APPENDIX B14 - INTERIM CLOSURE AND RECLAMATION PLAN, VERSION 2 (JAN.2014)

INTERIM CLOSURE AND RECLAMATION PLAN

January 7, 2014

MEADOWBANK GOLD PROJECT

Interim Closure and Reclamation Plan

Submitted to:
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Executive Summary

Agnico Eagle Mines Ltd. (AEM) has been operating the Meadowbank Gold Project (the Project) since 2008. This document presents the Interim Closure and Reclamation Plan (ICRP) for the Project. Planning for mine closure and reclamation is an iterative process where ICRPs are prepared and updated on a regular basis, when there is a significant change to the mine plan, or according to key milestones in the mine life (INAC 2007). This ICRP document is an update to the closure and reclamation plan for the development phase of the Project (AEM 2008) and the reclamation cost estimate prepared by Brodie (2008). The purpose of the ICRP is to:

- Comply with the department of Aboriginal Affairs and Northern Development Canada (formerly Indian and Northern Affairs Canada [INAC]) policy requirements and guidelines (INAC, 2002; INAC, 2007) for full cost of restoration (clean-up, modification, decommissioning, abandonment);
- Promote environmental stability of facilities and infrastructure and minimize maintenance and monitoring requirements at abandonment;
- Minimize potential impacts from contaminants;
- Ensure removal of all hazardous materials and waste;
- Address water license requirements (NWB 2008); and
- Document working goals, objectives and criteria for closure.

A summary of baseline environmental conditions is provided in Section 2.4. This includes descriptions for the regional and local study areas of:

- the atmospheric environment;
- physical components such as surficial and bedrock geology, permafrost, and hydrogeology and hydrology;
- chemical components such as soil, sediment and surface and ground water quality, and acid rock drainage and metal leaching potential;
- biological components such as vegetation habitat, aquatic biota and habitat and wildlife; and
- the social environment, including traditional land use and archaeological and cultural sites.

A description of each of the Project facilities is provided in Section 2.5. This includes:

- the Baker Lake Site Facilities, including the barge landing and Bulk Fuel Storage Facility;
- the All-Weather Private Access Road, that links Baker Lake to the mine site, and borrow pits;
- dikes and saddle dams constructed for the Project;
- open pits;
- Waste Rock Storage Facilities, for the Portage and Goose deposits and the Vault deposit;

- Tailings Storage Facilities;
- Water management facilities for the mine site, including contact and non-contact water diversions systems, the Reclaim Pond and Attenuation Pond;
- Infrastructure at the Mill and Service Areas, including the accommodations, service buildings, on-site roads, Airstrip and Emulsion Plant; and
- Waste management facilities, including the Landfills, Incinerator, Hazardous Material Storage Area, and Landfarm.

Objectives for mine closure have been developed by Environment Canada (EC 2009), and closure objectives and options by Aboriginal Affairs and Northern Development Canada (formerly Indian and Northern Affairs, INAC 2007). Specific objectives and closure activities for each of the Project facilities, and a description of any uncertainties for the closure activities, are provided in Section 3.3.

Progressive closure reflects actions that can be taken during mining operations to close and reclaim various mine components, either when operations in an area are complete or when supporting infrastructure is no longer needed. Progressive closure can reduce overall reclamation costs by incorporating closure activities in the mine plan, and enhances environmental protection by addressing concerns sooner and allowing more time for reclamation objectives and goals to be achieved. Progressive reclamation activities for the Project are planned for the open pits, Portage Waste Rock Storage Facility, Tailings Storage Facilities, water management infrastructure, and site infrastructure. As of January 2013, progressive reclamation activities at the Portage Waste Rock Storage Facility have commenced; 42% of the ultimate area has been covered with NPAG rock (AEM 2013a).

Permanent closure is defined as the final closure of the mine site after mining has ceased. Permanent closure is typically a planned event, the timing of which is dependent on the mine life of the project. The closure approach for the Project as well as specific closure activities at each Project facility is guided by the intended end land use of the area. Based on stakeholder and local community consultation to date, the intended end land use for project-affected areas is (a return to) the “natural” state. As such, closure activities are focused on decommissioning mine components so that they blend into the existing landscape to the extent possible. AEM will re-contour and grade the general mine area, including roads, to promote proper drainage of surface runoff and to provide a ground profile consistent with the surroundings. The Tailings Storage Facilities and Portage Waste Rock Storage Facility will be capped and re-contoured with a layer of non-potentially acid generating (NPAG) rock to encapsulate the tailings and waste rock in permafrost and promote natural surface drainage to Third Portage Lake. Reclamation efforts will focus on providing conditions conducive to natural re-colonization of the site by the surrounding native vegetation. Large-scale re-vegetation of the site is not considered feasible at this time as there is no readily-available seed material for native plants. In addition, there is a lack of available organic soils in the Project area which, in conjunction with the tough climatic conditions (short cold and dry growing seasons), makes it difficult to establish vegetation over large areas. The open pit areas will also be returned to a “natural” state by flooding and re-creating open water areas. This is consistent with the pre-development landscape in the mine area.

Monitoring activities are conducted in the closure and post closure phases of the Project to “ensure that closure activities and any associated environmental effects are consistent with those predicted in the closure plan and to ensure that the objectives of mine closure are being met" (EC 2009). The closure phase for the Project will commence after mining operations have ceased in 2018. The closure period includes reclamation activities over a two to three-year period, as well as the extended period associated with pit flooding and stabilization of water levels and water quality. Monitoring will be conducted over the closure period to evaluate stability of mine components, thermal conditions of capping layers, and water quality across the site and in the receiving environment. It is anticipated that this closure phase will last approximately 10 years (to 2028), after which the dikes will be breached allowing mixing of pit and lake water, and the Project will enter the post-closure phase. Environmental monitoring will continue at a reduced frequency for approximately 5 additional years to ensure that closure objectives continue to be met. Assuming acceptable conditions can be demonstrated, AEM will then apply to regulators to terminate the post-closure program. The planned closure and post-closure monitoring activities associated with each of the Project Facilities are provided in Section 3.6. Details related to the Project closure schedule are provided in Section 3.7.

A financial security cost estimate of the closure and reclamation activities for the Project, based on the current end of mine life configuration, has been prepared using the RECLAIM template (Version 6.1, March 2009); details of this estimate are provided in Section 4.0. The cost estimate has been developed assuming third party contractor rates, on the basis that AEM is unable to fulfill its closure and reclamation obligations, and the government is required to take over reclamation of the Meadowbank Gold Project.

Temporary closure is defined as the cessation of mining and processing operations for a finite period with the intent to resume mining activities as soon as possible after the cause for the temporary closure has been resolved. Temporary closure may last for a period of a few weeks (short-term) to several years (long term), based on economic, environmental and/or social factors (INAC 2007). The objectives of temporary closure activities are to protect humans, wildlife and the environment, and maintain regulatory compliance until mining operations can resume. All facilities and personnel necessary to achieve the temporary closure objectives must be maintained operational. Temporary closure activities specific to each of the Project facilities are presented in Section 5.3.

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1.0 INTRODUCTION

Agnico Eagle Mines Ltd. (AEM) has been operating the Meadowbank Gold Project (the Project) since 2008; the Project is located approximately 70 km north of the Hamlet of Baker Lake, Nunavut as shown in Figure 1.1. The Project is subject to the terms and conditions of the Nunavut Impact Review Board (NIRB) Project Certificate (No. 004) issued in accordance with the Nunavut Land Claims Agreement Article 12.5.12 on December 30, 2006 (NIRB 2006), and Nunavut Water Board Water License No. 2AM_MEA0815 issued June 9, 2008 (NWB 2008). This document presents an Interim Closure and Reclamation Plan (ICRP) for the Project and forms a component of the documentation series produced in accordance with the above.

The Project is an open pit gold mine located on Inuit-owned land in the Kivalliq region of Nunavut. The total mineral reserve for the Project was originally estimated at 3.5 million ounces of gold. The mine is expected to produce an average of 360,000 ounces of gold per year from 2013 to 2015, with a mine life through the beginning of 2018.

The ore will be extracted from the Portage, Goose and Vault deposits during the operational lifespan of the mine. The Portage and Goose open pits are located near the mine plant and camp. The Vault pit is approximately 8 km to the north from the mine plant and camp. Water retention dikes were constructed from mined rock to allow for the mining of ore beneath shallow lakes. Tailings and waste rock are placed in separate storage facilities. Figure 1.2 provides the general layout of the Project mine site. Upon conclusion of mining, AEM will fully decommission the mine site and all other Project related infrastructure, namely the Baker Lake Marshalling Facility (Figure 1.3) and All Weather Private Access Road (Figure 1.4a to c).

The design goals for the Project include minimizing the area of surface disturbance, stabilizing disturbed land surfaces against erosion, and returning the land to suitable conditions for post-mining uses such as traditional pursuits and wildlife habitat. Successful completion of the Closure and Reclamation Plan involves both physical components (open pits, buildings, infrastructure, and waste storage facilities) and chemical components (non-contact and contact waters, potential spills of contaminated water, tailings, and hazardous materials). Upon conclusion of activities, AEM will fully decommission the mine site and related infrastructure, by removing the mill and ancillary buildings, by removing or disabling access roads (i.e. including the All Weather Private Access Road) and by re-contouring disturbed areas.

The closure and reclamation process will provide flexibility based on adaptive management methods and will be progressively modified in accordance with the results of ongoing monitoring and assessment during mine operations. The level of detail and strategy outlined in this ICRP reflect the current and planned development for the Project. This ICRP incorporates the following:

- A plan for temporary closure if, for some unforeseen reason, the Project was halted with the intent of resuming mining activities at a later date; and
- A plan for permanent closure following conclusion of mining activities.

1.1 Interim Closure and Reclamation Plan Objectives

Planning for mine closure and reclamation is an iterative process where ICRPs are prepared and updated on a regular basis, when there is a significant change to the mine plan, or according to key milestones in the mine life (INAC 2007).

This ICRP document is an update to the closure and reclamation plan for the development phase of the Project (AEM 2008). It provides conceptual details on the reclamation of mine components that will be closed near the end of mining operations, and operational detail for components which are to be progressively reclaimed earlier in the mine life. This document does not include detailed engineering closure designs, or specific post-closure monitoring programs as these will be developed in the future. However, a view of the current closure concepts for each area of the mine site and the plans to advance these designs is provided.

This ICRP document does not include fisheries no-net-loss compensation activities. Independent closure plans and cost estimates for these activities are provided in the following documents:

- 'Agnico Eagle Mines: Meadowbank Division No-Net-Loss Plan', October, 2012, and
- 'Agnico Eagle Meadowbank Mine Draft No Net Loss Plan, Implementation Cost Estimate and Construction Schedule', May 2013.

This ICRP uses currently accepted management practices and appropriate mine closure techniques to comply with accepted protocols and standards. This plan has been prepared based on project design and operation, and provides details on strategies to minimize the area of surface disturbance, stabilize disturbed land surfaces and permafrost against erosion and degradation, and return the land to post-mining uses for traditional pursuits (MMC 2007a). The purpose of the ICRP is to:

- Comply with the department of Aboriginal Affairs and Northern Development Canada (formerly Indian and Northern Affairs Canada [INAC]) policy requirements and guidelines (INAC, 2002; INAC, 2007) for full cost of restoration (clean-up, modification, decommissioning, abandonment);
- Promote environmental stability of facilities and infrastructure and minimize maintenance and monitoring requirements at abandonment;
- Minimize potential impacts from contaminants;
- Ensure removal of all hazardous materials and waste;
- Address water license requirements (NWB 2008); and
- Document working goals, objectives and criteria for closure.

The final closure and reclamation plan for the Project will build on this ICRP and will be developed in conjunction with an up to date mine plan so that considerations for site closure can be incorporated into the mine design. Monitoring will be carried out during all stages of the mine life to demonstrate the safe performance of the mine facilities. If any non-compliant conditions are identified, then maintenance and planning for corrective measures will be completed in a timely manner to ensure successful completion of the Reclamation and Closure Plan.

1.2 Approach to the Development of the Interim Closure and Reclamation Plan

AEM is committed to responsible mining practices for the protection of human, wildlife and aquatic life health, and for minimizing impacts on the environment. AEM intends to leave behind a positive community and environmental legacy. This commitment is in agreement with the broad objectives listed in the INAC (2007) guidelines for mine closure:

- Physical stability: The components of the reclaimed site should be built or modified at closure so that they do not erode, subside or move under extreme design events, and therefore do not pose a threat to humans, wildlife, or environmental health and safety;
- Chemical stability: The components of the reclaimed site should be chemically stable so as to prevent adverse soil, water and air quality effects that might pose a risk to humans, wildlife or environmental health and safety; and
- Future use and aesthetics: The reclaimed site should be compatible with the surrounding lands at the completion of the reclamation activities.

These broad objectives were used to support the identification of closure objectives that are specific to the Project. These specific objectives are presented in Table 1.1.

Table 1.1: Closure Objectives for Meadowbank Gold Project

Objective #	Description
1.	Physically and chemically stable lands and waters at the reclaimed Meadowbank sites that are safe for human, wildlife and aquatic life
2.	Lands and waters at the reclaimed Meadowbank sites that allow for traditional uses
3.	Final landscape guided by pre-development conditions and traditional knowledge
4.	Post closure conditions that, where appropriate, do not require a continuous presence of project staff until a walk-away condition is achieved.

1.3 Closure and Reclamation Planning Team

AEM is in the process of developing a closure and reclamation planning team, as recommended in the INAC (2007) guidelines. The team will review interim and final closure and reclamation plans and communicate its content to all departments of the Project. The communication effort is intended to provide a sufficient level of awareness among operations staff as to the importance of closure and reclamation activities on Project development. The proposed team members are comprised of Engineering and Environment Department staff members.

External support for the development of the plan is currently provided by Golder Associates Ltd. (Golder), although other consultants and contractors may be involved in the preparation of the final plan.

1.4 Definition of Terms

A glossary of commonly used terms in the ICRP is included in Appendix A. A list of acronyms and abbreviation is provided in Appendix B.

1.5 Approach to Inclusion of Long-Term Community Values

AEM is committed to the sustainable development of the Kivalliq region and will strive to maximize the benefits of the Project for all parties involved while minimizing or eliminating any negative impacts or long-term influences on the environment and local communities. AEM has made it a priority to keep the community informed of the Project advancements or setbacks, and to create constructive dialogue between all parties. Consequently, numerous mine elements have been planned based on community input. This practice of information sharing will continue through all phases of mine development, including the development of the closure and reclamation plan, and will provide a framework for addressing future opportunities and concerns.

