# Appendix 9

# Meadowbank and Whale Tail 2021 Annual Geotechnical Inspection

**REPORT**

# 2021 Annual Geotechnical Inspection

*Meadowbank Complex, Nunavut*

Submitted to:

**Agnico Eagle Mines Ltd.**

Meadowbank Division
PO Box 540
Baker Lake, Nunavut, X0C 0A0

Submitted by:

**Golder Associés Ltée**

7250, rue du Mile-End, 3e étage, Montréal (Québec) H2R 3A4, Canada

+1 514 383 0990

21468006-1606-R-Rev0

11 February 2022

# Distribution List

1 electronic copy: Agnico-Eagle Mines Ltd.

1 electronic copy: Golder Associés Ltd.

# Executive Summary

Agnico-Eagle Mines Limited (AEM) has mandated Golder Associés Ltée (Golder) to carry out the 2021 geotechnical inspection of the Meadowbank mining complex, including the Meadowbank and Whale Tail Project sites, in accordance with the requirements of the water licences (No. 2AM-MEA0815 and 2AM-WTP1830). The inspection was carried out from July 27 to August 2, 2021 and concerned the geotechnical aspects and the review of the instrument data available for the dewatering dikes, the structures of the tailings pond (tailings storage facility [TSF]), the structures of the all-weather access road (AWAR) located between the Meadowbank site and the town of Baker Lake, as well as the road between the Meadowbank and Whale Tail Project sites (Whale Tail Project road), the fuel storage infrastructures at the Meadowbank site, the Whale Tail Project site and Baker Lake, the other site infrastructures such as the pumping ramp of the attenuation pond, the diversion ditches and surface water management infrastructures, the access roads, the landfill, the contaminated soil storage area (landfarm), the wastewater management pond (Stormwater Pond), the Rock Storage Facility (RSF) till plug, the diffusers, the erosion and sediment protection structure, the airstrip as well as the crusher retaining wall.

Based on observations collected during the inspection, as well as instrumentation data, the condition of the dewatering dikes is satisfactory. It is recommended to keep reporting piezometers that have recorded data below 0°C in the past on East Dike and Bay-Goose Dike and be very careful in interpreting their data, as they may be damaged. Once a piezometer has frozen, it is no longer completely reliable even if it thaws.

The subsidence and tension cracks observed in 2013 and 2014 on the upstream side of the thermal cover of Bay-Goose Dike were still visible but no longer appear to be active. Water accumulation at the downstream toe and flow from the downstream side of Bay-Goose Dike to Bay-Goose pit should continue to be monitored. Flow areas identified as North Channel, Channel 1, and Channel 3 should continue to be carefully monitored as instrumentation data and field observations seem to indicate that flow is occurring in these areas but is draining directly into the pit instead of accumulating at the downstream toe of the dike. The flow of the Central Channel area should continue to be monitored.

The dewatering dikes at the Whale Tail Project site were in good condition during inspection.

Seepage through the foundation of Whale Tail Dike (WTD), which is measured in the downstream collection trench, was stable in 2021. The seepage is managed by redirecting it by gravity to the attenuation pond and a pumping system is in place to intercept the seepage, although it is not currently active. Monitoring of the instrumentation data and seepage rates must continue to understand spatial and temporal evolution of the seepage.

No seepage was observed in 2021 at the downstream toe of Waste Rock Storage Facility (WRSF) Dike and its foundation was frozen all year long. This is likely linked to the effectiveness of the thermal berm that was constructed in 2020 upstream of the dike, as well as the low upstream pond level management strategy that were part of AEM’s mitigation plan. Monitoring of the instrumentation data must continue to validate the effect of these measures on the foundation and assess its long-term thermal behaviour.

Based on the observations collected during the inspection, as well as the instrumentation data, the TSF structures generally are in good condition. The tailings beaches were adequate along the structures, with the exception of

the south side of Central Dike and Saddle Dam 5, where shallow water was ponding, as well as the downstream side of the west end of the Stormwater Dike that separates the two TSF cells, where tailings are submerged.

No new deformation was observed on Stormwater Dike in 2021 and old deformation features are disappearing. It is recommended to continue to monitor the potential movements of the Stormwater Dike and to follow the emergency measures plan in case of deterioration of the situation. The presence of water against the downstream toe of this dike is geotechnically acceptable.

Most traces of erosion and tension cracks in the fine filter material of the North Cell Internal Structure have disappeared after remediation work. The structure is performing well.

A water pond is present at the downstream toe of Central Dike. This accumulation of water is fed by an underground flow which is partly connected to the south cell of the TSF. During the inspection, the accumulation of water was observed at the downstream toe of the dike, approximately between Sta. 0+300 and the southern access road at Sta. 0+830. The water was orange in color with high turbidity earlier in the season, similarly to previous years. At the time of inspection, an average seepage rate of approximately 150 $m^3/h$ was being pumped to the South Cell of the TSF to maintain the downstream pond level at elevation (El.) 115 m.

Most of the AWAR culverts were in good condition. It is recommended that special attention be paid to culverts R-00A (2+550), PC-14 (4+260), the unidentified culvert at kilometre 5+700, and the culvert PC-16 (54+950). If insufficient capacity to manage runoff is observed at the time of the spring freshet, then it would be recommended to clear the obstructions or repair the culverts. It is also recommended to monitor the progress of erosion of culverts PC 17A (8+830), PC-11 (39+552), R14 (67+840), R18-B (82+500), R-20 (85+490), R-23 (93+600), and R24 (98+100) during the spring freshet, since there are signs of water flow below the road at these locations. If the condition of these culverts continues to deteriorate due to erosion, it is recommended that they be repaired. The bridges along the AWAR were in good geotechnical condition and no notable sign of erosion of the abutments was observed. Bridge 1 has a deformation of the metal panels of the two abutments. Signs of settlement were observed at Bridge 6, R15. The bridge sloped towards the west side of the two abutments. The foundation of the bridge showed no signs of deterioration. Remediation work is not required at this time, however the situation should be monitored.

The presence of unstable blocks and loose rocks along steep walls is still observed in quarries 3, 7, 9, 10, 16, 18 and 23 along the AWAR, although no significant degradation of the wall conditions have been observed in the absence of work in these quarries. It is recommended to workers to use caution in these quarries if work resumes there and for AEM to inform them of the potential hazards.

The culverts on the Whale Tail Project road were in good condition. It is recommended to pay special attention to culverts #5 (117+525), #7 (118+013), #7-2 (118+016), #12 (4+179 to 4+186; 3 outlets out of 5), #13 (120+615), #27-2 (123+300), #38 (125+049), #48 (127+203), #52 (128+195), #54 (128+388), #55 (128+440), #61 (129+050), #63 (129+390), #65 (130+924), #66 (132+324), #82 (136+143), #83 (136+300), #85 (136+671), #86 (136+740), #88 (136+861), #89 (137+180), #93 (138+100), #101 (139+025), #105 (140+555), #111 (142+461), #112 (142+630), #113 (142+736), #115 (142+865), #116 (142+940), #118 (143+433), #133 (148+141), #135 (148+567), #137 (148+940), #138 (149+000), #150 (152+171 to 152+179; 1 outlet out of 5), #160 (155+966), #178 (161+170), #234 (170+385), #243 (171+593), #256 (173+350), #268 (175+774), #281 (178+350). If insufficient capacity to manage runoff is observed at the time of the spring freshet, then it would be recommended to clear the obstructions or repair the culverts. It is also recommended to monitor the erosion progress of culverts # 167 (41 + 843) and # 232 (53 + 928) since there are signs of water flow below the road at these locations.

Culvert erosion should be monitored during the spring freshet. The bridges along the Whale Tail Project road were in good geotechnical condition and no notable sign of erosion of the abutments was observed besides limited surficial erosion of the granular fill behind a concrete wall at Bridge 148, which poses no geotechnical concern. The crack observed in 2019 and 2020 in the concrete of the northwest abutment of Bridge 160.8 (160 + 800) is no longer visible in 2021.

During the inspection of the quarries and eskers along the Whale Tail Project road, unstable and loose rocks along steep walls and unstable ground slopes were observed in all quarries and eskers except eskers # 3, # 5, and # 6. No significant degradation of the wall and slope conditions have been observed in the absence of work in these locations, however it is recommended that workers be cautious at these locations if work resumes there and that AEM advise them of the dangers of falling boulders or potential slope failures.

The fuel storage infrastructure at the Whale Tail Project site was in good condition, with some backfill material missing.

Water accumulation was observed in several areas of the Baker Lake fuel storage infrastructure and at the Meadowbank main camp site. The disposal of fluids accumulated in secondary containment infrastructure should be managed to minimize the amount of water in contact with the base of the tanks. Exposed geomembrane was observed on the south side of Tanks 1 to 4, and in the northeastern corner of Tank 4. It is recommended to cover the exposed area with a geotextile and backfill material to restore the protection of the geomembrane. Tension cracks at the top of the slope north of Tank 5 detected in 2020 appeared inactive. The area should be monitored and repaired as necessary to protect the geomembrane.

A hole in the exposed geomembrane was present at the Baker Lake site at the south-southwest corner of Tank 3 at the toe of the slope. The liner should be repaired, and the exposed area should be covered with geotextile and backfill material to restore the protection of the geomembrane. Animal burrows have been observed at the Baker Lake site near the south side of Tanks 3 and 4. It is recommended to assess whether the underlying geosynthetics have been damaged.

The geomembrane of the 20 Jet A fuel tanks at the Baker Lake site remains exposed and almost entirely flooded in 2021. The geomembrane had a tear in the southwest corner of the tanks that could not be seen due to the water. It is recommended to remain vigilant during the spring freshet and throughout the year to manage the accumulation of water in the containment area.

It is recommended to monitor the performance of the five culverts installed in the Vault road during the spring freshet. A set of two culverts is installed between lakes NP1 and NP2 near the Meadowbank site; these culverts are in good condition. Another set of three culverts is installed further down the road to the Vault pit, and these culverts are all partially collapsed in the middle.

The Meadowbank West and East Diversion ditches and their sediment control elements, as well as the Whale Tail Project site Diversion ditches, were in good condition. It is important to inspect them during the spring freshet.

The landfill, the wastewater management pond (Stormwater Pond), the airstrip and the crusher retaining wall at Meadowbank, as well as the diffusers, landfill, and attenuation pond ramp at the Whale Tail Project site, were in good condition. The Meadowbank contaminated soil storage area (landfarm) show some minor cracks, to be monitored.

# Sommaire exécutif

Agnico-Eagle Mines Ltée (AEM) a mandaté Golder Associés Ltée (Golder) pour réaliser l'inspection géotechnique 2021 du complexe minier Meadowbank, incluant les sites de Meadowbank et Whale Tail Project, en conformité avec les exigences du permis d'utilisation des eaux d'AEM (licences No. 2AM-MEA0815 et 2AM-WTP1830). L'inspection a été réalisée du 27 juillet au 2 août 2021 et concernait les aspects géotechniques et la revue des données d'instruments disponibles pour les digues d'assèchement, les structures du parc à résidus (PAR), les structures de la route d'accès (AWAR) située entre le site de Meadowbank et la ville de Baker Lake, ainsi que la route de Whale Tail Project, les infrastructures d'entreposage du carburant au site de la Mine, au site de Whale Tail Project et à Baker Lake, de même que les autres infrastructures du site telles que la rampe de pompage du bassin d'atténuation, les fossés de dérivation et infrastructures de gestion des eaux de surface, les routes d'accès, la zone d'entreposage de matières résiduelles, la zone d'entreposage de sols contaminés, l'étang de gestion des eaux usées (Stormwater Pond), le till de colmatage de la halde à stériles (RSF), les diffuseurs, la structure de protection contre l'érosion et les sédiments, la piste d'atterrissage ainsi que le mur de soutènement du concasseur.

Basée sur les observations collectées lors de l'inspection, ainsi que les données d'instrumentation, la condition des digues d'assèchement est satisfaisante. Il est recommandé de continuer à signaler les piézomètres qui ont enregistré des données à une température inférieure à 0 °C par le passé aux digues East Dike et Bay-Goose Dike et d'être très prudent lors de l'interprétation de leurs données, car ils pourraient être endommagés. Une fois qu'un piézomètre a gelé, il n'est plus totalement fiable même s'il dégèle.

Il est recommandé de conserver une distance suffisante entre la pile de roches stériles ultramafiques et le pied aval de la digue South Camp Dike afin de permettre une observation visuelle adéquate de la zone du pied aval.

L'affaissement et les fissures de tension observés en 2013 et 2014 du côté amont de la couverture thermique de la digue Bay-Goose Dike étaient encore visibles, mais ne semblent plus actifs. L'accumulation d'eau au pied aval et l'écoulement du côté aval de la digue Bay-Goose Dike vers la fosse Bay-Goose doivent continuer à être surveillés. Les zones d'écoulement identifiées comme North Channel, Channel 1 et Channel 3 doivent continuer à être rigoureusement surveillées, car les données d'instrumentation et les observations de terrain semblent indiquer qu'un écoulement se produit dans ces zones, mais s'évacue directement dans la fosse au lieu de s'accumuler au pied aval de la digue. L'écoulement de la zone d'écoulement Central Channel doit continuer à être surveillé.

Les digues d'assèchement du site de Whale Tail Project (Whale Tail Dike, WRSF Dike, Mammoth Dike, North-East Dike) étaient en bonne condition lors de l'inspection.

Les exfiltrations à travers de la fondation de la digue Whale Tail Dike mesurées dans la tranchée de collecte en aval étaient stables en 2021. Les exfiltrations sont gérées par redirection gravitaire vers le bassin d'atténuation et un système de pompage est en place pour interception des exfiltrations, bien qu'il ne soit actuellement pas actif. Le suivi de l'instrumentation et des exfiltrations doit se poursuivre afin de comprendre l'évolution spatiale et temporelle des exfiltrations.

Aucune exfiltration n'a été observée en 2021 au pied aval de la digue WRSF Dike et sa fondation était gelée toute l'année. Ceci est vraisemblablement attribuable à l'efficacité de la berme thermique construite en 2020 en amont de la digue, ainsi que de la stratégie de maintien d’un niveau d’eau bas dans le réservoir en amont inclus dans le plan de mitigation d’AEM. Le suivi des instruments doit se poursuivre pour valider l’effet de ces mesures sur la fondation et évaluer le comportement thermique de celle-ci à long terme.

Sur la base des observations collectées lors de l’inspection, ainsi que les données d’instrumentation, les structures du PAR sont en bonne condition de façon générale. La plage de résidus était adéquate tout le long des structures, à l’exception du côté sud de Central Dike et Saddle Dam 5 où une faible profondeur d’eau a été observée, ainsi que du côté aval de l’extrémité ouest de la digue Stormwater Dike qui sépare les deux cellules du PAR, où les résidus sont submergés.

Aucune nouvelle déformation n’a été observée sur Stormwater Dike en 2021 et les traces des anciennes déformations sont de moins en moins visibles. Il est recommandé de continuer à surveiller les mouvements potentiels de la digue Stormwater Dike et de suivre le plan de mesures d’urgence en cas de détérioration de la situation. La présence d’eau le long du pied aval est acceptable d’un point de vue géotechnique pour cette digue.

La plupart des traces d’érosion et des fissures de tension dans le matériau de filtre fin de la digue *North Cell Internal Structure* ont disparu après les travaux de remédiation. La structure est en bonne condition.

Un étang d’eau est présent au pied aval de la digue Central Dike. Cette accumulation d’eau est alimentée par un écoulement souterrain qui est relié en partie à la cellule Sud du PAR. Lors de l’inspection, l’accumulation d’eau a été observée au pied aval de la digue, approximativement entre le chaînage 0+300 et le chemin d’accès sud au chaînage 0+830. L’eau avait une coloration orange avec une forte turbidité plus tôt dans la saison, comme au cours des années précédentes. Au moment de l’inspection, un taux d’exfiltration moyen d’approximativement 150 $m^3/h$ était pompé vers la Cellule Sud du PAR pour maintenir le niveau de l’étang d’eau au pied aval à l’Él. 115 m.

Les ponceaux de l’AWAR étaient pour la plupart en bonne condition. Il est recommandé de prêter une attention particulière aux ponceaux R-00A (2 + 550), PC-14 (4 + 260), au ponceau non-identifié au kilomètre 5 + 700, et au ponceau PC-16 (54 + 950). Si une capacité insuffisante à gérer les écoulements est observée au moment de la crue printanière, il serait alors recommandé de dégager les obstructions ou de réparer les ponceaux. Il est également recommandé de suivre la progression de l’érosion des ponceaux PC 17A (8 + 830), PC-11 (39 + 552), R14 (67 + 840), R18-B (82 + 500), R-20 (85 + 490), R-23 (93 + 600) and R24 (98 + 100) lors de la crue printanière, puisqu’il y a des signes d’écoulement d’eau en dessous de la route à ces emplacements. Si la condition de ces ponceaux continue à se détériorer en raison de l’érosion, il est recommandé de les réparer. Les ponts le long de l’AWAR étaient en bonne condition géotechnique et aucun signe notable d’érosion n’a été observé. Le Pont 1 comporte une déformation des panneaux métalliques des deux culées. Des signes de tassement ont été observés au Pont 6, R15. Le pont s’inclinait vers le côté ouest des deux culées. La fondation du pont ne montrait pas de signe de détérioration. Il n’est pas requis d’effectuer des travaux de remédiation pour le moment, cependant la situation doit être surveillée.

La présence de blocs instables et de roches meubles le long de parois raides est encore observée dans les carrières 3, 7, 9, 10, 16, 18 et 23 situées le long de l’AWAR, bien qu’aucune dégradation significative des parois n’ait été relevée en l’absence de travaux dans les carrières. Il est recommandé aux travailleurs d’être prudents dans ces carrières en cas de reprise des travaux et à AEM de les informer des dangers potentiels.

Les ponceaux de la route de Whale Tail Project étaient en bonne condition. Il est recommandé de prêter une attention particulière aux ponceaux #5 (117+525), #7 (118+013), #7-2 (118+016), #12 (4+179 à 4+186; 3 sorties sur les 5), #13 (120+615), #27-2 (123+300), #38 (125+049), #48 (127+203), #52 (128+195), #54 (128+388), #55 (128+440), #61 (129+050), #63 (129+390), #65 (130+924), #66 (132+324), #82 (136+143), #83 (136+300), #85 (136+671), #86 (136+740), #88 (136+861), #89 (137+180), #93 (138+100), #101 (139+025), #105 (140+555), #111 (142+461), #112 (142+630), #113 (142+736), #115 (142+865), #116 (142+940), #118 (143+433), #133 (148+141), #135 (148+567), #137 (148+940), #138 (149+000), #150 (152+171 to 152+179; 1 sortie sur les 5), #160 (155+966), #178 (161+170), #234 (170+385), #243 (171+593), #256 (173+350), #268 (175+774), #281 (178+350). Si une capacité insuffisante à gérer les écoulements est observée au moment de la crue printanière, il serait alors recommandé de dégager les obstructions ou de réparer les ponceaux. Il est également recommandé de suivre la progression de l'érosion des ponceaux #167 (41+843) et #232 (53+928), puisqu'il y a des signes d'écoulement d'eau en dessous de la route à ces emplacements. L'érosion des ponceaux devrait être suivie lors de la crue printanière. Les ponts le long de la route de Whale Tail Project étaient en bonne condition géotechnique, et aucun signe notable d'érosion des culées n'a été observé en dehors d'une faible érosion superficielle du remblai granulaire en arrière d'un mur de béton au Pont 148, ce qui n'est pas problématique d'un point de vue géotechnique. La fissure observée en 2019 et 2020 dans le béton de la culée nord-ouest du Pont 160.8 (160+800) n'est plus visible.

Lors de l'inspection de la route de Whale Tail, des roches instables et meubles le long de parois raides et des pentes de sol instables ont été observées dans toutes les carrières et les eskers, à l'exception des eskers #3, #5 et #6. Bien qu'aucune dégradation significative des parois et des pentes n'ait été relevée en l'absence de travaux, il est recommandé aux travailleurs d'être prudents à ces emplacements en cas de reprise du travail et à AEM de les informer des dangers de chute de blocs ou de ruptures de pente potentiels.

Les infrastructures d'entreposage de carburant du site de Whale Tail Project étaient en bonne condition. Une partie de remblai granulaire était manquante.

Une accumulation d'eau a été observée dans plusieurs zones de l'infrastructure d'entreposage de carburant de Baker Lake et au site du camp principal de Meadowbank. L'évacuation des fluides accumulés dans les infrastructures de confinement secondaire devrait être gérée de sorte à minimiser la quantité d'eau en contact avec la base des cuves. De la géomembrane exposée a été observée au sud des cuves 1 à 4, et au coin nord-est de la cuve 4. Il est recommandé de couvrir la zone exposée avec un géotextile et un matériau de remblai pour rétablir la protection de la géomembrane. Les fissures de tension détectées en 2020 au sommet du talus au nord de la cuve 5 semblent inactives. La zone devrait être surveillée et réparée au besoin pour protéger la géomembrane.

Un trou dans la géomembrane exposée était présent au site de Baker Lake au coin sud-sud-ouest de la cuve 3 au pied de la pente. La géomembrane devrait être réparée et la zone exposée devrait être couverte avec un géotextile et du matériau de remblai pour rétablir la protection de la géomembrane. Des terriers d'animaux ont été observés au site de Baker Lake à proximité du côté sud des cuves 3 et 4. Il est recommandé d'évaluer si les géosynthétiques sous-jacents ont été endommagés.

La géomembrane des vingt cuves de carburant Jet A au site de Baker Lake demeure exposée et presque entièrement inondée. La géomembrane comportait une déchirure au coin sud-ouest des cuves qui n'était pas visible cas sous le niveau de l'eau. Il est recommandé de rester vigilant lors de la crue printanière et tout au cours de l'année afin de gérer l'accumulation d'eau dans l'aire de confinement.

Il est recommandé de suivre la performance des cinq ponceaux installés dans la route de Vault lors de la crue printanière. Une série de deux ponceaux est installée entre les lacs NP1 et NP2 à proximité du site de

Meadowbank; ces ponceaux sont en bonne condition. Une autre série de trois ponceaux est installée plus loin sur la route vers la fosse Vault, et ces ponceaux sont tous trois partiellement effondrés au milieu.

Les fossés de dérivation Ouest et Est de Meadowbank et leurs éléments de contrôle des sédiments, ainsi que les fossés de dérivation du site de Whale Tail Project, étaient en bonne condition. Il est important de les inspecter durant la crue printanière.

La zone d’entreposage des matières résiduelles, l’étang de gestion des eaux usées (Stormwater Pond), la piste d’atterrissage et le mur de soutènement du concasseur à Meadowbank, ainsi que les diffuseurs, la zone d’entreposage des matières résiduelles et la rampe de l’étang d’atténuation de Whale Tail Project étaient en bonne condition. À Meadowbank, la zone d’entreposage des sols contaminés comportait des fissures de petite dimension, à surveiller.

# Study Limitations

Golder Associés Ltée (Golder) has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warranty, express or implied, is made.

This document, including all text, data, tables, plans, figures, drawings, and other documents contained herein, has been prepared by Golder for the sole benefit of Agnico-Eagle Mines Limited. It represents Golder's professional judgement based on the knowledge and information available at the time of completion. Golder is not responsible for any unauthorized use or modification of this document. All third parties relying on this document do so at their own risk.

The factual data, interpretations, suggestions, recommendations, and opinions expressed in this document pertain to the specific project, site conditions, design objective, development and purpose described to Golder by Agnico-Eagle Mines Limited and are not applicable to any other project or site location. To properly understand the factual data, interpretations, suggestions, recommendations, and opinions expressed in this document, reference must be made to the entire document.

This document, including all text, data, tables, plans, figures, drawings, and other documents contained herein, as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder. Agnico-Eagle Mines Limited may make copies of the document in such quantities as are reasonably necessary for those parties conducting business specifically related to the subject of this document or in support of or in response to regulatory inquiries and proceedings. Electronic media is susceptible to unauthorized modification, deterioration, and incompatibility and therefore no party can rely solely on the electronic media versions of this document.

# Table of Contents

## TABLES

**FIGURES (after the text)**



**APPENDICES**

**APPENDIX A5**
Whale Tail Dike

**APPENDIX A6**
IVR Dike D-1

**APPENDIX A7**
WRSF Dike

**APPENDIX A8**
Mammoth Dike

**APPENDIX B**
Tailings Storage Facility

**APPENDIX B1**
North Cell Internal Structure

**APPENDIX B2**
Saddle Dam 1

**APPENDIX B3**
Saddle Dam 2

**APPENDIX B4**
Stormwater Dike

**APPENDIX B5**
Saddle Dam 3

**APPENDIX B6**
Saddle Dam 4

**APPENDIX B7**
Central Dike - Saddle Dam 5

**APPENDIX C**
Analysis of the East Dike Seepage Event

**APPENDIX D**
All Weather Private Road

**APPENDIX D1**
AWAR Observations

**APPENDIX D2**
Culverts Photographic Log

**APPENDIX D3**
Bridges Photographic Log

**APPENDIX E**
Whale Tail Project Road

**APPENDIX E1**
Whale Tail Project Road Observations

**APPENDIX E2**
Culverts Photographic Log

**APPENDIX E3**
Bridges Photographic Log

**APPENDIX E4**
Culverts Photographic Log

**APPENDIX F**
Quarries

**APPENDIX G**
Bulk Fuel Facilities

**APPENDIX G1**
Baker Lake Tank Farm Photographic Log

**APPENDIX G2**
Meadowbank Tank Farm Photographic Log

**APPENDIX G3**
Whale Tail Project Tank Farm Photographic Log

**APPENDIX H**
Other Facilities

**APPENDIX H1**
Vault Culverts Photographic Log

**APPENDIX H2**
TSF Diversion Ditch Photographic Log

**APPENDIX H3**
RSF Till Plug Photographic Log

**APPENDIX H4**
Landfills Photographic Log

**APPENDIX H5**
Landfarm Photographic Log

**APPENDIX H6**
Crusher Retaining Wall Photographic Log

**APPENDIX H7**
Whale Tail Project Attenuation Pond Ramp Photographic Log

**APPENDIX H8**
Whale Tail Project Diffusers Photographic Log

**APPENDIX H9**
South Whale Tail Channel Photographic Log

**APPENDIX H10**
Saline Ditch Photographic Log

**APPENDIX H11**
Whale Tail Project Site Roads Photographic Log

**APPENDIX H12**
IVR Diversion Channel Photographic Log

**APPENDIX I**
Dikes Details and Instrumentation

# 1.0 INTRODUCTION

Agnico-Eagle Mines Limited's (AEM) Meadowbank Complex mandated Golder Associés Ltée (Golder) to conduct the 2021 annual geotechnical inspection, pursuant to the requirement of Type A Water Licence Permit No. 2AM-MEA0815 and 2AM-WTP1830 for the Meadowbank Complex, Nunavut, including the Meadowbank and Whale Tail Project sites.

Under Part I, Item 12 (pages 23 and 24), AEM is required to undertake an annual geotechnical inspection of its facilities between the months of July and September.

The following structures were covered at the Meadowbank site by the inspection:

- dewatering dikes (East Dike, South Camp Dike, Bay-Goose Dike, and Vault Dike)
- tailings storage facilities (Stormwater Dike, Saddle Dam 1, Saddle Dam 2, Saddle Dam 3, Saddle Dam 4, Saddle Dam 5, Central Dike, and the North Cell Internal Structure)
- South Cell pond and North Cell pond (reclaim ponds)
- geotechnical instrumentation
- all-weather access road (AWAR) and site roads (culverts and bridges at water crossings in particular)
- quarries on site and along the AWAR
- landfill and contaminated soil storage and bioremedial landfarm facility
- bulk fuel storage facilities at the mine site and in Baker Lake
- shoreline protection
- sediment and erosion control structures
- other structures: sumps, airstrip, Waste Rock Storage Facility (WRSF) till plug, RF1-RF2, Stormwater pond, diversion ditches

The following structures were covered at the Whale Tail Project site by the inspection:

- dewatering and water management dikes (Whale Tail Dike [WTD], WRSF Dike, IVR Dike, and Mammoth Dike)
- dewatering ramp (Whale Tail) and attenuation ponds (Whale Tail and IVR)
- geotechnical instrumentation
- Whale Tail Project Road and site roads (culverts and bridges at water crossings in particular)
- quarries and eskers along the Whale Tail Project Road
- bulk fuel storage facilities
- shoreline protection and diffusers
- sediment and erosion control structures
- Saline Ditch, IVR Diversion Ditch, and South Whale Tail Channel (SWTC)

- other structures: sumps and non-contact water management infrastructures

The 2021 geotechnical inspection was conducted from July 27 to August 2 by Marion Habersetzer, a professional geotechnical engineer from Golder. During the inspection, the weather was rainy to sunny with daily temperatures varying between 5°C and 15°C. The inspection was scheduled at the time of year when the seasonal depth of thaw (active layer) is expected to be near its maximum. Surface water flow is generally low to moderate at this time of year. Peak water flows typically occur during the spring thaw (mid-June through mid-July).

This report describes the geotechnical aspects of the areas inspected and presents general observations and recommendations. Figure 1 shows the main mine site area.

## 1.1 Scope Limitations

The scope of the inspection is limited to the geotechnical aspects of each of the facilities listed in Section 1.0 above. The inspection did not include other assessments such as structural, mechanical, or environmental. For additional information related to the limitations of this scope, reference should be made to the Study Limitations provided at the beginning of this report.

# 2.0 PRIORITY LEVEL DEFINITIONS FOR RECOMMENDATIONS

In this report, each recommendation is assigned a priority level. The ranking system is used to help AEM determine the priorities of the recommendations. The priority levels and descriptions are based on those in the Health, Safety, and Reclamation Code for Mines in British Columbia (Ministry of Energy and Mines 2017) and the associated Guidance Document.

The priority levels and descriptions presented in Table 1 are used in this document. It is recommended that the status of each recommendation be reported on in the next geotechnical safety system inspection for a follow-up and/or closeout, as appropriate. The recommendations are presented in each section below and summarized in Table 2. The term “structure” refers to any kind of geotechnical structure assessed during the geotechnical inspection, including dams, storage facilities, roads, bridges, and others.

**Table 1: Priority Levels and Descriptions**

| Priority Level | Description |
|---|---|
| P-1 | A high priority or actual structure safety issue considered immediately dangerous to life, health, or the environment; or a significant risk of regulatory enforcement. |
| P-2 | If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures. |
| P-3 | Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues. |
| P-4 | Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks. |

# 3.0 MEADOWBANK DEWATERING DIKES

The dewatering dikes at Meadowbank include: East Dike, South Camp Dike, Bay-Goose Dike, and Vault Dike. East Dike has been in operation since the dewatering of the northwestern arm of Second Portage Lake was completed in 2009. Bay-Goose Dike and South Camp Dike became operational in July 2012 when the dewatering of the Bay-Goose Basin was completed. Construction of Vault Dike was completed in March 2013 and phase 2 of the dewatering of Vault Lake was completed in 2014.

The most current version of the Operation, Maintenance, and Surveillance (OMS) manual (AEM 2021b) is dated November 2021 for the Meadowbank dewatering dikes. The most current version of the overall Emergency Response Plan for the mine (AEM 2021d) is dated September 2021. It is good practice to review these documents each year to keep the information updated, particularly the 24-hour contact name and phone number.

A detailed visual inspection of the dewatering dikes is performed by AEM once a month. The monthly inspection reports were reviewed as part of the annual inspection. Most of the instruments on East Dike, South Camp Dike, and Bay-Goose Dike are connected to a system that automatically collects and transmits data every three hours. Data for all instruments can be visualized on the Vista Data Vision software and are checked regularly (every three days at a minimum) by the mine environment team. A review of the instrumentation data for the Meadowbank dewatering dikes is presented in the following sections. During the year, weekly review of the instrumentation on the dewatering dikes is done by mine personnel and findings and internal recommendations are compiled in a follow-up file. No monthly or quarterly summary instrumentation report was issued in 2021. AEM indicated that the reporting format will be revaluated in 2022. The compilation of the instrumentation data was not part of the scope of this study, and the figures showing the data were provided by AEM. The information provided by AEM is presented as received in a document separates from this report. The data were sent as figures for the dewatering dikes and as PowerPoint and Excel files for the Tailings Storage Facility (TSF) structures. Continued monitoring and review of instrumentation data is recommended. In the case of a significant variation in the instrumentation data, the designer should be notified according to the OMS manual. A significant variation is defined by a change compared to usual seasonal trends and should be followed-up to monitor the evolution of the event and identify its causes and consequences, as well as the appropriate actions to take.

Figure A1 shows a plan view of East Dike, Figure A2 shows a plan view of South Camp Dike and Bay-Goose Dike, and Figure A3 shows a plan view of Vault Dike. These figures indicate the location of the photos taken and observations noted during the inspection.

## 3.1 East Dike

East Dike is located on the east side of Portage Pit and isolates the northwestern arm of Second Portage Lake. Dewatering of the northwestern arm of Second Portage Lake allowed for the development of Portage Pit and the construction of the TSF. At the time of the inspection, East Dike served as an access road to the northern portion of Bay-Goose Dike and had not been used as a haul road since 2011.

East Dike is approximately 800 m in length and was constructed within Second Portage Lake prior to dewatering. It consists of a wide rockfill shell, with downstream filters and a soil bentonite (SB) cut-off wall that extends to bedrock up to 8 m below lake level.

### 3.1.1 Field Observations during Inspection

At the time of the 2021 inspection, no signs of sloughing or settlement were observed on the structure (including the vicinity of the 2009 sinkhole near Sta. 60+472).

Three seepage zones were identified in the past near the downstream toe of East Dike (at Sta. 60+247, 60+498, and 60+575). The zones at about Sta. 60+247 and Sta. 60+498 each have a seepage collection sump with a pump connected to a year-round pumping system. At the time of the inspection, the seepage was being captured within these sumps. According to AEM, the zone at about Sta. 60+575 was practically dry all year, with very little ponding water and no flow observed during the inspection. No sign of new seepage on the ground surface or downstream was observed.

Special attention was given to the downstream area of East Dike, following the anomalous event that happened in winter 2021, during which an unusual seepage reporting to the surface of the downstream toe was observed, accompanied by a pressure rise in the nearby instruments. The event and its analysis by Golder are documented in Appendix C. No visual sign of that unusual seepage remained after freshet and during the inspection in July 2021, no unusual condition was noted anywhere on the structure.

From the visual inspection, the performance of East Dike is satisfactory, as:

- No visual signs of slope instability or erosion were observed on the upstream and downstream rockfill slopes.
- No visual signs of significant cracking or settlement were observed on the dike and along the cut-off wall alignment, besides one tension crack.
- Freeboard is adequate.

### 3.1.2 Geotechnical Instrumentation Data Review

Instrumentation has been installed within East Dike and includes piezometers, thermistors, inclinometers, and flow meters, as detailed in Appendix I (Table 1 and Table 2). The inclinometer at Sta. 60+195 was destroyed in the past and has not been replaced. Replacement of this instrument is not considered necessary; however, monitoring of East Dike should continue and, if anomalous conditions are observed, then replacing this inclinometer should be re-evaluated.

The following subsections present a summary of the data collected between September 2020 and August 2021. Previous annual geotechnical inspection reports contain additional information regarding instrumentation data collected prior to September 2020.

#### *3.1.2.1 Piezometers*

Three arrays of multilevel vibrating wire piezometers (VWPs) are installed within East Dike as follows:

- South Channel (Sta. 60+190)
- North Channel (Sta. 60+490)
- North Shallows (Sta. 60+700)

At each location, multilevel VWPs were installed:

- upstream side of the cut-off wall, approximately 2 m from the centreline
- immediately downstream of the cut-off wall, approximately 2 m from the centreline
- further downstream of the cut-off wall, approximately 10 m from the centreline

Single VWPs were also installed downstream of the cut-off wall near the contact area (base of cut-off wall and top of the bedrock surface). VWP-400-C and VWP-420-C show a seasonal trend that keeps rising through the years since 2015 (up to 2 m in the winter of 2021). For the last three years, the rising seasonal trend doubles each year. The increase is not associated with a rise of temperature but rather the contrary: it is considered that this behaviour is linked to progressive freeze-back of the foundation bedrock. It is recommended to closely follow the significant seasonal trend in the future and react quickly if need be. VWP-500-C and VWP-510-C only exhibited a small increase in 2021, which suggests that this behaviour may start in these instruments as well over the next years and should be monitored. For the first time in the recent history of East Dike, field observations were associated with a pressure increase in the South Channel, in the form of ponding water and seepage pathway shifts (detailed below).

Some of the installed piezometers on East Dike are broken or malfunctioning, most of them due to freezing, as detailed in Appendix I (Table 1). Those instruments give either no data or erratic data. A piezometer that has frozen at some point is unreliable, as freezing generally breaks the piezometer or shifts its calibration curve. It is thus recommended to flag these piezometers and be very careful when interpreting their data.

The piezometer data show that the pore water pressure is stable compared to the value recorded in the past with a long-term trend going towards a slow increase in the pore water pressure, possibly related to freeze-back of the pit walls.

Specific observations have been made for the three piezometric arrays located at Sta. 60+190, Sta. 60+490, and Sta. 60+700, as follows.

### *Sta. 60+190*

At Sta. 60+190, the observed levels are consistent with expectations for a functioning cut-off wall. There is a consistent drop in the hydraulic head across the cut-off. The general trend in the piezometric readings has been steadily increasing since 2014 and the increase is accelerating since 2019. In February 2021, a large pressure increase (up to 2.5 m) was observed in lines P1 and P2 of piezometer 60+190, while on the field, water was observed ponding at the downstream toe of the dike and freezing in place. No damage to the instruments due to potential freezing was detected, and the water was confirmed to come from seepage and not from a broken pipeline. The increasing pressure trend continued at a slower pace until June 2021. During this time, small variations were observed and correlated with field events. Temporary pressure releases were observed after ice and snow were removed from the dike toe, allowing water to flow until it froze again, suggesting ice blockage at the toe of the dike contributed to the observed pressures. Warmer temperatures were correlated with a slower pressure build-up. The onset of freshet with temperatures above freezing led to a complete dissipation of the pressure anomaly and a return to normal piezometric levels in all instruments. This trend is interpreted to be linked with restriction of the seepage pathway downstream of the dike. The identified mechanism was confirmed to be the most likely after discussions between Golder, AEM and the Meadowbank Dike Review Board (MDRB) members during the MDRB meeting held in November 2021. More details are provided in the presentation prepared by Golder for the MDRB, included in Appendix C.

As with other sections of East Dike, the increasing pressure is associated with progressive freeze-back of the foundation. At Sta. 60+190, the thermal sensors indicate still thawed conditions except for the P1 line, which is starting to freeze in winter; however it is probable that the surrounding areas are progressively freezing and concentrating the flow.

As observed in past years, no instrument froze in the winter (except for the P1 line which is starting to freeze seasonally but shows no sign of damage) and the temperature data indicate the presence of seepage. Since temperature fluctuations at 190-P1-C do not show seasonal variations correlated to air temperature in contact with the ground surface, it is highly probable that seepage water from the upstream side of the dike is responsible for the thermal behaviour. The recorded piezometric pressure decreases towards the downstream side and with elevation, which seems to indicate that flow is occurring towards the pit. Given the hydraulic head response consistent with the expectations of a functioning cut-off wall, it is reasonable to assume that the seepage water is originating from a different part of the dike. Freeze-back of the foundation appears to affect the seepage pathways and this area will have to be monitored closely in the future as new pressure build-up episodes are likely to happen in winter.

#### Sta. 60+490

At Sta. 60+490, flow through the dike is observed as the piezometric pressure is very similar before and after the cut-off wall (490-P3-B vs 490-P2-B in particular). There are spike increases in the hydraulic head in the spring of 2020, similar to previous years. These spikes are probably due to pumping interruption for maintenance or change of discharge from the lake to the pit. Signs of seepage are also observed in the thermal instrumentation data associated with this piezometric array. The general trend in the piezometric readings has been steadily increasing since 2014 and the increase seemed to accelerate from 2019. In 2021, the fluctuations are similar to those observed in 2020 with a general 0.5 m increase and should continue to be monitored. At Sta. 60+190, the thermal sensors indicate still unfrozen conditions, except for 490-P1-C, which is starting to freeze seasonally. However, it is probable that the surrounding areas are progressively freezing (as indicated by thermal variations in piezometer 60+500-C) and concentrating the flow.

None of the instruments are frozen (except 490-P1-C, which is now freezing seasonally with no sign of damage); there is a correlation between the lake temperature and the temperature recorded by the piezometric array at this location, and the temperature data follow the same trend with very little offset. These piezometric and thermal trends correspond to the seepage zone observed at Sta. 60+498. The recorded piezometric pressure decreases towards the downstream side and with elevation, which seems to indicate that flow is occurring towards the pit.

#### Sta. 60+700

At Sta. 60+700, piezometers at the P1 and P2 lines (downstream of the dike and close to the centreline) are frozen. These instruments are starting to show erratic data, with P1 levels exceeding P2 levels, and are no longer reliable. The general trend in the piezometric readings has been steadily increasing since 2014 and the increase seems to be accelerating since 2019 and should be monitored. Freeze-back of the foundation observed at Sta. 60+700 is likely causing the rise in pressure.

The temperature data are consistent with observations noted during previous years and indicate mostly frozen conditions.

#### 3.1.2.2 Thermal Regime

Five thermistor strings with 16 nodes at 1 m interval are installed on East Dike, as detailed in Appendix I (Table 1). The instrumentation data for the September 2020 to August 2021 period are consistent with historical trends, with a slow long-term cooling trend. Specific observations have been made for each instrument for the period analyzed, as follows.

In addition to thermistors, thermal sensors of piezometers installed in the cut-off wall and bedrock along the centreline at 60+550, 60+600, and 60+650 also indicate frozen condition.

### Sta. 60+092 and Sta. 60+842

The thermistors installed at Sta. 60+092 and Sta. 60+842 are located on the southern and northern abutments. The thermistor at Sta. 60+092 was not functional after September 2020, while only three beads have been functional at Sta. 0+842, making data too scarce in the covered period for a review of the thermal regime. The upper 1 m of the dike of both abutments is still in the active layer and there was typically little to no change in the ground thermal regime over the past years. As the dike is still in operation for several years and that the abutment is subject to develop and aggregate ice lenses, it is recommended to replace those string of thermistors in order monitor the thermal regime until post-closure phase of the mine.

### Sta. 60+185

The thermistor string installed in the South Channel at Sta. 60+185 (bedrock about 6 m below water surface at El. 127 m) recorded the following temperature variations, similar to previous years:

- The upper layer of the cap material (from El. 136 m to El. 131 m) was thawed in August 2021 and was frozen during the winter period (active layer). The active layer shows significant fluctuations in temperature, from 3°C to -10°C.
- The cut-off wall below El. 132 m remained thawed all year with a maximum of 2.5°C. This result concurs with potential seepage inferred from the thermal behaviour at 190-P1-C at Sta. 60+190. However, 190-P1-C is further downstream from the dike and the lag between maximum 190-P1-C and the data seem to suggest that water is originating from a different part of the dike structure closer to Sta. 60+490.
- The bedrock portion of the dike (below El. 126 m) remained thawed. The bedrock had a temperature variation between 1°C and 3°C but no increasing with depth.

Seepage is observed downstream and is collected in a seepage station. However, part of the seepage is now bypassing the seepage station and reporting to the downstream sump and Pit E (Section 3.1.2.5). In order to better understand the behaviour of the South Channel area and confirm the hypothesis of seepage pathway restriction, it is recommended to install additional thermistors on both sides of the South Channel along the centreline of the dike, as well as downstream, at a distance from the toe.

### Sta. 60+485

The thermistor string at Sta. 60+485, installed within the North Channel (bedrock at approximately El. 126 m, 7 m below lake level), indicated the following temperature variations, similar to previous years:

- The upper portion of the cut-off wall located in the lake (from El. 136 m to El. 132 m) was in an active zone. Significant temperature fluctuations were recorded (12°C to -15.5°C).
- The cut-off wall below El. 132 m and the bedrock remained thawed during the year with significant variations in temperature (between 12°C and 0.5°C).

The thermal variation observed within the cut-off wall below El. 132 m and in the bedrock is significant, with fluctuations between 12°C and slightly above 0°C. From September 2020 to August 2021, there is good correlation between recorded temperatures and the upstream lake temperatures, indicating advective flow through the dike (i.e., recorded temperature changes are primarily a result of temperature changes in water flowing through this area). The delay between changes in the recorded temperatures within the lake and within the cut-off wall is minimal. The temperature responses recorded in the piezometers at Sta. 60+490 P2 (A, B, C) are also significant, as are the responses recorded within the piezometers at Sta. 60+472, Sta. 60+480, and Sta. 60+500. Temperatures in piezometers at Sta. 60+190 P1-C, Sta. 60+450, and Sta. 60+490 P1/P3 react as well but with a decreasing amplitude over the years. At the edge of the seepage area, temperature sensors in piezometers 400-C and 420-C show cooling trends in the foundation, suggesting that the seepage is getting more constrained as foundation freeze-back occurs. Seepage is observed downstream and is collected in the sump and removed via the pumping system.

#### *Sta. 60+695*

The thermistor string installed in the North Shallow at Sta. 60+695 (bedrock at approximately El. 128.5 m, 4.5 m below upstream lake level) recorded the following temperature variations:

- The thermistor beads from El. 136 m to 134 m indicate that the upper portion of the cut-off wall was thawed in August 2021 and frozen during the winter (active layer), similar to previous years. The recorded temperature variations are between 6°C and -16°C.
- The thermistor beads from El. 134 m to 127 m indicate that the cut-off wall and the till between these elevations remained frozen throughout the monitoring period, with temperature fluctuations between 0°C and -9°C. The frozen depth has increased by just under 1 m since 2020, indicating continuation of the strong freezing trend observed since 2018 in the area.
- The temperature recorded in the bedrock varied between -1°C and 1°C increasing with depth.

In addition to thermistor data, piezometer thermal sensors confirm that there is a general cooling trend that is observed between Sta. 60+550 and 60+700. At Sta. 60+700, piezometers (P1 and P2 lines) are entirely in permafrost, while the upstream line (P3) remains thawed in contact with lake water.

### *3.1.2.3 Inclinometers*

Two inclinometers are installed on East Dike at Sta. 60+495 and 60+705, as detailed in Appendix I (Table 2). The inclinometer displacements are referenced along Axis A and Axis B; Axis A is perpendicular to the cut-off wall alignment (positive displacements are towards the Pit side), while Axis B is parallel to the cut-off wall (positive displacements are towards the increasing chainage), perpendicular to Axis A.

Recorded displacements are small. The maximum cumulative displacements at the crest were observed in the inclinometer installed at Sta. 60+705. The cumulative displacement is about 47 mm perpendicular to the cut-off wall (Axis A) and -25 mm aligned to the cut-off wall (Axis B). From 2020 to 2021, no significant movements were observed for all inclinometers; they have all been relatively stable since 2014. The recorded displacements are well within the tolerable displacements for the structure and are not a concern.

### *3.1.2.4 Seismograph*

No peak particles velocity measurements (measured by the peak vector sum) were taken in 2021 for East Dike as no blasts occurred in the vicinity of East Dike.

### *3.1.2.5 Flow Meters*

The flow at the downstream toe between September 2020 and August 2021 was measured by the flow meters installed in the two seepage collection sumps downstream of East Dike. The average flow measured during the year was around 15.5 $m^3/h$ with peak activity averaging approximately 40.4 $m^3/h$ in July 2021. The measured flow is relatively stable compared to values from the past year. Over the 2020/2021 winter, the flow was measured between 8 and 18.9 $m^3/h$ and had decreased compared to the last winter, when 25 $m^3/h$ was recorded. It is considered that flow during winter is more representative of the seepage, with no incidence of precipitations and snowmelt. It should be noted that during the winter of 2020/2021, field observation of water ponding at the downstream toe and recorded pressure increases in the instruments of East Dike suggest a change in seepage pathway. According to AEM, the inflow into the seepage station at Sta. 0+195 was entering the well at an unusually high elevation in February and March 2021, which stopped at the end of March. From March 2021 onward, some of the seepage water is now reporting to the downstream pond or Pit E instead of the seepage station. Because this water is no longer collected by the stations, this likely causes the global flow rates to be underestimated. AEM also reported issues with air intake in the pump which causes fluctuations in the flowrate measurements and render the readings inaccurate. The team on site is working to resolve this issue and obtain more reliable measurements. Golder recommends installing a flowmeter at each seepage collection station to measure the seepage rates independently. It is also recommended to measure turbidity in each station instead of only sampling the total volume, as it would provide more information on the origin of the turbidity in the event of a change.

During the year, the water quality in the sump was monitored by the environment department every week during freshet. According to the procedure in place, the water is pumped in Portage Pit instead of being sent to Second Portage Lake when the total suspended solids criterion is exceeded. This was the case from May 2021 to the end of November 2021. Over the past years, the total suspended solids were usually acceptable during the winter, until the freshet. At the time of the inspection, the water was still pumped into the pit.

Based on the instrumentation data, the performance of East Dike is satisfactory, as:

- Seepage rates, while higher than anticipated in the design (expected to be between 300 and 600 $m^3$/day), are stable compared to historical values and are controlled by the pumping system in place. The total suspended solids criterion is low enough for the water to be released in Second Portage Lake, except during the freshet and summer of 2021.
- Instrumentation data: piezometric, thermal, seepage, and inclinometer data do not show deteriorating conditions.
- The unusual seepage observations during the winter of 2021 was well documented and investigated, and the mechanism identified after analyses by both AEM and Golder is not deemed likely to impact the performance of East Dike. The mechanism is detailed in the presentation enclosed in Appendix C.

A photographic log and the record of inspection form for East Dike is provided in Appendix A1.

## 3.2 South Camp Dike

South Camp Dike is located south of the plant site area and is used to connect the mainland to South Camp Island. South Camp Dike, in conjunction with Bay-Goose Dike, isolates a portion of Third Portage Lake (Bay-Goose Basin) that allowed the development of Goose Island Pit and the southern portion of Portage Pit. It covers a narrow channel, approximately 60 m wide, with shallow water depths ranging from 0.5 m to 1.0 m.

South Camp Dike has a broad rockfill shell with a bituminous geomembrane liner installed on the upstream side. Compacted granular material mixed with bentonite was placed above the toe of the liner. The liner was installed on native frozen (permafrost) till material in a trench approximately 3 m to 5 m below the lakebed surface. At the time of the inspection, South Camp Dike was used as an access road to connect the southern part of Bay-Goose Dike and the contractor's garage area with the mine facilities.

### 3.2.1 Field Observations during Inspection

An ultramafic waste rock stockpile about 10 m high is located 20 m away from the downstream toe of the dike. The distance between South Camp Dike and the waste rock dump is sufficient to allow a complete visual inspection of the downstream area of the dike. It is recommended to continue keeping the downstream toe of the dike clear to facilitate inspection. The downstream toe and slope area were in good condition.

A limited amount of water was ponding on the downstream side of South Camp Dike. No flow was observed. This is likely due to run-off water. The pond was slightly larger than in 2020, which can be linked to recent torrential rains a few days before the inspection.

No geotechnical issues or seepage were observed during the inspection.

A photographic log and record of inspection form for South Camp Dike is provided in Appendix A2.

### 3.2.2 Geotechnical Instrumentation Data Review

Two thermistor strings are installed on the upstream side of South Camp Dike. SD-10 is located near the liner toe. SD-09-A is located approximately 20 m further upstream within Third Portage Lake. Based on the thermistors data, no signs of seepage are evident, and the recorded value follows historical trends.

The following summarizes the observations regarding the thermal regime at these locations:

- The temperature profile at SD-09-A on the upstream side of the dike shows the soils located beneath the dike foundation and liner have remained frozen (permafrost) below El. 127 m. An active layer is present between El. 133 m and 127 m. The summer warm-up is more pronounced in 2019, 2020, and 2021 compared to the previous years. It may be linked to a change in the instrument setup after 2019.
- The temperature profile at SD-10 shows that the foundation of the dike below the thermal cap stayed frozen all year long.

## 3.3 Bay-Goose Dike

Bay-Goose Dike is located within Third Portage Lake on the southern side of Portage Pit and encompasses the Goose Island Pit. Bay-Goose Dike, in conjunction with South Camp Dike, isolates a portion of Third Portage Lake (Bay-Goose Basin).

Bay-Goose Dike is approximately 2,200 m long and consists of a wide rockfill shell, with downstream filters and a cut-off wall. For the majority of the dike, the cut-off wall extends to bedrock and consists of SB and/or cement-soil bentonite (CSB). For portions of the dike where the cut-off wall was not constructed to bedrock, jet grouting of the soil between the base of the cut-off wall and the bedrock was performed, thereby extending the low permeability element of the dike to the bedrock surface. The water depth beneath the dike is up to 9 m, with a maximum depth to bedrock below lake elevation upwards of 20 m.

Instruments to monitor and assess the performance of the dike are installed on Bay-Goose Dike. The instrumentation includes piezometers, flow meters (water collection pipe and a plastic bucket), thermistor strings, and inclinometers. Every blast in the vicinity of the dike was monitored for blast vibration during mining of the

Meadowbank pits, but this monitoring has now been terminated since no more blasting activity is taking place there.

### 3.3.1 Field Observations during Inspection

The tension cracks observed in 2013 and 2014 on the upstream side within the thermal cap (between approximately Sta. 32+100 and 31+750) were still visible during the 2021 inspection but did not show signs of progression and were not active anymore. Settlement within the thermal cap and on the upstream side of the crest (from approximately Sta. 32+100 to 31+950 and 31+400 to 31+300), ranging from 0.1 m to greater than 1.0 m, was observed but did not show any significant sign of movement since previous years. These areas should continue to be closely monitored to make sure no aggravating conditions are developing. As it is hard to visually observed movement on an unequal surface, it is recommended to fill up the past deformation in a way to produce a flat surface. A flat surface would ease the visual observation. The filling work should be completed in summertime to avoid inclusion of snow in the backfill material that will thaw at summertime and generate additional deformation.

Seepage channels and water accumulation were observed at the toe of the dike during the inspection (North Channel, Central Channel, Central Shallows, and Channel 3). There is currently no downstream seepage collection system at the downstream toe of the dike as the amount of seepage reporting downstream is currently too small to require such a system. Part of the seepage seems to be reported to the pit. Flow from these channels is monitored by various stations. At the time of the inspections, stations 6, 7, 8 and 9 were active and no turbidity was observed in the water at the downstream toe. Refer to Section 3.3.2.5 for flowmeter measurements.

Water was observed flowing in the North Channel during the inspection at Sta. 30+420 m. The flow was lower than previous years and not measurable. According to AEM, water was observed ponding at the toe during the year. Due to the topography, it is possible that water is ponding in this area from a nearby seepage channel (i.e., near the northern abutment). It is recommended to regularly inspect this area, monitor the flow of water, and be on the lookout for signs of seepage from the toe of the dike and in Pit E4.

Water flow was observed into the Central Shallow seepage channel during the inspection at Sta. 30+625 and 30+655. The flow was low and within the expected trend.

A water pond formed by the Central Channel seepage was observed downstream at Sta. 31+125. The mine pumps this pond several times in the summer, and piezometers show a response to the pumping. The inflow has not been monitored in this area since 2015. It is recommended to keep measuring the water inflow when pumping the water pond formed at Central Channel.

Water flow was observed at Channel 3 during the inspection at about Sta. 31+500 m. The flow was low and within the expected trend. A drainage channel is dug into the ring road nearby to allow water to flow freely into the pit. According to AEM, water has been reported to the pit from this location during the year through a drainage ditch.

A water pond was observed downstream at Sta. 31+750, between Channel 2 and Channel 1. This water pond is not considered seepage as its level never changes except at freshet and after rain events. It is recommended to visually inspect the pond periodically and, if the level changes, to monitor water flow.

Channels 1 and 2 were not active at the time of the inspection. An accumulation of water was observed further downstream against Goose Pit ring road. According to AEM, water is observed downstream in that area during freshet season and naturally drains to Goose Pit without reaching the dike toe. The instrumentation near Sta. 32+000 (Channel 1) indicates a potential seepage zone in that area. It is probable that seepage occurs at this location but reports directly to the pit. The instrumentation at this location needs to be closely monitored for changing trends.

Due to Goose Pit being mostly flooded, water inflow through the wall is no longer visible except at the top of the walls. The previously observed water inflows near Channels 1, 2, and 3 are not being monitored because the pit is not accessible anymore.

From the visual inspection, the performance of Bay-Goose Dike is satisfactory, as:

- No visual signs of slope instability or erosion were observed on the upstream and downstream rockfill slopes.
- The settlement and sloughing observed in the thermal cap and in the upstream side of the crest are stable and are no longer active.
- Freeboard is adequate.

A photographic log and the record of inspection is provided in Appendix A2.

### 3.3.2 Geotechnical Instrumentation Data Review

Instruments were installed on Bay-Goose Dike to monitor the performance of the dike following construction, during dewatering and operation, and into closure. They include piezometers, thermistors, and inclinometers (standard type and time domain reflectometer cable). At the time of the inspection, all the piezometers and thermistors on Bay-Goose Dike had an automatic data collection and transmission system to the Vista Data Vision database. The following subsections present a summary of the data collected between September 2019 and September 2020.

It must be noted that the current instrumentation of Bay-Goose Dike was designed for performance monitoring from dewatering to closure based on the expected operation duration of about 10 years. The in-pit tailings deposition implies that the dike will be in operation for another decade. As a result, some verifications were made in 2020 following Golder's recommendations to verify whether the current instruments layout and spacing allows for proper monitoring of these contact areas and detection of any degradation that could lead to seepage through the dike. Of particular interest are the sections where SB and CSB portions of the cut-off wall are in contact. The review of the available instrumentation and its spatial distribution by AEM and Golder shows that coverage is still adequate. Routine monitoring of the instruments should continue and focus particularly on areas with SB/CSB contact, areas with seepage and areas where instruments exhibit a trend that is different from previous observations or unexpected variations.

#### *3.3.2.1 Piezometers*

Arrays of multilevel VWPs were installed within Bay-Goose Dike as detailed in Appendix I (Table 4).

At each location, multilevel VWPs were installed:

- Upstream of the cut-off wall, approximately 2 m from the centreline.
- Immediately downstream of the cut-off wall, approximately 2 m from the centreline.
- Further downstream of the cut-off wall, approximately 14 m from the centreline.

In addition, single VWPs were installed immediately downstream of the cut-off wall near the contact area (base of cut-off wall and top of bedrock surface) at several stations.

Some of the installed piezometers on Bay-Goose Dike are broken or malfunctioning, probably from freezing, as detailed in Appendix I. Those instruments give either no data or erratic data. A piezometer that has frozen at some point is unreliable, as freezing generally breaks the piezometer or shifts its calibration curve. It is thus recommended to flag these piezometers and be very careful when interpreting their data while staying vigilant about any rapid piezometric variance. The first time a piezometric rapid increase associated to a frozen piezometer is observed, it is important to remain vigilant without overweighting the abnormal trend. For the instruments showing very high piezometric readings, it is recommended to compare the pressure recorded to the instrument limit to identify if the variance could be due to factors other than mechanical problems such as seepage.

From 2012 to 2021, a generalized trend can be observed in the pore water pressure measurements of most non-frozen piezometers located along the dike (upstream and downstream side). An increase in pore water pressure is observed during winter (approximately November to May). The pore water pressure tends to stabilize or decrease during freshet (approximately May to September). Historically, the rising trend has been attributed to ice build-up at the downstream toe of the dike and the decrease has been attributed to melting of this ice.

A cooling trend starting in July 2012 can be observed in all piezometers installed on Bay-Goose Dike. The instruments located farther on the downstream side generally record lower temperatures than the instrument closer to the dike and the lake. As a result, the instruments on the upstream side of the dike are generally the last ones to freeze and the ones farthest on the downstream side are the first to freeze. In some sectors, most of the piezometers are in frozen condition, while in some sectors almost none of the piezometers are in frozen condition. There seems to be a correlation between the sector in which seepage has been observed historically and the number of frozen instruments. In sectors where freeze-back is occurring, pressures are generally on a slow and steady rise.

There is generally a drop in the hydraulic head across the cut-off wall and within the grouted bedrock in the downstream direction. In general, the data from the piezometers are similar to the historical trend.

In addition to the seasonal trend described above, specific observation trends can be observed for various areas of the dikes. These areas generally coincide with seepage channels as the majority of piezometers are frozen in non-seepage channel areas.

The OMS manual provides procedures in the event of significant or rapid pore water pressure increases or decreases that need to be followed. The designer needs to be advised in the event of unusual variations.

### North Portion (Sta. 30+158 to 30+516.5)

The piezometric level has been stable since 2015 with cyclical variation but has not recovered to the level before 2015. In the unfrozen piezometers on the downstream side near the cut-off wall, similar to 2020, a 0.5 m increase in pore water pressure is observed for instruments on the downstream side from the beginning of summer 2021 and had not dissipated at the time of the inspection. Large-scale seasonal variations are seen in the pore water pressure recorded in all piezometers, with fluctuation more pronounced on the downstream side. At 30+378.5 m, pore water pressure on the downstream side is now roughly equal to the upstream water head.

These variations in pore water pressure are happening in the zone associated with the North Channel seepage and monitored by seepage stations no. 8 and no. 9. In the past, the pressure typically increased in magnitude of the pore water pressure until freshet and then suddenly decreased from mining activity and the depressurisation of the rock walls in Pit E5. However, with the pit walls freezing back, pressure is progressively prevented from dissipating by drainage trough the wall face. Equalization of water pressures on both sides of the wall at 30+378.5 m suggests a progressive blockage of the seepage pathway downstream of the dike at this location, rather than an increase in seepage rates based on the observed decrease in visible seepage. It is possible that the seepage will overtop the blockage and relocate to a nearby location where the pathway is still open; attention must be paid during routine inspection to detect any new seepage location.

The temperature recorded by the piezometers indicates a general cooling trend. See section on thermal regime below for more details. Thermal data from instruments in the pit wall were not available for review.

### *Central Shallows (Sta. 30+645.5 to 30+804)*

The majority of the piezometers installed in this area are frozen and give erratic data. Seepage station no. 7, which was active during the summer of 2021, is near this area.

The unfrozen piezometers (30+645) indicate stable pore water pressures in 2021 with a slight increase (0.5 m) during the summer. In the previous years, this seasonal increase dissipated almost entirely after the summer. At the time of the instrumentation review, this had not yet happened.

### *Central Channel (Sta. 31+020 to 31+220)*

There is a seepage zone with ponding water observed downstream associated with this channel. The majority of the piezometers in this area are not frozen.

From 2012 to 2021, the maximum and minimum recorded pore water pressures for the piezometers downstream have been following the usual trend with a slight increase in the past three years. Since mining was stopped and there are no more blasting operations, the general trend has smoothed out. There is generally a pressure build-up from the winter onset to the freshet in June the following year. In 2021, the pressure fluctuation was about 0.7 m, similar to 2020. Compared to previous years, the amplitude of the release at freshet is decreasing, which is associated with the progressive freeze-back of the foundation bedrock seen in the thermal sensor of the VWP at Sta. 31+165. Pressures measured downstream of the dike (P2 line) have exceeded the upstream water head during the winter for two years. This is not correlated to any observation of the field but is linked to these instruments freezing. At the moment, flow rates within the usual trend exclude increased seepage at this location. As with the North Channel, a seepage pathway change is possible in the future.

On a smaller scale, the pore water pressure data tend to fluctuate more during freshet than during winter. This behaviour seems to be consistent with the explanation that the recorded pore water pressures are influenced by the pumping of the water pond located downstream.

### *Channel 3 (Sta. 31+565 to 31+700)*

There is a seepage zone monitored by station no. 6 associated with this channel. There is a drainage channel dug into the ring road in the area to allow water to flow freely in the pit. The piezometric array in this area is mostly frozen and a cooling trend can be observed in the recorded temperature since 2011.

From 2018 to 2021, the pore water pressure has been slowly and steadily increasing, with a decrease in the seasonal variation amplitudes. All piezometers show that pressure minimum has slightly increased over since 2018 (0.5 m per year), although the pressure release in the summer of 2021 (about 0.4 m) is larger than in 2020. The minimum pressure reached during the period from August 2020 to September 2021 was 132.7 m.

Piezometers at Sta. 31+600 located downstream now read the same values or slightly higher values than the upstream instruments. This could indicate a rise in the downstream pressure due to freeze-back of the surrounding area, as normal seepage rates measured in 2021 exclude an increase in the seepage at this location.

#### Channels 1 and 2 (Sta. 31+815 to 32+105)

No seepage has been observed at the toe of the dike in 2021, but there is a water pond in this location that naturally drains to Goose Pit through a constructed drainage channel. Most of the piezometers are not frozen in this area.

The recorded pore water pressure in the piezometers located in Channels 1 and 2 has generally been stable (0.4 to 0.6 m fluctuation from winter to freshet) since last year for the piezometric arrays of Channels 1 and 2. The rapid pressure rise trend observed in 2018 in this area has not been observed in 2021 in any instrument of this area. However, a marked seasonal increase (about 0.8 m in 2021) is still observed over the winter at 31+885 in P2 instruments (directly downstream of the dike) except for the deeper instrument in the bedrock. This pressure dissipated in the summer of 2021. During this increase, the P2 water pressures exceed the upstream levels, suggesting blockage of the seepage pathway, similarly to other seepage locations experiencing freezing, despite all sensors being unfrozen at 31+885. This suggests that the seepage pathway may be blocked at another location where it normally reports, which was the interpretation given to the 2018 pressure rise. All piezometers in the area are on a steady increase since 2018, with pressure rising by 0.5 m to 1 m in 2021.

The thermal data at Sta. 31+815 might indicate some sign of seepage as the thermal cooling is less pronounced and there is a wider fluctuation of temperature recorded at this location than in the other thermistors nearby.

### 3.3.2.2 Thermal Regime

Thirty-three thermistors (from T1 to T30 and T3’ to T5’) have been installed on Bay-Goose Dike. From August 2020 to September 2021, the following observations have been made.

In addition to thermistors, thermal sensors of piezometers installed show a general cooling trend and freeze-back of instruments over the years.

#### Sta. 30+134 (T1), Sta. 30+827 (T14), and 32+140 (T30) - abutments

The three thermistors installed at Sta. 30+134 (T1), Sta. 30+827 (T14), and Sta. 32+140 (T30) are located on the northern abutment, Goose Island, and the western abutments. The first node of these thermistors is installed about 1 m below the dike crest. For this period, the dike and its foundation were entirely frozen on the northern abutment (T1), the Goose Island abutment (T14), and the western abutment (T30).

Piezometers at 30+158 confirm this trend with all three lines (P1, P2, P3) frozen all year long.

#### Sta. 30+185 (T2), Sta. 30+489.5 (T9), Sta. 30+553.25 (T10), Sta. 30+621.5 (T11), Sta. 30+650 (T12), Sta. 30+713 (T13), Sta. 31+080 (T15), Sta. 31+134.5 (T16), Sta. 31+170 (T17), Sta. 31+352 (T18), Sta. 31+752.5 (T21), and Sta. 31+820 (T22) – SB wall

Twelve thermistors were installed in the SB portion of the cut-off wall. All the thermistors except for T18 show a similar trend:

- The wall is frozen all year below El. 134 m, with the exception of one node in T2 (El. 129 m), T9 (El. 131 m), and T13 (El. 132.5 m).

- There is generally an active layer in the upper bedrock, while the deeper bedrock is thawed all year. The bedrock is frozen down to El. 115 m to 125 m, except at T16 where the bedrock remains entirely unfrozen. T12 shows more seasonal variations (freeze/thaw at depth) than other instruments.
- All thermistors except T22 show that the frozen front is progressing deeper every year.

TH18 (31+352) indicates that the wall and the bedrock remained frozen.

Piezometers at 30+645.5, located between T11 and T12, show that P1 and P2 lines are entirely frozen, while P3 line is still unfrozen but progressively coming close to 0°C.

Piezometers at 31+165, located between T17 and T18, show that the P1 line is in permafrost and that the P2 line is only frozen in the till and upper bedrock while the deep bedrock cools down but remains unfrozen.

