

Appendix 14

Meadowbank and Whale Tail MDRB Report No.30

October 31st, 2022

Mr. Alexandre Cauchon
General Manager
Agnico–Eagle Mines, Meadowbank Division
Baker Lake Office

Email: alexandre.cauchon@agnicoeagle.com

Dear Mr. Cauchon,

Report No 30
Meadowbank Mine Dike Review Board (MDRB)
Site visit September 13th to 16th, 2022.

1.0 INTRODUCTION

A site visit was made by the MDRB from September 13th to September 16th, 2022. Both Board members: Kevin Hawton and Anthony Rattue participated in the visit and the on-site meetings.

The objective of gaining updated knowledge pertaining to Meadowbank, Vault and Amaruq sites was achieved. The material presented and discussed covered current operations, and performance monitoring of the structures. Members of WSP Golder (WSPG) and SNC-Lavalin Inc. (SLI) participated in some of the discussions by video conference.

On-ground visits were made at the three sites and a helicopter flyover was also carried out during the transit flights between Meadowbank and Amaruq.

The present report covers all three sites. A list of persons having participated is included in Appendix A and a selection of photographs is included in Appendix B.

A brief summary of the subject matter and comments are presented in the following sections. The Board's recommendations are underlined in the text.

The Board submitted a draft version on October 2nd. AEM has indicated that the final version, this document, could be submitted without modification.

2.0 OPERATIONS

An overview of mine status, current operations and future potential was provided to the Board for information. Various potential scenarios could prolong mine life to 2029 or even 2033.

The Board is pleased to see that AEM has initiated the formation of a team dedicated to closure and reclamation. To date there have been limited cases of mine closure in the North from which to derive precedence. Certain issues may take longer than expected to resolve and opportunities may otherwise be missed. The timing is appropriate. Principles and Objectives have been set out and a list of activities prepared. Stakeholder engagement is envisaged from the outset.

The Board sees the need to address the water treatment needs, methods and timing to allow tailings capping and re-filling of the pits prior to breaching the dikes. Some discussion was held

at the meeting pertaining to the location of breach(es) in the Bay-Goose and East Dikes and the Board anticipates more discussion at future meetings.

AEM presented information pertaining to the corporate initiatives to develop company wide standards for Water Management, Environmental Incident Management and a Risk Assessment Tool for Tailings Storage Facilities. The latter is presented as a paper for publication in the Canadian Geotechnical Journal. The Board will review these documents and comment if appropriate.

3.0 ANNUAL GEOTECHNICAL INSPECTION

A presentation was made by WSPG of the findings of the 2022 annual inspection. No new items of major concern were brought to light but some maintenance requirements were indicated.

An additional topic covered by WSPG relates to the review of the Instrumentation Monitoring Plan. The objective is to optimize the effort required for data interrogation and analysis based on historic trends and the perceived level of risk for each structure. Also included is the proposal to use “Alarm” or “Alert” levels to draw attention to changes in automated instrument readings. The Board endorses this initiative but cautions that establishing alert levels for instruments that exhibit for example, an annual cyclic tendency, may not be easy and a few iterations may be required before a reliable system is established.

4.0 WATER AND TAILINGS MANAGEMENT AT MEADOWBANK

4.1 Tailings Management

All ore from Meadowbank, Vault and Amaruq is processed at the Meadowbank facility and consequently the tailings are also deposited at this facility. The current tailings deposition, which is limited to that from Amaruq ore, is entirely “in-pit”. Deposition of tailings is currently into Pit E (photo #1). The available volume in the mined-out pits is deemed to be adequate for the current life of mine.

No “landscaping” deposition was made into the North Cell (NC) (photo #3) or the South Cell (SC) of the Tailings Storage Facility (TSF) during 2022. As stated in previous reports, the Board agrees that warm weather deposition is appropriate to prepare the final tailings surface for NPAG capping rockfill. The central parts of both cells are unfrozen at depth and consolidation settlement is likely occurring. The reclaim sump in the NC (photo #4) is operational for run-off control and for any future deposition.

4.2 Water Management

The reclaim of supernatant water is currently from Pit E (photo #2). As in previous years, some problems with reclaiming the supernatant water arose during the winter season. This exacerbates the fresh water consumption that AEM is endeavouring to minimize. AEM has the situation in hand and there are no comments from the Board.

4.3 TSF Structure Performance

The performance of all the structures, namely Saddle Dams SD1, SD2, SD3, SD4 and SD5, Stormwater Dike and Central Dike as well as RF-1, RF-2 and the North Cell Internal Structure (NCIS) is satisfactory. However, a few observations were made during the visit and meetings as described below.

At SD-1, the thermistor string T-3 is no longer functional. However, the foundation and the tailings upstream of the structure are frozen. The Board does not see a necessity to replace this instrument.

A pump station is being maintained at the toe of SD-1 (photo #5) to collect any run-off (contact water) and to discharge the same to the NC as necessary.

At SD-2, the thermistor string T-4 is non-functional but is not deemed critical now that the dam and its foundation are frozen.

AEM has suggested that the ditch at the toe of saddle dams SD-2, SD-4 and SD-5 be backfilled with rock to reduce the accumulation of water (run-off from outside the TSF) and the Board concurs.

A fine crushed rock filter lines the inner slope of the NCIS and RF-2. As the annual geotechnical report notes, this material is subject to erosion from any water flow along the toe (photo #6), from seepage through or over the slope and constitutes an on-going maintenance item. The Board suggests that a berm of coarser rockfill be placed along the toe to alleviate this issue as the capping may still be several years in the future.

The situation at Stormwater Dike (photo #7) is little changed from last year. An area of shallow ponded water is noted at the west end. Down drag of ice or frozen tailings adhering to the liner is a possibility however, as the tailings deposit is at or about the maximum planned elevation little consequence is envisaged. Nevertheless, "landscaping" tailings deposition and/or the placement of finer material should precede the placement of the capping rockfill along the upstream crest.

