scenario studied in this mandate:

- The water balance model dated November 2015 by AEM was entered into the water quality model. This water balance model incorporates the Whale Tail tailings deposition.
- The model was updated to forecast the following parameters in order to better evaluate and confirm if any of them could become a parameter of concern at closure. The underlined parameters are currently the parameters of concern and their forecasted trends will be presented in graphs:

Physico-Chemical Parameters:

- Alkalinity
- Hardness
- <u>Total dissolved solids</u>

Cations:

- Aluminium (Al)
- Silver (Ag)
- Arsenic (As)
- Barium (Ba)
- Cadmium (Cd)
- <u>Chrome (Cr)</u>
- Manganese (Mn)
- Mercury (Hg)
- Molybdenum (Mo)
- Nickel (Ni)
- Lead (Pb)
- <u>Selenium (Se)</u>
- Zinc (Zn)
- <u>Copper (Cu)</u>
- <u>Ammonia (NH_3)</u>
- <u>Iron (Fe)</u>

Anions:

- Fluoride (F)
- Sulphate (SO_4)
- Cyanide (CN)
- Nitrate (NO_3)
- Chloride (Cl)

- The water balance model takes into consideration the mining of Whale Tail Pit from 2020 to 2023.
- The water balance model also reflects the ownstream Pond water transfer to Goose Pit that occurred in 2015.

3.1.4 Tailings

For Meadowbank mining and milling, the assumption that the tailings originating from the Portage, Goose and Vault pits will not undergo significant amounts of sulphide oxidation has been based on the observation that iron staining is absent from tailings materials in the North Cell TSF which suggests minimal oxidation of the sulphide content of the tailings. This may be as a result of the water saturated conditions that prevail throughout the year in the North Cell TSF. Moreover, since tailings are frozen almost all year round, this suggests that little oxidation would be expected to occur. AEM has conducted both a laboratory based SFE Leach test and SPLP1312 leach test on a representative tailings sample from the Portage/Goose/Vault pits. However, as these tests are not representative of the leachable fraction upon oxidation of the sulphide content of the tailings in field conditions, an overview of a suitable field based program has been provided in Section 6.2.

AEM has also conducted some testing on a single ore sample from the Whale Tail Pit, including an SFE Leach test. Preliminary results indicate that the tailings from Whale Tail Pit could leach slightly higher concentrations of arsenic, copper and nickel than the tailings from Portage, Goose and Vault pits, and higher concentrations of chromium.

SFE leach test results obtained from Portage/Goose/Vault tailings and Whale Tail tailings were integrated into the water quality forecast model to account for possible loading from the leaching of the tailings deposited in the TSF for that month.

3.1.5 Limitations

The limitations of the Meadowbank water quality mass balance model and ensuing results and conclusions presented in this Technical Note are listed below:

- In order to simplify the model, the mass balance model assumes that the pond and pits are completely mixed systems. However, the results from this model provide only an indication of the concentrations in the ponds and pits and these should not be considered as absolute values at this time. Future monitoring of flows and water quality would need to be undertaken to validate this assumption.
- The mass balance model is based on the water quality analysis results provided by AEM:

  Water quality data provided for ST-21 is taken from samples collected at the surface of the North Cell TSF Reclaim Pond. Therefore the concentrations provided by AEM for ST-21 may not be representative of the entire TSF Reclaim Ponds water quality.

  The water quality data used to assess the future mill effluent while processing the Whale Tail Pit ore is based on a sample from a batch SO_2/air cyanide destruction bench scale test performed on a single ore sample from the area. This water sample may not be representative of the actual future water quality when the Whale Tail Pit will be in operation.
- The model does not make allowances for the impact that changes in the TSF (surface area, volume, tailings characteristics, etc.) will have on the TSF Reclaim Ponds water quality over time.
- It should be noted that at this point, given the limitations, assumptions and limited data currently available, the model should only be used as a preliminary means to evaluate the impact of the mill effluent on the future water quality in the North and South Cell TSF Reclaim Ponds and Portage and Goose pits.

3.1.6 Input parameters

For this study, the water quality forecasting mass balance model was updated based on the following input data:

- Flows and volumes provided in the water balance developed by AEM, dated November 2015 with a production rate of 9000 tonnes of ore/day from the Whale Tail Pit
- Assumptions presented below in Section 3.1.2
- Water analyses for ST-21 (North Cell TSF Reclaim Pond) (sample taken on anuary 8th, 2015)
- Water analyses for ST-18 (South Cell TSF Attenuation Pond) (Average of 2011-2014)

- Water analyses for Third Portage Lake (Average of East Basin in Summer 2015)
- Water analyses for the mill effluent (sample taken on October 15th, 2015)
- Water analyses for the future mill effluent when Whale Tail Pit will be in operation (pilot test on March 30th, 2015)
- Water analyses for ST-19 (Portage Pit) (Average of 2015)
- Water analysis for ST-20 (Goose Pit) (sample taken on August 9th, 2015).

3.1.6.1 Input Concentrations

Table 3-1 presents the input concentrations considered for the water quality forecast model for the Mill, Third Portage Lake, South Cell, North Cell, Goose Pit and Portage Pit. The concentrations are highlighted in red when they are above the CCME guidelines highlighted in green.

Table 3-1: Input Concentrations Selected for the Mass Balance Model

ers	Units	MILL EFFLUENT	FUTUR MILL EFFLUENT (w/ Whale Tail)	RECLAIM ST-21 NORTH CELL	THIRD PORTAGE LAKE	RECLAIM SOUTH CELL ST-18	PORTAGE PIT ST-18	GOOSE PIT ST-20
Basis of data used for model:		Sample taken in Oct. 15, 2015	Sample taken Mar 30, 2015 (Pilot test)	□anuary 8, 2014	Average- East Basin Summer 2015	Avg 2011 □2014	Average 2015	August 09, 2015
	mg $CaCO_3$/L	45	135	135	9.100	115.565	67.875	75
	mg $CaCO_3$/L	2030	2030	1329	12	264.350	175.00	104.0000
um (Al)	mg/L	0.043	0.54	0.072	0.0018	0.0097	0.0030	0.0030
g)	mg/L	0.00161	0.000496	0.0001	0.000005	0.0023	0.00005	0
(As)	mg/L	0.0493	0.33	0.021	0.0005	0.0035	0.0182	0.0003
Ba)	mg/L	0.09	0.0851	0.0838	0.0037	0.0972	0.0101	0.0163
n (Cd)	mg/L	4.59E-04	4.90E-05	1.34E-03	2.50E-06	2.13E-03	1.00E-05	1.00E-05
m (VI)	mg/L	9.00E-05	1.17E-02	0	0.0001	0.0000	0	0.0003
Cu)	mg/L	5.28	5.28	9.053	0.0005	0.0042	0.0005	0.0003
	mg/L	1.74	2.73	0.03	0.010	0.024	0.0063	0.0100
ese (Mn)	mg/L	0.0116	0.186	0.0595	0.002	1.871	0.0814	0.0058
(Hg)	mg/L	0.000005	0.000005	0.0002	0.000003	0.0002	0.00001	0.0001
num (Mo)	mg/L	1.14	0.128	0.5826	0.0002	0.022	0.0405	0.0148
li)	mg/L	0.0894	0.0559	0.2525	0.001	0.018	0.020	0.009
)	mg/L	0.00061	0.0114	0.0016	0.00005	0.0023	0.00019	0.0002
n (Se)	mg/L	0.285	0.01	0.072	0.0001	0.002	0.0013	0.0005
	mg/L	0.001	0.004	0.001	0.001	0.007	0.001	0.001
	mg N/L	□30/mth	□50/mth	36.8	0.019	6.884	2.569	0.570
	mg/L	North Cell: Winter:□2□/mth Summer: □1□/mth South Cell: Winter: □700/mth Summer: □350/mth	Winter:□2□/mth Summer: □1□/mth	1035	0.79	43.1450	12.6250	13.7000
	mg/L	0.39	0.17	0.180	0.079	0.547	0.2400	0.5500
	mg N/L	22.8	6.05	25.500	0.033	8.293	9.0050	4.1100
)	mg/L	16.3	16.3	8.330	0.0010	0.1738	0	0.0050
	mg SO4/L	□1100/mth	□3520/mth	2115.0000	5.1000	277.0750	120.1500	45.8000
ids	mg/L	North Cell: Winter:□4.4□/mth Summer: □2.8□/mth South Cell: Winter: □2.3□mth Summer: □1.7□/mth	Winter:□6.9□/mth Summer: □5.3□/mth	1329	22.1250	739	400.875	217

A couple of items to note on the parameters used for the updated water quality forecast model in this study:

- To evaluate the concentration of ammonia that may be added to the TSF Reclaim Ponds on a monthly basis, the difference in concentration of CN-WAD before and after the cyanide destruction system was evaluated. CN-WAD was removed and converted to cyanate (CNO-). Assuming that 100% of the cyanate is hydrolyzed to ammonia (NH_3), it was evaluated that on average, approximately 30 mg N/L of ammonia was added to the mill effluent for Meadowbank exploitation, and 50 mg N/L of ammonia for the mining of Whale Tail Pit. For the purpose of the model, it is assumed that these concentrations of ammonia are added to the mill effluent every month. This additional ammonia load is added to the load already present in the reclaim water. The same concentration is added in the South Cell and North Cell.
- Based on the measured data, the chloride concentration continues to increase in the mill effluent. To account for this trend, it is assumed that 2,000 mg/L of chloride is added to the mill effluent every year during the "winter" months (October until May) and 1,000 mg/L every year during the "summer" months (June to September) in the North Cell, for operations at Meadowbank and Whale Tail Pit. For the South Cell, during Meadowbank operations, a concentration of 700 mg/L of chloride is added during the "winter" months and 350 mg/L during the "summer" months. For mining of Whale Tail Pit , the values are the same as for the North Cell. This additional chloride load is added to the load already present in the reclaim water. This value was evaluated by adjusting the model to fit with the measured chloride values in the Reclaim Ponds in 2014 and 2015.
- The sulphates are also accumulating in the mill effluent based on the measured data. After evaluating by adjusting the model to fit with the measured sulphate values, a concentration of 1,100 mg/L is assumed to be added to the mill effluent during Meadowbank exploitation and a concentration of 3,520 mg/L during mining of Whale Tail Pit. These values are the same for the North and South Cells.
- Table 3-2 summarizes the actual mill effluent water quality data and the bench scale test data obtained using Whale Tail ore. When comparing the mill effluent water quality data to the bench scale test data using Whale Tail ore, aside from sulphate concentration, the Whale Tail Pit concentrations for the different parameters are lower for the Whale Tail ore compared to the actual mill effluent values. Lower concentrations for parameters of concern in the Whale Tail mill effluent could lead to optimistic concentration values at closure. For this reason, it is assumed that the copper and cyanide concentrations are similar to the concentrations currently observed in the mill effluent.

Table 3-2: Input Concentrations Selected for the Mass Balance Model

PARAMETERS (mg/L)	Mill Effluent Sample Oct□11□12	Mill Effluent Sample □an□2□□14	Mill Effluent Sample Oct□2□□14	Mill Effluent Sample Oct□1□□1□	Whale Tail Batch CN Deto□ Test March 201□
Total Cyanide	10.13	18.80	111	16.3	2.02
Dissolved Copper	7.07	7.8	6.795	5.28	0.0243
Dissolved Iron	0.83	0.8	0.14	1.74	2.73
Chloride	1375	2129	2199	1200	17
Sulphate	2683	2565	2400	2500	8000
Selenium	0.025	0.19	0.154	0.269	0.01

3.2 Water Quality Forecast Results

With the help of the water quality forecast mass balance model, the concentrations of parameters were forecasted in the Portage and Goose pits until December 2029, after the mine closure. December 2029 is the last month in the AEM water balance model.

Table 3-3 summarizes the forecasted concentrations and compares the values against the Canadian Council of Ministers of Environment (CCME) guidelines for the Protection of Aquatic Life, right before the breaching in December 2028. Any values in red indicate a concentration that is higher than the CCME recommended guideline.

Figures showing the changes in the concentrations of various parameters (cyanide, copper, iron, chromium, ammonia, nitrate, selenium, sulphate and chloride) in the North and South Cells TSF Reclaim Ponds and in the Portage and Goose pits can be found in Appendix A of this report.

The forecasted concentrations in the graphs are also compared with CCME guidelines, as well as the Water License limit and the Third Portage Lake 2015 water quality. Since there are no binding limits, the matter was discussed with AEM, and it was decided again that the CCME guidelines were the most suited guidelines for this project.

Table 3-3: Forecasted Concentration in the Portage and Goose pits at Closure (December 2028)

			Scenario A		
PARAMETERS	UNITS	CCME GUIDELINES	PORTAGE PIT	GOOSE PIT	ASSUME COMPLETE MI□ING OF BOTH PITS
Alkalinity	mg $CaCO_3$/L	n/a	10.0	9.6	
Hardness	mg $CaCO_3$/L	n/a	24.3	22.5	
Total dissolved solids	mg/L	n/a	62.3	44.0	
Aluminium (Al)	mg/L	0.1	0.004	0.003	
Silver (Ag)	mg/L	0.0001	0.00001	0.00002	
Arsenic (As)	mg/L	0.005	0.002	0.001	
Barium (Ba)	mg/L	n/a	0.004	0.004	
Cadmium (Cd)	mg/L	0.00004	0.00001	0.00001	
Chromium (VI)	mg/L	0.001	0.003	0.00005	0.002
Copper (Cu)	mg/L	0.002	0.018	0.024	0.019
Iron (Fe)	mg/L	0.3	0.036	0.019	
Manganese (Mn)	mg/L	n/a	0.003	0.003	
Mercury (Hg)	mg/L	0.000026	0.000003	0.000003	
Molybdenum (Mo)	mg/L	0.073	0.002	0.006	
Nickel (Ni)	mg/L	0.025	0.0008	0.0010	
Lead (Pb)	mg/L	0.001	0.00009	0.00005	
Selenium (Se)	mg/L	0.001	0.0001	0.0014	0.0003
Zinc	mg/L	0.03	0.001	0.001	
Ammonia (NH_3) (ionized)	mg N/L	0.86	0.45	0.33	
Chloride	mg/L	120	10.5	7.4	
Fluoride (F)	mg/L	0.12	0.08	0.08	
Nitrate (NO_3)	mg N/L	2.94	0.08	0.15	
Sulphate (SO4)	mg SO4/L	n/a	47.0	19.0	
Total Cyanide (CNt)	mg/L	0.000005	0.000004	0.000	

3.3 Discussions

3.3.1 Forecasted Concentrations

The parameters with higher forecasted concentrations than the CCME guidelines are copper for both pits, chromium (VI) for Portage Pit and selenium for Goose Pit. The forecasted concentration for selenium in Goose Pit is very close to the CCME guidelines. The forecasted concentration for chromium in Portage Pit is very close to the CCME guideline. Forecasted copper concentrations however are high relative to the CCME guidelines.

