LUPIN MINES INCORPORATED
(a wholly-owned indirect subsidiary of Mandalay Resources Corp.)

February 1, 2021

Manager of Licensing
Nunavut Water Board P.O. Box 119
Gjoa Haven, NU X0B 1J0

To whom it may concern,

RE: 2020 Annual Geotechnical Inspection – Lupin Mine Tailings Containment Area, Nunavut
Lupin Mine, Nunavut, License Number 2AM-LUP2032

Please accept this cover letter with their plans to implement the engineer's recommendations. The 2020 Lupin Geotechnical Inspection Report (the "Report"), completed by Stantec, to fulfil Part J, Item 12 of water licence 2AM-LUP2032 submitted to the Nunavut Water Board. Stantec makes the following general recommendations:

Of the repairs and maintenance recommended in Table 3, it is recommended that the following repairs be prioritized:

1. Upon recommencement of closure activities in 2021, the localized failed section of Dam M should be repaired.
2. Monitor the seepage at the downstream toe of the divider dyke for erosion and potential instability. Repair as needed in 2021 when access is available.
3. Monitor the proximity of the breached location in Dam L for any seepage and potential instability. Repair as needed in 2021 when access is available.
4. Monitor the water level behind Dam N and lower the water level to maintain a minimum 1m freeboard.

After the completion of the priority repairs, LMI should consider carrying out the following repairs:

- Once the repair at Dam M is completed, re-slope the buttress to 2H:1V as per design for the closure configuration. Similar re-sloping should be done to the buttress at Dam K to achieve the closure configuration.
- Monitor the seepage at Dam 2 and manage it as necessary by pumping the seepage back into Pond 2.
- General repairs o downstream surfaces and upstream slope erosion at the HWM.

LMI will carry the out geotechnical engineers prioritized repairs as list below during the 2021 season. The Engineers report was issued to LMI in December 2020 and there were no activities or personnel at site due to the time of the year. As noted in the Geotechnical Report LMI did carry out work as per the 2019 Geotechnical Report and other areas as requested by the engineer.

1. Upon recommencement of closure activities in 2021, the localized failed section of Dam M should be repaired. LMI will also be carrying out the closure work as per the construction drawings filed with the NWB in July 2020 under Part G, Item 1.
2. Monitor the seepage at the downstream toe of the divider dyke for erosion and potential instability. Repair as needed in 2021 when access is available.
3. Monitor the proximity of the breached location in Dam L for any seepage and potential instability. Repair as needed in 2021 when access is available.
4. Monitor the water level behind Dam N and lower the water level to maintain a minimum 1m freeboard.

After the completion of the priority repairs, LMI will continue carrying out the following:

- Once the repair at Dam M is completed, re-slope the buttress to 2H:1V as per design for the closure configuration. Similar re-sloping should be done to the buttress at Dam K to achieve the closure configuration. LMI submitted the construction drawings for Dam K in July 2020 under Part G, Item 1
- Monitor the seepage at Dam 2 and manage it as necessary by pumping the seepage back into Pond 2.
- General repairs to downstream surfaces and upstream slope erosion at the HWM

If you have any questions regarding the above, please do not hesitate to contact me.

Sincerely,

Lupin Mines Incorporated

"Karyn Lewis"

Karyn Lewis

2020 Lupin Mine Tailings Area Inspection Report

Annual Geotechnical Inspection of the Tailings Containment Area

December 18, 2020

Prepared for:

Lupin Mines Incorporated

Prepared by:

Alvin Tong, P.Eng.

Revision	Description	Author		Quality Check		Independent Review	
0	Draft	AT	Nov 16			TP	Nov 17
1	FINAL	AT	Dec 16				

Sign-off Sheet

This document entitled 2020 Lupin Mine Tailings Area Inspection was prepared by Stantec Consulting Ltd. ("Stantec") for the account of Lupin Mines Inc. (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

REGISTERED PROFESSIONAL ENGINEER
C. A. TONG
LICENSEE
Dec. 18 2020
NT/NU

Prepared by ______________________________

(signature)

Alvin Tong, P.Eng.

Reviewed by ______________________________

(signature)

Tim Peterson, P.Eng.

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1.0 INTRODUCTION

Lupin Mines Incorporated (LMI) retained Stantec Consulting (Stantec) to complete the annual geotechnical dam inspection at the Lupin Mine tailings containment area (TCA). The Lupin Mine site is currently undergoing active closure and operates under the Nunavut Water License 2AM-LUP1520 (NWB 2015) for LMI. LMI is a wholly-owned indirect subsidiary of Mandalay Resources.

The Lupin Mine is located on the northwest shore of Contwoyto Lake, approximately 400km northeast of Yellowknife, Northwest Territories (Figure 1). The site consists of a mill, camp and support facilities, fuel storage, airstrip, and the TCA (Figure 2). A detailed view of the mill site is provided in Figure 3 and of the TCA in Figure 4.

The water license explicitly requires an annual geotechnical inspection to be completed for the TCA internal and external dams, TCA reclamation covers, including a quantitative assessment of any seepage from the TCA (NWB 2015). Stantec has provided a qualified person to conduct the geotechnical inspection to fulfill the requirements listed in Part E, Item 6 of the water license, which stipulates the following:

“The tailings containment area shall be constructed, operated and maintained to engineering standards such that:

- A minimum freeboard of 1.0 meter shall be maintained at all times or as recommended by a geotechnical engineer and as approved by the Board in writing;
- Seepage from the Tailings Containment Area is minimized;
- Any seepage that occurs is collected and returned immediately to the Tailings Containment Area;
- Erosion of constructed facilities is addressed immediately;
- The solids fraction of the mill tailings shall be permanently contained within the Tailings Containment Area or underground as backfill.
- Implement measures to ensure that the Tailings Containment Area is adequately covered or managed, including the use of approved binding agents, to prevent windblown tailings from impacting other areas of the project site;
- During care and maintenance, inspection shall be carried out on a bi-weekly basis during the freshet (approx. May and June), and monthly during the reminder of the open water period (approx. July – October) of the following:
  - Collection and return of seepage in Dam 2;
  - Water levels in Ponds 1 and 2, and Cells 3 and 5;
  - General surface erosion and anomalies on dams; and,
  - Toe erosion along Dam K and surface erosion at locations on the crest. Manage and route surface flow as necessary to prevent further erosion over the crest of Dam K.
  - Monitor the condition and any potential seepage through the Divider Dyke.
  - Records of these inspection shall be kept for review upon the request of an Inspector, or as otherwise approved by the Board.
  - More frequent inspections shall be performed at the requests of an Inspector.
  - An inspection of the Tailings Containment Area shall be carried out annually during ice free, open water condition by a geotechnical Engineer. The Engineer’s report shall be submitted to the Board within sixty (60) days following the inspection and shall include a cover letter from the Licensee outlining an implementation plan to respond to the Engineer’s recommendations.”

This report summarizes Stantec's observations of the TCA's condition in 2020 and presents our recommendations. Previous annual inspections, safety reviews, and risk assessments with respect to the TCA made available to Stantec include:

- Construction reporting during active closure activities;
- Inspection Report from 2019 by Stantec Consulting;
- Inspection Report from 2018 by Stantec Consulting;
- Inspection Report from 2017 by Norwest Corporation;
- Inspection Report from 2016 by Norwest Corporation;
- Inspection Reports from 2012-2015 by SRK Consulting;
- 2015 Dam Safety Review Report by SRK Consulting; and,
- 2012 TCA Risk Assessment and Water Quality Review by SRK Consulting.

While the annual inspection is carried out to satisfy the license requirements, the format and methodology used are in accordance to the best engineering practice using the Inspection and Maintenance of Dams Safety Guidelines issued by the Province of British Columbia, Water Management Branch (BCWMB 2011) and the Mining Association of Canada (MAC) Guidelines.

1.1 PROJECT DESCRIPTION

1.1.1 Location and Access

The Lupin Mine is only accessible by air or winter road. The air access is serviced by a gravel runway, capable of handling large aircraft such as Hercules C-130 and Boeing 737 jets. Charter flights are typically deployed from Yellowknife for worker rotation and re-supply during the open water seasons. When the mine was in operation, it used the Tibbitt to Contwoyto Winter Road to resupply the mine. This winter road currently ends at the Ekati Diamond Mine and has not been extended to the Lupin Mine since 2005, when the mine went into care and maintenance status.

1.1.2 History and Current Status

Currently the Lupin Mine is in active closure and licensed accordingly. Mining operations ceased in 2005. Current closure activities include, but are not limited to, mill demolition, water treatment and discharge, water quality monitoring, tailings cover construction, dam repairs, and waste management as needed.

1.1.3 Site Infrastructure

The mine site consists of the following main structures: mill site, camp and support facilities, fuel storage, airstrip, and tailings containment area (TCA).

- The mill site included an underground hoist and wheelhouse, ball mill, concentrator, and a paste backfill plant (all now decommissioned and demolished).
- The camp and support facilities included multiple wings of accommodations for workers, an office building, recreation facilities, cool and warm storage, generators (all now demolished). In additional there are sewage lagoons and dams, and waste management facilities. Gravel roads are in place to connect the facilities.
- Fuel storage includes the main tank farm that contains diesel fuel for annual operation, along with fuel for aircraft. Fuel is pumped to a satellite tank farm as needed for equipment fueling and power generation to minimize the

risk of spillage and accidents from using the large fuel tanks at the main farm. Most of the fuel tanks are not decommissioned and demolished.

- The airstrip is a gravel runway that can accommodate aircraft up to the size of a Boeing 737 jet.
- The TCA consists of a number of frozen core dams that provide a closed system for tailings and water treatment. Tailings are contained in a number of cells and progressive reclamation is ongoing and has now been completed at several cells. Water treatment is carried out using Pond 1 as a holding pond for effluent, treating the water in a plant, and then using Pond 2 as a polishing pond to allow the solids to precipitate prior to discharge to the environment. Details of the TCA configuration are described in Section 2 of this report.

1.2 CLIMATE

Stantec evaluated the climate data from an automated weather station known as Lupin (CWIJ) available in the Weather Underground database (WU 2016). Intermittent climate data is also available from the Environment Canada database under station Lupin CS Climate ID 230N002. The climate data evaluation was done from May 2005 to April 2017. The climate data evaluation has not been updated in since 2018 as the data was not made publicly available. The evaluation results indicate the station reported an annual mean temperature of -13°C. The average winter temperature, from October to April, was around -21°C. The average summer temperature, from May to September, was around 8°C. Annual total precipitation was averaged to be around 592mm, where the data does not differentiate between snow and rain. The mean wind direction was south-southeast, with average wind speed of 16km/h and high of 50km/h.

1.3 SITE GEOLOGICAL CONDITIONS

The Lupin Mine is located in the Archean metaturbidite sequence of the Contwoyto Formation. The rocks have been subjected to both regional and contact metamorphism, including deformations and intrusions.