As far as the downstream toe of the Stormwater Dike is concerned, the eastern end is characterized by a very uneven tailings surface (photo #8) and the western end by seasonally ponded water. All run-off (and supernatant water during tailings deposition) ultimately reports to the sump adjacent to SD-3. Consequently, there is a constant source of water to recharge the groundwater in the talik zone (remnant of 2nd Portage Lake). Water draining through this talik zone reports to the pond downstream of Central Dike. One of the aims in the water management plan is to minimize this flow. The Board recommends that consideration be given to relocating the sump further south, along a rock outcrop that could be a potential site for the spillway, and to deposit additional tailings along the toe of Stormwater Dike to encourage permafrost aggradation.

The base seepage flow from Central Dike (photo #9) is around 60 m³/h (Minimum of 20 m³/h recorded during the winter) and the thermistors indicate stable conditions. Piezometric values show a small rising trend possibly due to changes in conditions in the surrounding areas such as the water level in Pit A. The yellow Trigger Action Response Plan (TARP) designation is appropriate for this structure.

5.0 MEADOWBANK DEWATERING DIKES

5.1 South Camp Dike

There is no adverse behaviour at South Camp Dike.

5.2 Bay-Goose Dike

The Bay-Goose Dike is performing as intended. No adverse trends are noted in the instrumentation. Seepage is observed at the toe in some locations (photo #10) as has been the case in the past.

A slow but gradual cooling trend is noted in the foundation which, as elsewhere, is accompanied by small increases in piezometric levels as the drainage pathways become more constrained by frozen ground.

Some maintenance work on the crest has been carried out to fill depressions that, by and large, have been present since just after construction. Safety windrows (bumpers) have been added along the crest of the slopes that will have the unfortunate side effect of accumulating snow in the winter season. The Board appreciates that levelling the crest will have a beneficial influence on surface run-off but suggests that additional areas be leveled to promote runoff and that openings be made in the windrows to minimize water ponding when the rockfill in these structures is frozen.

5.3 East Dike

As was described in the previous report, (Meeting #29) at East Dike, the continuing ingress of freezing in the foundation, as seen from the temperature measurements, is apparently also manifested by restricted seepage flow outlet points. This structure, one of the oldest at Meadowbank, has been the focus of surveillance over the last twelve months with additional thermistors and piezometers having been added in the South Channel (photo #11) to facilitate interpretation of the condition. The surface and seepage drainage has been improved; however, groundwater flow continues to by-pass the pump sump at certain times during the winter. The Board continues to support the hypothesis that the change in flow paths is associated with ground freezing.

As was noted in 2021, water flows onto the Pit E ramp and for a short period in early summer, reached an estimated flowrate of 100 m³/h. The build-up of an ice dam in the waste rock pile and subsequent release is a possible explanation. Continuing surveillance is warranted; however, the Board sees no immediate cause for concern with respect to dike integrity.

It should be noted that these observations were made in the South Channel of the East Dike profile whereas the 2008 incident, involving erosion and the appearance of a sinkhole, occurred in the North Channel.

As a general note on the description of foundation conditions at the various dikes, the Board would like to comment on the use of the word “thawed”. If indeed the ground was previously frozen, a state with temperatures above zero can indeed be described as thawed. However, a talik zone for which temperatures have not yet descended below zero would be better described as “unfrozen”.

5.4 Vault Dike

Mining operations have now ceased at the Vault Pit however, the integrity of Vault Dike is of interest until final closure. The dike and its foundation remain frozen and thus, the performance is satisfactory.

5.5 Lake Levels

Under natural conditions (prevailing), there is a 1 m difference between 3rd Portage Lake and 2nd Portage Lake (photo #12). Consequently, when the area enclosed by East Dike and Bay-Goose Dike will be flooded at closure, a head difference may be created across East Dike in a direction opposite to the way for which it was designed and operated. The closure plans will have to consider this situation or the case including a breach in East Dike as well as in Bay-Goose Dike with the head difference occurring through the waste rock in Portage Pit. Alternate arrangements involving raising of the water level in 2nd Portage Lake may also be possible. It is understood that maintaining the current water level in 3rd Portage Lake will be a critical consideration.

6.0 WATER MANAGEMENT AT AMARUQ SITE

6.1 IVR Dike

The IVR Dike has been in operation for just over one year now. Visual observations brought to light an area of the crest of the upstream thermal berm that has undergone some settlement and drone surveys have confirmed the fact that it is fairly uniformly distributed over the highest part of the structure. As can be appreciated from photo #13, the movement relative to a thermistor casing anchored in rock is about 25 cm. This instrument indicates that the active zone depth was about 2 m. The foundation and the lower part of the sand and gravel (esker material) embankment zone remain frozen. It is suspected that the compaction of the esker material may have been affected by freezing conditions during construction. Inclusion of ice and snow in the rockfill would have been manifested in a more irregular surface. The IVR Dike is a wide low head structure and even if deformation was to cause a leak in the liner and allow some seepage at high pond levels it is unlikely to lead to erosion and failure of the dike. Otherwise, performance as indicated by the instruments is satisfactory.

The water accumulation at the downstream toe due to inadvertent valve operation was seemingly without consequence for the dike (photo #14).

6.2 IVR Diversion Ditch

No adverse performance has been noted for this structure.

6.3 Saline Ditch

Some maintenance items have been addressed to ensure performance as intended.

6.4 WRSF Dike

The structure (photo #15) is performing well. With no periods of high water in Mammoth Lake being recorded this last spring, the foundation remained in a frozen state. Also, there has been little or no ponded water on the upstream side.

6.5 Mammoth Dike

There are no issues, also due to a lower level of the lake at freshet.

6.6 South Whale Tail Diversion Channel

The channel was constructed to divert run-off from the Whale Tail catchment directly towards Mammoth Lake thus by-passing the Amaruq mine site. Snow removal was performed in the invert prior to freshet. Good performance is noted despite local settlement of the invert.