The Portage and Goose pits will become hydraulically linked once the water level in both pits reaches 131 masl. Based on the lake data available and assumptions made in the original water quality modelling, the assumption is that both pits are well mixed. Complete mixing of both pits was assumed for those parameters and the model was updated to take this into account. The new concentrations are shown in a third column for each scenario. When the complete mixing of pits is considered, copper and chromium (VI) concentrations still do not meeting the guidelines, but the selenium concentration does. These values provide an indication of the possible attenuation, but this needs to be confirmed with further modeling and monitoring.

Furthermore, in 2015, water from the South Cell TSF Reclaim Pond was flowing through the Central □ike and accumulating in the downstream basin. The □ownstream □ike water was pumped back to the South Cell TSF Reclaim Pond. This excess water was eventually transferred in 2015 to Goose Pit. This caused an increase in the load of most parameters in this pit, as seen in the graphs presented in the Appendix A. Given there were very few exceedances in Goose Pit, the impacts on the water quality at closure are not major for now, but they should be analyzed if other transfers are planned.

3.3.2 Actual Concentrations vs Forecasted Concentrations in the North and South Cells

In the figures in Appendix A, measured concentrations taken in the North and South Cells TSF Reclaim Ponds in 2014 and 2015 are plotted against the forecasted concentrations in order to assess the accuracy of the model.

Based on this comparison, the following observations can be made:

- In general, the forecasted concentrations follow the same trend as the actual measure concentration.
- There have been some unforecasted peak copper concentrations, which match peaks in cyanide concentrations measured in the North Cell during the summer of 2015. This could be due to an operational issue with the cyanide destruction system. The operating pH could be too low, leading to higher cyanide concentrations and lower copper hydroxide precipitation. Besides these peaks, the copper actual concentrations vary many times between 0 and 10 mg/L, but stays within the range of the forecasted concentrations. However, South Cell□s actual and forecasted concentrations trends are

comparable. For cyanide, both South Cell and North Cell□s forecasted trends are lower than the measured concentrations.

- For iron, both forecasted trends are slightly higher than the actual concentrations, and are more pronounced in the North Cell. This suggests that most of the iron is present as a particulate that settles out readily in the TSF.
- The nitrate measured concentrations in the North Cell vary often between 5 and 65 mg/L while the forecasted concentrations stays within the range of 10 to 55 mg/L within the same period. For the South Cell, the actual trends are a bit lower than the forecasted concentrations.
- For both the South and North Cells, the selenium measured concentration trends are slightly lower than the forecasted concentrations.
- The measured and forecasted concentrations for sulphate are similar.
- The forecasted chloride concentration in South Cell TSF Reclaim Pond matches the measured concentrations. For the North Cell, forecasted and actual concentrations are in the same range, but the actual measured values vary a lot more.
- For ammonia, forecasted and measured concentration trends for both the North and South Cells are somewhat similar.
- The total dissolved solids forecasted concentration trends are similar to the measured trends in both North Cell and South Cell.

For the 2015 Meadowbank Water Quality Forecast □pdate, the model will be adjusted for iron, chlorides, selenium and cyanide in order to better reflect the measured values taken in the North and South Cells.

3.3.3 General Comments

The model used to forecast these concentrations is based on performing a mass balance only around the North and South Cell TSF ponds and the Portage and Goose pits. It does not take into account any geochemical reactions that could help precipitate or co-precipitate some elements, thus further reducing the concentration of certain parameters in the water column. Consequently, the results of the forecast model presented in this section can be considered conservative, since it assumes no loss of load from month to month.

In the following section of the report, the impact of geochemical reactions on equilibrium concentrations in the water column will be evaluated and discussed.

4.0 GEOCHEMICAL MODELLING

4.1 General

The following section presents the results from the geochemical modelling done using the forecasted water quality model results presented in Section 3.0.

The purpose of this exercise is to determine resulting bio-available concentrations of contaminants in the water column once total suspended solids have settled and chemical equilibrium is reached (i.e. account for processes such as mixing, gas phase equilibrium, adsorption and mineral precipitation that are likely to affect liable concentrations of metals, metalloids and sulphate).

4.2 Methodology

The USGS geochemical modelling tool PHREEQC (USGS 2015) was used to evaluate the equilibrium concentration in the water column for two periods: (1) in the North and South Cell TSF Reclaim Ponds at the end of September 2018 and (2) at closure in the Portage and Goose pits in December 2028. The inputs to the model were the forecasted concentrations evaluated using the forecasted water quality mass balance model discussed in Section 3.

4.3 Assumptions

The following assumptions were made when developing the geochemical model using the PHREEQC modeling tool:

- The concentrations used in the model are dissolved concentrations.
- The results obtained under equilibrium conditions assume that all of the total suspended solids have settled out of the water column.
- The tailings are assumed to be non-reactive in terms of oxidation of sulphide content, which is likely as long as there is a sufficiently deep water cover that is maintained over the tailings. As previously mentioned in Section 3.1.4, anecdotal information suggests the absence of iron staining of tailings materials in the North Cell TSF which infers that current oxidation of the sulphide content of the tailings is minimal.
- The Goose and Portage pits are assumed to be **completely mixed systems**.
- Input ammonia and nitrate are considered collectively as nitrate for the purpose of tracking total nitrogen as there is insufficient information to describe nitrification and de-nitrification pathways in these water bodies.
- Adsorption processes are limited to those associated with amorphous phase ferrihydrite.
- Gas phase equilibrium is limited to oxygen and carbon dioxide.

- Precipitating minerals are limited to those that would reach a positive saturation index.

4.4 Results

Table 4-1 presents the concentrations established by the water quality forecast modeling tool used as an input to the geochemical model and the forecasted equilibrium concentrations evaluated using the PHREEQC modeling tool after the end of Meadowbank operations in September 2018 in North and South Cells, and in Goose and Portage pits at closure in December 2028. The results are compared against the following:

- CCME guidelines for the Protection of Aquatic Life for all parameters other than total nitrogen.
- Total nitrogen has been compared with the threshold concentration for classification of an Oligotrophic lake in terms of nutrient concentrations (Nurnberg 1996). The basis of the use of this threshold concentration is that the various lake systems that surround the mine are considered Oligotrophic (Azimuth. 2015).

Any values highlighted in bright red indicate an equilibrium concentration at closure that is higher than the adopted guideline value, while a pale red value indicates a concentration forecasted by the water quality mass balance model that is higher than the adopted guideline value at closure.

The light gray and red font cells highlight parameters that exceed the CCME guidelines based on the forecasted concentration evaluated at the end of September 2018 (i.e. period before the beginning of Whale Tail Pit operation), while the dark grey cells for that same period indicate parameters where the equilibrium concentrations are higher than the CCME guidelines.

Table 4-1: Forecasted Equilibrium Concentrations (Eq. Conc.) in the North and South Cells and Portage and Goose pits

			AT END SEPT. 2018						AT CLOSURE, BEFORE BREACHIN			
			NORTH CELL		SOUTH CELL		MIXED PITS		PORTAGE PIT		GOOSE PIT	
UNITS	*CCME GUIDELINES*	*3rd PORTAGE LAKE (avg. Summer 2015)*	*Mass Balance Conc.*	*PHREEQC Eq. Conc.*	*Mass Balance Conc.*	*PHREEQC Eq. Conc.*	*Mass Balance Conc.*	*PHREEQC Eq. Conc.*	*Mass Balance Conc.*	*PHREEQC Eq. Conc.*	*Mass Balance Conc.*	*PHREE Co*
			8.5	7.61	8.5	7.84	8.5	7.80	7.5	7.57	7.5	7.5
mg $CaCO_3$/L	*n/a*	*9.1*	11	12	69	81	59.7	69.93	10	24	10	9
mg $CaCO_3$/L	*n/a*	*12*	233	232	1546	1517	1335.8	1310.83	25	25	22	2
mg/L	*n/a*	*22.1*	1661		4247		3832.1		64		44	
mg/L			2333		6642		5950.7		100		50	
mg/L			695		1535		1400.2		22		6	
mg/L	*0.1*	*0.0018*	0.0202	0.000208	0.118	0.000378	0.102343	0.0003507	0.00362	0.000166	0.00260	0.000
mg/L	*0.0001*	*0.000005*	0.000255	0.000255	0.001615	0.001610	0.001397	0.001393	0.00000673	0.00000399	0.0000175	0.0000
mg/L	*0.005*	*0.0005*	0.00857	0.00000440	0.0538	0.0000984	0.046510	0.0000833	0.00190	0.000000129	0.000843	0.0000
mg/L	*n/a*	*0.0037*	0.0113	0.00794	0.0737	0.00466	0.06371	0.0051862	0.00392	0.00378	0.00419	0.00
mg/L	*0.00004*	*0.000003*	0.000165	0.00004	0.000975	0.00068	0.00085	0.00058	0.00000912	0.00000021	0.0000108	0.0000
mg/L	*0.001*	*0.0001*	0.0000208	0.00001	0.000127	0.00009	0.00011	0.00008	0.00299	0.00027	0.0000505	0.000
mg/L	*0.002*	*0.0005*	0.512	0.00027	3.489	0.00586	3.011	0.00497	0.0184	0.0000039	0.0236	0.000
mg/L	*0.3*	*0.0100*	0.196	0.000000011	1.304	0.000000008	1.126	0.00000001	0.0371	0.000000011	0.0186	0.0000
mg/L	*n/a*	*0.0015*	0.00313	0.00000000017	0.0188	0.0000000001	0.01631	0.0000000	0.00340	0.00000	0.00298	0.00000
mg/L	*0.000026*	*0.000003*	0.00000151	0.0000012	0.00000891	0.00001	0.0000077	0.0000077	0.00000253	0.00000043	0.00000271	0.0000
mg/L	*0.073*	*0.0002*	0.119	0.11025	0.800	0.78918	0.691	0.68025	0.00159	0.00118	0.00551	0.00
mg/L	*0.025*	*0.0006*	0.00913	0.00139	0.062	0.0616	0.053	0.05194	0.000840	0.00002	0.000981	0.00
mg/L	*0.001*	*0.0001*	0.0000671	0.00E+00	0.000447	0.00000019	0.000386	0.0000002	0.0000862	0.00000000037	0.0000542	0.00000
mg/L	*0.001*	*0.0001*	0.0300	0.0299	0.201	0.201	0.174	0.17350	0.000106	0.00011	0.00139	0.00
mg/L	*0.03*	*0.0010*	0.000298	0.00001	0.00178	0.00028	0.00154	0.0002364	0.000969	0.00001	0.00101	0.00
mg/L	*120*	*0.79*	602.3	602.3	1131.1	1131.0	1046.259	1046.2	10.8	10.8	7.4	7.
mg/L	*0.12*	*0.079*	0.096	0.096	0.582	0.582	0.504	0.504	0.0765	0.0765	0.083	0.0
mg SO4/L	*n/a*	*5.1*	915.5	914.1	3293	3292	2911	2911	48.2	47.8	19.0	18
mg/L	*0.005*	*0.001*	3.97E-10	7.70E-11	2.32	0.825	1.950	0.69	0.00000411	0.00000057	0.0000019	0.0000
mg N/L	*0.86*	*0.019*	19.9		73.0		64.5		0.454		0.326	
mg N/L	*2.94*	*0.033*	2.573		17.1		14.8		0.0847		0.153	
mg N/L	*0.35*	*0.052*	22.5	22.5	90.1	90.2	79.3	79.3	0.538	0.538	0.478	0.4

concentration for Chromium (VI).

entration for classification of an Oligotrophic lake in terms of nutrient concentrations (Nurnberg 1996).

ht red" indicate forecasted and equilibrium concentration respectively at closure that are higher than CCME guidelines.

light or dark grey" indicated forecasted and eq. Conc. parameters respectively in the North and South Cells that are higher than CCME guideline.

4.5 Discussion

Modeling of equilibrium conditions predicts that the following soluble constituents will be removed from solution to a significant extent as a result of the precipitation of various oxides, hydroxides, co-precipitates and adsorption to amorphous ferrihydrite: aluminum, arsenic, cadmium, chromium, copper, iron, manganese, mercury, nickel, lead, zinc and cyanide.

The following constituents are predicted not to undergo a significant lowering in soluble concentration as a result of the same geochemical processes: silver, barium, molybdenum, selenium, total nitrogen, chloride, fluoride and sulphate.

North & South Cells in 2018

From October 2018 to June 2019, no ore will be processed through the mill, as the Meadowbank Mine operations will have ended, and Whale Tail Pit operations will not have started yet. Therefore, no tailings deposition will occur in the North and South Cell TSF.

A simulation was performed with the geochemical tool PHREEQC to evaluate the dissolved fraction of the different constituents that will remain in solution at equilibrium. The results are presented in Table 4-1. It is observed that there is some decrease in the concentrations of most parameters of concern. However, for most of parameters, it is not enough to meet the CCME guidelines. It is noted that there are more parameters of concerns that do not meet the guidelines in the South Cell than in the North Cell.

Portage and Goose Pits in 2028

Another geochemical simulation was performed using the forecasted concentrations of December 2028, before the breaching of dykes begins between Goose Pit, Portage Pit and Third Portage Lake in 2029. The parameters of concern that do not meet the guidelines with the mass balance approach were presented in Section 3-2, which are copper in both pits, chromium (VI) in Portage Pit and selenium in Goose Pit. Total nitrogen was also added to the list of parameters and does not meet the CCME guidelines for both pits with the mass balance approach.

When modeling these parameters, the predicted equilibrium concentrations exceed the CCME guideline for total nitrogen in both pits, and for selenium in Goose Pit. It should be noted that the concentrations of these parameters are only slightly lower at equilibrium.

5.0 TREATMENT REQUIREMENTS

□ased on the results of the water quality mass balance presented in Section 3 and the PHREEQC model presented in Section 4, treatment may be required for metal removal (primarily for selenium but potentially for other metals as well if the assumption that there is no re-suspension of solids is not accurate) and ammonia (to reduce total nitrogen). Treatment could be ideally undertaken at the South Cell and the North Cell TSF Reclaim Ponds.