AEM is committed to the following:

- Supporting the local community for procuring resources and personnel wherever possible.
- Maintaining open lines of communication between all parties involved. Extensive traditional knowledge has been gained and community input has been solicited through meetings, personal interviews, site visits, discussions with local heritage associations, and traditional knowledge-based land use maps.
- Understanding and integrating the Project within a context of ecosystem integrity, social health, and economic stability. AEM's objective is to minimize disturbance to the local environment during operations, and leave the site in as natural a state as possible after closure. Post-closure monitoring will be a key component in ensuring this objective is realized.

1.6 Approach to Inclusion and Management of Information

All available information and data required for the development and/or implementation of closure and reclamation measures will be compiled and incorporated in the ICRP at the time of its production. Any additional information and data produced following the completion of the ICRP will be incorporated into the final closure and reclamation plan.

2.0 PROJECT DESCRIPTION

2.1 History of the Project

The mine site of the Project is located in the Kivalliq region, Nunavut, approximately 70 km north of the Hamlet of Baker Lake, as shown in Figure 1.1. Mineral tenure covers 28,888 hectares and includes ten grandfathered Federal mining leases and three exploration concessions acquired from Nunavut Tunngavik Incorporated. The first gold discovery at the mine site occurred in 1987.

The exploration phase of the Project began in 1995, after Cumberland Resources Ltd. (Cumberland) purchased a 60% interest in the Project from Asamera Minerals and formed a joint venture with Comaplex Minerals. Cumberland acquired the 40% interest held by Comaplex Minerals in 1997 and hence became the sole owner of the Project. Cumberland later formed a subsidiary: Meadowbank Mining Corporation (MMC). The current Project proponent, Agnico Eagle Mines Ltd. (AEM), purchased Cumberland and its subsidiary in 2007.

Pre-feasibility engineering and environmental baseline studies, as well as community consultations, have paralleled the exploration programs. The Project was advanced to the feasibility phase in 2003, and the final environmental impact assessment was submitted to NIRB in 2005. A certificate for the development of the Project was granted by NIRB in 2006. As part of the implementation of the Project, permits and licenses were also obtained from the Nunavut Water Board (NWB), the Kivalliq Inuit Association (KIA), the Government of Nunavut (GN), Aboriginal Affairs and Northern Development Canada (AANDC; formerly INAC) and Fisheries and Oceans Canada (DFO).

The Project components consist of the mine site (Figure 1.2), the Baker Lake Site Facilities (Figure 1.3) and the All Weather Private Access Road (AWPAR, Figure 1.4a to c) linking Baker Lake to the mine site. Construction of the AWPAR was initiated in 2007 and completed in 2008. The development of the Project has required periodic construction activities since the exploration phase (i.e., South and North Camps and airstrip). Construction activities at the mine site and the Baker Lake Site Facilities, for the purpose of mining operations, began in 2008. Mining was initiated in 2009; operations at the mine process plant started in early 2010. Photos of the mine site at the start of the Project and current status are provided in Appendix C.

A closure and reclamation plan (AEM, 2008a) was developed before the start of mining operation and represented an updated compilation of the following components:

- Meadowbank Gold Project, Reclamation Cost Estimate (Brodie 2008);
- Abandonment and Restoration Plan, Agnico-Eagle Meadowbank Project, Baker Lake Facilities, License 8BC-MEA0709, October 24, 2007 (AEM 2007a);
- INAC Lease 66A/8-71-2 & 66A/8-72-2, Updated Closure and Reclamation Plan for the Tehek Lake All Weather Private Access Road, Baker Lake – Meadowbank, December 17, 2007 (AEM 2007b); and
- Meadowbank Gold Project, Preliminary Closure and Reclamation Plan, August, 2007 (MMC 2007a).

2.2 Mine Plan

Mining occurs as a truck-and-shovel open pit operation. The anticipated configuration of the mine site at the end of active mining operations (the beginning of 2018) is illustrated in Figure 1.2. The mine plan incorporated the construction of the following dikes:

- The East, West Channel (no longer in use – part of construction phase), Bay-Goose, South Camp and Vault dikes to isolate the mining activities from the surrounding lakes; and
- The Central and Stormwater dikes and Saddle Dams 1 to 5 to contain tailings.
- Dewatering allows mining activities in the pit and deposition of tailings. Specific areas that were dewatered include:
  - The northwest arm of Second Portage Lake (2PL) which followed completion of the East and West Channel dikes;
  - The Goose pit area in Third Portage Lake (3PL) which followed completion of the Bay-Goose and South Camp dikes; and
  - Vault Lake which followed completion of the Vault Dike.

The gold-bearing deposits are being mined from:

- The Portage pit, which extends approximately 2 km in a north-south direction across 2PL and into 3PL;
- The Goose pit, which is located 1 km to the south of Portage pit, in 3PL; and
- The Vault pit, which is located adjacent to and in Vault Lake, approximately 8 km north from Portage pit.

Based on AEM's 2013 Life of Mine calculations, approximately 29.5 Mt of ore will be mined from these pits over a period of nine years. Approximately 193 Mt of mine waste rock and till will also be generated (AEM 2013a). Table 2.1 summarizes the amount of ore and waste rock that has been mined from the pits from 2009 to 2012. Table 2.2 summarizes the amount of ore, till and waste rock that will be mined from the pits from 2013 to the end of mine life (the beginning of 2018). The waste rock is in large part deposited at the Portage (64.6 Mt) and Vault (64.7 Mt) Waste Rock Storage Facilities, with a total tonnage of 12.4 Mt planned as backfill in the Portage pit from 2013 to 2015. Waste rock that is not potentially acid generating was or will be used for construction activities (33.5 Mt) and capping of the Tailings Storage Facilities and Portage Waste Rock Storage Facility at closure (17.5Mt) (AEM 2013a).

Table 2.1. Meadowbank Mined Tonnages for 2009 to 2012

Year		2009	2010	2011	2012	Total
Portage/ Goose/ Vault Pits	Ore (Mt)	0.5	2.2	3.3	3.2	9.3
	Total Waste Rock (Mt) [(a)]	6.1	13.3	21.0	31.5	72.0

Note: (a) Total Waste Rock includes rock used for construction purposes (roads, dykes, etc.) and overburden stripping.
Source: AEM 2013a

Table 2.2. Projected Meadowbank Mined Tonnages for 2013 to 2018

Year		2013	2014	2015	2016	2017	2018	Total
Portage Pit	Total Waste Rock (Mt)	21.1	12.4	7.0	1.1	-	-	41.6
	NPAG (Mt)	7.4	6.4	4.2	0.5	-	-	18.5
	PAG (Mt)	13.7	6.0	2.8	0.6	-	-	23.1
	Till (Mt)	0.3	-	-	-	-	-	0.3
	Ore (Mt)	2.4	1.7	1.9	0.8	-	-	6.7
Goose Pit	Total Waste Rock (Mt)	10.7	3.5	0.3	-	-	-	14.6
	NPAG (Mt)	7.2	2.4	<0.1	-	-	-	9.7
	PAG (Mt)	3.5	1.1	0.2	-	-	-	4.9
	Till (Mt)	<0.1	-	-	-	-	-	<0.1
	Ore (Mt)	0.9	1.1	0.3	-	-	-	2.3
Vault Pit	Total Waste Rock (Mt)	0	11.8	21.3	20.4	8.0	0.3	61.8
	NPAG (Mt)	0	11.2	20.2	19.4	7.6	0.3	58.7
	PAG (Mt)	0	0.6	1.1	1.0	0.4	<0.1	3.1
	Till (Mt)	0	1.9	0.2	-	0.4	-	2.7
	Ore (Mt)	<0.1	1.5	2.9	4.0	2.5	0.2	11.2

Source: AEM 2013a

AEM has completed an assessment of the quantities and schedule of availability of non-Potentially Acid Generating (NPAG) rock suitable for closure activities, in particular the cover over the Portage Waste Rock Storage Facility (WRSF) and Tailings Storage Facilities (TSF). Table 2.3 summarizes the planned destination of NPAG waste rock mined from the Portage and Goose Pits, as per the *Updated Mine Waste Rock and Tailings Management Plan* (AEM 2013a). Material will be used for progressive closure activities or will be stockpiled at suitable locations to facilitate future placement.

Table 2.3. Portage & Goose NPAG Destinations & Tonnage, 2013 - 2018

Year	2013	2014	2015	2016	2017	2018	Total
Capping Portage Waste Rock Storage Facility	2,469,647	1,191,050	-	-	-	-	3,660,697
	8.8%	4.2%	-	-	-	-	13.0%
Central Dike	-	-	1,379,177	263,314	-	-	1,642,491
	-	-	4.9%	0.9%	-	-	5.8%
Capping TSF (North cell)	-	-	2,599,778	-	-	-	2,599,778
	-	-	9.2%	-	-	-	9.2%
Roads Maintenance	217,196	176,751	138,075	143,626	-	-	675,649
	0.8%	0.6%	0.5%	0.5%	-	-	2.4%
Airstrip Extension	163,413	-	-	-	-	-	163,413
	0.6%	-	-	-	-	-	0.6%
Saddle Dams	-	420,481	62,276	71,813	-	-	554,570
	-	1.5%	0.2%	0.3%	-	-	2.0%
Thermal Capping on Goose	357,390	-	-	-	-	-	357,390

Year	2013	2014	2015	2016	2017	2018	Total
Dike	1.3%	-	-	-	-	-	1.3%
Capping Primary Crusher Ramp	-	626,357	-	-	-	-	626,357
	-	2.2%	-	-	-	-	2.2%
NPAG Stockpile for Mine Closure Requirement[(a)]	12,145,021	5,770,434	-	-	-	-	17,915,455[(b)]
	43.1%	20.5%	-	-	-	-	63.5%
All Portage & Goose NPAG Destination	15,352,668	8,185,072	4,179,306	478,753	-	-	28,195,799
	54.5%	29.0%	14.8%	1.7%	-	-	100%

Notes:

(a) NPAG Stockpile for Mine Closure Requirements will be used for: *Capping TSF (South cell), Roads Maintenance, Saddle Dams and Capping Marginal Stockpile*.

(b) Not including 2012 NAG inventory of 2,810,338 tons.

Source: AEM 2013a

Mining activities will also generate approximately 29.5 Mt of tailings, which is estimated to result in a total volume of 23.2 Mm^3, assuming that 20% of that volume is trapped in ice (AEM 2013a). Tailings are or will be deposited in the North and South cells of the Tailings Storage Facilities, which is located in the north arm of 2PL (Figure 1.2). At closure the pits will be filled with water and the dikes would be breached to join adjacent lakes, the Tailings Storage Facilities and Portage Waste Rock Storage Facility covered, and site infrastructure removed (further details are provided in Section 3 below). The configuration of the mine site at post-closure is illustrated in Figure 2.1.

2.3 Permits and Authorizations

The overall approach to the development of this ICRP builds on lessons learned from selected aspects of closure and reclamation planning completed for other mining projects in northern Canada (see DDMI 2009 as an example).

The ICRP follows applicable regulatory guidelines, the principles of which are described in:

- Mine Site Reclamation Guidelines for the Northwest Territories (INAC 2007); and
- Mine Site Reclamation Policy for Nunavut (INAC 2002).

The Project is subject to the Federal and Territorial Acts and Regulations listed in Table 2.4. A summary of related authorizations (i.e., certificates, permits and licenses) granted for the Project is provided in Table 2.5.

Table 2.4. Relevant Federal and Territorial Acts and Regulations

Federal Acts and Regulations	Territorial Acts and Regulations
Arctic Waters Pollution Prevention Act and Regulations *Canadian Environmental Act* and Regulations *Fisheries Act* and Regulations *Navigable Waters Protection Act* and Regulations	*Nunavut Environmental Protection Act* and Regulations *Nunavut Transportation of Dangerous Goods Act* and Regulations

Federal Acts and Regulations	Territorial Acts and Regulations
Nunavut Land Claims Agreement and Regulations *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and Regulations *Territorial Lands Act* and Regulations	*Nunavut Mine Health and Safety Act* and Regulations

Table 2.5. List of Authorizations for the Project

Authorization	Issuing Authority	Note
Project Certificate NIRB-004	Nunavut Impact Review Board	Approval for the Meadowbank Project to proceed subject to its Terms & Conditions
Type A Water License 2AM-MEA0815 (2 Modifications to license and 1 Amendment) [(a)]	Nunavut Water Board	Approval for 700,000 m^3 of water annually - milling, mining and associated activities at the Meadowbank Project site
Subsurface Production Lease BL 14-001-PL Vault	Nunavut Tunngavik Inc.	Mining of Vault Pit
Production Lease KVPL08D280 (Amendment 1 and 2)	Kivalliq Inuit Association	Construction, operation and closure of the mine on Inuit owned land
Mine Water Compensation Agreement	Kivalliq Inuit Association	Compensation for water consumption at Meadowbank site and any changes in water quality, quantity or flow due to project activities
Road Water Compensation Agreement (Amendment 1)	Kivalliq Inuit Association	Compensation where development and operation of the AWPAR has substantial effect on water quality, quantity or flow
Right of Way KVRW06F04 (Amendment 1) for AWPAR	Kivalliq Inuit Association	Right of Way for the All Weather Private Access Road
Quarry Permit KVCA06Q11 for AWPAR	Kivalliq Inuit Association	Quarrying for the All Weather Private Access Road, for a total of 254,546 m^3 of material
Inuit Impact Benefit Agreement	Kivalliq Inuit Association	Benefit Agreement
Land Lease 66A/8-71-2	Aboriginal Affairs and Northern Development Canada	All Weather Private Access Road construction, operation, maintenance and reclamation
Land Lease 66A/8-72-2	Aboriginal Affairs and Northern Development Canada	Quarrying for the All Weather Private Access Road
Land Lease L-51260	Government of Nunavut	Baker Lake Marshaling Area
Land Lease L-51261	Government of Nunavut	Baker Lake Spud Barge
Land Lease L-51262	Government of Nunavut	AWPAR
Development Partnership Agreement	Government of Nunavut	Operation of Mine, Baker Lake Marshaling Facility and AWPAR
Scientific Research License	Nunavut Research Institute	Wind Data Collection

Authorization	Issuing Authority	Note
HADD Authorization NU-03-0191-03 for Portage and Bay Goose Pits	Department of Fisheries and Oceans Canada	Fish habitat alteration and destruction permit for Second Portage and Third Portage Lakes
HADD Authorization NU-03-0191-04 for Vault Pit	Department of Fisheries and Oceans Canada	Fish habitat alteration and destruction permit for Vault Lake
HADD Authorization NU-10-0049 for Vault Crossing	Department of Fisheries and Oceans Canada	Vault haul road culvert crossing
MMER Schedule 2 for Tailings Impoundment Area	Department of Fisheries and Oceans Canada	Allows for the deposition of tailings in Second Portage Lake

Note: (a) AEM is currently negotiating an amendment to increase the annual volume of water

AEM was granted a Type A Water License in June, 2008 (NWB 2008). This license authorizes AEM to use water and dispose of waste associated with the mining and milling undertakings at the Project mine site. The license sets out several conditions with respect to AEM's right to alter, divert or otherwise use water for the purpose of mining. Specifically, in Part J, the license stipulates the conditions applying to abandonment, reclamation and closure. A summary of the specific requirements listed within the water license for the ICRP are provided in Appendix D. The development of a closure and reclamation plan is also a requirement of the NIRB Project Certificate (NIRB 2006).