6.7 Whale Tail Dike

The dike (photo # 16) has been in operation since 2019. An initial grouting program extending from Stn. 0+180 to 0+516 was carried out in the unfrozen bedrock prior to dewatering the northern sector of Whale Tail Lake. Seepage and thaw of the foundation, particularly towards the East abutment, were noted shortly after commissioning. A remedial grouting program was undertaken from Nov 2019 to March 2020 and covered the stretch from Stn. 0+487 to 0+748. This had a successful outcome, insofar as considerable reduction in seepage, was achieved. However, seepage flow rates are not accurately documented, given that part of the seepage reports by surface flow to the attenuation pond and part becomes groundwater recharge. The seepage collection ditch, shown on photo #16 was modified in 2022 such that all surface water emanating from the dike toe now reports to the two weirs A and B (photos #17, 18 and 19) installed in series where a flow of about 100 m³/h is recorded. A few springs located downstream of the ditch are missed but from a temporary weir (C) the flow rate is estimated to be approximately 25 m³/h. There has been an improvement in the seepage collection system but the catchment is quite large and surface runoff “noise” in the measurements during periods of rain or snowmelt are likely. Good records of temperature and precipitation will be necessary to facilitate interpretation of data.

Thermistor data indicates that equilibrium conditions have not yet been attained at the dike. Grouting of bedrock, even unfrozen rock, will likely not create a complete cut-off and residual pathways will likely still exist. Previously frozen areas at the abutments may have thawed since the grouting program of 2019-2020. Seepage pathways may have increased but presently there are no definitive means available to assess the change.

Of note however is that the piezometer at Stn. 0+701 P2, has experienced a seasonal spike in late summer over the past two years. The piezometric level appears to rise rapidly by approximately 5 m to generally match the upstream lake level. The elevated water level remains static for approximately 3 months, followed by gradual decline to baseline levels during the winter months. It is possible that these occurrences are related the seasonal melting of the East abutment foundation bedrock, creating a temporary conduit for water from the lake to interact with the piezometer.

The on-site team has been monitoring deformation of the embankment in the vicinity of the East abutment (photo #20) and the Board was able to observe the situation. Foundation preparation for the dike involved the excavation of overburden and ground ice in the abutment area. This

ensured that the central part of the cross-section was constructed on rock or ice-poor till. However, ground ice remained in the toe areas both upstream and downstream. It is hypothesized that “warm” water in the raised southern part of Whale Tail Lake applied a heat flux to the residual ground ice and thaw induced settlement was the result. This settlement along the toe on the upstream side has resulted in open water ingress along the abutment toe, likely accelerating the thermal degradation. Quite severe cracking is the manifestation (photos #21 and #22) that has appeared due to ground subsidence. The thermal degradation may be occurring in the abutment bedrock below the core zone as well, potentially resulting in the seasonal spikes in piezometer at Stn. 0+701 P2.

The Board recommends the construction of a berm in this location. The rock groin seen in photo #20 could be continued to meet the dike embankment thus providing protection against wave attack and the area behind this groin filled with sand and gravel material to chase water out of the depression in order to facilitate ground freezing during the upcoming winter season. A lift of about 1 m thickness is proposed initially with additional granular fill added in late winter. Migration of sand particles into the dike fill would not be detrimental and would actually reduce inflow and outflow of water.

Some settlement, though of lesser magnitude, is observed on the downstream shoulder. The secant pile central cut-off is robust and the Board does not envisage a risk to dike integrity but the upstream remedial work should proceed without delay. The downstream East abutment area was noted to generally slope toward the toe of the dike. Regrading this area by fill placement would also minimize concentrated flows or water ponding against the toe, thus reducing the potential for further thermal degradation in this area.

Thaw is also indicated by the thermistors at the West abutment and the addition of a thermal berm at this location is also worthy of consideration.

AEM shares the Board’s opinion that diligent monitoring of the behaviour of this structure including in-depth analysis of instrument data is warranted.

6.8 Whale Tail Pit Wall

Seepage from the Whale Tail Dike area reports to the attenuation pond located in the vicinity of the Whale Tail Pit (South side). Seepage is noted on the south-east wall of the Whale Tail Pit (photo #23 and #24) and significant ice accumulation has been observed above the ramp. A push-back of this wall is currently underway as can be appreciated in the upper part of photo #23. The intent is to excavate a sump on the wide bench and to control by pumping the water flow that daylight on this North facing pit wall. This may be an optimal solution. However, depending on hydro-geological conditions, and the shape of the drawdown cone, water may still exit on to the pit wall at a lower elevation. If geological mapping reveals a significant conductor, the drilling of a pump well could be considered.

7.0 SUMMARY

In summary, the main points of the Board’s deliberations are:

The Board supports the initiative to establish alert levels for remote monitored instruments but cautions that this exercise may take a few years to finalize.

A re-arrangement of the SC of the TSF may be useful to reduce groundwater recharge and minimize seepage which exits at Central Dike.

The Board concurs with the hypothesis of ground freezing being the driver of the observations at the East Dike South Channel pump station. AEM has already acted upon the recommendation to enhance the drainage into the sump during the winter months so that ongoing monitoring of seepage rates can be continued.

A more intensive evaluation of the data related to the Whale Tail Dike performance is merited. A thermal berm at the East abutment (and possibly at the West also) is strongly recommended.

8.0 NEXT MEETINGS

The Board awaits instruction on meetings/site visits for 2023. Any other participation will be through further ad-hoc conference calls.

9.0 ACKNOWLEDGMENTS

The MDRB (Board) wishes to thank the AEM personnel for organizing the site visit which was highly successful and greatly appreciated.

The Board wishes to thank the personnel of AEM for the preparation of material and the participation of AEM, SLI and WSPG in the visit and/or conference calls during the presentations.

The Board is pleased to see that the core of the AEM team has been maintained over the period of the MDRB involvement in the Meadowbank project. The value of continuity cannot be overstated.