If high selenium concentrations persist, different treatment methods based on the adsorption process may be considered, such as□iron co-precipitation, □ero valent iron (oxidation), ion exchange, activated alumina or carbon.

If it is required to ensure that all metals are precipitated out, treatment for other metals (ie□ copper) should be planned. It may be removed through pH ad□ustment□caustic or lime can be added to the effluent to increase the pH to 9, causing the formation of metal hydroxide precipitates, which settle out. The different treatment options that may be considered to implement the precipitation of metals other than selenium are listed below□

- The existing Attenuation Pond water treatment plant (WTP) can be modified for metal precipitation with the addition of a lime or sodium hydroxide dosing system. The water will be eventually transferred from the North Cell to the South Cell TSF Pond. Then, the water could be pumped from the South Cell TSF pond to the WTP for treatment, and be recirculated back to the pond. Note that the average pH in 201□ in the Attenuation Pond was □.9□.
- Treatment in situ at South Cell TSF Reclaim Pond or at Portage and Goose pits. Lime or sodium hydroxide would be added in the pit, and the solids would settle in the pond.
- Increase the pH of the tailings water at the cyanide destruction system to favour the precipitation of dissolved metals as metal hydroxides so that they can settle out in the TSF.

If ammonia concentrations are too high, ammonia can be removed through a variety of treatment methods□

- In-situ aeration during the summer months□
- □iological treatment□
- Chemical oxidation□
- Membrane processes such as reverse osmosis□
- Ion exchange.

These technologies should be studied and evaluated in detail to determine if they are applicable to site and effluent conditions at Meadowbank. Laboratory and□or in-situ pilot tests should also be considered to validate the treatment method selected.

6.0 CONCLUSIONS

SNC-Lavalin was mandated by AEM to perform a preliminary assessment of the water quality forecast in Goose and Portage pits at closure based on the water balance developed by AEM that incorporates the additional tailings from Whale Tail Pit deposited in the existing TSF (North and South Cells).

The results of this feasibility assessment demonstrated the following□

- With regard to the water quality forecast in the pits at closure using a mass balance approach, the results show higher concentrations than the CCME guidelines for copper in both pits, chromium (VI) in Portage Pit and selenium in Goose Pit. When both pits are completely mixed, copper and selenium are still above the CCME guidelines□
- Chromium was not identified as a parameter of concern when assessing the water quality forecast with only tailings from Meadowbank only.
- In 2018, before Whale Tail Pit operations begin, many parameters could be above the CCME guidelines in North and South Cell TSF Reclaim Ponds based on the mass balance forecast approach. When evaluating the equilibrium concentrations using the geochemical modelling tool, some concentrations decrease, but in most cases, not enough to reach concentrations below the CCME guidelines□
- At closure, when evaluating the equilibrium concentrations using the geochemical modelling tool, the parameters of concern that remain above the CCME guidelines in the Goose and Portage pits are selenium and total nitrogen. Therefore these two parameters should be closely monitored and treatment should be considered in the event that these two parameters remain elevated in the TSF Reclaim Ponds. More accurate data on the Whale Tail tailings should be collected before a treatment strategy is developed.

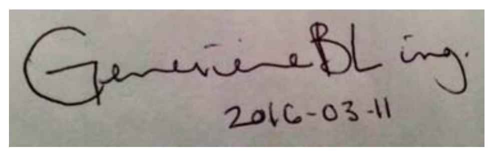
7.0 PERSONNEL

This report has been prepared by Geneviève Beaudoin-Lebeuf. We trust that this report is to your satisfaction. Should you have any questions, please do not hesitate to contact me.

Anh-Long Nguyen

SNC LAVALIN INC.
Sustainable Mine Development
Mining & Metallurgy

Prepared by:

Name	*Title*	*Signature*
Geneviève Beaudoin-Lebeuf, Eng.	Water Treatment Engineer	

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Anh-Long Nguyen, Eng.	Project Manager	

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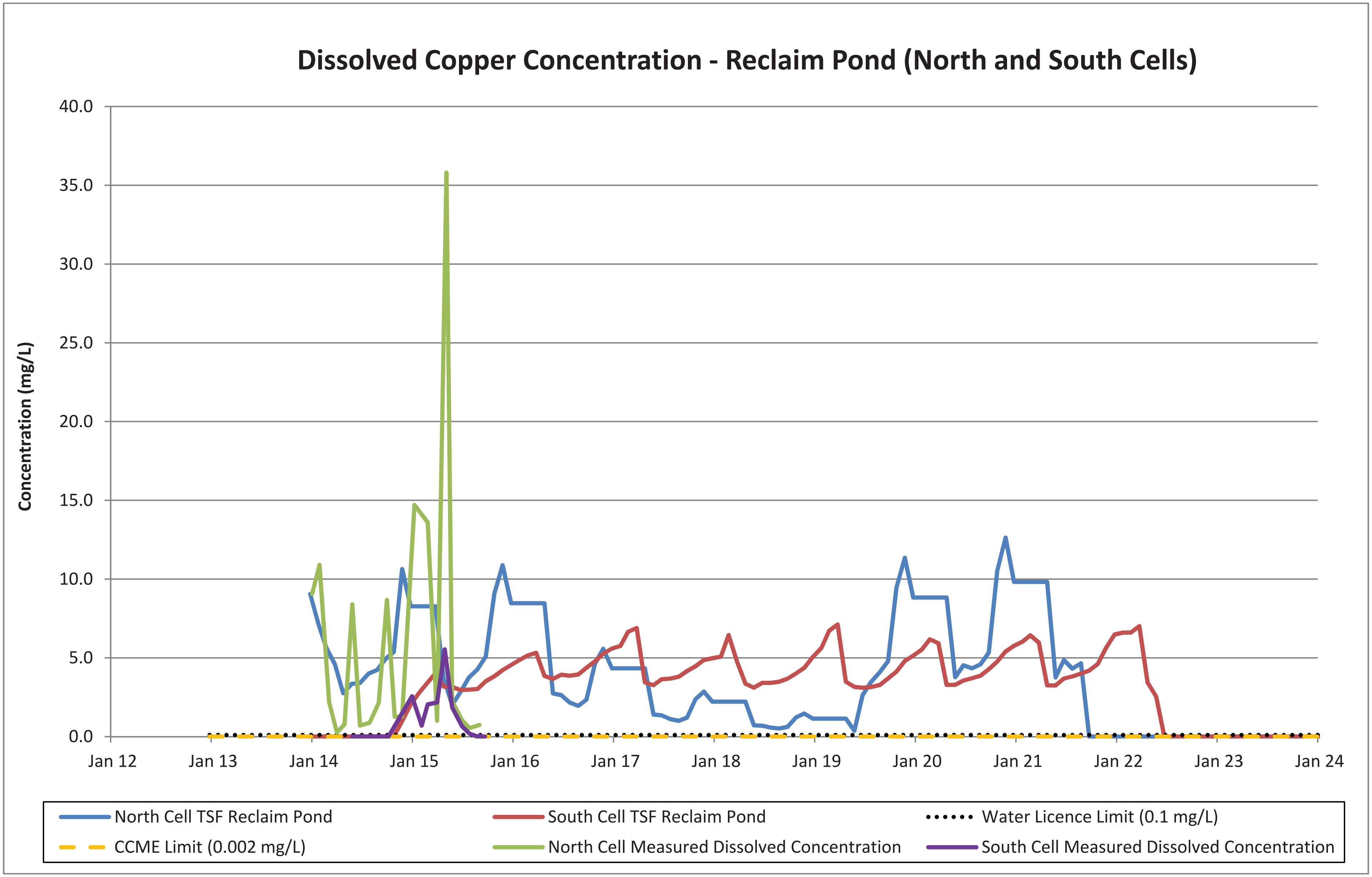
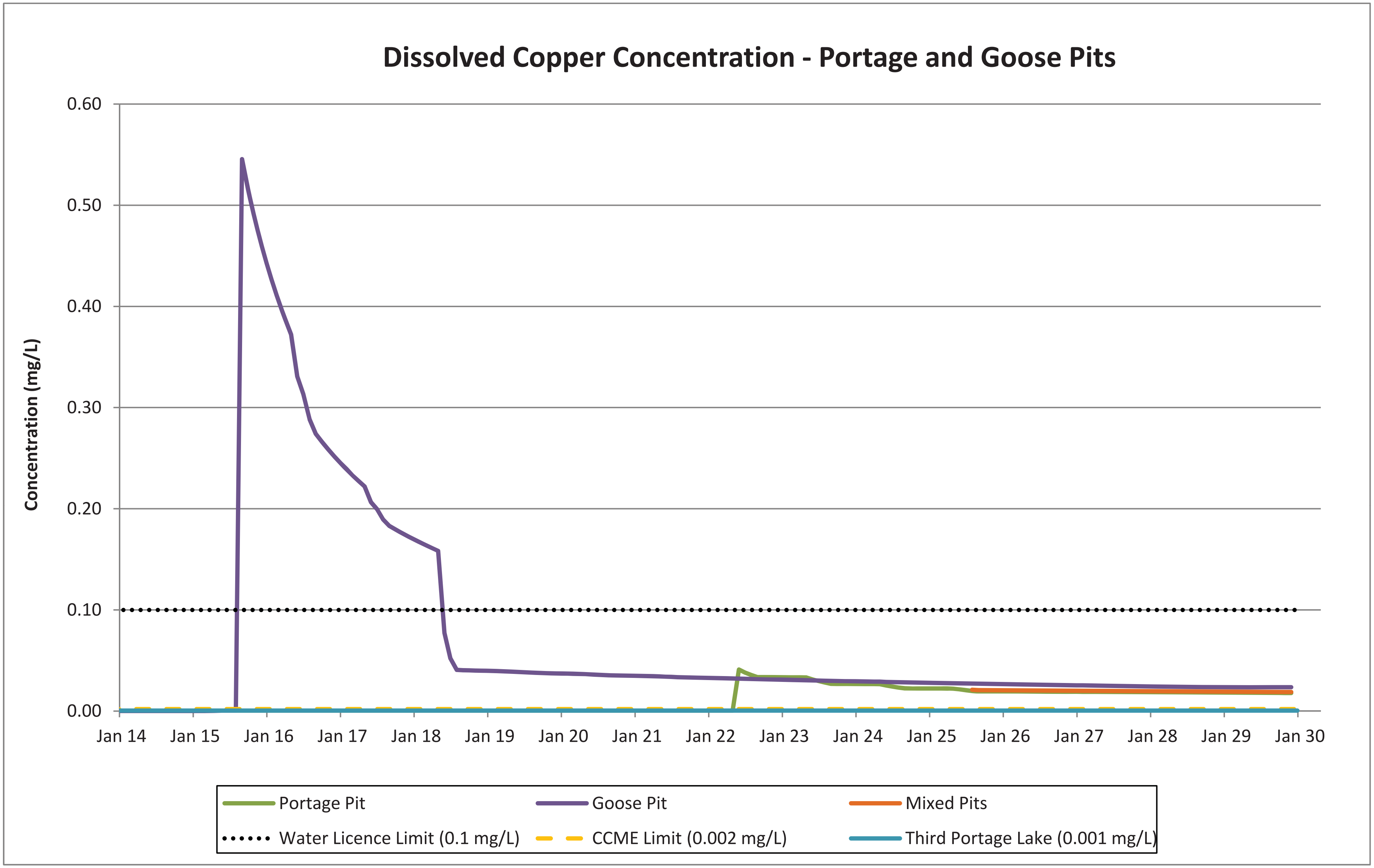
Water Quality Forecasting Figures