2.4 Environmental Baseline Conditions

The Project is situated in the tundra region of the central sub-Arctic (the Barren lands), at the lower end of the Northern Arctic Ecozone. Furthermore, the Project is within an area of continuous permafrost, in the Wager Bay Plateau Ecoregion. The landscape consists of rolling hills and relief with a low growing vegetative cover and poor soil development. Numerous lakes are interspersed among boulder fields, eskers and bedrock outcrops, forming complex drainages.

Second Portage (2PL), Third Portage (3PL), Tehek, Turn, Vault, Wally and Drill Trail lakes are the main water bodies in the Project mine site area. These lakes are ultra-oligotrophic (i.e., small drainage areas, very nutrient poor and unproductive) lakes and are situated on the watershed boundary that separates the Arctic and Hudson Bay drainages. This watershed divide is only a few hundred meters to the north of Second and Third Portage lakes. Falls on the Quoich River, about 50 km upstream from Chesterfield Inlet constitute an impassable barrier to upstream fish movement.

Overall, the Project is developed to have a negligible impact on the existing environment in a regional context, and a low to moderate impact on a local or site-specific context. The majority of the Project impacts on the environment will be mitigated through effective project design, management and monitoring programs, and the closure and reclamation plan.

Further details on the baseline environmental settings are provided in this section, divided according to the atmospheric, physical, chemical, biological and social environments. The settings presented herein constitute a summary of information compiled predominantly from the following reports:

- Final Environmental Impact Statement (Cumberland 2005a);

- Baseline Physical Ecosystem (Cumberland 2005b);
- Air Quality Impact Assessment (Cumberland 2005c);
- Baseline Kinetic Test Report (Cumberland 2005d);
- Baseline Terrestrial Ecosystem (Cumberland 2005e);
- Baseline Aquatic Ecosystem (Cumberland 2005f);
- Baseline Traditional Knowledge (Cumberland, 2005g); and
- Baseline Archaeology Report (Cumberland, 2005h).

2.4.1 Atmospheric Environment

2.4.1.1 Climate

The Project is located within a low Arctic eco-climate described as one of the coldest and driest regions of Canada. Climate data has been collected at the Environment Canada meteorological station at Baker Lake, near the Baker Lake Marshaling Facilities, since 1949.

Estimated average monthly climate characteristics for the Project mine site are provided in Table 2.6. Winter conditions occur from October through May, with temperatures ranging from -35.5ºC to -3.1ºC. Summer temperatures (i.e., June to September) range from 0ºC to +16.8ºC.

Table 2.6. Estimated Average Monthly Climate Data – Meadowbank Site

Month	Max. Air Temp. (ºC)	Min. Air Temp. (ºC)	Rainfall (mm)	Snowfall (mm)	Total Precip. (mm)	Lake Evap. (mm)	Min. Relative Humidity (%)	Max. Relative Humidity (%)	Wind Speed (km/h)	Soil Temp. (ºC)
January	-29.1	-35.5	0	6.9	6.9	0	67.1	75.9	16.3	-25.5
February	-27.8	-35.2	0	6	6.1	0	66.6	76.5	16	-28.1
March	-22.3	-30.5	0	9.2	9.2	0	68.4	81.4	16.9	-24.9
April	-13.3	-22.5	0.4	13.6	14	0	71.3	90.1	17.3	-18.1
May	-3.1	-9.9	5.2	7.7	12.8	0	75.7	97.2	18.9	-8
June	7.6	0	18.6	3.1	21.7	8.8	62.6	97.2	16.4	2
July	16.8	7.2	38.6	0	38.6	99.2	47.5	94.3	15.1	10.5
August	13.3	6.4	42.8	0.6	43.4	100.4	59.2	97.7	18.4	9.3
September	5.7	0.9	35.2	6.7	41.9	39.5	70.8	98.6	19.3	3.6
October	-5	-10.6	6.5	22.6	29.1	0.1	83.1	97.4	21.4	-2.8
November	-14.8	-22	0.2	16.2	16.4	0	80.6	91.1	17.9	-11.7
December	-23.3	-29.9	0	9.4	9.5	0	73.3	82.7	17.7	-19.9

Note: Data from Baker Lake A station is available from 1946 to 2011. During this period, the data quality is good, with the exception of years 1946 to 1949, and 1993 which were removed from the compilation.

Source: AEM 2013a

The long-term mean annual air temperature for the mine site is estimated to be approximately -11.1ºC. Air temperatures at the mine site are on average about 0.6ºC cooler than those at Baker Lake and extreme temperatures tend to be larger in magnitude. This climatic difference is thought to be the effect of a moderating maritime influence at Baker Lake.

The prevailing winds at Meadowbank for both the winter and summer months are from the northwest. A maximum daily wind gust of 93 km/h was recorded on September 1, 2009. Light to moderate snowfall is accompanied by variable winds up to 70 km/h, creating large, deep drifts and occasional whiteout conditions. Skies tend to be more overcast in winter than in summer.

Monthly rainfall, snowfall, and total precipitation values are shown in Table 2.6. August is the wettest month, with a total precipitation of 43.4 mm, and February is the driest month, with a total precipitation of 6.1 mm. During an average year the total precipitation is 249.6 mm, split between 147.5 mm of rainfall and 102.1 mm of snowfall precipitation.

Closure and reclamation planning must consider the potential impact of global warming on site conditions. BGC (2003) suggests that global average temperature may increase by about 2°C by 2100 due to global warming. However, this increase may be for sites located at 50°N, and could be 3.5 times greater for sites located at 80°N. These estimates suggest that the average annual temperature for the Project areas, located at around 65°N, may increase by approximately 5.5°C by 2100. A recent study from Intergovernmental Panel on Climate Change (IPCC 2007) suggests that the maximum average air temperature is projected to increase by 6.4°C by 2100 for sites located at 65°N latitude.

By the middle of the 21st century, the effect of temperature change is predicted to reduce near-surface permafrost by 12% to 15% once equilibrium conditions become established under the new temperatures. The predicted increase of 15% to 30% in active layer thickness will reach equilibrium relatively much faster.

Studies have indicated that the boundaries of discontinuous and continuous permafrost are expected to move northward due to global warming (Woo *et al.* 1992). Appendix E1 shows the permafrost map of Canada. Predictions based on a warming of 4°C to 5°C over the next 50 years (NRC 2004), which approximately double the rate described above from BGC (2003) and IPCC (2007), suggest that the Project areas would remain within the zone of continuous permafrost under this scenario. The active layer thickness would be expected to increase, while the total thickness of permafrost may slowly reduce in time. However, these changes are not anticipated to compromise the planned permafrost encapsulation strategies for the rock storage and tailings facilities.

2.4.1.2 Air Quality

The primary sources for air quality emissions for the Project are:

- Diesel fuel combustion emissions from the power plant and vehicles; and
- Fugitive dust emissions from tailings and waste rock disposal, process operations (including ore hauling), and road travel.

A limited number of diesel fuel point emission sources are present at the mine site. The most significant source is the diesel power plant exhaust stacks. Six diesel generators, with two on stand-by/service mode, supply the Project's maximum electrical demand, which is estimated at 15.5 MW. There are also three temporary electrical generation power sets; two at the mine site, and one at the Vault site.

Other potential sources of emissions are the milling and materials handling operations, although no Particulate Matter (PM) is anticipated from these wet streams. Potential dry PM emission sources include the truck dump bin vent, primary crushing, ore stockpile, pebble crushing plant, and furnace. Plant design includes the installation of dust control equipment that will control emissions of PM to the ambient air for all these sources.

Fugitive dust emissions from the Tailings Storage Facilities and waste rock storage facilities is caused by three distinct activities: equipment traffic in the storage areas, waste aggregate unloading (handling), and wind erosion of pile surfaces and ground areas around open rubble piles. Fugitive dust from the coarse ore stockpile will comprise emissions from the conveyor ore drop at the top of the pile and wind erosion. However, road travel is anticipated to be the largest contributor of dust emissions at the mine site, caused by entrainment in vehicle wheels and the wake created by moving vehicles.

In 2012 a dust and air quality monitoring program was conducted at the mine site to measure dustfall, Total Suspended Particulates (TSP), PM10, PM2.5 and Nitrogen Dioxide (NO2), as per the NIRB Project Certificate. No other gaseous pollutants were monitored because of low concentrations predicted in pre-construction dispersion modeling (Cumberland 2005c). Four locations were established around the mine site in 2011 in consultation with Environment Canada.

Measured parameters were compared to Government of Nunavut (GN) Environmental Standards for Ambient Air Quality (October 2011), where applicable (TSP, PM2.5, NO_2). Results indicated that the GN standards were not exceeded for the applicable measured parameters at any time point or monitoring location in 2012 (AEM 2013b).

Dustfall results were compared to the Alberta Environment Department's recreational area dustfall guideline for context (no GN guidelines are available). This guideline was exceeded at least once at all stations prior to May 2012. However, the guideline was not exceeded at any site beginning in June 2012, which coincided with increased dust suppression efforts on the roads with calcium chloride (AEM 2013b).

AEM is required by the Greenhouse Gas Emissions Reporting Program to track greenhouse gas emissions based on annual fuel consumption, composition and the US EPA's AP-42 emission factors. Statistics on greenhouse gas (GHG) emissions in Canada for the year 2000 estimated an annual production of 726,000,000 tonnes (EC 2001). In comparison, the Project's GHG emissions were calculated at 202,201 tonnes carbon dioxide equivalent in 2012 (AEM 2013b). This corresponds to approximately 0.027% of Canada's total emissions. As a result, the potential impact of air disturbance from the Project on plants and wildlife is considered to be low (Cumberland 2005a). Additionally, AEM is implementing a fuel reduction management plan to lower its fuel consumption rates, and consequently, reduce its GHG emissions.

2.4.2 Physical Environment

2.4.2.1 Topography and Watersheds

The landscape in the region and immediate vicinity of the Project consists of rolling hills and relief with low growing vegetative cover and poor soil development. Numerous lakes are interspersed among boulder fields, eskers and bedrock outcrops, forming complex drainages. The Project mine site is located close to the surface water divide between the Back River basin, which flows north to northeast towards the Arctic Ocean, and the Quoich River basin, which flows east to southeast into Chesterfield Inlet. The terrain along the AWPAR has low relief, and is generally gently-to moderately-sloping with short, steep slopes occurring locally on some bedrock surfaces. Elevation ranges from approximately 130 m above mean sea level at lakeshores up to 200 m on ridge crests.

2.4.2.2 Surficial Geology

Laterally extensive deposits of glacial till cover the Project mine site. Block fields of weathered parent material interspersed with thin veneers of till or organics are common. However, the predominant surficial material is locally derived glacial till. Till thickness at site was determined from core and reverse circulation overburden drill holes and ranges up to 12.5 m with an average of less than 3 m. Appendix E2 shows the regional geology of the Meadowbank area and contours that indicate the approximate thickness of overburden (till).

In general, the till can be described as unsorted, medium brown, silty sand/gravel till, with between 20% and 40% fines (silt and clay) of locally derived volcanic, sedimentary, and lesser granitic clasts. Clast sizes range from granule to boulder with a high proportion in the granule to pebble range. In most of the channels between the lakes and ponds, coarse-grained soils are common. In some, the finer organic material and sediments have been removed by flow between lakes, leaving a stony pavement. In others, solifluction has brought coarse-grained material into the low-lying areas from adjacent slopes.

Small deposits of deltaic sand and fine gravel flank some streams along Third Portage Lake. Glaciofluvial deposits are volumetrically insignificant. The site was above the last glacial marine transgression; consequently, no glaciomarine deposits are known in the area. Material recovered from beneath the Project lakes during geotechnical drilling along the proposed dike alignments can be generally described as cobbles and gravel with traces of sand, silt, and clay. Samples of sand and clay were obtained locally. Further details on the rock types comprising the Portage, Goose, and Vault deposits and their relative proportions within the footprint of the deposits can be found in Cumberland (2005b).

Two main faults have been encountered in the geotechnical drilling completed to date: the Second Portage Lake fault, and the Bay Zone fault. The Second Portage Lake fault trends in a northwest-southeast direction along Second Portage Lake, while the Bay Zone Fault trends in a north-south direction. Stratigraphic contacts are also pervasive structures. No sites of palaeontological or palaeobotonical significance have been found.

The terrain along the AWPAR is dominated by undulating and irregular bedrock surfaces, veneers and blankets of till and/or weathered (frost-shattered) bedrock (felsenmeer), and discontinuous organic veneers. Occasional marine (beach) deposits and very small glaciofluvial deposits are present locally. Shallow, hand-dug soil pits excavated in late July 2005 indicate thaw to depths of 1 m or less on imperfectly- to poorly-drained upland till surfaces at this time of year (Cumberland 2005b).

2.4.2.3 Bedrock Geology

The Project mine site is underlain by a sequence of Archaean greenstone (ultramafic and mafic flow sequences) and metasedimentary rocks that have undergone polyphase deformation resulting in the superposition of at least two major structural events. Enclosed within the greenstone are volcaniclastic sediments, felsic-to-intermediate flows and tuffs, sediments (greywackes), and oxide iron formations. The sequence also contains sericite schists, which are believed to be altered felsic flows or dikes. The ultramafic rocks are variably altered, containing serpentinite, chlorite, actinolite, and talc. The ore in the Vault deposit is hosted in intermediate volcanic rocks. The ore in the Portage deposit is hosted in iron formation rocks.

2.4.2.4 Geological Hazards and Seismicity

The Project area is located in an area of low seismicity. Table 2.7 presents seismic risk calculations, while Appendix E3 shows the seismic zoning map of the Project.