Signed:



Kevin Hawton, P. Eng



D. Anthony Rattue, P. Eng.

ATTACHMENT A

ATTENDANCE AT SEPTEMBER 2022 SITE VISIT AND PRESENTATIONS

Attendance		
Guillaume Baril	AEM	Geotechnical Technician
Fredérick L. Bolduc	AEM	Geotechnical Coordinator
Thomas Dahm	AEM	Geotechnical Technician
Patrice Gagnon	AEM	Water Management and Geotechnical Coordinator
Jessica Huza	AEM	
Michel Julien	AEM	V.P. Environment
Alexandre Lavallée	AEM	Environment and Critical Infrastructure Superintendent
Thomas Lepine	AEM	EoR – Technical Specialist, Env. Management
Camille Pelletier	AEM	Water and Tailings Engineer
Erika Voyer	AEM	Closure Engineer
Yves Boulianne (On-line)	GAL	Geotechnical Engineer
Marion Habersetzer (on-line)	GAL	Geotechnical Engineer
Anh-Long Nguyen (On-line)	SLI	Project Manager
Kevin Hawton		Dike Review Board
Anthony Rattue		Dike Review Board

ATTACHMENT B

SELECTED PHOTOGRAPHS



Photo #1 Tailings discharge into Pit E



Photo #2 Reclaim pumps in Pit E

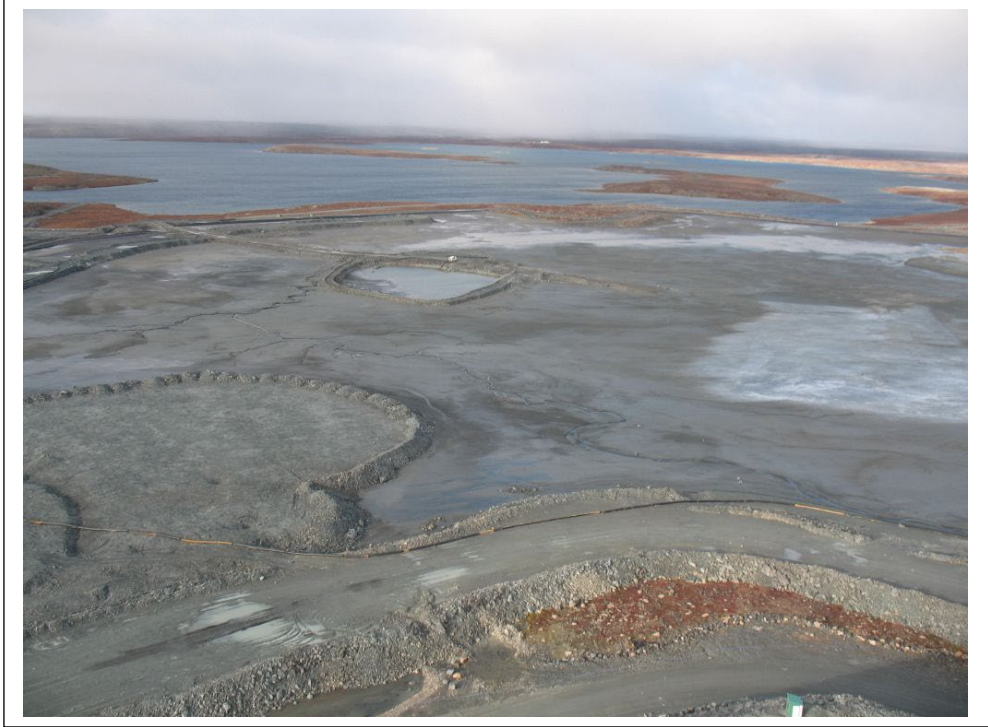


Photo #3 North Cell of TSF



Photo #4 Reclaim sump in North Cell



Photo #5 Saddle Dam SD-1