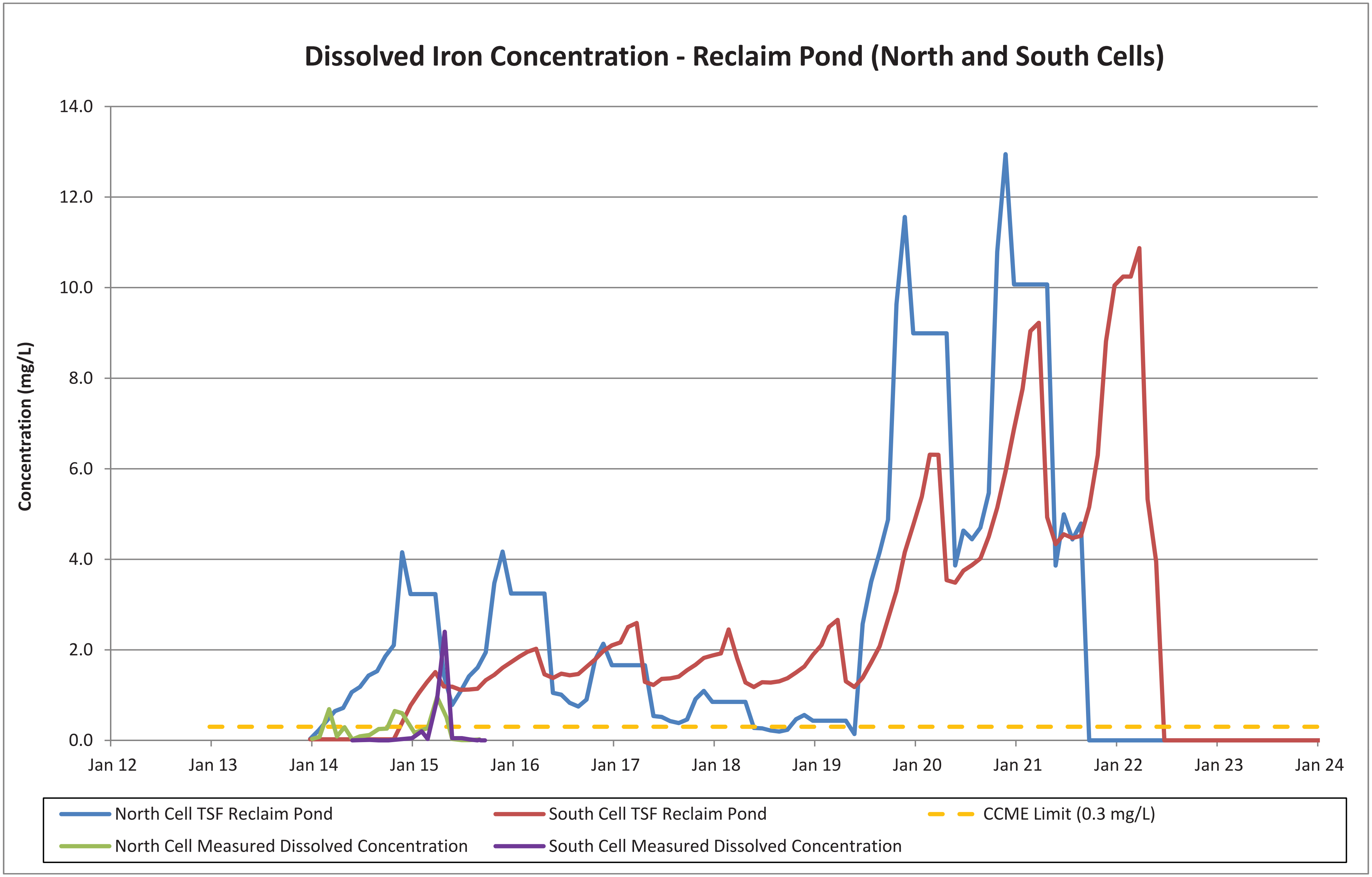
APPENDIX A

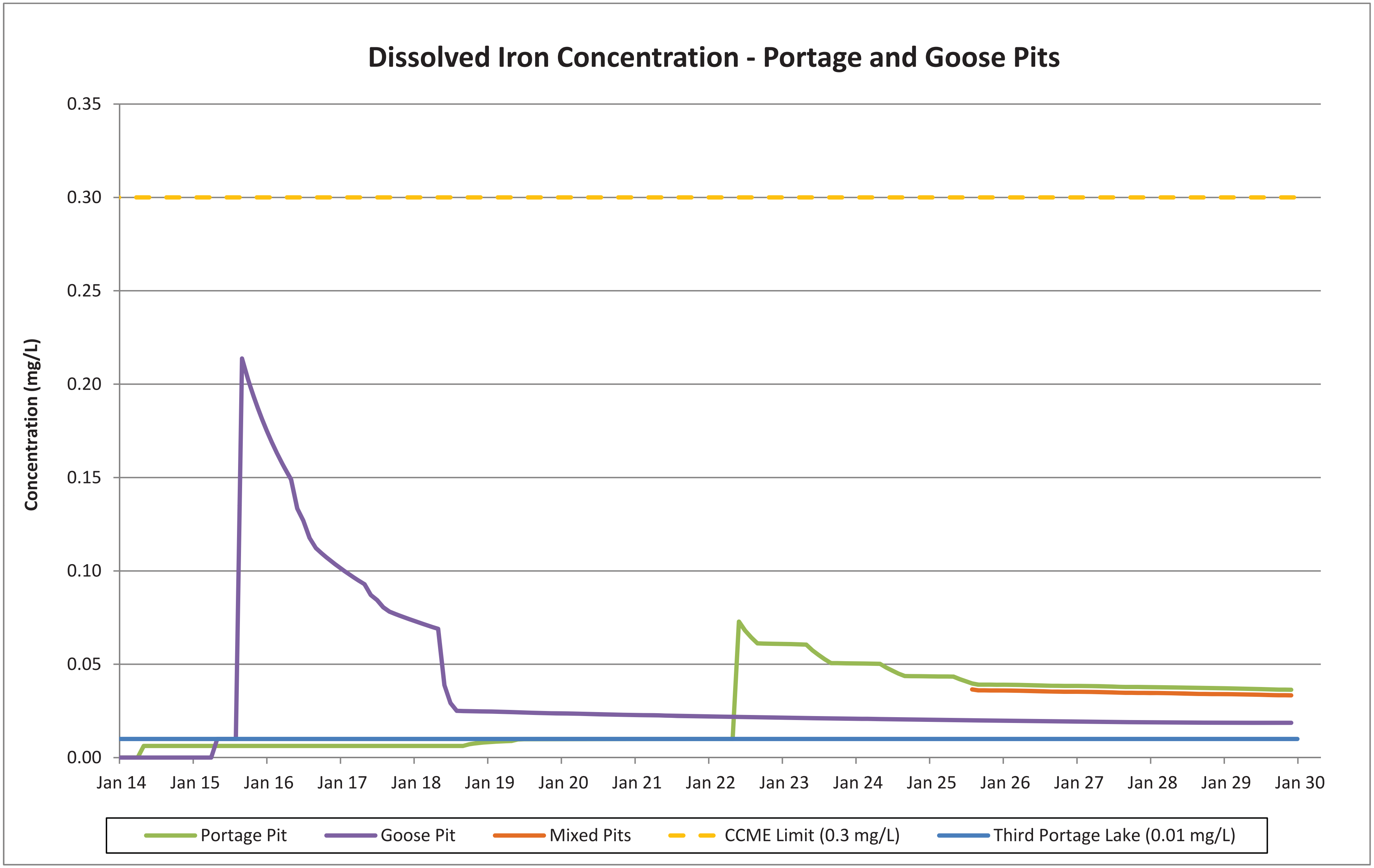


Dissolved Copper Concentration - Reclaim Pond (North and South Cells)
Concentration (mg/L)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Jan 12
Jan 13
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
North Cell TSF Reclaim Pond
South Cell TSF Reclaim Pond
Water Licence Limit (0.1 mg/L)
CCME Limit (0.002 mg/L)
North Cell Measured Dissolved Concentration
South Cell Measured Dissolved Concentration

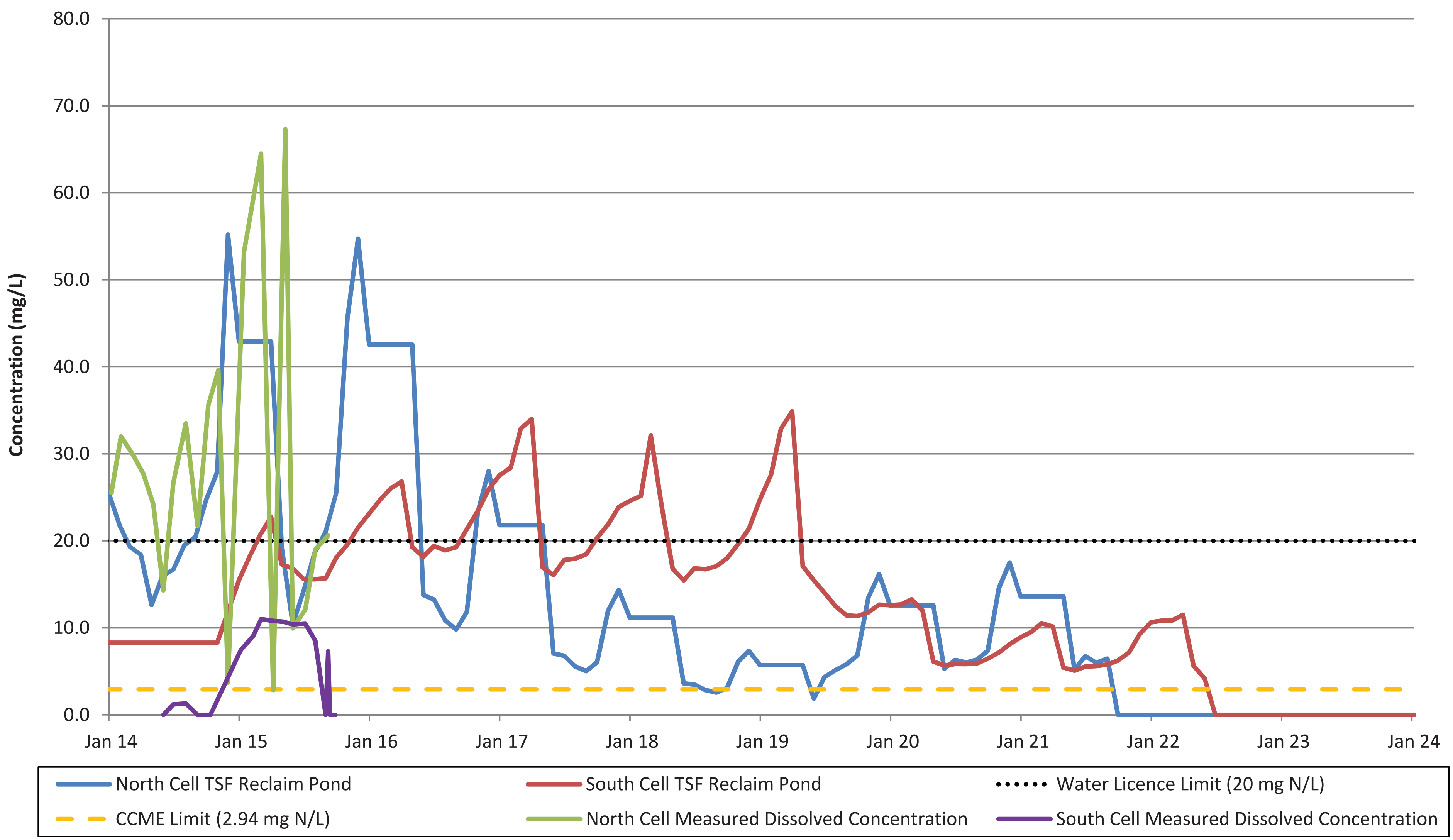


Dissolved Copper Concentration - Portage and Goose Pits
Concentration (mg/L)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
Jan 25
Jan 26
Jan 27
Jan 28
Jan 29
Jan 30
Portage Pit
Goose Pit
Mixed Pits
Water Licence Limit (0.1 mg/L)
CCME Limit (0.002 mg/L)
Third Portage Lake (0.001 mg/L)

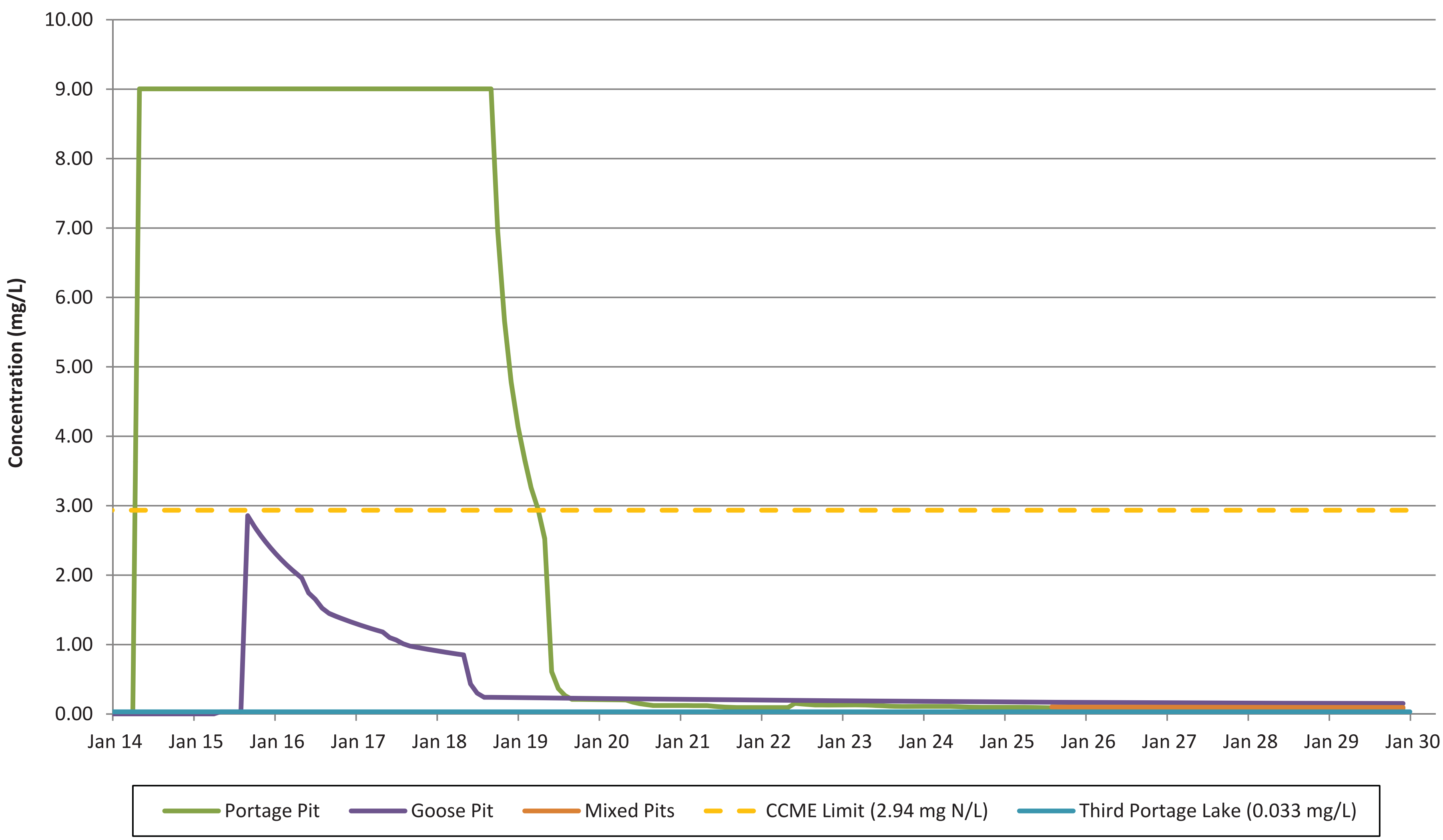

Dissolved Iron Concentration - Reclaim Pond (North and South Cells)
Concentration (mg/L)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Jan 12
Jan 13
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
North Cell TSF Reclaim Pond
South Cell TSF Reclaim Pond
CCME Limit (0.3 mg/L)
North Cell Measured Dissolved Concentration
South Cell Measured Dissolved Concentration