Piezometers at 31+815, located between T21 and T22, show that the upper three sensors in the P1 line are now in permafrost while the deeper bedrock and the P2 and P3 line remain unfrozen.

### *Sta. 30+260 (T3), Sta. 30+261.5 (T3’), Sta. 30+272 (T4), Sta. 30+273.5 (T4’), Sta. 30+288.5 (T5), Sta. 30+290 (T5’), Sta. 30+330.5 (T6), and Sta. 30+827 (T14) – CSB/SB wall*

This portion of the dike contains a cut-off wall where settlement could occur due to CSB, a rigid material, sitting on top of SB, a soft material. The thermistor nodes configuration for T3 (Sta. 30+260), T4 (Sta. 30+272), and T5 (Sta. 30+288.5) has nodes located very close together to monitor the interface between the CSB and SB materials as noted below. Thermistors T3, T4, and T5 were not installed to the designed depths, but instead have been installed below the interface and monitor the bedrock contact. These thermistors were usually recording temperatures above 0°C, but all three are now recording partial, seasonal freezing in the base of the wall and upper bedrock. T3’ (30+261.5), T4’ (Sta. 30+273.5), and T5’ (Sta. 30+290) provide readings across the CSB/SB interface.

T3 to T5 show that the SB wall and the bedrock are starting to freeze with pockets of unfrozen material remaining for now in the bedrock but a marked cooling trend.

Thermistor T6 indicates that the SB and foundation are completely unfrozen below El. 130 m. From El. 130 to 132 m, the CSB wall fluctuates above and below 0°C and from El. 132 to 135 m, and the dike remained frozen.

No seepage directly downstream of this portion of the dike was observed; however, based on the topography, it is anticipated that seepage from this area could report to a lower point within the North Channel (i.e., 30+360). These thermistors show that the till and bedrock were largely unfrozen from August 2020 to September 2021 (see details below).

Piezometers at 30+276.5, located in bedrock between T4’ and T5, show that the P1 and P2 lines are now in permafrost, while P3 line remains unfrozen but cooling down.

T14 (30+827) indicates that the wall and the bedrock remained frozen.

### Sta. 30+386 (T7), Sta. 30+417.5 (T8), Sta. 31+595 (T19), Sta. 31+605 (T20), Sta. 31+850 (T23), Sta. 31+880 (T24), Sta. 31+960 (T25), Sta. 31+995 (T26), Sta. 32+030 (T27), Sta. 32+060 (T28), and Sta. 32+100 (T29) – jet-grouted section

Eleven thermistors were installed in areas where the bottom of the cut-off wall was jet grouted. These thermistors show that the maximum active layer depth was above 129 m to 130 m between August 2020 and September 2021. The majority of the rockfill stayed frozen all year and the till and bedrock were unfrozen all year with an exception at T19, T20, and T29. A general cooling trend is observed, which is relatively slow in all instruments except in T19, 20, and T29, where it is faster.

At T19, the jet-grouted area is now partially frozen. At T29, the frozen front has reached the middle of the section that is both jet-grouted and grouted, about El. 125 m.

At T20, the jet-grouted section is now perennially frozen, while the grouted section below El. 118 m is still unfrozen.

Piezometer 31+600, located between T19 and T20, shows that P1 and P2 lines are freezing from the surface. The deeper instruments and the P3 line remain unfrozen. Similarly, piezometers at 32+105, located near T29, show that the P1 line is in permafrost and that the P2 and P3 lines are freezing back with the upper sensors frozen all year long, while the deep bedrock at the P2 and P3 line remain unfrozen.

Piezometers at 32+000, located between T26 and T27, show that the upper two sensors (in till) in the P1 line are in permafrost while the bedrock, most of the P2 and the P3 line, remain unfrozen.

### Piezometers Thermal Sensors in Seepage Channels

#### North Channel (Sta. 30+158 to 30+516.5)

Piezometers at 30+453.5 are progressively freezing, with the P1 line and the upper sensor in the P2 line (P2C in bedrock) now frozen.  Piezometers at 30+378.5 are unfrozen all year, except for the upper sensor in the P1 line (P1C at the bedrock interface) now frozen all year long. A continued cooling trend is observed in the North Channel.

#### Channel 1 and 2 (Sta. 31+815 to 32+105)

Piezometers at 31+885 are unfrozen all year and the temperatures are stable (no cooling). Piezometers at 32+000 are still unfrozen except upper instruments on the P1 and P2 lines (P1B1/B2 in till and P2B2/C in till) that are now frozen. Similarly, piezometers at 32+065 remain unfrozen, however the upper sensors in the P1 and P2 line (P1B2/B3 in till and bedrock, P2B3/ C in till) is now frozen. A cooling trend is observed in piezometers at Sta. 32+000 and 32+065.

### 3.3.2.3 Inclinometers

Eight standard inclinometers are installed on Bay-Goose Dike, as detailed in Appendix I (Table 5 and Table 6). The inclinometer displacements are referenced along Axis A and Axis B. Axis A is perpendicular to the cut-off wall alignment (positive displacement towards the Pit side) while Axis B is perpendicular to Axis A, parallel to the cut-off wall (positive displacements towards the increasing stationing). Cumulative displacement in Axis A varied from 0.1 mm to 12.5 mm. Cumulative displacement values for Axis B varied from 0.1 mm to about 9 mm. The larger settlement happened in the upper portion of the dike and in the thermal cap. Recorded displacements are mainly small and are within the tolerable displacements for the structure.

At 32+065, in December 2020, the readings seem to indicate displacements of up to 5 mm in the SB and CSB walls along both axes. However, the next measurements no longer showed this anomaly and were consistent with previous values, suggesting that the December 2020 readings were erroneous. One possible reason would be the presence of ice in the inclinometer that caused error in the measurements. In August 2021, a local displacement of 4 mm towards the south, parallel to the wall, was measured at El. 134.5 m. This must be confirmed with the next reading to confirm that this is a real movement, in which case close monitoring of the area is required.

No other significant movement was observed for other inclinometers from August 2020 to September 2021, of which measurements have remained relatively stable since 2014. Offsets in the measurement were previously linked to the replacement of the reel.

#### 3.3.2.4 Seismograph

Seismograph monitoring of blast vibrations on the crest of Bay-Goose Dike has been done for every blast at Goose-Pit and Pit E4/E5. AEM analysed the monitored blast vibrations after each event. The maximum allowable peak vector sum for all dikes is set at 50 mm/s per the designer’s recommendations. No blast was done in the reported period since mining activities were terminated at the Meadowbank site.

#### 3.3.2.5 Flow Meters

In 2021, the total average flow of all active monitored seepage stations, no. 6, 7, 8, and 9, due to seepage from the toe of the dike was measured at a maximum of 18 $m^3$/d, compared to 10.5 $m^3$/d in 2020, 38.2 $m^3$/d in 2019, 10.7 $m^3$/d in 2018, 14.7 $m^3$/d in 2017, 24 $m^3$/d in 2016, 29 $m^3$/d in 2015, 132.2 $m^3$/d (1.5 L/s) in 2013, and 97.2 $m^3$/d (1.22 L/s) in 2012. The measured flow does not take into account the inflow of water from the pond at Central Channel, as this value has not been measured since 2015 (61 $m^3$/d in 2013 and 2014). Overall, seepage is relatively stable and less than anticipated and thus is currently not a concern.

The North Channel is being monitored by stations 8 (30+420) and 9 (30+380) and had no measurable flow in 2021, compared to 5.8 $m^3$/d in 2019, 0.7 $m^3$/d in 2018, 4.9 $m^3$/d in 2017, 1.9 $m^3$/d in 2016, 17 $m^3$/d in 2015, 58 $m^3$/d in 2013, and 80.8 $m^3$/d in 2012. It is the second year that no measurable seepage is observed at this seepage station, which could be linked to the progressive freezing of the area.

The Central Shallow seepage channel is being monitored by station 7 and had an average flow of 8.3 $m^3$/d compared to 6.9 $m^3$/d in 2020, 15 $m^3$/d in 2019, 4.5 $m^3$/d in 2018, 5.6 $m^3$/d in 2017, 11.5 $m^3$/d in 2016, 12 $m^3$/d in 2015, 13.3 $m^3$/d in 2013, and 18.9 $m^3$/d in 2012. This is consistent with historical trends.

Channel 3 is monitored by station 6, which recorded an average of 7.1 $m^3$/d compared to 8.2 $m^3$/d in 2020, 17.4 $m^3$/d in 2019, 2.6 $m^3$/d in 2018, 4.2 $m^3$/d in 2017, and 9.3 $m^3$/d in 2016. This is consistent with historical trends.

Flows observed in 2021 are stable compared to previous years. It is recommended to continue monitoring the evolution of the seepage at the toe of the dike and to continue measuring the inflow of water from the pond at Central Channel.

Based on the instrumentation data, the performance of Bay-Goose Dike is satisfactory, as piezometric, thermal, seepage, and inclinometer data do not show concerning deteriorating conditions, although the evolution of the North Channel and Channels 1 and 2 must be monitored.

## 3.4 Vault Dike

Vault Dike is located across a shallow creek that connects Wally Lake and Vault Lake, at the Vault Pit area. Vault Dike was designed and constructed as a zoned rockfill dam with filter zones and an impervious upstream liner consisting of a bituminous membrane. The dike has an upstream key trench made of aggregate mixed with bentonite.

### 3.4.1 Field Observations during Inspection

No geotechnical concerns were identified, and Vault Dike was in good condition.

A photographic log and record of inspection form for Vault Dike is provided in Appendix A3.

### 3.4.2 Geotechnical Instrumentation Data Review

Four thermistor strings were installed on Vault Dike and four are operational, as detailed in Appendix I (Table 7). The instrumentation is indicating that the foundation of the dike is mostly frozen all year long and that the structure is behaving as expected with data following historical trends. Given that the remaining instruments indicate a frozen state as expected, it is considered unnecessary to replace the broken instrument.

The following thermal regime observations were made:

- The instrumentation shows that the entire foundation of Vault Dike (till and bedrock) is frozen, with instruments at the center of the dike (TH06 and 07) showing a decrease in the active layer thickness over the years (permafrost rising in the dike material).
- The upstream toe liner tie-in remained entirely frozen all year long.
- The active layer in the rockfill was up to 4 m thick in the summer of 2021.

# 4.0 WHALE TAIL PROJECT DEWATERING AND WATER MANAGEMENT DIKES

The dewatering and water management dikes at the Whale Tail Project site include: WTD, WRSF Dike, IVR Dike, and Mammoth Dike. Whale Tail Dike has been in operation since the dewatering of Whale Tail North pond in March 2019. The commissioning of WRSF Dike and Mammoth Dike began with freshet 2019 onset when water reached the toe of the structures. The IVR Dike was built in early 2021 and is not yet fully commissioned.

The most current version of the OMS manual (AEM 2021c) is dated November 2021 for the Whale Tail Project dewatering dikes. The most current version of the overall Emergency Response Plan (AEM 2021d) is dated September 2021. It is good practice to review these documents each year to keep the information up to date, particularly the 24-hour contact name and phone number.

A detailed visual inspection of the dewatering dikes is performed by AEM once a month, with more frequent routine inspections conducted as required by the OMS manual depending on the Trigger Action Response Plan (TARP) level. All instruments on WTD, IVR Dike, WRSF Dike, and Mammoth Dike are connected to a system that automatically collects and transmits data every three hours. Data for all instruments can be visualized on the Vista Data Vision software. A review of the instrumentation data for the Whale Tail Project dewatering dikes is presented in the following sections. During the year, regular review of the instrumentation on the dewatering dikes is done by mine personnel and observations and recommendation are compiled in a follow-up file. No instrumentation summary reports were issued in 2021. AEM indicated that the reporting format will be re-evaluated in 2022. The compilation of the instrumentation data was not part of the scope of this study, and the figures showing the data were provided by AEM. The information provided by AEM is presented as received in a document separates from this report. The data were sent as figures for the dewatering dikes. Continued monitoring and review of instrumentation data is recommended. In the case of a significant variation in the instrumentation data, the designer should be notified according to the OMS manual. A significant variation is defined by a change compared to usual seasonal trends and should be followed-up to monitor the evolution of the event and identify its causes and consequences, as well as the appropriate actions to take.

Figure C3 shows a plan view of WTD, Figure C1 shows a plan view of WRSF Dike, and Figure C4 shows a plan view of Mammoth Dike. These figures indicate the location of the photos taken and observations noted during the inspection.

## 4.1 Whale Tail Dike

Whale Tail Dike is a structure to isolate the Whale Tail Pit from Whale Tail Lake. The WTD is located on a shallow plateau of the lake floor with an approximate 2 m depth of water. This plateau is located between deeper sections of the lake with water depths of about 12 m. The WTD is a zoned rockfill dike with a core composed of a dynamically compacted fine filter. The low permeability element of this structure is a cement-bentonite cut-off wall consisting of secant piles drilled through the densified fine filter core and anchored into the bedrock. The elevation of the cut-off wall is 157 m, and is covered by a 2 m thick rockfill thermal cover with a crest at elevation 159 m. The bedrock foundation was curtain grouted to a depth of 10 m along the western section of the dike in 2018-2019. The foundation along the eastern section of the dike was not initially curtain grouted as it was frozen at the time of construction. The dike has an average height of 9 m and a 13 m wide crest. Upstream and downstream rockfill platforms with a crest elevation of 154 m are present, although the upstream platform is submerged by water.

The downstream side of the dike was dewatered between March and September 2019 and the Whale Tail South (WTS) Lake level upstream side of the dike is limited by discharge through the SWTC. An important seepage was observed at the toe of the dike from the summer of 2019. The surface seepage is collected in a trench from Sta. 0+720 to 0+430 and monitored by two V-notch weirs installed in the trench at Sta. 0+430 and 0+520. About 35 visible streams from the downstream toe are identified with survey sticks at the crest of the trench. Another 20 are identified right at the toe of the dike. Two other streams in the two bays downstream of 0+430 are observed as well. A sandboil area was reported by AEM at 0+365 as well as an additional visible flow area at 0+277. Based on WTS water level measurements in the past 2 years, it is likely that about 200 to 550 $m^3$ of the seepage is not visible but flows through the bedrock. Both visible and underground seepage appear to report to the Attenuation Pond by gravity.

To mitigate the seepage, a grouting remediation campaign was conducted from November 2019 to March 2020 to inject a grout blanket at the interface between the fractured bedrock and the secant piles, directly downstream of the cut-off wall between Sta. 0+750 and 0+176. The effectiveness of this campaign seems to be confirmed by instrument data and observed seepage flow rates (Section 4.1.2).

A seepage interception system composed of a series of four pumping stations (P1 to P4) was installed over the winter of 2020 at the downstream toe of WTD, on the downstream side of the seepage collection trench. This system has not yet been commissioned. Refer to Section 11.5 for the description of this system.

### 4.1.1 Field Observations during Inspection

No major geotechnical concern was observed with WTD during the inspection. The dike is currently closed to all traffic. Some water was ponding on the downstream platform during the inspection. It is recommended to profile the downstream platform surface to promote drainage toward the downstream slope.

Near the East abutment, some tension cracks (20 mm wide, a few meters long) as well as settlement (300 to 500 mm deep) were observed close to the downstream edge of the crest, outside of the cut-off wall. This area is known to be subject to new foundation thawing from instrumentation data and the deformations are likely thaw-induced. No specific action is required yet, but the situation must be closely monitored.

At the time of the inspection in July 2021, the V-notch measuring seepage was not functional but was repaired in September 2021. According to AEM, the seepage rate was stable compared to 2020, about 60 to 100 $m^3$/h. The seepage water was clear but pumped from the Attenuation Pond for treatment due to a high pH (around 9 to 10). According to AEM, the water quality has been relatively constant since the fall of 2019. The seepage interception system was not active since the water quality is not suitable for pumping back to WTS.

The discharge of water from the water treatment plan in WTS was located upstream of the dike at approximately Sta. 0+700 through newly installed diffusers (Section 11.2).

### 4.1.2 Geotechnical Instrumentation Data Review

Piezometers, thermistors, and a seepage monitoring station are installed on WTD (Appendix I). Many of these instruments have shown evidence of seepage through the bedrock since their installation. Data have been reviewed since instrument installation, as this is the first data review for Whale Tail Project that forms part of this inspection report.

#### *4.1.2.1 Piezometers*

In general, the series of P1 and P2 piezometers (downstream of the cut-off wall) react to pumping of the Attenuation Pond, suggesting a connection through the bedrock. The P3 instruments (upstream of the cut-off wall) show higher pressures than the downstream side. At Sta. 0+260, the P1 line further downstream indicates higher pressure than the P2 line, closer to the wall. At Sta. 0+360, this is only the case near the surface of the foundation (piezometers C). This trend is not observed at Sta. 0+440, where P1 pressures are lower than P2 pressures. In general, gradients are consistent with observed seepage areas and directions. An upstream to downstream and downward vertical gradient is observed across the wall (P2-P3 lines). Lower pressure at Sta. 0+360 in the P2 line compared to the corresponding piezometers at 0+260 and 0+440 suggests a lateral gradient towards this location, consistent with the potential seepage flowpath identified by the geophysical survey.

The piezometers have mostly stabilized around the beginning of August 2019 after dewatering of the downstream side and are now on a stable trend. The series of P3 piezometer generally show a link to the downstream pond level at depth (piezometers A and B) and to the lake water level within the embankment (piezometers C). The exception to this trend is PZ 0+440 P3, where all piezometers follow the lake water level trend. At 0+260, deeper P3 instruments (A and B), P2 instruments as well as P1A (in the bedrock) react slightly to lake level variations.

New piezometers were installed in the spring of 2021 at 0+550 and 0+701. These instruments appear to have stabilized following their installation and indicate a functioning cut-off wall, however more data must be collected before establishing trends at these locations.

In addition to the general trends, the following observations were made:

- PZ 0+260 P1C shows a rapid increase in pressure (+0.7 m) at the end of August 2020 and the pressure remained high during the following winter (about 152.5 m). The pressure slowly dissipated during the spring of 2021 back to normal levels by August 2021. Another spike is visible at the end of the available data, on August 8, 2021. PZ 0+260 P1B had a similar pressure increase in March 2021 (+0.4 m) which then slowly dissipated by August 2021. A similar trend with less amplitude was observed in 2020 in PZ 0+260 P1B. The variations do not seem linked with fluctuations of the Attenuation Pond level, nor the WTS lake level. Of the piezometers at 0+260, only P1C is frozen and thus this increase cannot widely be attributed to freezing around the instruments.
- PZ 0+260 P3A and B exhibit a pressure rise between September and November 2021 (+0.3 m). The variations do not seem linked with fluctuations of the Attenuation Pond level. None of the piezometers at 0+260 are frozen and thus this increase cannot be attributed to freezing around the instruments.
- PZ 0+360 P1C has been flagged as unreliable due to unrealistic data trends showing an excessively high increase in pressure. However, it has a unique trend that seems to be seasonal similar to the previous year, a large pressure increase occurred in December 2020 (about +17 m), followed by a partial dissipation in April 2021 (about -12 m), and another spike in May 2021 (about +10 m). In 2020, the pressure had come back to below the lake level by November, but in 2021 this is to confirm as the pressure decrease was not yet over at the time of the instrumentation review. No other variation observed in other instruments is visible in PZ 0+360 P1C. This instrument is not frozen and should continue to be monitored.
- PZ 0+440: P1B and P2C have been on a slow rising trend between August and November 2020 (+0.3 m), and the pressure then dissipated slowly by February 2021. No correlation with WTS or Attenuation Pond levels are observed, nor with the presence of ice at the downstream toe observed in the winter. These instruments have been noted in the past for having local trends that could indicate an uncertain mechanism potentially including flow across the cut-off wall but this is not supported by thermal data.

Some piezometers have been flagged as frozen over the last few months (PZ 0+260 P1C, PZ 0+360 P2A, PZ 0+440 P2C, and P3C). At this date, all these instruments except PZ 0+260 P1C have thawed and readings appear normal, not suggesting any apparent damage to the sensors. Their data must be interpreted with caution.

#### *4.1.2.2 Thermistors*

Eight thermistor strings have beads showing capacitive effect due to water infiltration within the cable. Other than those, here are the relevant observations:

- West abutment (0+110, 0+142): in permafrost condition until August 2020 when the bedrock thawed entirely and rapidly, reaching the lake temperature (13°C), suggesting seepage is now going through the upper bedrock in this area. This section of the bedrock was not injected during the grouting campaign as it was still frozen. Cooling seems to be observed in the deep bedrock through 2021, to be confirmed after the open water season. At the very edge of the abutment (0+110), the bedrock is still frozen, placing the limit of the permafrost between 0+110 and 0+142.
- 0+210, 0+240, 0+596, 0+635: data are missing to establish a trend in TH 0+210, but the bedrock remains thawed at these locations with seemingly little amplitude in the seasonal variations.
- 0+310, 0+453, 0+580: rapid warm-up in summers in the upper bedrock, suggesting lake connection through fractured upper bedrock in this zone. No sign of cooling at depth.

- Upstream thermistor at 0+260: the deep bedrock has been thawed since the installation of the instrument but seems to be starting to freeze after the bedrock grouting operations. The trend is the same in 2021.
- 0+360, 0+407: strong reactivity in the cut-off wall and at the bedrock interface. The deep bedrock has been thawed since the installation of the instruments but seems to be starting to freeze below El. 135 m. This could be a result of the bedrock grouting operations.
- 0+425, 0+550, 0+645: these instruments were installed in the spring of 2021. The lower bedrock (below El. 134 m to 135 m) thawed in summer, while the upper bedrock close to the dike interface (above El. 142 m to 144 m) remained thawed since the installation.
- 0+475: newly installed instrument, no data provided yet.
- 0+500: this instrument was installed in the spring of 2021. The bedrock thawed entirely in summer with a temperature increase of 7°C. Likely similar to TH 0+520, to confirm with more data next year.
- 0+520, 0+530, 0+580: strong seasonal variations linked to lake temperatures in summer, similarly to INC-0+560. A potential explanation is that water may flow along the grout curtain stopping at 0+516 and seeping through the bedrock (potential seepage location). The deep bedrock seems to be starting to freeze again at 0+520 below El. 130 m after April 2020, with stable temperatures at that depth in 2021. This could be a result of the bedrock grouting operations.
- 0+607, 0+665, 0+675, 0+685, 0+695, 0+707: temperature variations are mainly located within the wall and in the upper bedrock, suggesting less connectivity of the bedrock to the lake at this location. This might suggest a potential defect within the wall and a seepage location within the heavily fragmented bedrock. Permafrost condition no longer observed in deep foundation (below El. 132 m) since the end of 2020 at 0+607.
- 0+720, 0+740: the temperature variations seem to be mostly above the interface, with little variations in the thawed upper bedrock (between 0°C and 3°C).
- Most thermistors installed upstream of the cut-off wall (0+190, 0+260, 0+336, 0+710) indicate that the temperature trend within the bedrock follows the lake water seasonal temperature variations since July 2019, suggesting the bedrock is fractured and connected to the lake in these areas. The TH 0+260 is still exhibiting this trend in the upper bedrock while the deeper bedrock below El. 134 m is starting to freeze.
- Upstream thermistor at 0+750: the bedrock was originally in a permafrost state below El. 148 m. However, the bedrock above El. 143 m thawed after August 2020 and reacts to seasonal lake temperature variations since, suggesting seepage is going through the upper bedrock in this area. This section of the bedrock was not injected during the grouting campaign as it was still frozen.
- East abutment (0+772, 0+790): most of the bedrock is in a permafrost state. Until April 2020, the bedrock above El. 148 m showed a small reactivity to lake temperature variations, while the base of the wall from El. 151 m to 153 m exhibited a stronger connection to the lake, similar to nearby TH 0+675. Only the topmost part of the wall is now showing reactivity, with permafrost in all the bedrock. This could be a result of the bedrock grouting operations. TH 0+790 was installed in 2021 and currently shows continuously frozen bedrock. The permafrost limit is thus placed between 0+740 and 0+772.

- Downstream instruments (0+340, 0+618): these instruments were installed a distance away from the downstream toe to monitor freeze-back of the foundation. At 0+340, the bedrock is still thawed below El. 141 m, however the upper bedrock above remained frozen during the summer of 2021. At 0+618, the bedrock was entirely thawed during the summer.

Based on temperature profiles and geophysical surveys conducted in 2019, AEM identified the most conductive zones (less latency and most compliance to lake trend) ranking as follows: 0+520, 0+453, 0+310, 0+210, and finally 0+675. The less thermally reactive zones shown by TH 260-360-407-607 confirmed that the potential seepage zone at 0+360 shown by Willowstick was not backed by TH analysis, perhaps because it is in deep bedrock. However, 0+210 showed a seepage zone. In summary, likely seepage zones were identified by thermistors at:

- 0+210
- 0+450 to 0+550
- 0+650 to 0+750

These areas were targeted by the bedrock grouting campaign. Several areas show freezing of previously thawed bedrock (0+260, 0+360, 0+407, 0+520, 0+772), suggesting a reduction in the local seepage rate through the bedrock. On the contrary, some areas previously in permafrost experienced a rapid thawing in 2020 (0+142, 0+750 upstream), and the trend appears stable in 2021 (no further degradation). This is likely due to the seepage flow concentrating due to the decrease in conductivity in grouted zones and relocating to previously frozen areas near the abutments. In the case of the East abutment, this correlates with observed tension cracking due to thaw-induced settlement. Although seepage relocation and continued thawing of the foundation has the potential to increase the seepage rates and impact the structure’s performance, no such increase is observed at the moment.

Some areas show a strong reactivity to lake water temperature variations (most of them between 0+520 and 0+707) that correlates with the seepage pathways identified. The thermal trends have been stable for 2 to 3 years and so far do not suggest deteriorating conditions.

#### *4.1.2.3 Inclinometers*

Four shape-array accelerometers (inclinometers) are installed in the cut-off wall of WTD. Displacements observed are within the OMS manual values (less than 50 mm cumulative displacement). Movements with an amplitude of 2 to 3 mm on the longitudinal axis of the dike have been observed at some other locations but are within the instrument precision limit and so may not be accurate.

There is a seasonal cooling and warming trend observed in the thermistors of the inclinometers that are within the cut off wall, the same is observed on both the piezometers’ temperature and thermistor strings. The following observations were made for the different inclinometers:

- INC-0+205: the cut-off wall is moving slightly towards the downstream side (maximum amplitude 25 mm) and slightly towards the west (maximum 15 mm). No significant movement was recorded in 2021. The thermistor suggests that the upper bedrock is thermally connected to the lake temperature, which is confirmed by nearby thermistor TH-0+210, although the inclinometer started freezing for the first time over the winter of 2021.

- INC-0+366: above the platform at El 154 m, the cut-off wall was moving slightly towards the downstream side (maximum 15 mm from the baseline). Between El. 143 and 154 m, the wall is moving towards the downstream side (maximum 6 mm). No significant movement was recorded in 2021. This area seems thermally connected to the lake as well through the bedrock, as the thermistor shows seasonal variations in the bedrock. Progression of the freezing front is observed in the dike over the years.
- INC-0+560: the portion of the cut-off wall above the platform at El. 154 m was moving towards the upstream side (maximum 19 mm) and towards the east (maximum 13 mm). No significant movement was recorded in 2021. The thermal regime is stable in this instrument, with the bedrock fully thawed and rapid warming in summer at the base of the cut-off wall, but with a lag compared to the lake temperature variations which does not suggest significant seepage.
- INC-0+726: above El. 152 m, the cut-off wall was moving mostly towards the upstream. Below El. 152 m, the wall was moving towards the downstream side. Movement towards the east is observed between El. 145 and 155 m (maximum 19 mm) and towards the west above that elevation (maximum 18 mm). The general movement trend is more pronounced at the bedrock interface. No significant movement was recorded in 2021. The bedrock was thawed since 2019, but started to freeze during the winter in 2021 above El. 147 m.

#### 4.1.2.4 Flowmeters

The seepage flow that daylights at the downstream toe of the dike is collected into a trench where several V-notch weirs have been installed. Some areas of seepage are not collected but only visually assessed, accounting for about 100 $m^3/h$ in 2020. Calculations done by AEM in the past based on measured water levels on both sides of the dike suggested that about 200 to 250 $m^3/h$ of the seepage was not observed but instead flowed within the bedrock.

In 2021, the maximum flow rate measured in the V-notch weir at Sta. 0+430 when functional was stable at around 61 $m^3/h$ as of mid-November 2021. Pumping rates were used to estimate the seepage rate when the V-notch weir was not functional and AEM estimated a maximum of 100 $m^3/h$ with this method. It is important to keep a functional seepage rate measurement all year. The grouting operations seem to have significantly decreased the seepage rate compared to 2019. However, the impact on the non-visible seepage flowing through the bedrock is unknown and it is possible that seepage is now reporting to different areas of the downstream side and are not measured. It is recommended to keep monitoring the areas to detect any new visible seepage, such as the abutments, especially the thawing East abutment through which thermal data suggest water may be flowing. Monitoring of the pumping flow within the pit is not considered accurate due to the several water income from the surface and other income from the pit wall. It is recommended to monitor the southern pit wall water income and evaluate if it is possible to install a flow monitoring point capturing the water income for the south wall at least relatively visually.

## 4.2 Waste Rock Storage Facility Dike

The WRSF Dike is a water retention infrastructure designed to prevent contact water from the Whale Tail WRSF accumulating in the WRSF pond from reporting to Mammoth Lake. The water collected in the WRSF pond located upstream of the dike is pumped to the Attenuation Pond and treated prior to being discharged. An area of approximately 109 ha drains towards the WRSF pond. The WRSF Dike is located south of the Whale Tail WRSF. This structure is a zoned rockfill dike with a filter system. The low permeability element of the dike consists of a bituminous geomembrane installed on the upstream face up the El. 157.8 m and anchored in a key trench with fine filter amended with bentonite (FFAB). The key trench is excavated in frozen fluvioglacial sand and gravel type material or bedrock.

In the summer of 2019, seepage was observed at the downstream toe of the WRSF Dike, along with tension cracks and settlement in the crest surface. The upstream pond was pumped out to control the seepage. The seepage mechanism, although not confirmed, was suspected by AEM to be linked with thawing of the foundation below the upstream toe liner tie-in and/or a defect in the liner.

During the winter of 2020, a thermal berm was built on the upstream side of the dike, to promote freezing of the key trench and of the foundation. The thermal berm is composed of compacted sand and gravel, which has been amended with bentonite up to El. 156 m, covered with a rockfill protection layer on the crest and upstream slope. A sump was excavated at the upstream toe of the thermal berm around Sta. 0+300 to pump out the upstream pond water as needed to maintain the water level at the operational level at El. 154 m.

No seepage was observed during the summer of 2021, similar to 2020, likely due to the good performance of the thermal berm and the draw-down of the upstream pond water level.

### 4.2.1 Field Observations during Inspection

The WRSF Dike was in good condition at the time of the inspection. Old tension cracks and settlement signs were no longer visible.

Some water was observed ponding at the downstream toe of the dike. No sign of flow indicating seepage was observed.

A pipline was present at the upstream toe for upstream pond level water management, however the pumping system installed in the upstream sump was not active at the time of the inspection.

No pumping was ongoing in the downstream sump at the time of the inspection.

### 4.2.2 Geotechnical Instrumentation Data Review

Only thermistors are monitoring WRSF Dike (Appendix I). There are nine thermistor strings installed within the WRSF Dike.

These instruments show that:

- The upstream liner tie-in (TH-01 and TH-03) is now entirely frozen. This confirms the effectiveness of the mitigation measures put in place to promote freezing of the tie-in.
- The exposed rockfill (TH-02, TH-04) reacted to seasonal variations (active layer above El. 153 m) while the rockfill covered by the thermal berm (TH-03, TH-06, TH-07) remained frozen.
- The foundation till (frozen at the time of construction) remained frozen during the summer of 2021 (TH-04, TH-06, TH-07). The overburden upstream of the dike at 0+172 was in the active zone (TH-05). The underlying bedrock in these areas remains frozen.
- The foundation bedrock remains frozen during the entire year.
- Thermistors installed in the upstream thermal berm (TH-08 and TH-09) show that the rockfill is in the active zone but that most of the esker (below El. 156.5 m) as well as underlying materials have remained frozen over the summer of 2021, indicating that the thermal berm is performing as intended.

## 4.3 IVR Dike

IVR Dike D-1 (IVR Dike) is water retaining infrastructure built to prevent water from the IVR Attenuation Pond from flowing towards the Amaruq main camp area. This structure is a zoned rockfill dike with a filter system and an upstream thermal berm. The low permeability element of the dike consists of a low linear density polyethylene (LLDPE) installed on the upstream face up to El. 165.5 m and anchored in a central key trench with FFAB. The key trench is excavated in frozen glacial till or bedrock. The liner is covered in a granular material protection layer. IVR Dike is equipped with an emergency spillway at El. 164.8 m. Additional rockfill was placed on top of the crest near the abutments to increase thermal insulation where the dike's height is the lowest. The dike was built in the winter of 2021 and the till foundation outside the key trench was only prepared by removing organic materials at the surface.

### 4.3.1 Field Observations during Inspection

No major geotechnical concern was observed during the 2021 inspection. At the time of the inspection, IVR Dike was not yet fully commissioned, meaning that the IVR Attenuation Pond had not yet reached the upstream toe of the dike, however some water from runoff was ponding against it on both the upstream and downstream sides. There was no sign of flow or seepage.

Relatively small areas of settlement (300 to 500 mm) were observed on the north abutment, upstream of the thermal rockfill berm. The crest surface is irregular in the northern half of the dike, where water was channeling on the foundation before the dike was built. Tension cracks were visible in the rockfill near the downstream edge of the crest in the southern part of the dike, and near the upstream edge around Sta. 0+450.

The deformations are likely due to settlement in the rockfill and shallow foundation after thawing during the dike's first summer season. Instruments show that the foundation is still frozen 2 m below the ground surface. As a result, these deformations are not a concern at the moment but must be monitored to detect any degradation of the structure. No repairs are required in the current conditions.

Pipes are passing along the downstream toe of IVR Dike at the time of the inspection, partially blocking the emergency spillway outlet. These objects must be raised on a support at the spillway outlet to avoid blocking it and to ensure the hydraulic capacity of the spillway. If lifted on concrete blocks, these blocks should be placed outside of the spillway outlet and a horizontal support be placed between them so that no obstruction is left within the spillway.

### 4.3.2 Geotechnical Instrumentation Data Review

Only thermistors are monitoring IVR Dike (Appendix I). There are seven thermistor strings installed within IVR Dike.

Instruments show the following trend for the first hakf-year of operation of IVR Dike:

- The rockfill dike remained frozen below El. 163 m (IVR-TH-04) with temperatures ranging from -14°C to 0°C.
- The key trench remained frozen below El. 162.5 m (IVR-TH-01, IVR-TH-05). A large jump in temperature was observed in June 2021 below El. 162 m between dike Stations 0+145 to 0+0+180, with temperature in the fine filter rising from about -16.5°C to -2°C, and in the FFAB from about -16°C to -4°C. The IVR-TH 05 shows that between Sta. 0+180 and 0+220, this jump was not observed, as temperatures in later winter (May 2021) when the thermistor was installed were already higher by about 6°C. Since air temperatures on

site at that period were still well below 0°C, this difference may not be related to thawing but rather to the temperature conditions at the time of backfill of these sections of the key trench, as the air was warming up significantly at that time of year and some snowmelt was starting to cause water to flow to topographical low points of the trench. Temperatures in the key trench remained stable in summer and below 0°C. The upper part of the coarse filter (above El. 161 m) was slightly above 0°C during the summer of 2021 (IVR-TH-02).

- The foundation till and bedrock remained frozen (IVR-TH-02, IVR-TH-03, IVR-TH-04) with temperatures ranging from -15°C to -2.5°C in the till, and -15°C to -7.5°C in the bedrock.
- The upstream thermal berm remained frozen below El. 164 m (IVR-TH-03).
- The overburden and bedrock at the downstream edge of the dike footprint remained frozen in 2021 (IVR-TH-06) with temperatures ranging from -12.5°C to -0.5°C under the rockfill. Upstream of the dike, they remained frozen below El. 161 m, with temperatures ranging from -9.5°C to -0.5°C, while the exposed upper layer of overburden thawed.

## 4.4 Mammoth Dike

Mammoth Dike is a water retaining infrastructure built to isolate the Whale Tail Pit from Mammoth Lake. Mammoth Lake receives water from WTS Lake through the SWTC, treated water from the Attenuation Pond, and from the North-East Sector. Mammoth dike is located across the northeast finger of the Mammoth Lake. This structure is a zoned rockfill dike with a filter system. The low permeability element of the dike consists of a bituminous geomembrane installed on the upstream face up to El. 153.5 m and anchored in a key trench with FFAB. The key trench is excavated in frozen glacial till or bedrock. The liner is covered in a granular material protection layer.

### 4.4.1 Field Observations during Inspection

No geotechnical concern was observed during the inspection. Water was ponding about 20 m away from the downstream toe in the low topographical point. No sign of flow indicating seepage was observed.

### 4.4.2 Geotechnical Instrumentation Data Review

Only thermistors are monitoring Mammoth Dike (Appendix I). There are three thermistor strings installed within Mammoth Dike.

The instruments show that the foundation bedrock remains frozen underneath the dike, with an active layer above El. 152 to 153 m that becomes shallower over the years. The upstream liner tie-in is entirely frozen.

# 5.0 TAILINGS STORAGE FACILITY

The TSF is located within the dewatered portion of the northwestern arm of Second Portage Lake and consists of the North Cell and the South Cell. The South Cell is comprised of Central Dike, Saddle Dam 3, Saddle Dam 4, and Saddle Dam 5, all built to El. 145 m. The North Cell is comprised of peripheral structures Saddle Dam 1, Saddle Dam 2, RF1, and RF2. The North Cell was internally raised with the construction of the North Cell Internal Structure to a variable elevation ranging from 152 to 154 m. Stormwater Dike is an internal structure separating the North Cell from the South Cell. A plan view of the TSF is shown in Figure 1.

A retention basin and a series of diversion ditches surround the catchment basin of the North Cell. These structures are designed to convey surface water runoff away from the TSF. Since 2014, the Western Diversion

Ditch has been collected within a retention basin prior to being pumped within the North Cell when the water quality is inadequate due to a turbidity problem from the erosion of the side slope and the crest of the ditches. Three temporary retention basins and one ditch are constructed within the North Cell, at the downstream toe of the North Cell Internal Structure to collect seepage through and runoff from this structure. Refer to Section 10.2 for the inspection of these diversion structures.

The North Cell is being progressively closed in sections except for the North Cell Internal Structure area which is receiving tailings. Progressive capping was completed in 2019 and tailings deposition resumed in the North Cell from July 2, 2021, from the North Cell Internal Structure and was still ongoing during the inspection. The South Cell has now reached almost full capacity, with only limited residual capacity left. Water is transferred as needed from the North Cell to the South Cell to control the water elevation of the North Cell, and excess water from the South Cell is pumped out to Bay-Goose Pit or Portage Pit. The OMS manual for the TSF includes alert criteria based on reservoir levels and clear responsibilities to manage th e situation in case of rising water level to avoid overtopping of the structures.

In the summer of 2014, the mine constructed an engineered tailings barrier along RF1 and RF2 to mitigate migration of tailings through RF1 and RF2. Refer to Section 10.3 for the inspection of these structures.

The most current version of the TSF OMS manual (AEM 2021a) is dated July 2021. The most current version of the overall Emergency Response Plan for the mine (AEM 2021d) is dated September 2021. An update is in progress by AEM. It is good practice to review these documents each year to keep the information up to date, particularly the 24-hour contact name and phone number.

An inspection of the TSF is performed once a month by AEM. The instruments have been automatically read every three hours since 2017. The monthly inspection reports were reviewed as part of the annual inspection and provided satisfactory information about the evolution of the structures. A summary of the instrumentation data obtained from the TSF is presented in Section 5.1.2 and Section 5.7.2. A presentation of the instrumentation data by AEM from September 2020 to August 2021 was provided to Golder for review. Continued monitoring and review of instrumentation data is recommended. In the case of a significant variation in the instrumentation data, the designer should be notified according to the OMS manual. A significant variation is defined by a change compared to usual seasonal trends and should be followed-up to monitor the evolution of the event and identify its causes and consequences, as well as the appropriate actions to take.

Figure B1 shows a plan view that indicates the location of the pictures and general observations related to the North Cell and South Cell, as well as the North Cell Internal Structure. Figure B2 contains a plan view that shows the location of the photos and observations noted on Stormwater Dike. Figure B3 contains a plan view that shows the location of the photos and observations noted on Saddle Dam 1, Saddle Dam 2, and Saddle Dam 3. Figure B4 contains a plan view that shows the location of the photos and observations noted on Central Dike, Saddle Dam 5, and Saddle Dam 4.

## 5.1 General Observations of the Tailings Facility

### 5.1.1 Field Observations during Inspection

Per the TSF design and the standard operating practices, captured in the OMS manual, a tailings beach must be always present against all peripheral structures, except Saddle Dam 3 which was modified to allow water ponding.

At the time of the inspection, the pond of water in the North Cell was located towards the centre of the facility and there was a tailings beach against the peripheral structures to protect them from ice in the winter and to prevent the migration of water out of the TSF (see Figure 1 for an approximate location of the tailings beach). The tailings elevation in the North Cell varied between approximately El. 149.5 m and 152.1 m and the pond elevation was at El. 146.51 m. The tailings beaches against the structures of the North Cell were adequate. The North Cell Internal Structure is built partially on the North Cell tailings and partially on the rockfill cover placed over the last few years for closure operations. At the time of the inspection, tailings deposition was ongoing from the North Cell Internal Structure and water was channeling from the deposition point towards the reclaim pond in the south part of the North Cell. It was observed that channelling was occurring far from the dike slopes, which is an improvement from last year when fine filter was eroded by the channelling water (Section 5.4.1).

At the time of the inspection, the tailings elevation varied between approximately El. 132 and 144.6 m in the South Cell and the pond elevation was at El. 140.98 m. Water in the South Cell was ponding against the south part of the downstream toe of Stormwater Dike, while a tailings beach developed against the rest of Stormwater Dike. This is a favourable point for South Cell closure and environmental aspects, given that it is inferred that the Stormwater Dike foundation presents some open windows of exposed fractured bedrock that may contribute to feeding the seepage at Central Dike. A tailings beach developed against the majority of Central Dike and Saddle Dams 4 and 5. Water was observed ponding against the liner in the corner of Central Dike and Saddle Dam 5. At the time of the inspection, no tailings deposition was done in the South Cell, as it is now inactive.

At the time of the inspection, Saddle Dams 3, 4, and 5 were operational, with water ponding against the erosion protection of Saddle Dam 3 and tailings deposited against Saddle Dams 4 and 5. Permanent sumps have not yet been installed on the downstream side of Saddle Dam 4 and Saddle Dam 5, and water accumulation is pumped as required. A permanent sump is in operation on the downstream side of Saddle Dam 3. It is important that the water level on the downstream side not be allowed to rise higher than the granular layer of the upstream toe liner tie-in to prevent uplifting of the geomembrane. In general, a lot of water was observed ponding on and around the dikes. According to AEM, torrential rains had occurred a few days before the inspection, accounting for the ponding water, but the freshet was mild and spring runoff was limited this year.

No depressions in the tailings have been observed this year during the inspection, nor reported by AEM.

Photographs of the North Cell and South Cell of the TSF are provided in Appendices B1 to B7.

### 5.1.2 Geotechnical Instrumentation Data Review

Nine thermistors are installed in the tailings of the North Cell of the TSF, as detailed in Appendix I (Table 12). They indicate that the tailings in the North Cell are not entirely frozen, including in the talik area where the reclaim pond was kept during operation.

NC-T1 shows that the tailings and the bedrock did not freeze between September 2020 and August 2021 below El. 140 m, with temperatures ranging between 0°C and 2.5°C. The unfrozen conditions are attributed to the presence of the supernatant water pond close to the instrument, and the fact that it was always within the supernatant pond during tailings deposition. Between El. 140 m and 143 m, tailings remained frozen.

NC-T2 shows that the tailings and the bedrock did not freeze between September 2020 and August 2021 below El. 125 m, with temperatures ranging between 0°C and 1°C. The unfrozen conditions are attributed to the location of the instrument directly within the supernatant water pond. Between El. 125 m and 145 m, tailings remained frozen. An active layer is present in the tailings above El. 145 m.

NC-17-01 shows that the tailings and bedrock remained frozen between September 2020 and August 2021, with temperatures ranging between 0°C and -16°C.

NC-17-02 shows that the tailings and the bedrock did not freeze in 2021 below El. 137.5 m, with temperatures ranging between 0°C and 1.5°C. The unfrozen conditions are attributed to the presence of the supernatant water pond near the Saddle Dams close to the instrument. The depth of the frozen layer (above El. 137.5 in 2021) is slowly increasing over the years.

NC-17-03 shows similar data to NC-17-02 and the same cooling trend near the surface. The unfrozen conditions are attributed to the presence of the supernatant water pond between RF1 and RF2 close to the instrument.

NC-17-04 shows that the bedrock remained frozen in 2021 below El. 130 m, with temperatures ranging between -0.5°C and -4°C. Another zone located in the tailings between El. 140 and 145 m remained frozen, with temperatures ranging between 0°C and -22°C. The lower part of the tailings above the bedrock interface (between El. 132 m and 140 m) froze in winter with a seasonal warmup in the summer of 2021, similar to previous years. This is consistent with the observations of a talik zone made when the reclaim water pond was present at this location during operations. An active layer is observed in the tailings above El. 145 m.

NC-17-05 shows that the tailings and bedrock remained entirely frozen in 2021, for the first time not thawing in summer. No active layer was observed in the tailings.

NC-17-06 shows that the tailings and the bedrock remained frozen in 2021 below El. 145 m, with temperatures ranging between -10°C and 0°C. An active layer is observed in the tailings above El. 145 m.

NC-17-07 shows that the tailings and the bedrock remained frozen in 2021 below El. 146 m, with temperatures ranging between -16°C and 0°C. An active layer is observed in the tailings above El. 146 m.

NC-17-08 shows that the tailings and the bedrock did not freeze in 2021 below El. 140 m, with temperatures ranging between 0°C and 2.5°C. The unfrozen conditions are attributed to the location of the instrument directly within the supernatant water pond. The depth of the frozen layer (above El. 140 in 2021) is slowly increasing over the years.

The temperature profile measured in thermistor SWD-01 is discussed in the next section.

## 5.2 Saddle Dam 1 – North Cell

Saddle Dam 1 is located in the northwestern corner of the TSF and forms one of the perimeter structures of the North Cell intended to retain tailings and supernatant fluid during the operation and the closure of the TSF. Saddle Dam 1 crosses a depression between the northwestern arm of Second Portage Lake and Third Portage Lake.

Saddle Dam 1 is a rockfill embankment with an 3H:1V upstream slope and a 1.3H:1V downstream slope. This structure has inverted base filters, upstream graded filters, and a linear LLDPE geomembrane liner on the upstream dike face. The geomembrane liner is placed between an upper and lower non-woven geotextile layer for protection, and is covered by approximately 0.3 m of granular material up to El. 140 m. No granular layer was placed above El. 140 m and the liner is exposed above that elevation. According to the design, a tailings beach must be maintained on the face of the structure to reduce the potential for ice damage to the liner. The abutments are founded on bedrock, while the central portion of the dike is founded on ice-poor soil. Till and/or crushed aggregate mixed with dry bentonite powder have been placed above the toe of the liner.

### 5.2.1 Field Observations during Inspection

During the inspection, it was observed that Saddle Dam 1 is performing well and does not show any geotechnical concern. An adequate tailings beach was observed along the upstream face of Saddle Dam 1. A stockpile of fine filter material has been present on the north part of the dike since 2011 and poses no geotechnical concern.

A permanent dewatering pump is installed downstream within a seacan container. Water was observed ponding near the sump. Pumping was done during freshet, and as necessary during summer. The water was discharged directly on the liner at the time of the inspection, however at a very slow flow rate that should not damage the liner. The environment department is monitoring the water quality during the year and this information is shared with the water management team. The water quality results indicate that the water is not seepage from the North Cell. Given that the foundation of Saddle Dam 1 is now frozen and therefore the weight of tailings will preclude any liner heave, it will be possible at a later stage to remove this pumping station and to backfill the toe drain trench to allow natural drainage of the water toward Third Portage Lake. However, as this sump is a permanent feature, it is required that the water quality remains monitored and be reported; the sump therefore cannot be backfilled during operations to comply with legal requirements.

A photographic log and the record of inspection form for Saddle Dam 1 is provided in Appendix B2.

### 5.2.2 Geotechnical Instrumentation Data Review

Instrumentation on Saddle Dam 1 comprises thermistors, as detailed in Appendix I (Table 9). Four thermistor strings (T1, T2, T3, and T4) are installed on Saddle Dam 1 and are automatically read every few hours following the installation of dataloggers in 2017. Three thermistors (T1, T2, T3) are installed to monitor the thermal condition within the structure and its foundation. The fourth thermistor string (T4) is installed along the upstream face of the dam to monitor the thermal condition of the tailings.

Thermistor data from within the structure indicate that the dike foundation remained frozen from September 2020 August 2021. The foundation soil and bedrock remained in a frozen state with temperatures ranging from about -1.8°C to -5.5°C. At the upstream toe, below El. 132 m, the compacted till base material below the liner remained frozen. The majority of the rockfill shell remained frozen during the reported year as the active layer was 2 m, above El. 146 m. The instrumentation indicates the structure is behaving as expected with data following historical trends.

No sign of seepage or thawing of the foundation soil can be observed from the instrumentation data. The structure is performing as expected.

## 5.3 Saddle Dam 2 – North Cell

Saddle Dam 2 is located along the western side of the TSF and connects to the western corner of Stormwater Dike. Along with Saddle Dam 1, it forms one of the perimeter structures of the North Cell of the TSF that retain tailings and supernatant fluid during the operation and closure of the TSF. Saddle Dam 2 crosses a depression between the northwestern arm of Second Portage Lake and Third Portage Lake.

The upstream foundation of the dike and abutments are primarily founded on bedrock; however, some portions of the structure, underneath the inverted filter, are founded on ice-poor soil. During construction, a thin layer of low permeability till was placed and compacted along the toe liner tie-in connection with bedrock. A thin layer of crushed aggregate (0 to 22 mm) mixed with dry bentonite powder was also placed under the thin layer of low permeability till in areas where open factures were observed within the bedrock. The toe liner tie-in was then covered with till.

### 5.3.1 Field Observations during Inspection

During the inspection, it was observed that Saddle Dam 2 is performing well and does not show any geotechnical concern. An adequate tailings beach was observed against the upstream side of the structure.

During the inspection, some water was observed ponding on the downstream side within the rockfill embankment (between approximately Sta. 20+275 and Sta. 20+475). This water has been observed since the 2015 annual inspection and the instrumentation indicates that the foundation remains frozen. Per AEM, water has been ponding at that location for a long time. The water is run-off water and is tested by the environmental team regularly during open water season.

A photographic log and the record of inspection form for Saddle Dam 2 is provided in Appendix B3.

### 5.3.2 Geotechnical Instrumentation Data Review

Instrumentation on Saddle Dam 2 comprises thermistors, as detailed in Appendix I (Table 10). Four thermistor strings (T1, T2, T3, and T4) have been installed at Saddle Dam 2 to monitor the thermal condition within the structure and its foundation.

Thermistor data from within the structure indicates that the dike foundation remained frozen from September 2020 to August 2021 with temperatures ranging from -4°C to -8°C. At the upstream toe of the dike, the semi-pervious backfill remained frozen during the year. The rockfill mostly stayed in frozen condition with an active layer above El. 146 m. The instrumentation indicates that the structure is behaving as expected with data following historical trends.

No signs of seepage or thawing of the foundation soil were observed. The structure is performing as expected.

## 5.4 North Cell Internal Structure – North Cell

The North Cell Internal Structure is located within the North Cell of the TSF, in its northern section. It is built over the existing tailings of the North Cell and the rockfill cover placed over the last years for closure operations.

The North Cell Internal Structure is designed and constructed as a permeable zoned rockfill dam with filter zones, built on the top surface dried tailings of the North Cell and on the existing rockfill cover. The bulk part of the North Cell Internal Structure consists of coarse rockfill material. The upstream face is designed at a 3H:1V slope and the downstream faces are designed at a 1.5H:1V slope. The upstream face of the North Cell Internal Structure comprises two granular filter zones. The filter zones are designed to prevent tailings migration and internal erosion, while allowing water to flow through the embankment. A system of ditches and sumps at the downstream toe of the structure is designed to collect seepage and runoff water.

### 5.4.1 Field Observations during Inspection

Tailings deposition was done from the North Cell Internal Structure at the time of the inspection. The deposition points are well built and the supernatant water is flowing well toward the west side of Stormwater Dike, where water is transferred into the South Cell. Channelling of water has been observed since 2019 at the upstream toe of the eastern part of the dike but has now shifted towards the center of the cell, which avoids filter erosion at the toe of the slope.

No sign of deformation, sloughing or recent tension cracks were observed. Some traces of old cracks from 2019 remained visible, but most of the fine filter layer has been repaired by AEM in 2021. In some areas, the fine filter was eroded from the top of the slope in a vertical wash-out scar, likely by water being discharged from a pipe on the crest. The underlying coarse filter was not visible, indicating that the filter system is not yet open and should still function. However, it is recommended to repair these scars to ensure the filter do not erode further, and to extend the water discharge pipe toward the North Cell to avoid water flowing on the filters. Alternatively, a sacrificial liner could be placed on the filter slope at the discharge location to protect the filter from being washed out.

The pumping stations on the downstream side of the dike are in place and working as needed. AEM indicated that the incoming water is from run-off and not from seepage. The capacity of the North Cell to store the inflow design flood must be ensured continuously during tailings deposition.

A photographic log and the record of inspection form for the North Cell Internal Structure is provided in Appendix B1.

### 5.4.2 Geotechnical Instrumentation Data Review

Four vertical thermistor strings were installed on the crest of the North Cell Internal Structure, with three of them in operational order, as detailed in Appendix I (Table 8). NCIS-01, NCIS-02, NCIS-03, and NCIS-04 show frozen tailings and an active layer within the rockfill (1.5 to 2.5 m thick). In the northern part of the dike (NCIS-03) where the rockfill cover is the thickest, the depth of the active layer seems to be decreasing slowly over the years.

Sixteen prisms are installed on the crest of the North Cell Internal Structure. Prisms were not read in 2021 in the absence of visible deformation on the crest.

## 5.5 Stormwater Dike

Stormwater Dike is an internal structure that subdivides the TSF into the North Cell and the South Cell within the dewatered northwestern arm of Second Portage Lake. Stormwater Dike cannot be considered as a temporary structure anymore, as it is planned to not fill the South Cell to the same elevation as the North Cell. Therefore, there will remain an elevation difference between tailings elevations on both sides. For this reason, it is recommended to review the design basis criteria and assess whether the actual dike configuration and construction still meets the design criteria and will continue to behave in a satisfactory manner in post-closure conditions. The work could be carried out by the Engineer of Record, but should be revised by the original dike designer.

In this document, the North Cell side is taken as upstream and the South Cell side as downstream.

Stormwater Dike is a rockfill embankment structure. The upstream slope is approximately 3H:1V and the downstream slope is about 1.3H:1.0V. A bituminous geomembrane liner has been installed above the graded filters on the upstream face of the dike. Low permeability till was placed and compacted along the upstream toe of the dike as a tie-in of the liner.

The majority of the dike is seated on dense till from the former lakebed within the talik, with lakebed sediments still present in some areas, while the abutments are generally founded on bedrock.

### 5.5.1 Field Observations during Inspection

Since 2016, tension cracks and signs of settlements have been noticed on the crest of Stormwater Dike in a repeated pattern over the years. The most probable mechanism of the movement is settlement due to the thawing of soft sediments caused by the rise of ponding water in the South Cell through the Stormwater Dike foundation. To mitigate against a possible foundation failure, a rockfill buttress support was constructed at the downstream toe of Stormwater Dike in the South Cell (from approximatively Sta. 10+300 to Sta. 10+700). After the movement had stopped during each episode, the cracks were filled with bentonite. This is a good practice to limit water infiltration within the cracks.

No cracks or deformations were observed on Stormwater Dike at the time of the inspection. The structure was in good condition. Some discarded materials were stored at the east entrance of the dike and should be removed.

During the annual inspection, the downstream toe of the dike was not visible as it has been entirely covered by tailings and the South Cell pond. On the upstream side, capping was very close to the dike

A photographic log and the record of inspection form for Stormwater Dike is provided in Appendix B4.

### 5.5.2 Geotechnical Instrumentation Data Review

Two thermistors, one piezometer, and 20 prisms are monitoring Stormwater Dike, as detailed in Appendix I (Table 13). Extensometers and crackmeters previously in place have been removed.

SWD-01 is installed on the upstream side of Stormwater Dike within the North Cell tailings. This thermistor shows that the tailings and the bedrock did not freeze between September 2020 and August 2021 below El. 132 m with temperatures ranging between 0°C and 2.2°C. The unfrozen conditions are attributed to the presence of the supernatant water pond close to the instrument which prevents freezing of the existing talik zone. The temperature readings indicate that the tailings between El. 132 m and 147 m stay frozen throughout the year. No active layer was observed in 2021, similarly to 2020.

SWD-03 is installed on the downstream side of Stormwater Dike (approximately Sta. 10+690 m) within the stabilization buttress and is covered by the South Cell reclaim pond. This thermistor shows that the lakebed sediments, till and bedrock remained entirely unfrozen all year for the first time since its installation, indicating that the talik condition that was initially present in this area before construction has returned. This could be explained by the water level having overtopped the rockfill buttress, which previously allowed convection of cold air in winter to cool the foundation, while it is now insulated from outside air variations. No visible deformations are associated with this thawing in the foundation, which must be monitored closely for any deteriorating conditions.

The piezometers show a trend in pore water pressure that used to follow the evolution of the water level in the South Cell reclaim pond but have disconnected from it since March 2020. In 2021, the instruments showed the same behaviour as in 2020, with pressure appearing disconnected from the South cell but still reacting to freshet inflow with a sharp increase in pressure (+14 m in PZ-SWD-03-A and +10 m in PZ-SWD-03-B). In 2020, this increase dissipated around September. On the extended data received from AEM, which span until October 2021, this pressure had not yet dissipated but seems to be following the same pattern as in 2020. It is recommended to watch for other unusual fluctuations in these instruments. These two instruments have been at 0°C since they were installed but have stayed thawed since the summer of 2020.

Prisms have not been read in 2021 in the absence of visible deformation.

## 5.6 Saddle Dam 3, Saddle Dam 4 and Saddle Dam 5 – South Cell

The South Cell of the TSF consists of four perimeter structures: Central Dike, Saddle Dam 3, Saddle Dam 4, and Saddle Dam 5. Saddle Dam 3 is located in the northwestern corner of the South Cell and is merged into Saddle Dam 2. Saddle Dam 4 is located in the southwestern corner of the South Cell and is merged into Saddle Dam 5, which merges with the southern end of Central Dike.

Saddle Dams 3, 4, and 5 are designed and constructed as zoned rockfill dams with filter zones, low permeability upstream liners, and upstream toe liner tie-in key trenches. Cross-sections of Saddle Dams 3, 4, and 5 consist of a rockfill embankment, constructed from run-of-mine waste rock, placed in lifts and compacted. The upstream faces are designed at a 3H:1V slope and the downstream faces are designed at a 1.5H:1V slope. The upstream faces of Saddle Dams 3, 4, and 5 are comprised of two granular filter zones and a LLDPE liner extending along the upstream foundation. The filter zones are meant to keep the tailings inside the facility in a case of liner puncture, but mainly act as appropriate bedding for the liner. An upstream liner tie-in key trench excavated to bedrock and filled with compacted till is located along the upstream area of the structures.

### 5.6.1 Field Observations during Inspection

At the time of the inspection, all dikes were operational. The water level of the South Cell was above the upstream toe of the erosion protection cover of Saddle Dam 3. No geotechnical issues were observed with these structures. A section of pipe and a metal rod were present on the liner in the upstream slope of Saddle Dam 4 and should be removed to avoid damaging the liner.

During the inspection, water was observed ponding in some areas of the downstream side of Saddle Dam 4 and Saddle Dam 5, slightly more than in 2020, likely due to recent rains. As the downstream toe is higher than the South Cell pond along Saddle Dam 4 and Saddle Dam 5, this water does not come from the TSF. On the downstream side of Saddle Dam 3, in the sump, water is ponding at a level below the South Cell elevation. It is important to maintain the water level on the downstream side lower than the level of the upstream toe liner tie-in granular material layer to prevent uplift of the geomembrane. As the elevation of the downstream side is lower than the elevation of the granular material, this should not be a problem if the downstream water level is managed.

A photographic log and the record of inspection forms for Saddle Dams 3 and 4 is provided in Appendix B5 and Appendix B6. A photographic log and the record of inspection form for Saddle Dam 5 is provided in Appendix B7.

### 5.6.2 Geotechnical Instrumentation Data Review

Five thermistors are installed at Saddle Dam 3 with three of them operational in 2021, as detailed in Appendix I (Table 14). These thermistors are mostly in permafrost condition, with the bedrock frozen all year. It will be important to keep following the performance of the structure as Saddle Dam 3 is operational for containment of supernatant water. Additional instrumentation will have to be installed for closure.

Four thermistors are installed at Saddle Dam 4 with three of them operational in 2021, as detailed in Appendix I (Table 15). These thermistors are mostly in permafrost condition, with the bedrock frozen all year. The beads in the bedrock for SD4-T4 (in the upstream toe liner tie-in) should be repaired.

Three thermistors were installed at Saddle Dam 5, as detailed in Appendix I (Table 16). SD5-T4 shows frozen bedrock and rockfill up to El. 142 m, while SD5-T2 further downstream indicates that the bedrock and the rockfill are mostly frozen up to El. 140 m with temperatures between -7.5°C and 0°C. SD5-T3 indicates that the bedrock and the compacted till of the tie-in are frozen up to El. 140.5 m.

## 5.7 Central Dike – South Cell

Central Dike is located along the eastern side of the TSF and crosses a depression within Second Portage Lake. Along with Saddle Dam 4 and Saddle Dam 5, Central Dike forms one of the perimeter structures of the South Cell.

Central Dike design includes a compacted rockfill embankment with an upstream seepage barrier, granular filters, and a key trench along the centreline of the dike transitioning on the upstream toe near both abutments. The foundation soils include lakebed sediments and till overlying bedrock. Soft and ice-rich soils were removed from the Central Dike footprint during construction.

### 5.7.1 Field Observations during Inspection

During the inspection, water was observed ponding at the downstream toe of the dike between approximately Sta. 0+300 and the southern access road at Sta. 0+830. Seepage into the basin at the downstream toe of Central Dike has been observed since 2014 when tailings deposition was transferred from the North Cell of the TSF to the South Cell. The rate of seepage increased proportionally to the rise of the pond level of the South Cell. Field investigations coupled with seepage-stability analyses indicated that the seepage is mainly controlled by openings in the bedrock and that the dike is physically stable. The decrease of the South Cell water level and use of tailings to seal the bottom of the cell reduced the seepage rate, which was 150 $m^3$/h at the time of the inspection and stable (Section 5.7.2). The South Cell level was low in 2021 (El. 140.98 m) with pumping volumes similar to 2020 corresponding to precipitation only. AEM also reported that the seepage rate did not decrease below that value in the fall of 2021, while it usually decreases to a low of 50 $m^3$/h during winter. It is possible that the late summer conditions in 2021 contributed to keep the seepage pathway open, however there is a possibility that the South Cell is being drained at a higher rate than usual given the spontaneously low water level. There is a possibility that such seepage could flow below the instrumented zone at Central Dike and report directly to the Portage Pit downstream. This should be confirmed at the onset of winter based on the seepage rate evolution, and further investigated.

During the spring, the water in the downstream pond reportedly had an orange coloration with high turbidity, similar to previous years. This event is monitored by AEM and has been attributed to precipitation of iron oxide from bacterial processes.

Central Dike is in good condition. At the time of the inspection, there was a tailings beach against the entire length of the structure except the southern part, from Sta. 0+850 m, where water is ponding on the LLDPE liner. Stormwater Pond was being pumped out into the South Cell at the time of the inspection, and the discharge was located at the corner of Saddle Dam 5 and Central Dike, adding water to the pond. AEM is planning to remove the water ponding in this area per the design requirements. The water discharge was done directly against the liner, with the water falling onto the LLDPE at a high velocity at around Sta. 0+950. This could cause erosion of the material over time, therefore it is recommended to protect the liner at this location (e.g., with a piece of sacrificial liner placed over the dike liner).

The angular granular material (fine filter) in direct contact with the LLDPE liner and the cable with a metallic plug observed on the liner previously were no longer visible.

A photographic log and the record of inspection form for Central Dike and Saddle Dam 5 is provided in Appendix B7.

### 5.7.2 Geotechnical Instrumentation Data Review

Instruments were installed on Central Dike to monitor the dike's performance during its construction, operation, and closure. At the time of the inspection, the instrumentation on Central Dike consisted in a total of 55 piezometers and 21 thermistor strings installed in 18 boreholes, as detailed in Appendix I (Table 17).

The following presents a summary of the data collected from September 2020 to August 2021 for the piezometers and the thermistors.

#### *5.7.2.1 Thermistors*

The thermistors are showing similar trends as in the past. The following observations of the thermistor data can be made:

- Throughout the year, temperature variations up to 1°C can be observed for each bead, except in rockfill near the surface (up to 10 m deep) where the amplitude is larger.
- **P1 line (instruments installed along the central key trench):** instruments show thawed conditions within the rockfill, the till, and the bedrock (from El. 110 m to 65 m), typically with temperatures ranging between 1°C and 2°C.
- **P2 line (instruments installed along the downstream toe of the Central Dike footprint for a final crest elevation of 150 m):**
  - A cooling trend is visible at the extremities of the dike. The bedrock at 545-P2 is almost entirely frozen above El. 62 m, with the interval between El. 74 and 80 m remaining thawed all year at around 0.1°C. At 587-P2, the base of the rockfill and the till are in permafrost, while the freezing front is slowly progressing at depth in the bedrock, reaching El. 97 m in 2021. The deep bedrock is stable with temperatures of up to 1.5 °C.
  - At 800-P2, the rockfill, till, and bedrock remain thawed and the temperatures are stable (2°C to 3°C). 650-P2 shows a similar situation (between 0.4°C and 1.1°C in the rockfill, till, and bedrock).
- **P3 line (downstream of Central Dike):**
  - Thermistors 465-P3 and 1050-P3 show stable permafrost conditions.
  - Thermistors 650-P3 is still in frozen conditions but seem to indicate a slight warmup since the end of 2020, to monitor for further evolution.
  - Thermistors 875-P3 and 975-P3 installed near Portage Pit show that the bedrock remained unfrozen below approximately El. 95 m, with temperatures ranging from 0°C to 1°C. The node at El. 75 m in 875-P3 is starting to freeze in 2020. A freezing trend is observed in these two instruments. This seems to indicate that a permafrost condition has developed in part of the Portage Pit wall.
  - The thermistor installed in the West Road (745-P3) indicated that the rockfill stayed unfrozen above El. 123 m. The foundation till thaws in summer each year since 2017, while frozen conditions are

observed the rest of the year. The rockfill and dense till between El. 104 and 123 m are no longer monitored as beads are either broken or capacitive but were previously observed to stay frozen all year long, suggesting that this instrument is at the limit of the permafrost downstream of Central Dike.

These observations tend to confirm the visual observation of seepage downstream as the foundation of the dike (till and bedrock) directly on the downstream side are unfrozen all year. A cooling trend is slowly starting on the edges of the dike but have not yet reached the middle, where the seepage is located. Till and bedrock temperature tend to decrease further from the downstream side and the piezometers near Portage Pit show permafrost condition. The exception is instrument 650-P3, which evolution must be monitored to confirm whether the observed warming trend is accurate.

No thermal information is available in the Portage Pit wall. With the Pit filling up with tailings and water, it is possible that the frozen wall will thaw, or has already begun thawing, which could reopen some pathways for the South Cell water to seep through. This would be undetected in the Central Dike instruments, installed higher up in the bedrock.