The area was glaciated, and experienced isostatic rebound after the melt. The glaciers and runoff from the melt washed out the erodible soils and formed lakes in low lying areas. The easily erodible glaciolacustrine and glacio-fluvial sands were reworked and displaced by the meltwater and resulted in the outcrops present with thin soil veneers, abandoned beaches and esker formations (Kinross 2005). Where bedrock is not present at the surface, the overburden typically consists of coarse grained glacial till which is intermittently covered by glaciolacustrine and glacial-fluvial deposits. The till is a silty sand with gravel and boulders, with low plasticity and ice depending on the depth.

1.4 PERMAFROST AND DAM GEOTECHNICAL CONDITIONS

The site is within a continuous permafrost region. The active layer is observed to be variable between the depth of 2m to 3m based on available data. During operation, scheduled monitoring was completed of all instrumentation, recording water levels, water quality and production volumes. This monitoring program was reduced accordingly during the care and maintenance period and is now carried out when work is being done on site. Thermistors are installed in several dams and in the tailings cover to monitor their performance. Some of the thermistors are no longer functional or damaged beyond repair. The remaining thermistors are read at least once annually during the geotechnical inspection and more often when site access allows. The thermistor readings indicate that permafrost remains within the dams and reclaimed tailings, and the readings are consistent with historical variation and limits.

2.0 TAILINGS CONTAINMENT AREA DAMS

The tailings are primarily comprised of amphibole and quartz, which account for 80% of the volume. Pyrrhotite and arsenopyrite make up an additional 17%. The tailings have been shown through various studies to have a potential for acid generation (Kinross 2005). All of the tailings are contained within the TCA.

The Lupin Mine TCA consists of eight (8) perimeter dams and nine (9) internal dams. The perimeter dams are Dams 1A, 1B, 1C, and Dams 2 through 6. The internal dams are Dam 3a through 3e, Dams J through N, and the Divider Dykes. Combinations of the perimeter dams and internal dams form Tailings Cells 1 through 5 for containment. As the progressive reclamation is being completed, some of the internal dams (3a, 3b, 3c, 3e) are incorporated into the cover and are no longer considered as individual dams. Currently, Cells 1 and 2 are completely reclaimed, while Cell 3 is approximately 85% covered and Cell 5 is approximately 75% covered with the latest closure activities. About 87% of the entire tailings area is reclaimed with at least 1m of sand/gravel cover. No new tailings have been produced since 2005 when the site went into care and maintenance status.

All dams are constructed from esker sands and gravels, with the perimeter dams and Dam K, incorporating a geosynthetic liner for seepage control. All the perimeter dams are designed as frozen core dams founded on permafrost. Generally, the perimeter dams range in height from 1 to 8 meters. The internal dam heights range from 6 to 12 meters.

The active closure procedures for water management, direct runoff and seepage from Cell 3 into Cell 4. The water in Cell 4 then flows through the Divider Dykes either though the control structure or by seepage into Pond 1. Cell 5 runoff is preferably pumped directly into Cell 4, but sometimes goes into Pond 1 for expedient operation. The Pond 1 water level is managed by siphoning water into Pond 2. Water treatment is carried out by treating the water in-situ in Pond 2, by adding lime to raise the pH. Precipitates from this treatment are deposited in Pond 2. The treated water in Pond 2 is siphoned into the environment in accordance with the Water License requirements (NWB 2015). Pond 2 does not have any flood overflow structures, such as a spillway or a control gate, to manage the water level. All water is retained, and discharge is restricted until water quality meets the discharge requirement outlined in the Water License (NWB 2015).

2.1 DAM CONSEQUENCE CLASSIFICATIONS

Stantec utilized the Canadian Dam Association Guidelines (CDA 2014) to classify the consequence classification of each dam. The CDA consequence classifications are shown in

Table 2.1. The dam consequence classifications of the dams based on Stantec's 2020 inspection are outlined in Table 2.2. These consequence classifications are in line with the classifications outlined in the 2015 Dam Safety Review (SRK 2015).

An emergency preparedness plan (EPP) is noted by the DSR (SRK 2015) to be in place and deemed appropriate for care and maintenance status. Stantec did not review the EPP. Due to the lack of transportable tailings, permanent population, or infrastructure downstream of the perimeter dams, a detailed inundation study is deemed non-applicable.

Table 2.1: CDA Dam Consequence Classifications

Dam Class	Population at Risk(1)	Incremental Losses		
		Loss of Life(2)	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	• Minimal short-term loss; • No long-term loss	Low economic losses Area contains limited infrastructure or services
Significant	Temporary only	Unspecified	• No significant loss or deterioration of fish or wildlife habitat • Loss of marginal habitat only • Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	• Significant loss or deterioration of important fish or wildlife habitat • Restoration or compensation in kind highly possible	High economic losses affecting infrastructure, public transportation, and commercial facilities
Very High	Permanent	100 or fewer	• Significant loss or deterioration of critical fish or wildlife habitat • Restoration or compensation in kind possible but impractical	Very high economic losses affecting important infrastructure or services (e.g. highway, industrial facility, storage facilities for dangerous substances)
Extreme	Permanent	More than 100	• Major loss of critical fish or wildlife habitat • Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services (e.g. hospital, major industrial complex, major storage facilities for dangerous substances)

Note 1. Definition for population at risk:
None - There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure. **Temporary** - People are only temporary in the dam-breach inundation zone (e.g. seasonal cottage use, passing through on transportation routes, participating in recreational activities). **Permanent** - The population at risk is ordinarily located in the dam-breach inundation zone (e.g. as permanent resident); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimate of potential loss life (to assist in decision-making if the appropriate analysis is carried out).
Note 2. Implication for loss of life:
Unspecified - The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

Table 2.2: Lupin TCA Dam Consequence Classifications

Dam		Consequence Classification	Rationale
Perimeter Dams	1A	Significant	Release of water that might not meet discharge criteria into the environment
	1B	Significant	Release of water that might not meet discharge criteria into the environment
	1C	Significant	Release of water that might not meet discharge criteria into the environment
	2	Significant	Release of water that might not meet discharge criteria into the environment
	3	Low	No free-standing water; Stable reclaimed tailings with very limited impact consequence upon failure
	4	Significant	Release of water that might not meet discharge criteria into the environment
	5	Low	No free-standing water; Stable reclaimed tailings with very limited impact consequence upon failure
	6	Low	No free-standing water; Stable reclaimed tailings with very limited impact consequence upon failure
Internal Dams	3D	Low	Any release of effluent or tailings are contained within the TCA
	J	Low	Any release of effluent or tailings are contained within the TCA
	K	Low	Any release of effluent or tailings are contained within the TCA
	L	Low	Any release of effluent or tailings are contained within the TCA
	M	Low	Any release of effluent or tailings are contained within the TCA
	N	Low	Any release of effluent or tailings are contained within the TCA
	Divider Dykes	Low	Any release of effluent or tailings are contained within the TCA

3.0 2020 TCA INSPECTION

3.1 GENERAL

Mr. Alvin Tong, P.Eng., a Senior Geotechnical Engineer with Stantec, conducted the geotechnical inspection on the 17th and 18th of September 2020. Detailed visual inspection was completed on all TCA components, along with readings of instrumentation. Mr. Dave Vokey, representative of LMI, was on site for communication and organization, but did not accompany Stantec on the inspection.

The weather during inspection was below freezing and overcast with sunny periods. Detailed inspection and photograph logs are provided in Appendix A.

The general observations indicated that the perimeter dams are in stable condition. Various earthwork was done in 2020 as part the closure activities and emergency water management. The divider dyke and Dam L were raised by 0.5m and 0.8m, respectively, for emergency water management to prevent overtopping. Prior to the emergency raise, Dam L was mechanically breached and backfilled by the contractor to dewater Cell 3 without the engineer-of-record (EOR) authorization or engineering oversight. During repair of Dam M, earthwork equipment has caused a localized minor failure at the downstream face of the dam. Dam K received maintenance and repairs this year. The Pond 2 water level was lowered significantly by the water treatment and discharge operation, providing a freeboard upwards of 5m at the perimeter dams.

Since the inspection in September, LMI has transferred some water from Cell 5 to Pond 1 and Cell 3 into Cell 4, but Stantec was informed that the freeboards in Pond 1 and Cell 4 were not compromised.

3.2 INSTRUMENTATION

3.2.1 Thermistors

Thermistors were installed in the TCA between 1995 and 2004 to monitor the performance of the dams and tailings covers. From the existing records, there were thirteen thermistors installed in the dams, but only five of them are currently functional. There were seven functional thermistor last year, but the one thermistor located on each Dam 1A (D1A-00-01s) and Dam 4 (D4-3) were damaged this year and cannot be readily repaired without specialized equipment and supplies. Of the five functioning thermistors, three are in the perimeter dams and two are in the internal dams. There are an additional seven thermistors installed in the reclaimed tailings cover, but three of them do not have calibration data on record to evaluate the results. This report focuses on the thermistor readings from dams, using the thermistor readings from the cover for reference and comparison.

The thermistors were read monthly during operation up until 2006, and then read semi-annually during care and maintenance. Not all the functioning thermistors were read consistently throughout the care and maintenance period. To provide a point of reference in this report, selected data series between August and September, from year 2010 to 2020, are shown for comparison, while maximum values are calculated from the entire series from the first available records to 2014.

For the perimeter dams, the four functioning thermistors are less than 20m deep. The four thermistor readings are shown in the figures below. The data suggests the 2020 readings are within the historical variations, taking into account annual climatic variations and time of reading. Generally, the active layer (thaw zone) ranges from 2m to 3m depth, as interpolated by the 0°C gradient line. The largest historical variation in the 2020 data set is approximately 3.3°C (between -1.2°C and -4.5°C) in Dam 1 (D1A-00-01s) at the depth of 7m.