Table 2.7. Peak Horizontal Ground Accelerations for the Meadowbank Project Site

Return Period of Seismic Event (years)	Peak Horizontal Ground Acceleration (g)
100	0.018
200	0.025
475	0.034
975	0.044

Source: Seismic Risk Calculations for the Meadowbank Project Site, GSC 2003

2.4.2.5 Permafrost

The Project is located within the zone of continuous permafrost (see Appendix E1). Permafrost is defined as ground that remains at or below 0°C for at least two years. Permafrost does not necessarily contain ice; rather, its definition is based solely on the temperature of the mineral or organic parent material. Permafrost in the Project area is considered stable and has temperatures colder than -5°C (Cumberland 2005a). Permafrost depths are estimated to be between 450 and 550 m, depending on proximity to lakes, slope, aspect, and other site-specific conditions. The measured active layer depth in the project area currently ranges from about 1.3 m in areas of shallow overburden and away from the influence of lakes, up to 4.0 m adjacent to lakes, and up to 6.5 m beneath the streams connecting Third Portage and Second Portage lakes.

Lake ice thickness is estimated to be around 1.5 to 2.5 m thick during mid- to late-spring, depending on site-specific conditions of water depth and exposure. Where water depth is greater than about 2 to 2.5 m, taliks are expected. Round lakes that do not freeze to the bottom in winter and have a diameter in the order of 570 m or greater, or elongated lakes that do not freeze to the bottom and have a width in the order of 320 m or greater, are expected to have a talik that extends through permafrost. The taliks beneath Second and Third Portage lakes likely extend through permafrost. The talik beneath Vault Lake likely does not penetrate through permafrost.

The ground ice content of permafrost soil and rock in the Meadowbank area is expected to be between 0% and 10% (dry permafrost) based on regional scale compilation data. Locally on land, ice lenses and ice wedges are present, as indicated by ground conductivity, and by permafrost features such as frost mounds. These areas of local ground ice are generally associated with low-lying areas of poor drainage.

Rock and soil-related terrain instability is a minor concern in the Meadowbank project area. Although permafrost will degrade in certain areas, for the most part the permafrost is “dry,” and has low ground ice content. The exception is the wetlands occupying lowlands adjacent to lakes and ponds where excess ground ice is present and thaw instability is foreseeable. These impacts can be mitigated using currently accepted permafrost engineering practices as part of dike construction, drawdown and re-watering of lakes, pit development, and waste rock facilities and Tailings Storage Facilities construction and closure.

2.4.2.6 Hydrogeology

In areas of continuous permafrost, there are two groundwater flow regimes: a deep regime beneath the permafrost and a shallow regime in the active layer near the ground surface (see Appendix E4). The deep groundwater regime is connected to taliks located beneath large lakes. The water level elevations in lakes that have these deep taliks provide the driving force, or hydraulic head, for the deep groundwater flow. The presence of the thick and low permeability permafrost beneath land located between large lakes results in negligible recharge to the deep groundwater flow. Smaller lakes, which have taliks that probably do not extend down to the deep groundwater regime, do not influence the groundwater flow in the deep regime. Consequently, recharge to the deep groundwater flow regime is predominantly limited to areas of talik beneath large surface water bodies.

From late spring to late summer when temperatures are above 0°C, the active layer becomes thawed. Within the active layer, the water table is expected to be a subdued replica of the topographic surface. Groundwater gradients, or the slope of the groundwater level, are assumed to be similar to topographic gradients. Locally, groundwater in the active layer would flow to local depressions and ponds that drain to Second Portage and Third Portage lakes, or would flow directly to these two water bodies.

There does not appear to be a detectable difference in the hydraulic conductivity of the various rock types. Ultramafic rocks, at a given depth, have similar hydraulic conductivity to those of the Intermediate Volcanics at the same depth. The hydraulic conductivity of the shallow exfoliated and weathered bedrock and faults, regardless of rock type, is generally higher than the deeper, less fractured rock.

Groundwater sources from either the active layer or from the deep groundwater regime below the permafrost are not presently utilized for drinking water at the Project site, due to the presence of deep permafrost, the seasonal nature of the active layer, and the availability of good quality surface drinking water sources in the vicinity of the Project site.

2.4.2.7 Surface Water Hydrology

Hydrology in the Project area is highly influenced by geographic location, the headwater nature of the Project watersheds, and by the seasons. The Project area streams are relatively short, small- to medium-width ephemeral channels with boulders. They connect all Project area lakes in a cascading network.

Snowmelt runoff in the region begins in the period from late May to mid-June, and the snowmelt peak is often the peak flow for the year. Secondary peaks due to rainfall events can occur during the summer and can sometimes exceed snowmelt peaks. Flows typically decline through the late summer and fall, with freeze-up occurring in late September for the smallest streams and in late November for the medium channels. All channels are anticipated to freeze to the bottom with zero flows over the winter period.

Third Portage Lake currently drains into Second Portage Lake via two small, ephemeral channels that are impassable by fish. The width of these channels is between 50 to 150 m. The construction of the West Channel Dike in 2009 blocked a third outlet channel with similar characteristics. The elevation difference is 1 m between these two lakes.

Discharge from Second Portage Lake flows south into Tehek Lake via a wide connecting channel and small chute about 50m long. Vault, Wally, and Drill Trail lakes are connected in succession. Water from these lakes is directed to Second Portage Lake, just north of its outlet to Tehek Lake.

Average runoff depths for the four monitored basins (2PL, 3PL, Drill Trail Lake, Turn Lake) over 2002 to 2004 ranged from 112 mm for Third Portage Lake to 176 mm for Drill Trail Lake. The variation in runoff correlates roughly with the relative percentage of lake surface area in each basin. Site runoff data were combined with analysis of available regional stream flow data to estimate long-term average and extreme discharge characteristics for the Project area. Table 2.8 summarizes the mean monthly runoff from May through October, as a proportion of total annual runoff.

Table 2.8. Estimated Mean Monthly Runoff Depth as Proportion of Annual Depth – Project Basin

Month	Percent of Mean Annual Runoff
May	0%
June	30%
July	40%
August	20%
September	9%
October	1%
Year	100%

Source: Cumberland 2005b

Table 2.9 summarizes the results of frequency analyses of annual runoff for Project area basins. Analysis of the available data from the four regional stream flow stations was carried out to develop estimates of flood flows and low flows for the outlets of Turn, Drill Trail, Third Portage, and Second Portage lakes.

Table 2.9. Estimated Annual Runoff Depths – Project Basin

Return Period (Years)	Condition	Estimated Basin Runoff Depth (mm)		
		Drill Trail & Turn	Third Portage	Second Portage
100	Wet	378	238	284
50	Wet	345	217	259
20	Wet	300	189	225
10	Wet	266	168	200
5	Wet	230	145	173
2	Median	175	110	131
5	Dry	135	85.1	101
10	Dry	118	74.3	88.5
20	Dry	105	66.2	78.8
50	Dry	92.6	58.4	69.5
100	Dry	84.8	53.4	63.6

Source: Cumberland 2005b

2.4.2.8 Lake and Littoral Zone Characteristics

Several bathymetric surveys were conducted for the lakes in the Project mine site area (Golder 2002, 2003, 2006a, 2008a and b, Dougan 2011). Appendix E5 shows the most recent bathymetry data for Second and Third Portage, Vault, Wally, Turn and Drill Tail lakes. The surface area, volume and average depth of these lakes are summarized in Table 2.10.

Table 2.10. Characteristics of Lakes at Mine Site Area

Lake	Surface Area (10^3 m^2)	Water Volume (10^6 m^3)	Average Depth (m)
Second Portage	3,851	29.72	7.72
Third Portage	33,065	446.23	13.50
Vault	980	2.2	10 (maximum)
Wally	7,671	27.90	3.64
Turn	3,235	26.47	8.18
Drill Tail	2,149	11.67	5.43

Source: Golder 2006a

These water bodies are headwater lakes, and the surface area for each constitutes an appreciable portion of their respective basin drainage area. Small channels connect the lakes in the Project mine site area, although there is little flow between lakes during most of the year. The ice-free season is very short, with ice breakup occurring in late-June to mid-July and ice freeze-up beginning in late September or early October, with complete ice cover by late October. No flow is anticipated between lakes during the ice cover period. Maximum ice thickness is at least 2 m by March/April.

Lake shorelines are covered predominantly with a complex mixture of boulders and large cobble with some gravel to a depth of between 4 to 6 m below the surface. These substrates are very stable and not subject to erosion except by ice scouring and ice rafting. Below a depth of about 6 m, there is a transition to fines, with the bottom consisting predominantly of silt/clay. The organic carbon content of the fine sediment provides a food source for burrowing invertebrate worms and chironomid larvae. The majority of the lakes are relatively shallow, with average depths between 3.6 and 13.5 m maximum depth. In larger lakes, such as Second and Third Portage lakes, maximum depth in certain areas can exceed 40 m.

2.4.3 Chemical Environment

2.4.3.1 Soil Chemistry

All samples of overburden (till) other than Third Portage trench spoil piles have no potential to generate Acid Rock Drainage (ARD). The ARD potential of trench spoil piles is due to the higher sulphide content of soil directly above the ore deposit. Rock samples collected along the AWPAR are indicated to be non-acid-generating (Cumberland 2005b).

2.4.3.2 Sediment Quality

Sediment can be an important source or sink for contaminants such as metals. Contaminants entering aquatic systems (via tributary streams or directly from local sources) are usually associated with suspended particulate material in the water column that eventually settle in depositional areas as sediment, especially in deeper areas of lakes. Sediment provides a long-term, temporal record of deposition, integrating concentrations over time.

Lakebed substrate in the project area is a key habitat attribute that dictates the species composition and abundance of benthic invertebrates and its importance as feeding habitat by fish. Water depth is the strongest determinant of physical features of the lake substrate, especially grain size. Between the surface and about 4 m depth, substrate consists of a heterogeneous mixture of boulder, rock, and cobble. At depths of less than 2 m, the lakebed substrate is ice scoured and subject to erosion by wave-driven currents. Below 4 m depth, sediment grain size diminishes with sand, silt, and clay becoming more abundant. At depths of 6 to 8 m and greater, bottom sediment consists of a uniform silt/clay mixture that dominates aerial substrate distribution in Second Portage Lake (70%) and Third Portage Lake (81%).

Sediment samples at depths of 8 m or greater collected from numerous locations throughout the Project mine site area and reference lakes revealed a great similarity in grain size, organic carbon (2.5% to 5%) and metals concentration. Total metals concentration in sediment was similar among project and reference lakes and over years, suggesting that the erosional and geochemical processes within lakes in the Meadowbank region are similar.

At Meadowbank, all sediment metals concentrations observed can be regarded as background because of the near absence of anthropogenic activities. Metals concentrations are generally similar across the area, including reference lakes, and reflect the natural, mineralized nature of the sediments and low rate of deposition. Adverse impacts to the benthic community were not observed and fish tissue metals concentrations are low and similar to concentrations in fish found in other pristine lakes.

2.4.3.3 Surface Water Quality

The lakes in the Project mine site are ultra-oligotrophic, soft water, nutrient poor and isothermal, with neutral pH and high oxygen concentrations year round. Limnological conditions tend to be very stable. The vertical distribution of temperature, oxygen and nutrients is typically uniform during summer and winter, with minor temporary stratification. Water clarity is high, with Secchi depths of 10 m or more. The dissolved and suspended solids concentrations are very low. The headwater nature of the Project lakes means that there are no large streams entering or leaving the watershed. As a result, external sources of nutrients or sediment to potentially contribute to nutrient enrichment or productivity of the system are limited (Cumberland, 2005a).

Due to the site's northern latitude and climate, lakes naturally experience long periods of cold temperatures and low light levels during the winter months. Ice covers the lakes for extended periods of time each year and low water temperatures exist year round. As a result of the ice cover, gas exchange with the atmosphere is limited most of the year. However, oxygen concentrations remain high under the ice because of the low rates of biological activity and decomposition of organic material.

Turbidity and suspended and total dissolved solids in surface waters are low, typically below laboratory detection (<1.1 NTU, <1 mg/L and <10 mg/L, respectively). Hardness (4.4 to 9.5 mg/L), and dissolved anions (chloride, fluoride, sulphate) were also very low and near detection limits (<0.05 to 0.06 mg/L). Surface water has circum-neutral pH (6.6 to 7.7) and low conductivity (5 to 77 µS/cm). Nutrient concentrations (nitrogen, carbon, phosphorus) in the project lakes do not differ significantly within or between lakes and seasons and are typical of ultra-oligotrophic lakes. Nitrogen nutrients (nitrate, nitrite, ammonia, dissolved phosphate) seldom exceed 0.001 mg/L, while dissolved phosphate ranges from <0.001 to 0.003 mg/L. Dissolved organic carbon (DOC) concentrations range from 1.4 to 2.3 mg/L.

Average baseline water qualities in Second Portage, Third Portage and Wally lakes are presented in Table 2.11. Total and dissolved metals concentrations are remarkably similar within and between lakes between 1997 and 2002. Total antimony, arsenic, chromium, copper, mercury, and nickel concentrations from lakes in the Project mine site are all below laboratory detection limits and well below water quality guidelines for the protection of aquatic life (CCME 2007). In addition to common salts (sodium, magnesium), the only metals to exceed detection limits are aluminum (0.006 to 0.014 mg/L), lead (up to 0.0012 mg/L), and zinc (0.001 to 0.019 mg/L). Only lead marginally exceeded surface water quality guidelines at a few sampling stations. Dissolved metals concentrations comprise the vast majority of total metals concentrations where results exceeded detection limits, indicating that nearly all metals are dissolved and not associated with particulates, which is consistent with the low suspended solids concentrations observed.