#### *5.7.2.2 Piezometers*

The general piezometric trend is stable. Most instruments are correlated with the downstream pond elevation.

It can be observed that the piezometers located in boreholes between Sta. 0+595 and Sta. 0+975 are strongly reacting to the level of the water pond located downstream of Central Dike. In those boreholes, the piezometers that are not frozen and not in suction (currently or previously) are recording piezometric elevation around El. 115 m, the downstream pond level. The piezometers between Sta. 0+595 and Sta. 0+975 located in the rockfill, till, and bedrock are reacting similarly, which seems to indicate a hydraulic connection between the downstream pond, the till, and the bedrock. The piezometric elevation recorded in the till and the bedrock between Sta. 0+595 and Sta. 0+875 is generally slightly higher than the elevation of the downstream pond, indicating excess pore water pressure or a higher seepage flow. Piezometers 650-P2 and 875-P3 are the only instruments that seem to react to the South Cell level instead of the downstream pond level. Piezometer 650-P2-A has been on the rise since December 2015, with a deceleration of the increase after 2018, and the measured piezometric elevation exceeds the dike crest elevation (150 m) This instrument may need to be doubled to confirm this trend. Piezometers 875-P3-A and B are still on a slow rise despite the stabilization of the South Cell level and exhibit small reactions to the downstream pond variations. Pressure in piezometers 875-P3-A and B now overlap. Piezometers at 875-P3 are also the only instruments in the P3 zone that are recording an unexplained upward trend.

The piezometers located at Sta. 465 and Sta. 580 are not reacting to the downstream pond water level or the elevation of the South Cell and indicate much lower piezometric elevations, with the exception being 580-P1R-A, located in the sand horizon in the bedrock. This trend used to be observed at piezometer 545-P1-D, located in the till, however since reinstallation of the instruments in that hole in 2020, they all follow the downstream pond variations. Piezometer 700-P1-B used to follow the downstream pond variations with a higher pressure, but in July 2021 the pressure dropped by about 4 m and now overlaps with the downstream pond level, suggesting the establishment of a direct hydraulic connection.

Piezometers 595-P1-B and C used to exhibit a unique trend consisting in two subsequent spikes in the fall and in winter, followed by a progressive pressure decrease until the summer, returning to normal levels. This behaviour is no longer observed after the instrument have been reinstalled in 2020, and they are now following the downstream pond variations. In the summer of 2021, the pressures in 595-P1-A and B (lower bedrock) increased by about 1 m, still following the downstream pond variations. Piezometer 825-P1-E is continuing its slow increasing trend (about 1 m in a year) and does not seem to react to the South Cell nor the downstream pond variations.

Generally, a downward hydraulic gradient in part of the bedrock and the till can be interpreted in piezometers located in the same boreholes. Small upward gradients in the till or the upper bedrock can also be observed in some boreholes, such as 580-P1-R, 595-P1, and 815 P1R. Significant upward pressure gradients in the bedrock can now only be observed in hole 850-P1, which means that several locations of previously observed upward gradient have now evolved towards a pressure equalization between the instruments. It is not possible to observe a generalized upward hydraulic gradient trend that would indicate that pressurized bedrock is transmitting pore water pressure to the till. The piezometric elevation in the bedrock is often similar to or smaller than recorded in some parts of the till layer. However, due to the topography, it is possible that water is reporting from bedrock located higher and induces excess pore water pressure on the foundation soil located lower below.

Some instruments were broken or malfunctioning, as detailed in Appendix I (Table 17). Those instruments give either no data or erratic data.  A piezometer that has frozen once cannot be relied upon even if it thawed, as freezing generally breaks the piezometer or shifts its calibration curve. It is recommended to flag these piezometers and be careful when interpreting their data even if they seem probable.

As in previous years, it can be observed that some piezometers are recording negative pressure (suction). Negative pressure for unfrozen conditions was recorded in two piezometers, as detailed in Appendix I (Table 18), which is two less than in 2020. In the piezometers that are no longer in suction (580-P1R-B, 750-P1-A), no change in their historical trend (slow increasing trend) was observed. Piezometers in suction are recording very few variations in measured pore water, while the other instruments are reacting to the downstream pond elevation. These instruments are generally located in the bedrock. Based on the available information, it is not possible to determine the exact cause of this suction. This could be due to a problem with the instruments or to a non-continuous geological environment in which the water table is located locally below the installation depth of some of the instruments. The results of these instruments must be interpreted with caution.

#### 5.7.2.3 Flow Meters

At the time of the inspection, a seepage flow of approximately 150 $m^3/h$ was pumped out to maintain the downstream pond at El. 115 m, compared to 110 $m^3/h$ in 2020. Water inflow from this location has been pumped back to the pits (A and E) in 2021 to avoid ice build-up upstream of the dike. Pumping out water from the South Cell combined with an adapted tailings deposition plan effectively reduced the amplitude of the seepage over the last years and the seepage appears stable since 2020. AEM indicated that the flow had decreased to 25 $m^3/h$ in winter of 2020 based on pumping data, a decrease from 50 $m^3/h$ last year.

#### 5.7.2.4 Seismograph

Seismograph monitoring of blast vibrations on the crest of Central Dike has occurred at four locations along the dike for every blast at Portage Pit. The maximum allowable peak vector sum for all dikes is set at 50 mm/s as per the designer’s recommendations. No blast was done in the reported period since mining activities were terminated at the Meadowbank site.

#### 5.7.2.5 Turbidity and Water Quality

The turbidity of water in the downstream pond has been monitored from 2015. The turbidity of the downstream pond usually increases with the pump speed. Turbidity data was not available to Golder for 2021 to compare with the threshold value of 15 mg/L for environmental discharge, however the seepage pond water was discharged in the pits all year in 2021.

In the freshet of 2021, similar to previous years since 2017, a change in the water coloration was observed in the downstream pond. The water turned orange and back to normal several times in the cycles. An orange sludge was observed on the surfaces below the water level. No change in pH was measured but turbidity increased during the summer. Per AEM, the available results from chemical analyses indicate that no tailings are present in the downstream pond and that the coloration is linked to natural bacterial processes. This situation is stable.

# 6.0 ALL-WEATHER ACCESS ROAD

The AWAR, formerly referred to as the All-Weather Private Access Road, was built in 2007 to 2008 to connect the hamlet of Baker Lake to the Meadowbank Mine site. The road is approximately 107 km long with nine bridge crossings and culverts installed at a total of 38 locations. Each structure along the AWAR, their designated name, their approximate location, and the observations noted during the inspection is provided in Appendix D1.

The road design is based on a general rockfill sub-base and crushed granular rockfill surfacing with a combined minimum thickness of 1 m over thawed stable soil and 1.2 m over thawed susceptible soil.

No sign of thermal degradation of the permafrost was observed on the road during the inspection. It should be noted that signs of thermal degradation may not necessarily be observed due to the regular road maintenance performed by AEM. During the inspection, water levels and flow velocities at the crossings were normal for the time of year.

Fill material that comprises the majority of the road provides no significant barrier to low gradient water flow due to its coarse nature. During higher flow and runoff periods, water may flow through portions of the road fill. Water was observed flowing through the rockfill at some culvert locations during the inspection and signs that water flowed beneath the road were observed at some other locations during the inspection. This could also be due to the inlet or the outlet of some culverts having been installed too high or too low, which did not promote the flow of water through the culvert until a certain water level had been reached.

During the year, AEM conducts regular and event-based visual inspections of the fish-bearing water crossing locations along the access road. This data should continue to be compiled by AEM to confirm the hydraulic function of the crossings, the adequacy of the crossing locations with respect to the watercourses, and minimal impact to fish habitat.

It is understood that AEM’s monitoring program includes an assessment of sedimentation and potential erosion issues at the major bridge crossings. Consideration should be given to expanding AEM’s monitoring program to include all culverts and bridges along the road to assess whether they are providing adequate capacity during the freshet and following large precipitation events.

Following comments of regulators on the monitoring of erosion of the bridges abutments and drainage of quarries, special attention was paid to these locations.

## 6.1 Culverts

The culverts were generally in good condition at the time of the inspection. No significant degradation of culvert conditions has been observed when compared to the 2020 inspection. Most culverts were unobstructed with no signs of erosion and no signs of damage to the culverts. Many sections of the road that were not equipped with culverts showed accumulation of ponding water against the sides of the road.

Culverts in the following discussion, and in the photographic log, have been identified by name (e.g., R-24) to be consistent with those indicated on the as-built drawings provided by AEM. Each culvert is also identified by its approximate kilometre location (e.g., km 98+250) along the road alignment.

Signs indicating that minor erosion has occurred were observed at the inlet of PC-17A (8+830), and at the outlet of R14 (km 67+840) and R24 (km 98+100). No action is recommended for the culverts showing signs of erosion as the situation seems stable. Culvert erosion progression should be monitored at freshet.

During the inspection, signs of water flowing beneath the road were observed at some locations. This is generally due to the inlet or the outlet of the culvert having been installed too high or too low, which did not promote the flow of water through the culvert until water reached a certain level. This condition can promote erosion and risk of washout beneath the road and should be monitored. This situation has been observed in the past and seems to be stable as no signs of deteriorating conditions were observed. This condition was observed at PC-17A (8+830), PC-11 (39+552), R-14 (67+840), R-18B (82+500), R-20 (85+490), R-23 (93+600), and R-24 (98+100). PC-11, PC-17A, R-14, R-20, and R-23 showed a flow of water during the inspection. Flow at PC-17A did not shift location since 2020, while flow at R-14 seemed to shift from between the North and middle culverts to between all culverts. No sign of erosion was noted. The progression of the situation should be monitored at freshet.

Obstructed and damaged culverts were observed at some locations during the inspection. In many cases, the obstructions are related to inlets and/or outlets becoming partially or completely obstructed by accumulated rockfill and road material. There was no substantial increase in the number of significantly damaged culverts observed during the 2021 inspection when compared to last year. The following culverts were too damaged and obstructed to function properly: R-00A (2+550), PC-14 (4+260), unnamed culvert at 5+700, and PC-16 (54+950). If insufficient capacity to handle the flow is observed at locations where culverts are obstructed or damaged, it is recommended to clear the obstructions or repair the culvert.

The observations and descriptions for each culvert at the time of the inspection as well as recommendations can be found in Appendix D1. For example, for some culverts, it is recommended to monitor the water level upstream and the flow through the culvert during high flow events (e.g., freshet season). A photographic log of the culverts is included in Appendix D2.

## 6.2 Bridges

Nine bridges are located along the AWAR: four Acrow Panel bridges and five Rapid Span bridges. A structural and/or mechanical assessment of the bridges was not conducted and is beyond the scope of this geotechnical inspection. A description of the observations of the bridges made during the inspection is presented in Appendix D1. A photographic log of the bridges is included in Appendix D3.

The bridges have been identified in sequence, increasing in number along the road from Baker Lake to Meadowbank (e.g., from Bridge 1 to Bridge 9). The name of each bridge (e.g., R02) is consistent with the as-built drawings of the AWAR provided by AEM. Each bridge is also identified by its approximate kilometre location (e.g., km 8+750).

Due to the low-lying terrain between Baker Lake and Meadowbank, water flow typically occurs in broad areas and not in well-defined channels. The majority of water crossings spanned by bridges have increased channelization of flow due to the embankment fill at the crossing location. No significant signs of embankment erosion were observed at the time of the inspection as they are generally constructed with coarse rockfill.

The bridges and their embankments were in good geotechnical condition at the time of the inspection. Signs of settlement were observed at Bridge R-15 and this condition should continue to be monitored. Some bridges showed limited surficial erosion of the granular material on the abutments, but none that posed a geotechnical concern or indicated degrading conditions. The following observations were made for each bridge during the inspection and are listed in Appendix D1:

- **Bridge R02 at about km 8+750**: Normal flow was observed at the time of the inspection. No signs of erosion or turbidity were noted. Both abutments show deformation of the corrugated steel bins under the weight of the bridge. In 2011, two additional culverts of 1,800 mm in diameter were installed nearby to increase the drainage capacity during high flow events and prevent the road and the bridge from washing out. It is understood that AEM removes snow and ice at this location and other bridges before the freshet and will continue this practice in the future.
- **Bridge R05 at about km 17+600**: Minor damage to the bin wall of both abutments was observed; it is likely a result of past snow removal activities. No reparation is required yet. No evidence of erosion was observed, and the foundation was in good condition. The streambed consists primarily of cobbles, gravel, and a few boulders towards the perimeter of the channel.
- **Bridge R06 at about km 23+100**: Construction of the bridge has concentrated flow in this area. Very limited surficial erosion of the granular material on the north abutment was observed. No signs of turbidity were observed, and the bridge was in good condition at the time of the inspection.
- **Bridge R09 at approximately km 48+500**: Construction of the bridge has concentrated flow in this area. Water is flowing under the northeast abutment, but no signs of turbidity or erosion were observed at the time of the inspection and the bridge was in good condition. Small tension cracks are visible on the top of the south abutment. They seem inactive and healing but should continue to be monitored.
- **Bridge R13 at about km 62+060**: At the time of the inspection, the bridge was in good general condition. Some erosion of the granular material on the northeast abutment was observed but no signs of turbidity were observed.
- **Bridge R15 at about km 69+200**: Signs of settlement were observed as the bridge was dipping toward the western side on both abutments. The bridge foundation did not show any signs of adverse conditions but is slowly settling. No remediation work is recommended for the moment, but the situation should be monitored. Minor damage to the bin wall of both abutments was also observed and is likely a result of past snow removal activities. Limited surficial erosion of the granular material at the south abutment, but no sign of turbidity was observed.
- **Bridge R16 at about km 73+800**: No signs of erosion or turbidity noted, despite some flow beneath the north abutment. Construction of the bridge has concentrated the flow in this area.
- **Bridge R18 at about km 79+500**: The bridge is generally in good condition. The middle steel panel on the bridge deck was repaired since last year. Limited surficial erosion of the granular material was observed, but

no sign of turbidity or sediment migration into the streambed was observed. A boulder field is located beneath the bridge and no flow was observed at the time of the inspection.

- **Bridge R19 at about km 83+150**: Steel plates with pipe anchors are installed along both embankments of the bridge. Some damage (bending) to the steel containment plates was observed, which may be associated with snow removal activities. The damage is minor and does not impact the geotechnical integrity of the bridge or of the embankment as the surrounding pipes seem to hold the metal sheet in place (protecting the abutment backfill). The northwest railing is slightly bent. No turbidity or erosion was observed at the time of the inspection.

# 7.0 WHALE TAIL PROJECT ROAD

The Whale Tail Project Road was built between 2016 and 2019 to connect the Meadowbank Mine site to the Whale Tail Project site under development. The road is 64 km long with eight bridge crossings and culverts installed at a total of 290 locations. Each structure along Whale Tail Project Road, their designated name, their approximate locations, and the observations noted during the inspection is provided in Appendix E1.

The road design is based on a general rockfill from quarries or sand and gravel from esker burrow pit sub-base and crushed granular rockfill surfacing with a combined minimum thickness of 1.0 m over thawed stable soil and 1.2 m over thawed susceptible soil.

The surface of the road at the time of the inspection in good general condition. The road material had been repaired between km 174 and 177 after major erosion and settlement was observed in 2020. Erosion is now minimal and limited to the side slopes between 160+430 and 176+000, with no hazard posed to traffic or the stability of the road. It is recommended to be on the watch for further signs of erosion along the high sandy side slopes along the road and to backfill potential erosion at the toe of bridges as soon as it is noticed. A photographic log of the inspected road is provided in Appendix E2.

No other sign of thermal degradation of the permafrost was observed on the road during the inspection. It should be noted that as with the AWAR, signs of thermal degradation may not necessarily be observed in the future due to the regular road maintenance performed by AEM. During the inspection, water levels and flow velocities at the crossings were normal for the time of year.

Fill material that comprises the majority of the road provides no significant barrier to low gradient water flow due to its coarse nature. During higher flow and runoff periods, water may flow through portions of the road fill. Water was observed flowing through the rockfill near some culverts during the inspection, and signs that water flowed beneath the road were observed at some locations during the inspection. This could also be due to the inlet or the outlet of some culverts having been installed too high or too low, which did not promote the flow of water through the culvert until a certain water level had been reached.

As with the AWAR, AEM is conducting regular and event-based visual inspections during the year of the fish-bearing water crossing locations along the access road. This data is compiled by AEM to confirm the hydraulic function of the crossings, the adequacy of the crossing locations with respect to the watercourses, and minimal impact to fish habitat.

It is understood that AEM's monitoring program includes an assessment of sedimentation and potential erosion issues at the major bridge crossings. Consideration should be given to expanding AEM's monitoring program to include all culverts and bridges along the road to assess if they are providing adequate capacity during the freshet and following large precipitation events.

Following comments of regulators on the monitoring of erosion of the bridges abutments and drainage of quarries, special attention was paid to these locations.

## 7.1 Culverts

All culverts with a diameter larger than 900 mm were thoroughly inspected. Smaller diameter culverts were checked from the road surface. Culverts not observed should be considered possibly buried.

The culverts were generally in good condition at the time of the inspection. Most culverts were unobstructed with no signs of erosion and no signs of damage to the culverts. Culverts observed to be buried last year were mostly still buried.

Many culverts seem to have been installed rather high, depending on the permeability of the road to freshet flow, thus possibly posing a risk of road washout. The worst condition would be a continuous boulder field under the sand and gravel road foundation without a rockfill layer at the base of the road.

A photographic log of the inspected culverts is provided in Appendix E4. Given that culverts are almost all in good condition, only locations where important observations were made are documented in the photographic log. Culverts in the following discussion, and in the photographic log, have been identified by their identification number to be consistent with those indicated on the list provided by AEM. Each culvert is also identified by its approximate kilometre location (e.g., km 132+324) along the road alignment, starting at Vault Pit.

No signs of erosion were observed during the inspection.

During the inspection, signs of water flowing beneath the road were observed at some locations. This is generally due to the inlet and the outlet of the culvert having been installed high above original natural ground surface, which does not promote the flow of water through the culvert until a certain water level has been reached. This condition can promote erosion and risk of washout beneath the road and should be monitored. The progression of the situation should be monitored at freshet.

Obstructed and damaged culverts were observed at some locations during the inspection. In many cases, the obstructions are related to inlets and/or outlets becoming partially or completely obstructed by accumulated rockfill and road material or blocks. The following culverts were completely obstructed or collapsed at a least one of the extremities: #5 (117+525), #7 (118+013), #7-2 (118+016), #12 (4+179 to 4+186; 3 outlets out of 5), #13 (120+615), #27-2 (123+300), #38 (125+049), #48 (127+203), #52 (128+195), #54 (128+388), #55 (128+440), #61 (129+050), #63 (129+390), #65 (130+924), #66 (132+324), #82 (136+143), #83 (136+300), #85 (136+671), #86 (136+740), #88 (136+861), #89 (137+180), #93 (138+100), #101 (139+025), #105 (140+555), #111 (142+461), #112 (142+630), #113 (142+736), #115 (142+865), #116 (142+940), #118 (143+433), #133 (148+141), #135 (148+567), #137 (148+940), #138 (149+000), #150 (152+171 to 152+179); 1 outlet out of 5), #160 (155+966), #178 (161+170), #234 (170+385), #243 (171+593), #256 (173+350), #268 (175+774), #281 (178+350). If insufficient capacity to handle the flow is observed at locations where culverts are obstructed or damaged, it is recommended to clear the obstructions or repair the culvert. It is still recommended to monitor culverts #167 (41+843; not seen in 2021, possibly buried) and #232 (53+928), where there are signs of water flowing below the culverts.

The observations and descriptions for each culvert at the time of the inspection as well as recommendations are provided in Appendix E1. For example, for some culverts it is recommended to monitor the water level upstream and the flow through the culverts during high flow events (e.g., freshet season).

## 7.2 Bridges

Eight bridges are located along Whale Tail Project Road. A structural and/or mechanical assessment of the bridges was not conducted and is beyond the scope of this geotechnical inspection. A description of the observations of the bridges made during the inspection is presented in Appendix E1. A photographic log of the bridges is included in Appendix E3.

The bridges have been identified by their approximate kilometre location (e.g., km 132+000) along the road alignment, starting at Vault Pit.

Due to the low-lying terrain between Meadowbank and the Whale Tail Project site, water flow typically occurs in broad areas and not in well-defined channels. The majority of water crossings spanned by bridges have increased channelization of flow due to the embankment fill at the crossing location. Embankments are generally constructed with coarse rockfill.

The bridges and their embankments were in good geotechnical condition at the time of the inspection. No signs of erosion or turbidity were observed. Only limited surficial erosion of the granular material behind the concrete wall at the southwest abutment of the bridge 148 (148+000) was noted, which does not pose a geotechnical problem but may create turbidity in the stream during freshet. The crack present on the northwest concrete abutment of bridge 160.8 (160+800) that first observed in 2019 was not visible in 2021, possibly covered in granular material.

# 8.0 QUARRIES AND ESKERS

## 8.1 Quarries along the All-Weather Access Road

Twenty-two quarries were developed in the past along the AWAR to provide material for its construction. An additional quarry was developed near the airstrip at Meadowbank to provide further construction materials. All quarries were inspected as part of the geotechnical inspection. A summary of the observations and recommendations made during the 2021 inspection for the structures along the AWAR road, including the quarries, is provided in Appendix E1. In accordance with the as-built drawings, the quarries have been numbered sequentially from 1 to 22 starting near Baker Lake and increasing towards Meadowbank. The airstrip quarry is referred to as Quarry 23 and is used to store miscellaneous items such as drill core on racks, diamond drill contractor drill rigs, seacan containers, pipes, and culverts.

The closure and reclamation plan requires that all quarries and borrow sources developed during the construction of the AWAR be reclaimed following their use. The closure plan further requires that all quarry slopes be left at an angle of 45° to 50°. During the inspection, it was observed that slope remediation was partly completed but none of them were totally reclaimed. Most quarries are clean although some walls need scaling. Most quarry walls were also free of loose blocks and granular material. Loose blocks and granular material had been placed at the toe of the walls. At the time of the inspection, most of the quarries were dry.

During the inspection, it was observed that Quarries 4, 13, and 14 were flooded. These quarries have been flooded for a couple of years and it is understood that AEM is evaluating how to eliminate the ponding of water within these quarries. Quarries 15 and 23 contained minor accumulations of water. Quarries that contain significant amounts of ponded water should be monitored to assess if ponding persists and, if necessary, whether ditches should be developed to facilitate the drainage of water.

Unstable blocks and loose rocks along steep walls remain in Quarries 3, 7, 9, 10, 16, 18, and 23. The west wall of Quarry 3 also contains a falcon nest that prevents its maintenance. It is recommended that workers be cautious in these quarries, be aware of the potential hazard, and stay at a minimum 20 m from the walls.

Quarry 20 was being used at the time of the inspection, with a front shovel working on the west wall.

A photographic log of the quarries along the AWAR is included in Appendix F.

## 8.2 Eskers and Quarries along Whale Tail Project Road

Seven eskers and five rock quarries were developed along Whale Tail Project Road to provide material for its construction. Most of them are still active. All eskers and quarries were inspected as part of the geotechnical inspection. A summary of the observations and recommendations made during the 2021 inspection for the structures along Whale Tail Project Road, including the eskers and quarries, is presented in Appendix E1. In accordance with the as-built drawings, eskers have been numbered sequentially from 1 to 6 starting at Meadowbank and increasing towards the Whale Tail Project site. The quarries are not numbered and were identified for the inspection by their approximate location along Whale Tail Project Road.

The closure and reclamation plan requires that all quarries and borrow sources developed during the construction of Whale Tail Project Road be reclaimed following their use. The closure plan further requires that all quarry slopes be left at an angle of 45° to 50°. At the time of the inspection, all of the quarries and eskers were dry, except esker #2 and rock quarry 168, which contained a small accumulation of water. Rock quarry 165 was dry at the time of the inspection, but the concave shape of its floor suggests that it probably floods at freshet.

Unstable loose rocks along steep walls and unstable soil slopes were observed in all eskers and quarries, except eskers #3, #5, and #6. It is recommended that workers be cautious in these locations and are aware of the potential rockfall hazard.

# 9.0 BULK FUEL STORAGE FACILITIES

This section contains the observations made during the 2021 annual inspection of the Baker Lake, Meadowbank, and Whale Tail Project tank farm facilities (Main Camp only).

## 9.1 Baker Lake Tank Farm

The Baker Lake tank farm consists of seven large-capacity tanks (10 million litres each) and 20 Jet-A fuel tanks (100,000 L each) that were constructed within five bermed areas (containment cells). Tanks 1 and 2 are located within the first containment area, which is located on the western side of the fuelling area. Tanks 3 and 4 are located within a second containment area adjacent to the first. A central berm is located between the two containment areas. Tanks 5 and 6 are within the third containment area located north and upslope of Tanks 3 and 4. Tanks 5 and 6 are situated within an entirely separate containment cell sub-excavated into the hill slope above the initial tank farm area. Tank 7, built in the winter of 2020, is located within a new containment area built north and upslope of Tanks 5 and 6. A new tank was under construction next to Tank 7 at the time of the inspection. Twenty Jet A Fuel tanks were installed in 2013 in a containment area located northwest of Tanks 5 and 6, lying over a 0.5 m-thick granular base fill material.

Each containment area has been lined with a 1.5 mm high density polyethylene geomembrane to provide secondary containment, except the Jet-A fuel tanks area that are lined with a bituminous geomembrane.

Visual inspection of the majority of the liner in the containment areas for Tanks 1 to 6 was not possible as it is covered with granular fill material to provide protection. The granular fill material protecting the geomembrane was eroded due to wave actions in some areas, exposing the geomembrane. This condition was observed all along the south side of Tanks 3 and 4 and on the north and west sides of Tank 1. A section of exposed geomembrane with a fold was observed at the northeastern corner of Tank 4. The hole in the exposed geomembrane (300 mm diameter hole) previously observed on the southwestern corner of Tank 3 at the toe of the slope had been repaired but the liner was ripped again, as was frequently observed in the past. The reason is likely snow removal activities or other equipment passing close to the corner. The liner should be repaired. It is also recommended to cover the exposed area with geotextile and fill material to re-establish the liner protection and to prevent further damage by equipment.

Few animal burrows were observed on the south side of Tanks 3 and 4 this year, less than in 2020. It is recommended to assess whether the geosynthetics have been damaged. AEM expressed concern about possible damage to the geomembrane during removal of the granular cover. Golder considers that this verification should still be performed at least once to ensure that the reoccurring burrows are not causing damage to the geomembrane. This verification should be documented to allow for resolution of this recommendation.

Ponded water was observed on the southern side of all containment areas including the one around Tank 7. Water ponding in these areas has been observed over the years, however the amount of water ponding is higher in 2021 than in 2020, likely due to recent heavy rains. No sump or pump was visible during the site visit, although AEM indicate that the containment areas were pumped dry in the spring. It is recommended to keep the water accumulation at a minimum near the tank foundation. Signs of high-water levels being present in this area in the past were noted during the inspection.

AEM reported that a fuel leak occurred in 2020 in one of the old fuel tanks. The tank was repaired, and all other tanks were maintained by AEM after that event. During the 2021 inspection, no sign of damage was observed following this leak. However, the geomembrane is covered in granular fill over most of the tank containment area and damage (e.g., melting of the geomembrane) might have gone undetected. It is recommended to expose the geomembrane near the leak and inspect the liner for any sign of degradation, and repair it if needed, before covering it back.

The geomembrane of the containment cell of the 20 Jet A fuel tanks remains uncovered around the tanks. A hole in the liner (100 mm wide) was previously observed on the southwest corner of the containment area, but its location was not visible in 2021 due to a high-water level in the containment area all around the tanks. Therefore, it cannot be validated that the hole was satisfactorily repaired or that new holes appeared. It is recommended to remove the accumulation of water before it freezes to avoid damaging the geomembrane of the containment cell by ice accumulation and repair any holes detected then. The bituminous geomembrane no longer shows signs of melting. The melting of the bitumen that occurred in the past may have damaged it in such a way that contaminated water could seep into the environment.

The embankments around the first and second tank farm containment areas were stable. The northern slope of the containment area of Tanks 5 and 6 are steep and the sand and gravel cover may be prone to erosion. Tension cracks observed in the fine filter surface on top of the slope and on the crest in 2020 were still visible but appeared inactive. The area should be monitored and repaired if needed to re-establish liner protection.

The fuelling station on the western side of the tank farm consists of two containers and a pumping system. The fuelling area is covered by granular road base material. The fuelling station was in good geotechnical condition.

A photographic log of the Baker Lake tank farm and a plan view that shows the location of the photos and observations are included in Appendix G1.

## 9.2 Meadowbank Tank Farm (Main Camp)

The Meadowbank Main Camp tank farm consists of a single large-capacity tank (5.6 million litres) constructed within an area that has been sub-excavated to provide secondary containment. The area has been lined with a 1.5 mm high density polyethylene geomembrane.

At the time of the inspection, the tank backfill foundation pad was in good condition. The liner was well covered with granular fill material for protection.

Water (approximately 50 mm) was observed ponding within the eastern corner, as in previous years. Signs of high-water levels being present in this area in the past were noted during the inspection. Pumping of ponded water is considered a good practice and should resume.

A fuelling station is located on the northern side of the tank farm. The fuelling area is covered by granular road base material and a geomembrane liner is installed below the refuelling area.

As the tank farm area has been sub-excavated, runoff from the tank farm is not anticipated to occur. The side slopes in the tank area are shallow and appear stable.

A photographic log and a plan view that shows the location of the photos and observations noted at the Meadowbank tank farm is provided in Appendix G2.

## 9.3 Whale Tail Project Tank Farm

The permanent Whale Tail Project tank farm is located north of the main camp.

At the time of the inspection, the tank farm was in good condition. No sign of instability was observed during the inspection. The bituminous geomembrane was largely exposed but in good condition. Some water was observed ponding within the embankment on the southern and eastern sides of the tank.

Some granular material is missing on the liner anchor on the Eastern corner. It is recommended to repair this area.

The use of bituminous geomembrane, as with the other tanks farms, can be environmentally problematic in case of jet fuel spill that could melt the material and cause a breach in the containment system.

A photographic log is contained in Appendix G3.

# 10.0 OTHER MEADOWBANK FACILITIES

This section contains the observations made for the other Meadowbank facilities visited during the 2021 geotechnical inspection such as site roads, the diversion ditch and erosion protection structure, the Rock Storage Facility (RSF) till plug, the landfill, the contaminated soil storage and bioremedial landfarm facility, the Stormwater Management Pond, the airstrip, and the crusher retaining wall. Figure H1 shows the location of the photos taken during the inspection for the other Meadowbank facilities.

## 10.1 Site Roads

The following roads were inspected:

- East Road: Former haul road between North Portage Pit and East Dike.
- West Road: Haul road between North Portage Pit and the plant.
- Vault Road: Haul road between North Portage Pit and the Vault deposit.
- RF1: Starts near the northern abutment of Stormwater Dike and follows the eastern perimeter of the North Cell of the TSF and the southwestern side of the Portage RSF.
- RF2: Starts at the end of RF1 and follows the western side of the Portage RSF.

### 10.1.1 Field Observations during Inspection

These roads were of adequate width and had appropriate berms at the time of the inspection. The haul road from Goose Pit to the plant was not inspected during this investigation. No geotechnical concerns were identified with East Road, West Road, RF1, and RF2.

Three culverts are installed beneath Vault Road at coordinates 640 964 E / 7 217 466 N. They were slightly collapsed in the middle and showed signs of erosion at the inlet. The inlet of the northern culvert was out of the water. This condition has been observed since 2012. No action is required as the condition is stable. These culverts need to be monitored during freshet to ensure they provide sufficient capacity, and that erosion is not occurring. Two other culverts are located at 639 214 E / 7 216 189 N on Vault Road. These culverts are in good condition even though water flows below the culverts on the NP1 Lake side when the water level is low. It is recommended to observe this area at freshet and to clear the obstructions if insufficient capacity to handle the flow is observed.

Temporary roads developed for construction purposes were not inspected.

Photographs of the Vault Road culverts are provided in Appendix H1.

### 10.1.2 Geotechnical Instrumentation Data Review

Four thermistors were installed to monitor the temperature of RF1 and RF2 (which delineates the northeastern side of the TSF North Cell), as detailed in Appendix I (Table 11).

Three thermistors are installed on RF1 (T121-1, T73-6, and RF1-3). Thermistor T121-1 shows frozen conditions all year long. Thermistor T73-6 shows sub-zero temperatures now up to the surface, indicating progression of the freezing front. RF1-3 shows frozen conditions all year long below El. 147.8 m and an active layer above that elevation which decreases in depth over the years.

One thermistor is installed on RF2 (T122-1) and indicates that the RF2 foundation is in a permafrost state.

## 10.2 Diversion Ditches and Sediment and Erosion Protection Structure

A retention basin and a series of diversion ditches (Western and Eastern) surround the catchment basin of the North Cell. These structures are designed to convey surface water runoff away from the TSF.

Since 2014, the Western Diversion Ditch has been directing the water to a retention basin, which is then pumped to the North Cell due to a turbidity problem caused by the erosion of the ditches. Rehabilitation work was done in 2016 to address the situation. The Eastern Diversion Ditch discharges to lake NP-2, then lake NP-1, and then to Dog Leg Lake. Sediment barriers and erosion protection structures are installed at the outlet of the diversion ditch in Lake NP-1, Lake NP-2, and Third Portage Lake (Dog Leg Lake).

During the inspection, it was observed that the diversion ditches around the TSF western and eastern extensions were in good condition. The erosion protection structure and sediment barriers were also in good condition at the time of the inspection. It is important that they be inspected during to the freshet season as snow melts away and allows visual assessment. The Western Diversion Ditch will need to be amended for closure in order to drain the accumulation of water in its northern part.

Photographs of the diversion ditch and its sediment and erosion protection structure are provided in Appendix H2.

## 10.3 Rock Storage Facility Till Plug

The RSF till plug is located on the upstream side of the Diversion ditches access road between the Portage RSF and lake NP2. The till plug is a zoned low permeability earth fill structure intended to prevent seepage from the RSF to reach lake NP2 and to facilitate seepage collection on the upstream side.

The till plug was constructed in the summer of 2013. Its construction consisted in a layer of till with 1 m minimum thickness placed on a foundation excavated to permafrost, which was then covered by 1 m of fine ultramafic rockfill. The materials were compacted with an excavator bucket.

No sign of erosion or geotechnical issues were identified with this structure during the inspection. A pump equipped with an automatic switch was installed within the pond contained by the plug to redirect the water to the North Cell. As the chemical monitoring in NP2 has not shown any signs of contamination for the last years, the performance of the till plug is considered adequate.

Appendix H3 contains photographs of the till plug.

## 10.4 Landfill

The Meadowbank landfill is located on the northeastern side of the TSF, within the Portage RSF area. It is being progressively constructed and filled. Waste material is being dumped within a bermed area on a pad built using waste rock from the open pit. The waste is then covered with a thin layer of rockfill to reduce windblown debris. No geotechnical concerns were identified with the landfill. The large area of landfill located at the top of the RSF where waste was blown away by the wind has now been backfilled, and a new landfill area is under development on a lower bench of the RSF. Photographs of the landfill are provided in Appendix H4.

## 10.5 Contaminated Soil Storage and Bioremedial Landfarm Facility

The Meadowbank Contaminated Soil Storage and Bioremedial Landfarm Facility is currently located north of Central Dike, within the South Cell. A 1 m thick till pad has been placed for the landfarm foundation. A berm surrounds the landfarm to contain the fluid/runoff and stops it from moving laterally. Contaminated soils are stored within this cell to promote biodegradation until the soil meets environmental criteria before being disposed within the Portage RSF.

The active area lies over a natural steep slope covered by rockfill as a pad made to operate the landfarm. The west slope of the rockfill pad is at its angle of repose (seemingly 1.1 to 1.3H:1V). This rockfill was probably placed without neither lifts nor compaction and extends into the South Cell pond. The slope is considered at risk for high deformation to slope failure. Small tension cracks, about 2 m long and less than 1 cm wide, were observed in the eastern part of the berm on the crest. It is recommended to keep this area on watch for further development. If signs of instability are developing again inside the pile, the area should be closed and a thorough assessment and mitigation measures should be put in place.

Photographs of the Contaminated Soil Storage and Bioremedial Landfarm Facility are provided in Appendix H5.

## 10.6 Stormwater Management Pond

The Stormwater Management Pond is located near the main camp and is being used to store various site waters and sewage. No runoff from the pond was observed at the time of the inspection. No geotechnical concerns were identified with Stormwater Management Pond and the nearby crusher ramp. At the time of the inspection, due to a high-water level, Stormwater Management Pond was pumped out into the South Cell. Due to the proximity of the crusher ramp to the pond, it is recommended that regular geotechnical inspections of the crusher ramp be conducted. The surface of the ramp was not inspected on safety grounds.

## 10.7 Airstrip

There are several small channels dug adjacent to the airstrip to divert water into small excavations or “ponds.” The channels and ponds are unlined, and the ponds have no designed outlet structure. In general, these ponds serve to collect water and allow suspended sediments to settle out before the water overflows into other vegetated areas and/or infiltrates them, depending on the thermal state of the soils.

The runway was built to allow a Boeing 737-200 to land at the Meadowbank site. The northwestern boundary of the airstrip extends approximately 20 m within the lake and was constructed in two phases. Rockfill was placed 1 m above water during Phase 1 and the rockfill was constructed to its final elevation during Phase 2. The rockfill slopes for Phase 2 have a side slope of 1.5H:1.0V. The rockfill of Phase 2 is surrounded by a 17 m wide bench going from the toe of Phase 2 to the edge of the crest of Phase 1. The Phase 1 rockfill surface and visible side slope were built with coarse boulders to protect the embankment against waves and ice action. The airstrip construction within the lake is considered appropriate.

The slopes were profiled along a portion of the airstrip to a 3H:1V slope to prevent settlement.

No geotechnical concerns were identified with this structure during the inspection, although some erosion features are observed on the abutments, likely due to washouts of the material by runoff water. These scars are normally repaired as part of the airstrip maintenance to prevent progression of the erosion.

## 10.8 Crusher Retaining Wall

No geotechnical concerns were identified with this structure during the inspection. A photographic log of the crusher retaining wall is provided in Appendix H6.

# 11.0 OTHER WHALE TAIL PROJECT FACILITIES

## 11.1 Attenuation Ponds and Ramps

The Whale Tail attenuation pond is located within the former footprint of Whale Tail North Pond which was dewatered for the development of the Whale Tail Pit. It receives contact water pumped over the Whale Tail Project site, and its water is treated by the water treatment plant for environmental discharge in WTS Lake or Mammoth Lake.

The IVR attenuation pond is located within the former lake A53 which was partially dewatered and converted into an attenuation pond for the development of the IVR Pit. Similarly, to the Whale Tail attenuation pond, it receives contact water pumped over the Whale Tail Project site, and its water is treated by the water treatment plant for environmental discharge in WTS Lake or Mammoth Lake. At the time of the inspection, it had been operational for a short time only and the water was not reaching the IVR Dike.

A ramp and a pump pad were constructed at each attenuation pond to install the reclaim pump that transfers water from the attenuation pond to the water treatment plant. At the Whale Tail attenuation pond, the primary ramp was built in winter with run-of-mine non-acid generating rockfill on the frozen foundation. Due to thaw-induced settlement and space required for piping lines, the ramp was rebuilt and widened in the summer of 2019. A secondary ramp, also built with rockfill, goes to the pump pad from the ring road south of the pit. The IVR attenuation pond ramp was built in several steps since the dewatering of lake A35 in 2020. It was not yet inspected in 2021 but will be in 2022.

No geotechnical concerns were identified with this the Whale Tail attenuation pond and ramp during the inspection. The discharge points of contact water into the attenuation pond are located directly on the lakebed sediments, which are eroded where the water flows down to the pond (channeling). This does not pose any geotechnical hazard but increases the turbidity in the reclaim water.

Photographs of the Whale Tail attenuation pond and ramp are provided in Appendix H7.

## 11.2 Mammoth Lake and Whale Tail South Diffusers

Three diffusers are installed in Mammoth Lake for discharge of non-contact and treated water into the environment. The diffusers appear to be well installed and functioning normally.

Additional diffusers were installed in WTS Lake since the 2020 inspection. They appeared to function well, except one diffuser outlet that was ripped by the ice according to AEM.

Photographs of the Mammoth Lake diffuser are provided in Appendix H8.

## 11.3 South Whale Tail Channel

The SWTC is built between WTS Lake and Mammoth Lake and convey water from WTS to Mammoth Lake. Its purpose is to limit the water level in WTS to reduce the hydraulic head at WTD. The SWTC inlet elevation at WTS is 155.37 m and is built with a fan shape to reduce risks of blockage by ice or debris. The channel is excavated in the natural ground and covered in granular transition layers, a geotextile, and riprap. Figure C5 shows a plan view of the SWTC.

No geotechnical concerns were identified with this structure during the inspection. Water was flowing in the SWTC. Some settlement was observed in the rockfill berm and slope above the riprap, but since it did not reach the actual channel footprint, it is not deemed a concern at the moment. Turbidity barriers were in place at the outlet in Mammoth Lake.

Photographs of the SWTC are provided in Appendix H9.

## 11.4 Saline Ditch

The Saline Ditch is a water collection ditch built in the periphery of the underground WRSF, located northeast of the Whale Tail Pit. Due to the underground operations in permafrost, large quantities of calcium chloride are used and retained in the waste rock. The purpose of the Saline Ditch is to collect saline water runoff from the facility, and to redirect it by gravity into the groundwater storage pond GSP-1 for recirculation. Figure C6 shows a plan view of the Saline Ditch.

During inspection, the Saline Ditch was dry. No signs of deformation or erosion were observed. The outlet of the ditch towards the AP5 quarry, constituted of a culvert beneath the road, was clear. Blocks and debris were present in the Saline Ditch just upstream of the culvert in a section where the ditch depth is limited. It is recommended to clear these objects to allow water to flow to the outlet and prevent water flowing out of the ditch.

The Saline Ditch is being backfilled all along the road by mud and gravel from the road, pushed into the ditch by snow removal operation in winter and surface grading in summer. The ditch depth has been significantly reduced. The ditch should be cleared of this extra material to maintain its hydraulic capacity and respect the design freeboard. It is likely that this operation will have to be repeated every year in the spring since material will keep being pushed in the ditch from the road during snow removal operations. AEM is working on a solution to limit the amount of material entering the ditch, such as a boulder barrier system.

Photographs of the Saline Ditch are provided in Appendix H10.

## 11.5 Sumps and Non-contact Water Management Infrastructures

A number of water collection sumps and non-contact water pumping stations are present on the Whale Tail Project site. No geotechnical concern was observed with these structures. Water that meets environmental quality criteria is discharged into Mammoth Lake, otherwise it is collected in the attenuation pond and treated before discharge.

A seepage interception system composed of a series of four pumping stations (P1 to P4) is present at the downstream toe of WTD. Its purpose is to collect the seepage water and redirect it to WTS if water quality allows, or the attenuation pond to limit water flowing through the foundation and delaying freeze-back, as well as providing a real-time monitoring of the visible seepage rate. Each pumping station is composed of a vertical culvert embedded in the foundation and equipped with an electrical pump, encased in a seacan. It is currently not in operation. The sandy material which the seacans are installed on previously settled and eroded. AEM repaired the foundation using crushed rockfill. Only station P1 now shows minor surface erosion and all stations are in good condition.

## 11.6 Site Roads

Site roads and culverts at the Whale Tail Project Site were mostly in good condition during inspection. These roads were of adequate width and had appropriate berms at the time of the inspection. On Road 22 near the Mammoth Lake diffuser, a culvert was installed in 2020 and the water ponding observed last year was no longer problematic. Near Mammoth Dike, some water was still ponding against the road and signs of material being washed out by overtopping water was observed. However, no major damage to the road surface was observed. AEM is planning to install a new culvert where the damage is the most visible.

Road 24 (adjacent to SWTC) and Road 25 (Whale Tail WRSF periphery) were repaired in 2020 and are now in good condition.

The haul roads around the ore stockpile were not inspected for safety reasons. Temporary roads developed for construction and dewatering purposes were not inspected.

Photographs of the Whale Tail Project site roads are provided in Appendix H11.

## 11.7 Landfill

The Whale Tail Project landfill is located within the Whale Tail WRSF area. It is being progressively constructed and filled. Waste material is being dumped within a bermed area on a pad built using waste rock from the open pit. The waste will later be covered with a thin layer of rockfill to reduce windblown debris. No geotechnical concerns were identified with the landfill. Photographs of the landfill are provided in Appendix H4.

## 11.8 IVR Diversion Channel

The IVR Diversion Channel is built north of the IVR Pit and its purpose is to collect and divert runoff water that comes from the North East watershed into Nemo Lake water to avoid water ingress into the IVR Pit. The channel is excavated in the natural ground and covered in granular material, a geotextile, and riprap. An access built with esker material is adjacent to the channel. Figure C7 shows a plan view of the IVR Diversion Channel.

No geotechnical concerns were identified with this structure during the inspection. Minor tension cracks were observed in the lateral slope of the access, which is less than about 1.5 m high, due to esker material deforming in the slope. No immediate action is required, but it is recommended to repair the access road if the deformations prevent equipment traffic for maintenance.

Photographs of the IVR Diversion Channel are provided in Appendix H12.

# 12.0 SUMMARY AND RECOMMENDATIONS

The following table presents a summary of the key findings and recommendations of the 2021 geotechnical inspection, as well as evolution observed compared to the previous inspection. General recommendations that do not require a specific action are not reiterated in the table for clarity purposes.

**Table 2: Summary of Recommendations and Priority Levels from the 2021 Geotechnical Inspection**

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| **Meadowbank Dewatering Dikes** | | | |
| 2018 | P-4 | ■ Regular monitoring and assessment of the monitoring data in the dikes (piezometric, flow, thermal, inclinometer, and seismograph, including monitoring to control the reaction to blasting around Pit E5) should continue. It is recommended to flag the piezometers that recorded data below 0°C in the past and be very careful when interpreting their data as they might be broken. Once a piezometer has frozen, it cannot be relied upon even if it thaws. | ■ Item closed in 2021: AEM is performing a good level of monitoring and follow-up. |
| **Bay-Goose Dike** | | | |
| 2018 | P-4 | ■ Water ponds were observed at the downstream toe during the inspection, similar to the previous inspection. It is recommended to pump them periodically to allow for good visual inspection of the downstream toe if visibility is impaired by the presence of the pond. The pond flow formed by seepage should continue to be monitored and recorded, **no additional action to take**. | ■ Still the case in 2021. Appropriate monitoring is performed. |
| 2018 | P-4 | ■ Limited evidence of seepage is observed at the downstream toe of the North Channel, Channel 1, and Channel 3. The instrumentation data and field observations seem to indicate that seepage occurs at these locations but reports directly to the Pits instead of the downstream toe area. To continue monitoring, **no additional action to take.** | ■ Seepage ongoing. |
| 2018 | P-3 | ■ The piezometers in the North Channel show a pressure build-up with the drilling operations associated with the freezing of the nearby pit wall, which needs to be closely monitored to verify the interpretation of the freeze-back. The designer must be advised in the event of significant variations leading to a TARP level change, in accordance with the OMS manual. | ■ Still the case in 2021, similar to other channels where a cooling trend is observed. **Item now closed**, refer to item below for continued monitoring. |
| 2020 | P-4 | ■ The general trend in the piezometric readings has been steadily increasing since 2018 and the increase seems to accelerate (about 0.5 m/year at the moment) and should continue to be monitored. **No additional action needed.** | ■ Still the case in 2021. Appropriate monitoring is performed. The designer must be advised in the event of significant variations leading to a TARP level change, in accordance with the OMS manual. |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| 2021 | P-4 | ■ The dike crest deformation observed immediately after placement of the thermal cap several year ago do not ease the visual inspection as it is hard to visually observed movement on an unequal surface. It is recommended to fill up the past deformation in a way to produce a flat surface. A flat surface would ease the visual observation. The filling work should be completed in summertime to avoid inclusion of snow in the backfill material that will thaw at summertime and generate additional deformation. | |
| **East Dike** | | | |
| 2019 | P-3 | ■ VWP-400-C and VWP-420-C show a seasonal trend that is rising through the years since 2015 and doubled annually over the last two years. Total head is now rising close to 2 m in 2019 from those two VWPs, while temperature is cooling. It is recommended to further investigate this behaviour (planned by AEM) and closely follow the significant seasonal trends in the future to react quickly if need be. Based on those aspects, it is considered that those observations should have triggered a yellow threshold criterion per the Dewatering Dykes OMS manual (yellow - personal notification and action required). | ■ Behaviour investigated and likely linked to freeze-back of the surrounding area.<br>■ Still visible in 2021, to keep monitoring. |
| 2019 | P-4 | ■ The general trend in the piezometric readings has been steadily increasing since 2014 and the increase seems to accelerate in 2019 and should be monitored. | ■ Still the case in 2021, to be monitored closely due to recent seepage event. |
| 2021 | P-3 | ■ Following the unusual seepage event in winter 2021:<br>▪ improve the seepage monitoring by measuring the flow rate and turbidity at each seepage collection station. The flow rate measurement method must be improved for accuracy.<br>▪ install additional thermistors to cover the South Channel area along the centreline and at a distance from the downstream toe. | |
| 2021 | P-4 | ■ The two thermistors string located at both abutments are not functioning anymore. As the dike is still in operation for several years and that the abutment is subject to develop and aggregate ice lenses, it is recommended to replace those string of thermistors in order monitor the thermal regime until post-closure phase of the mine. | |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| **Whale Tail Project dewatering and water management dikes** | | | |
| **Whale Tail Dike** | | | |
| 2020 | P-3 | ■ Continue monitoring the seepage at the downstream toe of the dike, both by measuring the flow rates and observing areas of visible seepage. Instruments showing a possible shift in seepage locations at the abutments (0+142, 0+750) must be closely monitored and the data correlated with field inspections according to the OMS manual frequency. | **Resolved in 2021:** included in routine monitoring by AEM. |
| 2020 | P-3 | ■ Monitor and investigate unusual instrumentation data trend:<br>▪ PZ 0+260 P1C: rapid increase in pressure (+0.7 m) at the end of August 2020, which is not completely dissipated yet. To monitor and investigate if the trend continues.<br>▪ INC-0+560: a rapid warmup within the wall between El. 152 and 155 m in summer 2020, looking like a seepage signature. To investigate with surrounding instruments and field observations. | **Resolved in 2021:**<br>▪ PZ 0+260 P1C: increase of pressure dissipated. Mechanism not well understood, to keep monitoring for future occurrences.<br>▪ INC-0+560: investigation shows no sign of new seepage. |
| 2021 | P-3 | The following piezometers show unexplained trends, which mechanisms need to be investigated to rule out the development of adverse conditions:<br>■ PZ 0+260 P3A and B exhibit a pressure rise between September and November 2021 (+0.3 m). Mechanism to be investigated.<br>■ PZ0+360 P1C exhibits a unique high-pressure trend that seems to be seasonal. Mechanism to be investigated. | |
| 2021 | P-3 | ■ Monitoring of the pumping flow within the pit is not considered an accurate indicator of the seepage due to the several water incomes from the surface and other income from the pit wall. It is recommended to monitor the southern pit wall water income and evaluate if it is possible to install a flow monitoring point capturing the water income for the south wall at least relatively visually. | |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| **WRSF Dike** | | | |
| 2020 | P-3 | ■ The instrumentation data seems to indicate that the thermal berm is performing as intended and is promoting freeze-back of the foundation. Since the seepage mechanism is still not well understood, it is important to keep monitoring the performance of WRSF Dike and be ready for seepage management by pumping of the upstream pond if it is observed again. | **Resolved in 2021:** thermistors confirmed that the thermal berm was working as intended and that the foundation remained frozen all year. |
| **IVR Dike** | | | |
| 2021 | P-3 | ■ Raise piping present in the lower part of the emergency spillway to free the spillway outlet. The raise must be done in a way that will not leave any obstruction in the spillway (e.g. concrete blocks outside of the spillway outlet and a horizontal support in between) | |
| **Tailings storage facilities** | | | |
| **Saddle Dam 2** | | | |
| 2018 | P-4 | ■ Water was observed on the downstream side ponding within the rockfill embankment between Sta. 20+275 and Sta. 20+475 and should be monitored. The water originates from run-off as proved by water sampling and testing. | ■ Item closed in 2021. Good monitoring performed by AEM. |
| **Stormwater Dike** | | | |
| 2018 | P-4 | ■ In April 2018, oblique tension cracks (up to 5 cm wide) were observed similar to previous years. The cracks have been filled with bentonite after stabilization in the summer of 2018. The evolution of the zone should be monitored. In case of new cracks, measures indicated in the OMS manual should be implemented. | ■ 2021: no new sign of deformation was observed, similarly to 2019 and 2020. **Considered resolved** due to several years without deformation. |
| 2018 | P-4 | ■ An assessment should be conducted as to whether the design criteria will still be met with a different final tailings elevation on both sides of the dike. This can be done by the Engineer on Record but needs to be reviewed by the designer engineer. Tailings surface differential elevation could also impact the seepage flow, which may impact the thermal regime and affect the cells freeze back | ■ Still the case in 2021: no development on this aspect. |
| 2020 | P-4 | ■ Monitor the piezometers PZ-SWD-03-A and B as they are starting to show large and unexplained variations in the pressure readings. | ■ Still the case in 2021 and being monitored: trend seems to be seasonal, mechanism to confirm. |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| **North Cell Internal Structure** | | | |
| 2018 | P-3 | ■ The water is flowing well toward the west side of Stormwater Dike, where water is transferred into the South Cell. The early stages of the deposition seem satisfactory. The pumping stations on the downstream side of the dike are in place and working as needed. The capacity to store the inflow design flood must be verified during tailings deposition when updating the deposition plan. | ■ **Resolved in 2021:** tailings are again being deposited in the North Cell. Inflow design flood capacity was verified by AEM. |
| 2019 | P-2 | ■ Channelling of water has been observed at the upstream toe of the eastern part of the dike. The water flow has started to erode fine filter material at the toe. It is recommended to protect the filters in this area or to start capping this area as part of the closure plan. | ■ **Resolved in 2020**: water is channeling away from the dike slopes after deposition resumed. |
| 2019 | P-2 | ■ Tension cracks (2 to 5 m long, a few millimeters wide) have been observed during the inspection in the fine filter surface between Sta. 2+650 and 2+800 m, near the crest. They need to be monitored and repaired as they may decrease the efficiency of the filters in case of further tailings deposition. | ■ **Resolved in 2020**: remediation work done, and no more deformation observed. |
| 2020 | P-3 | ■ Deformation was observed in the upstream slope around Sta. 2+260, where the toe of the slope seems to have moved toward the upstream side of the dike. The filter system in this area is still expected to perform well, as no cracks or openings are present in the transition layers. To monitor for aggravation and possible repair needed. | ■ **Resolved in 2020**: remediation work done, and no more deformation observed. |
| 2020 | P-2 | ■ Tension cracks (several meters long, 10 to 150 mm wide) have been observed during the inspection in the fine filter surface between Sta. 2+300 and 3+150 m, mostly located between the middle and the bottom of the upstream slope, with narrow cracks on the crest of the fine filter at Sta. 2+780. They need to be monitored and repaired as they may decrease the efficiency of the filters in case of further tailings deposition. It is recommended to protect the filters in the areas showing deformation or to start capping this area as part of the closure plan. | ■ **Resolved in 2020**: remediation work done, and no more deformation observed. |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| 2020 | P-3 | ■ Linear erosion features were observed at several locations in the upstream surface, where the fine filter has started to wash out from the crest to the toe of the upstream toe. They were likely caused by important volumes of water draining from the crest during freshet, as no water discharge had been done in these areas. To monitor for aggravation and possible repair needed. | ■ Still the case in 2021 in the repaired fine filter. Lengthening the pipes toward the center of the cell could help reduce the water flow on the filter and its erosion. Alternatively, a liner could be used to protect the filter at the discharge location. |
| **Central Dike** | | | |
| 2018 | P-3 | ■ Seepage from the South Cell is ponding on the downstream side of Central Dike. The water had an orange coloration with high turbidity, and AEM reported that these associated with rapid temperature variations were observed during most of the open water season in the previous years.<br>The water level of the reclaim pond was temporarily lowered in autumn 2017 to reduce the hydraulic pressure on the seepage, and tailings deposition was amended to better cover the area between Saddle Dams 4 and 5. The mitigation measures resulted in a significantly decrease in the average flow. It is recommended to continue:<br>1. Maintain a tailings beach against Central Dike.<br>2. Promote beach deposition to seal assumed fractured bedrock areas expected to control the seepage under Central Dike.<br>3. Control the hydraulic gradient by proper management of South Cell water pond and dike downstream toe pond.<br>4. Closely monitoring the water quality.<br>5. Inspect the structure for changing conditions. | ■ Orange coloration was observed during the freshet of 2021, as usual.<br>■ Seepage is stable (150 $m^3/h$ at the time of the inspection).<br>■ The South Cell has reached its full capacity and most water was pumped out of the cell. No more tailings deposition is planned in the South Cell at the moment.<br>■ Monitoring recommendations are still valid in 2021 and included in routine surveillance and maintenance by AEM. The situation has been stable for several years and this item can thus be **considered resolved.** |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| 2019 | P-3 | ■ It is recommended to clean the angular granular material in direct contact with the LLDPE liner at approximately Sta. 0+750 m. A metallic piece around a pipe was also observed against the LLDPE liner at Sta. 1+000 m. This operation is required regularly and should be detailed in a procedure prepared by AEM. The procedure needs to be communicated to all concerned workers and added to the OMS manual. P-3 priority level instead of P-2 as the South Cell is inactive. | ■ **Resolved in 2021**. |
| 2019 | P-3 | ■ Water was observed ponding along the LLDPE liner on the south side of Central Dike and Saddle Dam 5, from Sta. 0+850 m. It is recommended to remove this water before it freezes to protect the LLDPE liner. Recurring situation every year that is usually well managed by AEM. | ■ Still the case in 2021. |
| 2021 | P-3 | ■ Water is being discharged from a small height at high velocity directly on the LLDPE liner at around Sta. 0+950. The liner should be protected with a sacrificial liner to avoid erosion by the water flow if AEM decides to discharge water into the South Cell again. | |
| **Saddle Dams 3, 4, and 5** | | | |
| 2018 | P-4 | ■ During the inspection, water was observed ponding on the downstream side of Saddle Dam 3 and Saddle Dam 4. As the downstream toe is higher than the South Cell pond, this water does not come from the tailings storage facility. It is important to maintain the water level on the downstream side lower than the granular layer of the upstream toe liner tie-in granular material to prevent uplift of the geomembrane. As the elevation of the downstream side is lower than the elevation of the granular material, this should not be a problem if the downstream water level is managed. The management of this water could be simplified by the construction of a sump, as indicated in the construction drawings, to direct the water in a low point. This is the case for Saddle Dam 3. | ■ **Resolved in 2021:** although the water ponding at the downstream toe of these dikes is still present, there is a significant backfill over the liner at Saddle Dam 3 and a tailing beach all along Saddle Dam 4, which greatly reduce the risk of uplift of the geomembrane. |
| 2021 | P-3 | ■ A section of pipe with a metal connector and a metal rod are present on the liner and should be removed to avoid damaging the liner. | |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| **All-Weather Access Road** | | | |
| 2018 | P-4 | ■ The erosion of the culverts is stable. The progression of the erosion of culverts PC-17A (8+830), PC-11 (39+552), R14 (67+840), R18-B (82+500), R-20 (85+490), R-23 (93+600), and R24 (98+100) should be monitored at freshet for any signs of progression or washout, as signs of water flowing beneath the road were observed at these locations. | ■ Still the case in 2021. |
| 2018 | P-4 | ■ For some culvert locations, monitoring is recommended to see if flow occurs through the culvert (i.e., during the freshet). If insufficient capacity to handle the flows is observed, or water circulates under the road, then it is recommended to clear the obstructions or repair the culverts. Particular attention should be paid to R-00A (2+550), PC-14 (4+260), the unnamed culvert at 5+700, and PC-16 (54+950). | ■ Still the case in 2021. |
| **Whale Tail Project Road** | | | |
| 2019 | P-3 | ■ Obstructed and damaged culverts were observed at some locations: #5 (117+525), #7 (118+013), #7-2 (118+016), #13 (120+615), #27-2 (123+300), #45 (125+710), #48 (127+203), #54 (128+388), #55 (128+440), #64 (129+920), #65 (130+924), #83 (136+300), #85 (136+671), #86 (136+740), #88 (136+861), #89 (137+180), #93 (138+100), #97 (138+436), #98 (138+482), #101 (139+025), #105 (140+555), #112 (142+630), #113 (142+736), #115 (142+865), #116 (142+940), #117 (143+173), #118 (143+433), #133 (148+141), #150 (152+171 to 152+179), #151 (152+562), #160 (155+966), #163 (156+474), #192 (163+190), #234 (170+385), #241 (171+235), #268 (175+774), #278 (177+870), #283 (178+965), and #284-2 (179+072). If insufficient capacity to handle the flow is observed at locations where culverts are obstructed or damaged, it is recommended to clear the obstructions or repair the culvert. It is still recommended to monitor culverts #167 (41+843) and #232 (53+928) where there are signs of water flowing below the culverts. | ■ Still the case in 2021 for #5 (117+525), #7 (118+013), #7-2 (118+016), #12 (4+179 to 4+186; 3 outlets out of 5), #13 (120+615), #27-2 (123+300), #38 (125+049), #48 (127+203), #52 (128+195), #54 (128+388), #55 (128+440), #61 (129+050), #63 (129+390), #65 (130+924), #66 (132+324), #82 (136+143), #83 (136+300), #85 (136+671), #86 (136+740), #88 (136+861), #89 (137+180), #93 (138+100), #101 (139+025), #105 (140+555), #111 (142+461), #112 (142+630), #113 (142+736), #115 (142+865), #116 (142+940), #118 (143+433), #133 (148+141), #135 (148+567), #137 (148+940), #138 (149+000), #150 (152+171 to 152+179; 1 outlet out of 5), #160 (155+966), #178 (161+170), #234 (170+385), #243 (171+593), #256 (173+350), #268 (175+774), and #281 (178+350). |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| 2020 | P-3 | ■ The road material, constituted of fine esker-like material, was observed to be eroded on the shoulders and side slopes by run-off water, especially at km 174 and 177.<br>■ Settlement of the east shoulder was observed at km 176.5. Ponding water present at the toe of the slope.<br>It is recommended to repair the eroded sections of the road, to be on the watch for further signs of erosion along the high sandy side slopes along the road, and to backfill potential erosion as soon as it is noticed. | ■ **Resolved in 2020:** the road was repaired after the summer of 2020 and new signs of erosion are minor. |
| **Quarries and Eskers** | | | |
| 2018 | P-4 | ■ Presence of unstable blocks and loose rocks along steep walls and unstable slopes was observed in Quarries 3, 7, 9, 10, 12, 16, 18, and 23, as well as all eskers and quarries along the Whale Tail Project road except Esker #5. It is recommended that workers be cautious in these quarries and are aware of the potential hazard. | ■ Still the case in 2021 with Quarries 3, 7, 9, 10, 16, 18, and 23, as well as with all eskers excepted #3, #5, and #6. |
| **Bulk Fuel Facilities** | | | |
| **Baker Lake Tank Farm** | | | |
| 2018 | P-4 | ■ Ponded water within most containment cells was observed. Removal of water should be managed to keep the water accumulation at a minimum near the tank foundation. | ■ Still the case in 2021, higher water level in Jet A fuel tanks containment area that is preventing visual inspection. |
| 2018 | P-3 | ■ The granular fill material protecting the geomembrane was eroded due to wave actions in some areas, exposing the geomembrane. This condition was observed all along the south side of Tanks 3 and 4 and on the west side of Tank 1. A section of exposed geomembrane with a fold was observed at the northwestern corner of Tank 2 and the northeastern corner of Tank 4. It is recommended to cover the exposed area with geotextile and fill material to re-establish the liner protection. Liner is exposed on the northern side of Tank 5. As this condition appears above the elevation of the southern berm, it is considered that the protection of the liner with granular material is not as important as in other areas; however, it remains a good practice and provides protection against animal damage. | ■ 2021: partially resolved: still exposed geomembrane on the south side of Tanks 1 to 4, and in the northeastern corner of Tank 4. |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| 2018 | P-2 | ■ A hole in the exposed geomembrane (300 mm diameter hole) was observed on the south southwestern corner of Tank 3 at the toe of the slope. The hole in the geomembrane should be repaired to ensure a good performance of the retention basin. It is also recommended to cover the exposed area with geotextile and fill material to re-establish the liner protection. | ■ 2021: the geomembrane was damaged again at the same location. It should be repaired and covered with geotextile and granular material. |
| 2018 | P-3 | ■ Animal burrows were observed near the southern corner of Tank 2. It is recommended to assess whether the geosynthetics have been damaged under the granular cover at one location at least. | ■ Still the case in 2021: animal burrows were observed on the south side of Tanks 3 and 4, although less than in 2020. |
| 2020 | P-2 | ■ A hole in the liner was observed on the southwestern corner of the containment cell of the 20 Jet A fuel tanks. The hole in the geomembrane should be repaired to ensure a good performance of the retention basin. | ■ 2021: uncertain, high-water level prevented visual observation of the hole location or any new holes. |
| 2020 | P-3 | ■ On the northern side of Tank 5, tension cracks parallel to the slope (10 to 30 mm wide) and signs of settlement (about 50 to 100 m) were observed in the fine filter surface on top of the slope and on the crest. The area should be monitored and repaired if needed to re-establish liner protection. | ■ **Resolved in 2021:** tension cracks are still visible but seem inactive. Regular monitoring recommended. |
| 2021 | P-2 | ■ A fuel leak was reported by AEM in 2020 from one of the old fuel tanks. The geomembrane could be damaged by fuel contact under the granular cover. The geomembrane should be exposed for visual inspection in the leak area, repaired if needed, and covered again. | |
| **Meadowbank Tank Farm** | | | |
| 2018 | P-4 | ■ Ponded water within the secondary containment cell was observed. Removal of water should be managed to keep the water accumulation at a minimum near the tank foundation. | ■ Still the case in 2021. |
| **Whale Tail Project Tank Farm** | | | |
| 2020 | P-3 | ■ Some granular material is missing on the liner anchor on the eastern corner. It is recommended to repair this area. | |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| **Other Meadowbank structures** | | | |
| **Meadowbank Site Roads** | | | |
| 2018 | P-4 | ■ Three culverts were installed on Vault Road (coordinates 640 964 E / 7 217 466 N). As previously observed in past annual inspections, these three culverts were partially collapsed in the middle and showed signs of erosion at the inlet. This is currently not a significant issue, but it is recommended to monitor these culverts at freshet to ensure they provide sufficient capacity and that erosion is not occurring. | ■ Still the case in 2021. |
| **Landfill and Contaminated Soil Storage and Bioremedial Landfarm Facility** | | | |
| 2018 | P-2 | ■ The landfarm lies over a natural steep slope covered by rockfill as a pad made to operate the landfarm. The slope is considered at risk for high deformation to slope failure. The risk will increase as the water level in the South Cell raises. Signs of superficial slope failure were observed during the inspection. It is recommended to watch out for signs of instability and be prepared to close off the area if need be. Workers who access the area should be informed of the potential risk and be trained to recognize signs of instability. | ■ 2021: new, small crack appeared on the eastern side. It is recommended to keep this area on watch for further development. |
| **Other Whale Tail Project structures** | | | |
| **Saline Ditch** | | | |
| 2020 | P-3 | ■ The outlet of the ditch towards the AP5 quarry, constituted of a culvert beneath the road, was obstructed at its outlet and water was ponding at its inlet and in the southwestern extremity of the Saline Ditch. It is recommended to clear this culvert. | **Resolved in 2021**: the culvert is unobstructed and water is no longer ponding. |
| 2021 | P-3 | ■ Blocks and debris are present in the ditch close to the south culvert (ditch outlet) and should be cleared to avoid water flowing out of the ditch. | |

| Year of Recommendation | Priority Level | Recommended Action | Follow up the years after |
|---|---|---|---|
| 2021 | P-2 | ■ The ditch is being backfilled all along the road by mud and gravel from the road, pushed into the ditch by snow removal operation and surface grading. The ditch depth has been significantly reduced. The ditch should be cleared every year of this extra material to maintain its hydraulic capacity. | |
| **Sumps and Non-contact Water Management Infrastructures** | | | |
| 2020 | P-3 | ■ The sandy material on which the seacans are installed has settled and eroded at stations P1, P3, and P4. No damage to the stations themselves have been observed so far, however it is recommended to repair the seacan foundations with non-erodible material such as rockfill. | **Resolved in 2021:** fill foundation repaired and only minor surface erosion is not observed. |
| **Site Roads** | | | |
| 2020 | P-4 | ■ A culvert should be installed on Road 22 near the Mammoth Lake diffuser beneath the road to avoid erosion issues.<br>■ Road 24, along the South Whale Tail Channel, shows large settlement and tension cracks. It is recommended to repair the road to re-establish the rolling surface.<br>■ Road 25, around the Whale Tail WRSF, has a rough surface. It is recommended to add granular material to the road surface and to grade it. | **Resolved in 2021**: work done satisfactory. |
| **Additional Recommendations** | | | |
| 2019 | P-4 | ■ Since AEM is a member of the Mining Association of Canada, it is recommended that a tailings management audit be held in the framework of the Towards Sustainable Mining initiative. | ■ **Resolved in 2021**: an external TSF audit was conducted in November 2021. |

WRSF = waste rock storage facility; AEM = Agnico-Eagle Mines Limited; VWP = vibrating wire piezometer; OMS = Operations, Maintenance, and Surveillance; TARP = Trigger Action Response Plan; LLDPE = low linear density polyethylene

# Signature Page

**Golder Associés Ltée**

SIGNATURE ON PROTECTED ORIGINAL

Marion Habersetzer, P.Eng., M.Sc.
*Geotechnical Engineer*

SIGNATURE ON PROTECTED ORIGINAL

Yves Boulianne, P.Eng.
*Principal Associate, Senior Geotechnical Engineer*

MH/YB/cd

# 13.0 REFERENCES

AEM. 2021a. Tailings Storage Facilities Operation, Maintenance and Surveillance Manual. Version 10. July 2021.