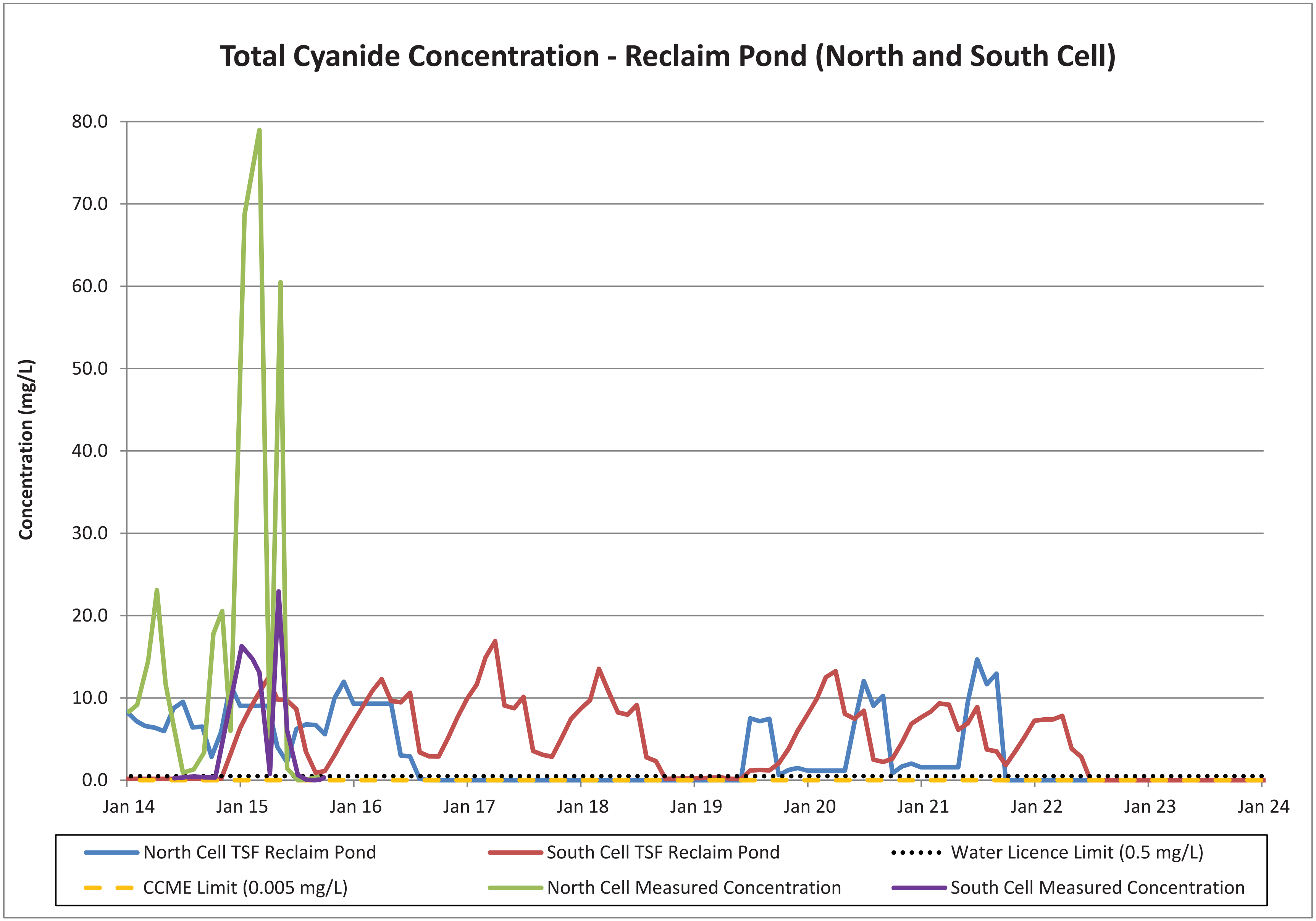

Dissolved Iron Concentration - Portage and Goose Pits
Concentration (mg/L)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
Jan 25
Jan 26
Jan 27
Jan 28
Jan 29
Jan 30
Portage Pit
Goose Pit
Mixed Pits
CCME Limit (0.3 mg/L)
Third Portage Lake (0.01 mg/L)

Total Nitrate Concentration - Reclaim Pond (North and South Cells)

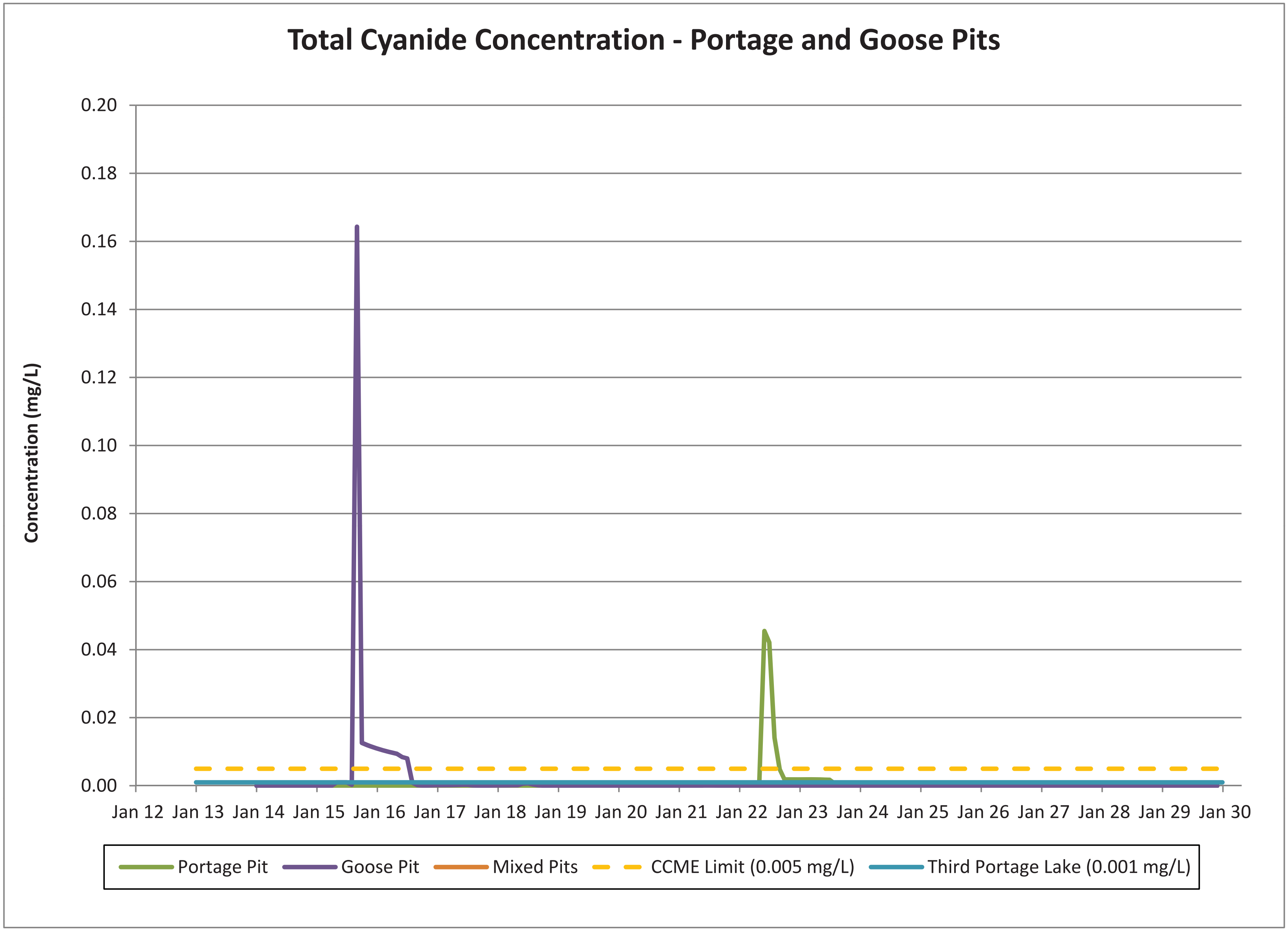


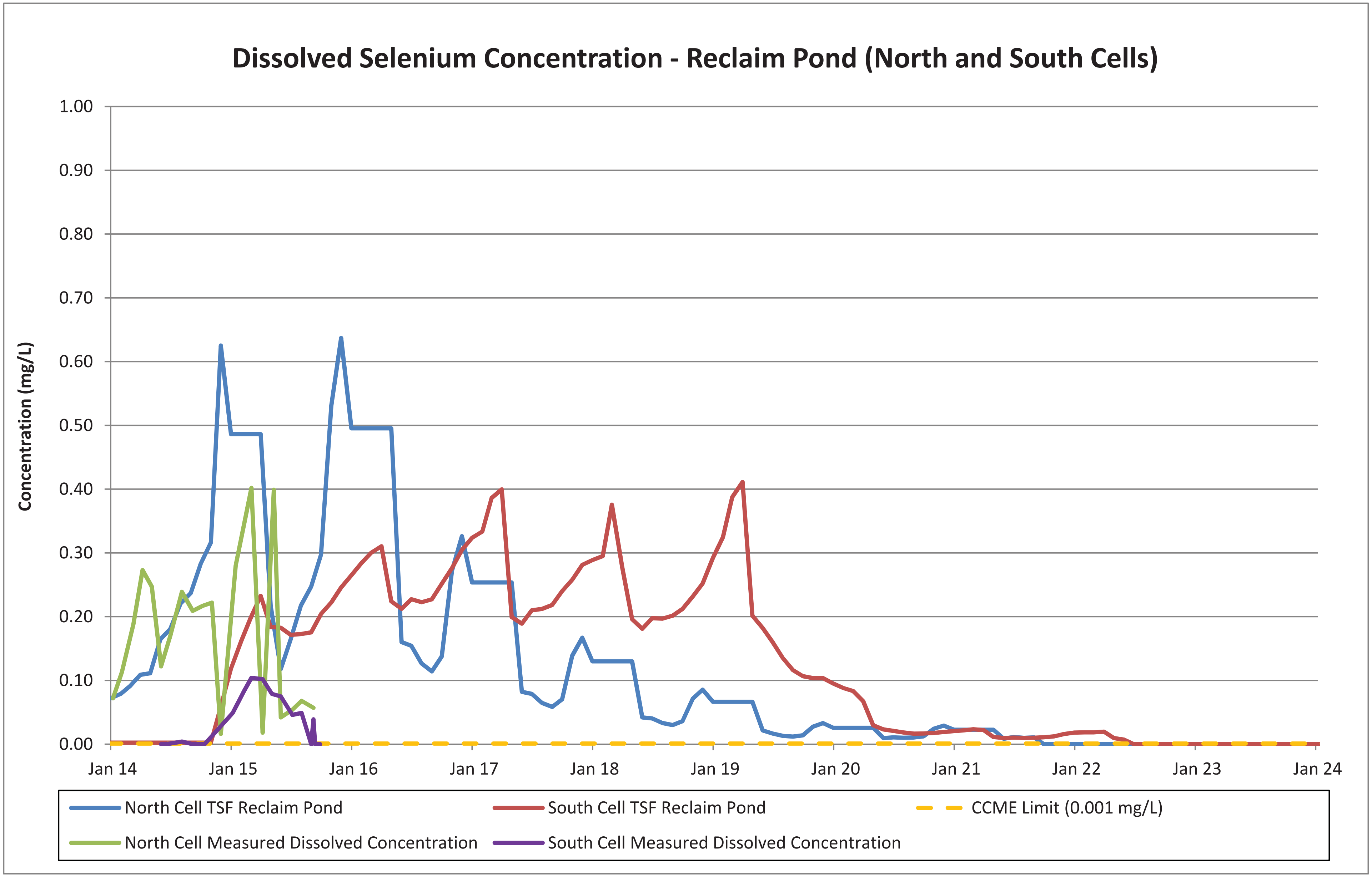
Total Nitrate Concentration - Portage and Goose Pits