Table 2.11. Average Baseline Water Quality in Third Portage, Second Portage and Wally

Parameter	Units	Third Portage Lake (N=18)	Second Portage Lake (N=14)	Wally Lake (N=3)
Conventional parameters				
Hardness	mg/L	5.3	8.9	17.2
pH	pH units	6.8	7.5	7.3
Dissolved anions				
Total alkalinity	mg/L	4	7	13
Chloride	mg/L	0.5	0.6	0.7
Fluoride	mg/L	0.07	0.07	0.05
Sulphate	mg/L	1.3	2.8	5.3
Nutrients				
Ammonia nitrogen	mg/L	0.01	0.02	0.02
Total kjeldahl nitrogen	mg/L	0.09	0.08	0.11
Nitrate nitrogen	mg/L	0.004	0.007	0.024
Nitrite nitrogen	mg/L	0.001	0.001	0.001
Total phosphate	mg/L	0.002	0.003	0.003
Total phosphorus	mg/L	0.002	0.003	0.003
Organic parameters				
Dissolved organic carbon	mg/L	1.4	1.7	2.2
Cyanides				
Total cyanide	mg/L	<0.005	<0.005	<0.005
Total metals				
Aluminum	mg/L	0.006	0.007	0.008
Antimony	mg/L	<0.0005	<0.0005	<0.0005
Arsenic	mg/L	<0.0005	<0.0005	<0.0005
Barium	mg/L	<0.02	<0.02	<0.02
Beryllium	mg/L	<0.001	<0.001	<0.001
Boron	mg/L	0.1		0.1
Cadmium	mg/L	<0.00005	<0.00005	<0.00005
Calcium	mg/L	1.2	2.3	4.6
Chromium	mg/L	<0.001	<0.001	<0.001
Cobalt	mg/L	<0.0003	<0.0003	<0.0003
Copper	mg/L	0.001	0.001	0.002
Iron	mg/L	<0.03	<0.03	<0.03
Lead	mg/L	0.0006	0.0009	0.0007
Lithium	mg/L	<0.005	<0.005	<0.005
Magnesium	mg/L	0.5	0.8	1.3
Manganese	mg/L	0.001	0.0016	0.0013
Mercury	mg/L	<0.00005	<0.00005	<0.00005

Parameter	Units	Third Portage Lake (N=18)	Second Portage Lake (N=14)	Wally Lake (N=3)
Molybdenum	mg/L	<0.001	<0.001	<0.001
Nickel	mg/L	<0.001	<0.001	<0.001
Potassium	mg/L	2	2	2
Selenium	mg/L	<0.001	<0.001	<0.001
Silver	mg/L	<0.00002	<0.00002	<0.00002
Sodium	mg/L	2	2	2
Thallium	mg/L	<0.0002	<0.0002	<0.0002
Tin	mg/L	<0.0006	<0.0005	<0.0005
Titanium	mg/L	<0.01	<0.01	<0.01
Uranium	mg/L	<0.0002	<0.0002	<0.0002
Vanadium	mg/L	<0.03	<0.03	<0.03
Zinc	mg/L	0.005	0.005	0.013

Note: N = number of samples used to calculate average values.

Spring freshet water is moderately acidic and has very low sulphate, dissolved metals, and total dissolved solids. The quality of water infers limited interaction of surface drainage water with the underlying bedrock (Cumberland, 2005a).

2.4.3.4 Groundwater Quality

Groundwater baseline data were collected from four monitoring wells located within the three main rock types in the area of the Goose and Portage deposits and from the talik underlying the proposed tailings facility area at Second Portage arm. Wells were not installed in the Vault deposit as it lies within continuous permafrost.

No samples reported Canadian Metal Mining Effluent Regulations (MMER, EC 2002) exceedances, although some samples reported exceedances of Canadian Environmental Quality Guidelines (CCME 2007). Concentrations of total metals generally exceeded those of dissolved metals for all wells. The chemical signature of groundwater (from major ion chemistry) is distinct between each lithology and differs from that of lake water. Groundwater quality is generally consistent with rock leachate characteristics, with the majority of constituents present in rock leachate also present in the groundwater of the corresponding lithology.

The groundwater is brackish to saline with high total dissolved solids and chloride concentrations. Based on data from other sites in the Canadian Shield, it is expected that the salinity of the groundwater will increase with depth. Water samples collected from monitoring wells installed in the talik beneath Second and Third Portage lakes to depths of 175 m have chloride concentrations of up to 626 mg/L and total dissolved solids values up to 800 mg/L. This represents a salinity of 1.1, where salinity is equal to approximately 1.8 times the chloride concentration (in parts per thousand). Water samples collected from a number of large lakes in the area have chloride concentrations of less than 1 mg/L. By comparison, sea water has chloride concentrations of approximately 19,000 mg/L.

2.4.3.5 Acid Rock Drainage and Metal Leaching Potential

A materials geochemical program was developed to characterize the Project geologic materials and define the nature and magnitude of impacts that may result from the interaction between these materials and the environment during all phases of project development, including post-closure. This program involved characterizing:

- Geochemistry of bedrock in the area of the proposed open pits and planned mine infrastructure away from the ore deposits through static testing;
- Tailings material and overburden through static testing; and
- Long-term weathering behaviour of selected pit rock and tailings samples with respect to acid rock drainage (ARD) potential and constituent leaching rates through kinetic testing.

Metal concentrations in leachate generated by static and kinetic tests were compared to the Canadian Council of Ministers of the Environment's (CCME) Canadian Environmental Quality Guidelines (CCME 2007) for the protection of freshwater aquatic life, and to the Canadian Metal Mining Effluent Regulations (EC 2002).

Pit rock samples were obtained from exploration drill core specifically for ARD and metal leaching testing to determine the spatial and compositional variability of each rock unit to be disturbed, including targeted testing of starter pit rock that was used for construction of mine site roads and dikes. Analysis of weathered drill core that had been exposed to climatic conditions on site for 11 to 12 years was conducted to document the effects of weathering on the chemical characteristics of pit rock. Tailing solids and decant water samples were obtained from the metallurgical program, which focused on the processing characteristics of representative ore samples from each deposit.

The rock types and their relative proportions within the footprint of Portage, Goose, and Vault deposits are discussed in Cumberland (2005d). The results of kinetic testing relating the measured potential of rock to generate ARD and to leach metals are summarized in Table 2.12. The sulphide content of pit rock from each lithology is generally low, with median total sulphur contents of less than 1%. The bulk of the Iron Formation (IF) and quartzite rock is potentially acid generating (PAG). The ARD potential was realized under accelerated laboratory weathering tests but not under field conditions, after over two years of exposure. Ultramafic (UM) rock is NPAG and has the highest median buffering capacity of all rock types. The bulk of the Intermediate Volcanics (IV) rock type is NPAG.

Table 2.12. Summary of Kinetic Testwork for Pit Rock

Area **Lithology**	**Portage**			**Vault** **IV**
	UM	**IF**	**IV**	
Proportion of Pit Rock Waste	36%	37%[(a)]	28%	100%
ARD Potential[(b)]	2% PAG 2%Uncertain 96%NPAG	67% PAG 13%Uncertain 20%NPAG	20% PAG 14%Uncertain 66% NPAG	14% PAG; 11% uncertain; 75% NPAG
Laboratory Test Leachate MMER Exceedances	As	pH, Zn	n.e.[(c)]	n.e.[(c)]

Area Lithology	Portage			Vault IV
	UM	IF	IV	
Field Barrel Test Leachate MMER Exceedances	n.e.	n.e.	n.e.	n.e.

Notes:

(a) IF rock proportions include 2% of quartzite rock.

(b) Based on static testing database (Golder 2005)

(c) Result from the 100-kg composite sample

n.e.: no exceedances

Source: Cumberland 2005d

The relative potentials of the rock types to generate ARD or leach metals under neutral drainage conditions and the implications for potential use as construction rock are presented in Table 2.13. This is based on a classification system used to identify the appropriate use and storage for all mine rock. This system identifies PAG or NPAG rock types and those with the potential for metal leaching (ML).

Table 2.13. Rock Types and Potential for ARD

Open Pit	Material Type	Potential for ARD	Potential for ML	Restrictions for Storage or use in Construction
All Pits	Overburden	None	Low	None
	Tailings	High	High	Requires measures to control ARD
	Lake Sediment	Variable (none to high)	High	May require collection and treatment of drainage
Portage & Goose	Ultramafic & Mafic Volcanic	None	Low	May require collection and treatment of drainage
	Intermediate Volcanics	Variable (none to moderate)	Moderate	Requires measures to control ARD
	Iron Formation	High	High under ARD conditions Low under neutral conditions	Requires measures to control ARD
	Quartzite	High	Low	Co-disposal with ultramafic/mafic volcanic or cap/water cover
Vault	Intermediate Volcanics	Low	Variable (low to moderate)	May require collection and treatment of drainage

Source: Cumberland 2005a

PAG mine rock will be stored in the Waste Rock Storage Facilities (mostly the Portage facility), which are designed for long-term stability with minimal environmental and aesthetic impact. The surface storage area will be constructed to minimize the disturbed area. The Portage Waste Rock Storage Facility will be capped with a layer of acid-buffering ultramafic rock to constrain the active layer within non-acid generating rock. The waste rock below the capping layer will freeze, minimizing ARD generation in the long term. All of the waste rock from the Vault pit can be stored in the Waste Rock Storage Facility northwest of the pit. Geochemical predictions indicate it will not be necessary to place capping over the Vault Waste Rock Storage Facility.

The tailings chemistry will be dependent on the origin of the processed ore. It is estimated that 53% of the ore processed will originate from the Portage deposit, 8% from Goose deposit, and 39% from the Vault deposit. A summary of the tailings chemistry is provided in Table 2.14. The Tailings Storage Facilities will be capped with a layer of acid-buffering ultramafic rock to constrain the active layer within non-acid generating rock. The tailings below the capping will freeze, minimizing ARD.

Table 2.14. Summary of Tailings Chemistry

Deposit	Portage	Goose	Vault
Proportion of Total Tailings	53%	8%	39%
ARD Potential of Tailings	PAG	PAG	PAG
Flotation Circuit Tailings MMER Exceedances	pH, Cu, Ni, Zn	pH, Cu, Ni, Zn	n.e.
Whole Ore Circuit Tailing Composite Sample[(a)] MMER Exceedances	n.e.[(b)]	n.e.	n.e.

Notes:

(a) Sample consisting of 54% Portage, 8% Goose, and 39% Vault whole ore tailings.

(b) The term n.e. stands for no exceedances

Source: Cumberland 2005c

2.4.4 Biological Environment

Baseline studies on vegetation, and terrestrial wildlife in and around the Project area were conducted for 3 study areas (Cumberland 2005e):

- A regional study area (RSA) centered on the Project area, and encompassing the mine site, the AWPAR and the Baker Lake Marshaling Area;
- A local study areas (LSA) centered on two sites, the Portage and Goose deposit area and Vault deposit; and
- The AWPAR LSA composed of a 3 km wide corridor centered on the AWPAR.

A map illustrating the three baseline study areas is provided in Appendix E6. Baseline surveys were conducted for the terrestrial components described below.

2.4.4.1 Overall Ecosystem

The Project Area is characterized by a continuous vegetation cover interspersed with bedrock outcroppings and continuously aggrading surfaces. Vegetative cover is composed of lichens, mosses, ericaceous shrubs and heaths, herbs, grasses, and sedges.

2.4.4.2 Vegetation Habitat

Baseline vegetation studies were conducted in 1999 and 2002 for the mine LSA and in 2005 for the AWPAR road (Cumberland 2005e). An inventory of the flora plant communities was performed and showed that vegetation at the mine site is typical of upland tundra. No sensitive, rare, regionally unique or endangered species or communities were identified within the Project area or AWPAR LSA (Cumberland 2005a). The baseline studies provided field data and set the framework for the Ecological Land Classification (ELC) units. In addition, a land classification initiative undertaken by the Nunavut Department of Sustainable Development provided additional ground data and the mapping methodology used to generate to the ELC mapping (Cumberland 2005e).

The thirty-one ELC units identified to describe the vegetation characteristics of the mine site RSA are shown in Appendix E7. Further details are found in the baseline terrestrial report (Cumberland 2005e).

The ELC units for the Project area are defined in Table 2.15.

Table 2.15. Ecological Land Classification Unit Definition

ECL Unit	Definition
Betula Community	The Betula (dwarf birch) community is associated with sites with near mesic regimes on a variety of slope positions; this unit is characterized by a moderate to high cover of dwarf birch.
Betula–Carex Community	The dwarf birch-sedge community is associated with sites with near mesic to hygric moisture regimes. It is found on flat (level) to gently sloping sites with hummocky or tussocky surfaces. Dwarf birch is a dominant species; a number of sedge species may be present in the troughs.
Betula–Grass Community	The dwarf birch-grass community is characterized by sites that have dwarf birch and grass (Hierochloe sp.) as dominant species.
Betula–Moss Community	The dwarf birch-moss community is also found on sites with near mesic moisture regimes often with a hummocky surface expression. These sites generally have a moderate cover of dwarf birch (>20%), however at least one other shrub is also dominant along with mosses.
Boulder	Exposed boulders have a very high reflectance value in imagery, and are very easy to identify. The variable size and shape of boulders add texture to the imagery that allows it to be distinguished from the bedrock association. Lichens are generally associated with the boulders.
Boulder–Moss	This unit is similar to the boulder unit in texture, however mosses are found in spaces between the boulders.
Boulder–Water	This unit is also similar to the boulder unit in texture, however standing (or flowing) water is found in interstitial spaces between the boulders. It is situated in depressions or adjacent to water bodies.
Boulder – Shrub Community	The boulder-shrub unit consists of boulder fields where the spaces between the clusters or individual boulders have become covered with mats of heath forming plants. Various shrubs (i.e., crowberry, bearberry, bilberry, dwarf birch) as well as lichens are present in the spaces.
Carex Community	Carex (sedge) communities generally occur in poorly drained areas and around water features. The vegetation composition and the high water content characteristics provide a unique spectral signature that is easily recognizable from other vegetation classes; however, this ELC unit can be highly confused with