Photo #6 North Cell RF-2



Photo #7 Stormwater Dike

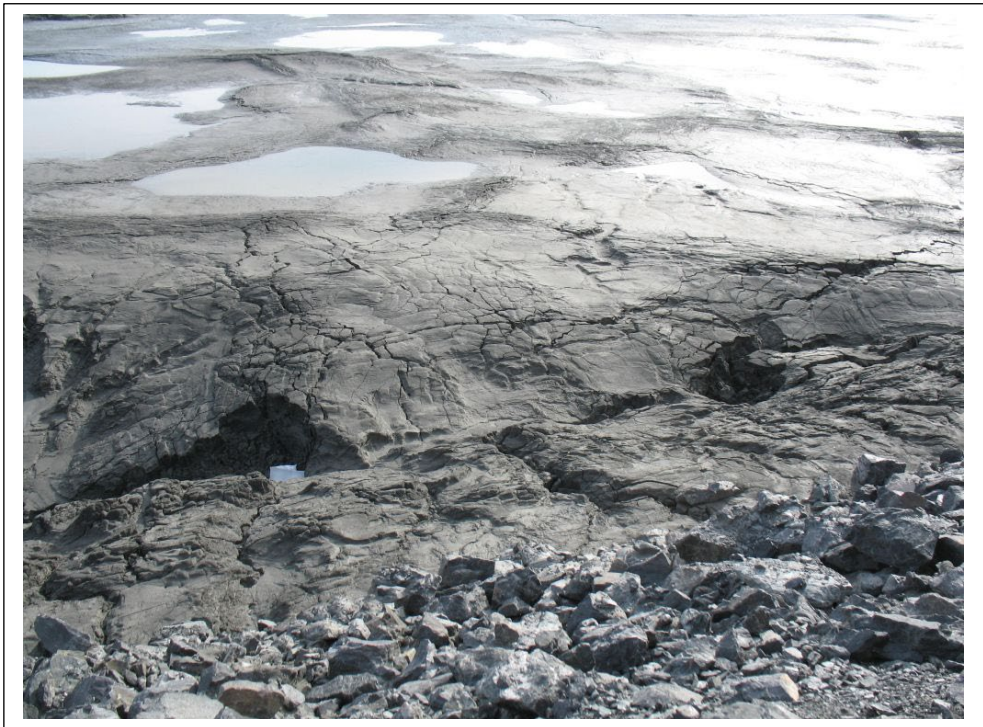


Photo #8 Toe of Stormwater Dike



Photo #9 Central Dike



Photo #10 Seepage from Bay-Goose Dike



Photo #11 Pump installation at East Dike south channel



Photo #12 Channel from 3rd Portage Lake to 2nd Portage Lake



Photo #13 IVR Dike Crest



Photo #14 IVR Dike D/S toe



Photo #15 WRSF Dike



Photo #16 Whale Tail Dike. Seepage collection ditch

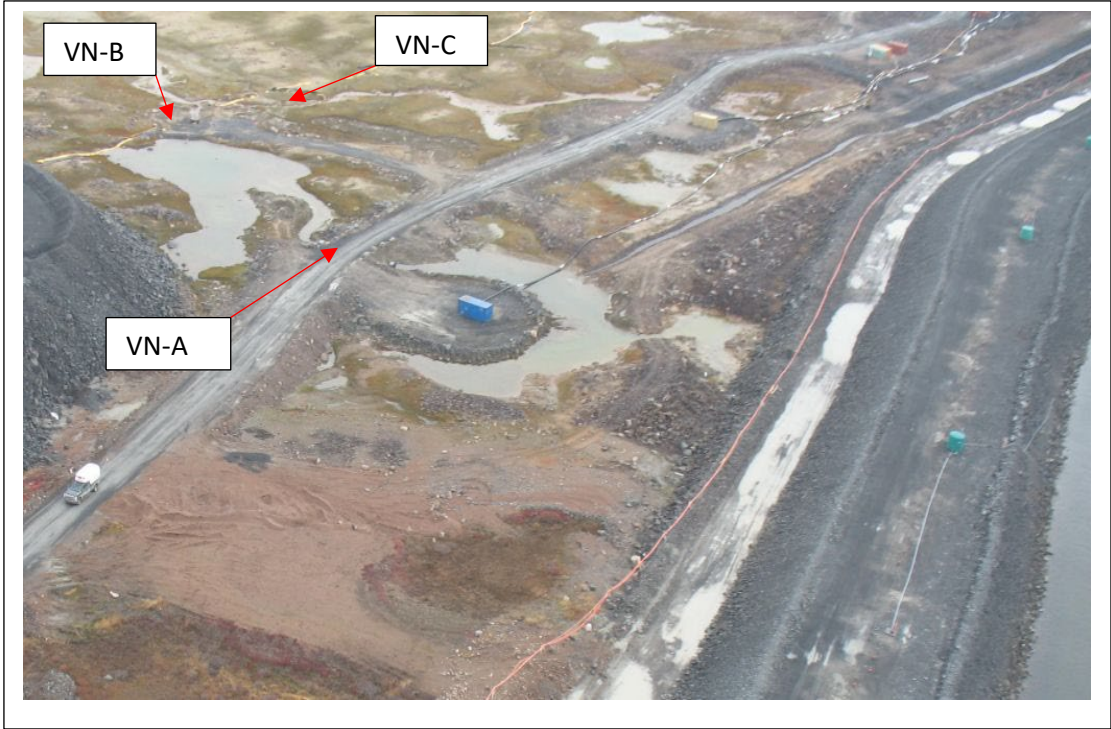


Photo #17 Whale Tail Dike. Weir locations



Photo #18 V-notch Weir A



Photo #19 V-notch Weir B

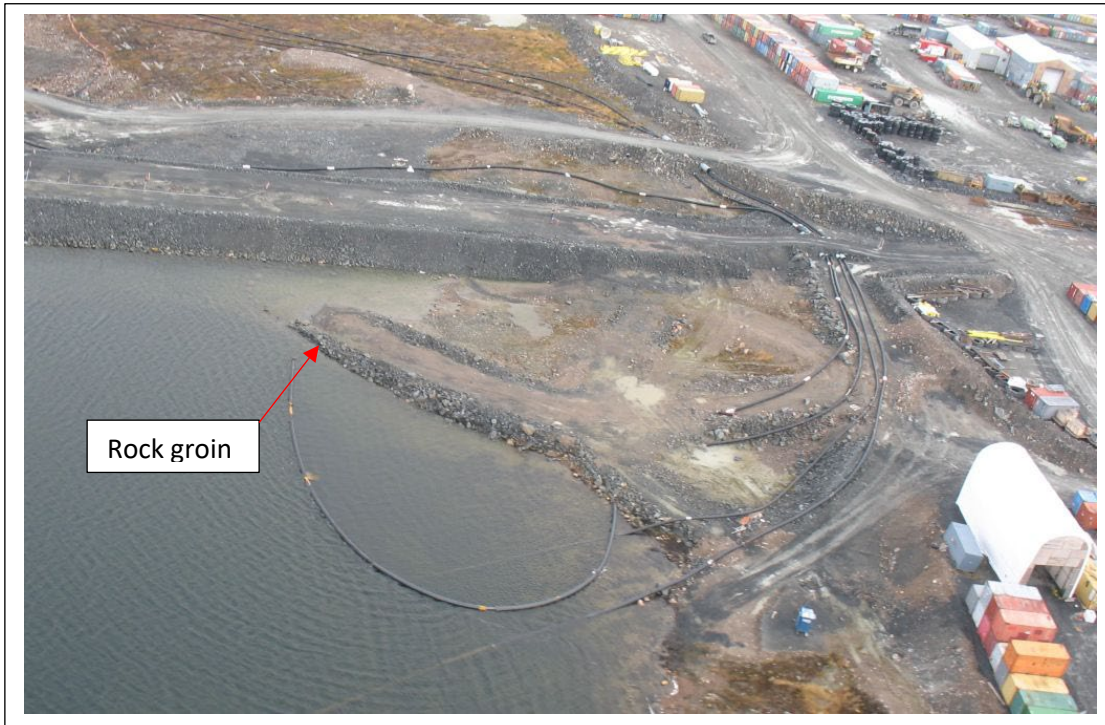


Photo #20 Whale Tail Dike. East abutment



Photo #21 East abutment. Cracking on crest



Photo #22 East abutment U/S slope



Photo #23 Whale Tail Pit, south wall

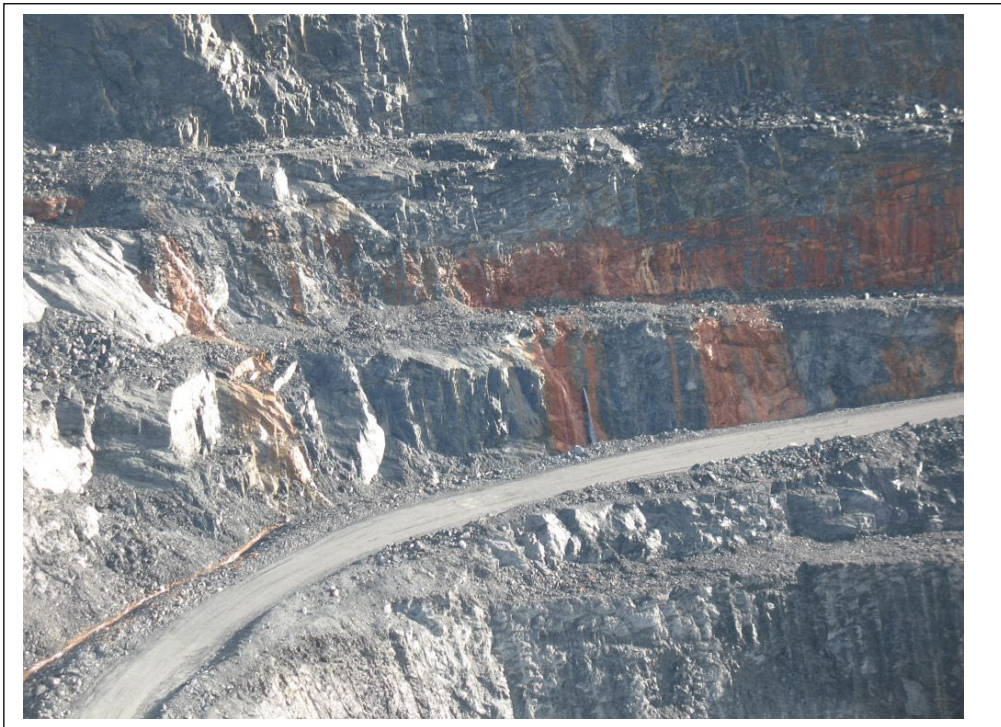


Photo #24 Whale Tail Pit, south wall, zoom



AGNICO EAGLE

To: D. Anthony Rattue and K. Hawton

From: Agnico Eagle Mines, Meadowbank, Nunavut Division

Date: January 4th, 2023

RESPONSE TO COMMENTS, MEADOWBANK DIKE REVIEW BOARD No.30 – MEADOWBANK REPORT

The thirtieth meeting between the Meadowbank Dike Review Board (the Board) and Agnico Eagle Mines Limited (AEM) was held September 13th to September 16th, 2022, at the Meadowbank Complex.

The objective of the meeting was to present and discuss the current status of the operations and construction at the Meadowbank Complex which includes Vault and Amaruq, as is conducted yearly. On-ground site visits and helicopter flyovers were also conducted for each site.

On October 2nd, 2022, the Board provided their report (MDRB Meeting Report 30) with their recommendations. This letter provides the response from AEM related to the Board recommendations for the report. All Board recommendations are contained in the following table along with their location, action plan, current status, and anticipated completion date. This table will be used to follow up on each recommendation throughout the upcoming year and to update the Board when the next MDRB Meeting is held.

Best Regards,

Frederick L. Bolduc
Water & Tailings General Supervisor
Meadowbank, Nunavut Division
Agnico Eagle Mines