AEM. 2021b. Dewatering Dikes Operation, Maintenance, and Surveillance Manual. Version 9. November 2021.

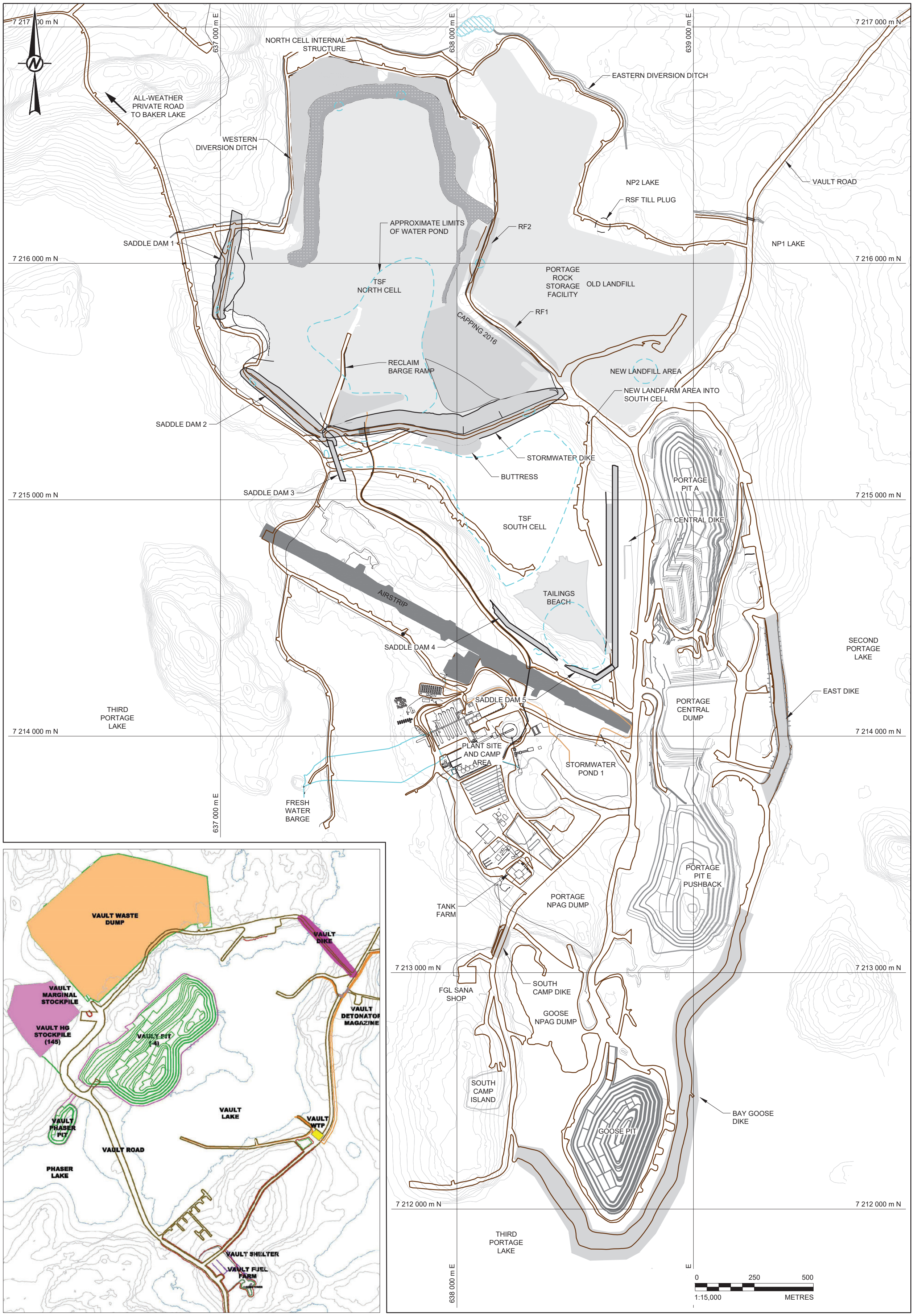
AEM. 2021c. Whale Tail Water Management Infrastructure Operation, Maintenance and Surveillance Manual. Version 2. November 2021.

AEM. 2021d. Emergency Response Plan, Meadowbank Complex. Version 16. September 2021.

Ministry of Energy and Mines. 2017. Health, Safety, and Reclamation Code for Mines in British Columbia. June 2017.

# FIGURES

## Figure 1
## Figures A to H




LEGEND

TOPOGRAPHIC CONTOUR

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., MEADOWBANK DIVISION IN "MBK Site map updated JULY 2014.dwg" DATED JULY 8, 2014.

CLIENT

AGNICO EAGLE

CONSULTANT

GOLDER MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

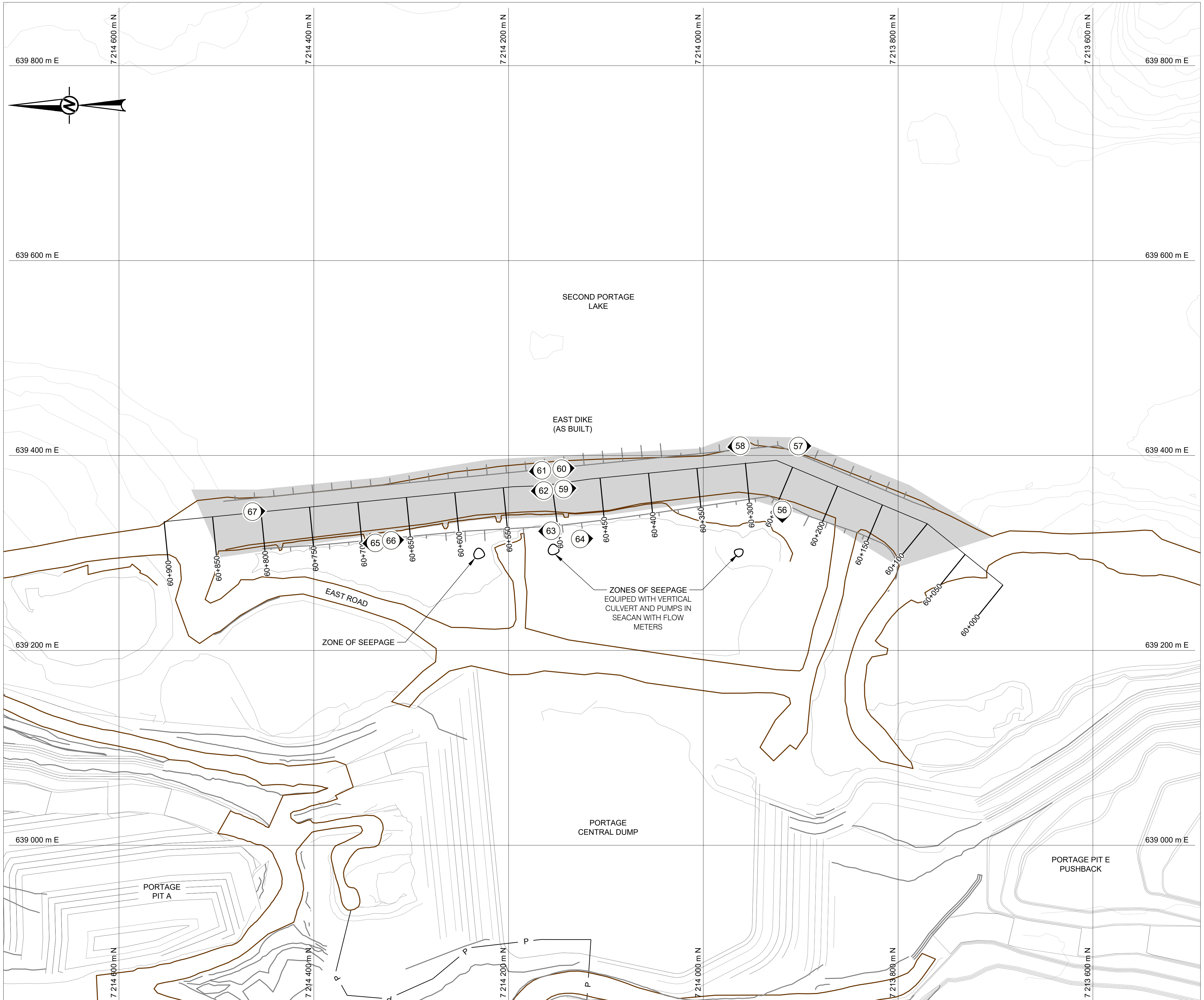
PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

**MEADOWBANK MINE SITE DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | 1 |




LEGEND

TOPOGRAPHIC CONTOUR

1 — IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., MEADOWBANK DIVISION IN "MBK Site map updated JULY 2014.dwg" DATED JULY 8, 2014.

0 100 200

1:4 000 METRES

CLIENT

AGNICO EAGLE

PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION

TITLE

EAST DIKE DURING THE ANNUAL INSPECTION OF 2021

CONSULTANT

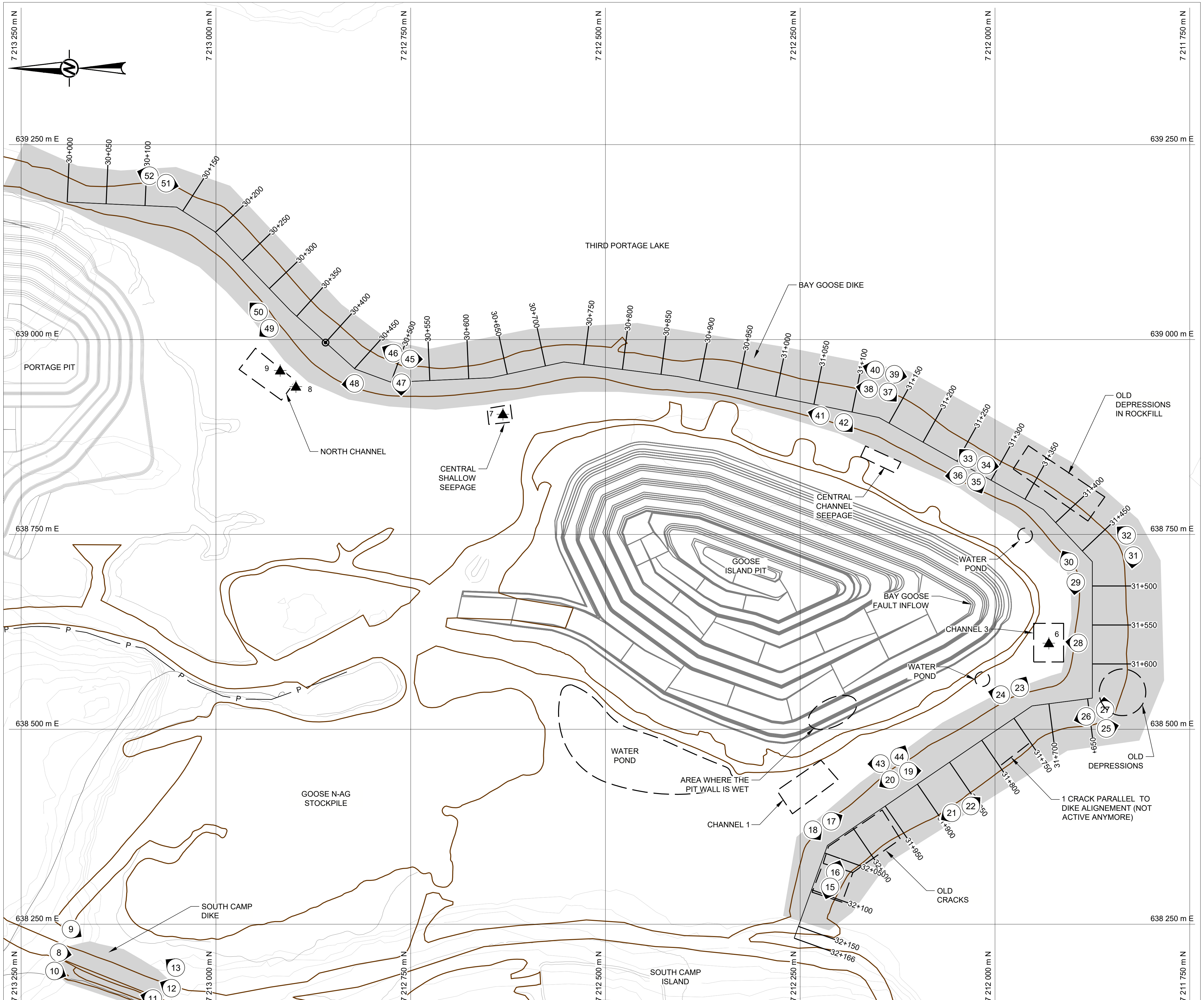
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | A1 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm




LEGEND

TOPOGRAPHIC CONTOUR

1 IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021

MANUAL MONITORING FLOW STATION

1 WATER ACCUMULATION. NO SIGN OF FLOW.

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., MEADOWBANK DIVISION IN "MBK Site map updated JULY 2014.dwg" DATED JULY 8, 2014.

0 100 200
1:5 000 METRES

CLIENT

AGNICO EAGLE

PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

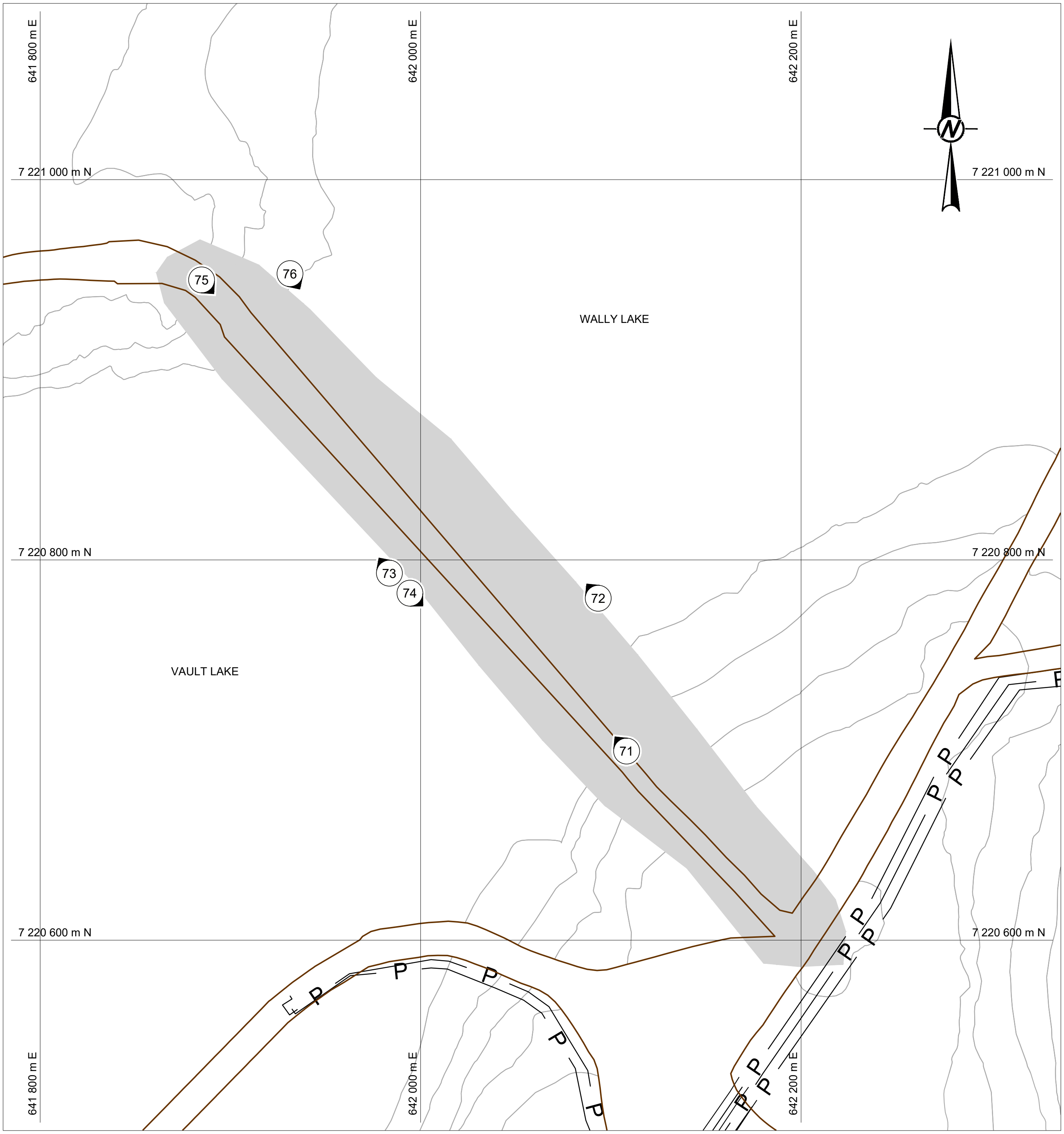
**BAY-GOOSE AND SOUTH CAMP DIKES DURING THE ANNUAL INSPECTION 2021**

CONSULTANT

GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | A2 |




LEGEND

TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., MEADOWBANK DIVISION IN "MBK Site map updated JULY 2014.dwg" DATED JULY 8, 2014.

0 12.5 25

1:750 METRES

CLIENT

AGNICO EAGLE

CONSULTANT

GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

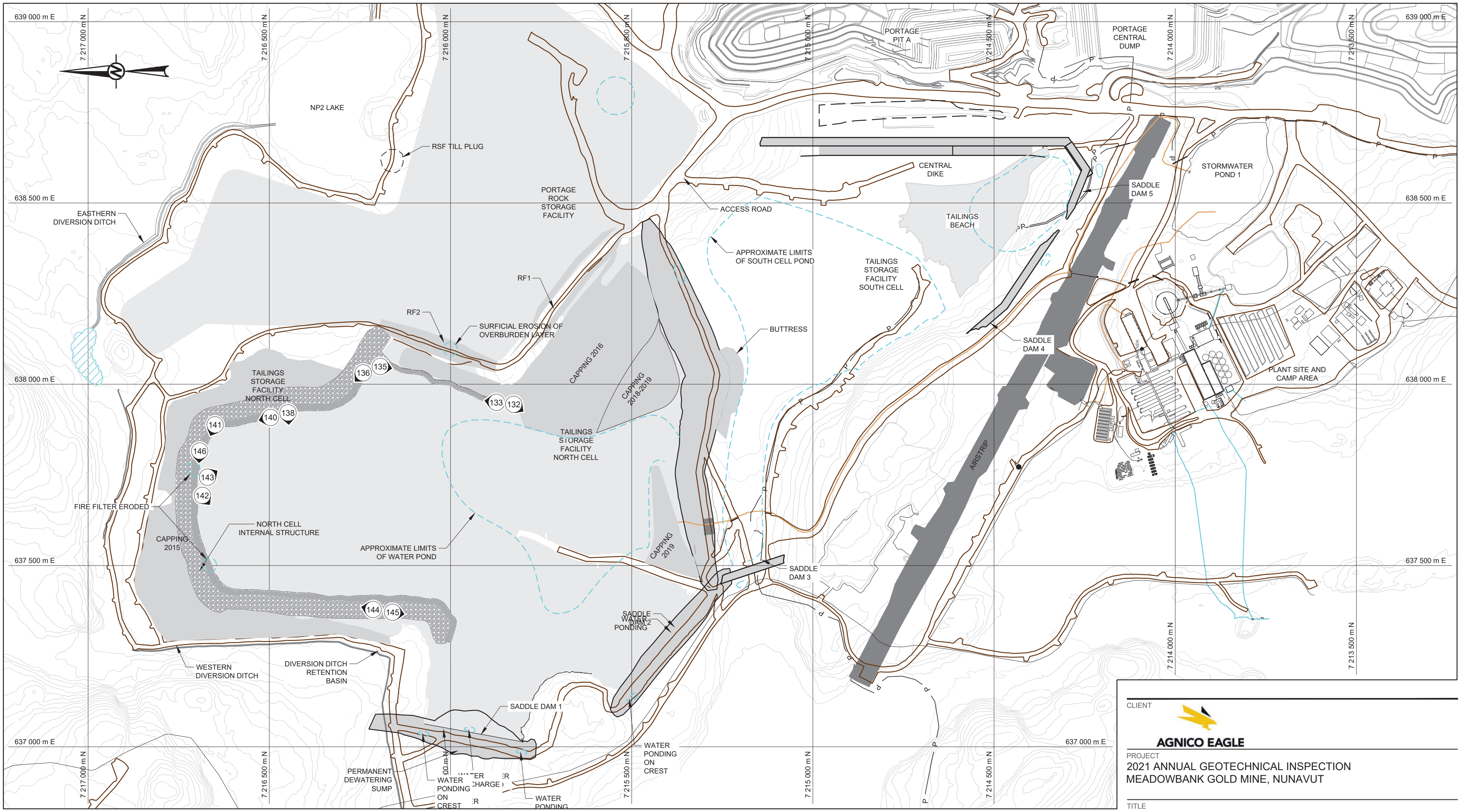
**VAULT DIKE DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | A3 |

Path: C:\Users\CPachis\AppData\Local\Temp\6\AcPublish_34556\ | File Name: 21468006-5000-01.dwg

25 mm

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A




LEGEND

TOPOGRAPHIC CONTOUR

1 IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., MEADOWBANK DIVISION IN "MBK Site map updated JULY 2014.dwg" DATED JULY 8, 2014.

0 250 500

1:10 000 METRES

CLIENT

AGNICO EAGLE

PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

**GENERAL VIEW OF TAILINGS STORAGE FACILITY DURING THE ANNUAL INSPECTION 2021**

CONSULTANT

GOLDER
MEMBER OF WSP

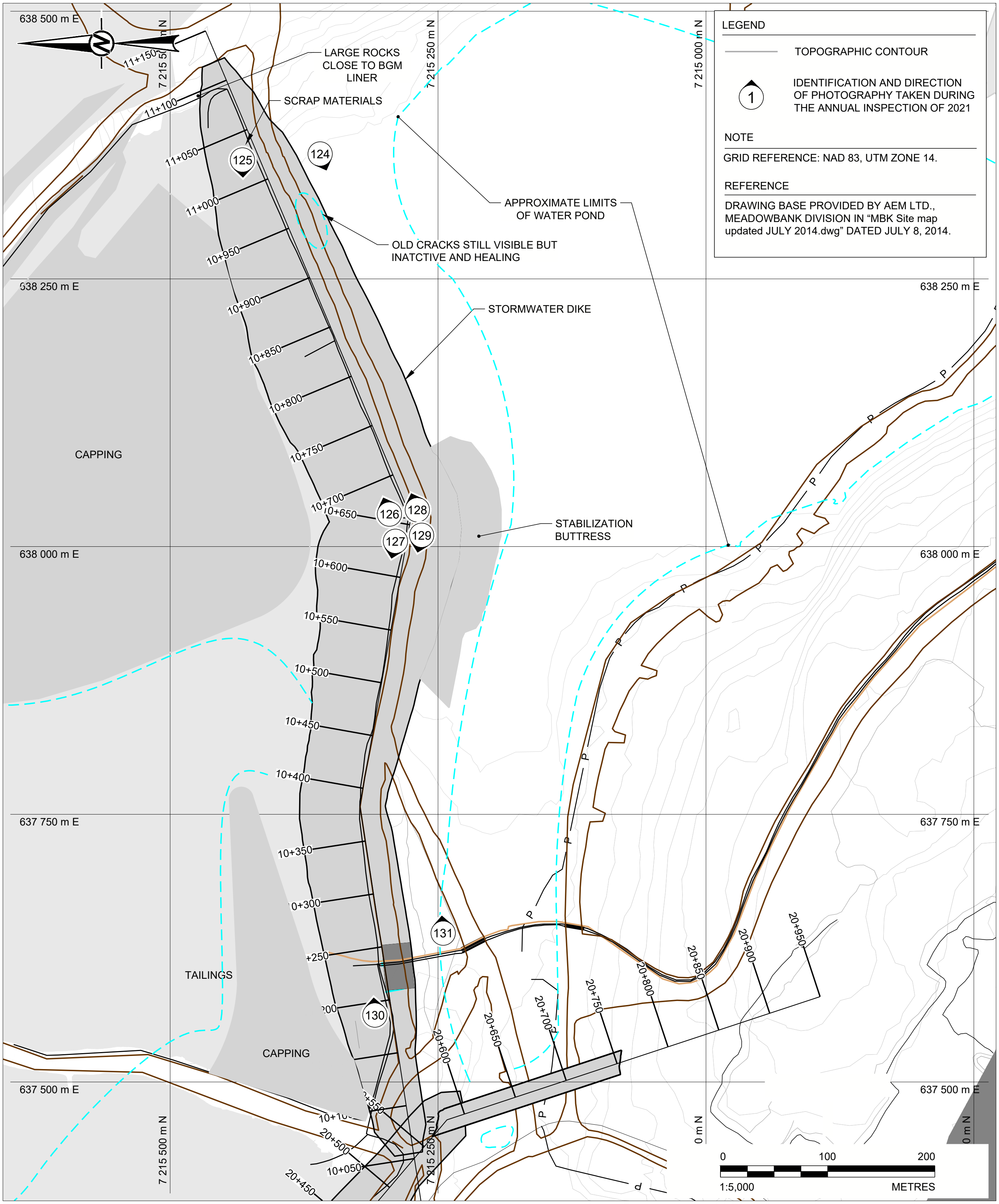
| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | B1 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

Path: C:\Users\CParihar\AppData\Local\Temp\AcPublish_34556\ | File Name: 21468006-5000-01.dwg




CLIENT

AGNICO EAGLE

CONSULTANT

GOLDER MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

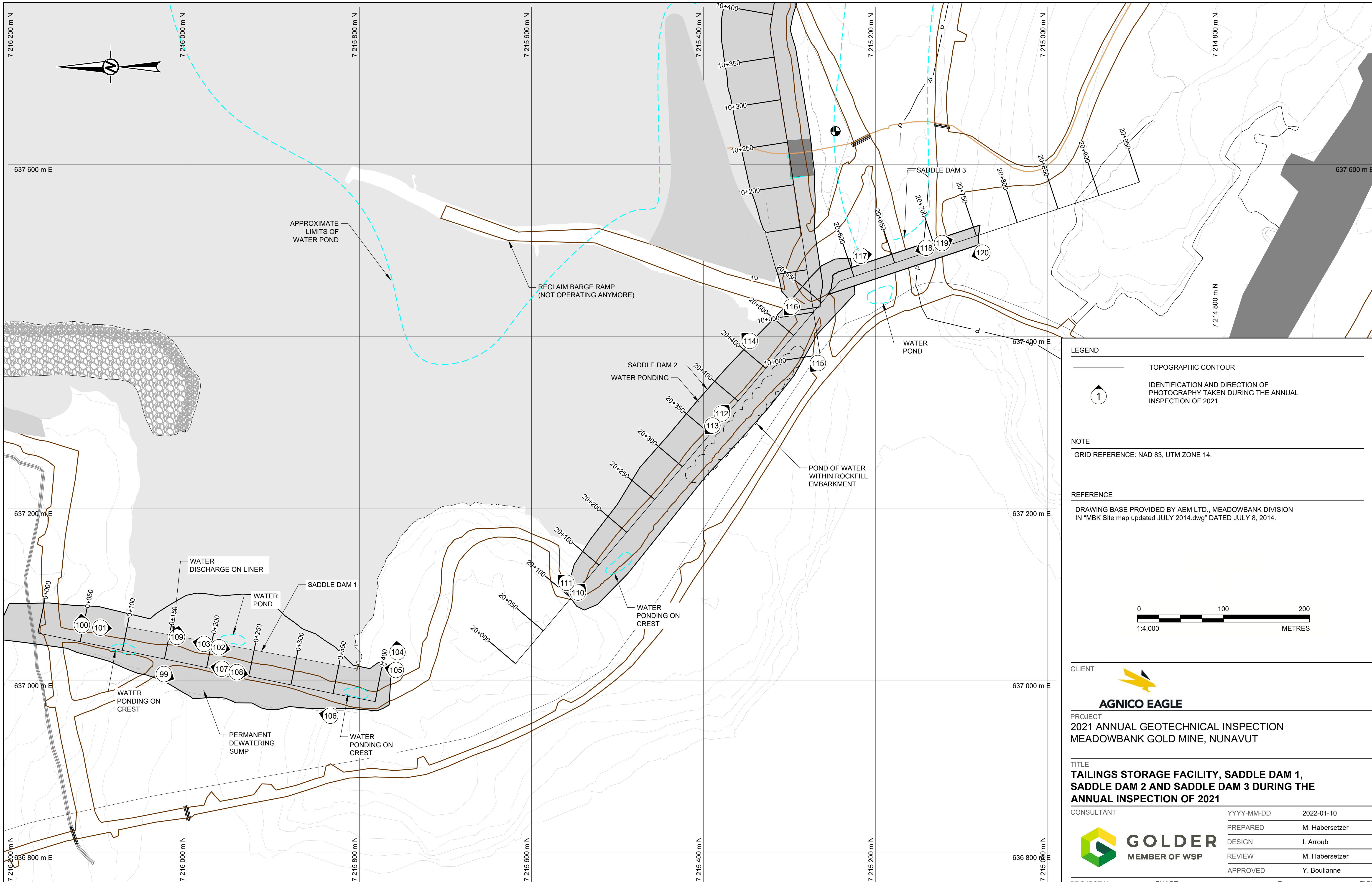
PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

**STORMWATER DIKE DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | B2 |




LEGEND

TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., MEADOWBANK DIVISION IN "MBK Site map updated JULY 2014.dwg" DATED JULY 8, 2014.

0 100 200

1:4,000 METRES

CLIENT

AGNICO EAGLE

PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

**TAILINGS STORAGE FACILITY, SADDLE DAM 1, SADDLE DAM 2 AND SADDLE DAM 3 DURING THE ANNUAL INSPECTION OF 2021**

CONSULTANT

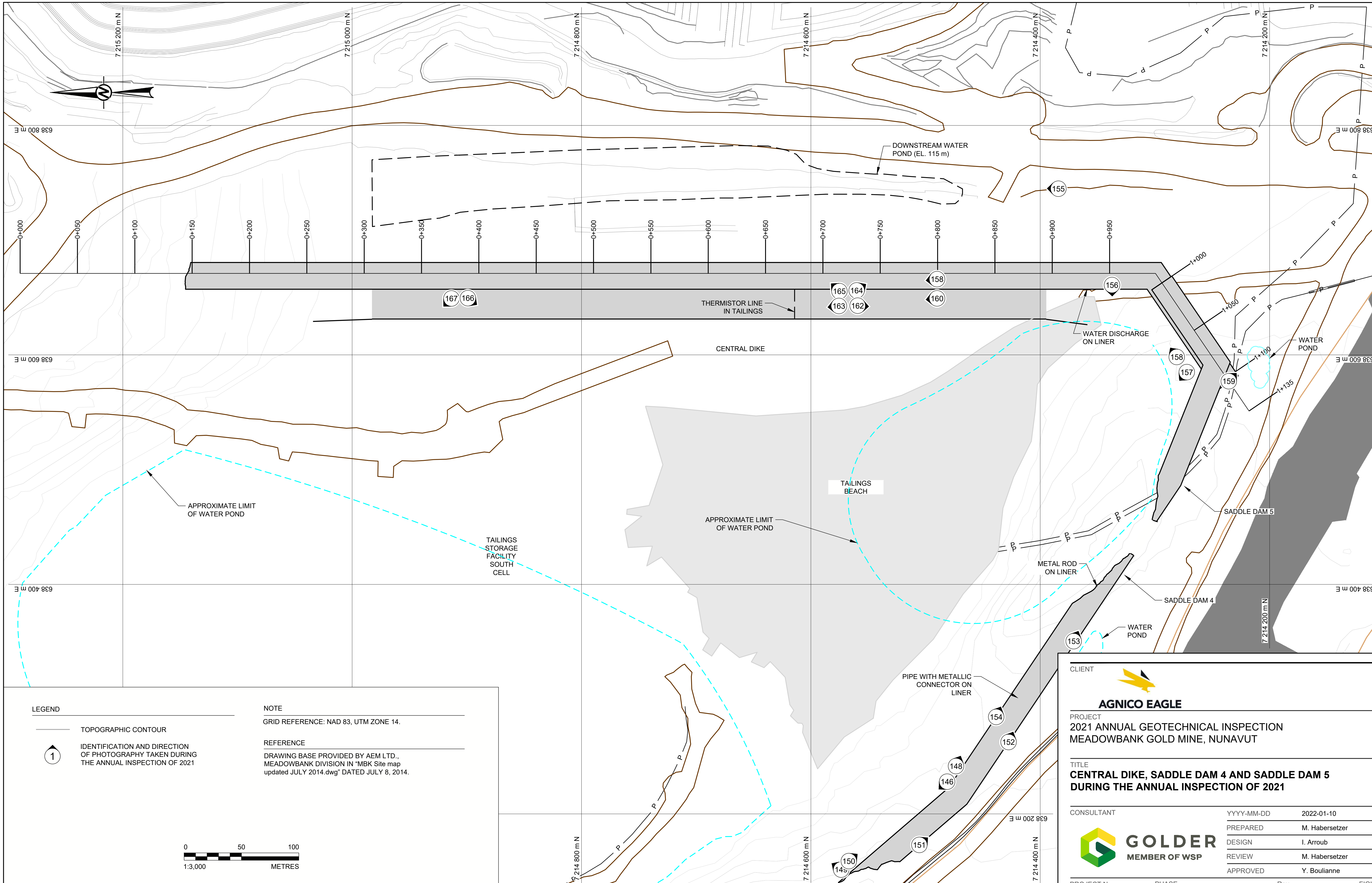
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | B3 |

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Path: C:\Users\CPachis\AppData\Local\Temp\AcPublish_34556\ | File Name: 21468006-5000-01.dwg




LEGEND

TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., MEADOWBANK DIVISION IN "MBK Site map updated JULY 2014.dwg" DATED JULY 8, 2014.

0 50 100
1:3,000 METRES

CLIENT

AGNICO EAGLE

PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

**CENTRAL DIKE, SADDLE DAM 4 AND SADDLE DAM 5 DURING THE ANNUAL INSPECTION OF 2021**

CONSULTANT

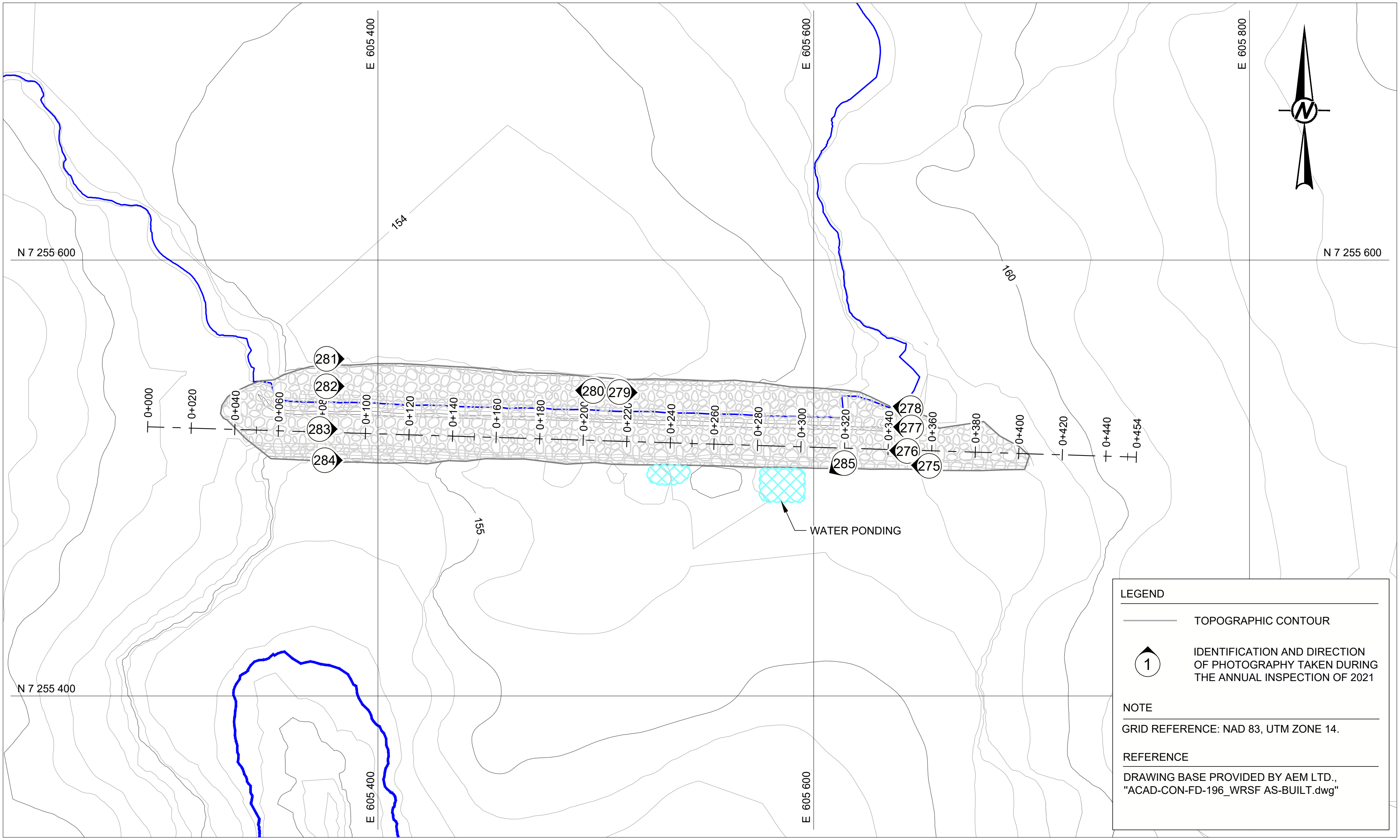
GOLDER MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | B4 |

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

Path: C:\Users\CPachis\AppData\Local\Temp\AcPublish_34556\ | File Name: 21468006-5000-01.dwg




LEGEND

TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., "ACAD-CON-FD-196_WRSF AS-BUILT.dwg"

0 50 100
1:2 500 METRES

CLIENT
AGNICO EAGLE

CONSULTANT
GOLDER
MEMBER OF WSP

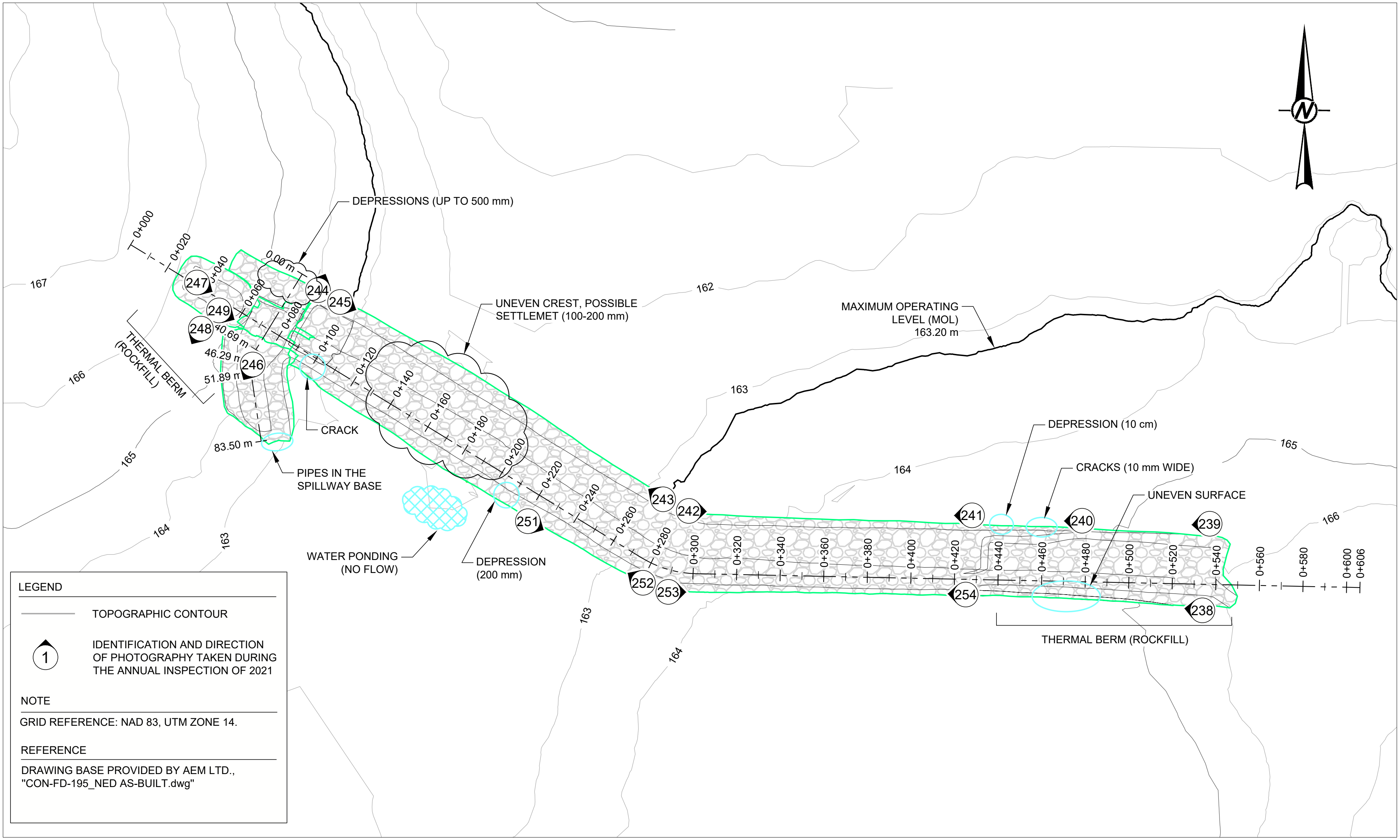
| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| DESIGNED | I. Arroub |
| PREPARED | M. Habersetzer |
| REVIEWED | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT
2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE
**WRSF DIKE DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | C1 |

Last Edited By: cpachis Date: 2021-10-21 Time:2:45:54 PM | Printed By: CPachis Date: 2022-01-10 Time:10:51:27 AM
Path: C:\Users\CPachis\AppData\Local\Temp\6\AcPublish_34556\ | File Name: 21468006-5000-01.dwg




LEGEND

TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., "CON-FD-195_NED AS-BUILT.dwg"

0 50 100
1:2 500 METRES

CLIENT

AGNICO EAGLE

CONSULTANT

GOLDER
MEMBER OF WSP

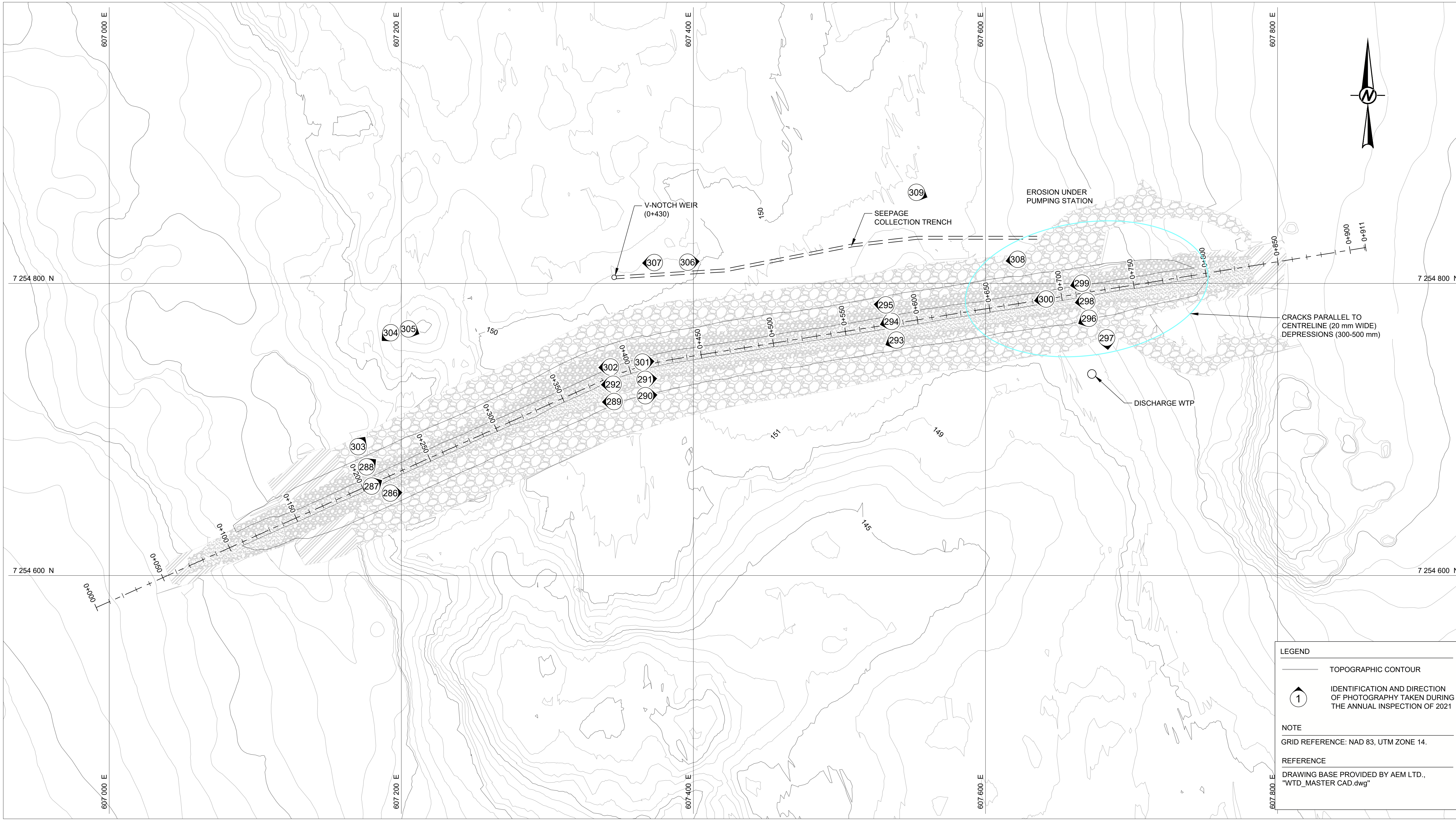
| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| DESIGNED | I. Arroub |
| PREPARED | M. Habersetzer |
| REVIEWED | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT
2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE
**IVR D1 DIKE DURING THE ANNUAL INSPECTION 2021**

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | C2 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
25 mm




CLIENT

AGNICO EAGLE

CONSULTANT

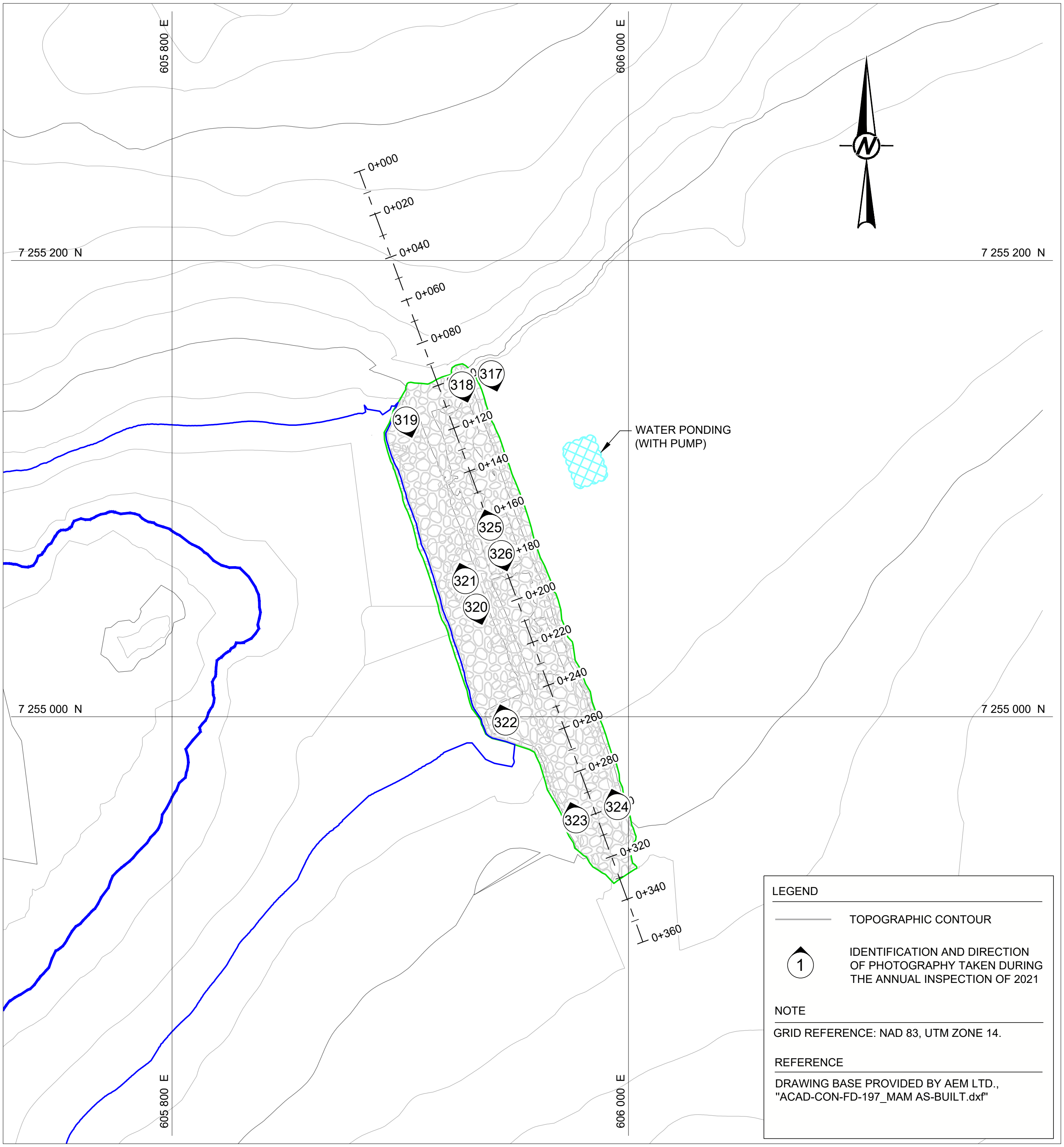
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| DESIGNED | I. Arroub |
| PREPARED | M. Habersetzer |
| REVIEWED | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT
2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE
**WHALE TAIL DIKE DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | C3 |




0 50 100

1:2 500 METRES

CLIENT

AGNICO EAGLE

CONSULTANT

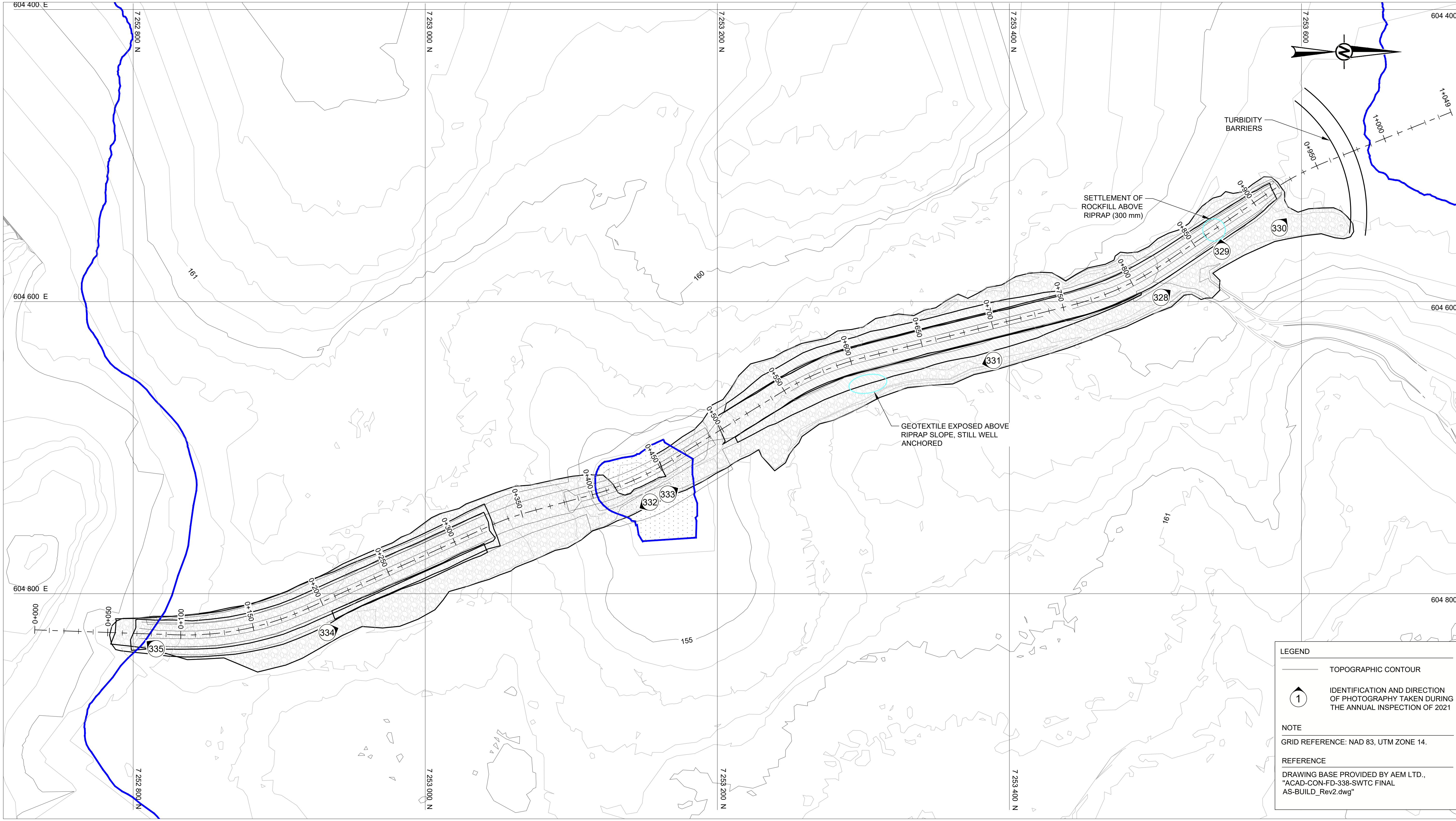
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| DESIGNED | I. Arroub |
| PREPARED | M. Habersetzer |
| REVIEWED | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT
2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE
**MAMMOTH DIKE DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | C4 |




CLIENT

AGNICO EAGLE

CONSULTANT

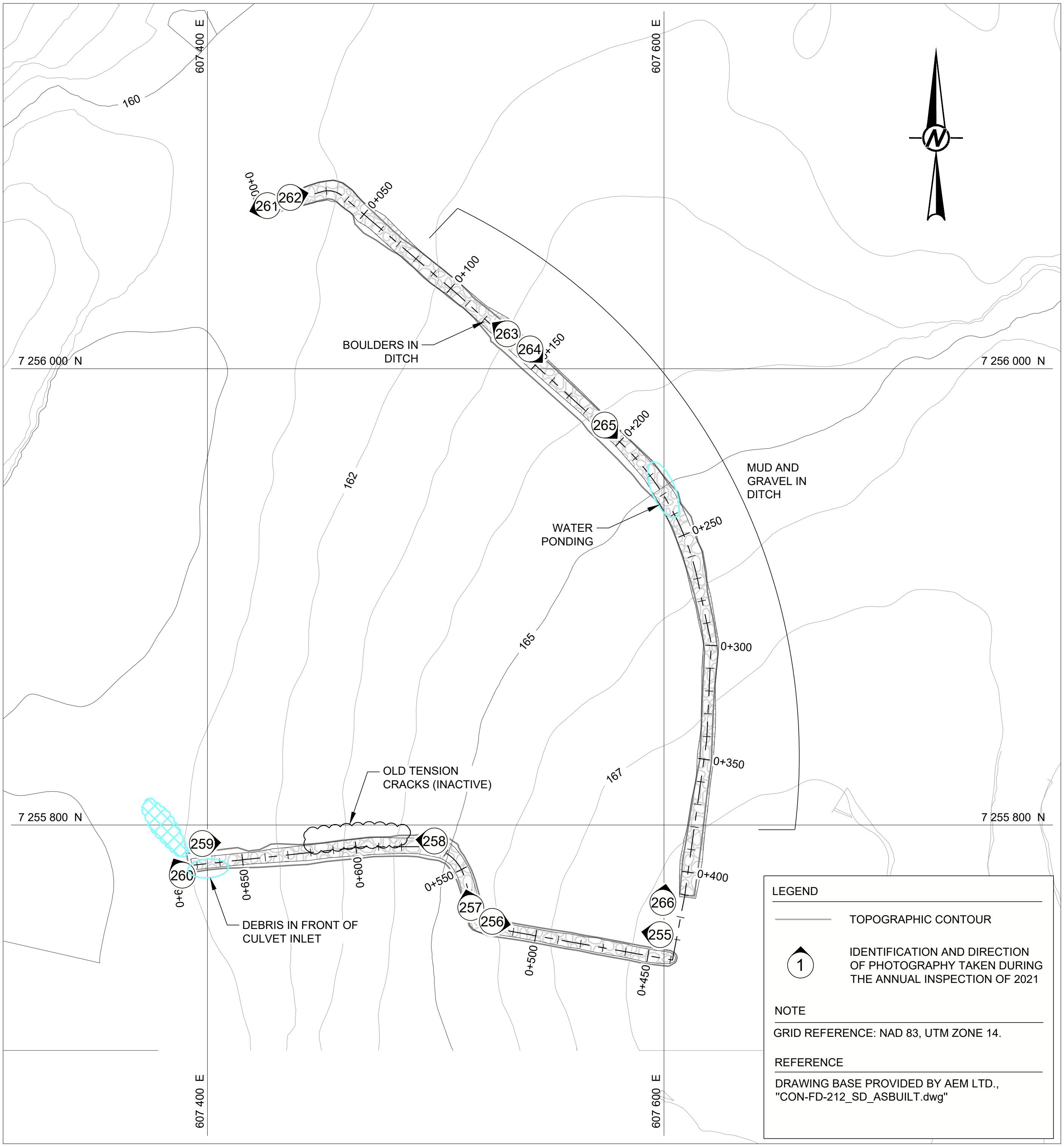
GOLDER
MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| DESIGNED | I. Arroub |
| PREPARED | M. Habersetzer |
| REVIEWED | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT
2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE
**SOUTH WHALE TAIL CHANNEL DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | C5 |




CLIENT

AGNICO EAGLE

CONSULTANT

GOLDER MEMBER OF WSP

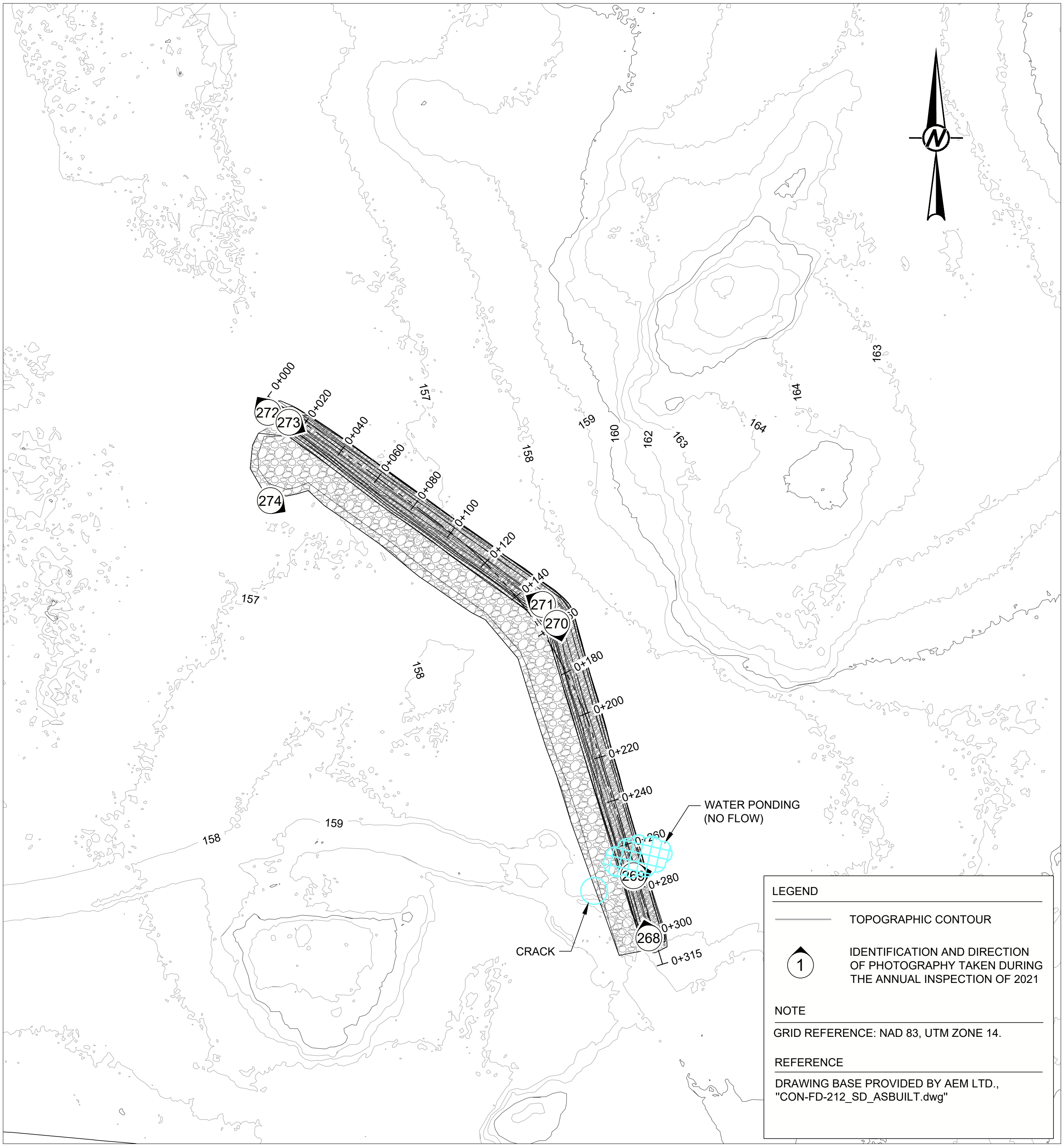
| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| DESIGNED | I. Arroub |
| PREPARED | M. Habersetzer |
| REVIEWED | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT
2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE
**SALINE DITCH DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | C6 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
25 mm




0 50 100

1:2 500 METRES

CLIENT

AGNICO EAGLE

CONSULTANT

GOLDER
MEMBER OF WSP

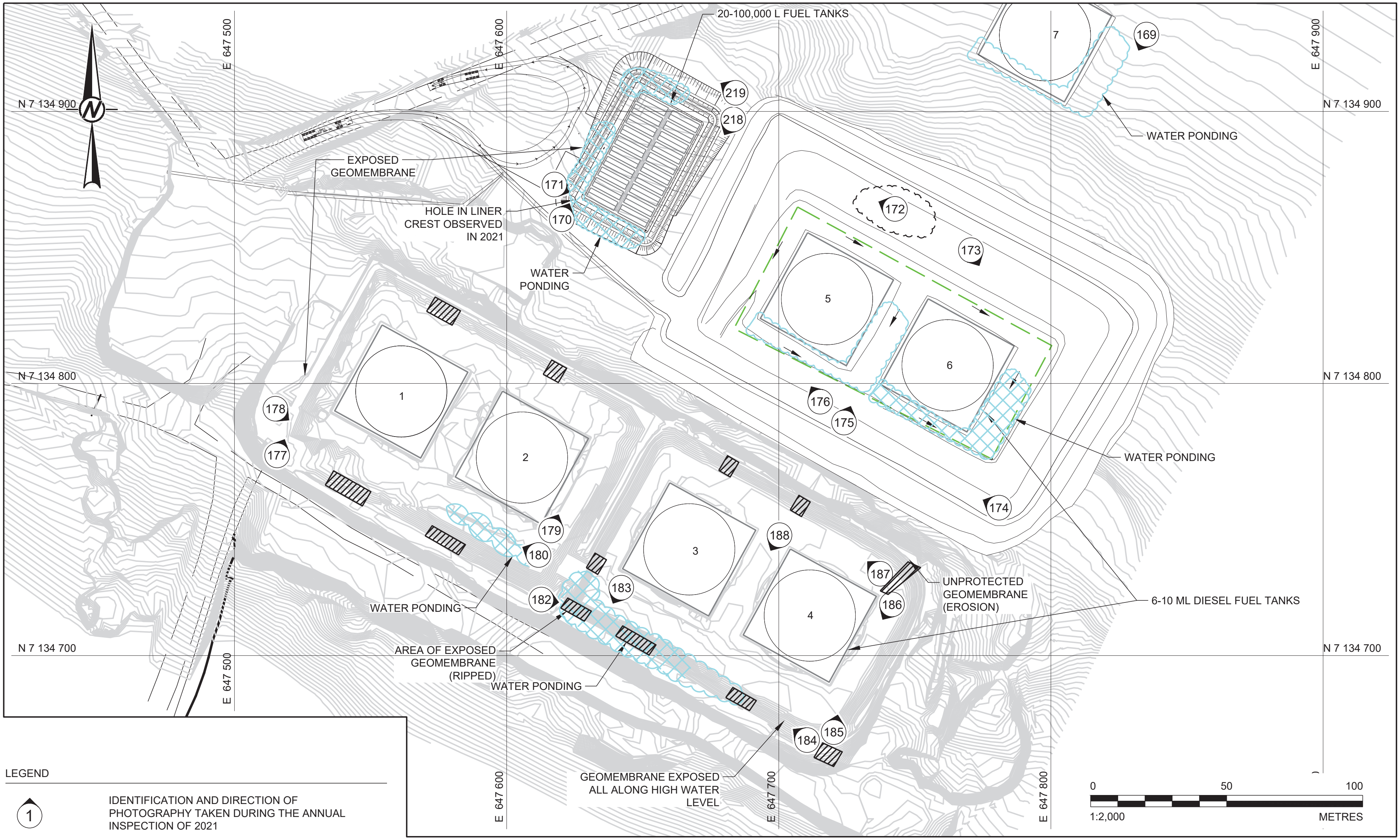
| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| DESIGNED | I. Arroub |
| PREPARED | M. Habersetzer |
| REVIEWED | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT
2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE
**IVR DIVERSION CHANNEL DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT NO. | PHASE | REV. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | C7 |

Path: C:\Users\CPachis\AppData\Local\Temp\6\AcPublish_34556\ | File Name: 21468006-5000-01.dwg




LEGEND

| | |
|---|---|
| 1 | IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021 |
| (hatched box) | EXPOSED GEOSYNTHETICS |

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

BASE PLAN PROVIDED BY AEM LTD. IN "PORTAGE_GOOSE_VAULT_END2019_LOM2013_V4D-WITH LABEL.dwg, RECEIVED OCTOBER 7, 2013

CLIENT

AGNICO EAGLE

CONSULTANT

GOLDER MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

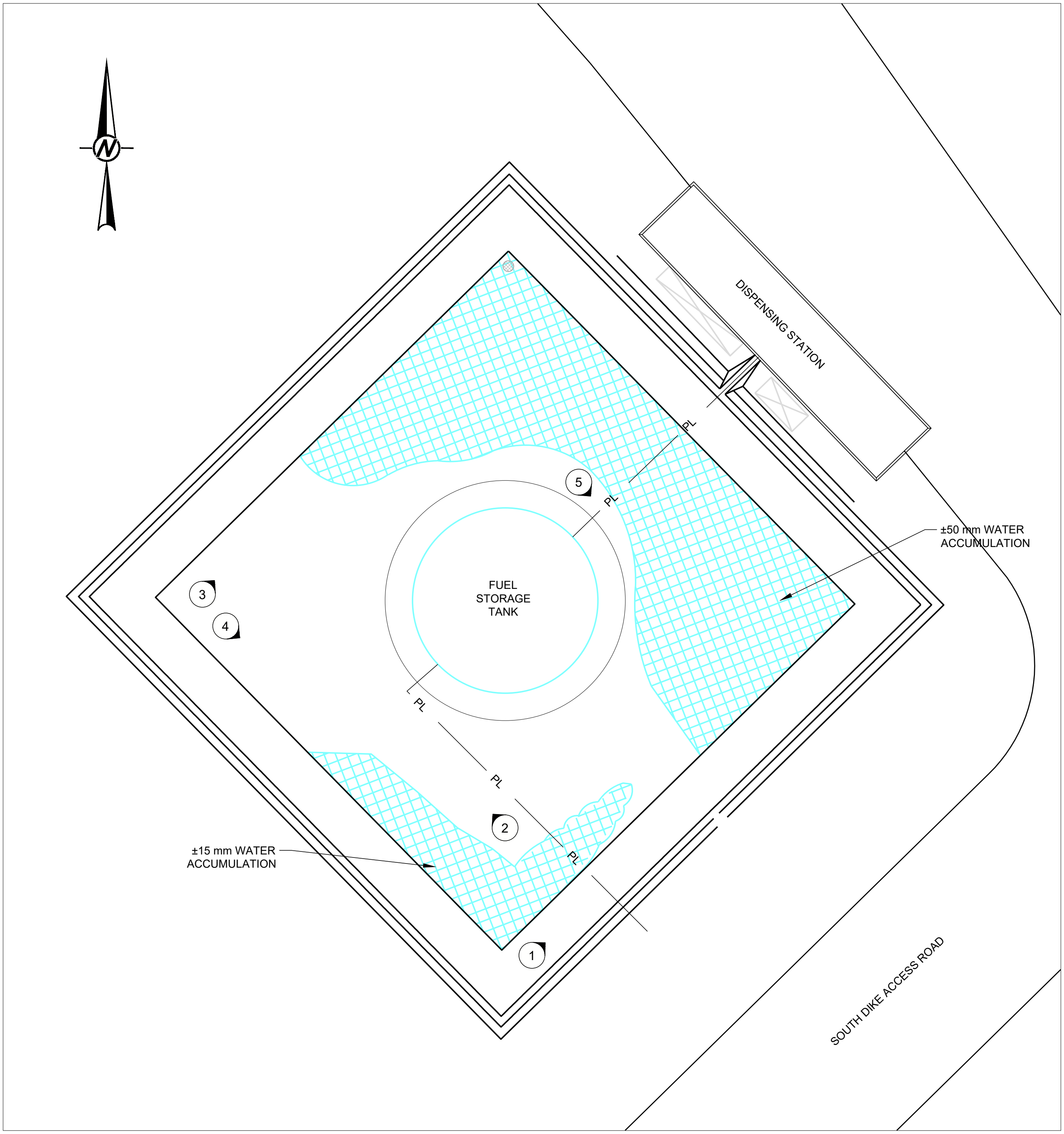
TITLE

**BAKER LAKE TANK FARM DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | G1 |

25 mm

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A




LEGEND

1 IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021

REFERENCE

BASE PLAN INFORMATIONS IS PROVIDED BY CUMBERLAND DATED FEBRUARY 03, 2008

CLIENT

AGNICO EAGLE

CONSULTANT

GOLDER MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

**MEADOWBANK TANK FARM DURING THE ANNUAL INSPECTION OF 2021**

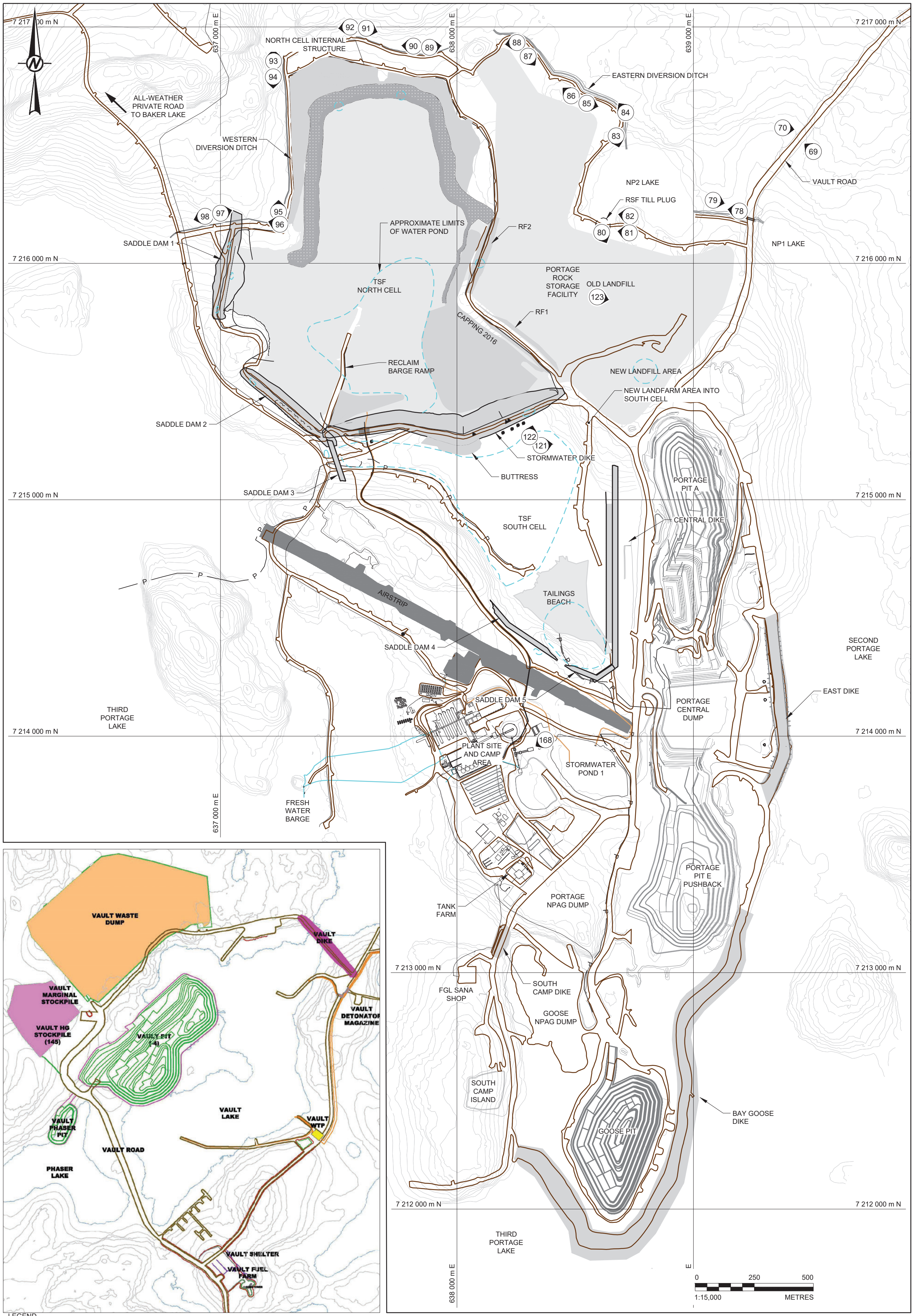
| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | G2 |

Path: C:\Users\CPachis\AppData\Local\Temp\6\AcPublish_34556\ | File Name: 21468006-5000-01.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25 mm

0




LEGEND

TOPOGRAPHIC CONTOUR

IDENTIFICATION AND DIRECTION OF PHOTOGRAPHY TAKEN DURING THE ANNUAL INSPECTION OF 2021

NOTE

GRID REFERENCE: NAD 83, UTM ZONE 14.