ECL Unit	Definition
	shallow water. These sites are generally dominated by sedges and/or cotton-grasses.
Carex –Shrub Community	Sedge-shrub communities generally occur in flat, poorly drained areas and around water features. Sedges are dominant along with willows.
Carex –Moss Community	Sedge-moss communities generally occur in flat, poorly drained areas and around water features. Sedges are dominant along with mosses.
Grass Community	The grass community is found on mesic sites. *Hierochloe alpina (*alpine holygrass) is the dominant plant species.
Lichen Community	The lichen community occurs on a variety of well-drained landforms on xeric to submesic sites. Lichens generally occupy over 60% of the ground surface.
Lichen–Boulder Community	The lichen-boulder community is found in boulder fields and on morainal deposits throughout the project area. The surface is rough and broken. Boulder cover varies form between 20 to 80%. Hair lichens can be common on the “tundra” between the boulders while crustose lichens are found on the boulder surfaces.
Lichen–Cobble Community	This unit is similar to the lichen-boulder community; however, the surface is not as rough. The cover of vascular plants is low in this unit.
Lichen–Grass Community	This ground cover in this community is dominated by a combination of lichens and grasses; alpine holygrass is generally common.
Lichen–Moss Community	The lichen-moss community generally occurs on well-drained morainal material. The ground surface is covered by a variety of lichens and mosses; the cover of vascular plants is low.
Lichen–Shrub-Moss Community	This unit is found on morainal material on mesic sites. It is somewhat similar to the Shrub and Moss units. The lichen and moss layers each cover over 20% of the ground surface. The moderately developed shrub layer is dominated by Labrador tea with lesser amounts of lingonberry and cloudberry and a low cover of dwarf birch.
Moss –Carex - Water	This community is associated with level sites and depressions. It is often found on the edge of ponds and lakes.
Moss Community	The moss community occurs on a variety of landforms but most often on mesic sites on moraine. Mosses are a dominant ground cover; most sites have a moderate cover of ericaceous shrubs (no single species is a dominant) and low cover of dwarf birch, herbs, graminoids and lichens.
Moss -Gravel Community	The moss-gravel community occurs on well-drained sites. It is characterised by a high cover of exposed gravel on the soil surface and with moss cover over 20%.
Rock	Bedrock outcrops have a very high reflectance value in imagery, similar to boulders. The outcrops are generally in a linear orientation and make up a relatively small proportion of the total classified area. Lichens and a variety of low shrubs are generally associated with bedrock.
Rock – Shrub Community	The rock-shrub community occurs on areas of bedrock outcrop on upper and crest of slope positions. Bedrock cover is generally greater than 40%; *Empetrum nigricans* (crowberry) is usually a dominant although the cover of ericaceous shrubs also is greater than 20%.
Sand – Water	Beaches, sand banks and shallow water deltas are identified in the image. Sand has a very high reflectance value and is easily identified in the classification.
Shadow	Shadows in the image are generally from cloud cover and tend to black out the spectral signature of the land beneath it. Areas under shadows cannot be

ECL Unit	Definition
	classified and are not included in this classification.
Shrub Community	The shrub community is generally found on xeric to mesic sites on morainal parent material. Low shrubs are dominant in this unit; however, any one of several shrub species may be common on an individual site. These sites also have a low to moderate cover of forbs, graminoids, lichens, and mosses.
Shrub – Grass – Moss	This community is found on mesic sites. It is dominated by a combination of shrubs, graminoids, and mosses.
Shrub – Gravel Community	The shrub-gravel community is uncommon and is found on well drained, coarse textured soils. It is associated with eskers or gravelly, morainal ridges.
Water	Characterized by standing water. Deepwater areas are easily interpreted due to the spectral energy being absorbed by the water with very little reflectance. However, shallow water (2 m or less) can be confused with wetlands. In areas of shallow water, the bottom of the waterbody reflects the spectral energy. Shallow water is very closely related to the wetland community class (sedge community) because of the high water content, therefore, the separation of these classes can be highly confused.
Disturbed Sites	There is very little disturbed land in the area being classified. The class includes any urban area (Baker Lake) or camp settlements large enough to be detected in the imagery. Due to the characteristics of this class, it cannot be automatically classified; therefore, these areas were added manually. This class represents a very small proportion of the total classified area.
Ice	Ice has a very high reflectance value and is easily identified in the classification. There are a few areas with ice floating on waterbodies.
Unclassified	A very small percentage of cells within the imagery do not fall within a defined class. These cells have been grouped as unclassified.
Ridge Crest Community	This ELC unit is typically associated with eskers. Vegetation cover is often non-contiguous as the environment is dry and unstable. Two associations were mapped in the LSA (i.e., ridge crest community – sand association and ridge crest community – cobble association). The vegetation in this unit occurs in dense mats, which may include bog blueberry, lingonberry, crowberry, black bearberry, or prickly saxifrage. Moss campion, snow cinquefoil, grasses (e.g., purple reedgrass), and xeric woodrushes (e.g., confused woodrush) may be present. Lichens are sparse in this unit. The ridge crest community - cobble association is similar to the lichen-rock community – boulder association.

Source: Cumberland 2005e

Area summaries of the ELC units in the mine site LSA, AWPAR LSA and the RSA are presented in Table 2.16.

Table 2.16. Area Summary of ELC Units in the Mine Site LSA, AWPAR LSA and RSA

Wildlife ELC	Mine Site LSA		Access Road LSA		RSA	
	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of RSA
Water	5,990	31	3,054	11	98,890	19
Sedge	3,936	20	2,029	7	43,935	9
Birch & Riparian Shrub	1,690	9	3,726	14	64,128	13
Heath Tundra	1,441	7	8,126	29	115,086	23
Lichen	1,460	8	4,406	16	73,425	14

Wildlife ELC	Mine Site LSA		Access Road LSA		RSA	
	Area (ha)	% of LSA	Area (ha)	% of LSA	Area (ha)	% of RSA
Lichen-Rock	1,940	10	1,268	5	29,243	6
Ridge Crest/ Esker / Avens	26	<1	793	3	10,719	2
Rock & Boulder	2,841	15	2,275	8	45,939	9
Disturbed	15	<1	274	1	3,844	1
Residual	56	<1	1,617	6	25,526	5
Total	**19,395**	**100**	**27,568**	**100**	**510,735**	**101**

Source: Cumberland 2005e

Water is the most common ELC unit within the mine site LSA, covering about 31% of the land surface. The most common vegetated unit within the mine site LSA is Sedge, covering approximately 20%. Other common ELC units are Rock & Boulder and Lichen-Rock. Heath Tundra is the most common ELC unit within the access road LSA, covering approximately 29%. Other common ELC units are Lichen and Birch & Riparian Shrub. Similarly, Heath Tundra is the most common ELC unit within the RSA, covering about 23%, followed by Water (19%), Lichen (14%), and Birch & Riparian Shrub (13%).

Vegetation surveys at Meadowbank identified 121 vascular plant species (including hybrids and intergrades) from 26 families in the project area during the 1999, 2002 and 2005 baseline surveys. An additional 56 vascular plant species are likely to occur near the proposed mine development, but were not observed during field surveys. In addition, 53 non-vascular plants, primarily lichens, were identified during the same surveys; however, many of the non-vascular plants collected during those surveys remain unidentified (Cumberland 2005e).

No rare vascular plants or plant communities were found in the Project area. Although it is possible that some rare non-vascular species (e.g., lichens) may be present, very little is known of non-vascular plant distribution in the Arctic and most species are difficult to identify.

Seven vascular plant species of restricted range are known or expected to occur in the area, but none are considered to be rare or of special concern. These species include greyleaf willow, Bell's crazyweed, mountain heather, diapensia, alpine pussytoes, marsh marigold, and Rocky Mountain cinquefoil. Of these, the first five species were all recorded in the Project area.

2.4.4.3 Aquatic Biota and Habitat

Studies targeting the ecological characteristics of the aquatic environment in the Project mine site area have been conducted since 1991 and were compiled in the baseline aquatic ecosystem report (Cumberland 2005f). Results indicate that the Project lakes are ultra-oligotrophic/oligotrophic (i.e., nutrient poor and unproductive) lakes. Although biological productivity of the lakes is limited by nutrient availability, cold water and a short growing season, they support healthy communities of plankton, benthos and fish that are typical of oligotrophic Arctic lakes (Cumberland 2005f).

The headwater nature of the lakes in the Project area, their great distance from marine waters of Hudson Bay, the paucity of stream habitat, and impassable falls (i.e., Quoich River Falls) also determine why certain fish species are found in great abundance and why others are absent. For example, the high latitude, cold climate, and near absence of stream habitat explains the lack of Arctic grayling (Thymallus arcticus). Grayling require stream habitat for spawning during spring as well as for feeding. Their absence from the project area is due in great part to the lack of suitable habitat, but also because the project lakes are situated near the maximum northern range of their distribution (McPhail and Lindsay 1970). The lack of snow cover and brief freshet in spring does not provide sufficient water flow and adequate water temperature for successful incubation of eggs by grayling.

Lake cisco are also absent from the mine site lakes and are not known to occur in this watershed (Lawrence and Davies 1977, MacDonald and Stewart 1980). Arctic cisco are relatively abundant in lakes near Hudson Bay, where they have easier access to the ocean. Cisco, like Arctic char, often travel back and forth between the lake and marine environment, where they spend the short summer months foraging near shore in the brackish water, returning to lakes to overwinter.

Lake trout and round whitefish dominate in the mine site lakes and are typically the two most common species in Arctic headwater lakes in Nunavut and the Northwest Territories (Scott and Crossman 1979). Lake whitefish are also known to be present in other watersheds in this region, but are absent from the Quoich River system (Lawrence *et al.* 1977, MacDonald and Stewart 1980). This species is near the edge of its northerly distribution, which may also explain its absence in the mine site area lakes.

Landlocked (i.e., non-anadromous) Arctic char are present in all of the mine site lakes, although relative abundance differs among lakes. Char generally tend to be relatively more abundant in downstream lakes than upstream lakes. South of Tehek Lake, anadromous char are known to migrate up the Prince River to Whitehills Lake, which is used by Arctic char to overwinter (MacDonald and Stewart 1980).

Other fish species that comprise a very minor abundance (<1% combined) include burbot (Lota lota), ninespine stickleback (Pungitius pungitius) and slimy sculpin (Cottus cognatus). Burbot typically occur in deep water portions of lakes, and, given the lack of stream habitat are limited to lake basins. Unlike other species, they spawn during mid-winter under the ice over sand, gravel, and rubble substrates in shallow depths (Scott and Crossman 1979, Richardson *et al*. 2001). Juveniles and adults inhabit rocky shorelines at margins of deeper areas of lakes, as well as in deeper areas away from shorelines and shoals. Sculpin are spring spawners and spawn over sand, gravel and rock substrates in shallow water. Seasonal movements within lakes are restricted and this species is often favoured as a sentinel species. Ninespine stickleback are widespread in lakes and streams and inhabit shallow bays, ponds, and stream channels. Although stickleback prefer areas with macrophytes and vegetation, given the absence of aquatic plants in the mine site lakes, stickleback were associated with coarse substrates with good shelter nearshore associated with rocky, cobble shorelines.

2.4.4.4 Wildlife

Due to the extreme northern climate and low structural heterogeneity, relatively few terrestrial vertebrates are found in the Project area. During the baseline wildlife surveys, 61 terrestrial wildlife species were recorded: 12 mammals; 49 birds; and no amphibians or reptiles (Cumberland 2005e).

Barren-ground caribou is a key mammal as the Baker Lake Inuit population heavily depends on it for food. Caribou are listed as secure in Nunavut (GN 2001), and as a species of Special Concern federally (COSEWIC 2010). They are currently not under any of the schedules of the Species At Risk Act (SARPR 2010).

Seasonal and yearly differences of the various population parameters are difficult to determine as little scientific information is available on local caribou population parameters, distribution, abundance, and migration corridors. However, Inuit traditional knowledge of caribou is extensive as they are of very high value to the people in Baker Lake and other communities. Based on traditional and scientific knowledge of the area, caribou are present in the RSA in considerable numbers during the fall, winter, and spring, but are very sparsely distributed in summer. Caribou wintering in the RSA appear to originate from a number of different herds in the region, including the Beverly, Qamanirjuaq, Lorillard, Wager Bay, Boothia Peninsula, and Ahiak herds. In February 2004, an estimated 21,000 caribou were recorded in the area (Cumberland 2005e).

AEM has participated with the Government of Nunavut Department of Environment Caribou satellite collaring program since 2008. The joint satellite-collaring program was developed to provide information on the distribution of caribou occurring within the Meadowbank RSA and contribute data to other ongoing satellite-collaring programs for the Beverly and Qamanirjuaq herds. Based on the results of this monitoring program, collared caribou were primarily present in the Meadowbank RSA and LSA during the early winter period, although some presence during spring migration also occurred. Calving or post calving has not been documented within the Meadowbank study area to date (NEC 2013).

Barren-ground caribou was the most common mammal species recorded during baseline surveys. Other common mammal species recorded in the Meadowbank area included muskox (Ovibos moschatus), Arctic wolf (Canis lupus arctos), Arctic hare (Lepus arcticus), Arctic ground squirrel (Spermophilus parryi) and Arctic fox (Alopex lagopus). Grizzly bears (Ursus arctos horribilis) and wolverines (Gulo gulo) are occasionally seen in the Meadowbank area. Relevant existing traditional and scientific knowledge on key wildlife species was documented and supplemented with wildlife surveys during the terrestrial baseline study (MMC, 2005d).

The bird species observed in greater numbers than any other species during the surveys were snow goose (Chen caerulescens), Canada goose (Branta canadensis), Lapland longspur (Calcarius lapponicus), and horned lark (Eremophila alpestris). Other commonly observed breeding bird species were savannah sparrow (Passerculus sandwichensis), semipalmated sandpiper (Calidris pusilla), sandhill crane (Grus canadensis), and rock ptarmigan (Lagopus mutus). Sandhill crane, Canada goose, and snow goose were most common during the migratory period. Raptors, as well as all three species of jaegers, were recorded occasionally during baseline surveys.

2.4.5 Social Environment

The Project area is located in the Kivalliq Region, one of three administrative regions in Nunavut. The 2001 population estimates indicate that over 7,500 people spread among seven communities live in the Kivalliq region (Cumberland 2005g). Baker Lake, with an estimated population of over 1,500 in 2001, is the only inland community in the region. The regional economy is mixed, combining the formal wage economy with traditional ways of life. Participation in traditional ways of life is high, at about 50% both in Nunavut as a whole and in Baker Lake.

2.4.5.1 Recent and Traditional Land Use

Based on information from the Elders of Baker Lake, the area between Baker Lake and the Meadowbank site was most commonly used as part of a transportation corridor between Baker Lake and the Back River, their traditional winter hunting and fishing area. The traditional winter transportation route passed directly through Third Portage Lake. While hunting and fishing activities were, and still are, conducted near the mine property, these activities seem to be of an opportunistic nature while enroute to Back River and beyond. The Inuit also stop to camp at various lake sites—including the Portage Lakes—but these sites are not annually used. More permanent camp sites utilized by both current residents and their ancestors are further north.

Traditionally, Tehek and the Portage Lakes were used extensively for fishing, fox trapping, caribou hunting, and food caching (Cumberland 2005g). This area is also reported by the Elders to be very spiritual, and grave sites exist along the shore of Second Portage Lake. There are also other grave sites located randomly throughout the area between Baker Lake and the Project site.

No permanent outpost camps or commercial tourist facilities exist in the vicinity of the Project site, and no known traditional use areas were identified within the footprint of the Project area.

2.4.5.2 Archaeological and Cultural Site

Archaeological surveys were conducted in 1999, 2003 and 2005. The surveys covered the following main areas:

- Mine site and vicinity;
- The winter road alignment during the exploration phase, which is near the AWPAR alignment;
- Selected sites outside the development area; and
- The Baker Lake Site Facilities.