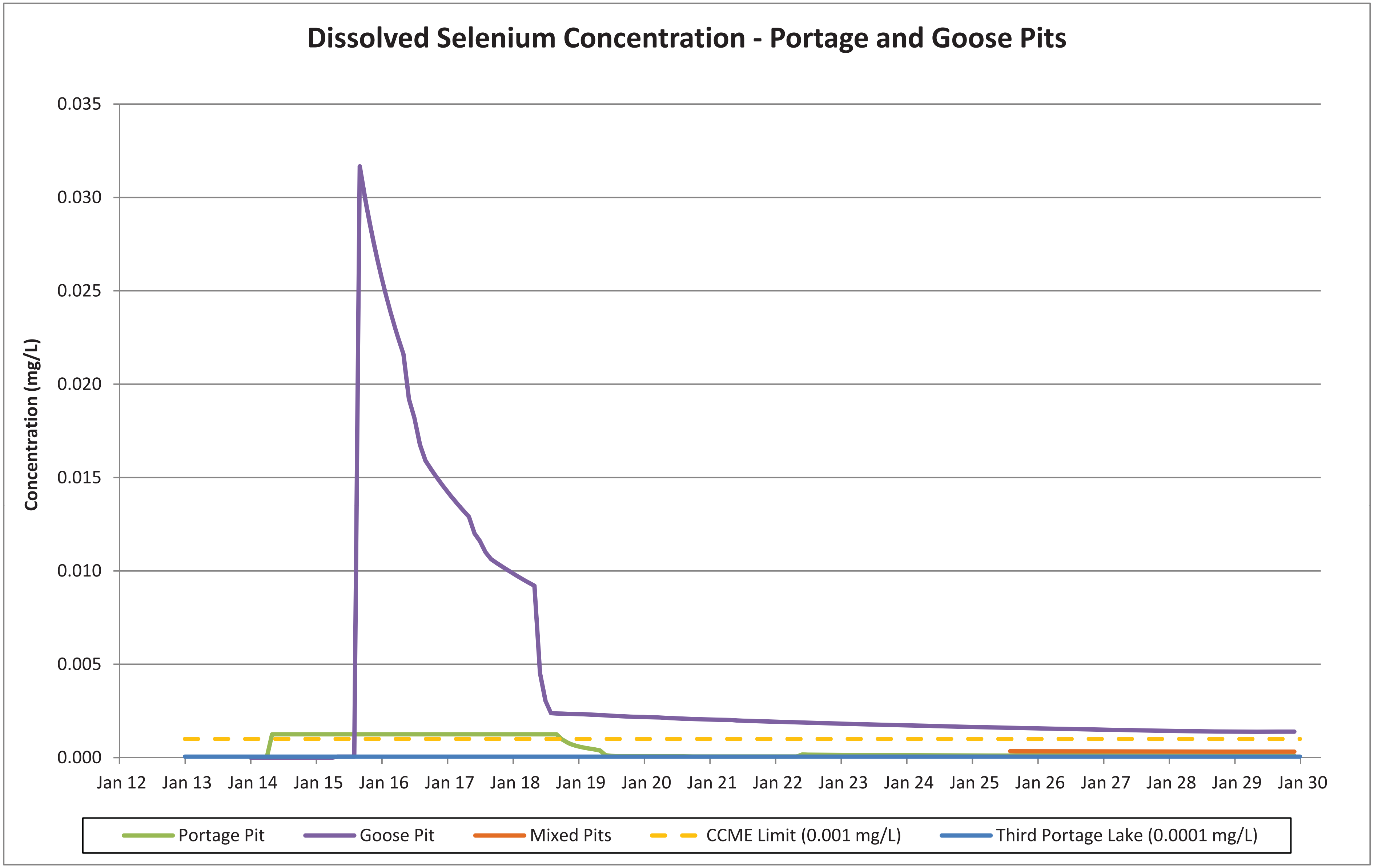


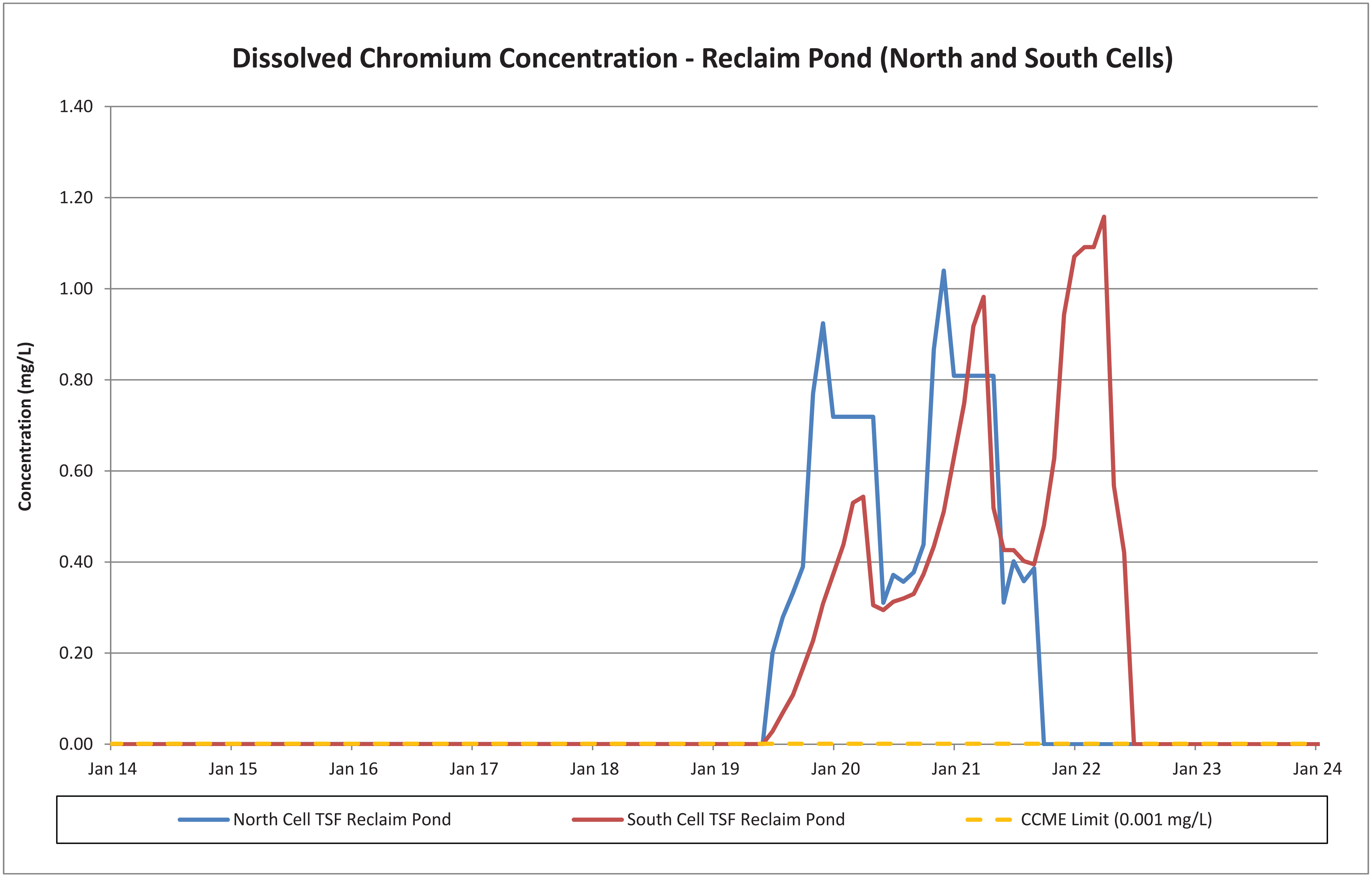


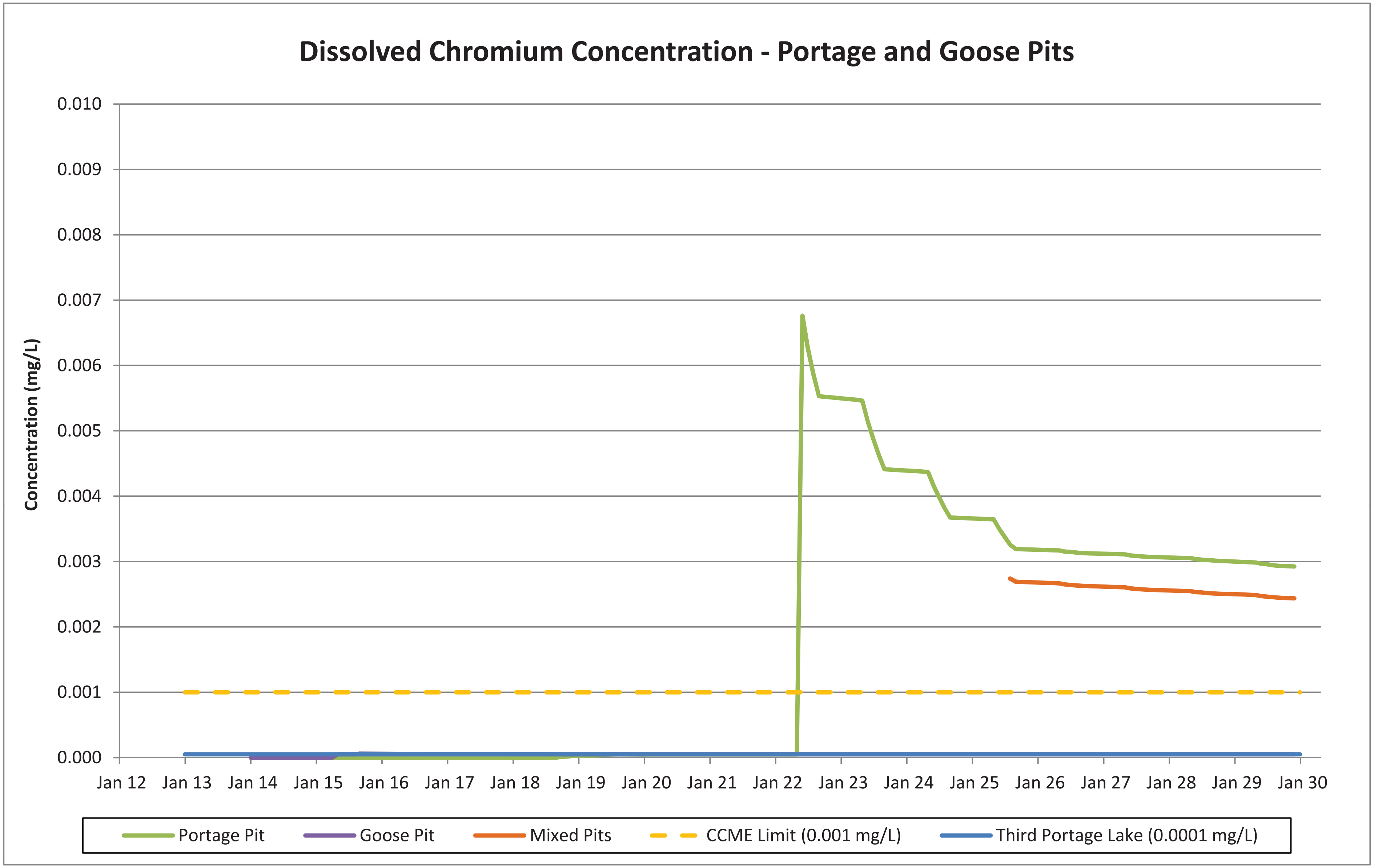
Total Cyanide Concentration - Reclaim Pond (North and South Cell)
Concentration (mg/L)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
North Cell TSF Reclaim Pond
South Cell TSF Reclaim Pond
Water Licence Limit (0.5 mg/L)
CCME Limit (0.005 mg/L)
North Cell Measured Concentration
South Cell Measured Concentration

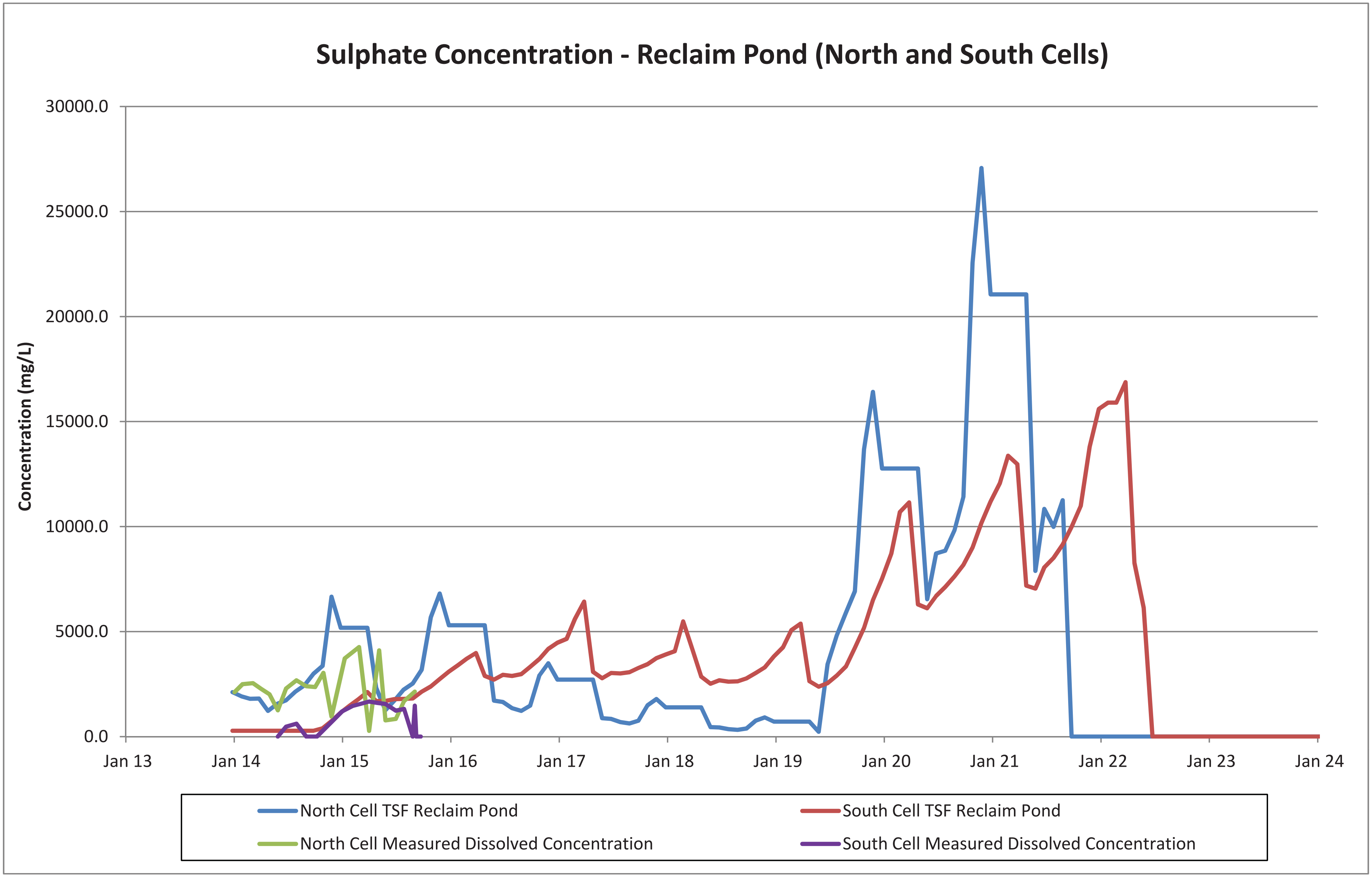

Total Cyanide Concentration - Portage and Goose Pits
Concentration (mg/L)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jan 12 Jan 13 Jan 14 Jan 15 Jan 16 Jan 17 Jan 18 Jan 19 Jan 20 Jan 21 Jan 22 Jan 23 Jan 24 Jan 25 Jan 26 Jan 27 Jan 28 Jan 29 Jan 30
Portage Pit
Goose Pit
Mixed Pits
CCME Limit (0.005 mg/L)
Third Portage Lake (0.001 mg/L)