REFERENCE

DRAWING BASE PROVIDED BY AEM LTD., MEADOWBANK DIVISION IN "MBK Site map updated JULY 2014.dwg" DATED JULY 8, 2014.

CLIENT

AGNICO EAGLE

CONSULTANT

GOLDER MEMBER OF WSP

| | |
|---|---|
| YYYY-MM-DD | 2022-01-10 |
| PREPARED | M. Habersetzer |
| DESIGN | I. Arroub |
| REVIEW | M. Habersetzer |
| APPROVED | Y. Boulianne |

PROJECT

2021 ANNUAL GEOTECHNICAL INSPECTION
MEADOWBANK GOLD MINE, NUNAVUT

TITLE

**MEADOWBANK MINE SITE DURING THE ANNUAL INSPECTION OF 2021**

| PROJECT No. | PHASE | Rev. | FIGURE |
|---|---|---|---|
| 21468006 | 5000 | 0 | H1 |

**APPENDIX A**

# Dewatering Dikes

**APPENDIX A1**

# East Dike

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 27, 2021 |
| **Location:** | East Dike | **Reviewed:** | Yves Boulianne |

| GENERAL INFORMATION | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill embankment with a soil bentonite cut-off wall and downstream filters | | |
| **Weather Conditions:** | Sunny | **Temperature:** | 15°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 57, 58, 59, 60, 61, 62, 67 | |
| 1.1 Crest elevation | 136.5 m<br>Cut-off 136.1m | | Design thermal cap crest revised in 2011 to El. 136.5 m (Golder 2011) |
| 1.2 Reservoir level | 133.07 m U/S | | |
| Current freeboard | 3.03 m | | Design 2 m. |
| 1.3 Distance to tailings pond (if applicable) | Not applicable | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 1.4 Surface cracking | Tension crack (approx. 3 m in length) around Sta. 60+480 m, inactive and completely healed. | | |
| 1.5 Unexpected settlement | None | | |
| 1.6 Lateral movement | Not apparent | | |
| 1.7 Other unusual conditions | None | | |
| **2. UPSTREAM SLOPE** | | 57, 58, 60, 61, 67 | |
| 2.1 Slope angle | Approx. 1.6H:1V | | |
| 2.2 Signs of erosion | Stable | | |
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | None observed | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 2.5 Face liner condition (if applicable) | Not applicable | | |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 63, 64, 65, 66 | |
| 3.1 Slope angle | Approx.1.6H:1V | | |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | Not apparent | | |
| 3.6 Vegetation growth | None observed | | |
| 3.7 Other unusual conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | 56, 63, 64, 65, 66 | |
| 4.1 Seepage from dam | Yes, presence of 3 zones | | Zone of seepage downstream near Sta. 60+247. A sump is installed (pumping system located in container on the photo). No additional seepage observed at the surface of the ground. Pumping collection system started on April 4, 2012. Flow is being monitored since July 2013. |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| | | | Zone of seepage downstream near Sta. 60+498. A sump is installed (pumping system located in container on the photo). Ponded water nearby. No additional seepage observed at the surface of the ground during the inspection. Pumping collection system started on April 4, 2012. Flow is being monitored since July 2013. |
| | | | Seepage zone near Sta. 60+575. According to AEM, this zone was practically dry all year. Water ponding was observed during inspection but no flow was noticed. |
| 4.2 Signs of erosion | Not observed | | |
| 4.3 Signs of turbidity in seepage water | Not observed | | Based on AEM's monthly report: seepage pumped into Portage Pit instead of Second Portage Lake after May 6th 2021 due to high TSS criteria. This is usual for the freshet season. |
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | None | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |
| **6. RESERVOIR** | | | |
| 6.1 Stability of slopes | Stable | | Low relief region, stable upstream and downstream of dike. Portage Pit is on the downstream side of the dike. |
| 6.2 Distance to nearest slide (if applicable) | None observed | | |
| 6.3 Estimate of slide volume (if applicable) | Not applicable | | |
| 6.4 Floating debris | None observed | | |
| 6.5 Other unusual conditions | None | | |
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | | | |
| 7.1 Surface condition | No spillway or outlet structure exists, only dewatering pump | | |
| 7.2 Signs of erosion | | | |
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |
| 7.10 Other unusual conditions | No | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | Yes | | See Section 3.1.2 of the report. |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | No data after June 2016. See Section 3.1.2 of the report. |
| 8.4 Settlement monuments | Not anymore | | They have been removed in the past. |
| 8.5 Seismograph | Periodic | | See Section 3.1.2 of the report. |
| 8.6 Inclinometer | Yes | | See Section 3.1.2 of the report |
| 8.7 Weirs and flow monitors | Yes | | Flow meters are installed for the two pumping systems downstream. The flow of the seepage zone at Sta. 60+575 is measured using a pipe. |
| 8.8 Data logger(s) | Yes | | The piezometers and thermistors on East Dike have automatic data collection since June 2012 (data transmitted every 3 hours). |
| 8.9 Other | | | |
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 9.1.3 Date of last revision | November 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES** | | | |
| **Inspector's Signature** | Marion Habersetzer | **Date:** | July 27, 2021 |

**Photograph A1-1 East Dike**

**Date**: July 27, 2021 **Photo Number**: 62

**Description**: From approximately Sta. 60+450, looking north at the crest.

**Photograph A1-2 East Dike**

**Date**: July 27, 2021 **Photo Number**: 59

**Description**: From approximately Sta. 60+450, looking south at the crest.

**Photograph A1-3 East Dike**

**Date**: July 27, 2021 **Photo Number**: 60

**Description**: From approximately Sta. 60+450 upstream, looking south at the crest.

**Photograph A1-4 East Dike**

**Date**: July 27, 2021 **Photo Number**: 61

**Description**: From approximately Sta. 60+450 upstream, looking north at the crest.

**Photograph A1-5 East Dike**

**<u>Date</u>**: July 27, 2021 **<u>Photo Number</u>**: 67

**<u>Description</u>**: From approximately Sta. 60+810, looking south at the crest and upstream slope.


**Photograph A1-6 East Dike**

**<u>Date</u>**: July 27, 2021 **<u>Photo Number</u>**: 58

**<u>Description</u>**: From Sta. 60+300 upstream, looking north at the crest and upstream slope.

**Photograph A1-7 East Dike**

**Date**: July 27, 2021 **Photo Number**: 57

**Description**: From approximately Sta. 60+250 upstream, looking south at the upstream slope.

**Photograph A1-8 East Dike**

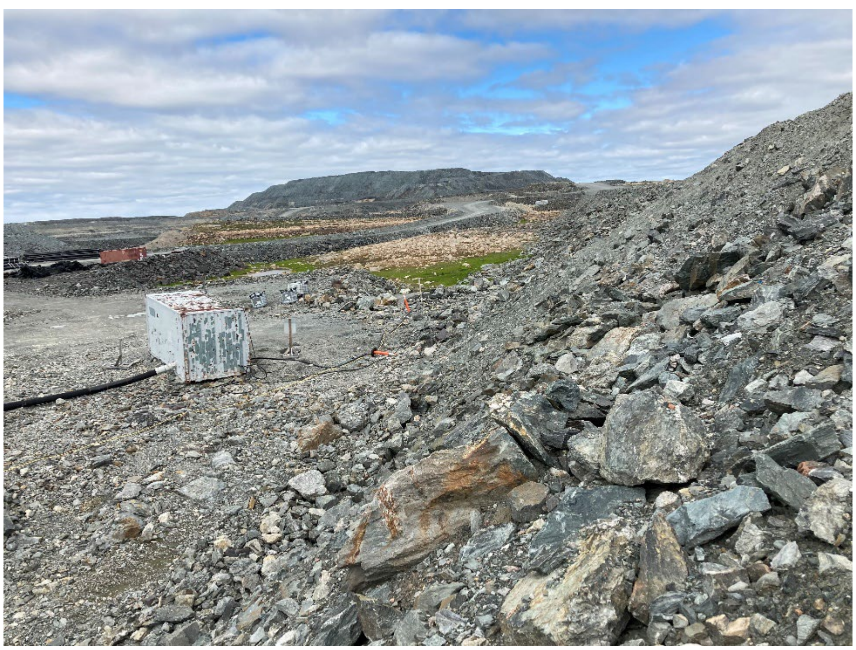
**Date**: July 27, 2021 **Photo Number**: 56

**Description**: From approximately Sta. 60+250, looking west at the downstream side and toe.

**Photograph A1-9 East Dike**

**Date**: July 27, 2021 **Photo Number**: 64

**Description**: From approximately Sta. 60+475, looking south at the downstream toe.



**Photograph A1-10 East Dike**

**Date**: July 27, 2021 **Photo Number**: 63

**Description**: From approximately Sta. 60+500, looking north at the downstream toe.

**Photograph A1-11 East Dike**

**<u>Date</u>**: July 27, 2021 **<u>Photo Number</u>**: 66

**<u>Description</u>**: From approximately Sta. 60+560, looking south at the downstream toe.

**Photograph A1-12 East Dike**

**<u>Date</u>**: July 27, 2021 **<u>Photo Number</u>**: 65

**<u>Description</u>**: From approximately Sta. 60+560, looking north at the downstream slope and toe.

**APPENDIX A2**

# South Camp Dike

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 27, 2021 |
| **Location:** | South Camp Dike | **Reviewed:** | Yves Boulianne |

| **GENERAL INFORMATION** | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill shell with upstream filter, a bituminous geomembrane liner and protective cover. | | |
| **Weather Conditions:** | Sunny | **Temperature:** | 15°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 8, 10, 11, 12, 13 | |
| 1.1 Crest elevation | El. 136.6 m (rockfill)<br>El. 134.7 m (liner) | | |
| 1.2 Reservoir level | U/S El.133.7 m<br>D/S | | No water observed at downstream toe since 2011, except periodic run-off. |
| Current freeboard | 2.9 m (rockfill crest)<br>1.0 m (liner crest) | | |
| 1.3 Distance to tailings pond (if applicable) | Not applicable | | |
| 1.4 Surface cracking | None at the time of inspection | | |
| 1.5 Unexpected settlement | None at the time of inspection | | |
| 1.6 Lateral movement | Not apparent | | |
| 1.7 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **2. UPSTREAM SLOPE** | | 10, 11 | |
| 2.1 Slope angle | Approx. 1.3H: 1V | | Adequate |
| 2.2 Signs of erosion | None observed | | |
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | Liner not visible at the time of the inspection | | Bituminous geomembrane liner. Compacted granular material mixed with bentonite was placed above the liner, followed by a thermal cap layer covering the entire liner face. |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 9, 13 | |
| 3.1 Slope angle | Approx. 1.4H:1V | | Adequate |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | None observed. | | |
| 3.6 Vegetation growth | No | | |
| 3.7 Other unusual conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | 9, 13 | |
| 4.1 Seepage from dam | Accumulation of run-off water. | | Little water ponding. No sign of flow. |
| 4.2 Signs of erosion | None observed | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 4.3 Signs of turbidity in seepage water | None | | |
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | None | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |
| **6. RESERVOIR** | | | |
| 6.1 Stability of slopes | Stable | | |
| 6.2 Distance to nearest slide (if applicable) | Not applicable | | |
| 6.3 Estimate of slide volume (if applicable) | None observed | | |
| 6.4 Floating debris | None | | |
| 6.5 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | | | |
| 7.1 Surface condition | No spillway or outlet structure exists | | |
| 7.2 Signs of erosion | | | |
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |
| 7.10 Other unusual conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | No | | |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | Section 3.2.2 of the report describes the thermal condition. |
| 8.4 Settlement monuments | No | | |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |
| 8.7 Weirs and flow monitors | No | | |
| 8.8 Data logger(s) | Yes | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 8.9 Other | No | | |
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | November 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES** | | | |
| **Inspector's Signature** | Marion Habersetzer | **Date:** | July 27, 2021 |

**Photograph A2-1 South Camp Dike**

**Date**: July 27, 2021 **Photo Number**: 11

**Description**: From the south abutment, looking north at the upstream slope and the thermistors instrumentation set-up.

**Photograph A2-2 South Camp Dike**

**Date**: July 27, 2021 **Photo Number**: 10

**Description**: From the north abutment, looking south at the upstream slope and thermistors instrumentation set-up.

**Photograph A2-3 South Camp Dike**

**Date**: July 27, 2021 **Photo Number**: 12

**Description**: From the south abutment, looking north at the crest.

**Photograph A2-4 South Camp Dike**

**Date**: July 27, 2021 **Photo Number**: 8

**Description**: From the north abutment, looking south at the crest.

**Photograph A2-5 South Camp Dike**

**<u>Date</u>**: July 27, 2021 **<u>Photo Number</u>**: 9

**<u>Description</u>**: From the north abutment, looking south at the downstream slope. There is some water ponding, from run-off.

**Photograph A2-6 South Camp Dike**

**<u>Date</u>**: July 27, 2021 **<u>Photo Number</u>**: 13

**<u>Description</u>**: From the south abutment, looking north at the downstream slope. There is some water ponding, from run-off.

**APPENDIX A3**

# Bay-Goose Dike

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 27, 2021 |
| **Location:** | Bay-Goose Dike | **Reviewed:** | Yves Boulianne |

| **GENERAL INFORMATION** | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill embankment with a cut-off wall (soil-bentonite, cement-soil-bentonite and jet grouting columns) and downstream filters | | |
| **Weather Conditions:** | Sunny | **Temperature:** | 15°C |

| **INSPECTION ITEM** | **OBSERVATIONS DATA** | **PHOTO** | **COMMENTS & OTHER DATA** |
|---|---|---|---|
| **1. DAM CREST** | | 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 29, 30, 32, 33, 34, 35, 36, 37, 38, 39, 40, 45, 46, 50, 51, 52 | |
| 1.1 Crest elevation | +/-138<br>cut-off 136.1m | | Thermal cap completed in May 2013. |
| 1.2 Reservoir level | 133.7 m upstream | | Downstream side dewatered since mid-November 2011. |
| Current freeboard | 2.4 m | | Design 2.0 m. |
| 1.3 Distance to tailings pond<br>(if applicable) | Not applicable | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 1.4 Surface cracking | Yes | | The tension cracks observed in 2013 on the upstream side within the thermal cap placed during winter 2013 are still visible but are no longer active. |
| 1.5 Unexpected settlement | Yes | | The rockfill cap added over the cut-off in the winter of 2013 is showing settlement all along the upstream side of the dike and over the cut-off. Settlement varies from 0.1 m to > 1 m. No longer active. |
| 1.6 Lateral movement | Not apparent | | |
| 1.7 Other unusual conditions | Yes | | |
| **2. UPSTREAM SLOPE** | | 15, 16, 21, 22, 25, 26, 31, 32, 39, 40, 45, 46, 51, 52 | |
| 2.1 Slope angle | Approx. 1.6H:1V | | Rockfill |
| 2.2 Signs of erosion | Stable | | |
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | Not applicable | | |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 19, 20, 23, 24, 28, 29, 30, 35, 36, 41, 42, 43, 44, 47, 48, 49, 50 | |
| 3.1 Slope angle | Approx.1.6H:1V | | |
| 3.2 Signs of erosion | None observed | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | Not apparent | | |
| 3.6 Vegetation growth | None observed | | |
| 3.7 Other unusual conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | 19, 20, 23, 24, 28, 29, 30, 35, 36, 41, 42, 43, 44, 47, 48, 49, 50 | |
| 4.1 Seepage from dike | Yes | | Seepage zone observed as well as water pond. The seepage is being monitored by the mine and does not show signs of aggravation. |
| | North Channel | | Monitored by stations 8 (30+420) and 9 (30+380). Water flowing was observed during the inspection. |
| | Central Shallow | | Presence of 2 seepage channels at 30+650 and 30+625. Flow was observed during inspection at 30+650. Monitored by station 7. |
| | Central Channel | | Presence of a seepage channel at Sta. 31+165. Water ponding was observed at the time of the inspection. It was pumped once after freshet only. |
| | Channel 3 | | Light flow observed during inspection. Monitored by station 6. |
| | Channel 1 | | This seepage channel was not flowing at the time of the inspection. |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| | Water Ponds | | Presence of water pond with no sign of seepage. Located at 31+750. Water was observed downstream of Channel 1 ponding against the ring road of Goose Pit. |
| 4.2 Signs of erosion | None observed | | |
| 4.3 Signs of turbidity in seepage water | No. | | |
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | Yes | | Inflow of water on pit wall. Probably due to the Bay-Goose fault and rock quality. In the vicinity of Channels 1, 2 and 3. Not monitored anymore. |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **6. RESERVOIR** | | 15, 16, 21, 22, 25, 26, 31, 32, 39, 40, 45, 46, 51, 52 | |
| 6.1 Stability of slopes | Stable | | |
| 6.2 Distance to nearest slide (if applicable) | None observed | | |
| 6.3 Estimate of slide volume (if applicable) | Not applicable | | |
| 6.4 Floating debris | None observed | | |
| 6.5 Other unusual conditions | None | | |
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | | | |
| 7.1 Surface condition | No spillway or outlet structure exists, only dewatering pump. | | |
| 7.2 Signs of erosion | | | |
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 7.10 Other unusual conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | Yes | | See Section 3.3.2 of the report. |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | See Section 3.3.2 of the report. |
| 8.4 Settlement monuments | No | | Survey monuments removed in the past. |
| 8.5 Seismograph | Periodic | | See Section 3.3.2 of the report. |
| 8.6 Inclinometer | Yes | | See Section 3.3.2 of the report. |
| 8.7 Weirs and flow monitors | Yes | | Seepage monitoring system installed at seepage channel to monitor flow. |
| 8.8 Data logger(s) | Yes | | The piezometers and the thermistors have automatic data transmission (every 3 hours). |
| 8.9 Other | | | |
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | November 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES** | | | |

| | | | |
|---|---|---|---|
| **Inspector's Signature** | Marion Habersetzer | **Date:** | July 27, 2021 |

**Photograph A3-1 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 51

**Description**: From approximately Sta. 30+142 (north abutment) looking southwest at the crest and upstream slope.

**Photograph A3-2 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 52

**Description**: From approximately Sta. 30+130 (north abutment), looking north at the crest and upstream slope.

**Photograph A3-3 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 50

**Description**: From approximately Sta. 30+340 on the crest, looking northeast at the dam crest and downstream slope

**Photograph A3-4 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 49

**Description**: From approximately Sta. 30+340, looking northwest at the north seepage channel.

**Photograph A3-5 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 48

**Description**: From approximately Sta. 30+450, looking north at the downstream slope.

**Photograph A3-6 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 46

**Description**: From Sta. 30+500, looking northeast at the crest and the upstream slope.

**Photograph A3-7 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 45

**Description**: From Sta. 30+500, looking south at the crest and the upstream slope.

**Photograph A3-8 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 47

**Description**: From Sta. 30+500, looking west at the downstream slope and toe.

**Photograph A3-9 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 39

**Description**: From approximately Sta. 31+130, looking south at the upstream slope.

**Photograph A3-10 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 40

**Description**: From approximately Sta. 31+130, looking north at the crest and upstream slope.

**Photograph A3-11 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 41

**Description**: From approximately Sta. 31+080 on the crest, looking north at the downstream slope and toe.

**Photograph A3-12 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 42

**Description**: From approximately Sta. 31+080 on the crest, looking southwest at the pond of water at Central Channel seepage at Sta. 31+165.

**Photograph A3-13 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 37

**Description**: From approximately Sta. 31+130, looking southwest at the crest.

**Photograph A3-14 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 38

**Description**: From approximately Sta. 31+130, looking north at the crest.

**Photograph A3-15 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 36

**Description**: From approximately Sta. 31+280 on the crest, looking north at the downstream slope and toe area.

**Photograph A3-16 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 35

**Description**: From approximately Sta. 31+280 on the crest, looking southwest at the downstream slope and the water pond at the downstream toe at Sta. 31+350.

**Photograph A3-17 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 34

**Description**: From approximately Sta. 31+280, looking south at the crest.

**Photograph A3-18 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 33

**Description**: From approximately Sta. 31+280, looking northeast at the crest.

**Photograph A3-19 Bay Goose Dike**

**Date: July 27, 2021** **Photo Number:** 31

**Description**: From approximately Sta. 31+475, looking west at the crest. Old cracks are disappearing.

**Photograph A3-20 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 32

**Description**: From approximately Sta. 31+475, looking northeast at the crest. Old cracks are disappearing.

**Photograph A3-21 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 30

**Description**: From approximately Sta. 31+475, looking east at the crest and the downstream slope.

**Photograph A3-22 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 29

**Description**: From approximately Sta. 31+475, looking west at the crest and the downstream slope toward Channel 3.

**Photograph A3-23 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 28

**Description**: From approximately Sta. 31+570, looking north toward Channel 3.

**Photograph A3-24 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 27

**Description**: From approximately Sta. 31+645, looking east at the crest.

**Photograph A3-25 Bay Goose Dike**

**<u>Date</u>**: July 27, 2021 **<u>Photo Number</u>**: 26

**<u>Description</u>**: From approximately Sta. 31+645, looking northwest at the crest and upstream slope.

**Photograph A3-26 Bay Goose Dike**

**<u>Date</u>**: July 27, 2021 **<u>Photo Number</u>**: 25

**<u>Description</u>**: From approximately Sta. 31+640, looking southeast at the upstream slope.

**Photograph A3-27 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 23

**Description**: From the crest at approximately Sta. 31+740. Looking southeast downstream toward Channel 3.

**Photograph A3-28 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 24

**Description**: From the crest at approximately Sta. 31+740, looking north downstream at the water pond at Sta. 31+750.

**Photograph A3-29 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 21

**Description**: From approximately Sta. 31+870, looking northwest at the crest and upstream slope.

**Photograph A3-30 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 22

**Description**: From approximately Sta. 31+870, looking southeast at the crest and upstream slope.

**Photograph A3-31 Bay Goose Dike**

**<u>Date</u>**: July 27, 2021 **<u>Photo Number</u>**: 19

**<u>Description</u>**: From approximately Sta. 31+920, looking south at the crest.

**Photograph A3-32 Bay Goose Dike**

**<u>Date</u>**: July 27, 2021 **<u>Photo Number</u>**: 20

**<u>Description</u>**: From approximately Sta. 31+920, looking northwest at the crest.

**Photograph A3-33 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 44

**Description**: From approximately Sta. 31+920, looking southeast at the downstream slope and toe.

**Photograph A3-34 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 43

**Description**: From about Sta. 31+920, looking northwest at the downstream slope and toe toward Channel 1 monitoring station.

**Photograph A3-35 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 17

**Description**: From approximately Sta. 32+030 looking southeast at the crest and downstream slope.

**Photograph A3-36 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 18

**Description**: From approximately Sta. 32+030 looking southeast at the crest.

**Photograph A3-39 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 16

**Description**: From approximately Sta. 32+025 (south abutment) looking east at the crest and upstream slope. Zone of high magnitude settlement in the ultramafic cap. The tension cracks seem no longer active.

**Photograph A3-40 Bay Goose Dike**

**Date**: July 27, 2021 **Photo Number**: 15

**Description**: From approximately Sta. 32+025 (south abutment) looking west at the crest. Zone of high magnitude settlement in the ultramafic cap. The tension cracks seem no longer active.

**APPENDIX A4**

# Vault Dike

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 27, 2021 |
| **Location:** | Vault Dike | **Reviewed:** | Yves Boulianne |

| GENERAL INFORMATION | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill embankment with filter zones, impervious upstream liner (bituminous membrane) and an upstream key trench (aggregate mixed with bentonite) | | |
| **Weather Conditions:** | Sunny | **Temperature:** | 15°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 71, 72, 73, 74, 75, 76 | |
| 1.1 Crest elevation | 142.4 m | | |
| 1.2 Reservoir level | 139.64 m U/S | | |
| Current freeboard | 2.76 m | | |
| 1.3 Distance to tailings pond (if applicable) | Not applicable | | |
| 1.4 Surface cracking | No | | |
| 1.5 Unexpected settlement | No | | |
| 1.6 Lateral movement | Not apparent | | |
| 1.7 Other unusual conditions | No | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **2. UPSTREAM SLOPE** | | 72, 76 | |
| 2.1 Slope angle | Approx. 1.5H:1V | | |
| 2.2 Signs of erosion | Stable | | |
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | No | | |
| 2.5 Face liner condition (if applicable) | Not applicable | | |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 71, 73, 74 | |
| 3.1 Slope angle | Approx.1.5H:1V | | |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | No | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | Not apparent | | |
| 3.6 Vegetation growth | None observed | | |
| 3.7 Other unusual conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | | |
| 4.1 Seepage from dam | None | | |
| 4.2 Signs of erosion | Not observed | | |
| 4.3 Signs of turbidity in seepage water | No | | |
| 4.4 Discoloration/staining | No | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | None | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |
| **6. RESERVOIR** | | | |
| 6.1 Stability of slopes | Good conditions | | |
| 6.2 Distance to nearest slide (if applicable) | None observed | | |
| 6.3 Estimate of slide volume (if applicable) | Not applicable | | |
| 6.4 Floating debris | None observed | | |
| 6.5 Other unusual conditions | None | | |
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | No spillway or outlet structure exists, only dewatering pump. | | |
| 7.1 Surface condition | | | |
| 7.2 Signs of erosion | | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |
| 7.10 Other unusual conditions | No | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | No | | |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | See Section 3.4.2 of the report. |
| 8.4 Settlement monuments | No | | |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |
| 8.7 Weirs and flow monitors | No | | |
| 8.8 Data logger(s) | No | | |
| 8.9 Other | | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | November 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES** | | | |

| | | | |
|---|---|---|---|
| **Inspector's Signature** | Marion Habersetzer | **Date:** | July 27, 2021 |

**Photograph A4-1 Vault Dike**

**Date**: July 27, 2021 **Photo Number**: 71

**Description**: From the east abutment, looking northwest at the crest.

**Photograph A4-2 Vault Dike**

**Date**: July 27, 2021 **Photo Number**: 74

**Description**: From downstream, looking southeast at the downstream toe.

**Photograph A4-3 Vault Dike**

**Date**: July 27, 2021 **Photo Number**: 73

**Description**: From downstream, looking northwest at the downstream toe.

**Photograph A4-4 Vault Dike**

**Date:** July 27, 2021 **Photo Number:** 75

**Description:** From the west abutment, looking southeast at the crest.

**Photograph A4-5 Vault Dike**

**Date**: July 27, 2021 **Photo Number**: 76

**Description**: From the upstream side, looking southeast at the upstream slope.

**Photograph A4-6 Vault Dike**

**Date**: July 27, 2021 **Photo Number**: 72

**Description**: From the upstream side, looking northwest at the upstream slope.

**APPENDIX A5**

# Whale Tail Dike

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Whale Tail Project | **Date:** | August 2, 2021 |
| **Location:** | Whale Tail Dike | **Reviewed:** | Yves Boulianne |

| **GENERAL INFORMATION** | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill shell with cement-bentonite secant pile cut-off wall enclosed in fine and coarse filter layers. 10 m deep grout curtain in the bedrock in the western section of the dike. Downstream grout blanket at bedrock interface all along the dike. | | |
| **Weather Conditions:** | Sunny | **Temperature:** | 20°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 299, 300, 301, 302 | |
| 1.1 Crest elevation | El. 159 m (rockfill)<br>El. 157 m (cut-off wall) | | A 2 m rockfill termal cap covers the cut-off wall (cement-bentonite secant piles) |
| 1.2 Reservoir level | U/S El.155.3 m (Whale Tail South) | | Operational water level: 155.5 m |
| Current freeboard | 3.7 m (rockfill crest)<br>1.7 m (cut-off wall) | | |
| 1.3 Distance to tailings pond (if applicable) | Not applicable | | |
| 1.4 Surface cracking | Some at the East abutment | | Associated to foundation thawing |
| 1.5 Unexpected settlement | Some at the East abutment | | Associated to foundation thawing |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 1.6 Lateral movement | Not apparent | | |
| 1.7 Other unusual conditions | None | | |
| **2. UPSTREAM SLOPE** | | 286, 289, 290, 293, 296 | |
| 2.1 Slope angle | 1.5H:1V(dike)<br>1.3H:1V (U/S berm) | | Adequate |
| 2.2 Signs of erosion | None observed | | |
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | Not applicable | | |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 288, 295, 299, 301, 302, 303, 304, 305, 306, 307, 308 | |
| 3.1 Slope angle | 1.5H:1V(dike)<br>1.3H:1V (D/S berm) | | Adequate |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | None observed. | | |
| 3.6 Vegetation growth | No | | |
| 3.7 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **4. DOWNSTREAM TOE AREA** | | 288, 295, 299, 301, 302, 303, 304, 305, 306, 307, 308 | |
| 4.1 Seepage from dam | Yes | 306, 307 | Collected in a trench from Sta. 0+430 to 0+720. Seepage interception system pumping water compose of 4 pumping stations (inactive). |
| 4.2 Signs of erosion | None observed | | |
| 4.3 Signs of turbidity in seepage water | None | | All seepage water is clear |
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | None | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |
| **6. RESERVOIR** | | 286, 289, 290, 293, 296 | |
| 6.1 Stability of slopes | Stable | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 6.2 Distance to nearest slide (if applicable) | Not applicable | | |
| 6.3 Estimate of slide volume (if applicable) | None observed | | |
| 6.4 Floating debris | None | | |
| 6.5 Other unusual conditions | None | | |
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | No spillway or outlet structure exists | | |
| 7.1 Surface condition | | | |
| 7.2 Signs of erosion | | | |
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |
| 7.10 Other unusual conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | Yes | | 9 piezometer holes with each 3 instruments. See Section 4.1.2 of the report |
| 8.2 Settlement cells | No | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 8.3 Thermistors | Yes | | 16 piezometers in the dike. See Section 4.1.2 of the report. |
| 8.4 Settlement monuments | No | | |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | Yes | | 4 shape array accelerometers. See Section 4.1.2 of the report. |
| 8.7 Weirs and flow monitors | Yes | | 2 V-notch weirs (0+430 and 0+560) |
| 8.8 Data logger(s) | Yes | | |
| 8.9 Other | No | | |
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | November 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES** | | | |
| **Inspector's Signature** | Marion Habersetzer | **Date:** | August 2, 2021 |

**Photograph A5-1 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**:305

**Description**: From approx. Sta. 0+250 downstream (P4 pumping station), looking east. A large amount of water is ponding.

**Photograph A5-2 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**:304

**Description**: From approx. Sta. 0+250 downstream (P4 pumping station), looking southwest. A large amount of water is ponding.

**Photograph A5-3 Whale Tail Dike**

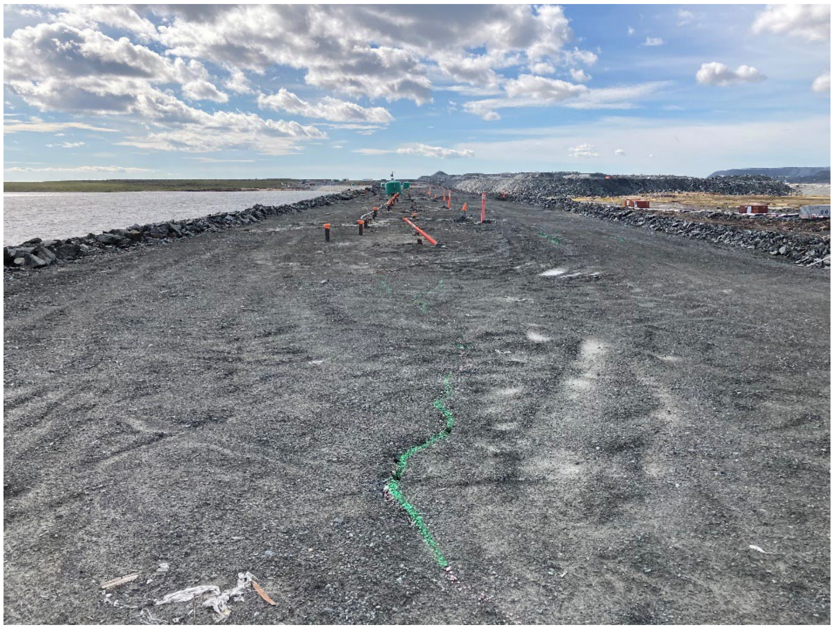
**Date**: August 2, 2021 **Photo Number**:309

**Description**: From approx. Sta. 0+600 downstream (P1 pumping station), looking southeast. Some erosion of the granular fill under the seacan.

**Photograph A5-4 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 296

**Description**: From approx. Sta. 0+725 (east abutment), looking southwest at the upstream slope and the discharge line from the water treatment plant.



**Photograph A5-5 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 298

**Description**: From approx. Sta. 0+725 (east abutment), looking west at the crest. Presence of tension cracks and settlement on the crest.

**Photograph A5-6 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 299

**Description**: From approx. Sta. 0+725 (east abutment), looking west at the downstream slope.

**Photograph A5-7 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 300

**Description**: From approx. Sta. 0+700 (east abutment), looking west at the crest. Tension cracks (150 mm wide).

**Photograph A5-8 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 293

**Description**: From approx. Sta. 0+575, looking west at the upstream slope.

**Photograph A5-9 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 294

**Description**: From approx. Sta. 0+575, looking west at the crest.

**Photograph A5-10 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 295

**Description**: From approx. Sta. 0+575, looking west at the downstream slope and downstream platform.

**Photograph A5-11 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 302

**Description**: From approx. Sta. 0+400, looking west at the downstream slope and downstream platform.

**Photograph A5-12 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 301

**Description**: From approx. Sta. 0+400, looking east at the downstream slope and downstream platform.

**Photograph A5-13 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 291

**Description**: From approx. Sta. 0+400, looking west at the crest.

**Photograph A5-14 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 292

**Description**: From approx. Sta. 0+400, looking east at the crest.

**Photograph A5-15 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 289

**Description**: From approx. Sta. 0+400, looking west at the upstream slope.

**Photograph A5-16 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 290

**Description**: From approx. Sta. 0+400, looking east at the upstream slope.

**Photograph A5-17 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 286

**Description**: From approx. Sta. 0+200 (west abutment), looking northeast at the upstream slope.

**Photograph A5-18 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 287

**Description**: From approx. Sta. 0+200 (west abutment), looking northeast at the crest.

**Photograph A5-19 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 288

**Description**: From approx. Sta. 0+200 (west abutment), looking northeast at the downstream slope and downstream platform.

**Photograph A5-20 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 303

**Description**: From approx. Sta. 0+200 on the downstream platform, looking northeast at the downstream slope and platform.

**Photograph A5-21 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 307

**Description**: From approx. Sta. 0+430 downstream, looking west at the seepage collection trench and a V-notch.

**Photograph A5-22 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 306

**Description**: From approx. Sta. 0+450 downstream, looking east at the seepage collection trench and downstream toe.

**Photograph A5-23 Whale Tail Dike**

**Date**: August 2, 2021 **Photo Number**: 308

**Description**: From approx. Sta. 0+675 downstream, looking west at the downstream slope and platform.

**APPENDIX A6**

# IVR Dike D-1

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Whale Tail Project | **Date:** | August 2, 2021 |
| **Location:** | IVR Dike | **Reviewed:** | Yves Boulianne |

| GENERAL INFORMATION | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill shell with a LLDPE geomembrane liner tied in a fine filter amended with bentonite key trench and an upstream thermal berm. | | |
| **Weather Conditions:** | Cloudy | **Temperature:** | 10°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 238, 239, 240, 241, 242, 243, 245, 247, 249, 250, 251, 252, 253, 254 | |
| 1.1 Crest elevation | El. 165.5 m (rockfill and liner) | | |
| 1.2 Reservoir level | U/S El. 161.65 m | | IVR Attenuation Pond |
| Current freeboard | 3.85 m (rockfill crest and liner) | | Max. operational water level: 163.2 m |
| 1.3 Distance to tailings pond (if applicable) | Not applicable | | |
| 1.4 Surface cracking | Yes | | Likely related to rockfill and shallow foundation thawing after winter construction |
| 1.5 Unexpected settlement | Yes | | Likely related to rockfill and shallow foundation thawing after winter construction |
| 1.6 Lateral movement | Not apparent | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 1.7 Other unusual conditions | None | | |
| **2. UPSTREAM SLOPE** | | 239, 240, 241, 242, 243, 244, 245 | |
| 2.1 Slope angle | 2H: 1V | | Adequate |
| 2.2 Signs of erosion | None observed | | |
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | Not observed | | Liner covered in a fine filter protection layer. |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 238, 249, 251, 252, 253, 254 | |
| 3.1 Slope angle | 2H:1V | | Adequate |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | None observed. | | |
| 3.6 Vegetation growth | None | | |
| 3.7 Other unusual conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | 238, 249, 250, 251, 252, 253, 254 | |
| 4.1 Seepage from dam | None observed | | Water ponding at the toe. No flow observed. |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 4.2 Signs of erosion | None observed | | |
| 4.3 Signs of turbidity in seepage water | None | | |
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | None | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | None | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |
| **6. RESERVOIR** | | 244 | |
| 6.1 Stability of slopes | Stable | | |
| 6.2 Distance to nearest slide (if applicable) | Not applicable | | |
| 6.3 Estimate of slide volume (if applicable) | None observed | | |
| 6.4 Floating debris | None | | |
| 6.5 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | | 246, 247, 248, 249 | |
| 7.1 Surface condition | Good | | |
| 7.2 Signs of erosion | None | | |
| 7.3 Signs of movement (deformation) | None | | |
| 7.4 Cracks | None | | |
| 7.5 Settlement | None | | |
| 7.6 Presence of debris or blockage | Yes, piping in the lower spillway | | |
| 7.7 Closure mechanism operational | None | | |
| 7.8 Slope protection | None | | |
| 7.9 Instability of side slopes | None | | |
| 7.10 Other unusual conditions | None | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | No | | |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | See Section 4.3.2 of the report. |
| 8.4 Settlement monuments | No | | |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |
| 8.7 Weirs and flow monitors | No | | |
| 8.8 Data logger(s) | Yes | | |
| 8.9 Other | No | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | November 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES** | | | |
| **Inspector's Signature** | Marion Habersetzer | **Date:** | August 2, 2021 |

**Photograph A6-1 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 239

**Description**: From approx. Sta. 0+540 (east abutment), looking west at the crest (thermal cap) and upstream slope.

**Photograph A6-2 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 238

**Description**: From approx. Sta. 0+540 (east abutment), looking west at the crest (thermal cap) and downstream slope.

**Photograph A6-3 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 240

**Description**: From approx. Sta. 0+480, looking west at the crest (thermal cap) and upstream slope. Presence of tension cracks in the rockfill of the thermal cap.

**Photograph A6-4 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 241

**Description**: From approx. Sta. 0+430, looking west at the crest and upstream slope. Presence of tension cracks and a pothole.

**Photograph A6-5 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 254

**Description**: From approx. Sta. 0+430, looking west at the crest and downstream slope. Presence of tension cracks.

**Photograph A6-6 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 243

**Description**: From approx. Sta. 0+300, looking northwest at the crest and upstream slope.

**Photograph A6-7 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 242

**Description**: From approx. Sta. 0+300, looking east at the crest and upstream slope.

**Photograph A6-8 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 252

**Description**: From approx. Sta. 0+300, looking northwest at the crest and downstream slope. Some water ponding at the toe.

**Photograph A6-9 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 253

**Description**: From approx. Sta. 0+300, looking east at the crest and downstream slope. Some water ponding at the toe.

**Photograph A6-10 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 251

**Description**: From approx. Sta. 0+220, looking southeast at the crest and downstream slope. Some water ponding at the toe.

**Photograph A6-11 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 250

**Description**: From approx. Sta. 0+190, looking southwest at the crest and downstream slope. Presence of potholes and water ponding at the toe.

**Photograph A6-12 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 244

**Description**: From approx. Sta. 0+070, looking northeast at the downstream toe and the attenuation pond.

**Photograph A6-13 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 245

**Description**: From approx. Sta. 0+070, looking southeast at the crest and downstream slope.

**Photograph A6-14 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 246

**Description**: From approx. Sta. 0+070, looking southwest at the emergency spillway.

**Photograph A6-15 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 247

**Description**: From approx. Sta. 0+030 (west abutment), looking southeast at the crest. Presence of settlement in the rockfill surface.

**Photograph A6-16 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 248

**Description**: From approx. Sta. 0+050, looking south at the spillway. Presence of piping at the outlet of the spillway.

**Photograph A6-17 IVR Dike D-1**

**Date**: August 2, 2021 **Photo Number**: 249

**Description**: From approx. Sta. 0+050, looking south at the spillway and the crest.

**APPENDIX A7**

# WRSF Dike

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Whale Tail Project | **Date:** | August 2, 2021 |
| **Location:** | WRSF Dike | **Reviewed:** | Yves Boulianne |

| GENERAL INFORMATION | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill shell with a bituminous geomembrane liner tied in a fine filter amended with bentonite and a protective cover. Upstream thermal berm composed of esker partially amended with bentonite and a rockfill protection cover. | | |
| **Weather Conditions:** | Sunny | **Temperature:** | 15°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 275, 276, 277, 278, 279, 280, 281, 282, 283, 284 | |
| 1.1 Crest elevation | El. 158.4 m (rockfill)<br>El. 157.8 m (liner) | | |
| 1.2 Reservoir level | U/S El.151.65 m (WRSF pond) | | |
| Current freeboard | 6.75 m (rockfill crest)<br>6.15 m (liner) | | Operational water level: 154 m |
| 1.3 Distance to tailings pond (if applicable) | Not applicable | | |
| 1.4 Surface cracking | No | | Old cracks are no longer visible. |
| 1.5 Unexpected settlement | No | | |
| 1.6 Lateral movement | Not apparent | | |
| 1.7 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **2. UPSTREAM SLOPE** | | 278, 279, 280, 281 | |
| 2.1 Slope angle | 2H: 1V | | Adequate |
| 2.2 Signs of erosion | None observed | | |
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | Not observed | | Liner covered by thermal berm. |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 275, 284, 285 | |
| 3.1 Slope angle | 1.5H:1V | | Adequate |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | None observed. | | |
| 3.6 Vegetation growth | No | | |
| 3.7 Other unusual conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | 275, 284, 285 | |
| 4.1 Seepage from dam | None observed | | Water ponding at the toe. No flow observed. |
| 4.2 Signs of erosion | None observed | | |
| 4.3 Signs of turbidity in seepage water | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | None | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |
| **6. RESERVOIR** | | 278 | |
| 6.1 Stability of slopes | Stable | | |
| 6.2 Distance to nearest slide (if applicable) | Not applicable | | |
| 6.3 Estimate of slide volume (if applicable) | None observed | | |
| 6.4 Floating debris | None | | |
| 6.5 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | No spillway or outlet structure exists | | |
| 7.1 Surface condition | | | |
| 7.2 Signs of erosion | | | |
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |
| 7.10 Other unusual conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | No | | |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | 9 thermistors. See Section 4.2.2 of the report. |
| 8.4 Settlement monuments | No | | |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |
| 8.7 Weirs and flow monitors | No | | |
| 8.8 Data logger(s) | Yes | | |
| 8.9 Other | No | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | November 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES** | | | |
| **Inspector's Signature** | Marion Habersetzer | **Date:** | August 2, 2021 |

**Photograph A7-1 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 275

**Description**: From approx. Sta. 0+350 (east abutment), looking west at the dike crest and downstream slope. Presence of water ponding at the toe.

**Photograph A7-2 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 276

**Description**: From approx. Sta. 0+350 (east abutment), looking west at the dike crest.

**Photograph A7-3 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 277

**Description**: From approx. Sta. 0+350 (east abutment), looking west at the upstream thermal berm crest.

**Photograph A7-4 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 278

**Description**: From approx. Sta. 0+350 (east abutment), looking west at the upstream thermal berm slope and dewatering ramp.

**Photograph A7-5 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 279

**Description**: From approx. Sta. 0+210, looking east at the upstream thermal berm and dewatering ramp.

**Photograph A7-6 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 280

**Description**: From approx. Sta. 0+210, looking west at the upstream thermal berm.

**Photograph A7-7 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 281

**Description**: From approx. Sta. 0+080 (west abutment), looking east at the upstream thermal berm slope and the upstream toe.

**Photograph A7-8 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 282

**Description**: From approx. Sta. 0+080 (west abutment), looking east at the upstream thermal berm crest.

**Photograph A7-9 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 283

**Description**: From approx. Sta. 0+080 (west abutment), looking east at the dike crest.

**Photograph A7-10 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 284

**Description**: From approx. Sta. 0+080 (west abutment), looking east at the downstream toe.

**Photograph A7-11 WRSF Dike**

**Date**: August 2, 2021 **Photo Number**: 285

**Description**: From approx. Sta. 0+310, looking southwest at the downstream toe and the downstream collection sump.

# APPENDIX A8

## Mammoth Dike

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Whale Tail Project | **Date:** | August 3, 2021 |
| **Location:** | Mammoth Dike | **Reviewed:** | Yves Boulianne |

| **GENERAL INFORMATION** | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill shell with a bituminous geomembrane liner tied in a fine filter amended with bentonite and a protective cover. | | |
| **Weather Conditions:** | Cloudy | **Temperature:** | 15°C |

| **INSPECTION ITEM** | **OBSERVATIONS DATA** | **PHOTO** | **COMMENTS & OTHER DATA** |
|---|---|---|---|
| **1. DAM CREST** | | 318, 319, 320, 321, 322, 323, 324, 325, 326 | |
| 1.1 Crest elevation | El. 155 m (rockfill)<br>El. 153.5 m (liner) | | |
| 1.2 Reservoir level | U/S El.152.61 m (Mammoth Lake) | | |
| Current freeboard | 2.39 m (rockfill crest)<br>0.89 m (liner) | | Operational water level: 152.5 m |
| 1.3 Distance to tailings pond (if applicable) | Not applicable | | |
| 1.4 Surface cracking | Not apparent | | |
| 1.5 Unexpected settlement | Not apparent | | |
| 1.6 Lateral movement | Not apparent | | |
| 1.7 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **2. UPSTREAM SLOPE** | | 319, 320, 321, 322, 323 | |
| 2.1 Slope angle | 2H: 1V | | Adequate |
| 2.2 Signs of erosion | None observed | | |
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | Not observed | | Liner covered by thermal berm. |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 317, 324 | |
| 3.1 Slope angle | 1.5H:1V | | Adequate |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | None observed. | | |
| 3.6 Vegetation growth | No | | |
| 3.7 Other unusual conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | 317, 324 | |
| 4.1 Seepage from dam | None observed | | Water ponding some distance from the toe. No flow observed. The pond was being pumped out at the time of the inspection. |
| 4.2 Signs of erosion | None observed | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 4.3 Signs of turbidity in seepage water | None | | |
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | None | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |
| **6. RESERVOIR** | | 319, 320, 321, 322, 323 | |
| 6.1 Stability of slopes | Stable | | |
| 6.2 Distance to nearest slide (if applicable) | Not applicable | | |
| 6.3 Estimate of slide volume (if applicable) | None observed | | |
| 6.4 Floating debris | None | | |
| 6.5 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | No spillway or outlet structure exists | | |
| 7.1 Surface condition | | | |
| 7.2 Signs of erosion | | | |
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |
| 7.10 Other unusual conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | No | | |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | 3 thermistors. See Section 4.4.2 of the report. |
| 8.4 Settlement monuments | No | | |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |
| 8.7 Weirs and flow monitors | No | | |
| 8.8 Data logger(s) | Yes | | |
| 8.9 Other | No | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | November 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES** | | | |
| **Inspector's Signature** | Marion Habersetzer | **Date:** | August 3, 2021 |

**Photograph A8-1 Mammoth Dike**

**Date**: August 3, 2021 **Photo Number**: 323

**Description**: From approx. Sta. 0+300 (south abutment), looking north to the crest and upstream liner tie-in.

**Photograph A8-2 Mammoth Dike**

**Date**: August 3, 2021 **Photo Number**: 324

**Description**: From approx. Sta. 0+300 (south abutment), looking north to the crest and downstream slope.

**Photograph A8-3 Mammoth Dike**

**Date**: August 3, 2021 **Photo Number**: 318

**Description**: From approx. Sta. 0+100 (north abutment), looking south to the crest.

**Photograph A8-4 Mammoth Dike**

**Date**: August 3, 2021 **Photo Number**: 317

**Description**: From approx. Sta. 0+100 (north abutment), looking south downstream slope and downstream area. Presence of a water pond some distance away from the toe, equipped with a pump.

**Photograph A8-5 Mammoth Dike**

**Date**: August 3, 2021 **Photo Number**: 319

**Description**: From approx. Sta. 0+110 (north abutment), looking south to the upstream liner tie-in.

**Photograph A8-6 Mammoth Dike**

**Date**: August 3, 2021 **Photo Number**: 321

**Description**: From approx. Sta. 0+180, looking north to the upstream liner tie-in.

**Photograph A8-7 Mammoth Dike**

**Date**: August 3, 2021 **Photo Number**: 320

**Description**: From approx. Sta. 0+180, looking south to the upstream liner tie-in.

**Photograph A8-8 Mammoth Dike**

**Date**: August 3, 2021 **Photo Number**: 322

**Description**: From approx. Sta. 0+250, looking north to the upstream liner tie-in.

**Photograph A8-9 Mammoth Dike**

**Date**: August 3, 2021 **Photo Number**: 325

**Description**: From approx. Sta. 0+180, looking north to the crest.

**Photograph A8-10 Mammoth Dike**

**Date**: August 3, 2021 **Photo Number**: 326

**Description**: From approx. Sta. 0+180, looking south to the crest.

**APPENDIX B**

# Quarries

**APPENDIX B1**

# North Cell Internal Structure

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 28, 2021 |
| **Location:** | North Cell Internal Structure | **Reviewed:** | Yves Boulianne |

| GENERAL INFORMATION | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill embankment with upstream filters built inside the existing North Cell | | |
| **Weather Conditions:** | Rainy | **Temperature:** | 10°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 132, 133, 135, 136, 140, 142, 143, 144, 145, 146 | |
| 1.1 Crest elevation | 152 to 154 m | | Design 154 m |
| 1.2 Reservoir level | 149.5 m to 152.1 m – tailings<br>146.51 m - water | | |
| Current freeboard | 1.9 m to 2.5 m - tailings<br>5.49 m to 7.49 m - water | | Design 2 m water, 0.5 m tailings |
| 1.3 Distance to tailings pond (if applicable) | >100 m | | Tailings beach all along the NCIS |
| 1.4 Surface cracking | None observed | | |
| 1.5 Unexpected settlement | None observed | | |
| 1.6 Lateral movement | Not apparent | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 1.7 Other unusual conditions | None | | Some water ponding on crest due to snow melt and precipitations. |
| **2. UPSTREAM SLOPE** | | 132, 133, 135, 136, 138, 140, 142, 143, 144, 145, 146 | |
| 2.1 Slope angle | Approx. 3H:1V | | Rockfill |
| 2.2 Signs of erosion | Localized erosion features on upstream slope. | 138, 143 | Due to water discharge from the crest |
| 2.3 Signs of movement (deformation) | None | | |
| 2.4 Cracks | None | | Surface repaired in 2021 |
| 2.5 Face liner condition (if applicable) | In good condition | | |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | | |
| 3.1 Slope angle | Approx.1.2H or 1.3 H:1V variable | | Rockfill |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | None observed | | |
| 3.6 Vegetation growth | None observed | | |
| 3.7 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **4. DOWNSTREAM TOE AREA** | | | |
| 4.1 Seepage from dam | Yes | | Pumping stations are in place downstream of the structure and in operation as needed. |
| 4.2 Signs of erosion | None observed | | |
| 4.3 Signs of turbidity in seepage water | Not applicable | | |
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |
| **6. RESERVOIR** | | | |
| 6.1 Stability of slopes | Stable | | |
| 6.2 Distance to nearest slide | None observed | | |
| 6.3 Estimate of slide volume (if applicable) | Not applicable | | |
| 6.4 Floating debris | None observed | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 6.5 Other unusual conditions | No | | |
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | | | |
| 7.1 Surface condition | No spillway or outlet structure exists, only dewatering pump. | | |
| 7.2 Signs of erosion | | | |
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |
| 7.10 Other unusual conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | No | | |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | See Section 5.4.2 of the report. |
| 8.4 Settlement monuments | Yes | | 16 prisms installed. See Section 5.4.2 of the report. |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 8.7 Weirs and flow monitors | No | | A temporary seepage collection and pump back system is built and will be completed at a later time according to the design. |
| 8.8 Data logger(s) | Yes | | |
| 8.9 Other | | | |
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | July 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |

**10. NOTES :**
Remediation plan is in preparation by the AEM team to repair the eroded fine filter layer.

| | | | |
|---|---|---|---|
| **Inspector's Signature** | Marion Habersetzer | **Date:** | July 28, 2021 |

**Photograph B1-1 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 144

**Description**: From the North Cell Internal Structure, looking northeast toward the upstream slope and the North Cell.

**Photograph B1-2 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 145

**Description**: From the North Cell Internal Structure, looking southwest toward the upstream slope and the North Cell.

**Photograph B1-3 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 142

**Description**: From the North Cell Internal Structure, looking southwest at the North Cell and upstream slope.

**Photograph B1-4 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 143

**Description**: From the North Cell Internal Structure, looking southeast at the North Cell and upstream slope.

**Photograph B1-5 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 146

**Description**: From the North Cell Internal Structure, looking east at a deposition point.

**Photograph B1-6 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 140

**Description**: From the North Cell Internal Structure at approx. Sta. 2+400, looking northwest at the upstream slope.

**Photograph B1-7 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 138

**Description**: From the North Cell Internal Structure at approx. Sta. 2+400, looking northwest at the upstream slope. Presence of erosion features in the fine filter.

**Photograph B1-8 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 136

**Description**: From the North Cell Internal Structure at approx. Sta. 2+700, looking northwest at the upstream slope.

**Photograph B1-9 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 135

**Description**: From the North Cell Internal Structure at approx. Sta. 2+700, looking northwest at the upstream slope.

**Photograph B1-10 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 132

**Description**: From the North Cell Internal Structure at approx. Sta. 3+100, looking southwest at the upstream slope.

**Photograph B1-10 Tailings Storage Facility**

**Date**: July 28, 2021 **Photo Number**: 133

**Description**: From the North Cell Internal Structure at approx. Sta. 3+100, looking northeast at the upstream slope.

**APPENDIX B2**

# Saddle Dam 1

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 28, 2021 |
| **Location:** | Saddle Dam 1 | **Reviewed:** | Yves Boulianne |

| GENERAL INFORMATION | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill embankment with inverted filter on base, upstream filters, a geomembrane liner tied in a toe till plug and protective cover. | | |
| **Weather Conditions:** | Cloudy | **Temperature:** | 15°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 99, 101, 102, 103, 105, 106, 107, 108 | |
| 1.1 Crest elevation | 150 m | | Design 150 m |
| 1.2 Reservoir level | 149.5 m - tailings | | |
| Current freeboard | 0.5 m -tailings | | Design 2 m water, 0.5 m tailings |
| 1.3 Distance to tailings pond (if applicable) | >300 m | | Tailings beach all along SD1 |
| 1.4 Surface cracking | None at time of inspection | | |
| 1.5 Unexpected settlement | None observed | | |
| 1.6 Lateral movement | Not apparent | | |
| 1.7 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **2. UPSTREAM SLOPE** | | 101, 102, 103, 104, 105, 109 | |
| 2.1 Slope angle | Approx. 3H:1V | | Rockfill |
| 2.2 Signs of erosion | None observed | | |
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | In good condition | | |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 99, 106 | |
| 3.1 Slope angle | Approx.1.2H or 1.3 H:1V variable | | Rockfill |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | None observed | | |
| 3.6 Vegetation growth | None observed | | |
| 3.7 Other unusual conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | 99, 106 | |
| 4.1 Seepage from dam | Uncertain | | A dewatering sump is installed downstream. Water was observed ponding in that area. |
| 4.2 Signs of erosion | None observed | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 4.3 Signs of turbidity in seepage water | Not applicable | | |
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |
| **6. RESERVOIR** | | 100, 104, 109 | |
| 6.1 Stability of slopes | Stable | | |
| 6.2 Distance to nearest slide | None observed | | |
| 6.3 Estimate of slide volume (if applicable) | Not applicable | | |
| 6.4 Floating debris | None observed | | |
| 6.5 Other unusual conditions | No | | A small pond of water was observed in the tailings and is not a concern. |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | | | |
| 7.1 Surface condition | No spillway or outlet structure exists, only dewatering pump. | | |
| 7.2 Signs of erosion | | | |
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |
| 7.10 Other unusual conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | No | | |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | See Section 5.2.2 of the report. |
| 8.4 Settlement monuments | No | | Construction drawings show settlement monuments to be installed on Stage 2 crest. |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 8.7 Weirs and flow monitors | No | | Per the design, a seepage collection and pump back system is built. |
| 8.8 Data logger(s) | Yes | | |
| 8.9 Other | | | |
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | July 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES :** | | | |
| **Inspector's Signature** | Marion Habersetzer | **Date:** | July 28, 2021 |

**Photograph B2-1 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 106

**Description**: From the south abutment (Sta. 0+350) looking north at the downstream face. Notice the sea-can container where a sump is installed.

**Photograph B2-2 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 99

**Description**: From Sta. 0+150 looking southwest at the downstream face. Notice the sea-can container where a sump is installed.

**Photograph B2-3 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 107

**Description**: From approximately Sta. 0+225, looking north at the crest.

**Photograph B2-4 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 108

**Description**: From approximately Sta. 0+225, looking south at the crest.

**Photograph B2-5 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 101

**Description**: From approximately Sta. 0+055, looking south at the crest and upstream slope.

**Photograph B2-6 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 102

**Description**: From approximately Sta. 0+195 upstream, looking south at the upstream slope. Adequate tailings beach against SD1. A small pond of water is present at the surface of the tailings and is not a concern.

**Photograph B2-7 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 103

**Description**: From approximately Sta. 0+195 upstream, looking north at the upstream slope. Adequate tailings beach against SD1.