MDRB30 Recommendations and Action Plan

Recommendation Number	Location	Year ⁽²⁾	Recommendation	Action Plan/Follow-up	Status	Completion Date
MDRB#29-9	Water Management	2021	The potential for advancing the construction of the permanent spillway between the NC and SC should be evaluated to permit some of the water transfer to be accommodated by gravity flow instead of pumping from the problematic collection sump.	The TSF Closure Landform study is ongoing and is looking at this opportunity. Details on this will be presented at the next MDRB meeting.	Ongoing	-
MDRB#29-12	Central Dike	2021	Discussions should be held with Golder to establish whether the range of operating levels in the Central Dike downstream pond could be widened to facilitate the pump operation.	As shared at MDRB#30, AEM is working on a proposal for Golder and the EOR for a stepped approach to increase the operating range of the CD D/S pond.	Ongoing	-
MDRB#30-1	Closure	2022	The Board is pleased to see that AEM has initiated the formation of a team dedicated to closure and reclamation. To date there have been limited cases of mine closure in the North from which to derive precedence. Certain issues may take longer than expected to resolve and opportunities may otherwise be missed. The timing is appropriate.	AEM will ensure that the Board is kept informed on matters related to closure that fall within their scope.	Closed	-
MDRB#30-2	Closure	2022	The Board sees the need to address the water treatment needs, methods and timing to allow tailings capping and re-filling of the pits prior to breaching the dikes.	AEM is currently working on a pre-feasibility level in-pit water treatment study that is looking at the needs, methods, and timing of the water treatment. Water treatment will be discussed further during the next MDRB meetings. It is expected that further work will be required once decisions have been made on the Life of Mine for the Meadowbank Complex. Further assessment of the tailings capping is being completed by AEM, as presented in the ICRP.	Closed	-
MDRB#30-3	Instrumentation Monitoring	2022	Included is the proposal to use "Alarm" or "Alert" levels to draw attention to changes in automated instrument readings. The Board endorses this initiative but cautions that establishing alert levels for instruments that exhibit for example, an annual cyclic tendency, may not be easy and a few iterations may be required before a reliable system is established.	AEM acknowledges that setting the correct alert levels for the various instrumentation will be an iterative process and will be adjusting them accordingly throughout the year as well as having them re-examined by an external party as part of the 2023 annual geotechnical inspection. An update on this initiative will be given during the next MDRB meeting.	Closed	-
MDRB#30-4	Tailings Management	2022	No "landscaping" deposition was made into the North Cell (NC) (photo #3) or the South Cell (SC) of the Tailings Storage Facility (TSF) during 2022. As stated in previous reports, the Board agrees that warm weather deposition is appropriate to prepare the final tailings surface for NPAG capping rockfill.	AEM agrees that additional tailings deposition needs to be performed at the North Cell and South Cell to prepare the final tailings surface and is planning to complete this deposition in future summers; more details to come on this with the new tailings deposition plan to be released in the upcoming months.	Closed	-
MDRB#30-5	TSF	2022	At SD-1, the thermistor string T-3 is no longer functional. However, the foundation and the tailings upstream of the structure are frozen. The Board does not see a necessity to replace this instrument.	AEM agrees.	Closed	-
MDRB#30-6	TSF	2022	AEM has suggested that the ditch at the toe of saddle dams SD-2, SD-4 and SD-5 be backfilled with rock to reduce the accumulation of water (run-off from outside the TSF) and the Board concurs.	AEM will include this work as part of the list of items to be considered for progressive closure.	Closed	-
MDRB#30-7	TSF	2022	A fine crushed rock filter lines the inner slope of the NCIS and RF-2. As the annual geotechnical report notes, this material is subject to erosion from any water flow along the toe (photo #6), from seepage through or over the slope and constitutes an on-going maintenance item. The Board suggests that a berm of coarser rockfill be placed along the toe to alleviate this issue as the capping may still be several years in the future.	AEM will develop a plan to place a berm of rockfill along the toe of the inner slope of the NCIS and RF-2 to prevent reoccurring erosion events.	Open	Jun-23
MDRB#30-8	TSF	2022	The situation at Stormwater Dike (photo #7) is little changed from last year. An area of shallow ponded water is noted at the west end. Down drag of ice or frozen tailings adhering to the liner is a possibility however, as the tailings deposit is at or about the maximum planned elevation little consequence is envisaged. Nevertheless, "landscaping" tailings deposition and/or the placement of finer material should precede the placement of the capping rockfill along the upstream crest.	As mentioned in recommendation MDRB#30-4 AEM agrees that additional tailings deposition needs to be performed at the North Cell to prepare the final tailings surface and is planning to complete this deposition in future summers; consideration will be made to add tailings at the west end of Stormwater Dike where water ponds. More details to come on this with the new tailings deposition plan to be released in the upcoming months.	Closed	-

MDRB30 Recommendations and Action Plan

Recommendation Number	Location	Year ⁽²⁾	Recommendation	Action Plan/Follow-up	Status	Completion Date
MDRB#30-9	TSF	2022	As far as the downstream toe of the Stormwater Dike is concerned, the eastern end is characterized by a very uneven tailings surface (photo #8) and the western end by seasonally ponded water. All run-off (and supernatant water during tailings deposition) ultimately reports to the sump adjacent to SD-3. Consequently, there is a constant source of water to recharge the groundwater in the talik zone (remnant of 2nd Portage Lake). Water draining through this talik zone reports to the pond downstream of Central Dike. One of the aims in the water management plan is to minimize this flow. The Board recommends that consideration be given to relocating the sump further south, along a rock outcrop that could be a potential site for the spillway, and to deposit additional tailings along the toe of Stormwater Dike to encourage permafrost aggradation.	AEM agrees with the Board that additional tailings deposition along the downstream toe of Stormwater Dike should be considered; this will be examined in the new tailings deposition plan to be released in the upcoming months as mentioned in recommendation MDRB#30-4. Relocating the sump adjacent to SD-3 to be further south along the rock outcrop will be considered; however given the topography of the area this may be a challenge. Moving the spillway to this location is being considered in the feasibility level TSF Closure Landform study. More information on this study will be provided to the Board during the next MDRB meeting.	Open	May-23
MDRB#30-10	Central Dike	2022	The base seepage flow from Central Dike (photo #9) is around 60 m ³ /h (Minimum of 20 m ³ /h recorded during the winter) and the thermistors indicate stable conditions. Piezometric values show a small rising trend possibly due to changes in conditions in the surrounding areas such as the water level in Pit A. The yellow Trigger Action Response Plan (TARP) designation is appropriate for this structure.	AEM agrees and will continue close monitoring of Central Dike and adapt the TARP level if required based on this monitoring.	Closed	-
MDRB#30-11	Bay Goose Dike	2022	Some maintenance work on the crest has been carried out to fill depressions that, by and large, have been present since just after construction. Safety windrows (bumpers) have been added along the crest of the slopes that will have the unfortunate side effect of accumulating snow in the winter season. The Board appreciates that levelling the crest will have a beneficial influence on surface run-off but suggests that additional areas be leveled to promote runoff and that openings be made in the windrows to minimize water ponding when the rockfill in these structures is frozen.	AEM agrees that additional leveling needs to take place on the crest of Bay Goose Dike and is working to arrange this work to be done for summer 2023. It will be investigated if openings should be made in the bumpers following observation of snow management in the winter of 2023.	Open	Sep-23
MDRB#30-12	East Dike	2022	The surface and seepage drainage has been improved; however, groundwater flow continues to by-pass the pump sump at certain times during the winter. The Board continues to support the hypothesis that the change in flow paths is associated with ground freezing. AEM has already acted upon the recommendation to enhance the drainage into the sump during the winter months so that ongoing monitoring of seepage rates can be continued.	AEM has continued working to fix the drainage to the sump pump at East Dike; the vertical collection culvert was partially excavated in early November and had additional drainage holes drilled into it. The East Dike flowmeter is also in the process of being replaced to prevent the erratic data seen in the past.	Open	Dec-22
MDRB#30-13	East Dike	2022	As was noted in 2021, water flows onto the Pit E ramp and for a short period in early summer, reached an estimated flowrate of 100 m ³ /h. The build-up of an ice dam in the waste rock pile and subsequent release is a possible explanation. Continuing surveillance is warranted; however, the Board sees no immediate cause for concern with respect to dike integrity.	AEM agrees with the Board and will continue monitoring the Pit E ramp for water flows and changing conditions.	Closed	-
MDRB#30-14	All Dikes	2022	As a general note on the description of foundation conditions at the various dikes, the Board would like to comment on the use of the word "thawed". If indeed the ground was previously frozen, a state with temperatures above zero can indeed be described as thawed. However, a talik zone for which temperatures have not yet descended below zero would be better described as "unfrozen".	Communication was sent on this topic and it was also discussed with the team to ensure proper nomenclature is used.	Completed	-