Figure 3-1: Thermistor Reading for Dam 2

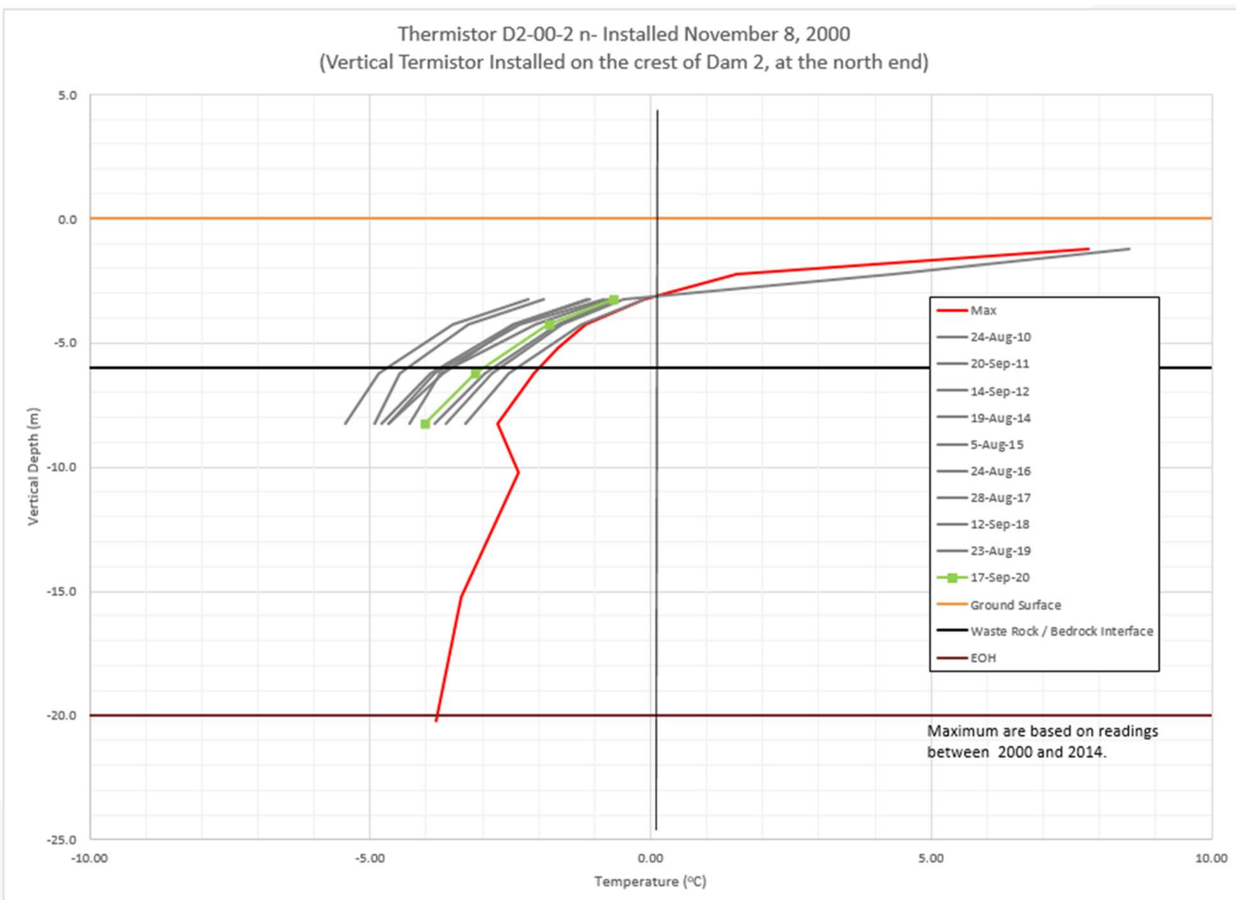


Figure 3-2: Thermistor Reading for Dam 4-1

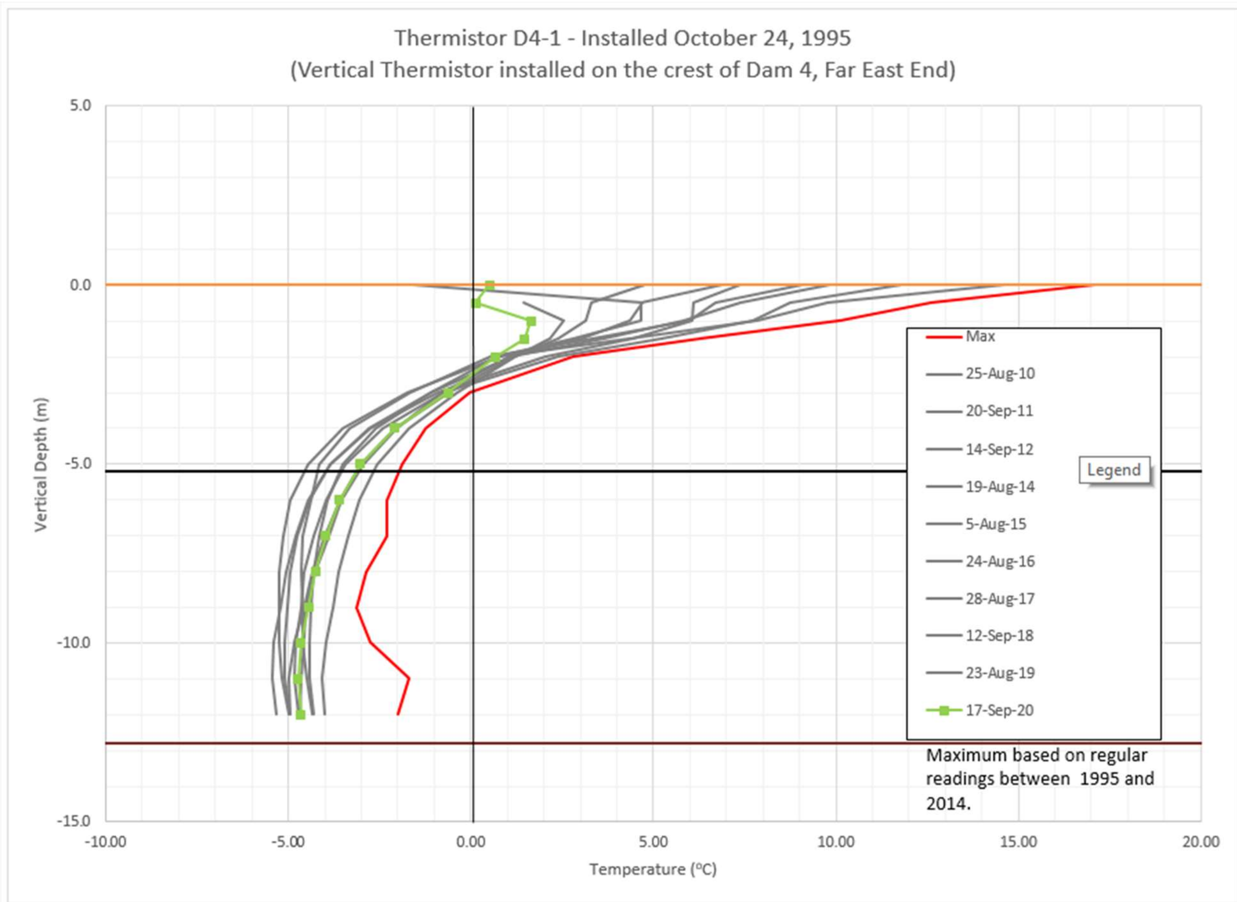
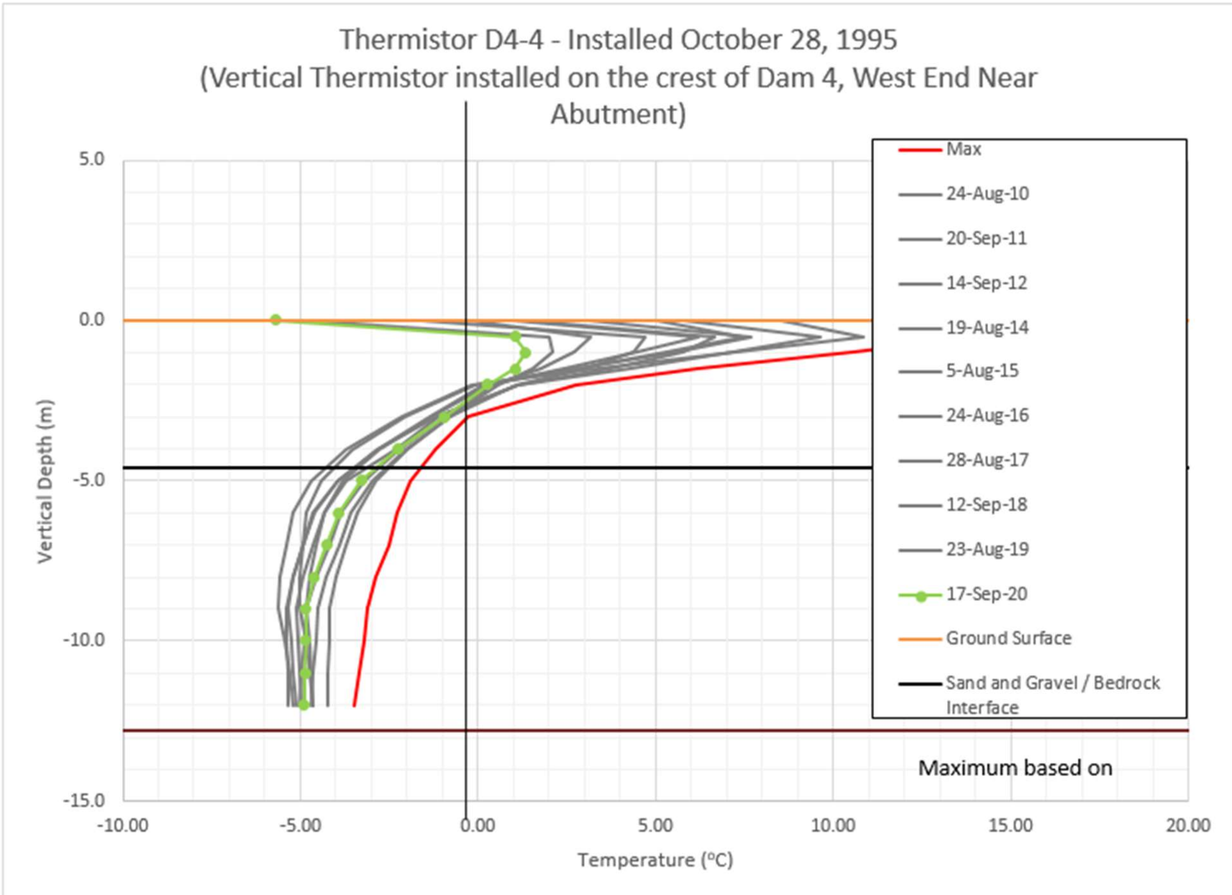


Figure 3-3: Thermistor Reading for Dam 4-4



For the internal dams, the two functional thermistors are also less than 20m deep in Dam K and Dam 3D. These were not historically monitored as rigorously as the ones installed in the perimeter dams, and only have recent data from 2014. The two thermistor readings are shown in the figures below. The active layer is observed to be between 2m to 3m, as interpolated by the 0°C gradient line. The variations between the data set are less than 2°C and generally occur below the historical maximum.