Approximately 70 sites of interest have been identified and detailed information on these sites are found in the Baseline Archaeology Report (Cumberland 2005h). Additionally, archaeological surveys were conducted by FMA Heritage Resources Consultants Inc. in 2007 and 2010 to supplement previous studies.

The area between Baker Lake and the Project site is considered primarily a transit route to the traditional winter hunting and fishing area of Back River, as evidenced by the many campsites and other heritage features along the corridor. Most of the sites encountered in the study area were temporary campsites and were occupied recently, probably within the last 50 years. No Pre-Dorset or Dorset sites were encountered in the study area, and only one Thule or early historic site was visited (Cumberland 2005h). Additionally, Baker Lake residents continue to hunt here and construct stone features in the traditional manner, particularly caches and tent rings. Consequently, there is a continuous temporal range which presents considerable difficulty in differentiating recent use from past use that would be considered archaeological (defined as more than 50 years old). The AWPAR was designed to avoid any potential archaeological sites.

The sites surveyed were typically small scale with one or two features of interest. The types of features encountered at the various sites included tent rings, semi-subterranean houses, autumn houses, hearths, shelters, inuksuit, markers, blinds, caches, storage features, kayak stands, fox traps, graves, campsites, kill-sites, and unidentified features. Further details can be found in the Baseline Archaeology Report (Cumberland 2005h) and the supplemental study reports (FMA 2007, 2010).

2.5 Project Facilities

2.5.1 Baker Lake Site Facilities

The Baker Lake Site Facilities are located about 2 km east of the Hamlet of Baker Lake, as shown in Figure 1.3. The Baker Lake facilities act as a transfer point and temporary storage for all dry freight and fuel materials arriving by barge prior to overland shipment to the mine site via the AWPAR. Additional details related to the facility are provided below.

Barge Landing: All construction and operating supplies for the Project are transported on ocean freight systems to Baker Lake. A barge unloading facility and a container handler receive all shipments prior to redirecting them to the mine site (MMC 2007b).

Bulk Fuel Storage Facility: The above ground Bulk Fuel Storage Facility includes six 10 Ml diesel fuel storage tanks to receive bulk shipment of diesel fuel and to provide sufficient above-ground fuel storage capacity to operate the Project for a year. The Bulk Fuel Storage Facility is located on the northeast corner of the Baker Lake Site Facility, approximately 300 m from the shore of Baker Lake. Fuel is shipped by barge to the facility, pumped from the barges to the storage tanks through a 200 mm hose, and distributed to highway vehicles or tanker trucks at a dispensing station located on the North side of the facility. The Bulk Fuel Storage Facility is used throughout the year. The tanks are located within a lined and bermed containment area capable of storing at least 110 percent of their total volume. In addition, twenty (20) - 100,000 L fuel tanks have been installed in 2013 within a lined and bermed containment pad at the fuel storage area to provide jet fuel storage capacity.

The dispensing station for the Jet A Facility is setup within an arctic container installed on a lined and compacted gravel pad. A collection sump is also located within the lined pad to collect accidental spills or leakage. A secondary containment area lined with a low permeable geomembrane provides additional fuel confinement at the fuel tank farm.

Dry Freight Storage Area: The general lay-down area of the dry freight storage area includes a terraced gravel based pad for stacking sea containers and other equipment. The area covers approximately 65,000 m^2. The roads and unloading platform of main traffic zones are covered with 1 m of compacted granular fill. The storage platforms are covered with 0.6 m of compacted granular fill to provide stable support.

Access Roads: An all-season road links the Baker Lake Site Facilities to the AWPAR leading to the mine site. Minimum road widths of 10 m and a turning radius of 50 m were used as the design criteria of the site access road (Golder 2006b). Roads have a gradient of 8% or less and are typically covered with compacted granular fill.

Water and Power Management: The general strategy for water management is to minimize sediment and pollutant mobilization by implementing best management practices during operation of the facilities. Water that has accumulated within the berms surrounding the Bulk Fuel Storage Facility is released to the environment once it is confirmed to meet all regulatory water quality criteria and approval has been granted from the government inspector.

Power for the facilities, including the office trailer, is supplied by portable generators and yard lighting is provided by portable, diesel powered light towers.

2.5.2 All-Weather Private Access Road

The All-Weather Private Access Road (AWPAR) is 108 km long and links the Hamlet of Baker Lake to the mine site, as shown in Figures 1.4a to 1.4c. The AWPAR was constructed above grade, using quarried material from non-acid generating rock. Its alignment is contained almost exclusively within the Prince River drainage to avoid stream crossings wherever possible. A total of 24 steams are crossed by the AWPAR, using 9 bridge and 15 culvert structures. Additional culverts have been installed in low lying areas to accommodate surface drainage patterns. Only six crossings occur on streams used by Arctic grayling as a migration route and/or for spawning. These streams are crossed using bridges to mitigate potential impacts to the migratory fish populations. Most of the remaining streams have little or no fisheries habitat value as they are mostly small in size and do not connect fish-bearing lakes upstream or downstream of the proposed crossing.

An additional 8 km of road was constructed between the mine site and the Vault pit in 2012. Three (3) culverts were installed at one stream crossing.

Culvert crossings were constructed using multiple full-rounded corrugated steel pipe culverts with an installation configuration consisting of a minimum of two culverts placed in an “offset stacked” configuration as defined in Golder (2007a). The bridge crossings have span lengths of either 12 m or 30 m. Five of the bridge crossings have abutments outside the watercourse (clear-span bridges) while the remaining bridge abutments encroach into the watercourse.

The road was built on two typical foundation conditions:

- Thaw susceptible soil: poorly drained, ice rich, organic or bog over bedrock; or
- Thaw stable soil: well drained over bedrock.

Table 2.17 presents the typical road design specifications based on the foundation conditions.

Table 2.17. AWPAR Typical Road Cross-Section Design Criteria

Foundation Conditions	Minimum Fill Thickness	Side Slopes	Minimum Depth ‘Granular Base’	Geotextile between Road Fill and Ground Surface
Thaw susceptible Soil (poorly drained, ice rich, organic or bog over bedrock)	1.2 m	4H:1V	0.15 m	Yes
Thaw Stable Soil (well drained over bedrock)	1.0 m	2H:1V	0.15 m	No

Graded aggregate from quarries along the road provided general road embankment fill. A total of 22 quarries were used, with rock that was determined to be not potentially acid generating (Cumberland 2005i). Finer graded road surfacing fill was obtained from further processing of the coarse aggregate. Two structural fill types were used to construct the AWPAR:

- Type 1 Fill: Minus 75 mm, well graded crushed “Granular Base”; and
- Type 2 Fill: Minus 300 mm well graded general “Rockfill”.

Additional Facilities along the AWPAR consist of 3 communication towers. Typical communication towers include the following:

- Antenna;
- Receiver/transmitter unit;
- Foundation mounts; and
- Portable generator.

2.5.3 Dikes and Saddle Dams

Non-acid generating overburden and waste rock materials produced during initial mining on the Portage Peninsula and from the pits are used for dikes and dams adjacent to the receiving environment, with the exception of a portion of the Central dike. Based on material balance estimations, sufficient quantities of suitable rockfill and till borrow materials are available for the remaining construction activities for the Central Dike and Saddle Dams 3-5.

The dikes are required to isolate mining activities from surrounding lakes (i.e., East, West Channel, South Camp and Bay-Goose dikes) or to contain tailings (i.e., Stormwater and Central Dikes, and Saddle Dams 1 to 5). All dikes and saddle dams are shown in Figure 1.2, and further details are provided below.

East Dike: Construction was started in 2008 and completed in 2009. The East Dike isolates the Tailings Storage Facilities and Portage Pit from Second Portage Lake. This dike was constructed with a rockfill shell and a compacted granular core with a downstream filter zone. A low-permeability cutoff wall consisting of soil-bentonite was constructed through the compacted granular core to bedrock. A grout curtain extends from the base of the cutoff wall into the underlying bedrock. The East Dike is founded on the lake bottom sediment and till materials with the cutoff wall and granular core zone extending to bedrock (Golder 2009). Water is seeping through this dike at a rate of approximately 1000 m^3 per day; this water is transferred to the attenuation pond. Appendix F1 provides as-built figures of the East Dike.

In 2013 AEM received a modification to the Type A Water License to allow discharge of this seepage back to 2PL. This will commence in December 2013. Once mining is completed in Goose Pit (mid-2015) this seepage will be directed to the pit as part of the re-flooding process.

West Channel Dike: The West Channel Dike was also constructed in 2008. The dike functioned to block the western outlet channel from Third Portage to Second Portage Lake, upstream of the East Dike. Following completion of the South Camp and Bay-Goose dikes, and dewatering of the Third Portage Lake area enclosed by these two dikes, the West Channel Dike was no longer required, and removed as part of the development of Portage Pit.

South Camp Dike: The South Camp Dike was built in 2009 to assist in isolating the Portage and Goose Pits from Third Portage Lake. The South Camp Dike has a broad rockfill shell with a bituminous geomembrane liner installed on the upstream side of the shell. Compacted granular material mixed with bentonite was placed above the toe of the liner. The liner was founded on native frozen (permafrost) till material or bedrock, in a trench approximately 3 to 5 m below the lakebed surface (AEM 2012b). The haul road is located on the downstream side of the dike. The dike is approximately 85 m long, with a crest width of approximately 25 m at elevation 136.6 m (minimum). Appendix F2 provides as built figures of the South Camp Dike.

Bay-Goose Dike: The Bay-Goose Dike was built over a 3-year period, from 2009 to 2011. The Bay-Goose Dike, together with the South Camp Dike, isolates the Portage and Goose Pits from Third Portage Lake. Appendix F3 presents as-built figures of the Bay-Goose Dike. The design of shallower sections, less than 8 m depth to bedrock, is based on the design for the East Dike. The design of medium depth sections, between 8 to 20 m depth to bedrock, involves either partial or full excavation of the lakebed soils to bedrock and construction of a cutoff wall to bedrock or into competent soils. The foundations were grouted to bedrock where the cutoff wall was not founded on bedrock (Golder 2013). The upstream slopes and abutments of the dike are protected against erosion and possible breaching due to wave and ice action. The downstream slopes are protected against the erosive action of runoff, seepage, flows, traffic, frost, and burrowing animals, where necessary.

Vault Dike: The Vault Dike was constructed in 2013 and isolates Vault Lake from Wally Lake, to allow mining of the Vault Pit following dewatering of Vault Lake. The Vault Dike is designed and constructed as a zoned rockfill dam with filter zones and a low permeability upstream bituminous liner tied into an upstream key trench made of aggregate mixed with bentonite (AEM 2013c). Appendix F4 presents as-built figures of the Vault Dike. Dewatering of Vault Lake commenced in 2013.

Central Dike: The Central Dike will retain tailings and limit seepage from the South Cell of the Tailings Storage Facilities towards the Portage Pit. The dike crest will be used to support tailings pipelines. The first two stages of the Central Dike have been constructed, bringing the current crest (partially) to an elevation of 120 meters above sea level (masl). Initially, the Central Dike will retain water while the South Cell functions as the attenuation pond. In 2015 (approximately at the end of March) tailings deposition will switch from the North Cell to the South Cell, at which point the Central Dike will also retain tailings. The Central Dike is founded on competent soils, with an engineered key trench extending to either bedrock or a dense till, free of pervious strata. The dike is constructed primarily of rockfill, with an upstream linear low-density polyethylene geomembrane liner tied into the key trench (Golder 2012a). The dike will be raised in stages to its current planned ultimate design elevation of 150 masl by 2016 (AEM 2013a). Appendix F5 provides figures of the ultimate Central Dike configuration.

Stormwater Dike: The Stormwater Dike provides the separation between the North and South Cells of the Tailings Storage Facilities. The dike crest will be used to support tailings pipelines and spigots. The dike is constructed with potentially acid generating rockfill and has a low hydraulic conductivity bituminous geomembrane liner on the upstream face that is keyed into the foundation soils (AEM 2013f). The first stage of the Stormwater Dike was built in 2009 to elevation 140 masl, the second stage of the Stormwater Dike was constructed in 2010 to elevation 148 masl, and in 2013 the third stage of the Stormwater Dike was completed to elevation 150 masl. Appendix F6 provides as-built figures for the Stormwater Dike constructed to 148 masl. As-built reporting for the 2013 dike raise has yet to be completed.

Saddle Dams 1 to 5: The purpose of the Saddle Dams is to retain the tailings within the Tailings Storage Facilities and limit seepage to the downstream environment. The dams also support the tailings pipelines. Saddle Dams 1 and 2 contain the tailings in the North Cell of the Tailings Storage Facilities, while Saddle Dams 3, 4 and 5 will contain the tailings in the South Cell (Figure 1.2). The first stage of Saddle Dam 1 was constructed in 2009 to an elevation of 141 masl and in 2010 was raised to its Stage 2 crest elevation of 150 masl. Construction of the first stage of Saddle Dam 2 commenced in 2010; it was completed in 2011 (Stage 2), in addition to the connection between Saddle Dam 2 and Stormwater Dike, to an elevation of 150 masl (AEM 2013f). Appendix F7 provides as-built figures for Saddle Dams 1 and 2. Construction of Saddle Dams 3, 4 and 5 is scheduled to occur in stages from 2015 through 2016.

Original designs for the mine included a 6th Saddle Dam, on the northwest corner of the Tailings Storage Facilities. In 2012, the design of the Portage Waste Rock Storage Facility (WRSF) was updated; tailings containment will be provided by the extension of the Portage WRSF over the previously planned Saddle Dam 6 footprint.

The dams are designed as rockfill structures with low hydraulic conductivity linear low density polyethylene geomembrane liners placed on the upstream face. Layered filters underlie the geomembrane liners. The geomembrane liners are tied-in to the upstream foundations. The geomembrane liner of Saddle Dam 1 is keyed into either the ice-poor native till or bedrock with a compacted till plug, while the geomembrane liners of Saddle Dams 2-5are tied to bedrock (AEM 2013f).

Rockfill Roads 1 and 2 (RF1 and RF2) are unlined rockfill dike structures that provide separation between the Tailings Storage and Portage Waste Rock Storage facilities, and a platform to support tailings pipelines and spigots. RF1 was constructed in 2009; RF2 was constructed in 2010.