MDRB30 Recommendations and Action Plan

Recommendation Number	Location	Year ⁽²⁾	Recommendation	Action Plan/Follow-up	Status	Completion Date
MDRB#30-15	Closure	2022	Under natural conditions (prevailing), there is a 1 m difference between 3rd Portage Lake and 2nd Portage Lake (photo #12). Consequently, when the area enclosed by East Dike and Bay-Goose Dike will be flooded at closure, a head difference may be created across East Dike in a direction opposite to the way for which it was designed and operated. The closure plans will have to consider this situation or the case including a breach in East Dike as well as in Bay-Goose Dike with the head difference occurring through the waste rock in Portage Pit. Alternate arrangements involving raising of the water level in 2nd Portage Lake may also be possible. It is understood that maintaining the current water level in 3rd Portage Lake will be a critical consideration.	The Closure team will be examining the pits flooding plan and the dike(s) breaching strategy in more detail as it ramps up the closure planning and studies in the upcoming year. AEM agrees on the potential of a breach in East Dike and that it may be the best way to deal with the head difference between 3rd Portage Lake and 2nd Portage Lake and will further assess the feasibility of this option.	Open	Oct-24
MDRB#30-16	WTD	2022	There has been an improvement in the seepage collection system but the catchment is quite large and surface runoff "noise" in the measurements during periods of rain or snowmelt are likely. Good records of temperature and precipitation will be necessary to facilitate interpretation of data.	AEM collects detailed records of temperature and precipitation and will use them in conjunction with the Whale Tail Dike seepage measurements to aid in interpretation.	Closed	-
MDRB#30-17	WTD	2022	The Board recommends the construction of a berm in this location. The rock groin seen in photo #20 could be continued to meet the dike embankment thus providing protection against wave attack and the area behind this groin filled with sand and gravel material to chase water out of the depression in order to facilitate ground freezing during the upcoming winter season. A lift of about 1 m thickness is proposed initially with additional granular fill added in late winter. Migration of sand particles into the dike fill would not be detrimental and would actually reduce inflow and outflow of water.	Following MDRB#30 AEM designed and constructed the first stage of the berm on the upstream east abutment of Whale Tail Dike. The second stage of the berm will be added in late winter. An update on the construction and performance of this berm will be given during the next MDRB meeting. AEM would like to thank the Board for their recommendations on the design of this berm.	Ongoing	Apr-23
MDRB#30-18	WTD	2022	Some settlement, though of lesser magnitude, is observed on the downstream shoulder. The secant pile central cut-off is robust and the Board does not envisage a risk to dike integrity but the upstream remedial work should proceed without delay. The downstream East abutment area was noted to generally slope toward the toe of the dike. Regrading this area by fill placement would also minimize concentrated flows or water ponding against the toe, thus reducing the potential for further thermal degradation in this area.	AEM will evaluate whether there is water ponding or concentrated flow in that sector and if it requires mitigation. If its the case the possibility of regrading the downstream east abutment area of Whale Tail Dike will be examined.	Open	Jul-23
MDRB#30-19	WTD	2022	Thaw is also indicated by the thermistors at the West abutment and the addition of a thermal berm at this location is also worthy of consideration.	AEM has designed and is proceeding through the permitting process to be ready to build a thermal berm along the western abutment in the winter of 2023. Thermal data will be re-assessed in Q1 2023 to inform on whether this construction will be done at the same time as the Eastern thermal berm or at a later date.	Open	Apr-23
MDRB#30-20	WTD	2022	AEM shares the Board's opinion that diligent monitoring of the behaviour of this structure including in-depth analysis of instrument data is warranted. A more intensive evaluation of the data related to the Whale Tail Dike performance is merited.	AEM is working on reviewing the instrumentation monitoring program to ensure that the instrumentation data related to Whale Tail Dike is still appropriate. Alerts will also be added to selected instruments to aid AEM in detecting changes in condition. Frequent structure inspections will be continued. An update on this initiative will be given during the next MDRB meeting.	Ongoing	-

MDRB30 Recommendations and Action Plan

Recommendation Number	Location	Year ⁽²⁾	Recommendation	Action Plan/Follow-up	Status	Completion Date
MDRB#30-21	Whale Tail Pit	2022	The intent is to excavate a sump on the wide bench and to control by pumping the water flow that daylights on this North facing pit wall. This may be an optimal solution. However, depending on hydro-geological conditions, and the shape of the drawdown cone, water may still exit on to the pit wall at a lower elevation. If geological mapping reveals a significant conductor, the drilling of a pump well could be considered.	AEM has evaluated this option with Golder in 2021. It was found at the time that the hydrogeological condition of the pit would not be favorable to this mitigation technique. More details on this study could be shared with the Board at their request.	Closed	-
MDRB#30-22	TSF	2022	A re-arrangement of the SC of the TSF may be useful to reduce groundwater recharge and minimize seepage which exits at Central Dike.	AEM agrees that re-arranging the South Cell could be beneficial for water management, particularly for the Central Dike seepage. Additional tailings deposition needs to be performed at the South Cell to prepare the final tailings surface and high priority will be given to improving water management; more details to come on this with the new tailings deposition plan to be released in the upcoming months as well as the results of the ongoing study on the closure landform.	Ongoing	-