Figure 3-4: Thermistor Reading for Dam 3D

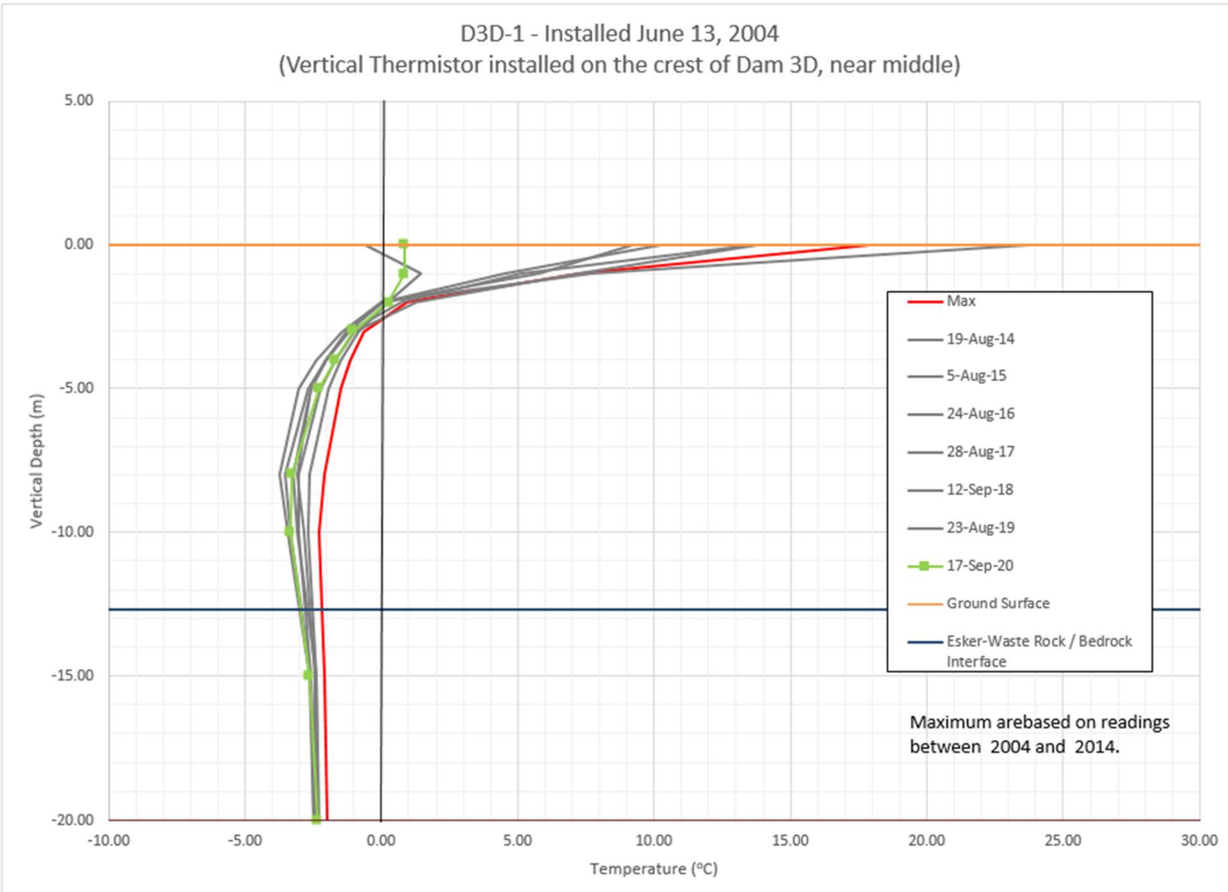
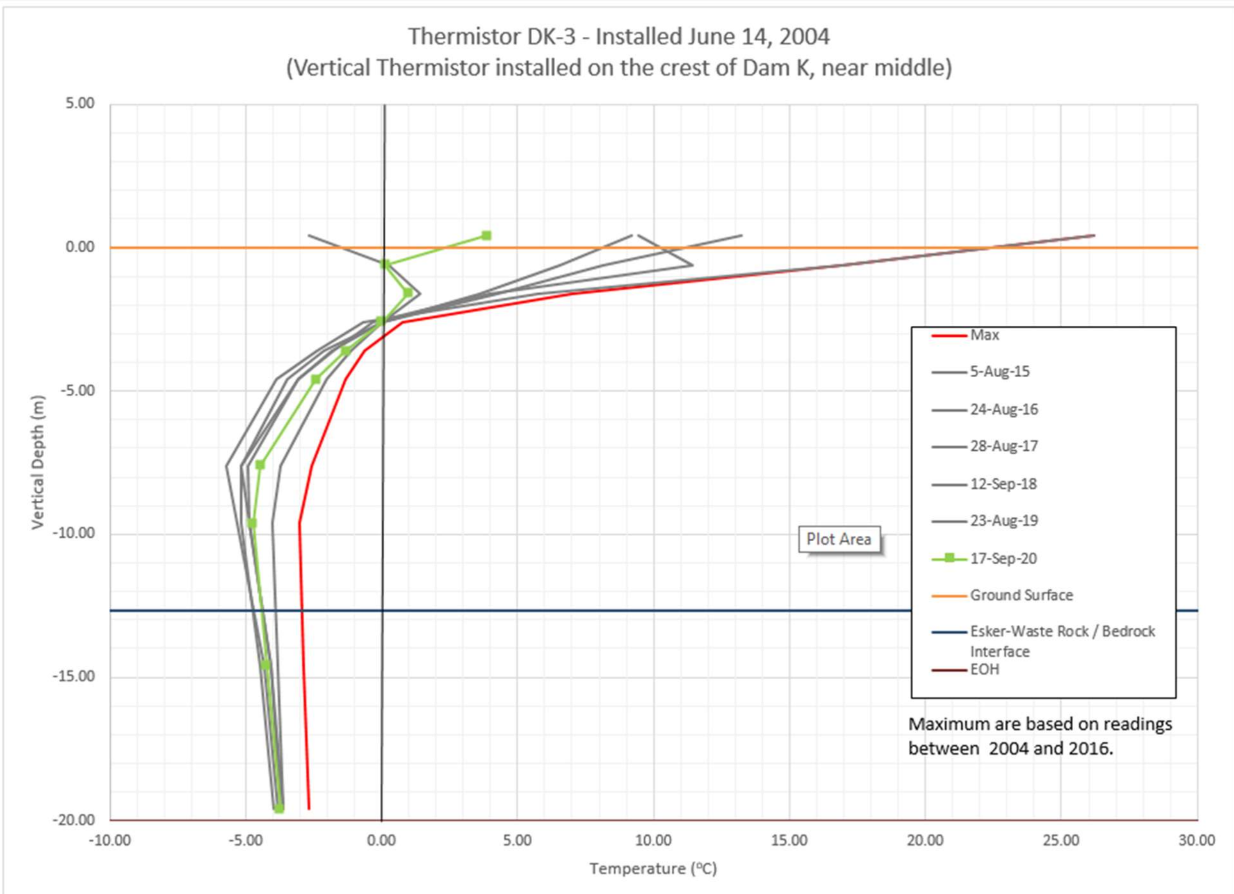


Figure 3-5: Thermistor Reading for Dam K



Readings from the four thermistors in the tailings cover are not presented in this report. The cover thermistor results are comparable to the readings from the dams. All the observed larger temperature variations remained below 0°C and well below the active layer. The observed active layer depths remain consistent with the site recorded data and information provided by national research (Penner 1983). The thermistor readings indicate that the frozen cores within the monitored dams are frozen below the active layer and are performing well.

3.2.2 Moisture Sensors

To provide insight into the performance of the cover, volumetric moisture sensors were installed in the Cell 1 and Cell 3 covers in 2018. The sensors are TEROS-12 VWC sensors that measure volumetric water content, temperature and electrical conductivity. The sensor readings are set to read once every 12 hours and the readings are recorded by dataloggers. Cells 1 and 3 each have one string of five sensors installed within the cover (C2VWC and C3VWC). The sensor spacings and background material are provided in Table 3.1.

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Table 3.1: VWC Installation Details

VWC ID	Cell 1-1		Cell 3-1	
	Depth (m)	Material	Depth (m)	Material
Port 5	1.0	Fine Sand (Cover)	0.35	Sand and Gravel (Cover)
Port 4	1.2	Fine Sand (Cover)	0.5	Sand and Gravel (Cover)
Port 3	1.4	Fine Sand (Cover)	0.6	Sand and Gravel (Cover)
Port 2	1.6	Fine Sand (Cover)	0.7	Sand and Gravel (Cover)
Port 1	1.8	Tailings	1.0	Sand and Gravel (Cover)

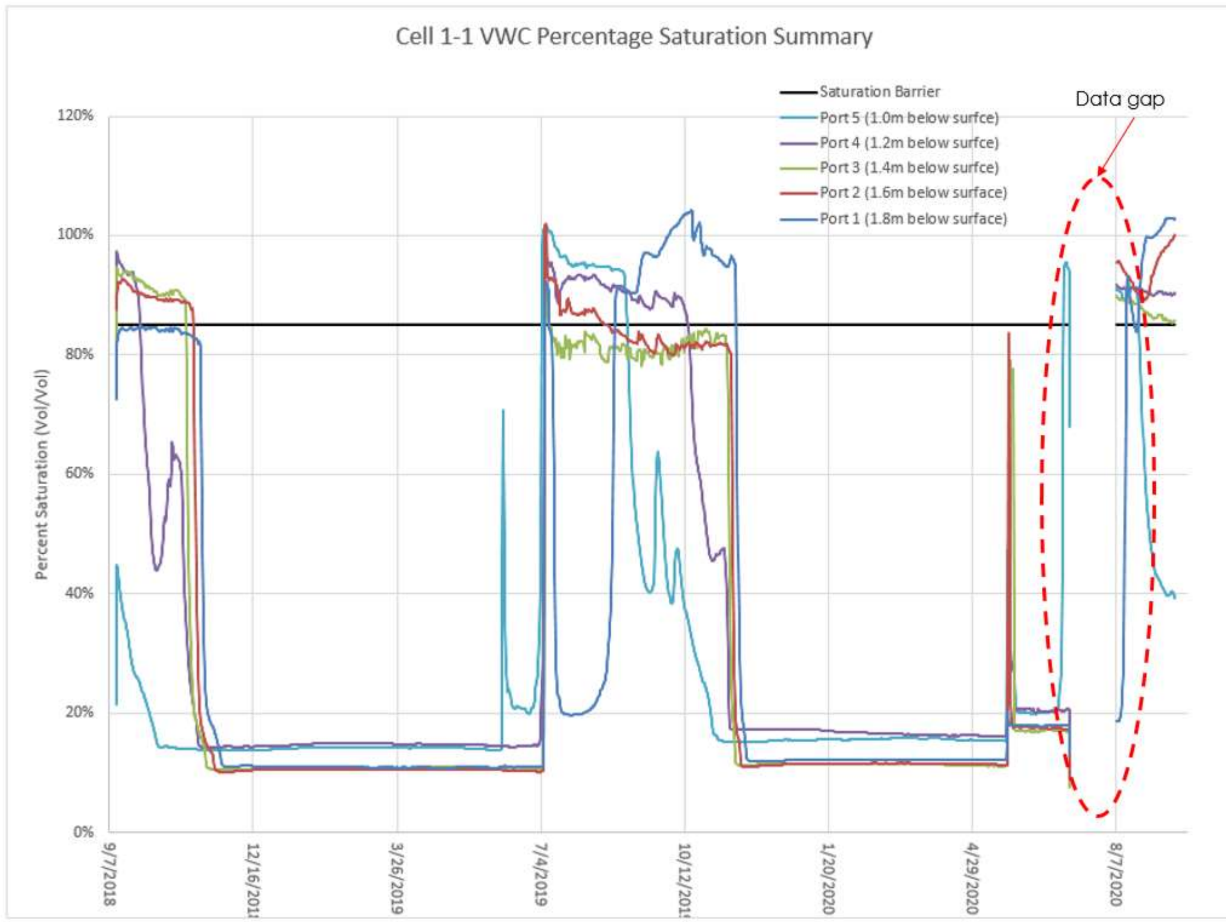
MEND (2009) show that an effective barrier against oxidization can be achieved with a soil cover with a moisture content that is greater than 85%. The intent of the sensor readings is to define the degree of saturation throughout the year at various depths within the cover. It should be noted that sensors register ice as a dry void. Thus, as the pore water freezes and ice forms, the moisture content reading in the sensors drops sharply. In order to calculate the volumetric water content, an assumed void ratio is assigned to each sensor string based on the cover material type. The assumed void ratio for Cell 2 cover is 0.42 which corresponds to a fine sand and Cell 3 cover is 0.33 which corresponds to a gravelly sand.