**Photograph B2-8 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 109

**Description**: From approximately Sta. 0+195 upstream, looking east at the North Cell. Water discharging on the liner.

**Photograph B2-9 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 105

**Description**: From the south abutment looking north at the upstream slope. Adequate tailings beach against SD1.

**Photograph B2-10 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 104

**Description**: From the south abutment looking east at the upstream slope and the North Cell.

**Photograph B2-11 Saddle Dam 1**

**Date**: July 28, 2021 **Photo Number**: 100

**Description**: From approximately Sta. 0+050 upstream, looking east at the North Cell.

**APPENDIX B3**

# Saddle Dam 2

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 28, 2021 |
| **Location:** | Saddle Dam 2 | **Reviewed:** | Yves Boulianne |

| **GENERAL INFORMATION** | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill embankment with inverted filter on base, upstream filters, a geomembrane liner tied in a toe till plug and upstream till blanket. | | |
| **Weather Conditions:** | Cloudy | **Temperature:** | 15°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 110, 112, 113, 115, 116 | |
| 1.1 Crest elevation | 150 m | | Design 150 m |
| 1.2 Reservoir level | 149.5 m - tailings | | |
| Current freeboard | 0.5 m - tailings | | Design 2 m water, 0.5 m tailings |
| 1.3 Distance to tailings pond (if applicable) | >200 m | | Adequate tailings beach |
| 1.4 Surface cracking | None at time of inspection | | |
| 1.5 Unexpected settlement | None observed | | |
| 1.6 Lateral movement | Not apparent | | |
| 1.7 Other unusual conditions | None | | |
| **2. UPSTREAM SLOPE** | | 110, 111, 114, 116 | |
| 2.1 Slope angle | Approx. 3H:1V | | Rockfill |
| 2.2 Signs of erosion | None observed | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | Good | | Wooden pallet on liner at 20+475 to remove. |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 115 | |
| 3.1 Slope angle | Approx.1.2H or 1.3H:1V variable | | Rockfill |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | None observed on slope | | |
| 3.6 Vegetation growth | None observed | | |
| 3.7 Other unusual conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | 115 | |
| 4.1 Seepage from dam | No | | |
| 4.2 Signs of erosion | None observed | | |
| 4.3 Signs of turbidity in seepage water | Not applicable | | |
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | Yes | | Limited water is still ponding within the rockfill embankment between 20+275 to 20+475 approximately. |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |
| **6. RESERVOIR** | | 111 | |
| 6.1 Stability of slopes | Stable | | |
| 6.2 Distance to nearest slide (if applicable) | None observed | | |
| 6.3 Estimate of slide volume (if applicable) | Not applicable | | |
| 6.4 Floating debris | None observed | | |
| 6.5 Other unusual conditions | No | | |
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | | | |
| 7.1 Surface condition | No spillway or outlet structure exists, only dewatering pump. | | |
| 7.2 Signs of erosion | | | |
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |
| 7.10 Other unusual conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | No | | |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | See Section 5.3.2 of the report. |
| 8.4 Settlement monuments | No | | Construction drawings show displacement monitoring on Stage 2 crest. |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |
| 8.7 Weirs and flow monitors | No | | |
| 8.8 Data logger(s) | Yes | | |
| 8.9 Other | | | |
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | July 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES :** | | | |
| **Inspector's Signature** | Marion Habersetzer | **Date:** | July 28, 2021 |

**Photograph B3-1 Saddle Dam 2**

**Date**: July 28, 2021 **Photo Number**: 110

**Description**: From Saddle Dam 2 (approximately Sta. 20+110) looking southeast at the crest and upstream slope.

**Photograph B3-2 Saddle Dam 2**

**Date**: July 28, 2021 **Photo Number**: 111

**Description**: From Saddle Dam 2 (approximately Sta. 20+110) upstream, looking southeast at the North Cell. The tailings beach against SD2 is adequate.

**Photograph B3-3 Saddle Dam 2**

**Date**: July 28, 2021 **Photo Number**: 112

**Description**: From approximately Sta. 20+370 looking southeast at the crest.

**Photograph B3-4 Saddle Dam 2**

**Date**: July 28, 2021 **Photo Number**: 113

**Description**: From approximately Sta. 20+370 looking northwest at the crest.

**Photograph B3-5 Saddle Dam 2**

**Date**: July 28, 2021 **Photo Number**: 116

**Description**: From approximately Sta. 20+525, looking northwest at the crest and upstream slope.

**Photograph B3-6 Saddle Dam 2**

**Date**: July 28, 2021 **Photo Number**: 114

**Description**: From approximately Sta. 20+475, looking northeast at the upstream slope.

**Photograph B3-7 Saddle Dam 2**

**Date**: July 28, 2021 **Photo Number**: 115

**Description**: From Saddle Dam 2 (approximately Sta. 20+500) downstream, looking northwest at the downstream toe and slope of Saddle Dam 2. Some water is ponding at the toe.

**APPENDIX B4**

# Stormwater Dike

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 28, 2021 |
| **Location:** | Stormwater Dike | **Reviewed:** | Yves Boulianne |

| GENERAL INFORMATION | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill embankment, upstream filters and a bituminous geomembrane liner. Compacted till placed above liner at toe, prior to tailings deposition. | | |
| **Weather Conditions:** | Rainy | **Temperature:** | 10°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 124, 125, 126, 127, 128, 129, 130 | |
| 1.1 Crest elevation | 150 m | | Design 150 m |
| 1.2 Reservoir level | 146.46 – water<br>144.6 m (max) – tailings<br>(South Cell)<br>149.5 m - tailings<br>(North Cell) | | |
| Current freeboard | 3.54 m – water<br>5.4 m - tailings<br>(South Cell)<br>0.5 m – tailings<br>(North Cell) | | Design 2 m in operation and 1 m at closure for water and 0.5 m for tailings. |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 1.3 Distance to tailings pond (if applicable) | Adequate (North Cell) | | Adequate beach in place all along the dike on North Cell. Some shallow water ponding against dike in some places (from 10+550 to 10+950 approximately). Water and tailings have reached the toe of the structure in the South Cell. |
| 1.4 Surface cracking | No | | Old tension cracks (mostly around 10+300) are inactive and are disappearing. They have since been filled with bentonite. |
| 1.5 Unexpected settlement | No | | |
| 1.6 Lateral movement | No | | |
| 1.7 Other unusual conditions | | | |
| **2. UPSTREAM SLOPE** | | 125, 126, 127, 130 | |
| 2.1 Slope angle | Approx. 3H:1V | | Rockfill |
| 2.2 Signs of erosion | None observed | | |
| 2.3 Signs of movement (deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | Good conditions. | | |
| 2.6 Other unusual conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 124, 131 | |
| 3.1 Slope angle | Approx.1.2H or 1.5 H:1V variable | | Rockfill |
| 3.2 Signs of erosion | None observed | | |
| 3.3 Signs of movement (deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or wet areas | None observed on slope | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 3.6 Vegetation growth | None observed | | |
| 3.7 Other unusual conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | Not visible | | Downstream toe and berm is submerged by the South Cell pond. The berm was constructed at the downstream toe to stabilize the movement and cracks observed in 2016. |
| 4.1 Seepage from dam | Not visible | | |
| 4.2 Signs of erosion | Not visible | | |
| 4.3 Signs of turbidity in seepage water | Not visible | | |
| 4.4 Discoloration/staining | Not visible | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other unusual conditions | Not visible | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of erosion | None observed | | |
| 5.3 Excessive vegetation | No | | |
| 5.4 Presence of rodent burrows | None observed | | |
| 5.5 Other unusual conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **6. RESERVOIR** | | | |
| 6.1 Stability of slopes | Stable | | |
| 6.2 Distance to nearest slide (if applicable) | None observed | | |
| 6.3 Estimate of slide volume (if applicable) | Not applicable | | |
| 6.4 Floating debris | None observed | | |
| 6.5 Other unusual conditions | No | | |
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | No spillway or outlet structure exists, only dewatering pump | | |
| 7.1 Surface condition | | | |
| 7.2 Signs of erosion | | | |
| 7.3 Signs of movement (deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of debris or blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope protection | | | |
| 7.9 Instability of side slopes | | | |
| 7.10 Other unusual conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | Yes | | See Section 5.5.2 |
| 8.2 Settlement cells | No | | |
| 8.3 Thermistors | Yes | | See Section 5.5.2 |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 8.4 Settlement monuments | Yes | | See Section 5.5.2 |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |
| 8.7 Weirs and flow monitors | No | | |
| 8.8 Data logger(s) | No | | |
| 8.9 Other | None | | |
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | July 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES :** | | | |

| | | | |
|---|---|---|---|
| **Inspector's Signature** | Marion Habersetzer | **Date:** | July 28, 2021 |

**Photograph B4-1 Stormwater Dike**

**Date**: July 28, 2021 **Photo Number**: 125

**Description**: From the east abutment (11+100 approximately), looking west at the upstream face and the rockfill cover of the North Cell. Shallow water ponding against portion of the dike (less than 30 cm deep). Large rocks are present near the liner.

**Photograph B4-2 Stormwater Dike**

**Date**: July 28, 2021 **Photo Number**: 124

**Description**: From the east abutment (11+100 approximately), looking west at the downstream slope.

**Photograph B4-3 Stormwater Dike**

**Date**: July 28, 2021 **Photo Number**: 126

**Description**: From Sta. 10+650 looking east at the crest and upstream slope.

**Photograph B4-4 Stormwater Dike**

**Date**: July 28, 2021 **Photo Number**: 127

**Description**: From Sta. 10+650 looking west at the crest and upstream slope. Shallow water against portion of Stormwater Dike.

**Photograph B4-5 Stormwater Dike**

**Date**: July 28, 2021 **Photo Number**: 129

**Description**: From approximately Sta. 10+650 looking west at the crest.

**Photograph B4-6 Stormwater Dike**

**Date**: July 28, 2021 **Photo Number**: 128

**Description**: From approximately Sta. 10+650 looking east at the crest.

**Photograph B4-7 Stormwater Dike**

**Date**: July 28, 2021 **Photo Number**: 130

**Description**: From Sta.10+175, looking east at the upstream slope. The tailings beach is adequate.

**Photograph B4-8 Stormwater Dike**

**Date**: July 28, 2021 **Photo Number**: 131

**Description**: From Sta.10+250, looking east at the downstream slope and the South Cell. The downstream toe is covered with water in this section.

**APPENDIX B5**

# Saddle Dam 3

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 28, 2021 |
| **Location:** | Saddle Dam 3 | **Reviewed:** | Yves Boulianne |

| GENERAL INFORMATION | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill embankment with inverted filter on base, upstream filters, a geomembrane liner tied in a toe till plug and upstream till blanket. | | |
| **Weather Conditions:** | Overcast | **Temperature:** | 10°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 118, 119, 120 | |
| 1.1 Crest elevation | 145 m | | Designed to be able to be raised up to El. 150 m |
| 1.2 Reservoir Level | 140.98 m - water<br>132 m – tailings (West extremity of the South Cell) | | |
| Current Freeboard | 4.02 (water) | | Water is in contact with the structure (against erosion protection cover). |
| 1.3 Distance To Tailings Pond (if applicable) | NA | | Water now reaches the structure but no tailings are planned to be in contact with the structure. |
| 1.4 Surface Cracking | None at time of inspection | | |
| 1.5 Unexpected Settlement | None observed | | |
| 1.6 Lateral Movement | Not apparent | | |
| 1.7 Other Unusual Conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **2. UPSTREAM SLOPE** | | 117 | |
| 2.1 Slope angle | 3H:1V | | |
| 2.2 Signs of Erosion | None observed | | |
| 2.3 Signs of Movement (Deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | Good | | |
| 2.6 Other Unusual Conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 120 | |
| 3.1 Slope angle | 1.5H:1V | | |
| 3.2 Signs of Erosion | None observed | | |
| 3.3 Signs of Movement (Deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or Wet Areas | None observed on slope | | |
| 3.6 Vegetation Growth | None observed | | |
| 3.7 Other Unusual Conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | 120 | |
| 4.1 Seepage from Dam | No | | |
| 4.2 Signs of Erosion | None observed | | |
| 4.3 Signs of Turbidity in Seepage Water | Not applicable | | |
| 4.4 Discoloration/staining | No | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other Conditions | Yes | | A sump was constructed on the downstream side to collect the ponding water, so its level does not exceed the elevation of the granular layer of the upstream toe liner tie-in. |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of Erosion | None observed | | |
| 5.3 Excessive Vegetation | No | | |
| 5.4 Presence of Rodent Burrows | None observed | | |
| 5.5 Other Unusual Conditions | None | | |
| **6. RESERVOIR** | | | |
| 6.1 Stability of Slopes | Stable | | |
| 6.2 Distance to Nearest Slide (if applicable) | None observed | | |
| 6.3 Estimate of Slide Volume (if applicable) | Not applicable | | |
| 6.4 Floating debris | None observed | | |
| 6.5 Other Unusual Conditions | No | | |
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | No spillway or outlet structure exists, only dewatering pump. | | |
| 7.1 Surface Condition | . | | |
| 7.2 Signs of Erosion | | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 7.3 Signs of Movement (Deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of Debris or Blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope Protection | | | |
| 7.9 Instability of Side Slopes | | | |
| 7.10 Other Unusual Conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | No | | |
| 8.2 Settlement Cells | No | | |
| 8.3 Thermistors | Yes | | See Section 5.6.2 of the report. |
| 8.4 Settlement Monuments | No | | |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |
| 8.7 Weirs and Flow Monitors | No | | |
| 8.8 Data logger(s) | Yes | | |
| 8.9 Other | | | |
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 9.1.3 Date of last revision | July 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES :** | | | |
| **Inspector's Signature** | Marion Habersetzer | **Date:** | July 28, 2021 |

**Photograph B5-1 Saddle Dam 3**

**Date**: July 28, 2021 **Photo Number**: 120

**Description**: From Sta. 20+750, looking northwest at the downstream slope and toe.

**Photograph B5-2 Saddle Dam 3**

**Date**: July 28, 2021 **Photo Number**: 119

**Description**: From Sta. 20+700, looking southeast at the crest.

**Photograph B5-3 Saddle Dam 3**

**Date**: July 28, 2021 **Photo Number**: 118

**Description**: From Sta. 20+700, looking northwest at the crest.

**Photograph B5-4 Saddle Dam 3**

**Date**: July 28, 2021 **Photo Number**: 117

**Description**: From Sta. 20+610, looking south at the upstream slope.

**APPENDIX B6**

# Saddle Dam 4

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 28, 2021 |
| **Location:** | Saddle Dam 4 | **Reviewed:** | Yves Boulianne |

| GENERAL INFORMATION | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill embankment with inverted filter on base, upstream filters, a geomembrane liner tied in a toe till plug and upstream till blanket. | | |
| **Weather Conditions:** | Rainy | **Temperature:** | 10°C |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **1. DAM CREST** | | 147, 148, 150, 151, 152, 153 | |
| 1.1 Crest elevation | 145 m | | Designed to be able to be raised to El. 150 m |
| 1.2 Reservoir Level | 140.98 m - water<br>144.5 m - tailings | | |
| Current Freeboard | 4.02 m - water<br>0.5 m - tailings | | |
| 1.3 Distance to Tailings Pond (if applicable) | Approx. 100 m | | |
| 1.4 Surface Cracking | None at time of inspection | | |
| 1.5 Unexpected Settlement | None observed | | |
| 1.6 Lateral Movement | Not apparent | | |
| 1.7 Other Unusual Conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **2. UPSTREAM SLOPE** | | 147, 148, 149, 150, 154 | |
| 2.1 Slope angle | 3H:1V | | |
| 2.2 Signs of Erosion | None observed | | |
| 2.3 Signs of Movement (Deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | Good | | |
| 2.6 Other Unusual Conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 151, 152, 153 | |
| 3.1 Slope angle | 1.5H:1V | | |
| 3.2 Signs of Erosion | None observed | | |
| 3.3 Signs of Movement (Deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or Wet Areas | None observed on slope | | |
| 3.6 Vegetation Growth | None observed | | |
| 3.7 Other Unusual Conditions | None | | |
| **4. DOWNSTREAM TOE AREA** | | 151, 152, 153 | |
| 4.1 Seepage from Dam | No | | |
| 4.2 Signs of Erosion | None observed | | |
| 4.3 Signs of Turbidity in Seepage Water | Not applicable | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other Conditions | Yes | | Runoff water accumulate at the downstream side of the structure. It is pumped out so that the water level does not exceed the elevation of the granular layer of the upstream toe liner tie-in. |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | Highly fractured bedrock observed at the western abutment. |
| 5.2 Signs of Erosion | None observed | | |
| 5.3 Excessive Vegetation | No | | |
| 5.4 Presence of Rodent Burrows | None observed | | |
| 5.5 Other Unusual Conditions | None | | |
| **6. RESERVOIR** | | 149 | |
| 6.1 Stability of Slopes | Stable | | |
| 6.2 Distance to Nearest Slide (if applicable) | None observed | | |
| 6.3 Estimate of Slide Volume (if applicable) | Not applicable | | |
| 6.4 Floating debris | None observed | | |
| 6.5 Other Unusual Conditions | None | | |
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | No spillway or outlet structure exists, only dewatering pump. | | |
| 7.1 Surface Condition | | | |
| 7.2 Signs of Erosion | | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 7.3 Signs of Movement (Deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of Debris or Blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope Protection | | | |
| 7.9 Instability of Side Slopes | | | |
| 7.10 Other Unusual Conditions | | | |
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | No | | |
| 8.2 Settlement Cells | No | | |
| 8.3 Thermistors | Yes | | See Section 5.6.2 of the report |
| 8.4 Settlement Monuments | No | | |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |
| 8.7 Weirs and Flow Monitors | No | | Construction drawings indicate a seepage collection system is to be constructed. |
| 8.8 Data logger(s) | Yes | | |
| 8.9 Other | | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | July 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |
| **10. NOTES :** | | | |
| **Inspector's Signature** | Marion Habersetzer | **Date:** | July 28, 2021 |

**Photograph B6-1 Saddle Dam 4**

**Date**: July 28, 2021 **Photo Number**: 151

**Description**: From 40+200 approximately, looking southeast at the crest and the downstream slope and toe.

**Photograph B6-2 Saddle Dam 4**

**Date**: July 28, 2021 **Photo Number**: 149

**Description**: From 40+150 approximately, looking northeast at the upstream slope and the South Cell.

**Photograph B6-3 Saddle Dam 4**

**Date**: July 28, 2021 **Photo Number**: 150

**Description**: From 40+150 approximately, looking southeast at the crest and the upstream slope.

**Photograph B6-4 Saddle Dam 4**

**Date**: July 28, 2021 **Photo Number**: 147

**Description**: From 40+250 approximately, looking northwest at the crest and the upstream slope.

**Photograph B6-5 Saddle Dam 4**

**Date**: July 28, 2021 **Photo Number**: 148

**Description**: From 40+250 approximately, looking southeast at the crest and the upstream slope.

**Photograph B6-6 Saddle Dam 4**

**Date**: July 28, 2021 **Photo Number**: 154

**Description**: From 40+300 approximately, looking southeast at the crest and the upstream slope. Presence of a pipe on the liner.

**Photograph B6-7 Saddle Dam 4**

**Date**: July 28, 2021 **Photo Number**: 152

**Description**: From 40+400 approximately, looking southeast at the crest and the downstream slope and toe.

**Photograph B6-8 Saddle Dam 4**

**Date**: July 28, 2021 **Photo Number**: 153

**Description**: From 40+450 approximately, looking southeast at the crest and the downstream slope and toe. A large amount of water is ponding at the toe.

**APPENDIX B7**

# Central Dike – Saddle Dam 5

| | | | |
|---|---|---|---|
| **Client:** | AEM | **By:** | Marion Habersetzer |
| **Project:** | Meadowbank | **Date:** | July 28, 2021 |
| **Location:** | Central Dike and Saddle Dam 5 | **Reviewed:** | Yves Boulianne |

| **GENERAL INFORMATION** | | | |
|---|---|---|---|
| **Dam Type:** | Rockfill embankment with inverted filter on base, key trench, upstream filters, a geomembrane liner tied in a toe till plug and protective cover. | | |
| **Weather Conditions:** | Rainy | **Temperature:** | 10°C |

| **INSPECTION ITEM** | **OBSERVATIONS DATA** | **PHOTO** | **COMMENTS & OTHER DATA** |
|---|---|---|---|
| **1. DAM CREST** | | 157, 158, 160, 161, 162, 163, 164, 165, 166 | |
| 1.1 Crest Elevation | Cofferdam Crest = 110 m<br>Rockfill crest = 145 m | | |
| 1.2 Reservoir Level | 140.98 m - water<br>144.56 m - tailings | | |
| Current Freeboard | 4.02 m - water<br>0.44 m - tailings | | |
| 1.3 Distance To Tailings Pond (if applicable) | Variable | | Adequate tailings beach against Central Dike, except south of Sta. 0+850, where water is ponding against the Central Dike and Saddle Dam 5. |
| 1.4 Surface Cracking | None at time of inspection | | |
| 1.5 Unexpected Settlement | None observed | | |
| 1.6 Lateral Movement | Not apparent | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| 1.7 Other Unusual Conditions | | | |
| **2. UPSTREAM SLOPE** | | 157, 158, 156, 162, 163, 166, 167 | |
| 2.1 Slope angle | 3:1V up to El. 130 m and 2H:1V above | | |
| 2.2 Signs of Erosion | None observed | | |
| 2.3 Signs of Movement (Deformation) | None observed | | |
| 2.4 Cracks | None observed | | |
| 2.5 Face liner condition (if applicable) | | | Liner covered by a granular protection layer up to El. 128 m and well protected underneath deposition fingers.<br>Presence of gravel on the liner at Sta. 0+750 m and of a cable with a metallic plug at Sta. 0+900 m. |
| 2.6 Other Unusual Conditions | None | | |
| **3. DOWNSTREAM SLOPE** | | 159, 155, 161 | |
| 3.1 Slope angle | 1.5H | | |
| 3.2 Signs of Erosion | None observed | | |
| 3.3 Signs of Movement (Deformation) | None observed | | |
| 3.4 Cracks | None observed | | |
| 3.5 Seepage or Wet Areas | | | |
| 3.6 Vegetation Growth | None observed | | |
| 3.7 Other Unusual Conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **4. DOWNSTREAM TOE AREA** | | 159, 155 | |
| 4.1 Seepage from Dam | Yes | 155 | Presence of a water pond formed by seepage on the downstream side between the downstream toe and West Road (0+300 to 0+830 approximately). The pond is pumped back to the South Cell and maintained at El. 115 m. The pumping rate was 150 $m^3$/hr at the time of the inspection. |
| 4.2 Signs of Erosion | None observed | | |
| 4.3 Signs of Turbidity in Seepage Water | Yes | | High turbidity events observed in the pond and an orange coloration was observed periodically. |
| 4.4 Discoloration/staining | No | | |
| 4.5 Outlet operating problem (if applicable) | Not applicable | | |
| 4.6 Other Unusual Conditions | | | |
| **5. ABUTMENTS** | | | |
| 5.1 Seepage at contact zone (abutment/embankment) | None observed | | |
| 5.2 Signs of Erosion | None observed | | |
| 5.3 Excessive Vegetation | No | | |
| 5.4 Presence of Rodent Burrows | None observed | | |
| 5.5 Other Unusual Conditions | None | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **6. RESERVOIR** | | | |
| 6.1 Stability of Slopes | Stable | | |
| 6.2 Distance to Nearest Slide | None observed | | |
| 6.3 Estimate of Slide Volume (if applicable) | Not applicable | | |
| 6.4 Floating debris | None observed | | |
| 6.5 Other Unusual Conditions | None | | |
| **7. EMERGENCY SPILLWAY/ OUTLET STRUCTURE** | No spillway or outlet structure exists, only dewatering pump. | | |
| 7.1 Surface Condition | | | |
| 7.2 Signs of Erosion | | | |
| 7.3 Signs of Movement (Deformation) | | | |
| 7.4 Cracks | | | |
| 7.5 Settlement | | | |
| 7.6 Presence of Debris or Blockage | | | |
| 7.7 Closure mechanism operational | | | |
| 7.8 Slope Protection | | | |
| 7.9 Instability of Side Slopes | | | |
| 7.10 Other Unusual Conditions | | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **8. INSTRUMENTATION** | | | |
| 8.1 Piezometers | Yes | | See Sections 5.6.2 and 5.7.2 of the report. |
| 8.2 Settlement Cells | No | | |
| 8.3 Thermistors | Yes | | See Section 5.7.2 of the report. |
| 8.4 Settlement Monuments | No | | |
| 8.5 Seismograph | No | | |
| 8.6 Inclinometer | No | | |
| 8.7 Weirs and Flow Monitors | No | | |
| 8.8 Data logger(s) | Yes | | |
| 8.9 Other | | | |
| **9. DOCUMENTATION** | | | |
| 9.1 Operation, Maintenance and Surveillance (OMS) Plan | | | |
| 9.1.1 OMS Plan exists | Yes | | |
| 9.1.2 OMS Plan reflects current dam conditions | Yes | | |
| 9.1.3 Date of last revision | July 2021 | | |
| 9.2 Emergency Preparedness Plan (EPP) | | | |
| 9.2.1 EPP exists | Yes | | |
| 9.2.2 EPP reflects current conditions | Yes | | |
| 9.2.3 Date of last revision | September 2021 | | |

| INSPECTION ITEM | OBSERVATIONS DATA | PHOTO | COMMENTS & OTHER DATA |
|---|---|---|---|
| **10. NOTES :** | | | |
| Inspector's Signature | Marion Habersetzer | **Date:** | July 28, 2021 |

**Photograph B7-1 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 167

**Description**: From approximately Sta. 0+400 (deposition point) looking west at the South Cell. Adequate tailings beach against the south section of the structure.

**Photograph B7-2 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 166

**Description**: From approximately Sta. 0+400 (deposition point) looking south at the upstream slope. Adequate tailings beach against the south section of the structure.

**Photograph B7-3 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 164

**Description**: From approximately Sta. 0+720 looking south at the crest.

**Photograph B7-4 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 165

**Description**: From approximately Sta. 0+720 looking north at the crest.

**Photograph B7-5 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 162

**Description**: From approximately Sta. 0+720 looking south at the crest and the upstream slope.

**Photograph B7-6 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 163

**Description**: From approximately Sta. 0+720 looking north at the crest and the upstream slope.

**Photograph B7-7 Central Dike and Saddle Dam 5**

**<u>Date</u>**: July 28, 2021 **<u>Photo Number</u>**: 161

**<u>Description</u>**: From approximately Sta. 0+800, looking north at the downstream slope and toe.

**Photograph B7-8 Central Dike and Saddle Dam 5**

**<u>Date</u>**: July 28, 2021 **<u>Photo Number</u>**: 160

**<u>Description</u>**: From approximately Sta. 0+800, looking north at the crest.

**Photograph B7-9 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 155
**Description**: From approximately Sta. 0+900 downstream, looking north at the downstream pond.

**Photograph B7-10 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 156
**Description**: From approximately Sta. 0+950, looking west at the water discharge on the liner.

**Photograph B7-11 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 157

**Description**: From approximately Sta. 1+050 looking west at the upstream slope of SD5.

**Photograph B7-12 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 158

**Description**: From approximately Sta. 1+000 looking east at the upstream slope of SD5 and Central Dike. Water is ponding against the liner.

**Photograph B7-13 Central Dike and Saddle Dam 5**

**Date**: July 28, 2021 **Photo Number**: 159

**Description**: From approximately Sta. 1+100 looking southeast at the downstream slope and toe of SD5. Water is ponding at the toe.

**APPENDIX C**

# Analysis of the East Dike Seepage Event

# East Dike seepage event in winter 2021
# Designer's opinion

**21468006-1607-PPT-RevA**

**Prepared by M. Habersetzer**

**Reviewed by Y. Boulianne**

November 22, 2021

# AGENDA

1) East Dike Design
2) Past Performance of East Dike
3) Observations
4) Inferred Mechanism
5) Recommendations

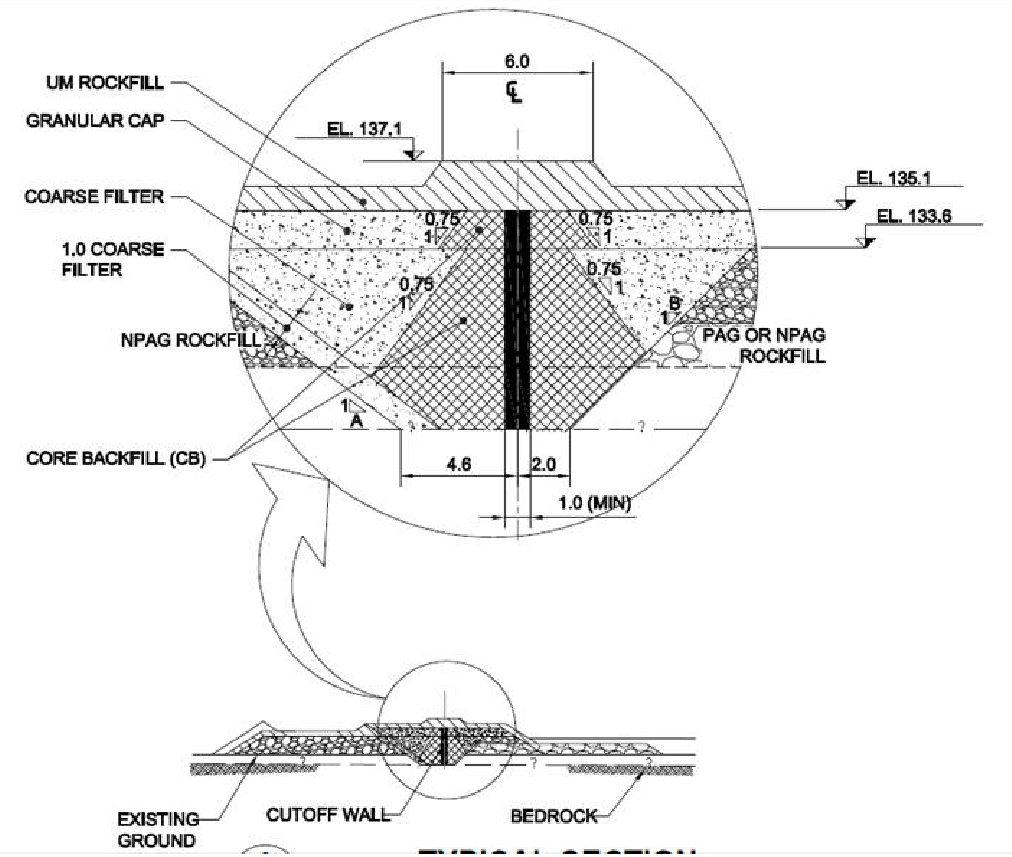
# 1) East Dike Design

## DESIGN INTENT AND ANTICIPATED BEHAVIOUR

**Design intent:** isolate Portage Pit and TSF from the Second Portage Lake (operation) and Second Portage Lake from Third Portage Lake (closure)

**Structure:** rockfill shell, granular core with soil-bentonite cut-off wall extending to bedrock in the middle, downstream granular filters and grout curtain from the base of the cut-off wall through the bedrock foundation.

**Expected thermal regime:** progressive freezing of the dike, cut-off wall protected from freeze/thaw by the rockfill on top.



# 1) East Dike Design

## DESIGN INTENT AND ANTICIPATED BEHAVIOUR

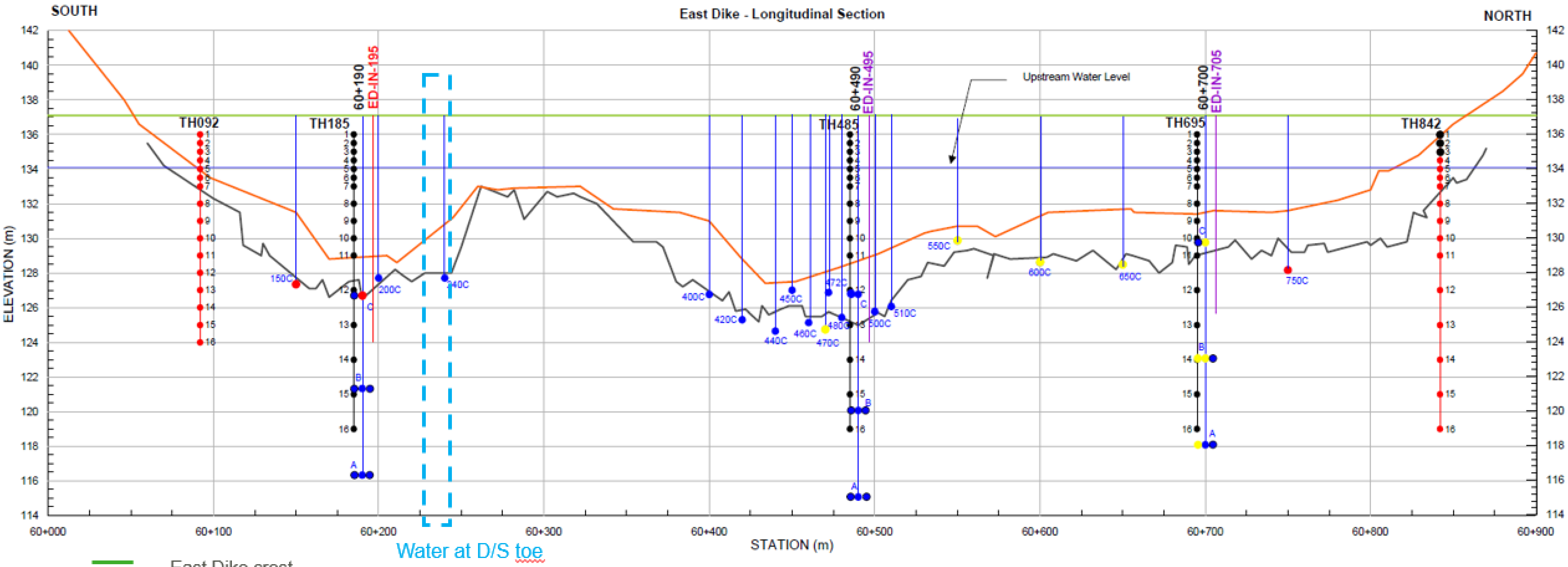
**Expected seepage per design:** 300 to 600 $m^3$/day in operation and 200 $m^3$/day after closure.

**Seepage collection system:** meant to collect and convey seepage and runoff away from the downstream toe area and allow monitoring of seepage through the dike. One pumping station at each seepage channel (North Channel and South Channel).

**Purpose of the instrumentation coverage:** monitor thermal and piezometric condition in the cut-off wall and across it, to measure the performance of the wall and compare behaviours of different areas. Coverage must be sufficient to determine the extent of any specific behaviour and must be adapted over the life of the structure (and into closure) as needed to achieve this purpose.

# 1) East Dike Design

## AS-BUILT PROFILE




East Dike crest
Lakebed sediments
Bedrock

# 2) Past Performance of East Dike

## EVENTS, OBSERVED TRENDS AND MITIGATION WORKS

3 identified seepage zones: North Shallow, North Channel, South Channel. Elsewhere: functioning cut-off wall, cooling trend, mostly frozen conditions.

South channel (Sta. 60+200): observed seepage at the downstream toe. Potential construction defects along steep bedrock foundation.

North Channel (Sta. 60+500):

- **May 2009:** seepage inferred at North Channel (60+490) based on dewatering rates and piezometric data (shallow bedrock and interface with the cut-off wall). Remedial grouting of the base of the cut-off wall and bedrock to reduce seepage (60+448 to 60+520).
- **July 2009:** sinkhole at Sta. 60+472 (18 $m^3$) with turbidity in the seepage. CPT campaign confirmed loss of fines in the cut-off wall in the area (inferred erosion).
- Adequate performance with manageable seepage after remedial grouting.

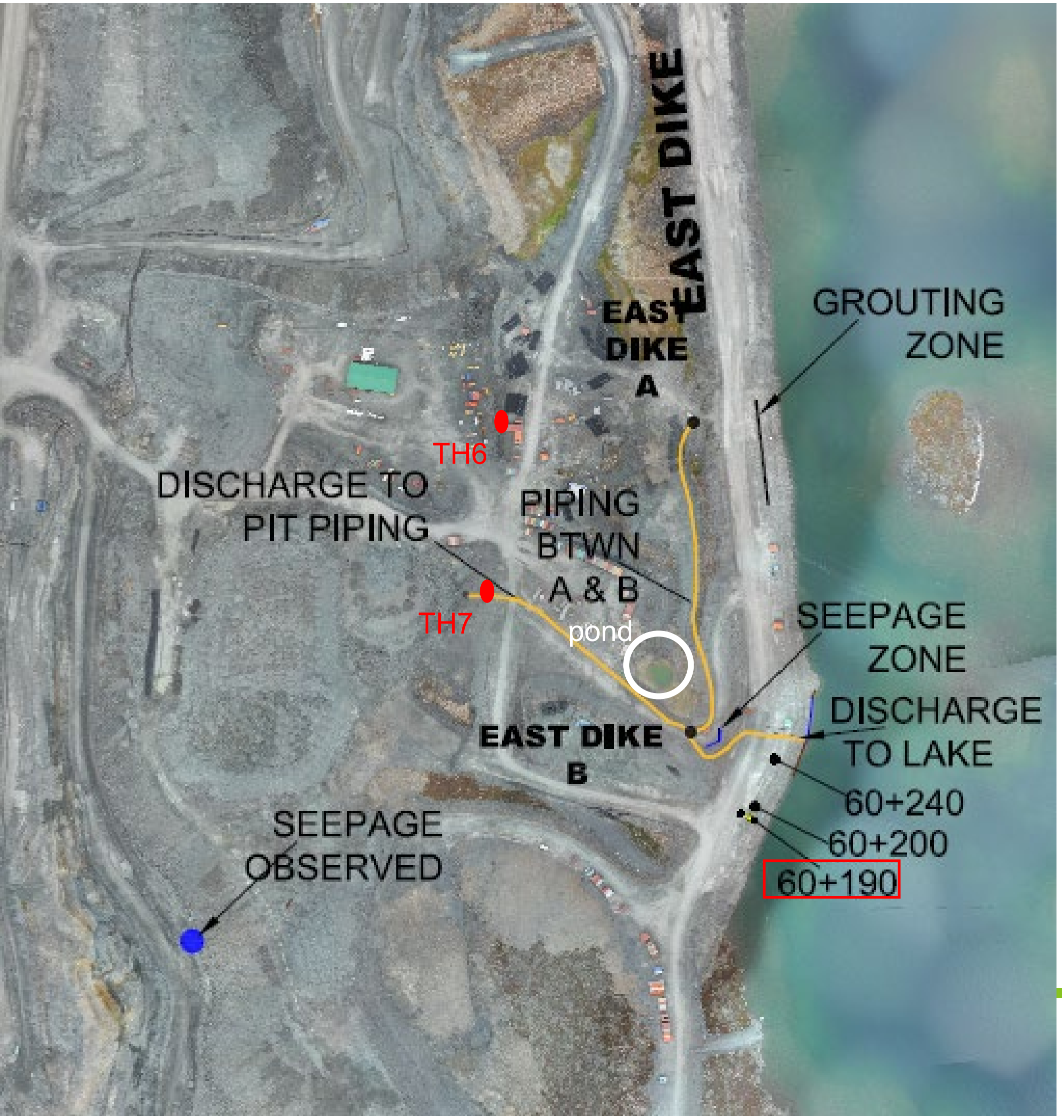
North Shallow (Sta. 60+700): water ponding on downstream toe. No visible flow.

**2012:** seepage collection system installed with one station downstream of each channel. Discharge to Second Portage Lake or Portage Pits if turbidity exceeds 15 mg/L. Global flow (cumulative for both stations) monitored was stable since 2013.

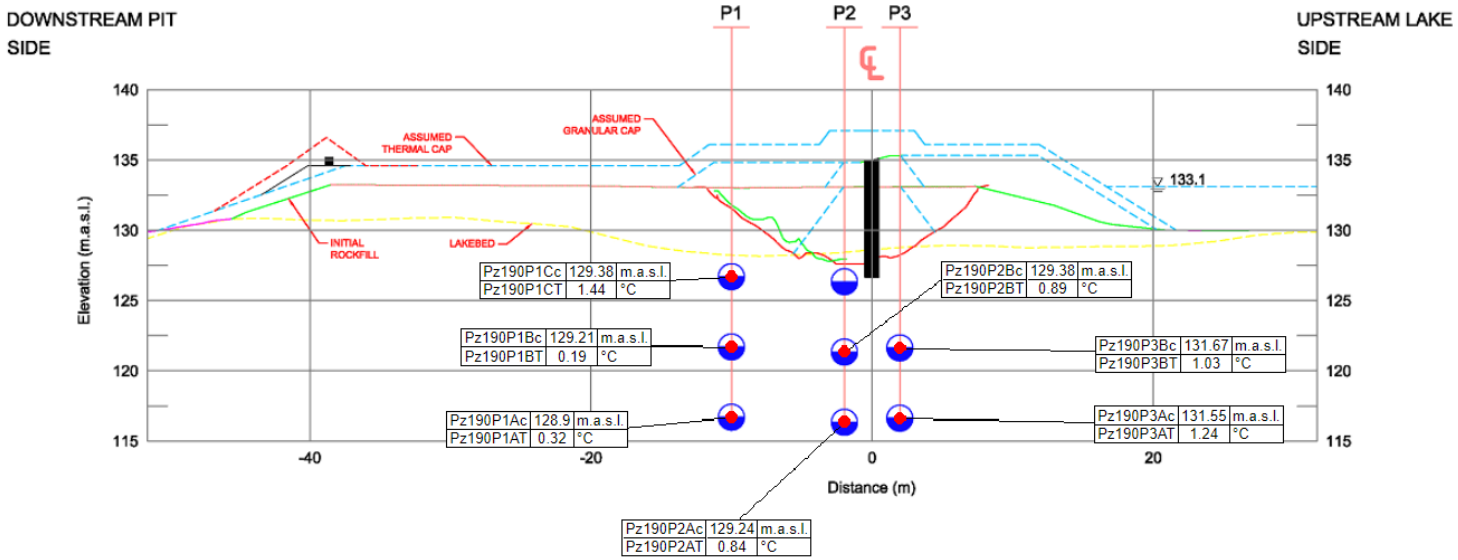
| Seepage area | Dike Station | Average seepage rate (flowmeter, 2018-2020) | Water quality |
|---|---|---|---|
| North Shallow | 60+700 | Not measured | Clear (no turbidity) |
| North Channel | 60+500 | 463 $m^3$/day with a maximum of 650 $m^3$/day at freshet | Usually clear in winter and turbid from freshet |
| South Channel | 60+250 | | Usually clear in winter and turbid from freshet |

# 3) Observations

## DIKE LAYOUT AND AS-BUILT CROSS SECTION AT 60+190




- Elevation of natural ground D/S of 60+190: about El. 129 m.
- Note: TSS measurements done at seepage station B only.

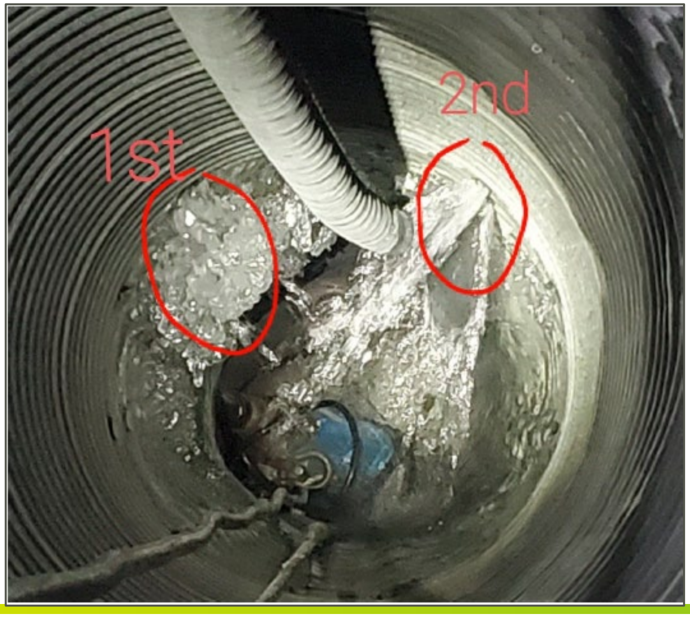


# 3) Observations

## FIELD VISUAL OBSERVATIONS (INFO FROM AEM)

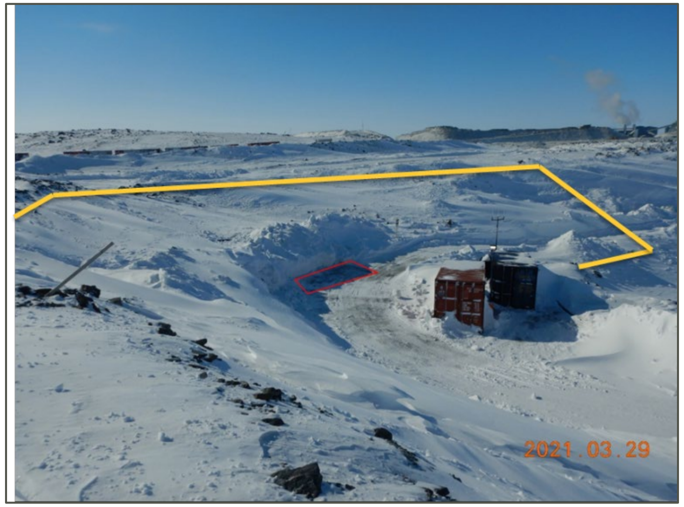
**February 27 and March 3, 2021:**

- Unusual increase in inflow in the East Dike seepage station at (0+195).
- Water entering into culvert higher than usual.
- No defect in culvert or pipes.




**March 29, 2021:**

- Water on road surface (including ice).
- Almost no water in seepage station.
- No visual sign of instability. Piezometers in the sector (190 to 240) started to rise on March 11 (1.65 m).




*photos by AEM*

# 3) Observations

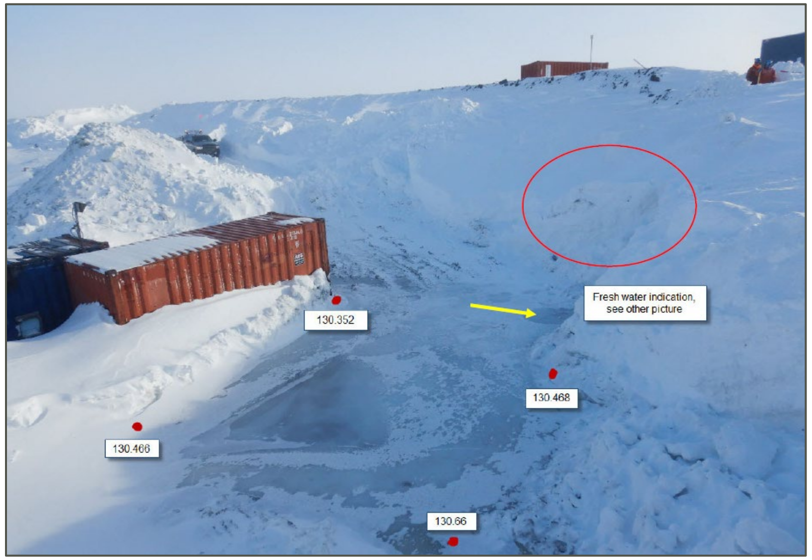
## FIELD VISUAL OBSERVATIONS (INFO FROM AEM)

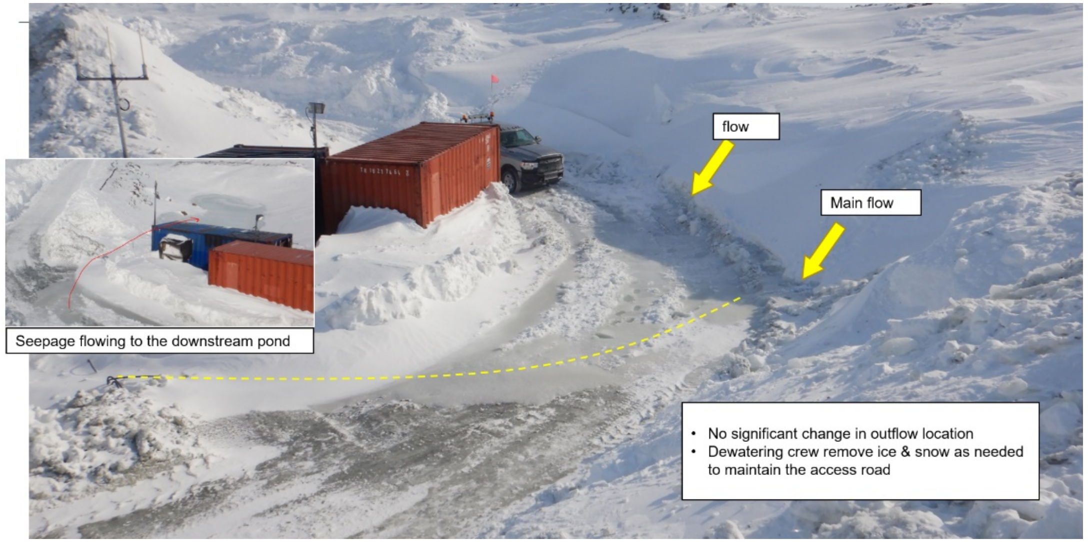
**April 6, 2021:**

- Snow removal in the downstream toe area.
- Significant water was released when snow was excavated. Water source identified at El. 130.3.
- Following the snow removal, piezometric level instantaneously dropped by 0.5 m

**April 18, 2021:**

- Water observed flowing on ground surface and toward downstream pond.
- Both seepage stations are dry (flow rate was 6 $m^3$/h from March 16 to 22)




*photos by AEM*

# 3) Observations

## FIELD VISUAL OBSERVATIONS (INFO FROM AEM)

**May 23, 2021:**

- Water level rising in downstream pond.
- New water inflow observed in Pit E ramp
- Piezometer pressure continues to rise but at a lower rate.
- Thermal regime shows warming up at shallow depth following air temperature trends

**June 19, 2021:**

- Water flowing on the East Dike access road
- Downstream pond water level rose in freshet, then stabilized
- Piezometer pressure dropping


*photos by AEM*

# 3) Observations

## FIELD VISUAL OBSERVATIONS (INFO FROM AEM)

**June 29, 2021:**

- No more water flowing on the access road (Reports directly to pond)
- Downstream pond level is stable (no pumping)
- Water still flowing in Pit E ramp

**July 27, 2021 (Golder geotechnical inspection):**

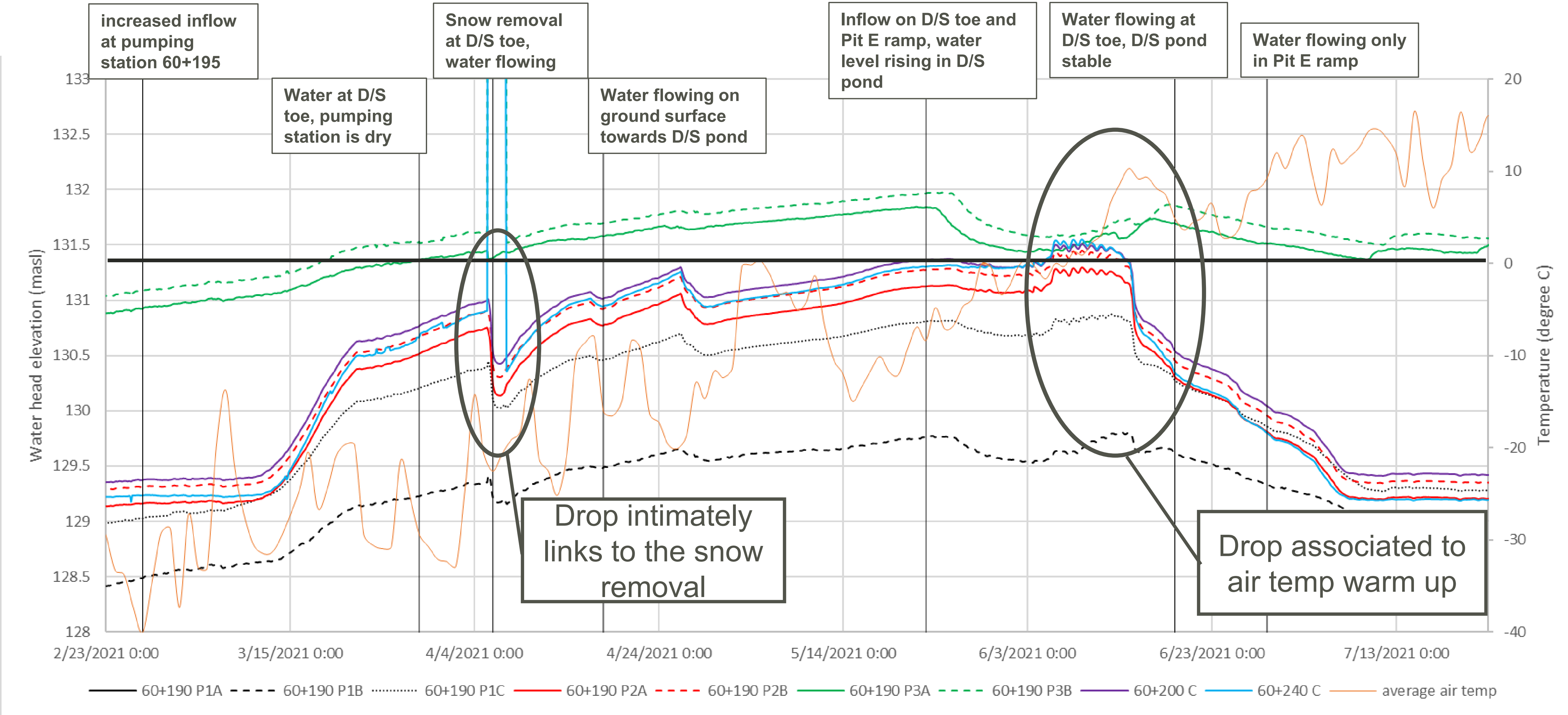
- No unusual observation on East Dike.
- Seepage stations are dry.
- Normal piezometric and thermal conditions for the summer.


*photos by AEM*

# 3) Observations

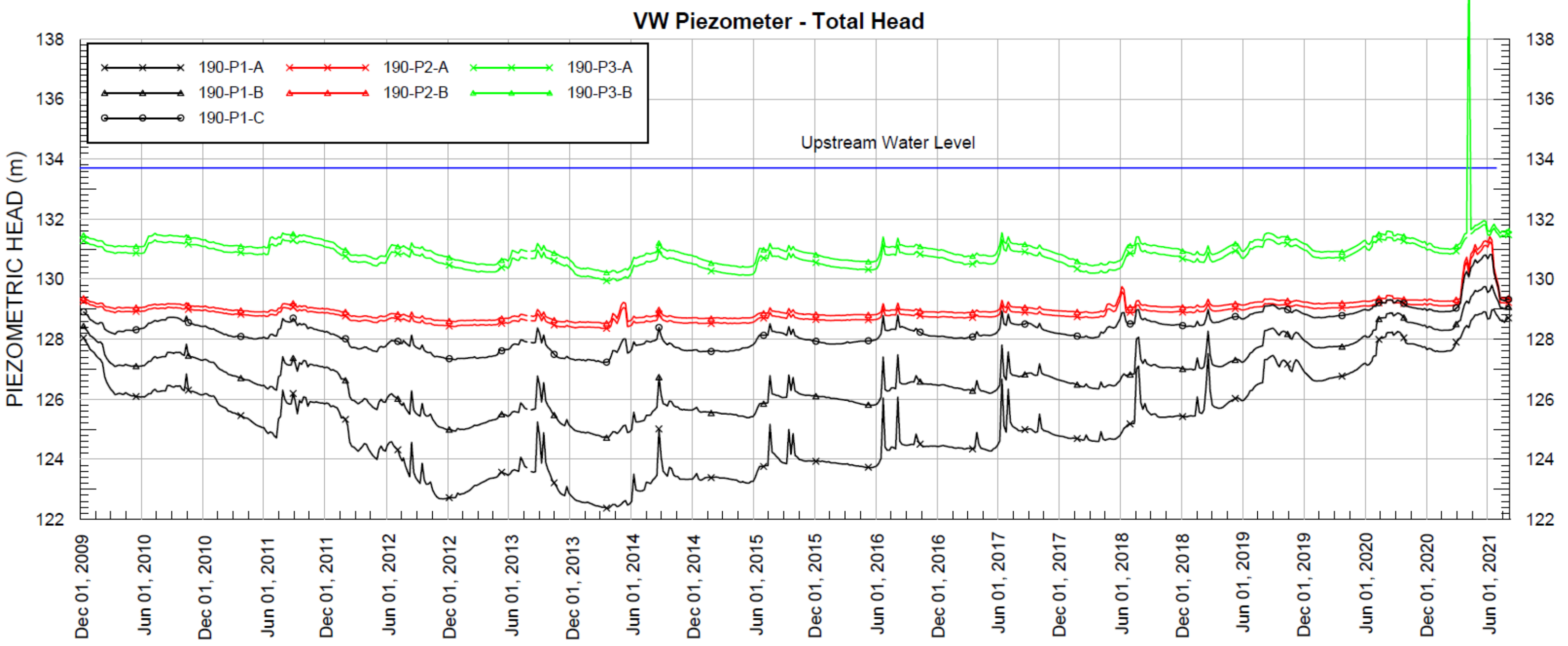


## INSTRUMENTATION DATA - PIEZOMETERS



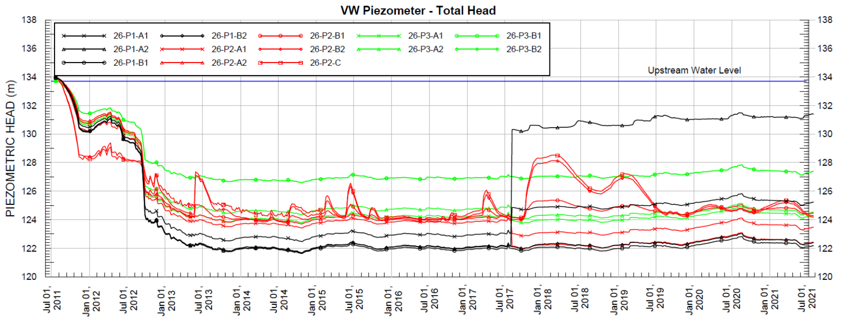
# 3) Observations

## INSTRUMENTATION DATA - PIEZOMETERS




Bay Goose Comparison;

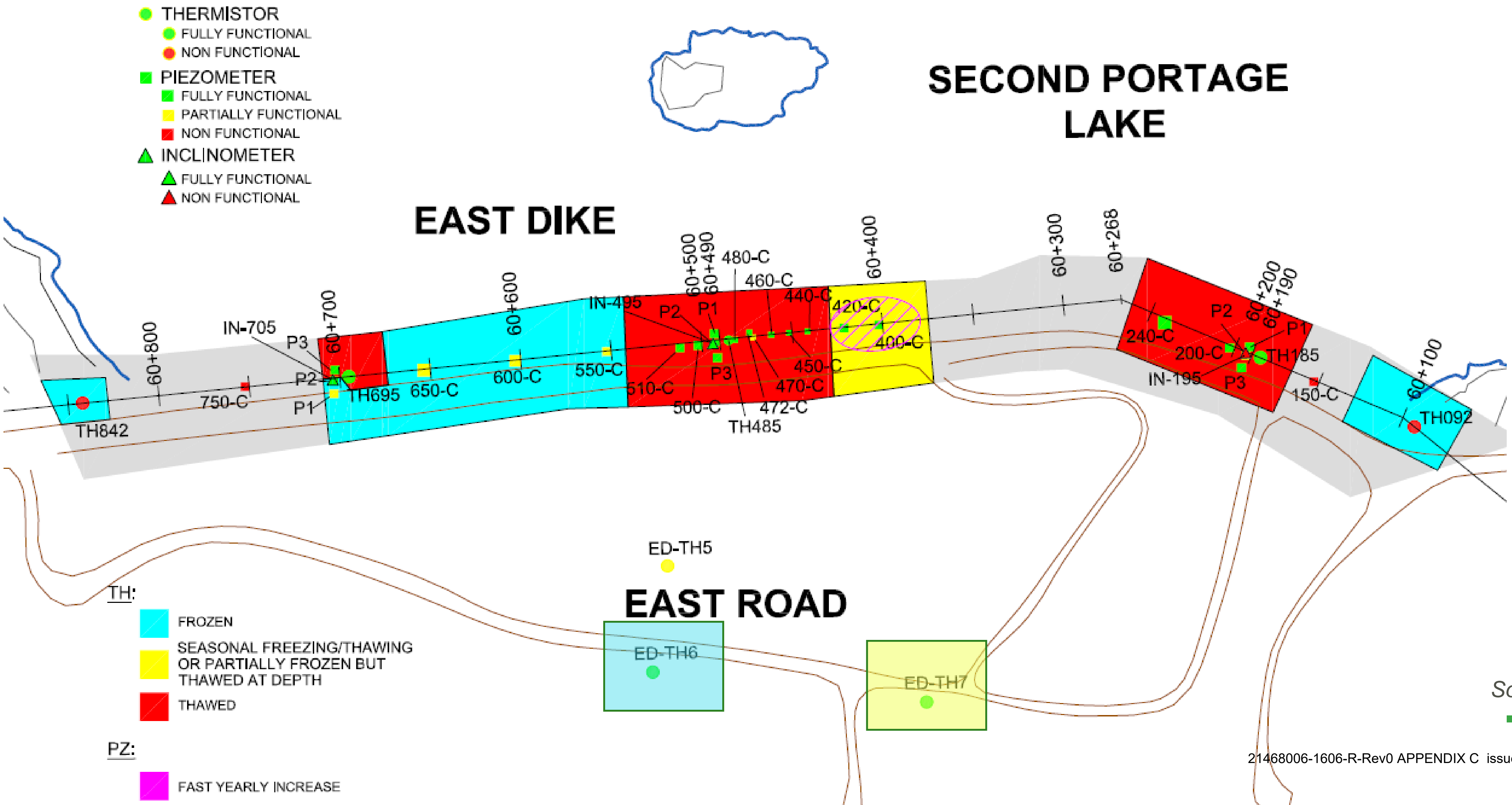
- Same periodic seasonal rising trend observed




- The 2 seepage zones (South Channel and North Channel) are not connected as water head remains below topographic heights in the separation.
- Piezometers are reacting to downstream toe ice blockage removal (important pressure release).
- Slight pressure release when seepage daylight on Pit E ramp (new seepage pathway).
- Fluctuations in pressures nearing freshet: possible impact of daily freeze/thaw of seepage pathway. Followed by rapid decrease in pressure when thawing starts.
- Overpressure entirely dissipated after thawing. Same pressure levels as before the event.

# 3) Observations

## INSTRUMENTATION DATA - THERMISTORS

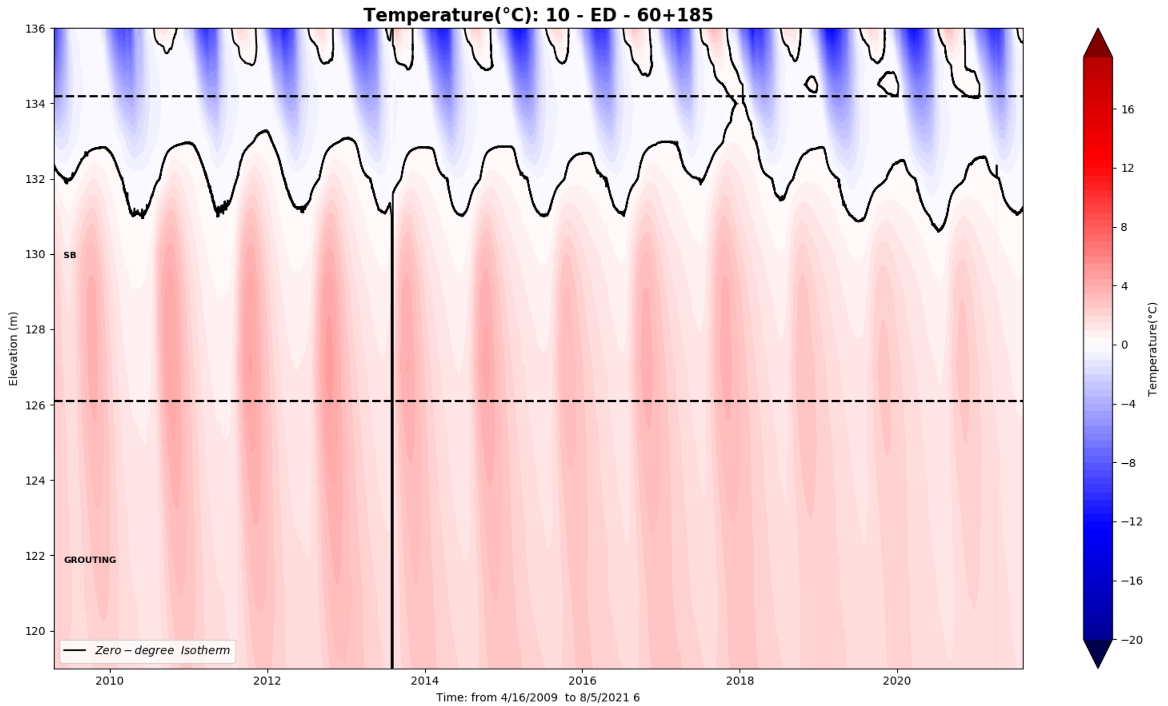


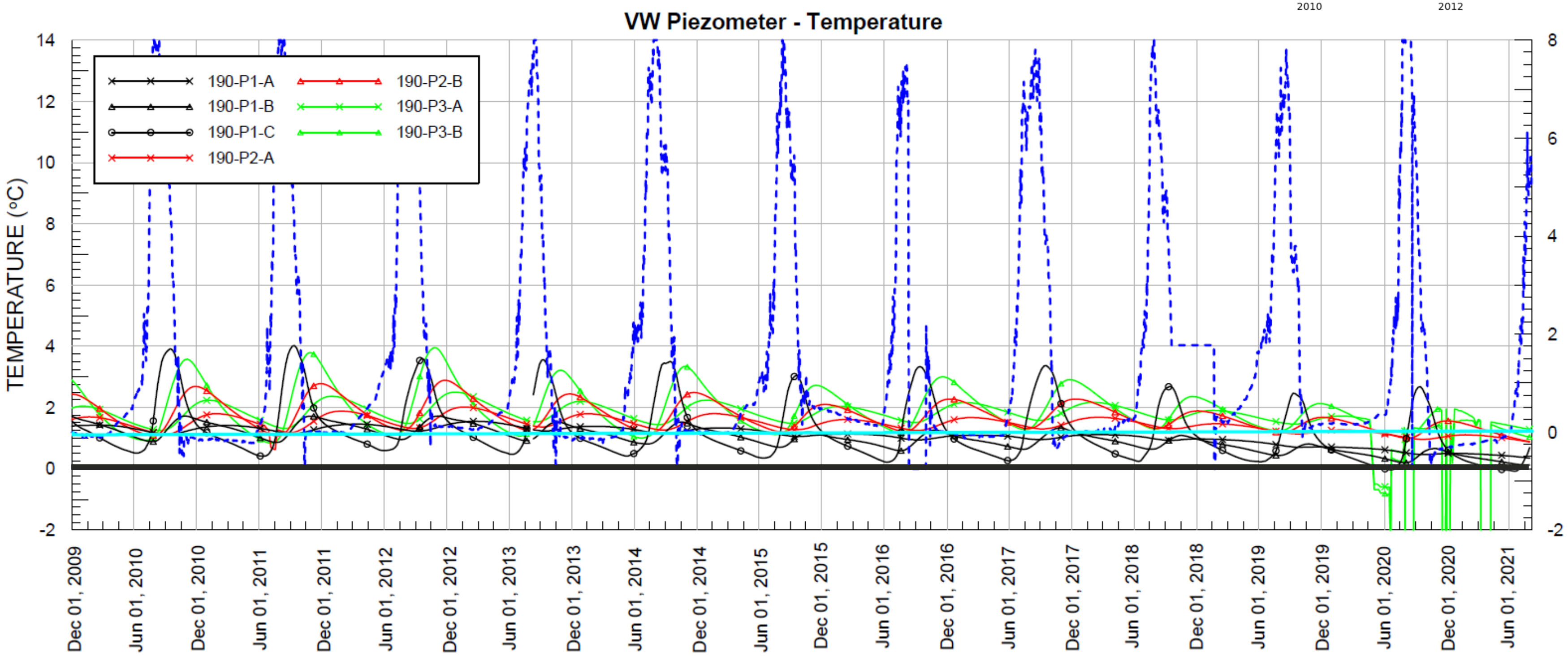

Source:AEM

# 3) Observations

## INSTRUMENTATION DATA - THERMISTORS

- General cooling trend in all instruments on East Dike.
- Downstream toe freezing at the South Channel: P1 piezometric line nearing 0°C.
- Downstream instruments: TH6 frozen, TH7 partially unfrozen in till and bedrock (potential pathway).
- North Channel and channels on Bay-Goose Dike see seepage zones narrowing due to surrounding area freezing.