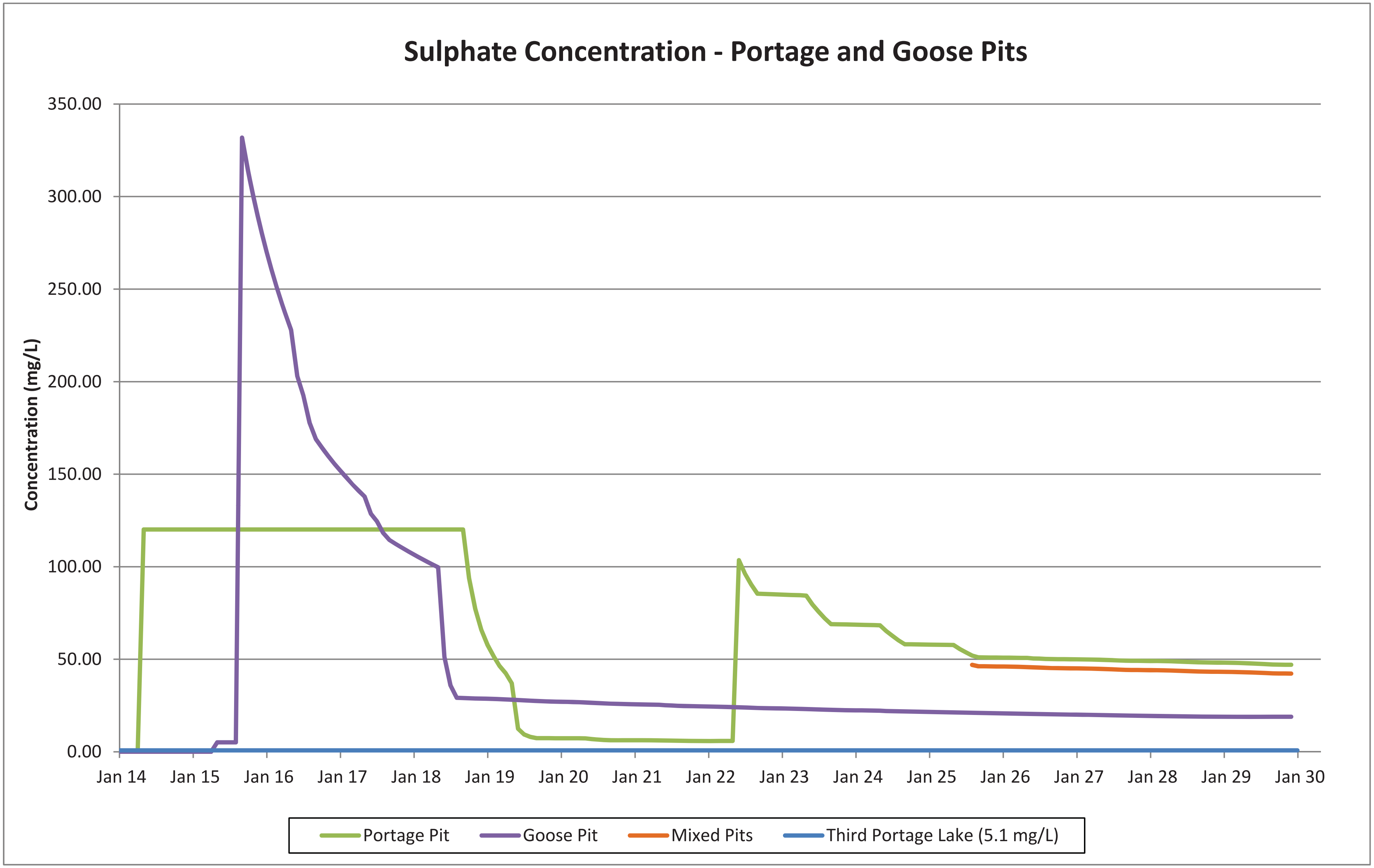

Dissolved Selenium Concentration - Reclaim Pond (North and South Cells)
Concentration (mg/L)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
North Cell TSF Reclaim Pond
South Cell TSF Reclaim Pond
CCME Limit (0.001 mg/L)
North Cell Measured Dissolved Concentration
South Cell Measured Dissolved Concentration

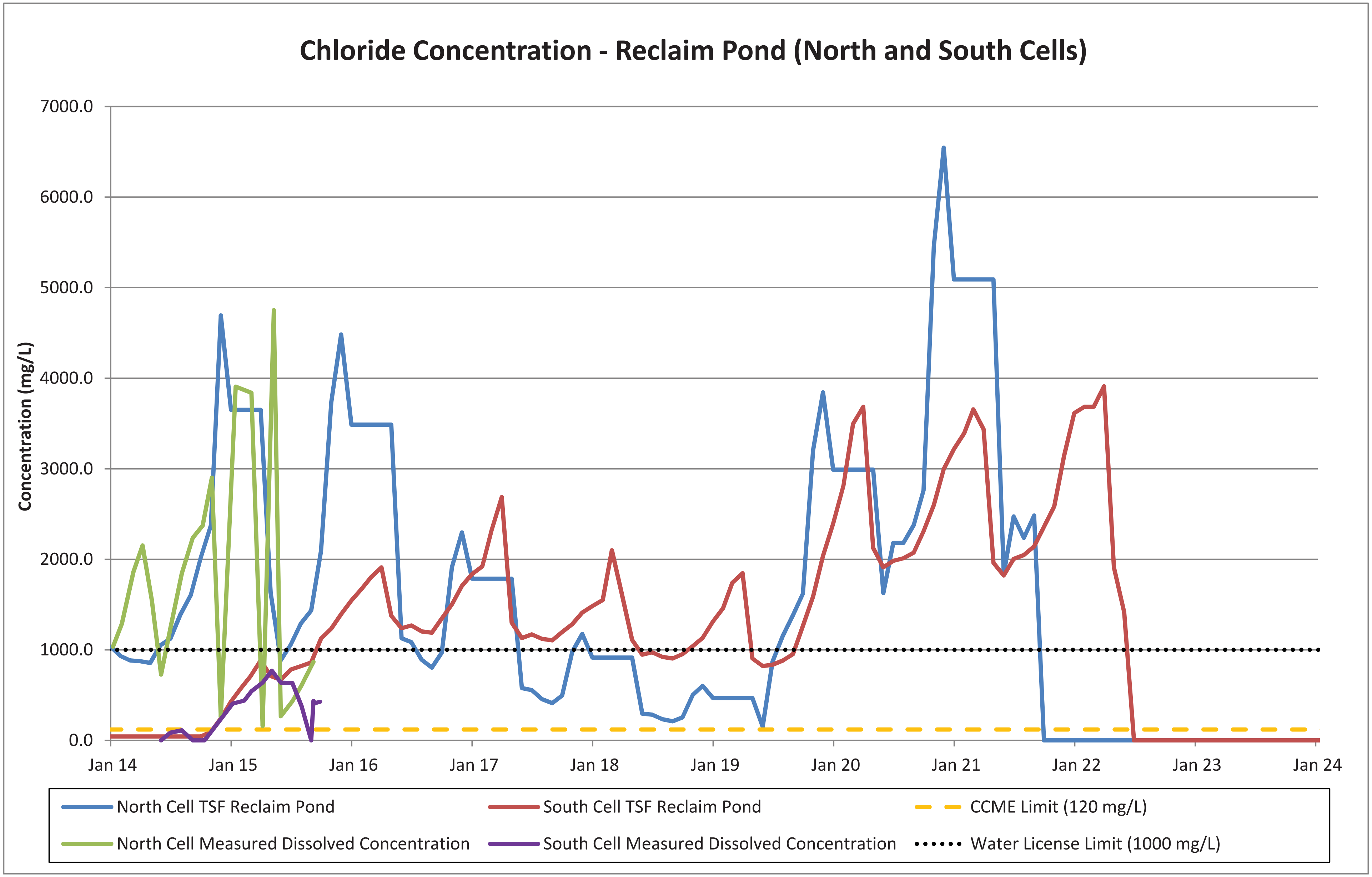

Dissolved Selenium Concentration - Portage and Goose Pits
Concentration (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Jan 12
Jan 13
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
Jan 25
Jan 26
Jan 27
Jan 28
Jan 29
Jan 30
Portage Pit
Goose Pit
Mixed Pits
CCME Limit (0.001 mg/L)
Third Portage Lake (0.0001 mg/L)

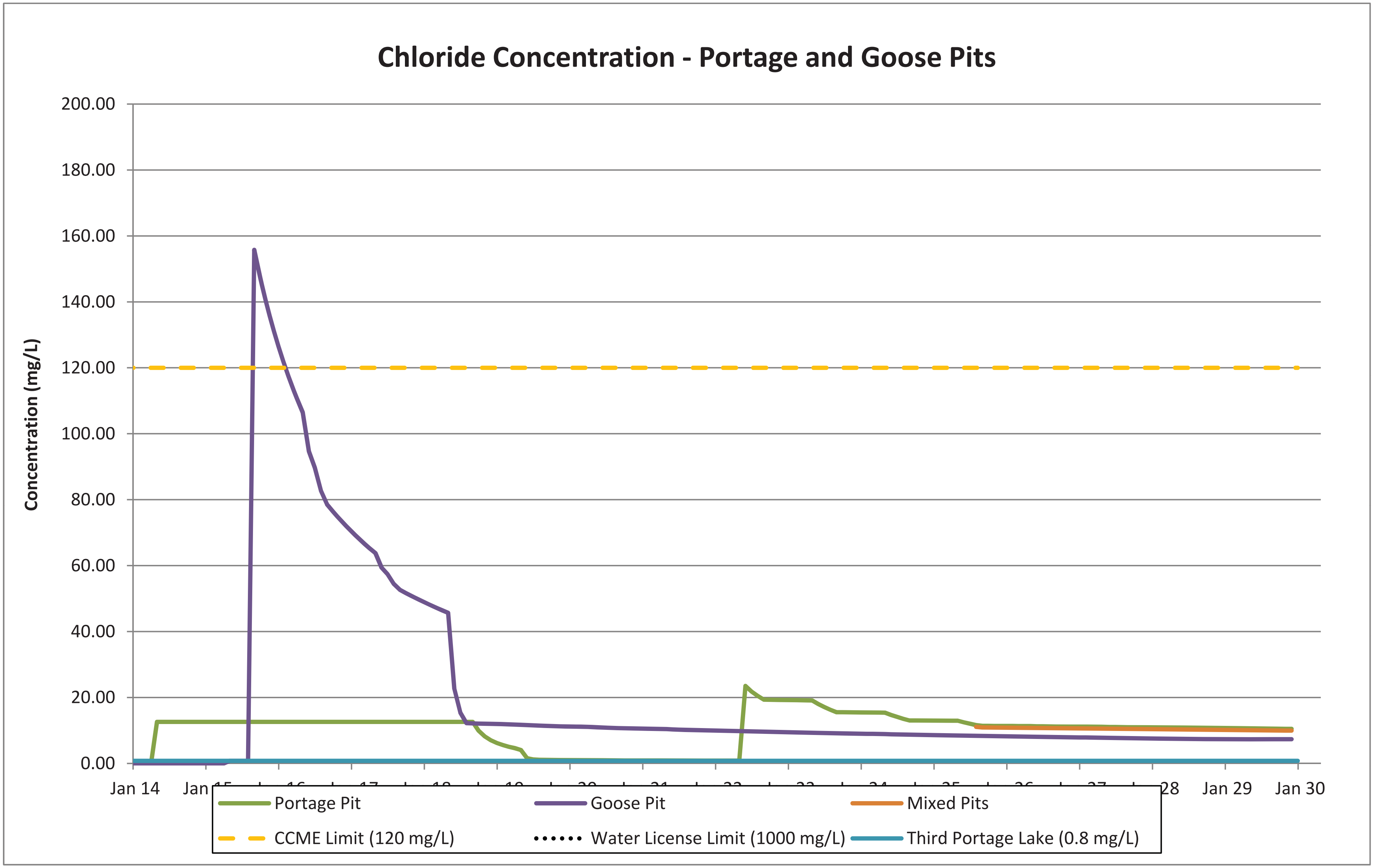

Dissolved Chromium Concentration - Reclaim Pond (North and South Cells)
Concentration (mg/L)
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
North Cell TSF Reclaim Pond
South Cell TSF Reclaim Pond
CCME Limit (0.001 mg/L)

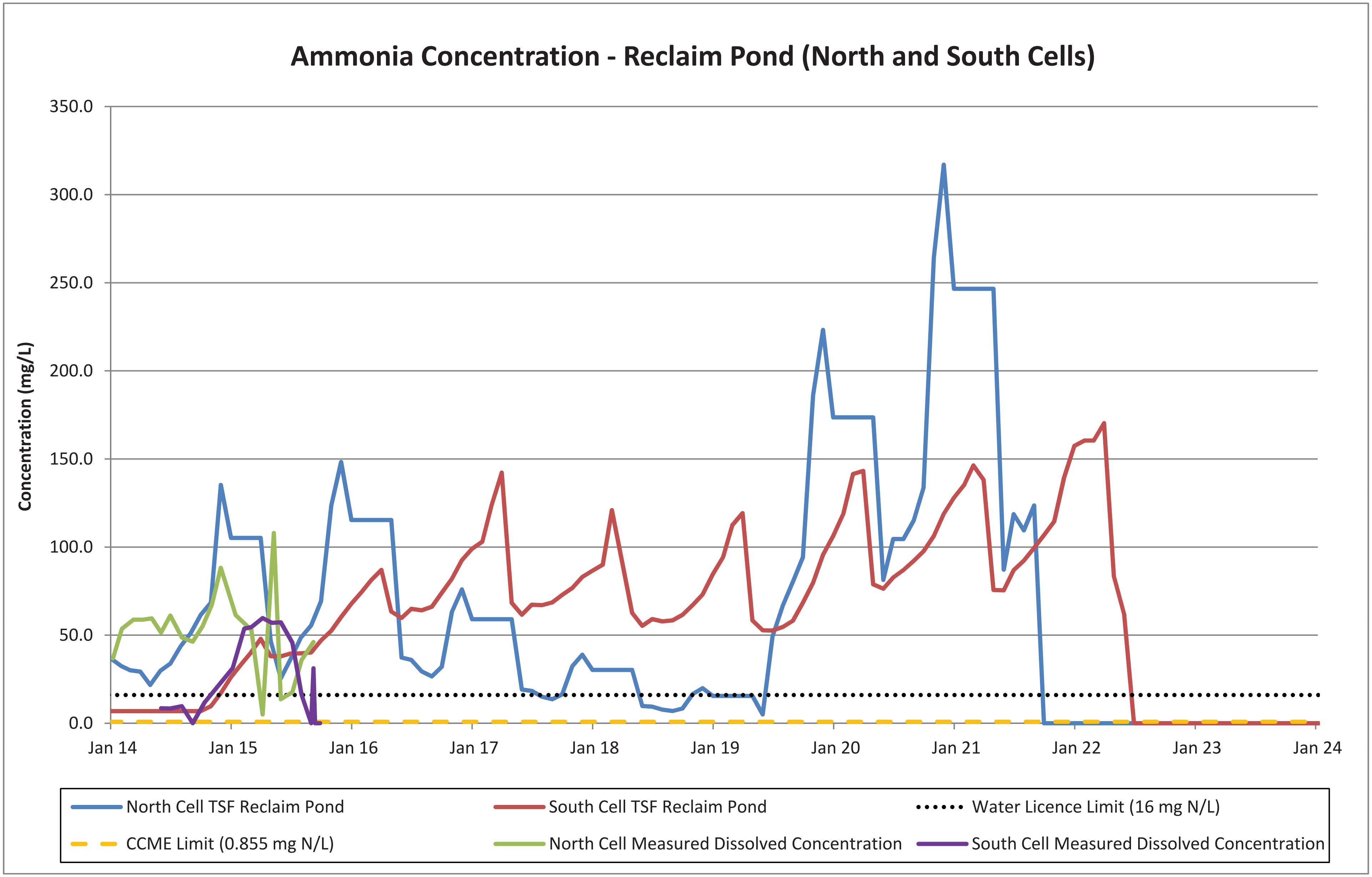

Dissolved Chromium Concentration - Portage and Goose Pits
Concentration (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
Jan 12
Jan 13
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
Jan 25
Jan 26
Jan 27
Jan 28
Jan 29
Jan 30
Portage Pit
Goose Pit
Mixed Pits
CCME Limit (0.001 mg/L)
Third Portage Lake (0.0001 mg/L)