The data from 2020 indicates that at both strings there is a zone of saturated material above the tailings.

3.2.2.1 Cell 1-1 VWC

The figure below shows the percentage saturation for VWC in Cell 1. All sensors show frozen conditions between November and July. In addition, all sensors indicate some variability in the initial data recorded between September and October 2018, potentially related to the method of installation. This variability can be confirmed with longer monitoring periods once a long-term trend is established. There is a spike in the percentage of saturation in all sensors in early July related to overall thawing. The 2020 data indicated Ports 1, 2 and 4 are above 85% saturation once thawed. Port 3 showed a variable trend but remains above 80% saturation. It should be note that there is a gap in data collection between July 6th to August 7th. The cause of the data gap is unknown and will be noted for future reference.

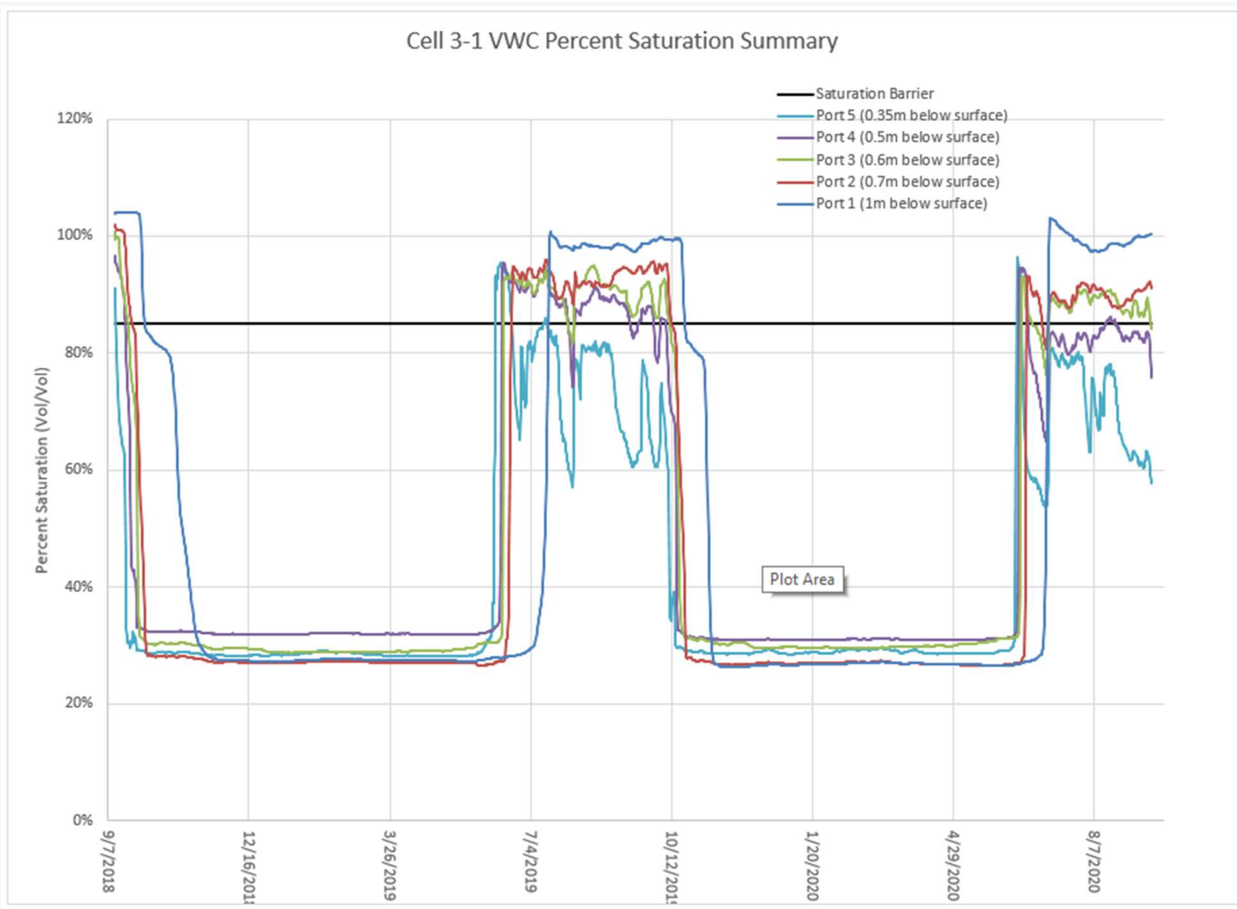
Figure 3-6: Cell 1-1 VWC Percentage Saturation Summary



3.2.2.2 Cell 3-1 VWC

The figure below shows the percentage saturation for VWC in Cell 3. The majority of the sensors show frozen conditions between October and June. Similar to Cell 1-1 VWC, all sensors indicate there might be variability at the initial data collection period between September and October 2018 potentially related to the method of installation. This variability can be confirmed with longer monitoring periods once a long-term trend is established. There is a spike in percentage of saturation in the top sensors in June signaling overall thawing. The 2020 data indicated Ports 3 to 1 are above 85% saturation once thawed. Port 5 showed a variable trend between 57% to 86% saturation, mostly related to surface evaporation and rehydration from rain.

Figure 3-7: Cell 3-1 Port 1 VWC Result



3.3 TCA PERIMETER DAMS

The perimeter dams (Dam 1A through Dam 6) were observed to be in stable condition, although some erosion was observed on the dam slopes from either surface runoff or wave action below the high-water mark (HWM). While most of the surface erosion was observed to be minor, repair work should be considered on the downstream face of Dam 1A and some areas along Dam 4. The rest of the dams should be monitored and repaired as needed, to prevent the erosion from becoming worse and creating preferential surface flow paths.

Previous annual inspections noted seepage from the northern toe buttress of Dam 2 into the seepage collection pond adjacent to Dam 2 Lake. This seepage was observed to be at a very low rate (<1L/min), but water was seen to be present in the seepage collection pond. It was communicated on site that the seepage water should be pumped back to Pond 2 as per requirement.

With the water treatment and discharge done as part of the closure activity, Pond 2 water level has lowered significantly. The observed freeboard at the perimeter dams was around 5m or greater. This well exceeds the minimum requirement of 1m freeboard as stated in the water license. Dam 1B, 1C, Dam 5 and Dam 6 do not have water on the upstream face of the dams.

3.4 INTERNAL DAMS

Various earthwork was completed in 2020 as part the closure activities and emergency water management. The summary of work done is:

- Dam L was mechanically breached and backfilled by the contractor to dewater Cell 3 without EOR authorization or engineering oversight.
- The divider dyke and Dam L were temporary raised by 0.5m and 0.8m, respectively, during freshet for emergency water management to prevent overtopping.
- During repair of Dam M, earthmoving equipment caused a localized minor failure at the downstream face of the dam. Repair work was suspended after this incident.
- A buttress was constructed to reinforce Dam K at the eroded toe and provide support beneath the gullies at the crest.

The Pond 2 water level was lowered significantly from water treatment and discharge operation, providing a freeboard upwards of 3m at the Dam J. All of the internal dams have some erosion on their downstream slopes, associated with either surface runoff or wave action at the HWM. Dam 3D also has some crest erosion from surface runoff. Dam J has wave action erosion at the HWM that has reduced the crest width.

Dam K has experienced considerable undercutting at the toe from Pond 2 wave action that was reported previously, and it was repaired this year. Construction was conducted as the Pond 2 water level was lowered to allow stable access to the toe of the dam. A buttress was constructed with compacted sand and gravel to reinforce the toe and support the face of the dam. The buttress was constructed to approximately half the height of the dam with a 5m crest. The construction work was overseen by a designated EOR representative to ensure the buttress was constructed using appropriate material and compacted accordingly.

Dam M was repaired with a reinforcement buttress and crest surface backfill in 2016 (Norwest 2016). The toe of the buttress has experienced some wave erosion at the HWM. The water level rose in 2019 freshet and by this year the buttress toe along with the riprap were submerged and localized minor sloughing was observed. During 2020 closure activities, seepages were observed along the toe at the old buttress crest. Engineering instruction was provided to the contractor to place additional fill to limit the seepage. During the construction, the loader got stuck and caused a minor localized failure at the downstream face when it tried to free itself. This was observed by the EOR representative and documented in an incident report. Further repair was suspended until the contractor could provide a different construct method.

During freshet, a shallow ditch was constructed at the north abutment of Dam N to passively manage the freshet water. This was backfilled after the freshet. Both the construction and backfill were overseen by EOR representative. During the inspection Dam N was observed to be in stable condition, but it had only 0.5m of freeboard between it and Pond 2. This was communicated to LMI site personnel, and the need to increase the freeboard to 1m to meet water license requirement was highlighted. Stantec was later informed that the pond level was lowered after water treatment operations and Cell N freeboard increased to 0.8m prior to winterization.

The water levels in Cell 3 and Cell 4 have risen due to closure activities and lack of associated water management. It is assumed the cause was the transfer of construction water into Cell 4 and well as cover placement that significantly reduced the surge capacity in Cell 3. The higher water levels necessitated a temporary raise of the Dam L and divider dyke to prevent overtopping. Dam L was raised by a maximum 0.8m and divider dyke was raised by a maximum of 0.5m. The raises were completed by placement of compacted sand and gravel over the crest width of the dam and dyke. The work was overseen by the EOR representative to ensure quality assurance.