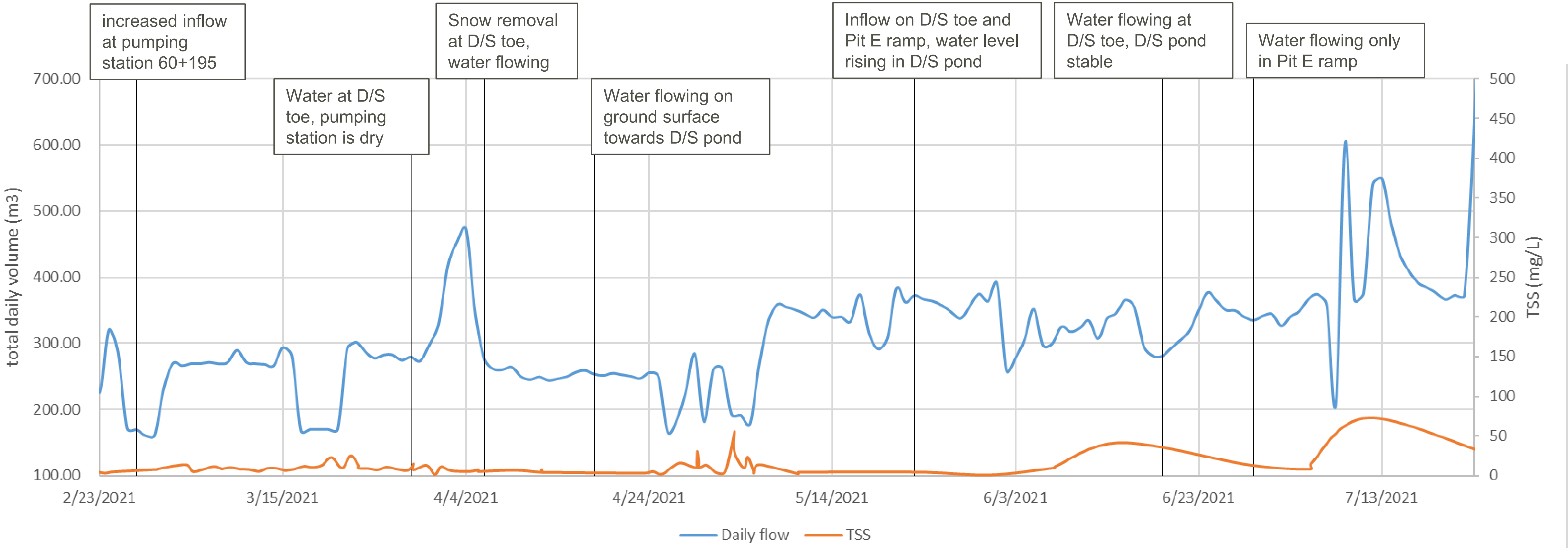



- Thermal variations of decreasing amplitude over the years in seepage channels. Possibly due to the opening of the pit and seepage going through deeper bedrock.
- Lots of snow accumulating on the downstream side of East Dike, especially against the south portion (likely insulating the foundation and slowing down freezing).

# 3) Observations

## INSTRUMENTATION DATA – TSS AND PUMPING RATES




- During the event, lower pumping rate than historically (168 m3/h vs 700 m3/h): seepage seems to be reaching less the pumping well, flow rate is underestimating the seepage rate. Potential blockage in the seepage pathway causing seepage redirection towards the surface.
- No change in global flow or TSS, but TSS changes could be diluted too much to be noticed.

# 4) Inferred Mechanism

## HYPOTHESIS 1: INCREASE IN SEEPAGE DUE TO DETERIORATION OF THE CUT-OFF WALL OR FOUNDATION

- Would result in sustained higher seepage after the event.
- Not backed by piezometric data: water head went back to the level before the event once freshet occurred.
- No deformation in the dike surface which could indicate internal erosion (like the sinkhole in 2009) or foundation erosion.
- No other sign of increased seepage (TSS or flowrate), Flowrate to be interpreted with caution as part of the seepage seems not to be collected by the system anymore.

→ **Unlikely scenario.**

# 4) Inferred Mechanism

## HYPOTHESIS 2: RESTRICTION OF THE USUAL SEEPAGE PATHWAY DOWNSTREAM OF THE DIKE DUE TO FREEZING AND DEVELOPMENT OF NEW PATHWAYS

- Restriction of available space in the foundation for seepage to flow through at the downstream toe due to the foundation freezing.
- Backed by global thermal trend on East Dike at the North Channel, and at most seepage channels at Bay-Goose Dike nearby. Cooling trend observed at the South Channel, even though freezing is less advanced and the downstream instruments (P1) are only starting to freeze. However, no functioning thermistor available at the lateral limits of the South Channel to confirm lateral restriction of the seepage zone.
- Piezometric data indicate that water was released once the water level overtopped the natural ground level (assumed frozen, constituting the pathway blockage). New seepage outlets observed (surface at 60+190 and Pit E ramp) suggesting new seepage pathway developing.
- Excess pressure entirely and rapidly released after the area thawed during freshet, confirming strong dependence of the mechanism on the thermal regime of the dike and foundation, especially on the downstream side.

→ **Most likely scenario, but more thermal data is required to confirm that this mechanism is responsible of the observed high pressure and surface seepage event in the South Channel.**

→ **Seepage pathway likely to have been durably affected, as the pumping station is no longer collecting all the seepage.**

# 5) Recommendations

## IMPACT ON CURRENT AND FUTURE DIKE PERFORMANCE

- Current impact on dike performance: estimated very low. Dike is stable, no sign of deteriorating conditions or erosion in the dike or foundation.
- Impact on seepage management: incomplete collection of the seepage due to new pathways bypassing the seepage collection system. Modify the pumping well location to better intercept the seepage, potentially closer to the dike where the foundation is less affected by the freeze back.
- Potential for future deterioration of the dike performance: possible depending on the seepage route. Visual inspections and instrumentation review to continue on a regular basis to monitor the situation and detect any change.

# 5) Recommendations

## PATH FORWARD

- Install additional thermistors around the South Channel (both sides) to monitor the evolution of the lateral limits of the unfrozen zone and confirm seepage pathway restriction hypothesis.
- Install additional thermistors directly downstream of both seepage channels, at a longer distance from the downstream toe than P1 line.
- Separate the measurements for flows at each pumping station (separate flowmeters). At the moment values are not reliable when the pump is not fully submerged, which is most of the time. Improve flow measurement method to provide values continuously. Measure TSS in each pumping station (currently only station B, in the South Channel).

GOLDER
MEMBER OF WSP

# Thank you!

**APPENDIX D**

# All Weather Private Road

**APPENDIX D1**

# AWAR Observations

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS |
|---|---|---|---|
| 0+430 | PRC1 | 1x600 mm CSP | Culvert owned by the town and not AEM. Minor damage to outlet. Minor obstruction of the outlet. Still in good condition. No action required |
| 0+470 | PRC2 | 2x600 mm CSP | Culvert owned by the town and not AEM. Good condition |
| 1+380 | PRC3 | 1x600 mm CSP | Culvert owned by the town and not AEM. Good condition |
| 2+550 | R-00A | 1x600 mm CSP | No sign of any flow. Inlet partially collapsed, outlet entirely collapsed with signs of obstruction from road material. |
| 4+260 | PC-14 | 2x600 mm CSP | These 2 culverts are too damaged to function any longer. If needed, new culvert should be installed further north. |
| 5+200 | Quarry 1 | | Rocks walls are generally clean and stable. |
| ~5+700 | unname d | 1x600 mm CSP | The inlet is buried in gravel. The outlet is in good condition. |
| 8+750 | R02 Centre Bridge | 30m Acrow Panel Bridge | In general good condition. The two corrugated steel bins at both abutments show deformation under the weight of the bridge. |
| 8+830 | PC-17A | 2X1800 mm CSP | Sign of erosion beneath the inlet and flow of water occuring beneath the culvert. The 1800 CSP were installed too high. While conditions are not perfect, they have proven stable over the past years. No sign of degradation from last year on both the inlet and outlet sides. Flow was observed beneath the culvert in the past, but in 2019 the flow moved further south (5-10 m from culvert). Stable, to keep monitoring for evolution. |
| 8+850 | PC-17 | 2x1200 mm CSP | In good condition |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS |
|---|---|---|---|
| 9+952 | PC-1 | 1x600 mm CSP | In good condition |
| 10+580 | R-03 | 1x600 mm CSP | In good condition |
| 12+050 | R-04 | 1x1200 mm CSP | In good condition |
| 12+745 | PC-13 | 1x600 mm CSP | In good condition but inlet slightly bent. |
| 13+250 | Quarry 2 | | The wall is mostly clean. One steep area is unstable and would require cleaning if operations resume. |
| 13+405 | PC-2 | 1x600 mm CSP | In good condition |
| 13+685 | PC-3 | 1x600 mm CSP | In good condition |
| 13+950 | unname d | 1x600 mm CSP | In good condition |
| 14+910 | PC-4 | 1x600 mm CSP | In good condition |
| 15+745 | R-05A | 1x1200 mm CSP | In good condition |
| 17+600 | R05 Center Bridge | 30m Acrow Panel Bridge | In good condition. Minor damage to the bin wall of both abutments as a result of past snow removal activites. No reparation required yet. |
| 18+280 | PC-5 | 1x600 mm CSP | In good general condition, but inlet slighlty damaged. |
| 18+900 | PC-6 | 1x600 mm CSP | In good condition |
| 20+240 | PC-7A | 2x600 mm CSP | In general good condition. The outlet of the northern culvert is damaged. |
| 20+250 | PC-7 | 1x600 mm CSP | The outlet of the  culvert is partly buried and to be cleaned. |
| 23+100 | R06 Center Bridge | 30 m Acrow Panel Bridge | In good condition. Limited surficial erosion of granular material on North abutment. |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS |
|---|---|---|---|
| 23+700 | Quarry 3 | | A crusher is installed in this quarry. The west wall is in good and stable condition, but would need additional cleaning locally. |
| 25+900 | R-07 | 1x1200 mm CSP | In good condition |
| 29+420 | PC-8 | 1x600 mm CSP | In good condition |
| 31+300 | Quarry 4 | | Quarry flooded. In good condition. |
| 34+650 | Quarry 5 | | Rock walls are in good and stable condition, except for a small portion on the east side. |
| 35+690 | PC-9 | 1x600 mm CSP | In good condition. |
| 36+470 | Quarry 6 | | The remaining rock walls are clean and stable. |
| 36+865 | PC-10 | 1x600 mm CSP | Not observed in 2021. |
| 39+552 | PC-11 | 1x600 mm CSP | In good condition. The inlet is too high and water is flowing underneath it. Not much flow observed, outlet was not visible, possibly buried. |
| 39+800 | Quarry 7 | | The quarry walls are in unstable condition with loose rocks. Scaling is recommended before resuming activities. |
| 41+300 | PC-12 | 1x600 mm CSP | In good condition, almost submerged. |
| 42+950 | Quarry 8 | | Walls are generally stabilized with rockfill berm but some others are in loose unstable condition (South wall). |
| 44+600 | Quarry 9 | | Presence of unstable loose rocks and boulders along the steepest and highest wall section. Some walls are in unstable condition with loose rocks. |
| 48+500 | R09 Center Bridge | 12m Rapid Span Bridge | In good general condition. A series of cracks is present on top of the South abutment (seems inactive). Some water flowing under the Northeast abutment, but no sign of erosion. To monitor. |
| 48+900 | Quarry 10 | | The steep west rock wall is unstable. |
| 53+500 | Quarry 11 | | Rock walls are clean and stable. |
| 54+950 | PC-16 | 1x600 mm CSP | Not observed in 2021. |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS |
|---|---|---|---|
| 58+300 | Quarry 12 | | In general good, stable condition. |
| 62+060 | R13 Center Bridge | 12 m Rapid Span Bridge | In general good condition. Surficial erosion of the granular material on the Northeast Abutment. |
| 62+350 | Quarry 13 | | Loose blocks were observed in some portions the the rock wall, but the quarry is in general good condition. Some water ponding. |
| 65+700 | Quarry 14 | | Quarry flooded. Loose blocks were observed in some portions the the rock wall, but in general good condition. |
| 67+600 | Quarry 15 | | Steep rock wall in relatively stable condition. Some water ponding. |
| 67+840 | R-14 | 3x1200 mm CSP | Middle and northern culverts show small sign of erosion at the outlet and have been damaged (collapsed) inside, below the road, but it is anticipated that they will continue to perform well. The South outlet is partly buried in gravel. All of them were installed too high but function well. Water is flowing under the road between the culverts, but no sign of erosion. No action required. |
| 69+200 | R15 Centre Bridge | 30 m Acrow Panel Bridge | Bin wall of both abutments were observed to be damaged but they are still holding well. Limited surficial erosion of the granular material on the South abutment The bridge is dipping toward the west side on both north and south abutments. The foundation does not show signs of failure but is slowly settling. Its condition should be monitored. |
| 70+400 | Quarry 16 | | Presence of unstable loose rocks and boulders but in general good condition. |
| 72+800 | Quarry 17 | | Steep rock wall in stable conditions. |
| 73+800 | R16 Centre Bridge | 12m Rapid Span Bridge | In good condition. Flow observed under the North abutment, but no sign of erosion. |
| 77+440 | R-17 | 1x1200 mm CSP | In good condition |
| 79+500 | R18 Centre Bridge | 12 m Rapid Span Bridge | In good condition. Limited surficial erosion of granular material on the abutments. |
| 80+200 | Quarry 18 | | In general good condition, south wall is high (about 8 m) with some loose blocks. |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS |
|---|---|---|---|
| 80+950 | R-18A | 3x1200 mm CSP | In good condition. |
| | R-18B | 1X600 mm CSP | In good condition, installed above ground surface (water can flow below culvert). |
| 83-150 | R19 Centre | 12m Rapid Span Bridge | Some damage to the steel containment plates and to one pile was observed, which may be associated with snow removal activity. The damage is minor and does not affect the geotechnical integrity of the bridge. Old tension cracks in the top surface on the North abutment have disappeared. Northwest railing is bent. |
| 84+300 | Quarry 19 | | Rock walls are in good condition. |
| 85+490 | R-20 | 1x1200 mm CSP | Outlet of the culvert is slighly twisted. The middle of the culvert is slightly collapsed. The inlet is installed above the ground surface and water is able to flow beneath the culvert. No follow-up required, in stable conditions. |
| 87+300 | R-21 | 2x1200 mm CSP | Both culverts are slightly collapsed in the middle. Should have been installed lower to avoid erosion issue. In stable condition. |
| 89+550 | Quarry 20 | | Quarry walls are in good condition. Active at the time of the inspection with material loading. |
| 93+400 | Quarry 21 | | Quarry walls are in good condition. |
| 93+600 | R-23 | 1x1200 mm CSP | Minor damage near the top, but still in good condition. The culvert is installed too high and as a result there is a low flow of water through the road rockfill. The situation has been under control over the past years. |
| 98+100 | R-24 | 2x1200 mm CSP | Both outlet are installed too high. The outlet of the southern culvert still shows small signs of erosion, but this has been under control over the past years. Both culvert show deformation in the upper part. |
| 99+200 | Quarry 22 | | In relative stable condition. |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS |
|---|---|---|---|
| 101+950 | R-25 | 2x600 mm CSP | One culvert is angling up toward the downstream end and natural drainage by gravity does not occur. A second culvert alongside is well installed and should drain water for the remainder of the season. No sign of erosion observed during the inspection. |
| | Western diversion ditch | 2x1200 mm CSP | Outlet in good condition and inlet slightly bent but still in good condition. |
| 104+400 | R-26 | 3x1200 mm CSP | In good condition |
| | Quarry 23 | | This is an active quarry used to store rock cores and other things. Because of the presence of loose rocks on top of steep wall, the workers who need access to the quarry should be aware of rockfall potential and stay at a minimum of 20 m away from the wall. Most of the unstable wall areas are bermed off. Areas of the quarry are flooded. |

**APPENDIX D2**

# Culverts Photographic Log

**Photograph D2-1: PC-17A km 8+830**

**<u>Date</u>**: July 30, 2021 **<u>Photo Number</u>**: 191

**<u>Description</u>**: View of the culvert outlets. No sign of degradation and the flow is stable south of the culverts (5-10 m away).

**Photograph D2-2: PC-11 km 39+552**

**<u>Date</u>**: July 30, 2021 **<u>Photo Number</u>**: 196

**<u>Description</u>**: View of the culvert inlet. Installed high but in good condition.

**Photograph D2-3: R-14 km 67+840**

**Date**: July 17, 2020 **Photo Number**: 204

**Description**: View of the culvert outlets. Water is flowing beneath the road between the culverts.

**APPENDIX D3**

# Bridges Photographic Log

**Photograph D3-1 Bridges 1 – R02 km 8+750**

**Date**: July 30, 2021 **Photo Number**: 189

**Description**: Looking at the north abutment. The corrugated steel bin shows deformation under the weight of the bridge.

**Photograph D3-2 Bridges 1 – R02 km 8+750**

**Date**: July 30, 2021 **Photo Number**: 190

**Description**: Looking at the south abutment. The corrugated steel bin shows deformation under the weight of the bridge.

**Photograph D3-3 Bridges 2 – R05 km 17+600**

**Date**: July 30, 2021 **Photo Number**: 192

**Description**: Looking at the north abutment.

**Photograph D3-4 Bridges 2 – R05 km 17+600**

**Date**: July 30, 2021 **Photo Number**: 193

**Description**: Looking at the south abutment. Minor damage to the bin wall.

**Photograph D3-5 Bridges 3 – R06 km 23+100**

**Date**: July 30, 2021 **Photo Number**: 194

**Description**: Looking at the north abutment.

**Photograph D3-6 Bridges 3 – R06 km 23+100**

**Date**: July 30, 2021 **Photo Number**: 195

**Description**: Looking at the south abutment.

**Photograph D3-7 Bridges 4 – R09 km 48+500**

**Date**: July 30, 2021 **Photo Number**: 197

**Description**: Looking at the north abutment.

**Photograph D3-8 Bridges 4 – R09 km 48+500**

**Date**: July 30, 2021 **Photo Number**: 199

**Description**: Looking from the northeast abutment. Water is flowing under the abutment, no erosion.

**Photograph D3-9 Bridges 4 – R09 km 48+500**

**Date**: July 30, 2021 **Photo Number**: 198

**Description**: Looking at the south abutment.

**Photograph D3-10 Bridges 5 – R13 km 62+060**

**Date**: July 30, 2021 **Photo Number**: 201

**Description**: Looking at the north abutment.

**Photograph D3-11 Bridges 5 – R13 km 62+060**

**Date**: July 30, 2021 **Photo Number**: 202

**Description**: Looking at the south abutment.

**Photograph D3-12 Bridges 6 – R15 km 69+200**

**Date**: July 30, 2021 **Photo Number**: 205

**Description**: Looking at the north abutment. Damage to the bin wall likely caused during snow removal activities. Bridge is tipping toward the west side on the abutment.

**Photograph D3-13 Bridges 6 – R15 km 69+200**

**Date**: July 30, 2021 **Photo Number**: 206

**Description**: Looking at the south abutment. Damage to the bin wall likely caused during snow removal activities. Bridge is tipping toward the west side on the abutment.

**Photograph D3-14 Bridges 7 – R16 km 73+800**

**Date**: July 30, 2021 **Photo Number**: 207

**Description**: Looking at the north abutment. In good condition.

**Photograph D3-15 Bridges 7 – R16 km 73+800**

**Date**: July 30, 2021 **Photo Number**: 208

**Description**: Looking at the south abutment. In good condition.

**Photograph D3-16 Bridges 8 – R18 km 79+500**

**Date**: July 30, 2021 **Photo Number**: 209

**Description**: Looking at the north abutment. In good condition.

**Photograph D3-17 Bridges 8 – R18 km 79+500**

**Date**: July 30, 2021 **Photo Number**: 210

**Description**: Looking at the south abutment. In good condition.

**Photograph D3-18 Bridges 9 – R19 km 83+150**

**Date**: July 30, 2021 **Photo Number**: 211

**Description**: Looking at the north abutment. Minor damage to steel plate due to snow removal activity.

**Photograph D3-19 Bridges 9 – R19 km 83+150**

**Date**: July 30, 2021 **Photo Number**: 212

**Description**: Looking at the south abutment. Minor damage to steel plate due to snow removal activity. Minor tension cracks, seem inactive.

**APPENDIX E**

# Whale Tail Project Road

**APPENDIX E1**

# Whale Tail Project Road Observations

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 116+449 | #1 | 450 mm | Not observed, seems to be under Vault Pad. | - |
| 116+675 | #2 | 300 mm | | - |
| 117+133 | #3 | 900 mm | In good condition. | - |
| 117+137 | #3-2 | 900 mm | | |
| 117+325 | #4 | 800 mm | In good condition. | - |
| 117+525 | #5 | 600 mm | In good condition but inlet buried. | - |
| 117+799 | #6 | 600 mm | Not observed. | - |
| 118+013 | #7 | 900 mm | Inlet in good condition, outlet totally buried. | - |
| 118+016 | #7-2 | 900 mm | | |
| 118+125 | #8 | 900 mm | In good condition. | - |
| 118+127 | #8-2 | 900 mm | | |
| 118+659 | #9 | 600 mm | Inlet in good condition, outlet damaged and pinched. | - |
| 119+400 | Bridge 3.4 | | In good condition. | 214: south<br>213: north |
| 119+264 | #10 | 600 mm | Inlet in good condition, outlet damaged and pinched. | - |
| 119+850 | #11 | 300 mm | In good condition. | - |
| 120+183 | #12 | 900 mm | Inlets in good condition. 3 outlets are buried. | 215 |
| 120+181 | #12-2 | 900 mm | | |
| 120+179 | #12-3 | 900 mm | | |
| 120+184 | #12-4 | 900 mm | | |
| 120+186 | #12-5 | 900 mm | | |
| 120+615 | #13 | 300 mm | Inlet in good condition, outlet not observed as it is buried. | - |
| 120+756 | #14 | 600 mm | In good condition. | - |
| 120+850 | #15 | 900 mm | In good condition. | - |
| 121+050 | #16 | 300 mm | Not observed. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 121+161 | #17 | 800 mm | In good condition, outlet damaged. | - |
| 121+330 | #18 | 700 mm | In good condition. | - |
| 121+574 | #19 | 900 mm | In good condition. | - |
| 121+931 | #20 | 900 mm | In good condition. | - |
| 121+929 | #20-2 | 900 mm | | |
| 122+310 | #21 | 300 mm | Not observed. | - |
| 122+423 | #22 | 600 mm | In good condition. | - |
| 122+442 | #23 | 600 mm | In good condition. | - |
| 122+493 | #24 | 600 mm | Not observed. | - |
| 122+530 | #25 | 600 mm | In good condition. | - |
| 123+216 | #26 | 800 mm | In good condition. | - |
| 123+218 | #26-2 | 800 mm | | |
| 123+275 | #27 | 600 mm | In good condition. | - |
| 123+300 | #27-2 | 600 mm | Outlet is buried. | |
| 123+325 | #27-3 | 600 mm | In good condition. | - |
| 123+349 | #28 | 600 mm | In good condition. | - |
| 123+375 | #28-2 | 600 mm | In good condition. | - |
| 123+779 | #29 | 900 mm | Not observed. | - |
| 123+781 | #29-2 | 900 mm | Not observed. | - |
| 123+968 | #30 | 900 mm | Not observed. | - |
| 123+970 | #30-2 | 900 mm | | |
| 124+005 | #31 | 900 mm | Not observed. | - |
| 124+383 | #32 | 900 mm | Not observed. | - |
| 124+405 | #33 | 900 mm | In good condition. | - |
| 124+426 | #34 | 900 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 124+428 | #34-2 | 900 mm | | |
| 124+581 | #35 | 700 mm | In good condition. | - |
| 125+000 | #36 | 700 mm | In good condition. | - |
| 125+035 | #37 | 900 mm | In good condition. | - |
| 125+049 | #38 | 900 mm | Inlet in good condition, outlet buried. | - |
| 125+193 | #39 | 900 mm | In good condition. | - |
| 125+195 | #39-2 | 900 mm | | |
| 125+291 | #40 | 900 mm | In good condition. | - |
| 125+388 | #41 | 600 mm | In good condition. | - |
| 125+416 | #42 | 600 mm | In good condition. | - |
| 125+460 | #43 | 600 mm | Not observed. | - |
| 125+490 | #44 | 300 mm | Not observed. | - |
| 125+710 | #45 | 600 mm | Not observed. | - |
| 126+500 | Quarry 10.5 | | Unstable wall, loose rocks. Workers should stay away from the wall. | - |
| 126+700 | Bridge 10.7 | 600 mm | In good condition. | 217: south<br>216: north |
| 127+020 | #46 | 900 mm | In good condition. | - |
| 127+101 | #47 | 900 mm | In good condition. | - |
| 127+103 | #47-2 | 900 mm | | |
| 127+104 | unnamed | 1000 mm | | |
| 127+105 | #47-3 | 900 mm | | |
| 127+107 | #47-4 | 900 mm | | |
| 127+203 | #48 | 900 mm | The inlet is 3/4 buried. | - |
| 127+411 | #49 | 450 mm | Not observed. | - |
| 127+748 | #50 | 600 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 127+905 | #51 | 300 mm | Not observed. | - |
| 128+195 | #52 | 700 mm | Inlet in good condition, outlet buried. | - |
| 128+240 | #53 | 700 mm | In good condition. | - |
| 128+388 | #54 | 600 mm | Inlet is buried. | - |
| 128+440 | #55 | 600 mm | Inlet is buried. | - |
| 128+485 | #56 | 600 mm | In good condition. | - |
| 128+635 | #57 | 450 mm | In good condition. | - |
| 128+740 | #58 | 900 mm | In good condition. | - |
| 128+760 | #59 | 900 mm | In good condition. | - |
| 128+775 | #60 | 900 mm | In good condition. | - |
| 129+050 | #61 | 600 mm | Inlet in good condition, outlet buried. | - |
| 129+265 | #62 | 600 mm | In good condition. | - |
| 129+390 | #63 | 300 mm | Inlet in good condition, outlet buried. | - |
| 129+920 | #64 | 600 mm | Not observed. | - |
| 130+924 | #65 | 800 mm | In good condition but inlet is buried. | - |
| 132+000 | Bridge 16 | | In good condition. | 219: south<br>218: north |
| 132+324 | #66 | 600 mm | In good condition but inlet is buried. | - |
| 132+689 | #67 | 600 mm | In good condition. | - |
| 132+750 | #68 | 600 mm | In good condition. | - |
| 133+000 | Esker #1 | | Active (gravel and rock). Presence of loose rock on the steep wall, risk of sloughing. | - |
| 133+250 | #68-A | 600 mm | In good condition. Above water. | - |
| 133+500 | #68-B | 600 mm | In good condition. | - |
| 133+784 | #69 | 600 mm | Not observed. | - |
| 133+837 | #70 | 600 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 134+580 | #73 | 1200 mm | In good condition. | 220 |
| 134+559 | #74 | 900 mm | In good condition. | - |
| 134+610 | #74-2 | 900 mm | | |
| 134+861 | #75 | 600 mm | In good condition. | - |
| 134+916 | #76 | 450 mm | In good condition. | - |
| 134+998 | #77 | 450 mm | Not observed. | - |
| 135+092 | #78 | 300 mm | Not observed. | - |
| 135+092 | #78-2 | 300 mm | | |
| 135+495 | #79 | 700 mm | In good condition. | - |
| 135+659 | #80 | 450 mm | In good condition. | - |
| 135+841 | #81 | 600 mm | In good condition. | - |
| 136+000 | Bridge 20 | | In good condition. | 222: south<br>221: north |
| 136+143 | #82 | 300 mm | Inlet in good condition, outlet buried. | - |
| 136+300 | #83 | 600 mm | Inlet is bent, still working. | - |
| 136+527 | #84 | 700 mm | In good condition. | - |
| 136+671 | #85 | 600 mm | Inlet in good condition, outlet is buried. | - |
| 136+740 | #86 | 600 mm | In good condition but outlet buried. | - |
| 136+810 | #87 | 600 mm | In good condition. | - |
| 136+881 | #88 | 300 mm | In good condition, the outlet is almost completely blocked. | - |
| | Quarry 21 (Q141) | | Not inspected. | - |
| 137+180 | #89 | 450 mm | In good condition, the outlet is high above ground. | - |
| 137+295 | #90 | 800 mm | In good condition. | - |
| 137+297 | #90-2 | 800 mm | | |
| 137+770 | #91 | 600 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 137+040 | #92 | 600 mm | In good condition. | - |
| 138+100 | #93 | 450 mm | Inlet in good condition, outlet totally buried. | - |
| 138+147 | #94 | 900 mm | In good condition. | - |
| 138+149 | #94-2 | 900 mm | In good condition. | - |
| 138+150 | #94-3 | 900 mm | In good condition. | - |
| 138+161 | #95 | 900 mm | In good condition. | - |
| 138+162 | #95-2 | 900 mm | In good condition. | - |
| 138+353 | #96 | 600 mm | In good condition. | - |
| 138+436 | #97 | 600 mm | In good condition. | - |
| 138+482 | #98 | 600 mm | In good condition. | - |
| 138+830 | #99 | 600 mm | In good condition. | - |
| 138+936 | #100 | 600 mm | In good condition. | - |
| 139+025 | #101 | 600 mm | Outlet in good condtiion, inlet totally buried. | - |
| 139+265 | #102 | 600 mm | In good condition. | - |
| 139+562 | #103 | 600 mm | In good condition. | - |
| 139+595 | #104 | 600 mm | In good condition. | - |
| 139+900 | Bridge 23.9 | | In good condition. | 224: south<br>223: north |
| 140+555 | #105 | 600 mm | In good condition but outlet buried. | - |
| 140+700 | #106 | 600 mm | In good condition. | - |
| 140+961 | #107 | 900 mm | In good condition. | - |
| 140+982 | #107-2 | 900 mm | | |
| 140+984 | #107-3 | 900 mm | | |
| 141+000 | Esker #2 | | In general good condition, but the small walls are steep and in loose conditions. Risk of rockfalls near the walls. | - |
| 141+551 | #108 | 600 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 141+905 | #109 | 800 mm | Not observed. | - |
| 142+100 | Bridge 26.1 | | In good condition. Southwest abutment bin wall appears tilted toward the West. No sign of instability, likely settling foundation. | 225: north<br>226: southwest abutment<br>227: southeast abutment |
| 142+350 | #110 | 450 mm | Not observed. | - |
| 142+461 | #111 | 300 mm | In good condition but inlet buried. | - |
| 142+630 | #112 | 300 mm | Outlet collapsed and inlet totally buried. | - |
| 142+736 | #113 | 450 mm | In good condition but inlet is buried. | - |
| 142+810 | #114 | 450 mm | In good condition. | - |
| 142+865 | #115 | 300 mm | In good condition but outlet is buried. | - |
| 142+940 | #116 | 450 mm | In good condition but outlet is buried. | - |
| 143+173 | #117 | 700 mm | In good condition. | - |
| 143+433 | #118 | 450 mm | In good condition but inlet is half blocked. | - |
| 143+777 | #119 | 300 mm | In good condition. | - |
| 144+125 | #120 | 300 mm | In good condition. | - |
| 144+300 | #121 | 900 mm | In good condition. | - |
| 144+302 | #121-2 | 900 mm | | |
| 144+304 | #121-3 | 900 mm | | |
| 144+414 | #122 | 900 mm | In good condition. | - |
| 144+416 | #122-2 | 900 mm | | |
| 144+418 | #122-3 | 900 mm | | |
| 144+575 | #123 | 800 mm | In good condition. | - |
| 144+710 | #124 | 300 mm | Not observed. | - |
| 145+040 | #125 | 800 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 145+240 | #126 | 800 mm | Installed oblique to the road, but in good condition. | - |
| 146+409 | #129 | 1200 mm | In good condition. | - |
| 146+180 | Quarry 30.5 | | The quarry was cleaned and is in good condition. Some walls still show some loose blocks. | |
| | 30+540 | 600 mm | Not observed. | - |
| 146+812 | #130 | 600 mm | Not observed. | - |
| 147+041 | #131 | 600 mm | Not observed. | - |
| 147+540 | #132 | 600 mm | In good condition. | - |
| 148+141 | #133 | 300 mm | In good condition but inlet is buried. | - |
| 148+300 | Bridge 32.3 | | In good condition. Some erosion of the granular material behind the concrete wall at the Southwest abutment, no stability issue. | 229: south<br>228: north |
| 148+389 | #134 | 300 mm | Not observed. | - |
| 148+567 | #135 | 300 mm | In good condition but inlet buried. | - |
| 148+905 | #136 | 300 mm | Not observed. | - |
| 148+940 | #137 | 300 mm | In good condition but inlet buried. | - |
| 149+000 | #138 | 300 mm | In good condition but inlet is buried. | - |
| 149+214 | #139 | 900 mm | In good condition. | - |
| 149+216 | #139-2 | 900 mm | | |
| 149+218 | #139-3 | 900 mm | | |
| 149+256 | #140 | 900 mm | In good condition. | - |
| 149+258 | #140-2 | 900 mm | | |
| 149+260 | #140-3 | 900 mm | | |
| 149+727 | #141 | 900 mm | In good condition. | - |
| 149+728 | #141-2 | 900 mm | | |
| 149+730 | #141-3 | 900 mm | | |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 149+732 | #141-4 | 900 mm | | |
| 149+734 | #141-5 | 900 mm | | |
| 150+160 | #142 | 450 mm | In good condition. | - |
| 150+291 | #143 | 600 mm | In good condition. | - |
| 150+319 | #144 | 1000 mm | In good condition. | - |
| 150+395 | #145 | 300 mm | Not observed. | - |
| 150+660 | #146 | 1200 mm | In good condition. | - |
| 150+855 | #147 | 600 mm | In good condition. | - |
| 151+173 | #148 | 600 mm | Not observed. | - |
| 151+000 | Rock quarry 35 (Q150) | | Active quarry. In general good condition but the western wall (4-5 m high) is in unstable condition. | - |
| 151+670 | #149 | 900 mm | In good condition. | - |
| 152+171 | #150 | 900 mm | In good condition but 1 outlet is buried. | - |
| 152+173 | #150-2 | 900 mm | | |
| 152+175 | #150-3 | 900 mm | | |
| 152+177 | #150-4 | 900 mm | | |
| 152+179 | #150-5 | 900 mm | | |
| 152+562 | #151 | 600 mm | Not observed. | - |
| 152+933 | #152 | 900 mm | In good condition. | - |
| 153+027 | #153 | 600 mm | In good condition. | - |
| 153+028 | #153-2 | 600 mm | | - |
| 153+030 | #153-3 | 600 mm | | - |
| 153+032 | #153-4 | 600 mm | | - |
| 153+033 | #153-5 | 600 mm | | - |
| 153+261 | #154 | 450 mm | Not observed. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 153+470 | #155 | 600 mm | In good condition. | - |
| 153+506 | #156 | 450 mm | Not observed. | - |
| 154+028 | #157 | 600 mm | In good condition. | - |
| 154+490 | #158 | 900 mm | In good condition. | - |
| 154+491 | #158-2 | 900 mm | | |
| 154+493 | #158-3 | 900 mm | | |
| 155+768 | #159 | 700 mm | Not observed. | - |
| 155+966 | #160 | 600 mm | In good condition but outled is buried. | - |
| 156+051 | #161 | 600 mm | Not observed. | - |
| 156+238 | #162 | 600 mm | Not observed. | - |
| 156+474 | #163 | 300 mm | Not observed. | - |
| 156+790 | #164 | 300 mm | In good condition. | - |
| 156+964 | #165 | 600 mm | In good condition. | - |
| 157+610 | #166 | 900 mm | In good condition. | - |
| 157+843 | #167 | 900 mm | Not observed. | - |
| 158+342 | #168 | 600 mm | In good condition. | - |
| 158+765 | #169 | 300 mm | In good condition. | - |
| 159+340 | #170 | 800 mm | In good condition. | - |
| 159+500 | Bridge 43.5 | | In good condition. | 231: south<br>230: north |
| 159+568 | #170-A | 900 mm | In good condition. | - |
| 159+577 | #170-B | 900 mm | | |
| 159+587 | #170-C | 900 mm | | |
| 159+815 | #171 | 600 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 160+431 | #173 | 1000 mm | In good condition. The 2 southern culverts are installed below ground surface and water is flowing. | photo 232: road erosion |
| 160+433 | #173-2 | 1000 mm | | |
| 160+435 | #173-3 | 1000 mm | | |
| 160+470 | #174 | 600 mm | In good condition. | - |
| 160+640 | #175 | 450 mm | In good condition. | - |
| 160+800 | Bridge 44.8 | | The crack ion the north-west concrete abutment, first observed in 2019, was not observed. Possible buried in granular material. | 234: south<br>233: north |
| 161+055 | #176 | 600 mm | In good condition. | - |
| 161+065 | #177 | 600 mm | In good condition. | - |
| 161+170 | #178 | 600 mm | In good condition but inlet half buried. | - |
| 161+485 | #179 | 700 mm | In good condition. | - |
| 161+803 | #180 | 600 mm | In good condition. | - |
| 161+935 | #181 | 600 mm | In good condition. | - |
| 162+000 | Esker #3 | | Not active. The slopes appear stable. | - |
| 162+126 | #182 | 800 mm | In good condition. | - |
| 162+185 | #183 | 800 mm | In good condition. | - |
| 162+187 | #183-2 | 800 mm | In good condition. | - |
| 162+230 | #184 | 600 mm | In good condition. | - |
| 162+404 | #185 | 300 mm | In good condition. | - |
| 162+541 | #186 | 450 mm | In good condition. | - |
| 162+570 | #187 | 600 mm | In good condition. | - |
| 162+595 | #188 | 600 mm | In good condition. | - |
| 162+870 | #189 | 700 mm | Not observed. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 162+985 | #190 | 900 mm | In good condition. | - |
| 163+046 | #191 | 300 mm | Not observed. | - |
| 163+190 | #192 | 600 mm | In good condition but outlet is buried. | - |
| 163+360 | #193 | 600 mm | In good condition. | - |
| 163+660 | #194 | 600 mm | In good condition. | - |
| 163+808 | #195 | 700 mm | Inlet extremity is torn off, but culvert is still in good condition. | - |
| 163+961 | #196 | 300 mm | In good condition. | - |
| 164+120 | #197 | 600 mm | In good condition. | - |
| 164+222 | #198 | 450 mm | In good condition. | - |
| 164+383 | #199 | 900 mm | In good condition. Water is flowing below the culverts. No sign of erosion. | - |
| 164+385 | #199-2 | 900 mm | | |
| 164+387 | #199-3 | 900 mm | | |
| 164+389 | #199-4 | 900 mm | | |
| 164+457 | #201 | 900 mm | Installed below the ground level. | - |
| 164+800 | #203 | 600 mm | In good condition. | - |
| 164+840 | #204 | 600 mm | In good condition. | - |
| 165+108 | #206 | 450 mm | In good condition. | - |
| 165+310 | #207 | 600 mm | In good condition. | - |
| 165+431 | #208 | 900 mm | In good condition. | - |
| 165+433 | #209 | 900 mm | In good condition. | |
| 165+435 | #210 | 900 mm | In good condition. | |
| 165+550 | #211 | 450 mm | In good condition. | - |
| 165+640 | #212 | 600 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 165+795 | #213 | 300 mm | Not observed. | - |
| 165+915 | #214 | 800 mm | In good condition. | - |
| 166+135 | #215 | 300 mm | In good condition. | - |
| 166+510 | #216 | 600 mm | Not observed. | - |
| 166+600 | Quarry Q165 | | In good condition. Dry but concave: probably flooded at freshet. | - |
| 166+790 | #217 | 450 mm | In good condition but outlet buried. | - |
| 167+233 | #218 | 900 mm | In good condition. | - |
| 167+235 | #218-2 | 900 mm | | |
| 167+237 | #218-3 | 900 mm | | |
| 167+239 | #218-4 | 900 mm | | |
| 167+460 | #219 | 300 mm | In good condition. | - |
| 167+883 | #221 | 900 mm | In good condition. | - |
| 167+885 | #221-2 | 900 mm | | |
| 167+887 | #221-3 | 900 mm | | |
| 168+000 | Rock quarry 52 | | Active. In good and clean condition, partially flooded. The northern wall may pose a rockfall hazard (loose blocks and cobbles) which workers need to be aware of. | - |
| 168+315 | #222 | 600 mm | In good condition. | - |
| 168+650 | #223 | 600 mm | In good condition. | - |
| 168+705 | #224 | 600 mm | In good condition. | - |
| 168+715 | #225 | 450 mm | In good condition. | - |
| 168+935 | #226 | 700 mm | In good condition. | - |
| 168+937 | #226-2 | 450 mm | | |
| 168+970 | #227 | 600 mm | In good condition. | - |
| 168+995 | #228 | 700 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 169+245 | #229 | 300 mm | Not observed. | - |
| 169+363 | #230 | 700 mm | In good condition. | - |
| 169+659 | #231 | 300 mm | Not observed. | - |
| 169+928 | #232 | 300 mm | In good condition. | - |
| 170+240 | #233 | 450 mm | In good condition. | - |
| 170+385 | #234 | 450 mm | In good condition but outlet is buried. | - |
| 170+500 | #235 | 600 mm | In good condition. | - |
| 170+625 | #236 | 450 mm | In good condition. | - |
| 170+655 | #237 | 600 mm | In good condition. | - |
| 170+850 | #238 | 600 mm | In good condition. | - |
| 171+060 | #239 | 600 mm | In good condition. | - |
| 171+164 | #240 | 600 mm | In good condition. | - |
| 171+235 | #241 | 600 mm | In good condition. | - |
| 171+329 | #242 | 600 mm | In good condition. | - |
| 171+593 | #243 | 600 mm | Outlet in good condition but inlet is damaged and obstructed. | - |
| 171+625 | #244 | 450 mm | In good condition. | - |
| 171+735 | #245 | 600 mm | Not observed. | - |
| 172+005 | #246 | 600 mm | In good condition. | - |
| 172+065 | #247 | 700 mm | In good condition. | - |
| 172+220 | #248 | 700 mm | In good condition. | - |
| 172+435 | #249 | 600 mm | In good condition. | - |
| 172+610 | #250 | 800 mm | In good condition. | - |
| 172+745 | #251 | 300 mm | In good condition. | - |
| 172+900 | #252 | 900 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 172+965 | #253 | 900 mm | In good condition. | - |
| 172+967 | #253-2 | 900 mm | In good condition. | - |
| 172+969 | #253-3 | 900 mm | In good condition. | - |
| 173+125 | #254 | 600 mm | In good condition. | - |
| 173+195 | #255 | 600 mm | In good condition. | - |
| 173+350 | #256 | 600 mm | In good condition but outlet buried. | - |
| 173+525 | #257 | 600 mm | Not observed. | - |
| 173+875 | #258 | 600 mm | Not observed. | - |
| 173+985 | #259 | 900 mm | In good condition. | - |
| 174+185 | #260 | 300 mm | In good condition. | - |
| 174+350 | #261 | 450 mm | In good condition. | - |
| 174+410 | #262 | 450 mm | In good condition. | - |
| 174+885 | #263 | 450 mm | In good condition. | - |
| 174+922 | #264 | 600 mm | In good condition. | - |
| 174+967 | #265 | 450 mm | In good condition. | - |
| 175+024 | #266 | 300 mm | In good condition. | - |
| 175+720 | Esker #5 | | Active (gravel). In good condition. | - |
| 175+720 | #267 | 900 mm | In good condition. | - |
| 175+774 | #268 | 600 mm | In good condition but inlet is half buried. | - |
| 175+860 | #269 | 600 mm | In good condition. | - |
| 176+000 | #270 | 600 mm | In good condition. | - |
| 176+050 | #271 | 600 mm | In good condition. | |
| 176+087 | #272 | 600 mm | In good condition. | |
| 176+649 | #273 | 300 mm | In good condition. | - |

| STATION | NAME | STRUCTURE DESCRIPTION | COMMENTS | Photo |
|---|---|---|---|---|
| 176+815 | #274 | 600 mm | In good condition. | - |
| 177+022 | #275 | 600 mm | In good condition. | - |
| 177+170 | | | Added pipe to drain area of accumulated water. This is a good practice. | - |
| 177+282 | #276 | 600 mm | In good condition. | |
| 177+622 | #277 | 450 mm | In good condition. | - |
| 177+870 | #278 | 1200 mm | In good condition. | - |
| 178+307 | #279 | 300 mm | Not observed. | - |
| 178+416 | #280 | 900 mm | In good condition. | - |
| 178+350 | #281 | 600 mm | In good condition but outlet buried. | - |
| 178+500 | Esker #6 | | In good condition. Storage of broken pieces. | - |
| | Esker #7 | | Not observed. Possible not yet developed. | - |
| 178+965 | #283 | 450 mm | Not observed. | - |
| 179+070 | #284 | 900 mm | In good condition. | - |
| 179+072 | #284-2 | 900 mm | | |
| 179+074 | #284-3 | 900 mm | | |
| 179+429 | #287 | 600 mm | Not observed. | - |
| 179+530 | #288 | 600 mm | In good condition. | - |
| 179+733 | #289 | 600 mm | Deformed but still in good condition. | - |
| 179+900 | unnamed | | Set of 3 culverts installed below ground level for fish. . Pipes present in some of the culverts. | - |
| 179+975 | #290 | 600 mm | Not observed. | - |
| | | | | |

**APPENDIX E2**

# Culverts Photographic Log

**Photograph E2-1: West shoulder, km 160+430**

**Date**: July 31, 2021 **Photo Number**: 232

**Description**: Road shoulder showing erosion from runoff water.

**APPENDIX E3**

# Bridges Photographic Log

**Photograph E3-1 Bridges 1 – km 119+400**

**Date**: July 31, 2021 **Photo Number**: 213

**Description**: Looking at the north abutment.

**Photograph E3-2 Bridges 1 – km 119+400**

**Date**: July 31, 2021 **Photo Number**: 214

**Description**: Looking at the south abutment.


**Photograph E3-3 Bridges 2 – km 126+700**

**Date**: July 31, 2021 **Photo Number**: 216

**Description**: Looking at the north abutment.

**Photograph E3-4 Bridges 2 – km 126+700**

**Date**: July 31, 2021 **Photo Number**: 217

**Description**: Looking at the south abutment.


**Photograph E3-5 Bridges 3 – km 132+000**

**Date**: July 31, 2021 **Photo Number**: 218

**Description**: Looking at the north abutment.

**Photograph E3-6 Bridges 3 – km 132+000**

**Date**: July 31, 2021 **Photo Number**: 219

**Description**: Looking at the south abutment.


**Photograph E3-7 Bridges 4 – km 136+000**

**Date**: July 31, 2021 **Photo Number**: 221

**Description**: Looking at the north abutment.

**Photograph E3-8 Bridges 4 – km 136+000**

**Date**: July 31, 2021 **Photo Number**: 222

**Description**: Looking at the south abutment.


**Photograph E3-9 Bridges 5 – km 139+900**

**Date**: July 31, 2021 **Photo Number**: 223

**Description**: Looking at the north abutment.

**Photograph E3-10 Bridges 5 – km 139+900**

**Date**: July 31, 2021 **Photo Number**: 224

**Description**: Looking at the south abutment.

**Photograph E3-11 Bridges 6 – km 142+100**

**Date**: July 31, 2021 **Photo Number**: 225

**Description**: Looking at the north abutment.

**Photograph E3-12 Bridges 6 – km 142+100**

**Date**: July 31, 2021 **Photo Number**: 227

**Description**: Looking at the south abutment.


**Photograph E3-13 Bridges 6 – km 142+100**

**Date**: July 31, 2021 **Photo Number**: 226

**Description**: Looking at the southwest abutment. Bin wall slightly tilted to the west.

**Photograph E3-14 Bridges 7 – km 148+300**

**Date**: July 31, 2021 **Photo Number**: 228

**Description**: Looking at the north abutment.

**Photograph E3-15 Bridges 7 – km 148+300**

**Date**: July 31, 2021 **Photo Number**: 229

**Description**: Looking at the south abutment.


**Photograph E3-16 Bridges 8 – km 159+500**

**Date**: July 31, 2021 **Photo Number**: 230

**Description**: Looking at the north abutment.

**Photograph E3-17 Bridges 8 – km 159+500**

**Date**: July 31, 2021 **Photo Number**: 231

**Description**: Looking at the south abutment.

**Photograph E3-18 Bridges 9 – km 160+800**

**Date**: July 31, 2021 **Photo Number**: 233

**Description**: Looking at the north abutment. A crack is present in the concrete on the western side.

**Photograph E3-19 Bridges 9 – km 160+800**

**Date**: July 31, 2021 **Photo Number**: 234

**Description**: Looking at the south abutment.

**APPENDIX E4**

# Culverts Photographic Log

**Photograph E4-1-1: #12 km 120+180**

**Date**: July 31, 2021 **Photo Number**: 215

**Description**: View of the culvert outlets. No sign of degradation and the flow is stable south of the culverts (5-10 m away).

**Photograph E4-2: #73 km 134+580**

**Date**: July 31, 2021 **Photo Number**: 220

**Description**: View of the culvert inlet. Installed high but in good condition.

# APPENDIX F

## Quarries

**Photograph F-1: Quarry 12 – km 58+300**

**Date**: July 30, 2021 **Photo Number**: 200

**Description**: View of north wall. Presence of loose blocks at the base of the wall.

**Photograph F-2: Quarry 13 – km 62+350**

**Date**: July 30, 2021 **Photo Number**: 203

**Description**: View of north and west walls. Water ponding in the quarry.

**APPENDIX G**

# Bulk Fuel Facilities

**APPENDIX G1**

# Baker Lake Tank Farm Photographic Log

**Photograph G1-1 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 177

**Description**: From the south side of Tank 1, looking southeast at Tanks 1, 2, 3, and 4. Presence of water ponding.

**Photograph G1-2 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 178

**Description**: Looking at the southwestern corner of Tank 1. Presence of water ponding.

**Photograph G1-3 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 179

**Description**: Looking northwest toward the south wall of the tank farm. Presence of water ponding and exposed geosynthetics in the slope at the high water line.

**Photograph G1-4 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 180

**Description**: Looking northeast toward Tank 2. Presence of water ponding.

**Photograph G1-5 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 183

**Description**: Looking southwest. Presence of water ponding and exposed geosynthetics in the slope at the high-water line.

**Photograph G1-6 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 182

**Description**: From the southwestern corner of Tank 3 looking southeast. View of exposed geosynthetics.

**Photograph G1-7 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 184

**Description**: From the south portion of the site looking northwest at the south side of Tank 3 and 4. View of exposed geosynthetics.

**Photograph G1-8 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 185

**Description**: From the south portion of the site looking northeast.

**Photograph G1-9 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 186

**Description**: From the northeastern corner of Tank 4 looking southwest.

**Photograph G1-10 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 187

**Description**: From the northern side of Tank 4, looking northwest toward Tanks 4, 3, 2, and 1. Presence of exposed liner due to erosion of the granular cover.

**Photograph G1-11 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 188

**Description**: From the northern side of Tank 4, looking southwest toward Tanks 3 and 4..

**Photograph G1-12 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 176

**Description**: Looking northwest at the southern and western sides of Tank 5.

**Photograph G1-13 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 175

**Description**: Looking north between Tanks 5 and 6. Water ponding.

**Photograph G1-14 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 174

**Description**: From the southern corner of Tank 6, looking northeast at the southern side of Tanks 5 and 6. Presence of water ponding.

**Photograph G1-15 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 173

**Description**: Looking southeast at the northeastern side of Tank 6.

**Photograph G1-16 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 172

**Description**: Looking west at the crest on the northeastern side of Tank 5. Presence of old tension cracks.

**Photograph G1-17 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 169

**Description**: Looking southwest at the crest on the northeast corner of Tank 7. Water ponding.

**Photograph G1-18 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 170

**Description**: From the southwestern corner of the Jet A fuel tanks looking northeast. Presence of exposed geomembrane and water ponding (high level).

**Photograph G1-19 Baker Lake Tank Farm**

**Date**: July 30, 2021 **Photo Number**: 171

**Description**: From the southwestern corner of the Jet A fuel tanks looking east. Presence of exposed geomembrane and water ponding (high level).

**APPENDIX G2**

# Meadowbank Tank Farm Photographic Log

**Photograph G2-1 Meadowbank Tank Farm**

**Date**: July 27, 2021 **Photo Number**: 4

**Description**: From the western corner, looking southeast. Presence of water ponding.

**Photograph G2-2 Meadowbank Tank Farm**

**Date**: July 27, 2021 **Photo Number**: 3

**Description**: From the western corner, looking northeast. Presence of water ponding.

**Photograph G2-3 Meadowbank Tank Farm**

**Date**: July 27, 2021 **Photo Number**: 1

**Description**: Looking northeast from the southern corner. Accumulation of water in the eastern corner.

**Photograph G2-4 Meadowbank Tank Farm**

**Date**: July 27, 2021 **Photo Number**: 2

**Description**: Looking northwest from the southern corner. Presence of water ponding.

**Photograph G2-5 Meadowbank Tank Farm**

**Date**: July 27, 2021 **Photo Number**: 5

**Description**: Looking southeast from the northeastern side of the tank. Presence of water ponding.

**APPENDIX G3**

# Whale Tail Project Tank Farm Photographic Log

**Photograph G3-4 Whale Tail Project Site Tank Farm**

**Date**: August 2, 2021 **Photo Number**: 234

**Description**: From the fuelling pad, looking west at the Tank Farm. Presence of water ponding.

**Photograph G3-5 Whale Tail Project Site Tank Farm**

**Date**: August 2, 2021 **Photo Number**: 235

**Description**: From the fuelling pad, looking north at the Tank Farm. Presence of water ponding.

**Photograph G3-8 Whale Tail Project Site Tank Farm**

**Date**: August 2, 2021 **Photo Number**: 236

**Description**: From the northwest corner of the tank, looking east.

**Photograph G3-8 Whale Tail Project Site Tank Farm**

**Date**: August 2, 2021 **Photo Number**: 237

**Description**: From the northwest corner of the tank, looking south.

**APPENDIX H**

# Other Facilities

**APPENDIX H1**

# Vault Culverts Photographic Log

**Photograph H1-1 Vault Road Culverts**

**Date**: July 27, 2021 **Photo Number**: 69

**Description**: Looking at the outlet of the three culverts located on Vault Road at 640964E/7217466N. All of them are deformed in the middle.

**Photograph H1-2 Vault Road Culverts**

**Date**: July 27, 2021 **Photo Number**: 70

**Description**: From the inlet side of the three culverts located on Vault Road at 640964E/7217466N. The culverts are slightly deformed on top in the middle.

**APPENDIX H2**

# TSF Diversion Ditch Photographic Log

**Photograph H2-1 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 79

**Description**: Looking east toward the inlet of the culverts beneath the road.

**Photograph H2-2 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 78

**Description**: Looking west toward NP2 lake.

**Photograph H2-3 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 83

**Description**: From the eastern diversion ditch looking south toward Lake NP2.

**Photograph H2-4 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 84

**Description**: From the eastern diversion ditch looking northwest.

**Photograph H2-5 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 85

**Description**: From the eastern diversion ditch, looking east.

**Photograph H2-6 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 86

**Description**: From the eastern diversion ditch, looking northwest.

**Photograph H2-7 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 87

**Description**: From the northern diversion ditch looking southeast.

**Photograph H2-8 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 88

**Description**: From the northern diversion ditch looking west.

**Photograph H2-9 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 89

From the northern diversion ditch looking east.

**Photograph H2-10 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 90

From the northern diversion ditch looking west.

**Photograph H2-11 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 91

**Description**: From the northern diversion ditch looking east.

**Photograph H2-12 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 92

**Description**: From the northern diversion ditch looking west.

**Photograph H2-13 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 93

**Description**: From 637281E/7216790N, looking north. View of the western diversion ditch.

**Photograph H2-14 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 94

**Description**: From 637281E/7216790N, looking south at the western diversion ditch.

**Photograph H2-15 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 95

**Description**: From 637251E/7216171N, looking north at the western diversion ditch.

**Photograph H2-16 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 96

**Description**: From 637251E/7216171N, looking southwest at the western diversion ditch and its retention basin.

**Photograph H2-17 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 97

**Description**: From 637074E/7216157N, looking east at the western diversion ditch.

**Photograph H2-18 Diversion Ditch and its Sediment and Erosion Protection Structure**

**Date**: July 27, 2021 **Photo Number**: 98

**Description**: From 637074E/7216157N, looking west at the western diversion ditch.

**APPENDIX H3**

# RSF Till Plug Photographic Log

**Photograph H3-1 RSF Till Plug**

**Date**: July 27, 2021 **Photo Number**: 82

**Description**: From the south side of NP2 Lake (north of the diversion ditch) looking west at the RSF till plug.

**Photograph H3-2 RSF Till Plug**

**Date**: July 27, 2021 **Photo Number**: 81

**Description**: From the south side of NP2 Lake (south of the diversion ditch) looking west at the RSF till plug.

**Photograph H3-3 RSF Till Plug**

**Date**: July 27, 2021 **Photo Number**: 80

**Description**: From the south side of NP2 Lake (south of the diversion ditch) looking southeast at the RSF till plug.

**APPENDIX H4**

# Landfills Photographic Log

**Photograph H4-1 Meadowbank Landfill**

**Date**: July 28, 2021 **Photo Number**: 123

**Description**: From the 2020 landfill location within the Rock Storage Facility, looking southeast. Recently backfilled area, new one under development below.

**Photograph H4-2 Whale Tail Project Landfill**

**Date**: August 2, 2021 **Photo Number**: 267

**Description**: From the new landfill location within the Whale Tail WRSF, looking north.

**APPENDIX H5**

# Landfarm Photographic Log

**Photograph H5-1 Contaminated Soil Storage and Bioremedial Landfarm Facility**

**Date**: July 28, 2021 **Photo Number**: 121

**Description**: From the eastern side of the Contaminated Soil Storage and Bioremedial Landfarm Facility, looking east at the containment berm. Small tension cracks are present on the crest.

**Photograph H5-2 Contaminated Soil Storage and Bioremedial Landfarm Facility**

**Date**: July 14, 2020 **Photo Number**: 122

**Description**: From the northeast extremity of the South Cell, looking northeast at the Contaminated Soil Storage and Bioremedial Landfarm Facility. In good condition.

**APPENDIX H6**

# Crusher Retaining Wall Photographic Log

**Photograph H6-1 Crusher Retaining Wall**

**Date**: July 16, 2020 **Photo Number**: 168

**Description**: From the base of the wall, looking southeast.

APPENDIX H7

# Whale Tail Project Attenuation Pond Ramp Photographic Log

**Photograph H7-1 Whale Tail Project Site Attenuation Pond Ramp**

**Date**: August 3, 2021 **Photo Number**: 310

**Description**: From the pump pad, looking southwest at the attenuation pond and western slope of the pump pad.

**Photograph H7-2 Whale Tail Project Site Attenuation Pond Ramp**

**Date**: August 3, 2021 **Photo Number**: 311

**Description**: From the pump pad, looking south at the pump pad.

**Photograph H7-3 Whale Tail Project Site Attenuation Pond Ramp**

**Date**: August 3, 2021 **Photo Number**: 312

**Description**: From the pump pad, looking northwest at the southern slope of the pump pad.

**Photograph H7-4 Whale Tail Project Site Attenuation Pond Ramp**

**Date**: August 3, 2021 **Photo Number**: 313

**Description**: From the pump pad, looking east at the pump pad and primary attenuation pond ramp.

**Photograph H7-5 Whale Tail Project Site Attenuation Pond Ramp**

**Date**: August 3, 2021 **Photo Number**: 314

**Description**: From the pump pad, looking east at the primary attenuation pond ramp.

**APPENDIX H8**

# Whale Tail Project Diffusers Photographic Log

**Photograph H8-1 Mammoth Lake Diffuser**

**Date**: August 3, 2021 **Photo Number**: 327

**Description**: From the access road, looking west. Three diffusers are present and working normally.

**Photograph H8-2 Whale Tail South Diffuser**

**Date**: August 2, 2021 **Photo Number**: 297

**Description**: From the east abutment of Whale Tail Dike, looking south. The diffuser present and working normally.

**APPENDIX H9**

# South Whale Tail Channel Photographic Log

**Photograph H9-1 South Whale Tail Channel**

**Date**: August 3, 2021 **Photo Number**: 330

**Description**: From the outlet into Mammoth Lake, looking northwest. Two turbidity barriers are deployed in the lake.

**Photograph H9-2 South Whale Tail Channel**

**Date**: August 3, 2021 **Photo Number**: 329

**Description**: From approx. Sta. 0+850, looking west. Settlement in the rockfill slope.

**Photograph H9-3 South Whale Tail Channel**

**Date**: August 3, 2021 **Photo Number**: 328

**Description**: From approx. Sta. 0+800, looking northwest.

**Photograph H9-4 South Whale Tail Channel**

**Date**: August 3, 2021 **Photo Number**: 331

**Description**: From approx. Sta. 0+675, looking southeast.

**Photograph H9-5 South Whale Tail Channel**

**Date**: August 3, 2021 **Photo Number**: 333

**Description**: From approx. Sta. 0+450 (Lake A45 area), looking northwest.

**Photograph H9-6 South Whale Tail Channel**

**Date**: August 3, 2021 **Photo Number**: 332

**Description**: From approx. Sta. 0+450 (Lake A45 area), looking southeast.

**Photograph H9-7 South Whale Tail Channel**

**Date**: August 3, 2021 **Photo Number**: 334

**Description**: From approx. Sta. 0+200, looking northwest.

**Photograph H9-8 South Whale Tail Channel**

**Date**: August 3, 2021 **Photo Number**: 335

**Description**: From the Whale Tail South Lake inlet, looking southwest.

**APPENDIX H10**

# Saline Ditch Photographic Log

**Photograph H10-1 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 261

**Description**: From the northern extremity of the Saline Ditch, looking west. The culvert is in good condition. Mud is accumulating in front of the inlet.

**Photograph H10-2 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 262

**Description**: From the northern extremity of the Saline Ditch, looking east. Mud and gravel are present in the ditch.

**Photograph H10-3 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 263

**Description**: From approx. Sta. 0+140, looking northwest. Presence of boulders and gravel in the ditch.

**Photograph H10-4 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 264

**Description**: From approx. Sta. 0+140, looking southeast. Presence of gravel in the ditch.

**Photograph H10-5 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 265

**Description**: From approx. Sta. 0+140, looking southeast. Presence of mud and gravel in the ditch, as well as some water ponding.

**Photograph H10-6 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 266

**Description**: From approx. Sta. 0+410, looking north.

**Photograph H10-7 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 255

**Description**: From approx. Sta. 0+440, looking west.

**Photograph H10-8 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 256

**Description**: From approx. Sta. 0+530, looking east.

**Photograph H10-9 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 257

**Description**: From approx. Sta. 0+530, looking north.

**Photograph H10-10 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 258

**Description**: From approx. Sta. 0+560, looking west.

**Photograph H10-11 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 259

**Description**: From the southwestern extremity of the Saline Ditch, looking east.

**Photograph H10-12 Saline Ditch**

**Date**: August 2, 2021 **Photo Number**: 260

**Description**: From the southwestern extremity of the Saline Ditch, looking northwest. Presence of boulders and debris in the ditch.

**APPENDIX H11**

# Whale Tail Project Site Roads Photographic Log

**Photograph H11-1 Whale Tail Project Site Roads**

**Date**: August 3, 2021 **Photo Number**: 316

**Description**: View of Road 22 near to Mammoth Dike. Water ponding against the road and traces of erosion from water overtopping the road.

**APPENDIX H12**

# IVR Diversion Channel Photographic Log

**Photograph H12-1 IVR Diversion Channel**

**Date**: August 2, 2021 **Photo Number**: 268

**Description**: From the south extremity of the IVR Diversion Channel, looking northwest.

**Photograph H12-2 IVR Diversion Channel**

**Date**: August 2, 2021 **Photo Number**: 269

**Description**: From around Sta. 0+020, looking northeast. Water is entering the channel from the natural topography.

**Photograph H12-3 IVR Diversion Channel**

**Date**: August 2, 2021 **Photo Number**: 270

**Description**: From around Sta. 0+130, looking southeast.

**Photograph H12-4 IVR Diversion Channel**

**Date**: August 2, 2021 **Photo Number**: 271

**Description**: From around Sta. 0+130, looking northwest.

**Photograph H12-5 IVR Diversion Channel**

**Date**: August 2, 2021 **Photo Number**: 272

**Description**: From around Sta. 0+270, looking north at the outlet. Water is flowing well towards the lake.

**Photograph H12-6 IVR Diversion Channel**

**Date**: August 2, 2021 **Photo Number**: 273

**Description**: From around Sta. 0+270, looking southeast.

**Photograph H12-7 IVR Diversion Channel**

**Date**: August 2, 2021 **Photo Number**: 274

**Description**: From around the access road Sta. 0+270, looking southeast. Tension cracks in the side slope of the road.

**APPENDIX I**

# Dikes Details and Instrumentation

# 1.0 MEADOWBANK DEWATERING DIKES

## 1.1 East Dike

East Dike was constructed in the summer of 2008; grouting of the foundation and bedrock occurred in 2008 and during the first quarter of 2009.

Instrumentation has been installed within East Dike and includes piezometers, thermistors, inclinometers, and flow meters. Survey monuments were removed from East Dike in the past as they have never been used. The inclinometer at Sta. 60+195 was destroyed in the past and has not been replaced. Replacement of this instrument is not considered necessary; however, monitoring of East Dike should continue and, if anomalous conditions are observed, then replacing this inclinometer should be re-evaluated.

Instrumentation within East Dike was installed in the spring of 2009 to monitor the dike's performance following construction and during dewatering, operation, and into closure. Additional instrumentation was added in 2009 and 2010 to increase coverage across the dike. Since June 2012, all piezometers and thermistors on East Dike have been connected to an automatic data collection and transmission system (VDV database). The following subsections present a summary of the data collected between September 2017 and August 2018.

Instrumentation within East Dike was installed in the spring of 2009 to monitor the dike's performance following construction and during dewatering, operation, and into closure. Additional instrumentation was added in 2009 and 2010 to increase coverage across the dike. Since June 2012, all piezometers and thermistors on East Dike have been connected to an automatic data collection and transmission system (VDV database). Two inclinometers are installed on East Dike at Sta. 60+495 and 60+705. An inclinometer was installed at Sta. 60+195, but was destroyed in July 2010 and has not been replaced.

Table 1 and Table 2 below detail instrumentation on East Dike.