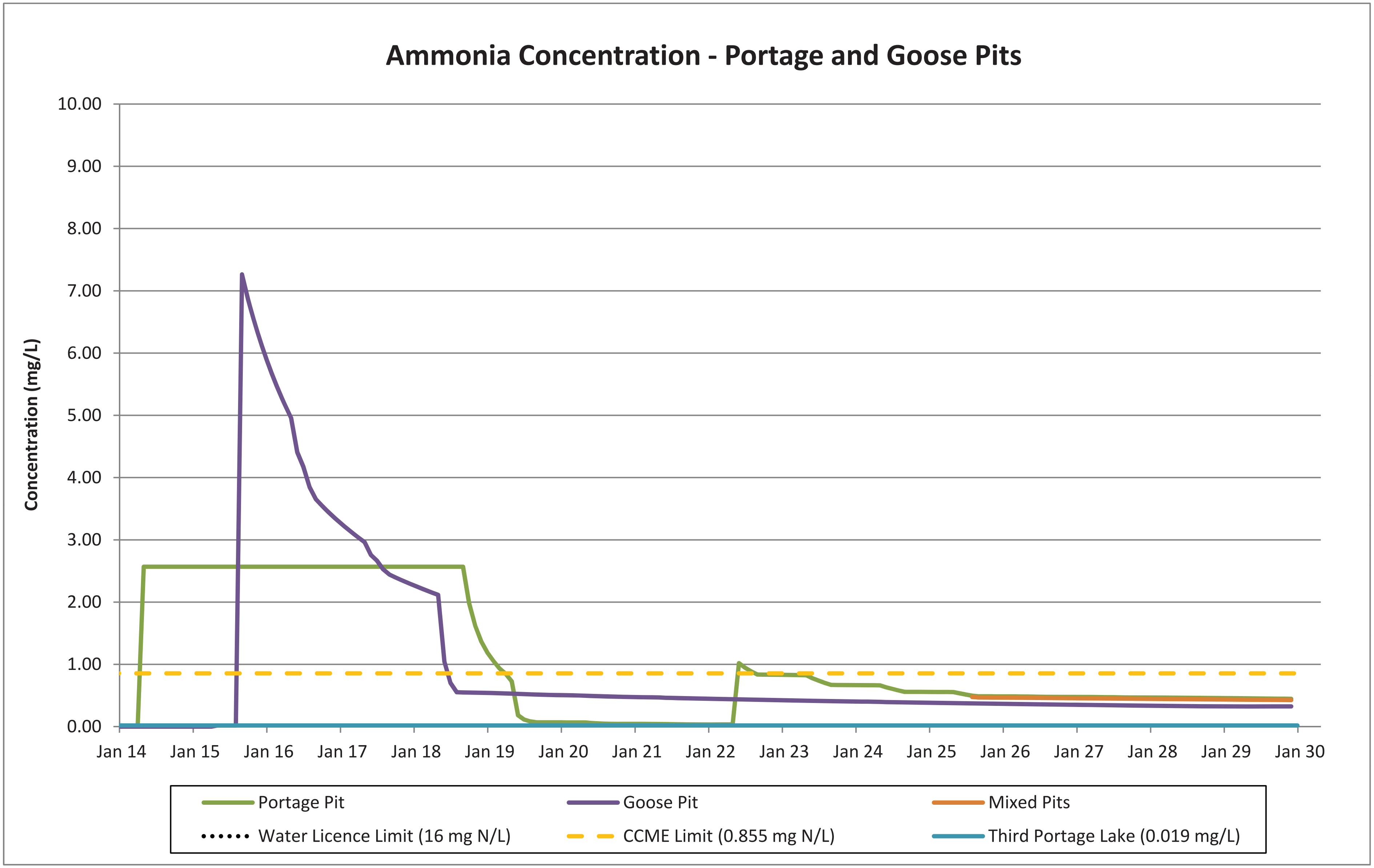

Sulphate Concentration - Reclaim Pond (North and South Cells)
Concentration (mg/L)
30000.0
25000.0
20000.0
15000.0
10000.0
5000.0
0.0
Jan 13
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
North Cell TSF Reclaim Pond
South Cell TSF Reclaim Pond
North Cell Measured Dissolved Concentration
South Cell Measured Dissolved Concentration

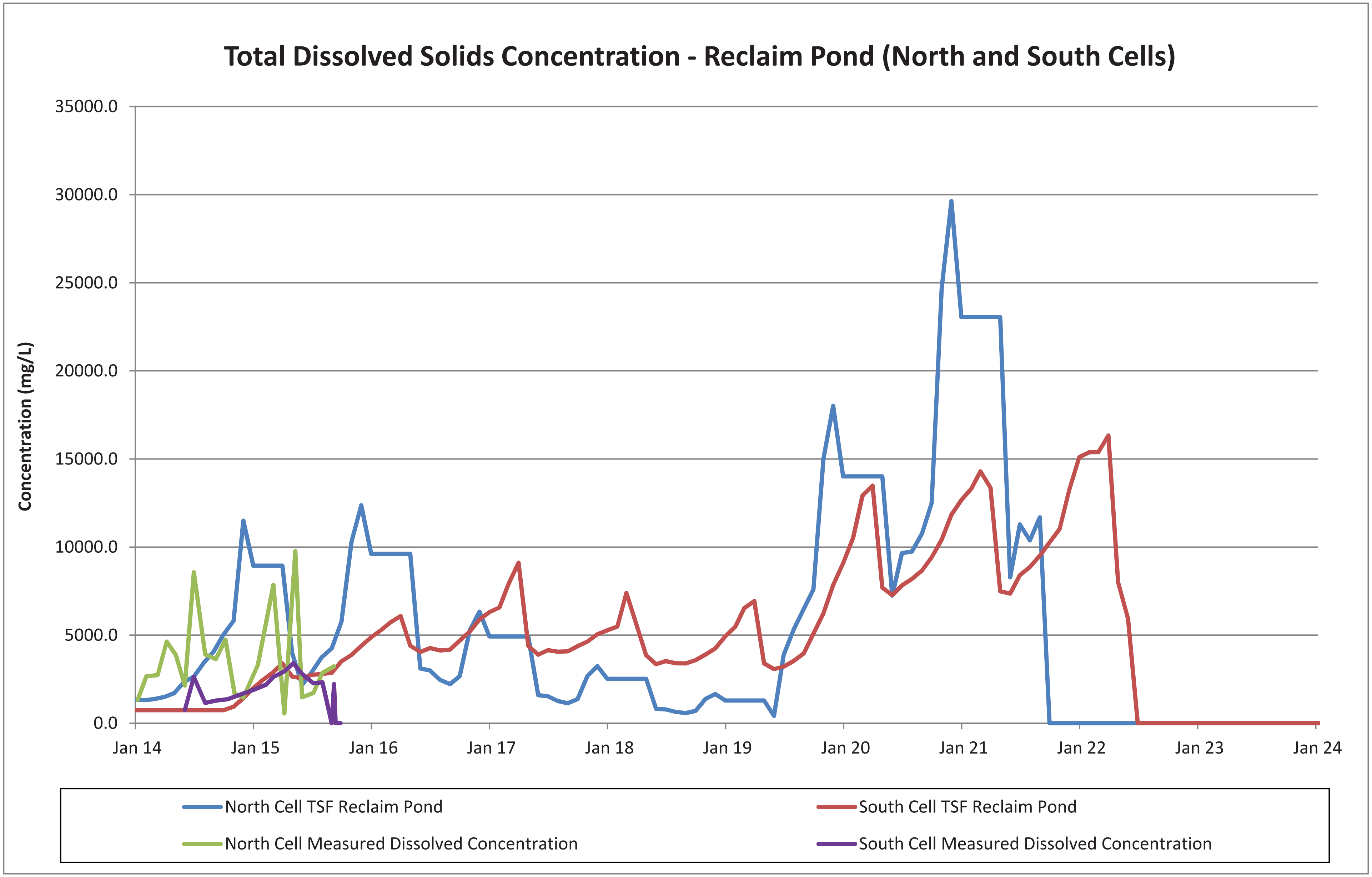

Sulphate Concentration - Portage and Goose Pits
Concentration (mg/L)
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
Jan 25
Jan 26
Jan 27
Jan 28
Jan 29
Jan 30
Portage Pit
Goose Pit
Mixed Pits
Third Portage Lake (5.1 mg/L)


Chloride Concentration - Reclaim Pond (North and South Cells)
Concentration (mg/L)
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
1000.0
0.0
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
North Cell TSF Reclaim Pond
South Cell TSF Reclaim Pond
CCME Limit (120 mg/L)
North Cell Measured Dissolved Concentration
South Cell Measured Dissolved Concentration
Water License Limit (1000 mg/L)

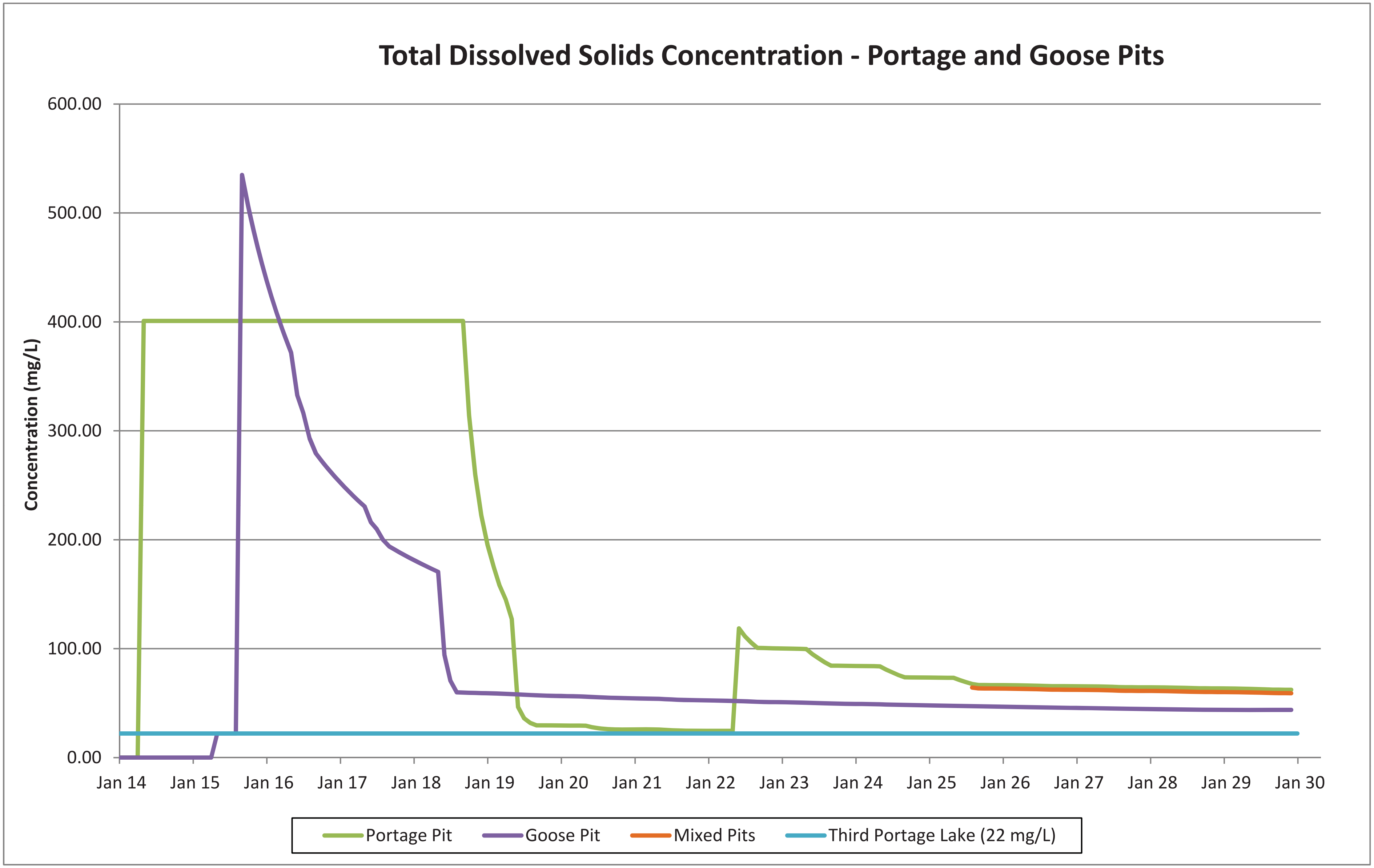

Chloride Concentration - Portage and Goose Pits
Concentration (mg/L)
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Jan 14
Jan 29
Jan 30
Portage Pit
Goose Pit
Mixed Pits
CCME Limit (120 mg/L)
Water License Limit (1000 mg/L)
Third Portage Lake (0.8 mg/L)


Ammonia Concentration - Reclaim Pond (North and South Cells)
Concentration (mg/L)
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
North Cell TSF Reclaim Pond
South Cell TSF Reclaim Pond
Water Licence Limit (16 mg N/L)
CCME Limit (0.855 mg N/L)
North Cell Measured Dissolved Concentration
South Cell Measured Dissolved Concentration


Ammonia Concentration - Portage and Goose Pits
Concentration (mg/L)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
Jan 25
Jan 26
Jan 27
Jan 28
Jan 29
Jan 30
Portage Pit
Goose Pit
Mixed Pits
Water Licence Limit (16 mg N/L)
CCME Limit (0.855 mg N/L)
Third Portage Lake (0.019 mg/L)



Total Dissolved Solids Concentration - Reclaim Pond (North and South Cells)
Concentration (mg/L)
35000.0
30000.0
25000.0
20000.0
15000.0
10000.0
5000.0
0.0
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
North Cell TSF Reclaim Pond
South Cell TSF Reclaim Pond
North Cell Measured Dissolved Concentration
South Cell Measured Dissolved Concentration



Total Dissolved Solids Concentration - Portage and Goose Pits
Concentration (mg/L)
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Jan 14
Jan 15
Jan 16
Jan 17
Jan 18
Jan 19
Jan 20
Jan 21
Jan 22
Jan 23
Jan 24
Jan 25
Jan 26
Jan 27
Jan 28
Jan 29
Jan 30
Portage Pit
Goose Pit
Mixed Pits
Third Portage Lake (22 mg/L)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