The cracks and erosion observed in the divider dyke were repaired by the newly placed compacted fill. However, new zones of seepage were observed at the newly constructed downstream toe of the divider dyke. These seepages were not observed previously and were monitored during closure activities. The seepages will continue to be monitored until the proposed spillway is constructed in 2021. The seepages are expected to stop once the spillway is constructed to passively manage the water at the closure elevation, which is below the observed seepage zones.

Both of the raises are considered temporary as the temporary rise on Dam L will be eventually be incorporated into the Cell 3 cover and the divider dyke will be breached and a spillway constructed to manage water in Cell 4 at the closure level, well below the current elevation.

4.0 RECOMMENDATIONS

Table 4.1 summarizes the observations and recommendations from the 2020 inspection, together with the findings from the 2019 inspection for comparison. The estimated freeboard is recorded by site engineering representative on September 30th.

Table 4.1: Inspection Observation and Recommendations

Inspection Item	2020 Inspection			2019 Inspection	
	Estimated Freeboard (m)	Observation	Recommendations	Observations	Recommendations
Perimeter Dams					
Dam 1A	5.4	Minor erosion on slopes with some deep erosion gullies. The thermistor was damaged.	Repair deep erosion gullies. Repair the thermistor if practicable.	Minor erosion on slopes with some deep erosion gullies	Repair deep erosion gullies.
Dam 1B	4.9	Pond 2 water was approximately 50m upstream from the dam.	Surface maintenance, e.g. grading and backfilling.	Pond 2 water was approximately 20m upstream from the dam.	Surface maintenance, e.g. grading and backfilling.
Dam 1C	4.9	Pond 2 water was approximately 50m upstream from the dam.	Surface maintenance e.g. grading and backfilling.	Pond 2 water was approximately 40m upstream from the dam.	Surface maintenance e.g. grading and backfilling.

Recommendations

Inspection Item	2020 Inspection			2019 Inspection	
	Estimated Freeboard (m)	Observation	Recommendations	Observations	Recommendations
Dam 2	5.5	Minor erosion in the slopes. Minor seepage was observed (<1L/min). Water was found in the seepage collection pond.	Surface maintenance e.g. grading and backfilling. Pump seepage back into Pond 2. (this was done after inspection overseen by EOR representative)	Minor erosion in the slopes. Minor seepage was observed (<1L/min). Water was found in the seepage collection pond.	Surface maintenance e.g. grading and backfilling. Pump seepage back into Pond 2.
Dam 3	No water is impounded by this dam	Minor erosion in the downstream slope.	Surface maintenance e.g. grading and backfilling.	Minor erosion in the downstream slope.	Surface maintenance e.g. grading and backfilling.
Dam 4	5.2	Minor erosion in the slopes and wave erosion at HWM. One of the thermistors is damaged.	Surface and toe maintenance e.g. grading and backfilling. Repair the thermistor if practicable.	Minor erosion in the slopes and wave erosion at HWM.	Surface and toe maintenance e.g. grading and backfilling.
Dam 5	N/A(1)	Cell 3 water is approximately 70m upstream from the dam. Minor erosion on surface.	Surface maintenance e.g. grading and backfilling.	Cell 3 water is approximately 70m upstream from the dam. Minor erosion on surface.	Surface maintenance e.g. grading and backfilling.
Dam 6	N/A(1)	Ponding in a natural low at the south abutment. Erosion gullies in the downstream slope.	Surface maintenance e.g. grading and backfilling. Monitor the ponded water level near the south abutment.	Ponding in a natural low at the south abutment. Erosion gullies in the downstream slope.	Surface maintenance e.g. grading and backfilling. Monitor the ponded water level in the south abutment.
Internal Dams					
Dam 3D	No water is impounded by this dam	Minor erosion in the slopes.	Surface and slope maintenance e.g. grading and backfilling.	Minor erosion in the slopes.	Surface and slope maintenance e.g. grading and backfilling.
Dam J	3.5	Over-steepened slope due to erosion.	Repair the eroded slope with compacted sand and gravel.	Over-steepened slope due to erosion and reduced crest width in some sections.	Repair the eroded slope and crest with compacted sand and gravel.
Dam K	N/A(1)	A reinforced buttress was	Finalize the re-slope of the buttress to	Undercut at HWM and five large	Execute the proposed 2020 plan to lower

Inspection Item	2020 Inspection			2019 Inspection	
	Estimated Freeboard (m)	Observation	Recommendations	Observations	Recommendations
		constructed along the eroded toe. The erosion gullies at the crest have been repaired.	2H:1V design to achieve final closure configuration.	erosion gullies in the downstream crest. Near vertical slope at the eroded toe. Temporary ditches constructed upstream of the crest to mitigate further damage.	Pond 2 water to allow access for toe repair. Repair the crest erosion after the toe repair. Potential regrade the cover provide better drainage to mitigate further damage
Dam L	2.4	A section of the dam was breached without authorization and backfilled without engineering supervision. The dam was raised by 0.8m temporary to manage freshet.	Monitor the proximity of the breach location for seepage, instability, and potential downstream damage from the water discharge.	Erosion in the crest and slopes.	Repair the eroded upstream slope, crest and armor the downstream toe for protection.
Dam M	2.2	Sloughing in localized sections of the buttress due to raised water level during 2020 freshet. A construction incident has caused a localized minor failure to the downstream face of the dam.	Repair the sloughed section of the buttress and the localized failed section once the water level is lowered. Re-slope the buttress to 2H:1V design for final closure.	Minor erosion at the downstream toe above the riprap protection	Repair the eroded toe areas.
Dam N	0.8(2)	A shallow channel was constructed to manage 2020 freshet. It was backfilled under engineering oversight. Material was stockpiled on the dam in preparation for cover placement.	Monitor the water level behind Dam N and lower the water when practicable to yield minimum 1m freeboard. Monitor the dam around the stockpile for deformation.	Minor wave action erosion at HWM.	Monitor the water level behind Dam N and lower the water when practicable to yield minimum 1m freeboard.
Divider Dykes	1.7	The dam was raised by 0.8m temporary to manage freshet. The old erosion and crest were repaired. New seepages are	Continue to monitor the seepages until the closure spillway is constructed. Repair any erosion	Erosion, sloughing and cracks along upstream and downstream of the northern portion of the dyke. Uneven	Second priority to complete the repair to the northern section

Inspection Item	2020 Inspection			2019 Inspection	
	Estimated Freeboard (m)	Observation	Recommendations	Observations	Recommendations
		observed at the downstream toe. These were monitored throughout the 2020 closure activities.	from the seepage as needed in 2021.	crest level and reduced crest width.	

Notes: 1. Water is not adjacent to the dam to determine available freeboard.

2. Freeboard at the lowest point of the dam and below the minimum requirement stated in the Water License (NWB 2015).

4.1 MONITORING FOR POTENTIAL IMPACT AT DAM L AND DAM M

There were two recorded incidents at Dam M and Dam L during the 2020 closure activities. These were documented as part of the construction records and summarized above. While the immediate impact at Dam L has been mitigated by the backfill placed by the contractor, there was no repair work done at the localized failure at Dam M. The short- and long-term impacts at both dams have yet to be evaluated in terms of potential instability and seepage. Once the closure activities recommence in 2021, monitoring must be done at these two locations document any changes and adverse impacts. Depending on the monitoring results, additional engineering evaluation might be required to mitigate the impacts.

4.2 MAINTENANCE AND REPAIR PRIORITIES

Of the repairs and maintenance recommended in Table 3, it is recommended that the following repairs be prioritized:

1. Upon recommencement of closure activities in 2021, the localized failed section of Dam M should be repaired.
2. Monitor the seepage at the downstream toe of the divider dyke for erosion and potential instability. Repair as needed in 2021 when access is available.
3. Monitor the proximity of the breached location in Dam L for any seepage and potential instability. Repair as needed in 2021 when access is available.
4. Monitor the water level behind Dam N and lower the water level to maintain a minimum 1m freeboard.

After the completion of the priority repairs, LMI should consider carrying out the following repairs:

- Once the repair at Dam M is completed, re-slope the buttress to 2H:1V as per design for the closure configuration. Similar re-sloping should be done to the buttress at Dam K to achieve the closure configuration.
- Monitor the seepage at Dam 2 and manage it as necessary by pumping the seepage back into Pond 2.

- General repairs o downstream surfaces and upstream slope erosion at the HWM.

All observations and records from monitoring subsequent to the 2020 inspection should be sent to Stantec and the Engineer-of-Record for review.

5.0 REFERENCES

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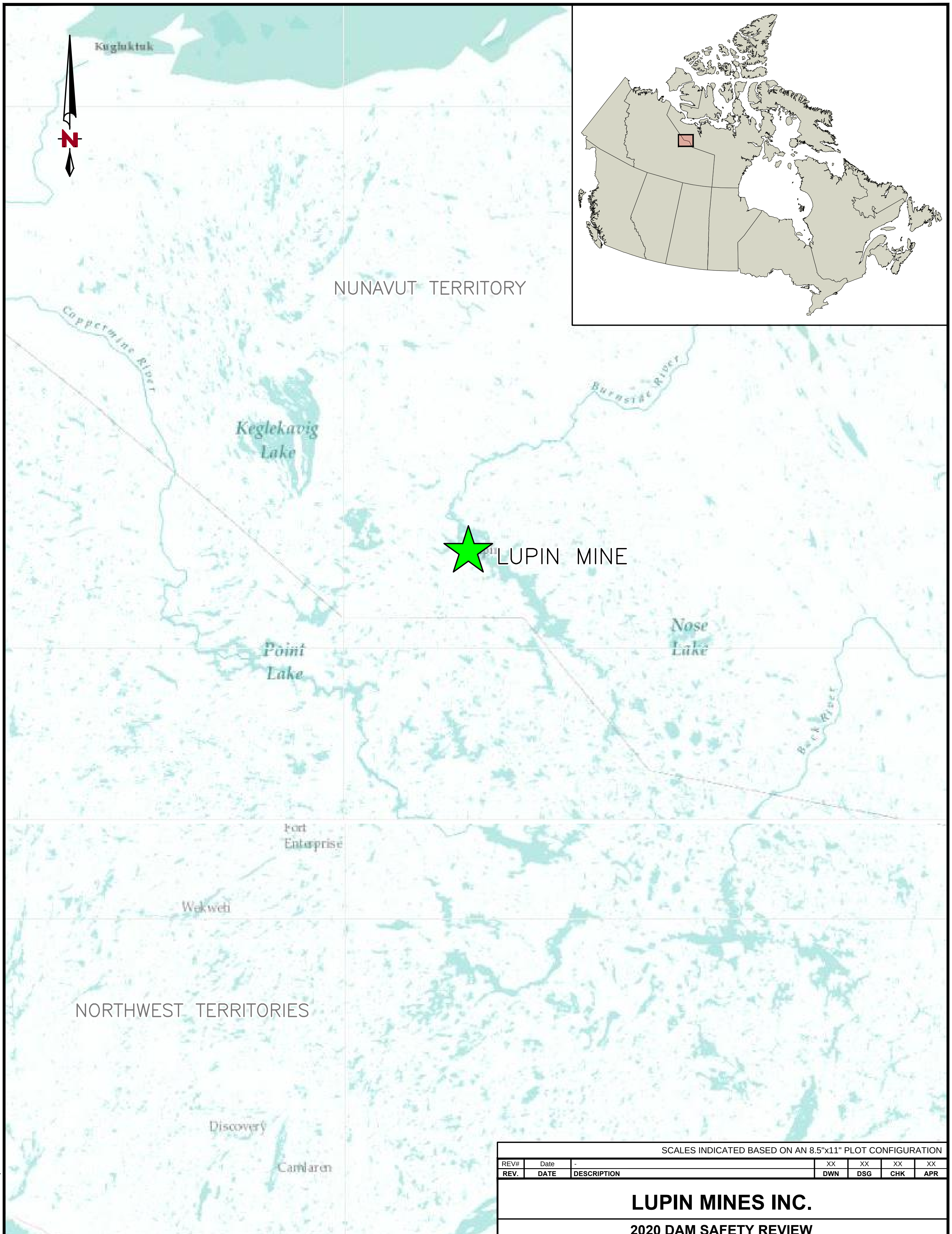