**Table 1: List of Piezometers and Thermistors on East Dike (source: AEM)**

| DH-ID | STA | Instrument_ID | Stratigraphic_Unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| 150C | 60+150 | Pz150C | Interface | × broken | | 127.35 |
| 190P1A | 60+190 | Pz190P1A | Bedrock | ✓ | | 116.7 |
| 190P1B | | Pz190P1B | Bedrock | ✓ | | 121.7 |
| 190P1C | | Pz190P1C | Interface | ✓ | | 126.7 |
| 190P2A | | Pz190P2A | Bedrock | ✓ | | 116.34 |
| 190P2B | | Pz190P2B | Bedrock | ✓ | | 121.34 |
| 190P2C | | Pz190P2C | Bedrock | × broken | | 129.34 |
| 190P3A | | Pz190P3A | Bedrock | ✓ | | 116.63 |
| 190P3B | | Pz190P3B | Bedrock | ✓ | | 121.63 |
| 200C | 60+200 | Pz200C | Interface | ✓ | | 127.71 |
| 240C | 60+240 | Pz240C | Interface | ✓ | | 128.71 |
| 400C | 60+400 | Pz400C | Interface | ✓ | | 126.76 |
| 420C | 60+420 | Pz400C | Interface | ✓ | | 125.32 |
| 440C | 60+400 | Pz440C | Interface | ✓ | | 124.66 |
| 450C | 60+450 | Pz450C | Interface | ✓ | | 127 |
| 460C | 60+460 | Pz460C | Interface | ✓ | | 125.15 |
| 470C | 60+470 | Pz470C | Interface | ✓ | | 127.76 |

| DH-ID | STA | Instrument_ID | Stratigraphic_Unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| 472C | 60+472 | Pz472C | Interface | ✓ | | 126.87 |
| 480C | 60+480 | Pz480C | Interface | ✓ | | 125.44 |
| 490P1A | 60+490 | Pz490P1A | Bedrock | ✓ | | 114.12 |
| 490P1B | | Pz490P1B | Bedrock | ✓ | | 119.12 |
| 490P1C | | Pz490P1C | Interface | ✓ | | 125.81 |
| 490P2A | | Pz490P2A | Bedrock | ✓ | | 115.07 |
| 490P2B | | Pz490P2B | Bedrock | ✓ | | 120.07 |
| 490P2C | | Pz490P2C | Interface | ✓ | | 126.76 |
| 490P3A | | Pz490P3A | Bedrock | ✓ | | 114.62 |
| 490P3B | | Pz490P3B | Bedrock | ✓ | | 119.62 |
| 500C | 60+500 | Pz500C | Interface | ✓ | | 125.78 |
| 510C | 60+510 | Pz510C | Interface | ✓ | | 126.06 |
| 550C | 60+550 | Pz550C | Interface | × temp only | Frozen | 129.85 |
| 600C | 60+600 | Pz600C | Interface | × temp only | Frozen | 128.6 |
| 650C | 60+650 | Pz650C | Interface | × temp only | Frozen | 125.48 |
| 700P1A | 60+700 | Pz700P1A | Bedrock | × temp only | Frozen | 118.81 |
| 700P1B | | Pz700P1B | Bedrock | × temp only | Frozen | 122.92 |
| 700P1C | | Pz700P1C | Interface | ✓ | Frozen | 130.5 |
| 700P2A | | Pz700P2A | Bedrock | ✓ | Frozen | 118.08 |
| 700P2B | | Pz700P2B | Bedrock | × temp only | Frozen | 123.08 |
| 700P2C | | Pz700P2C | Interface | × temp only | Frozen | 129.77 |
| 700P3A | | Pz700P3A | Bedrock | ✓ | | 117.93 |
| 700P3B | | Pz700P3B | Bedrock | ✓ | | 122.93 |
| 750C | 60+750 | Pz750C | Interface | × broken | Frozen | 128.16 |

| STA | DH-ID | Working Beads | Reliable Beads | Total Beads | Top Bead Elevation | Bottom Bead Elevation |
|---|---|---|---|---|---|---|
| 60+092 | TH092 | 0 | 0 | 16 | 136 | 119 |
| 60+185 | TH185 | 16 | 16 | 16 | 136 | 119 |
| 60+485 | TH485 | 16 | 16 | 16 | 136 | 119 |
| 60+695 | TH695 | 16 | 16 | 16 | 136 | 119 |
| 60+842 | TH842 | 3 | 3 | 16 | 136 | 119 |

**Table 2: Inclinometers on East Dike (source: AEM)**

| Location | Instrument ID | Operational (✓)/Not operational (×) | Manual/Automatic | Elevation interval in meters (top/bottom) |
|---|---|---|---|---|
| 60+195 | ED-IN-195 | ×(Damaged) | - | - |
| 60+495 | ED-IN-495 | ✓ | Manual | 136.6/124.1 |
| 60+705 | ED-IN-705 | ✓ | Manual | 137.1/126.1 |

## 1.2 South Camp Dike

South Camp Dike was constructed between April and June of 2009. Additional thermal capping material and rockfill for the haul road was added to the dike in the winter of 2009-2010.

Table 3 below details instrumentation on South Camp Dike.

**Table 3: List of Thermistors on South Camp Dike (source: AEM)**

| Hole | ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| 38-3 | SC-09-A | TH | ✓ | Manual | - | - | 16 | 133.03/110.03 |
| 38-5 | SC-10 | TH | ✓ | Manual | - | - | 16 | 132.40/109.40 |

## 1.3 Bay-Goose Dike

Construction of Bay-Goose Dike started in the summer of 2009. The earthworks component for the northern portion of the dike was mostly completed by early October 2009 and by October 2010 for the southern portion. Grouting of the foundation and bedrock occurred between March 2010 and July 2011. Jet grouting occurred in selected portions of the dike between October 2010 and May 2011. The first phase of dewatering Bay-Goose Basin was completed by mid-November 2011 and the second phase was completed in August 2012.

Instruments were installed on Bay-Goose Dike in the summer of 2011 to monitor the dike's performance following construction, during dewatering and operation, and into closure. Survey monuments were removed from Bay-Goose Dike as they have never been used. Additional boreholes have been drilled in the North Channel sector in 2017 to install TDR reflectometers and inclinometers in order to monitor the dike's reaction to nearby blasting in Pit E5.

Table 4, Table 5 and Table 6 below detail instrumentation on Bay-Goose Dike.

**Table 4: List of Piezometers and Thermistors on Bay-Goose Dike (source: AEM)**

| DH-ID | STA | Instrument_ID | Stratigraphic_Unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| 1P1A | 30+158 | Pz01P1A | Bedrock | × temp only | Frozen | 117.15 |
| 1P1B | | PZ01P1B | Bedrock | × temp only | Frozen | 120.89 |
| 1P1C | | Pz01P1C | Bedrock | × temp only | Frozen | 127.69 |
| 1P2A | | Pz01P2A | Bedrock | ✓ | Frozen | 117.92 |
| 1P2B | | Pz01P2B | Bedrock | ✓ | Frozen | 121.38 |

| DH-ID | STA | Instrument_ID | Stratigraphic_Unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| 1P2C | | Pz01P2C | Bedrock | ✓ | Frozen | 127.36 |
| 1P3A | | Pz01P3A | Bedrock | × temp only | Frozen | 116.43 |
| 1P3B | | Pz01P3B | Bedrock | × temp only | Frozen | 121.61 |
| 6P2 | 30+167 | Pz06P2 | SB | ✓ | Frozen | 128.67 |
| 7P2 | 30+249.5 | Pz07P2 | SB | × temp only | Frozen | 129.97 |
| 2P1A | 30+276.5 | Pz02P1A | Bedrock | × temp only | Frozen | 119.64 |
| 2P1B | | PZ02P1B | Bedrock | × temp only | Frozen | 123.94 |
| 2P1C | | Pz02P1C | SB | ✓ | Frozen | 130.53 |
| 2P2A | | Pz02P2A | Bedrock | ✓ | Frozen | 119.68 |
| 2P2B | | Pz02P2B | Bedrock | × temp only | Frozen | 124.36 |
| 2P2C | | Pz02P2C | SB | ✓ | Frozen | 130.43 |
| 2P3A | | Pz02P3A | Bedrock | ✓ | | 119.97 |
| 2P3B | | Pz02P3B | Grouting | ✓ | | 125.09 |
| 8P2 | 30+306.5 | Pz08P2 | SB | ✓ | Frozen | 129.77 |
| 3P1A | 30+378.5 | Pz03P1A | Bedrock | ✓ | | 112.68 |
| 3P1B | | PZ03P1B | Bedrock | ✓ | | 118.9 |
| 3P1C | | Pz03P1C | Jet Grouting | ✓ | Frozen | 124.83 |
| 3P2A | | Pz03P2A | Bedrock | ✓ | | 114.63 |
| 3P2B | | Pz03P2B | Bedrock | ✓ | | 119.47 |
| 3P2C | | Pz03P2C | Jet Grouting | ✓ | | 125.31 |
| 3P3A | | Pz03P3A | Bedrock | ✓ | | 114.37 |
| 3P3B | | Pz03P3B | Bedrock | ✓ | | 119.26 |
| 9P2 | 30+440 | Pz09P2 | CSB | ✓ | Frozen | 127.53 |
| 4P1A | 30+453.5 | Pz04P1A | Bedrock | × temp only | Frozen | 117.04 |
| 4P1B | | PZ04P1B | Bedrock | × temp only | Frozen | 119.21 |
| 4P1C | | Pz04P1C | | × temp only | Frozen | 125.12 |
| 4P2A | | Pz04P2A | Bedrock | ✓ | | 115.28 |
| 4P2B | | Pz04P2B | Bedrock | ✓ | | 120.24 |
| 4P2C | | Pz04P2C | Interface | ✓ | Frozen | 126.25 |
| 4P3A | | Pz04P3A | Bedrock | ✓ | | 115.46 |
| 4P3B | | Pz04P3B | Bedrock | ✓ | | 120.59 |
| 10P2 | 30+516.5 | Pz10P2 | CSB | × temp only | Frozen | 130.56 |
| 5P1A | 30+645.5 | Pz05P1A | Bedrock | × temp only | Frozen | 112.68 |
| 5P1B | | PZ05P1B | Bedrock | × temp only | Frozen | 118.9 |
| 5P1C | | Pz05P1C | Interface | × temp only | Frozen | 124.83 |
| 5P2A | | Pz05P2A | Bedrock | ✓ | Frozen | 114.63 |
| 5P2B | | Pz05P2B | Bedrock | × temp only | Frozen | 119.47 |
| 5P2C | | Pz05P2C | Interface | × temp only | Frozen | 125.31 |
| 5P3A | | Pz05P3A | Bedrock | ✓ | | 114.37 |

| DH-ID | STA | Instrument_ID | Stratigraphic_Unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| 5P3B | | Pz05P3B | Bedrock | ✓ | | 119.26 |
| 11P2 | 30+684.5 | Pz11P2 | SB | × temp only | Frozen | 130.87 |
| 12P2 | 30+770 | Pz12P2 | SB | ✓ | Frozen | 132.16 |
| 13P2 | 30+804.5 | Pz13P2 | SB | ✓ | Frozen | 130.05 |
| 14P2 | 31+052 | Pz14P2 | SB | × temp only | Frozen | 131.47 |
| 23P1A | 31+165 | Pz23P1A | Bedrock | × temp only | Frozen | 118.8 |
| 23P1B | | PZ23P1B | Bedrock | × temp only | Frozen | 123.51 |
| 23P1C | | Pz23P1C | Bedrock | × temp only | Frozen | 127.454 |
| 23P2A | | Pz23P2A | Bedrock | ✓ | | 117.07 |
| 23P2B | | Pz23P2B | Bedrock | ✓ | Frozen | 122.15 |
| 23P2C | | Pz23P2C | Bedrock | ✓ | | 128.018 |
| 23P3A | | Pz23P3A | Interface | ✓ | | 115.46 |
| 23P3B | | Pz23P3B | Grouting | ✓ | | 126.75 |
| 15P2 | 31+220 | Pz15P2 | SB | × temp only | Frozen | 130.73 |
| 16P2 | 31+565 | Pz16P2 | Bedrock | × temp only | Frozen | 131.048 |
| 24P1A1 | 31+600 | Pz24P1A1 | Bedrock | × temp only | Frozen | 111.3 |
| 24P1A2 | | PZ24P1A2 | Bedrock | × temp only | Frozen | 116.3 |
| 24P1B1 | | Pz24P1B1 | Bedrock | × temp only | Frozen | 121.8 |
| 24P1B2 | | Pz24P1B2 | Interface | ✓ | | 124.3 |
| 24P2A1 | | Pz24P2A1 | Bedrock | ✓ | Frozen | 110.15 |
| 24P2A2 | | Pz24P2A2 | Bedrock | ✓ | | 116.15 |
| 24P2B1 | | Pz24P3B1 | Interface | ✓ | | 120.65 |
| 24P2B2 | | Pz24P2B2 | Jet Grouting | ✓ | | 123.15 |
| 24P2C | | Pz24P2C | Jet Grouting | ✓ | | 124.64 |
| 24P3A1 | | Pz24P3A1 | Bedrock | ✓ | Frozen | 110.64 |
| 24P3A2 | | Pz24P3A1 | Bedrock | ✓ | | 115.64 |
| 24P3B1 | | Pz24P3B1 | Grouting | ✓ | | 121.16 |
| 17P2 | 31+615 | Pz17P2 | CSB | × temp only | Frozen | 129.398 |
| 18P2 | 31+700 | Pz18P2 | CSB | × temp only | Frozen | 130.387 |
| 25P1A1 | 31+815 | Pz25P1A1 | Bedrock | ✓ | | 117.02 |
| 25P1A2 | | PZ25P1A2 | Bedrock | ✓ | Frozen | 122.02 |
| 25P1B1 | | Pz25P1B1 | Bedrock | ✓ | Frozen | 127.52 |
| 25P1B2 | | Pz25P1B2 | Interface | ✓ | Frozen | 129.52 |
| 25P2A1 | | Pz25P2A1 | Bedrock | ✓ | | 113.82 |
| 25P2A2 | | Pz25P2A2 | Bedrock | ✓ | | 118.82 |
| 25P2B1 | | Pz25P3B1 | Bedrock | ✓ | | 124.32 |
| 25P2B2 | | Pz25P2B2 | SB | ✓ | | 126.32 |
| 25P2C | | Pz25P2C | SB | ✓ | | 127.32 |
| 25P3A1 | | Pz25P3A1 | Bedrock | ✓ | | 115.1 |
| 25P3A2 | | Pz25P3A2 | Bedrock | ✓ | | 120.1 |

| DH-ID | STA | Instrument_ID | Stratigraphic_Unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| 25P3B1 | | Pz25P3B1 | Bedrock | ✓ | | 123.1 |
| 25P3B2 | | Pz25P3B2 | Bedrock | ✓ | | 125.1 |
| 22P2 | 31+842 | Pz22P2 | Grouting | ✓ | | 116.8 |
| 26P1A1 | 31+885 | Pz26P1A1 | Bedrock | ✓ | | 104.44 |
| 26P1A2 | | PZ26P1A2 | Bedrock | ✓ | | 109.44 |
| 26P1B1 | | Pz26P1B1 | Grouting | ✓ | | 114.94 |
| 26P1B2 | | Pz26P1B2 | Jet Grouting | ✓ | | 117.94 |
| 26P2A1 | | Pz26P2A1 | Bedrock | ✓ | | 106.77 |
| 26P2A2 | | Pz26P2A2 | Bedrock | ✓ | | 111.77 |
| 26P2B1 | | Pz26P3B1 | Jet Grouting | ✓ | | 117.27 |
| 26P2B2 | | Pz26P2B2 | Jet Grouting | ✓ | | 120.27 |
| 26P2C | | Pz26P2C | CSB | ✓ | | 123.27 |
| 26P3A1 | | Pz26P3A1 | Bedrock | ✓ | | 104.743 |
| 26P3A2 | | Pz26P3A2 | Bedrock | ✓ | | 111.36 |
| 26P3B1 | | Pz26P3B1 | Bedrock | ✓ | | 117.46 |
| 26P3B2 | | Pz26P3B2 | Bedrock | ✓ | | 120.27 |
| 19P2 | 31+928 | Pz19P2 | CSB | ✓ | | 127.873 |
| 20P2 | 31+990 | Pz20P2 | CSB | ✓ | | 125.09 |
| 27P1A1 | 32+000 | Pz27P1A1 | Bedrock | ✓ | | 113.25 |
| 27P1A2 | | PZ27P1A2 | Bedrock | ✓ | | 118.25 |
| 27P1B1 | | Pz27P1B1 | Jet Grouting | ✓ | Frozen | 123.75 |
| 27P1B2 | | Pz27P1B2 | CSB | ✓ | Frozen | 125.75 |
| 27P2A1 | | Pz27P2A1 | Bedrock | ✓ | | 112.61 |
| 27P2A2 | | Pz27P2A2 | Bedrock | ✓ | | 117.61 |
| 27P2B1 | | Pz27P2B1 | Interface | ✓ | | 123.61 |
| 27P2B2 | | Pz27P2B2 | Jet Grouting | ✓ | | 123.11 |
| 27P2C | | Pz27P2C | CSB | ✓ | Frozen | 125.11 |
| 27P3A1 | | Pz27P3A1 | Bedrock | ✓ | | 126.61 |
| 27P3A2 | | Pz27P3A2 | Bedrock | ✓ | | 111.72 |
| 27P3B1 | | Pz27P3B1 | Bedrock | ✓ | | 116.72 |
| 27P3B2 | | Pz27P3B2 | Grouting | × | | 122.22 |
| 21P2 | 32+020 | Pz21P2 | Jet Grouting | ✓ | | 124.24 |
| 28P1A1 | 32+065 | Pz28P1A1 | Bedrock | ✓ | | 102.99 |
| 28P1A2 | | PZ28P1A2 | Bedrock | ✓ | | 107.99 |
| 28P1B1 | | Pz28P1B1 | Interface | ✓ | | 112.99 |
| 28P1B2 | | Pz28P1B2 | Jet Grouting | ✓ | | 115.99 |
| 28P2A1 | | Pz28P2A1 | Bedrock | ✓ | | 105.02 |
| 28P2A2 | | Pz28P2A2 | Bedrock | ✓ | | 110.02 |
| 28P2B1 | | Pz28P3B1 | Jet Grouting | ✓ | | 115.02 |
| 28P2B2 | | Pz28P2B2 | Jet Grouting | ✓ | | 118.02 |
| 28P2C | | Pz28P2C | CSB | ✓ | Frozen | 124.02 |
| 28P3A1 | | Pz28P3A1 | Bedrock | ✓ | | 105.91 |

| DH-ID | STA | Instrument_ID | Stratigraphic_Unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| 28P3A2 | | Pz28P3A2 | Bedrock | ✓ | | 110.91 |
| 28P3B1 | | Pz28P3B1 | Interface | ✓ | | 115.91 |
| 28P3B2 | | Pz28P3B2 | Jet Grouting | ✓ | | 122.22 |
| 28P3B3 | | Pz28P3B3 | Jet Grouting | ✓ | | 118.63 |
| 29P1A1 | 32+105 | Pz29P1A1 | Bedrock | ✓ | Frozen | 115.32 |
| 29P1B1 | | PZ29P1B1 | Bedrock | ✓ | Frozen | 120.32 |
| 29P1B2 | | Pz29P1B2 | Jet Grouting | ✓ | Frozen | 125.32 |
| 29P1B3 | | Pz29P1B3 | Jet Grouting | ✓ | Frozen | 127.32 |
| 29P2A1 | | Pz29P2A1 | Bedrock | ✓ | | 114.99 |
| 29P2B1 | | Pz29P3B1 | Bedrock | ✓ | | 119.99 |
| 29P2B2 | | Pz29P2B2 | Jet Grouting | ✓ | Frozen | 124.99 |
| 29P2B3 | | Pz29P2B3 | Jet Grouting | × | | 126.99 |
| 29P2C | | Pz29P2C | Jet Grouting | ✓ | Frozen | 129.99 |
| 29P3A1 | | Pz29P3A1 | Bedrock | ✓ | | 115.91 |
| 29P3B1 | | Pz29P3B1 | Bedrock | ✓ | | 120.91 |
| 29P3B2 | | Pz29P3B2 | Jet Grouting | ✓ | Frozen | 125.74 |
| 29P3B3 | | Pz29P3B3 | Jet Grouting | × | | 127.89 |

| STA | DH-ID | Working Beads | Reliable Beads | Total Beads | Top Bead Elevation | Bottom Bead Elevation |
|---|---|---|---|---|---|---|
| 30+134 | T01 | 16 | 16 | 16 | 135 | 115 |
| 30+185 | T02 | 16 | 15 | 16 | 135 | 115 |
| 30+260 | T03 | 16 | 16 | 16 | 130 | 125.5 |
| 30+260 | T03-1 | 16 | 16 | 16 | 139.97 | 116.97 |
| 30+272 | T04 | 16 | 16 | 16 | 13 | 125.5 |
| 30+272 | T04-1 | 16 | 16 | 16 | 139.97 | 116.97 |
| 30+388.5 | T05 | 16 | 16 | 16 | 130 | 125.5 |
| 30+388.5 | T05-1 | 16 | 16 | 16 | 139.97 | 116.97 |
| 30+330.5 | T06 | 16 | 16 | 16 | 135 | 115 |
| 30+386 | T07 | 16 | 16 | 16 | 135 | 115 |
| 30+417.5 | T08 | 16 | 16 | 16 | 135 | 115 |
| 30+489.5 | T09 | 16 | 16 | 16 | 135 | 115 |
| 30+553.25 | T10 | 16 | 16 | 16 | 135 | 115 |
| 30+621.5 | T11 | 16 | 16 | 16 | 135 | 115 |
| 30+650 | T12 | 16 | 16 | 16 | 135 | 115 |
| 30+713 | T13 | 16 | 16 | 16 | 135 | 115 |
| 30+827 | T14 | 16 | 16 | 16 | 135 | 115 |
| 31+080 | T15 | 16 | 16 | 16 | 135 | 115 |
| 31+134.5 | T16 | 16 | 16 | 16 | 135 | 115 |
| 31+170 | T17 | 16 | 16 | 16 | 135 | 115 |
| 31+352 | T18 | 16 | 16 | 16 | 135 | 115 |
| 31+595 | T19 | 16 | 16 | 16 | 135 | 108 |

| STA | DH-ID | Working Beads | Reliable Beads | Total Beads | Top Bead Elevation | Bottom Bead Elevation |
|---|---|---|---|---|---|---|
| 31+605 | T20 | 16 | 16 | 16 | 135 | 115 |
| 31+752.5 | T21 | 16 | 16 | 16 | 135 | 115 |
| 31+820 | T22 | 16 | 16 | 16 | 134 | 115 |
| 31+850 | T23 | 16 | 16 | 16 | 133.5 | 108 |
| 31+880 | T24 | 16 | 16 | 16 | 135 | 108 |
| 31+960 | T25 | 16 | 16 | 16 | 135 | 115 |
| 31+995 | T26 | 16 | 16 | 16 | 135 | 115 |
| 32+030 | T27 | 16 | 16 | 16 | 133.5 | 108 |
| 32+060 | T28 | 16 | 16 | 16 | 135 | 108 |
| 32+100 | T29 | 16 | 16 | 16 | 134 | 115 |
| 32+140 | T30 | 16 | 16 | 16 | 134 | 115 |

**Table 5: List of Inclinometers on Bay-Goose Dike (source: AEM)**

| Location | Instrument ID | Operational (✓)/Not operational (×) | Manual/Automatic | Elevation interval in meters (top/bottom) |
|---|---|---|---|---|
| 30+282 | BG-IN-30+282 | ✓ | Manual | 139.3/124.8 |
| 30+390 | BG-IN-30+390 | ✓ | Manual | 140.0/119.0 |
| 30+640 | BG-IN-30+640 | ✓ | Manual | 138.8/124.3 |
| 31+180 | BG-IN-31+180 | ✓ | Manual | 139.0/124.5 |
| 31+590 | BG-IN-31+590 | ✓ | Manual | 139.5/115.0 |
| 31+815 | BG-IN-31+815 | ✓ | Manual | 139.2/119.7 |
| 31+885 | BG-IN-31+885 | ✓ | Manual | 138.8/113.3 |
| 32+065 | BG-IN-32+065 | ✓ | Manual | 139.1/116.6 |

**Table 6: List of TDR Reflectometers on Goose Pit wall (source: AEM)**

| Location of hole | DL # | Instrument ID | Inclination (°) | Length (m) | Casing elevation (m) | Crimps |
|---|---|---|---|---|---|---|
| 31+255 | 9 | TDR-11 | 60 | 70 | 134.4 | Every 25 m |
| 31+153 | 9 | TDR-12 | 60 | 180 | 133.5 | Every 25 m |
| 31+058 | 9 | TDR-15 | 60 | 180 | 134.3 | Every 25 m |
| 31+035 | 9 | TDR-17 | 60 | 206.35 | 134.9 | Every 25 m |
| 30+937 | 9 | TDR-18 | 60 | 180 | 135.6 | Every 25 m |
| 30+960 | 9 | TDR-20 | 60 | 200 | 136.5 | Every 25 m |
| | | | | | | |

## 1.4 Vault Dike

The construction of Vault Dike was done in the winter of 2013 to keep its foundation frozen.

Five thermistor strings were originally installed on Vault Dike following its construction in the winter of 2013 and four are still operational. TH3 is installed in the deepest channel downstream, TH5 is installed under the liner, TH6 is installed upstream of the liner, TH7 is installed east of the deepest channel, and TH8 is installed upstream in the deepest channel outside of the key trench. One thermistor (TH-3, on the side of Vault Lake) had been damaged by sloughing in previous year and stopped working in October 2015.

Table 7 below details instrumentation on Vault Dike.

**Table 7: List of Thermistors on Vault Dike (source: AEM)**

| Hole | ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| 71-2 | VD-TH5 | TH | ✓ | Manual | - | - | 16 | 142.50/136.10 |
| 94-2 | VD-TH6 | TH | ✓ | Manual | - | - | 16 | 140.50/121.50 |
| 96-1 | VD-TH8 | TH | ✓ | Manual | - | - | 16 | 140.50/119.50 |
| 96-2 | VD-TH7 | TH | ✓ | Manual | - | - | 16 | 140.50/119.50 |

# 2.0 TAILINGS STORAGE FACILITY

The TSF was commissioned in conjunction with the mill start-up in February 2010, with tailings being deposited within the North Cell of the facility. The North Cell and structures Saddle Dam 1, Saddle Dam 2 and Stormwater Dike were constructed to El. 150 m in two stages from 2009 to 2011.

The construction of the South Cell started in 2012 with Central Dike, thereby closing the eastern portion of the South Cell. The beginning of the tailings deposition in the South Cell started at the end of 2014. From 2012 to 2018, Central Dike was raised to El. 145 m in six stages. To increase the capacity of the South Cell, additional peripheral structures (Saddle Dam 3, Saddle Dam 4 and Saddle Dam 5) were constructed to El. 145 m in three stages from 2015 to 2018. The South Cell is designed to be able to be raised to El. 150 m. The construction of subsequent portions of the South Cell could occur in the future in the unlikely case of additional capacity being required.

## 2.1 North Cell Internal Structure – North Cell

The North Cell Internal Structure was built in 2018 to El. 152 m from Sta. 1+100 m to 1+660 m and from 2+750 m to 3+200 m, and to El. 154 m from Sta. 1+660 m to 2+750. This stage is an intermediate phase and the structure could be raised and lengthened to provide additional capacity if required. The tailings deposition from the North Cell Internal Structure started in August 2018.

Tailings deposition was transferred from the North Cell to the South Cell at the end of 2014. Tailings deposition occurred during the summer of 2015 within the North Cell and resumed in the South Cell in October 2015. Progressive closure of the North Cell started in the winter of 2015 with the construction of a non-acid generating rockfill capping over the tailings and continued in the winter of 2016.

A rockfill berm was constructed in 2016 at the toe of Stormwater Dike in the South Cell (from Sta. 10+300 to Sta. 10+750) to mitigate the crest and downstream slope movement observed in this sector at the end of August 2016. Following an investigation and instrumentation program, the movements observed are inferred to be caused by the soft sediment foundation thawing and settling due to the South Cell water pond reaching the dike foundation during the summer. Water ponding against Stormwater Dike is part of the tailings deposition plan and is acceptable, as Stormwater Dike is not a peripheral structure. Having direct ponding water within Stormwater Dike foundation is geotechnically acceptable. For South Cell closure and environmental aspects, given that it is inferred that the Stormwater Dike foundation presents some open windows of exposed fractured bedrock that may contribute to feeding the seepage at Central Dike, it is recommended that a beach be put in place along Stormwater Dike downstream slope to seal the foundation before the end of the deposition activities.

Four vertical thermistor strings were installed on the crest of the North Cell Internal Structure in August 2018 (NCIS-01, NCIS-02, NCIS-03 and NCIS-04). NCIS-01, NCIS-02 and NCIS-04 are installed on the upstream side of the dike whereas NCIS-02 is installed on the downstream side.

Table 8 below details instrumentation on the North Cell Internal Structure.

**Table 8: List of Instruments on the North Cell Internal Structure (source: AEM)**

| Hole | Instrument ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| NCIS-T1 | NCIS-18-01 | Thermistor | ✓ | Automatic (DL55) | - | - | 16 | 140/110 |
| NCIS-T2 | NCIS-18-02 | Thermistor | No data X | Automatic (DL55) | - | - | 16 | 134/119 |
| NCIS-T3 | NCIS-18-03 | Thermistor | ✓ | Automatic (DL56) | - | - | 16 | 149/132.84 |
| NCIS-T4 | NCIS-18-04 | Thermistor | ✓ | Automatic (DL57) | - | - | 16 | 148/118 |
| PSM | NCIS1 TO NCIS16 | Prism | ✓ | Manual | - | - | - | - |

## 2.2 Saddle Dam 1 – North Cell

Stage 1 of Saddle Dam 1 was constructed in the fall of 2009 to a height of 10 m (crest elevation of 141 m) and a length of 250 m. Stage 2 was constructed in 2010 to an overall height of 20 m (final crest elevation of 150 m) and length of about 400 m.

Three thermistors (T1, T2, T3) are installed to monitor the thermal condition within the structure and its foundation; they were installed in 2009 and early 2010 as part of Stage 1. The fourth thermistor string (T4) was installed in 2009 and extended in 2010 along the upstream face of the dam to monitor the thermal condition of the tailings. The SD1-T1 thermistor string is installed in the centre of the upstream face of the dike immediately beneath the geomembrane liner to monitor temperatures within the deposited tailings. A thin layer of protective granular material exists above the geomembrane liner at this location. The SD1-T2 thermistor string is installed vertically through the upstream Stage 1 crest in the centre of the dike at El. 140 m. The SD1-T3 thermistor string is installed vertically through the upstream Stage 2 crest in the centre of the dike at El. 150 m. The SD1-T4 thermistor string is installed vertically through the upstream toe of the dike near the centre of the dike.

TH-T3 stopped working on November 2020, will be repaired in 2022

Table 9 below details instrumentation on Saddle Dam 1.

**Table 9: List of Thermistors on Saddle Dam 1 (source: AEM)**

| Hole | Instrument ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| SD1-T2 | SD1-02 | Thermistor | ✓ | Automatic (DL14) | - | - | 16 | 140/110 |
| SD1-T4 | SD1-04 | Thermistor | ✓ | Automatic (DL14) | - | - | 16 | 134/119 |
| SD1-T1 | SD1-01 | Thermistor | ✓ | Automatic (DL14) | - | - | 16 | 149/132.84 |

## 2.3 Saddle Dam 2 – North Cell

Saddle Dam 2 was constructed in one stage in 2011 to a crest elevation of 150 m. Saddle Dam 2 has a maximum height of about 10 m and a crest length of 460 m.

TH-T4 stopped working on July 2021.

Table 10 below details instrumentation on Saddle Dam 2.

**Table 10: List of Thermistors on Saddle Dam 2 (source: AEM)**

| Hole | Instrument ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| SD2-T3 | SD2-03 | Thermistor | ✓ | Automatic (DL15) | - | - | 16 | 144/129 |
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| SD2-T1 | SD2-01 | Thermistor | ✓ | Automatic (DL15) | - | - | 16 | 148.05/145.31 |
| SD2-T2 | SD2-02 | Thermistor | ✓ | Automatic (DL15) | - | - | 16 | 148/118 |

## 2.4 RF1/RF2 – North Cell

Four thermistors were installed in 2012 to monitor the temperature of RF1 and RF2 (which delineates the northeastern side of the TSF North Cell).

Table 11 below details instrumentation on RF1 and RF2.

**Table 11: List of Thermistors on RF1 and RF2 (source: AEM)**

| Hole | Instrument ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| 121-1 | 121-RF1-1 | Thermistor | ✓ | Manual | - | - | 16/16 | 136/90 |
| 73-6 | 73-6-RF1-2 | Thermistor | ✓ | Manual | - | - | 14/16 | 149.5/133 |
| RF1-3 | RF1-3 | Thermistor | ✓ | Manual | - | - | 11/11 | 148/144 |
| 122-1 | 122-1RF2 | Thermistor | ✓ | Manual | - | - | 14/16 | 137/90 |

## 2.5 North Cell Tailings

Five thermistors are installed in the tailings of the North Cell of the TSF (SWD-1, SD2-1, 90-1, NC-TH-1 and NC-TH-2). These thermistors were installed from 2012 to 2016. Thermistor 90-1 was installed in 2012 in the tailings of the North Cell near Saddle Dam 1. Thermistor NC-T1 and NC-T2 were installed in April 2016 in the tailings of the North Cell in the location of the former reclaim pond. Nine additional thermistors were installed in February 2017 in the tailings of the North Cell (SWD-01, NC17-01, NC-17-02, NC-17-03, NC-17-04, NC-17-05, NC-17-06, NC-17-07, NC-17-08).

Table 12 below details instrumentation in the North Cell tailings.

**Table 12: List of Thermistors in the North Cell tailings (source: AEM)**

| Hole | Instrument ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| NC-T1 | NC-T1 | Thermistor | ✓ | Manual | - | - | 16 | 146.6/86.6 |
| NC-17-01 | NC-17-01 | Thermistor | ✓ | Automatic (DL20) | - | - | 16 | 148/112 |
| NC-17-02 | NC-17-02 | Thermistor | ✓ | Automatic (DL21) | - | - | 16 | 147.6/102 |
| NC-17-03 | NC-17-03 | Thermistor | ✓ | Automatic (DL22) | - | - | 13/16 | 147.6/102.6 |
| NC-17-04 | NC-17-04 | Thermistor | ✓ | Automatic (DL23) | - | - | 16 | 148.5/122 |
| NC-17-05 | NC-17-05 | Thermistor | ✓ | Automatic (DL24) | - | - | 16 | 146.6/112.6 |
| NC-17-06 | NC-17-06 | Thermistor | ✓ | Automatic (DL25) | - | - | 16 | 148/112 |
| NC-17-07 | NC-17-07 | Thermistor | ✓ | Automatic (DL26) | - | - | 16 | 148/112 |
| NC-17-08 | NC-17-08 | Thermistor | ✓ | Automatic (DL27) | - | - | 15/16 | 146/99 |

## 2.6 Stormwater Dike – Divider Dike

Stormwater Dike was progressively constructed. Stage 1 was constructed in 2009 to a height of 10 m (crest elevation of 140 m) and a length of 860 m. Stage 2 was primarily constructed in 2010 to an overall height of 18 m (crest elevation of 148 m) and length of about 1,060 m. A horizontal bench is present along the upstream face of the structure due to the connection of the 2009 and 2010 portions of the structure. The junction between the bituminous liner of Stormwater Dike and the LLDPE liner of Saddle Dam 2 was completed in 2011. The crest of Stormwater Dike was raised to 150 m in 2013.

The majority of the dike is seated on dense till from the former lakebed within the talik while the abutments are generally founded on bedrock. The foundation preparation of Stage 2 was completed in winter conditions. It was generally done above water except in an area where water ponding was present (between Sta.10+500 and 10+750 approximately). This pond was located where the topography suggests that the soft lakebed sediment thickness may be greater than at other locations along the dike. Due to the presence of water, the ice crust was cracked with the excavator and only minimal foundation preparation was possible. As a result, most of the lakebed sediment probably remained in place in this area.

A single deep thermistor (T147-1) and a piezometer string (VWP 13265) were installed at the downstream toe of Stormwater Dike (within the South Cell). These instruments were broken in September 2016 during the construction of the buttress at the toe of Stormwater Dike within the South Cell. Three new thermistors (TH-SWD-01, TH-SWD-02, TH-SWD-03) and piezometers (PZ-SWD-02-A, PZ-SWD-03-A, PZ-SWD-03-B) were installed since then. SWD-01 is installed on the upstream side of Stormwater Dike within the North Cell tailings. SWD-02 is installed on the downstream side of Stormwater Dike (approx. Sta. 10+650 m) within the stabilization buttress. SWD-03 is installed on the downstream side of Stormwater Dike (approx. Sta. 10+690 m) within the stabilization buttress.

PZ-SWD-02-A and TH-SWD-02 are now broken, while the other piezometers are frozen but still transmit data.

In 25 August 2016 two wireline extensometers, four crack monitoring stations and three prisms were installed on the crest of Stormwater Dike in the area showing movements (between Sta. 10+500 and 10+750 approximately). Following the MDRB recommendations, AEM installed additional instruments in 2017 to monitor the response of Stormwater Dike during tailings deposition in the South Cell. In 2018, an additional prism and 3 crackmeters were added, leading to a total of 3 piezometers, 3 thermistors, 4 extensometers, 3 crackmeters and 20 prisms installed on Stormwater Dike.

Table 13 below details instrumentation on Stormwater Dike.

**Table 13: List of Instruments on Stormwater Dike (source: AEM)**

| Hole | Instrument ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| SWD-01 | SWD-01 | Thermistor | ✓ | Automatic (DL19) | | | 16 | 148/118 |
| SWD-02 | PZ-SWD-02-A | Piezo | × | Automatic (DL19) | 62 | Bedrock | | |
| | TH-SWD-02 | Thermistor | ✓ | Automatic (DL19) | | | 6 | 127/117 |
| SWD-03 | PZ-SWD-03A | Piezo | Frozen | Automatic (DL19) | 110 | Bedrock | | |
| | PZ-SWD-03B | Piezo | Frozen | Automatic (DL19) | 122 | | | |
| | TH-SWD-03 | Thermistor | ✓ | Automatic (DL19) | | | 14 | 125/111 |

## 2.7 Saddle Dam 3, Saddle Dam 4 and Saddle Dam 5 – South Cell

Stage 1 of Saddle Dam 3 and 4 was constructed in 2015. Stage 1 of Saddle Dam 5 was constructed in 2016. During Stage 1, Saddle Dam 3 and 4 were constructed to El. 140 m and Saddle Dam 5 to El. 137 m. Stage 2 of Saddle Dam 3, 4 and 5 was constructed to El. 143 m in 2016. Stage 3 of Saddle Dam 4 and 5 was constructed to El. 145 m in 2017. Stage 3 of Saddle Dam 3 was constructed partially to El. 145 m in 2017, with the installation the geomembrane and the construction of the liner erosion protection cover completed in 2018. These structures are designed to be able to be raised to El. 150 m and the final crest elevation of these structures is subject to review by AEM. At the end of Stage 3, the decision was made by AEM to close the abutments of these structures, as no further raise was planned at the moment. If these structures are to be raised higher, it will be necessary to re-open the abutments. The completed crest length is approximately 245 m for Saddle Dam 3, 365 m for Saddle Dam 4, and 255 m for Saddle Dam 5.

Five thermistors are installed at Saddle Dam 3. Three of these thermistors are located along the axis of the faulted zone that was encountered during the construction of Saddle Dam 3 (around Sta. 20+650). Along this axis, two thermistors are installed on the crest (SD3-T3 around the centerline and SD3-T2 on the upstream edge), and the other (SD3-T4) is installed on the upstream toe liner tie-in. Another thermistor is installed at Sta. 20+720 within the upstream toe liner tie-in (SD3-T5). One thermistor (SD3-T6) was installed in 2018 on the crest towards the junction with Saddle Dam 2.

Table 14 below details instrumentation on Saddle Dam 3.

**Table 14: List of Thermistors on Saddle Dam 3 (source: AEM)**

| Hole | Instrument ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| SD3-T2 | SD3-02 | Thermistor | ✓ | Automatic (DL16) | - | - | 16 | 139.1/123.1 |
| SD3-T3 | SD3-03 | Thermistor | ✓ | Automatic (DL16) | - | - | 15 | 138.6/121.6 |
| SD3-T4 | SD3-04 | Thermistor | × (since June 2019) | Automatic (DL16) | - | - | 0/15 | 137.3/122.3 |
| SD3-T5 | SD3-05 | Thermistor | × (since Dec 2019) | Automatic (DL16) | - | - | 16 | 138.4/122.4 |
| SD3-T6 | SD3-06 | Thermistor | ✓ | Automatic (DL16) | - | - | 16 | 143.9/113.9 |

Four thermistors are installed at Saddle Dam 4 near Sta. 40+300. One thermistor (SD4-T2) is installed on the upstream edge crest while another (SD4-T4) is installed in the upstream toe line tie-in, and another one (SD4-T1) is in the centre of the upstream face of the dike immediately on top of the geomembrane liner to monitor the thermal regime of the tailings in contact with the structure. One thermistor (SD4-T3) was installed on the middle of the crest in January 2018.

Table 15 below details instrumentation on Saddle Dam 4.

**Table 15: List of Thermistors on Saddle Dam 4 (source: AEM)**

| Hole | Instrument ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| SD4-T2 | SD4-02 | Thermistor | ✓ | Automatic (DL17) | - | - | 16 | 139/129 |
| SD3-T3 | SD3-03 | Thermistor | ✓ | Automatic (DL17) | - | - | 16 | 144/129 |
| SD4-T4 | SD4-04 | Thermistor | ✓ | Automatic (DL17) | - | - | 5/14 | 137.3/127.8 |
| SD4-T1 | SD4-01 | Thermistor | × (since August 2018) | Automatic (DL17) | - | - | 16 | 143.4/139.6 |

Three thermistors were installed at Saddle Dam 5 in 2018 near Sta. 40+680. One thermistor (SD5-T2) is installed on the downstream edge crest, one (SD5-T4) around the middle of the crest, and another (SD5-T3) is installed in the toe liner tie-in.

Table 16 below details instrumentation on Saddle Dam 5.

**Table 16: List of Thermistors on Saddle Dam 5 (source: AEM)**

| Hole | Instrument ID | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|
| # | ID | PZ/TH | Operational (✓)/Not operational (×) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in meters (top/bottom) |
| SD5-02 | SD4-02 | Thermistor | ✓ | Automatic (DL58) | - | - | 16(cap) | 144/129 |
| SD5-03 | SD3-03 | Thermistor | ✓ | Automatic (DL58) | - | - | 16 | 141/126 |
| SD5-04 | SD4-04 | Thermistor | ✓ | Automatic (DL58) | - | - | 16(cap) | 144/129 |

## 2.8 Central Dike – South Cell

Construction of Central Dike started in 2012 (stage 1) at the El. 110 m with a key trench located underneath the centreline. In 2013 (Stage 2), the footprint of Central Dike was widened for a crest elevation of 150 m, the structure was raised to El. 115 m and the key trench was relocated at the upstream toe. In 2014 (Stage 3), the key trench was relocated at the upstream toe and constructed to El. 132 m. Central Dike was raised to El. 137 in

2015 (Stage 4), to El. 143 m in 2016 (Stage 5), and to El. 145 m in two steps in 2017 and 2018 (Stage 6). Central Dike is designed to be able to be raised to El. 150 m and the final crest elevation is subject to review by AEM. The completed crest length is approximately 900 m at El. 145 m.

Desktop studies were undertaken by Golder in 2015 to estimate the seepage flows and pore water pressures, verify the dike stability, and attempt to predict the eventual flow volume that would report to the downstream toe for higher pond elevation. The seepage pathway used in the Golder 2015 model was through a layer of fine material in the till layer of the foundation as it was deemed the most critical scenario for the structure stability. The main recommendation from this desktop study was to maintain beaches adjacent to Central Dike and to maintain a 'back pressure' on the downstream side of Central Dike in order to reduce the hydraulic gradient by holding the downstream pond at El. 115 m. Willowstick was also hired to carry out electromagnetic surveys to detect seepage paths. The geophysical campaign led to additional recommendations and identified possible seepage path locations. Following the geophysical campaign, an investigation was conducted by SNC-Lavalin (SNC) and AEM in December 2015 at station CD-595, and between CD-810 and CD-850. Highly altered and fractured bedrock was encountered, and high hydraulic conductivity was measured from Packer testing. Instrumentation of the four boreholes with piezometers and thermistors was done at the same time. A study has been completed in 2017 by Golder to update the seepage modelling with a seepage flow through the bedrock, and allowed for updating of the Emergency Preparedness Plan as well as the Operation, Maintenance, and Surveillance Manual. The summer 2017 investigation and instrumentation campaign shows that the seepage pathway was most probably mainly controlled by the bedrock.

Instruments were installed on Central Dike to monitor the dike's performance during its construction, operation, and closure. Nine boreholes were drilled on three rows corresponding to the central key trench (545-P1, 580-P1, 650-P1 and 750-P1), the final downstream toe (545-P2 and 650-P2) and the Portage Pit limit (465-P3, 650-P3, 875-P3 and WR-P3). Four additional boreholes were drilled and instrumented in 2016 during the seepage field investigation in the key trench alignment (595-P1, 810-P1, 825-P1 and 850-P1). Two thermistor strings were also installed on the upstream face to monitor the temperature within the tailings of the South Cell.

Seven additional boreholes were drilled and instrumented in 2017 (700-P1, 745-P3, 800-P2, 800-P3, 875-P2, 975-P3 and 1050-P3).

In October 2020, four additional boreholes were drilled and instrumented to replace broken instruments (545-P1R, 595-P1R, 650-P1R, 815-P1R).

**Table 17: List of Piezometers and Thermistors on Central Dike (source: AEM)**

| DH-ID | STA | Instrument_ID | Stratigraphic_Unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| 465-P3 | 0+465 | 465-P3-A | Bedrock | ✓ | Frozen | 65 |
| 465-P3 | 0+465 | 465-P3-B | Bedrock | ✓ | Frozen | 85 |
| 545-P1R | 0+545 | 545-P1R-A | | ✓ | | |
| 545-P1R | 0+545 | 545-P1R-B | | ✓ | | |
| 545-P1R | 0+545 | 545-P1R-C | | ✓ | | |
| 545-P1R | 0+545 | 545-P1R-D | | ✓ | | |
| 545-P2 | 0+545 | 545-P2-A | Bedrock | × | Frozen | 65 |
| 545-P2 | 0+545 | 545-P2-B | Bedrock | × | Frozen | 85 |
| 545-P2 | 0+545 | 545-P2-C | Bedrock | × | Frozen | 11 |
| 545-P2 | 0+545 | 545-P2-D | Rockfill/till | × | Frozen | 104 |

| DH-ID | STA | Instrument_ID | Stratigraphic_Unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| 580-P1R | 0+580 | 580-P1R-A | Sand | ✓ | | 69.5 |
| 580-P1R | 0+580 | 580-P1R-B | Bedrock | ✓ | | 75.5 |
| 580-P1R | 0+580 | 580-P1R-C | Bedrock | ✓ | | 79 |
| 595-P1R | 0+595 | 595-P1R-A | | ✓ | | |
| 595-P1R | 0+595 | 595-P1R-B | | ✓ | | |
| 595-P1R | 0+595 | 595-P1R-C | | ✓ | | |
| 650-P1R | 0+650 | 650-P1R-A | | ✓ | | |
| 650-P1R | 0+650 | 650-P1R-B | | ✓ | | |
| 650-P1R | 0+650 | 650-P1R-C | | ✓ | | |
| 650-P2 | 0+650 | 650-P2-A | Bedrock | ✓ | | 65 |
| 650-P2 | 0+650 | 650-P2-B | Bedrock | ✓ | | 85 |
| 650-P2 | 0+650 | 650-P2-C | Bedrock | ✓ | | 99.5 |
| 650-P2 | 0+650 | 650-P2-D | Rockfill/till | ✓ | | 103.5 |
| 650-P3 | 0+650 | 650-P3-A | Bedrock | ✓ | Frozen | 65 |
| 650-P3 | 0+650 | 650-P3-B | Bedrock | ✓ | Frozen | 85 |
| 700-P1 | 0+700 | 700-P1-A | | ✓ | | |
| 700-P1 | 0+700 | 700-P1-B | | ✓ | | |
| 700-P1 | 0+700 | 700-P1-C | | ✓ | | |
| 700-P1 | 0+700 | 700-P1-D | | ✓ | | |
| 700-P1 | 0+700 | 700-P1-E | | × | | |
| 750-P1 | 0+750 | 750-P1-A | Bedrock | ✓ | | 65 |
| 750-P1 | 0+750 | 750-P1-B | Bedrock | ✓ | | 76 |
| 750-P1 | 0+750 | 750-P1-C | Dense till | ✓ | | 80 |
| 750-P1 | 0+750 | 750-P1-D | Dense till | ✓ | | 88 |
| 750-P1 | 0+750 | 750-P1-E | Rockfill | ✓ | | 100 |
| 800-P2 | 0+800 | 800-P2-A | Bedrock | ✓ | | 70.07 |
| 800-P2 | 0+800 | 800-P2-B | Bedrock | ✓ | | 85.7 |
| 800-P2 | 0+800 | 800-P2-C | Bedrock | ✓ | | 95.07 |
| 800-P2 | 0+800 | 800-P2-D | Rockfill/till | ✓ | | 105.07 |
| 800-P3 | 0+800 | 800-P3-A | Bedrock | ✓ | | 62.95 |
| 800-P3 | 0+800 | 800-P3-B | Bedrock | ✓ | | 82.95 |
| 800-P3 | 0+800 | 800-P3-C | Till | ✓ | | 96.45 |
| 810-P1 | 0+810 | 810-P1-A | Bedrock | × | | 67.7 |
| 810-P1 | 0+810 | 810-P1-B | Bedrock | × | | 79.9 |
| 810-P1 | 0+810 | 810-P1-C | Dense till | × | | 86.9 |
| 810-P1 | 0+810 | 810-P1-D | Dense till | × | | 93.9 |
| 815-P1R | 0+815 | 815-P1R-A | | ✓ | | |
| 815-P1R | 0+815 | 815-P1R-B | | ✓ | | |
| 815-P1R | 0+815 | 815-P1R-C | | ✓ | | |
| 825-P1 | 0+825 | 825-P1-A | Bedrock | ✓ | | 74.15 |
| 825-P1 | 0+825 | 825-P1-B | Bedrock | ✓ | | 93.5 |

| DH-ID | STA | Instrument_ID | Stratigraphic_Unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| 825-P1 | 0+825 | 825-P1-E | Till (casing) | ✓ | | 101 |
| 850-P1 | 0+850 | 850-P1-A | Bedrock | ✓ | | 72 |
| 850-P1 | 0+850 | 850-P1-B | Bedrock | ✓ | | 93.7 |
| 850-P1 | 0+850 | 850-P1-E | Rockfill | ✓ | | 106 |
| 875-P2 | 0+875 | 875-P2-A | Bedrock | ✓ | | 65.08 |
| 875-P2 | 0+875 | 875-P2-B | Bedrock | ✓ | | 85.08 |
| 875-P2 | 0+875 | 875-P2-C | Bedrock | × temp only | Frozen | 105.38 |
| 875-P2 | 0+875 | 875-P2-D | Till | × temp only | Frozen | 107.58 |
| 875-P3 | 0+875 | 875-P3-A | Bedrock | ✓ | | 65 |
| 875-P3 | 0+875 | 875-P3-B | Bedrock | ✓ | | 85 |
| 975-P3 | 0+975 | 975-P3-A | Bedrock | ✓ | | 64.53 |
| 975-P3 | 0+975 | 975-P3-B | Bedrock | ✓ | | 84.53 |
| 1050-P3 | 0+1050 | 1050-P3-A | Bedrock | ✓ | Frozen | 66.37 |
| 1050-P3 | 0+1050 | 1050-P3-B | Bedrock | ✓ | Frozen | 86.37 |

| DH-ID | STA | Instrument ID | Working Beads | Reliable Beads | Total Beads | Top Bead Elevation | Bottom Bead Elevation |
|---|---|---|---|---|---|---|---|
| 465-P3 | 0+465 | 465-TH-P3 | 10 | 10 | 13 | 105 | 69 |
| 545-P1 | 0+545 | 545-TH-P1 | 0 | 0 | 13 | 111 | 63 |
| 545-P2 | 0+545 | 545-TH-P2 | 13 | 13 | 13 | 105 | 51 |
| 580-P1R | 0+580 | 580-TH-P1R | 16 | 16 | 16 | 120.5 | 65.5 |
| 595-P1 | 0+595 | 595-TH-P1 | 16 | 16 | 16 | 114.6 | 69.6 |
| 650-P1R | 0+650 | 650-TH-P1R | 13 | 13 | 13 | 107.2 | 95.2 |
| 650-P2 | 0+650 | 650-TH-P2 | 13 | 13 | 13 | 105 | 51 |
| 650-P3 | 0+650 | 650-TH-P3 | 13 | 12 | 13 | 105 | 51 |
| 700-P1 | 0+700 | 700-TH-P1 | 16 | 16 | 16 | 118.4 | 63.4 |
| 745-P3 | 0+745 | 745-TH-P3 | 8 | 8 | 16 | 125.08 | 102.08 |
| 750-P1 | 0+750 | 750-TH-P1 | 13 | 12 | 13 | 111 | 63 |
| 800-P2 | 0+800 | 800-TH-P2 | 16 | 16 | 16 | 120.07 | 70.07 |
| 800-P3 | 0+800 | 800-TH-P3 | 14 | 13 | 14 | 118.95 | 62.95 |
| 810-P1 | 0+810 | 810-TH-P1 | 0 | 0 | 16 | 134.84 | 114.84 |
| 815-P1R | 0+815 | 815-TH-P1R | 13 | 13 | 13 | 98.5 | 80.5 |
| 825-P1 | 0+825 | 825-TH-P1R | 16 | 15 | 16 | 131.25 | 71.25 |
| 850-P1 | 0+850 | 850-TH-P1 | 16 | 15 | 16 | 133.02 | 73.02 |
| 875-P2 | 0+875 | 875-TH-P2 | 15 | 15 | 16 | 120.08 | 63.08 |
| 875-P3 | 0+875 | 875-TH-P3 | 13 | 13 | 13 | 105 | 51 |
| 975-P3 | 0+975 | 975-TH-P3 | 16 | 16 | 16 | 131.12 | 64.12 |
| 1050-P3 | 1+050 | 1050-TH-P3 | 16 | 15 | 16 | 134.77 | 65.77 |
| 650 US | 0+650 | CD-US-0+650 | 29 | 29 | 32 | 143 | 111.06 |

**Table 18: List of Piezometers Recording Suction on Central Dike**

| Name of Piezometer | Installation Unit | Observation |
|---|---|---|
| 545-P1-A | Bedrock | Suction. |
| 545-P2 B | Bedrock | Suction. Broken. |
| 545-P2-C | Bedrock | Suction. Broken. |
| 545-P2-D | Till | Suction. Broken. |
| 650-P2-D | Till | Suction. Frozen. |
| 650-P3-B | Bedrock | Suction. Frozen. |
| 750-P1-(B,C) | Bedrock, till | Suction. |

# 3.0 WHALE TAIL PROJECT DEWATERING DIKES

## 3.0 Whale Tail Dike

The construction of Whale Tail Dike started on July 2018 and ended in February 2019.

The instruments installed on Whale Tail Dike are summarized in Tables 19 and 20 below and consist of:

- 4 inclinometers in the cut-off wall;
- 34 thermistors in the dike;
- 3 thermistors in the upstream lake;
- 2 thermistors in the downstream area;
- 11 piezometer holes having each 3 to 4 instruments (47 piezometers in total).

Thermistors are mostly located downstream of the cut-off wall with the temporary thermistors installed justdownstream of the secant wall to gain more data on potential wall defects that would exhibit warm up in the cut off wall. The piezometers have 2 holes downstream (P1 & P2) of the wall and 1 upstream (P3) for a given section. All the instruments except for the temporary thermistors are connected to an automated data acquisition system that gathers data every 3 hours.

**Table 19: List of Piezometers and Thermistors on Whale Tail Dike (source: AEM)**

| DH-ID | STA | INSTRUMENT_ID | Stratigraphic unit | OP Status | Frozen Status | Elevation |
|---|---|---|---|---|---|---|
| PZ-1 | 0+260 | WTD_260_P1_A | Bedrock | ✓ | | 138.5 |
| | | WTD_260_P1_B | Bedrock | ✓ | | 145.5 |
| | | WTD_260_P1_C | Interface | ✓ | Frozen | 151.5 |
| PZ-2 | 0+260 | WTD_260_P2_A | Bedrock | ✓ | | 138.5 |
| | | WTD_260_P2_B | Bedrock | ✓ | | 145.5 |
| | | WTD_260_P2_C | Interface | Broken | | 150.5 |
| PZ-3 | 0+260 | WTD_260_P3_A | Bedrock | ✓ | | 138.32 |
| | | WTD_260_P3_B | Bedrock | ✓ | | 145.32 |
| | | WTD_260_P3_C | Interface | ✓ | | 149.82 |
| PZ-4 | 0+360 | WTD_360_P1_A | Bedrock | ✓ | | 132 |
| | | WTD_360_P1_B | Bedrock | ✓ | | 139 |
| | | WTD_360_P1_C | Interface | ✓ | | 145.53 |
| PZ-5 | 0+360 | WTD_360_P2_A | Bedrock | ✓ | | 132 |
| | | WTD_360_P2_B | Bedrock | ✓ | | 137 |
| | | WTD_360_P2_C | Interface | ✓ | | 142 |
| PZ-6 | 0+360 | WTD_360_P3_A | Bedrock | ✓ | | 132 |
| | | WTD_360_P3_B | Bedrock | ✓ | | 139 |
| | | WTD_360_P3_C | Interface | ✓ | | 142.8 |
| PZ-7 | 0+440 | WTD_440_P1_A | Bedrock | ✓ | | 137 |
| | | WTD_440_P1_B | Bedrock | ✓ | | 144 |
| | | WTD_440_P1_C | Interface | ✓ | | 139 |
| PZ-8 | 0+440 | WTD_440_P2_A | Bedrock | ✓ | | 137.19 |
| | | WTD_440_P2_B | Bedrock | ✓ | | 144.19 |
| | | WTD_440_P2_C | Interface | ✓ | Freezing | 149.19 |
| PZ-9 | 0+440 | WTD_440_P3_A | Bedrock | ✓ | | 136.35 |
| | | WTD_440_P3_B | Bedrock | ✓ | | 143.35 |
| | | WTD_440_P3_C | Interface | To investigate | | 148.35 |
| PZ-10 | 0+550 | WTD_550_P1_A | Bedrock | ✓ | | 141.15 |
| | | WTD_550_P1_B | Bedrock | ✓ | | 146.15 |
| | | WTD_550_P1_C | Interface | ✓ | | 149.85 |
| PZ-11 | 0+550 | WTD_550_P2_A | Bedrock | ✓ | | 141.30 |
| | | WTD_550_P2_B | Bedrock | ✓ | | 146.30 |
| | | WTD_550_P2_C | Interface | ✓ | | 149.80 |
| PZ-12 | 0+550 | WTD_550_P3_A | Bedrock | ✓ | | 141.32 |
| | | WTD_550_P3_B | Bedrock | Broken | | 146.32 |
| | | WTD_550_P3_C | Interface | ✓ | Near zero | 149.82 |
| PZ-13 | 0+710 | WTD_701_P1_A | Bedrock | ✓ | | 139.95 |
| | | WTD_701_P1_B | Bedrock | ✓ | | 144.95 |
| | | WTD_701_P1_C | Interface | ✓ | | 147.95 |
| PZ-14 | 0+710 | WTD_701_P2_A | Bedrock | ✓ | | 140.03 |
| | | WTD_701_P2_B | Bedrock | ✓ | | 145.03 |
| | | WTD_701_P2_C | Interface | ✓ | | 148.03 |
| | | WTD_701_P2_D | Fine Filter | ✓ | | 151.03 |
| PZ-15 | 0+710 | WTD_701_P3_A | Bedrock | ✓ | | 140.10 |
| | | WTD_701_P3_B | Bedrock | ✓ | | 145.10 |
| | | WTD_701_P3_C | Interface | ✓ | | 148.10 |
| | | WTD_701_P3_D | Fine Filter | ✓ | | 151.10 |
| Pz-DS | - | WTD_Pz_US | Water | ✓ | | 141.882 |
| Pz-US | - | WTD_Pz_US | Water | ✓ | | 146.856 |

| STA | DH-ID | New | Working beads | Reliable beads | Total beads | Top bead elevation | Bottom bead elevation |
|---|---|---|---|---|---|---|---|
| 0+110 | TH 0+110 | x | 14 | 14 | 16 | 156.4 | 141.4 |
| 0+142 | TH-1 | | 13 | 11 | 13 | 156.8 | 144.8 |
| 0+190 | TH-12 | | 12 | 10 | 13 | 157.4 | 140.4 |
| 0+210 | TH-2 | | 16 | 16 | 13 | 157.2 | 142.2 |
| 0+240 | TH 0+240 | x | 13 | 13 | 13 | 158.1 | 128.1 |
| 0+260 | TH-3 | | 13 | 11 | 13 | 157.0 | 127.0 |
| 0+276 | TH-LAKE | | 13 | 13 | 13 | 157.3 | 145.3 |
| 0+290 | TH-LAKE-US-290 | | 13 | 13 | 13 | 157.0 | 142.0 |
| 0+310 | TH-4 | | 13 | 13 | 13 | 157.0 | 127.0 |
| 0+336 | TH-US-0+336 | x | 13 | 13 | 13 | 156.4 | 142.4 |
| 0+360 | TH-5 | | 13 | 11 | 13 | 157.0 | 127.0 |
| 0+380 | TH 0+380 | x | 13 | 13 | 13 | 157.1 | 127.1 |
| 0+407 | TH-6 | | 13 | 9 | 13 | 157.0 | 127.0 |
| 0+425 | TH 0+425 | x | 13 | 13 | 13 | 158.6 | 128.6 |
| 0+453 | TH-7 | | 13 | 13 | 13 | 156.9 | 126.9 |
| 0+475 | TH 0+475_T | x | 13 | 13 | 13 | 161.0 | 146.0 |
| 0+500 | TH-500 | x | 16 | 15 | 16 | 157.1 | 142.1 |
| 0+520 | TH-8 | | 13 | 12 | 13 | 157.0 | 127.0 |
| 0+530 | TH-530 | | 13 | 13 | 13 | 159.0 | 147.0 |
| 0+550 | TH 0+550 | x | 13 | 13 | 13 | 158.0 | 128.0 |
| 0+580 | TH-580 | | 13 | 13 | 13 | 158.0 | 143.0 |
| 0+596 | TH 0+596 | x | 13 | 13 | 13 | 157.8 | 127.8 |
| 0+607 | TH-9 | | 13 | 10 | 13 | 157.0 | 127.0 |
| 0+635 | TH-635 | | 13 | 13 | 13 | 158.3 | 143.3 |
| 0+645 | TH 0+645 | x | 13 | 13 | 13 | 158.6 | 128.6 |
| 0+665 | TH-LAKE-US-665 | | 13 | 13 | 13 | 157.0 | 142.0 |
| 0+665 | TH-665 | | 13 | 13 | 13 | 158.3 | 143.3 |
| 0+675 | TH-10 | | 13 | 13 | 13 | 157.0 | 142.0 |
| 0+685 | TH-685 | | 13 | 13 | 13 | 157.5 | 145.5 |
| 0+695 | TH-695 | | 13 | 13 | 13 | 158.0 | 146.0 |
| 0+707.5 | TH-707.5 | | 13 | 13 | 13 | 158.0 | 143.0 |
| 0+710 | TH-13 | | 16 | 15 | 16 | 157.1 | 142.1 |
| 0+720 | TH-720 | | 13 | 13 | 13 | 157.0 | 145.0 |
| 0+740 | TH-740 | | 13 | 13 | 13 | 161.0 | 146.0 |
| 0+475 | TH-475 | | 13 | 13 | 13 | 159.0 | 147.0 |
| 0+750 | TH-14 | | 16 | 15 | 16 | 157.0 | 142.0 |
| 0+772 | TH-11 | | 13 | 0 | 13 | 157.0 | 142.0 |
| 0+790 | TH 0+790 | x | 16 | 16 | 16 | 157.2 | 142.2 |
| 0+618 | D/S East | | 9 | 9 | 16 | 152.0 | 137.0 |
| 0+340 | D/S West | | 16 | 16 | 16 | 148.6 | 134.6 |

**Table 20: List of Inclinometers on Whale Tail Dike (source: AEM)**

| STA | DH-ID | Working beads | Reliable beads | Total beads | Top bead elevation | Bottom bead elevation |
|---|---|---|---|---|---|---|
| 0+205 | INC_1 | 29 | 29 | 29 | 158.1 | 144.1 |
| 0+366 | INC_2 | 37 | 37 | 37 | 157.9 | 139.9 |
| 0+560 | INC_3 | 33 | 33 | 33 | 157.7 | 141.7 |
| 0+726 | INC_4 | 31 | 31 | 31 | 157.3 | 142.3 |

## 3.1 WRSF Dike

The construction of WRSF Dike occurred from January to February 2019 to maintain the frozen condition of the foundation. Thermistors TH-01 to 03 were installed in March 2019. Four (4) additional thermistors were installed in early October 2019 to monitor more precisely the temperature trends in WRSF Dike in order to study the seepage mechanism after water had been seeping through the dike since August 2019. Two (2) additional thermistors (Th-08 and TH-09) were installed in the constructed upstream thermal berm in 2020.

Table 21 below details instrumentation on WRSF Dike, with the exception of the newest instruments that were shortly installed at the time of the inspection (TH-08 and TH-09).

**Table 21: List of Thermistors on WRSF Dike (source: AEM)**

| Station | Instrument ID | Drawing Name | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|---|
| # | ID | | PZ/TH | Operational (✓) / Not operational (×)/Frozen (F) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in m (top/bottom) |
| 0+120 | WRSF-19-01 | TH-01 | TH | ✓ | Automatic (DL105) | | | 13/13 | 139/123 |
| 0+120 | WRSF-19-02 | TH-02 | TH | ✓ | Automatic (DL105) | | | 13/13 | 159/147 |
| 0+120 | WRSF-19-03 | TH-03 | TH | ✓ | Automatic (DL105) | | | 13/13 | 155/143 |
| 0+093 | WRSF-19-04 | TH-04 | TH | ✓ | Automatic (DL105) | | | 13/13 | 158/142 |
| 0+135 | WRSF-19-05 | TH-05 | TH | ✓ | Automatic (DL105) | | | 13/13 | 154/142 |
| 0+135 | WRSF-19-06 | TH-06 | TH | ✓ | Automatic (DL105) | | | 13/13 | 156/143 |
| 0+172 | WRSF-19-07 | TH-07 | TH | ✓ | Automatic (DL105) | | | 13/13 | 155/142 |

## 3.2 Mammoth Dike

The construction of Mammoth Dike occurred from February 2019 to March 2019 to maintain the frozen condition of the foundation.

There are three (3) thermistor strings installed within Mammoth Dike.

Table 22 below details instrumentation on Mammoth Dike.

**Table 22: List of Thermistors on Mammoth Dike (source: AEM)**

| Station | Instrument ID | Drawing Name | Type | Status | Readings | For PZ | | For TH | |
|---|---|---|---|---|---|---|---|---|---|
| # | ID | | PZ/TH | Operational (✓) / Not operational (×)/Frozen (F) | Manual/ Automatic | Elevation (m) | Stratigraphic unit | Number of operational beads | Elevation interval in m (top/bottom) |
| 0+143 | MD-19-01 | TH-01 | TH | ✓ | Automatic (DL106) | | | 13/13 | 139/123 |
| 0+143 | MD-19-02 | TH-02 | TH | ✓ | Automatic (DL106) | | | 13/13 | 155/143 |
| 0+143 | MD-19-03 | TH-03 | TH | ✓ | Automatic (DL106) | | | 13/13 | 154/142 |

## 3.3 IVR Dike

The construction of IVR Dike occurred from February 2021 to May 2021 to maintain the frozen condition of the foundation.

There are seven (7) thermistor strings installed within IVR Dike.

Table 23 below details instrumentation on IVR Dike.

**Table 23: List of Thermistors on IVR Dike (source: AEM)**

| DH-ID | STA | Instrument ID | Working Beads | Reliable Beads | Total Beads | Top Bead Elevation | Bottom Bead Elevation |
|---|---|---|---|---|---|---|---|
| liner | 0+180 | IVR-TH-01 | 16 | 16 | 16 | 164.5 | 159.5 |
| | 0+150 | IVR-TH-02 | 16 | 16 | 16 | 165 | 150 |
| | 0+150 | IVR-TH-03 | 16 | 16 | 16 | 165 | 150 |
| | 0+150 | IVR-TH-04 | 16 | 16 | 16 | 165 | 150 |
| horizontal in key trench | 0+145 to 0+220 | IVR-TH-05 | 13 | 13 | 13 | 159 | 159 |
| | 0+150 | IVR-TH-06 | 13 | 13 | 13 | 162 | 150 |
| | 0+150 | IVR-TH-07 | 13 | 13 | 13 | 162 | 150 |

GOLDER
MEMBER OF WSP

golder.com