SCALES INDICATED BASED ON AN 8.5"x11" PLOT CONFIGURATION

REV#	Date	-	XX	XX	XX	XX
REV.	DATE	DESCRIPTION	DWN	DSG	CHK	APR

LUPIN MINES INC.

2020 DAM SAFETY REVIEW

SCALE:	AS SHOWN
DATE:	2016-10-20
CO-ORD. SYS.:	UTM-NAD83-12
DRW'N BY:	KM
DSG'N BY:	--
REV'D BY:	AT
APP'D BY:	SE

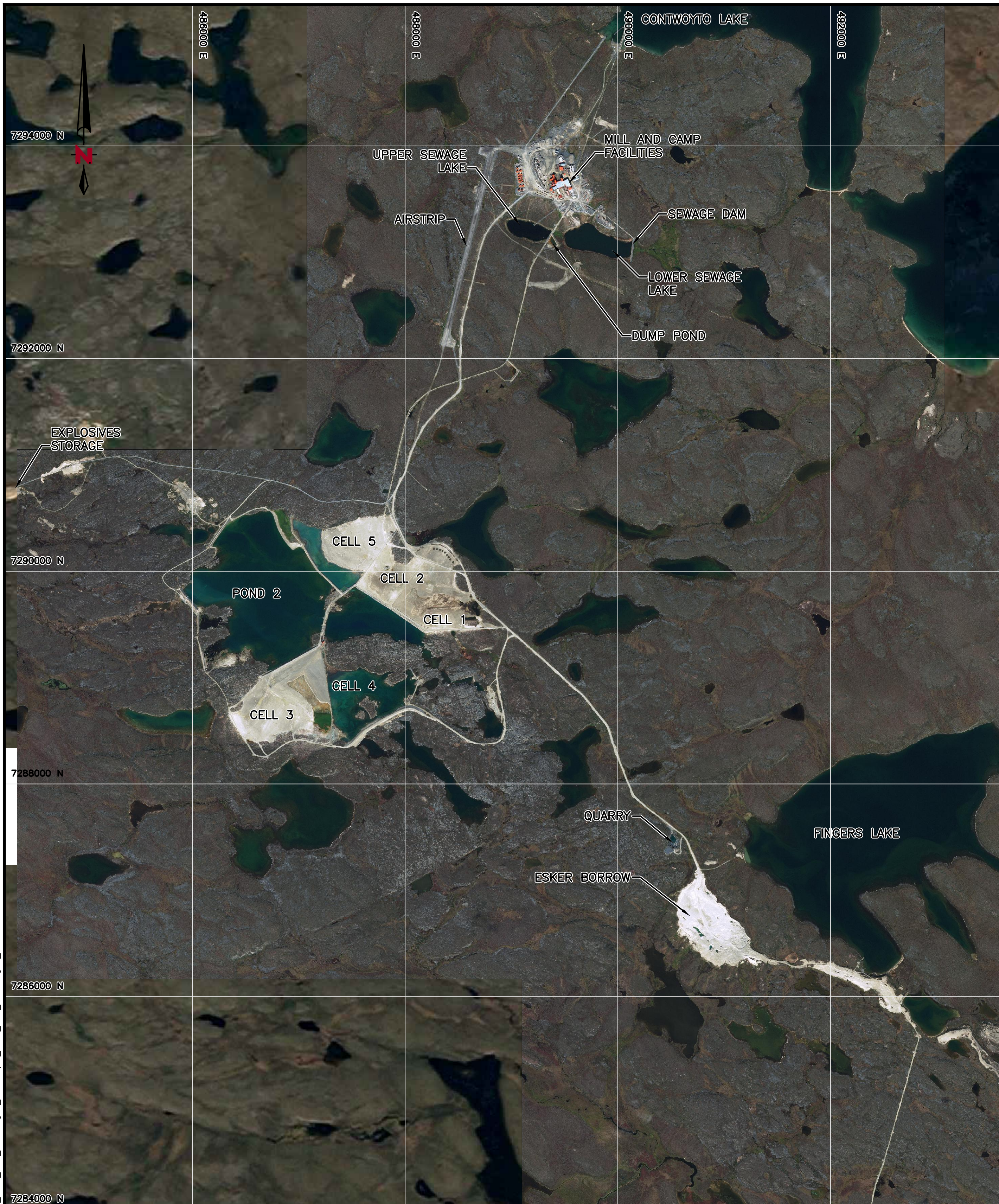
SITE LOCATION

Stantec

PROJECT NO.:	FIG. NO.:	REV.:
129500081	1	A

DATE: 9/29/2017 TIME: 16:00:20 PLOT SCALE: 1:3.872

FILENAME: Z:\924-2_DSI\DISC\DRAFTING\01.SITE LOCATION.DWG
XREF FILE(S):
IMAGE FILE(S): Lupin-Site Location-N Lupin-Site Location-S



1000m 500 0 1000 2000 3000m

SCALE 1:50,000

SCALES INDICATED BASED ON AN 8.5"x11" PLOT CONFIGURATION

REV#	Date	-	XX	XX	XX	XX
REV.	DATE	DESCRIPTION	DWN	DSG	CHK	APR

LUPIN MINES INC.

2020 DAM SAFETY REVIEW

SCALE:	AS SHOWN
DATE:	2016-10-20
CO-ORD. SYS.:	UTM-NAD83-12
DRW'N BY:	KM
DSG'N BY:	--
REV'D BY:	AT
APP'D BY:	SE

SITE OVERVIEW

Stantec

PROJECT NO.:	FIG. NO.:	REV.:
129500081	2	A

FILENAME: Z:\924-2_DS\DISC\DRAFTING\02.SITE OVERVIEW.DWG
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IMAGE FILE(S): Lupin-NE Lupin-NW Lupin-SW lupin_mine_wv2_2012aug21_north lupin_mine_wv2_2012aug21_south

DATE: 9/29/2017 TIME: 16:03:34 PLOT SCALE: 1:3.872

SCALES INDICATED BASED ON AN 8.5"x11" PLOT CONFIGURATION

REV#	Date	-	XX	XX	XX	XX
REV.	DATE	DESCRIPTION	DWN	DSG	CHK	APR

LUPIN MINES INC.

2020 DAM SAFETY REVIEW

SCALE:	AS SHOWN
DATE:	2016-10-20
CO-ORD. SYS.:	UTM-NAD83-12
DRW'N BY:	KM
DSG'N BY:	--
REV'D BY:	AT
APP'D BY:	SE

MILL SITE AND SUPPORT FACILITY PLAN

Stantec

PROJECT NO.:	FIG. NO.:	REV.:
129500081	3	A

LEGEND

THERMISTORS STATUS

- ACTIVELY MONITORED
- DAMAGED
- MONITORED DURING DSR-NO CALIBRATION DATA
- UNLOCATED-LOCATION ESTIMATED FROM HISTORICAL MAP
- VOLUMETRIC WATER CONTENT SENSOR STRINGS
- TEST PITS

500m 0 500 1000m

SCALE 1:20,000

SCALES INDICATED BASED ON AN 8.5"x11" PLOT CONFIGURATION

LUPIN MINES INC.

2020 DAM SAFETY REVIEW

TAILINGS CONTAINMENT AREA

SCALE:	AS SHOWN
DATE:	2019-09-26
CO-ORD. SYS.:	UTM83-12
DRW'N BY:	KM
DSG'N BY:	--
REV'D BY:	AT
APP'D BY:	SE

Stantec

PROJECT NO.:	FIG. NO.:	REV.:
129500081	4	A

PLOT SCALE: 1:3.872 TIME: 08:47:19 DATE: 11/12/2019
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XREF FILE(S):
IMAGE FILE(S): lupin mine wv2 2012aug21 north lupin mine wv2 2012aug21 south

Appendix A Photographic Log

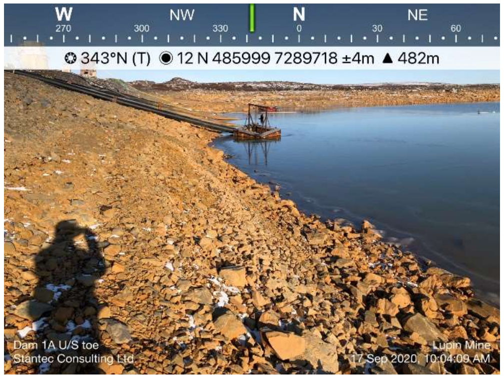

Photo 1: Looking north at the upstream slope of Dam 1A

Photo 2: Looking northwest at the crest of Dam 1A

Photo 3a: Looking northwest at the downstream slope of Dam 1A

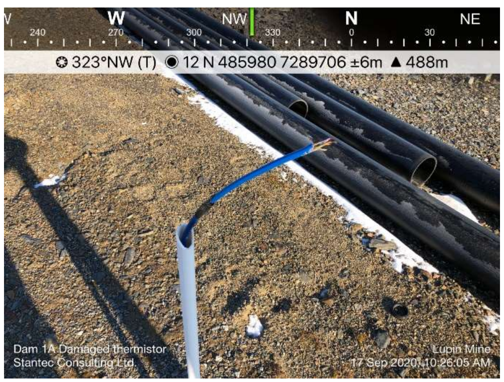

Photo 3b: View of the damaged thermistor.

Photo 4: Looking south at the upstream slope of Dam 1B.

Photo 5: Looking south at the downstream slope of Dam 1B.

LMI	**Lupin Mine Incorporated**
	2020 Dam Safety Inspection
Site Inspection Photograph Log for Dam 1A and 1B	
Stantec	PN: 129500081 · FIGURE 1 · REV. A

Photo 7: Looking south at the crest of Dam 1C

Photo 8: Looking southeast at the upstream slope of Dam 1C.

Photo 9: Looking south at the downstream slope of Dam 1C.

Photo 10: Looking southwest at the upstream slope of Dam 2.

Photo 11: Looking west at the downstream slope of Dam 1 with the seepage collection pond.

LMI	Lupin Mine Incorporated 2020 Dam Safety Inspection		
Site Inspection Photograph Log for Dam 1C and 2			
Stantec	PN: 129500081	FIGURE 2	REV. A

Photo 13: Looking northwest at the surface ditch along Dam 3.

Photo 14: Looking west at the crest of Dam 3.

Photo 15: Looking north at the surface ditch spillway on Dam 3.

LMI	Lupin Mine Incorporated
	2020 Dam Safety Inspection

Site Inspection Photograph Log for Dam 3

Stantec | PN: 129500081 | FIGURE 3 | REV. A

Photo 16: Looking northeast from the west abutment at the crest slope of Dam 4

Photo 17: Looking northeast from the west abutment at the upstream slope of Dam 4

Photo 18: View of the damaged thermistor

Photo 19: Looking west at a repaired erosion gully at the downstream crest near the east abutment of Dam 4.

Photo 20: Looking east at the downstream slope of Dam 4.

LMI	Lupin Mine Incorporated
	2020 Dam Safety Inspection
Site Inspection Photograph Log for Dam 4	
Stantec	PN: 129500081 · FIGURE 4 · REV. A

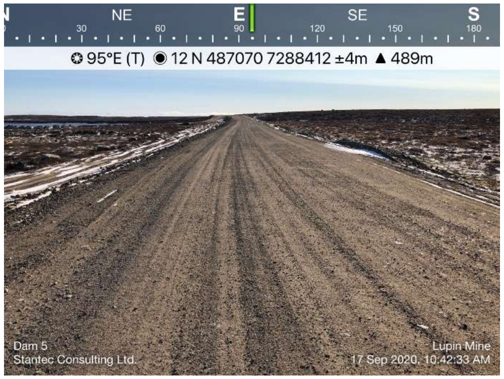

Photo 21: Looking east at the crest of Dam 5

Photo 22: Looking east at the upstream slope of Dam 5.

Photo 23: Looking southeast at the downstream crest of Dam 5.

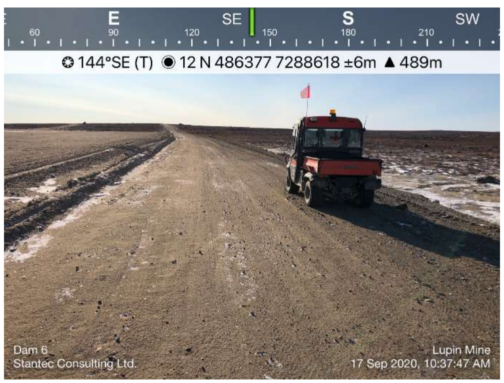

Photo 24: Looking southeast at the crest of Dam 6

Photo 25: Looking south at the downstream slope of Dam 6.

LMI	Lupin Mine Incorporated
	2020 Dam Safety Inspection
Site Inspection Photograph Log for Dam 5 and 6	
Stantec	PN: 129500081 | FIGURE 5 | REV. A

Photo 26: Looking south at the upstream crest of Dam J, adjacent to Pond 1.

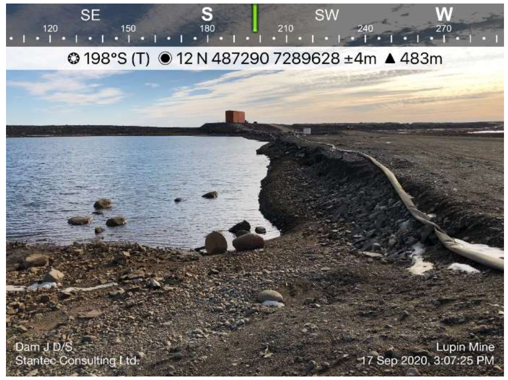

Photo 27: Looking south at the crest of Dam J, adjacent to Pond 1.

Photo 28: Looking north at the downstream slope of Dam J, adjacent to Pond 2.

Photo 29: Looking southeast from the west abutment at the downstream slope of Dam 3D.

Photo 30: Looking west from the east abutment at the crest of Dam 3D.

Photo 31: Looking northwest at the downstream crest of Dam 3D.

LMI	**Lupin Mine Incorporated**		
	2020 Dam Safety Inspection		
Site Inspection Photograph Log for Dam 3D and J			
Stantec	PN: 129500081	FIGURE 6	REV. A

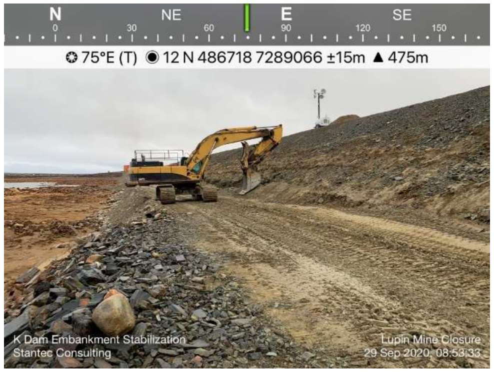

Photo 32: Looking east at the reinforcement buttress being constructed eroded toe at Dam K.

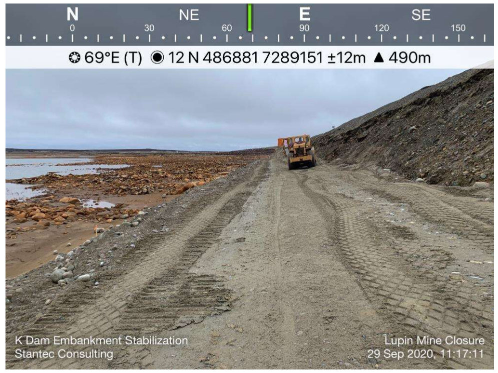

Photo 33: Looking east on the reinforcement buttress with compaction being carried out

Photo 34: Looking southwest toward the south abutment of the reinforcement buttress with compaction being carried out

Photo 35: Looking east at the reinforcement buttress being constructed eroded toe at Dam K.

Photo 36: Looking south on the reinforcement buttress with compaction being carried out

Photo 37: Looking southwest from the north abutment of the reinforcement buttress.

LMI	Lupin Mine Incorporated		
	2020 Dam Safety Inspection		
Site Inspection Photograph Log for Dam K			
Stantec	PN: 129500081	FIGURE 7	REV. A

Photo 38: Looking southwest at the upstream slop of raised Dam L and cover construction in the ponded area of Cell 3.

Photo 39: Looking west into partially constructed Cell 3 cover in the ponded area.

Photo 40: Looking west from Cell 3 onto the partially placed cover on exposed tailings.

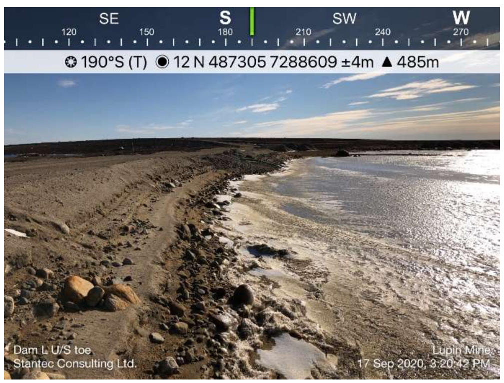

Photo 41: Looking south at the Dam L crest from the north abutment.

Photo 42: Looking southeast at the downstream slope of Dam L.

Photo 43: Looking north at the Dam L crest from the south abutment.

LMI	Lupin Mine Incorporated 2020 Dam Safety Inspection		
Site Inspection Photograph Log for Cell 3 Surface Ditch and Dam L			
Stantec	PN: 129500081	FIGURE 8	REV. A

Photo 44: Looking northwest at the crest of Dam M with Cell 5 to the right.

Photo 45: Looking northwest at the reinforcement buttress of Dam M at the toe of the dam.

Photo 46: Looking down at the incident on the Dam M buttress where localized failure caused by the equipment, near the junction of Dam N.

Photo 47: Looking at localized failure caused by the equipment near the junction of Dam N

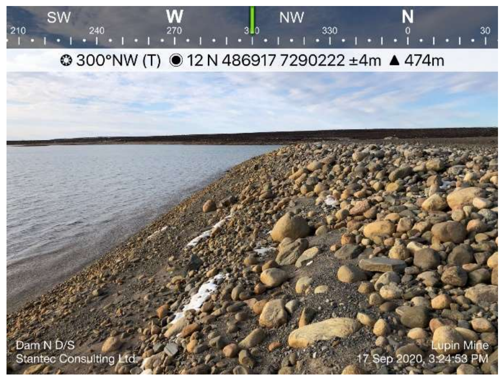

Photo 48: Looking northwest at the downstream slope of Dam N with Pond 2.

Photo 49: Looking north at the crest of Dam N and ponding water with approximately 0.8m freeboard.

LMI	**Lupin Mine Incorporated**
	2020 Dam Safety Inspection

Site Inspection Photograph Log
for Dam M and N

Stantec	PN: 129500081	FIGURE 9	REV. A

Photo 50: Looking north at the repaired upstream slope and crest of the southern divider dyke.

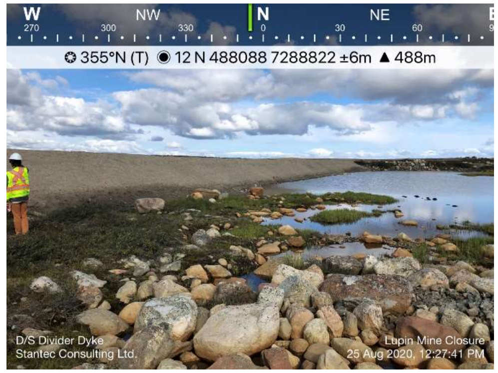

Photo 51: Looking north at the downstream slope and the seepage zones at the toe of the divider dyke.

Photo 52: Looking northwest at one of the seepage zone at the toe.

Photo 53: Looking north at the eroded crest slopes and sloughed crest of northern divider dyke.

LMI	Lupin Mine Incorporated
	2020 Dam Safety Inspection

Site Inspection Photograph Log for Divider Dykes

Stantec	PN: 129500081	FIGURE 10	REV. A