2.5.4 Open Pits

The deposits will be mined as truck-and-shovel open pit operations. The ore is, or will be, extracted from the following deposits during the operational lifespan of the mine (see Figure 1.2):

- Portage deposits (Pit A, B, C, D and E);
- Goose deposit; and
- Vault deposit.

The Portage and Goose deposits are located in a centralized mining and milling area. The Portage deposits are mined as a single pit (Portage pit) that is approximately 2 km long running north-south, across Second and Third Portage lakes. The Goose deposit is approximately 1 km south of the Portage deposit, under Third Portage Lake. The Vault deposit is approximately 8 km to the north of the Portage deposit, on the shores of Vault Lake.

Mining activities are planned to 2016 in the Portage deposits, to 2015 in the Goose deposit, and from 2015 to 2018 in the Vault deposit. The tonnages of ore and waste rock extracted from the pits to date are detailed on a yearly basis in Table 2.1. Projected tonnages of ore, till, and waste rock (NPAG and PAG) extracted from the pits from 2013 to 2018 are detailed in Table 2.2.

The current mine plan predicts the total amount of ore mined will be 29.5 Mt and the total amount of waste rock (NPAG and PAG) mined will be 193 Mt. A total of 64.6 Mt and 64.7 Mt of waste rock will be deposited to the Portage and Vault Waste Rock Storage Facilities respectively, with an additional 12.4 Mt of waste rock used as backfill into the Portage Pit. The remaining till and NPAG waste rock is used for the construction of the dikes, site infrastructure, and closure cover of the Portage Waste Rock Storage Facility and Tailings Storage Facilities (AEM 2013a).

2.5.5 Waste Rock Storage Facilities

Waste rock will be stored at the Portage and Vault Waste Rock Storage Facilities (Figure 1.2). The deposition schedule is illustrated in Appendix G for the Portage and Vault facilities, respectively. In addition, approximately 12.4 Mt of waste rock will be deposited from 2013 to 2015 in Portage Pit – Central (Appendix G). Deposition tonnages at the Portage and Vault Waste Rock Storage Facilities, separated into potentially (PAG) and non-potentially (NPAG) acid generating, are summarized in Table 2.18. The resulting storage volumes, footprint area, height, and crest elevation of these two facilities are provided in Table 2.19. The crest elevations of these facilities (i.e., respectively 220 and 230 m for Portage and Vault) are of the same order of the maximum elevations of the natural regional topography (i.e., 192 and 190 m) (AEM, 2013a).

Table 2.18 Quantities of Waste Rock by Destination

Destination	Rock Type	Quantity
Portage RSF	Waste Rock (about 18% NPAG)	64.6 Mt
Portage Pit Filling	Waste Rock (about 100% PAG)	12.4 Mt
Construction – Dykes, Roads, and Infrastructure (1)	Waste Rock (about 82% NPAG and 18% PAG)	33.5 Mt
Capping	Waste Rock (about 100% NPAG)	17.5 Mt
Rock Garden	Waste Rock (about 100% PAG)	0.3 Mt
Vault RSF	Waste Rock (about 95% NPAG)	64.7 Mt

Source: AEM 2013a

Table 2.19. Physical Characteristics of Portage and Vault Rock Storage Facilities

Physical Attribute	Portage Waste Rock Facility	Vault Waste Rock Facility
Approximate storage volume (Mm^3)	38.9	34.5
Approximate footprint area (ha)	80.8	80.1
Approximate height (m)	90	82
Approximate crest elevation (masl)	220	230
Maximum elevation of adjacent natural topography (masl)	192	190

Source: AEM 2013a
$Mm^3 = 1x10^6\ m^3$

In 2012, the Portage Waste Rock Storage Facility footprint was expanded from 63 ha to 80.8 ha. This expansion allows for stockpiling of NPAG waste rock in a separate area, accessible in the future for reclamation activities and on site construction. This is considered a minor revision as total volume of waste rock has not changed significantly, leaving the ultimate Portage Waste Rock Storage Facility configuration as originally designed (AEM 2013a).

2.5.6 Tailings Storage Facilities

All tailings will be deposited within the Tailings Storage Facilities until the end of mine operations. The facility includes two cells, the North Cell, where tailings will be deposited to approximately the end of March 2015, and South Cell, where tailings will be deposited from April 2015 (approximately) to the end of the mine life (the beginning of 2018) (Figure 1.2). The date for the switch from the North to South Cell is dependent on the tailings deposition rate; the current date is estimated based on calculations in the Life of Mine. The capacity of the Tailings Storage Facilities is illustrated by the storage elevation curves presented in Appendix H.

Ice becomes trapped in tailings as a result of slurry water or runoff freezing on the deposition surface before reaching the Reclaim Pond. The total volume of stored tailings must therefore include the volume of trapped ice. The tailings deposition plan assumes a 20% ice entrapment in the tailings; the Water Management Plan updated in 2012 (SNC 2013) verifies this assumption. Ice entrapment can be managed to a large degree by effective beach management and through the implementation of appropriate operational strategies (AEM 2013a).

2.5.7 Water Management Facilities

Water management facilities have been designed in consideration of storm drainage in cold regions, the permafrost thermal regime, and the importance of control and prevention of icing within and adjacent to drainage structures. The facilities include the components detailed below.

Dewatering systems: The Second Portage dewatering system was used to pump water from the north arm of Second Portage Lake into Third Portage Lake to permit operations at the Portage Pit and Tailings Storage Facilities. The system consisted of two pumps in parallel connected to a surface pipeline that conveyed water to a treatment facility for the removal of suspended solids prior to discharge to Third Portage Lake.

Water within the Bay-Goose and South Camp dikes was discharged directly to Third Portage Lake while it met the discharge criteria for total suspended solids. Water not meeting criteria was sent to the Second Portage dewatering system for removal of suspended solids prior to release to Third Portage Lake.

A similar dewatering system was implemented in Vault Lake in September 2013 to pump water from Vault Lake to Wally Lake to permit operations in the Vault Pit. Water will be treated for the removal of suspended solids (as required) prior to discharge to Wally Lake. As of November 2013, 75% of the Vault Lake water had been discharged to Wally Lake without treatment as the effluent met water license criteria for suspended solids and turbidity (the water also met Metal Mining Effluent Regulations criteria).

Flooding systems: Following completion of mining, the pit areas will be flooded. Flooding will be carried out through a combination of:

- Precipitation;
- Surface runoff;
- Seepage from the East dike (Portage and Goose pits only);
- Transfers of water from the Reclaim Pond North Cell in 2015 and South Cell in 2018 (Portage and Goose pits only; this water may require treatment prior to transfer); and
- Pumping from Third Portage and Wally lakes.

Pit flooding has been scheduled assuming the annual water volume withdrawn from Third Portage and Wally lakes for re-flooding purposes will be lower than the spring freshet volumes, resulting in no reduction to the lake water level (SNC 2013). The rate of transfer from source lakes will be controlled through pumps or engineered structures. Where possible, the water for flooding will be taken from deep areas of the source lakes to avoid the removal of oxygenated surface waters. Water intakes will be properly screened.

Waste rock storage runoff collection systems: The topography on the Southwest side of the Portage Waste Rock Storage Facility naturally conveys surface water runoff to the Tailings Storage Facilities North Cell. To date, this runoff is minimal, generally at spring freshet only. No seeps have been identified on the Southwest side of the Portage WRSF.

On the Northeast side of the Portage WRSF seepage and surface water runoff is collected in a sump and monitored; if necessary, this water is pumped or transported to the TSF North Cell.

The topography surrounding the Vault Waste Rock Storage Facility is anticipated to convey runoff into the Vault Attenuation Pond (SNC 2013).

Water Diversion Systems: Two water diversion systems were constructed in 2012 to divert surface water from undisturbed areas on the northern perimeter of the mine site away from the Portage Waste Rock Facility and Tailings Storage Facilities. These water diversion systems were constructed in conjunction with the revised Portage WRSF design (and the elimination of Saddle Dam 6 as discussed in Section 2.5.3). The Western diversion system runs from North to Southwest, with non-contact surface runoff water conveyed to Third Portage Lake; the Eastern diversion system runs from North to Southeast, with non-contact water being conveyed to NP1-N Lake, located east of the Vault haul road (Golder 2012b). The diversions are made of a mix of berms and ditches, and two impermeable dikes. A water diversion system, if deemed necessary, will also be put in place to divert outflows from Phaser Lake away from the Vault Lake Attenuation Pond. This system, which consists of pumps and piping, is required while the natural outlet of Phaser Lake to Vault Lake is blocked to allow mining in Vault Pit. The pumps will be decommissioned at mine closure and outflows from Phaser Lake will once again be allowed to flow into Vault Lake.

Pit sump and pumping systems: Sumps will be in place for collecting water draining from pit areas. Water from the Portage and Goose pit sumps will be pumped to the Reclaim Pond and/or Portage Attenuation Pond. Water from Vault Pit will be pumped as needed to the Vault Attenuation Pond.

Tailings pipelines: Tailings will be carried as slurry through a pipeline to the Tailings Storage Facilities. Tailings slurry water that does not get trapped within the tailings mass as ice ultimately drains to the Reclaim

Pond. The location of the pipelines along the perimeter will be determined by the deposition plan and operational consideration for the development of tailings beaches.

Attenuation ponds: When the Tailings Storage Facilities North Cell is in operation (i.e., used for tailings deposition), the Portage Attenuation Pond within the South Cell will contain accumulated pit sump water and associated freshet drainage from surrounding areas. A pipeline fitted with an effluent diffuser outfall was installed in May 2012 to discharge water, as needed, after treatment for removal of suspended solids, to Third Portage Lake (Figure 1.2). The Portage Attenuation Pond will become the Reclaim Pond once the Tailings Storage Facilities South Cell is in operation (currently scheduled for early 2015 [but could possibly be in late 2014]).

The Vault Attenuation Pond will be in operation when mining occurs at Vault Pit. The pond will collect runoff from the surrounding drainage basin as well as water drained from the Vault Waste Rock Storage Facility. Collected water will be discharged, as needed, after treatment for removal of suspended solids, to Wally Lake through the Wally Lake effluent outfall diffuser.

Reclaim Ponds: The Reclaim Pond is the water body located within the active cell of the Tailings Storage Facilities (i.e., the cell, north or south, where tailings deposition occurs). The Portage Attenuation Pond will therefore, as described above, become the Reclaim Pond once the South Cell is used for tailings deposition. The Reclaim Pond collects runoff water from the Portage WRSF, precipitation and tailings slurry water. A pumping system is used to pump water from the Reclaim Pond to the Mill for ore processing.

Stormwater Management Pond (Tear Drop Lake): This water body receives drainage from the Mill and service area (i.e., treated waste water, runoff from part of the airstrip, accommodation facilities, Mill, power plant, stockpiles and contractor areas). Water from the pond is transferred to the Reclaim Pond as necessary. Water will be directed to the Portage and Goose pits, once mining at these locations is completed and flooding starts (Figure 2.1).

Freshwater intake and treatment system: This system pumps water from Third Portage Lake for human consumption and for providing fresh make-up water to the Mill for ore processing. Water used for human consumption is treated with chlorination and UV light at the accommodation facilities.

Waste water treatment system: This system treats domestic sewage from the site. The treated water is then directed to the Stormwater Management Pond (Tear Drop Lake). This wastewater treatment plant is a tertiary treatment plant designed to remove organic material and nutrients. It is comprised of a primary clarifier, 3 Rotary Biological Contactors and a final clarifier. The dewatered sludge is disposed of in the Tailings Storage Facilities.

2.5.8 Infrastructure at Mill and Service Areas

This section describes the building and other infrastructure at the mine site used to provide living quarters to the working population and to support mining processes. This infrastructure is located near the Portage and Goose pits and the Tailings Storage Facilities (Figure 1.2). Additional infrastructure has been built near the Vault Pit. Further details on the components of this infrastructure are provided below.

Accommodations: The accommodation facilities (Figure 2.2) include 11 dormitory wings (termed the Main Camp), the construction office, the dry change room, the dispatch office, the drinking water treatment facility, housekeeping and building maintenance facilities, and kitchen (with cafeteria), all connected to each other by arctic corridors that are also linked to the Mill and Service Building. The facilities are constructed of ATCO-style rigid wall modules. The dormitory wings consist of single-occupancy rooms with shared washrooms and showers (a select few rooms have single use washroom and shower). A twelfth dormitory wing is present, but not linked to the complex by an arctic corridor. A gymnasium coverall was also built as part of the accommodation facilities. Additional structures include Nova Camp (additional year-round living quarters) and the Geology tents.

Ore processing: The mining processes involved for the extraction of gold from the raw ore material include crushing, grinding, gravity concentration, thickening, leaching, carbon-in-pulp, carbon stripping and gold recovery. Cyanide destruction, tailings deposition and carbon regeneration processes are also undertaken to support the extraction processes.

The crushing process consists of reduction of the raw ore material into coarse ore by using a gyratory crusher (also called the primary crusher), a cone crusher (secondary crusher) and a tertiary cone crusher (pebble crusher). The crushed material is stored in the Ore Dome until conveyed to the mill complex to pass through the extraction processes. A total of four conveyor belts are used to carry the ore from the primary crusher to the Mill.

The Mill building is a pre-engineered steel structure supported by concrete foundations and is located beside the accommodation facilities. The ten leach tanks are within bermed secondary containment located outside, on the south side of the mill. The assay lab and SO_2 Plant, located beside the mill building, provide support to the mining processes.

Power, electric grid and fuel: The Power Plant is a diesel-fired infrastructure with six (6) generator sets (i.e., generally with some active and some on standby/service mode) for electrical load bearing flexibility and efficiency, with a capacity for providing the 15.5 MW of energy required for the operation of the mine. The plant is a pre-engineered structure, and both the building and generator assembly are mounted on concrete foundations.

A local electrical network is in place to supply buildings and other infrastructure near the power plant (i.e., accommodation facilities, Mill, Service Building, contractor area, fuel tank area, and airstrip). In addition, a network of 5KV cable is installed to reach more remote infrastructure, that is, the freshwater intake pumping station, the Reclaim Pond barge pumping station and the Emulsion Plant.

The fuel storage and dispensing area is located beside the contractor area, south of the accommodation facilities and Mill. The primary storage consists of a 5.6 Ml steel tank located within a lined bermed containment structure. A fuel unloading and distribution pump and pipeline module feed a network system throughout the Mill area, supplying fuel to the exterior day tanks at the power plant. A fuel dispensing station for supplying light and heavy vehicles is located adjacent to the storage facility.

Services: Service infrastructure consists of buildings and structures for activities supporting mining activities, the Mill and the accommodation facilities. The Service Building is the largest service infrastructure and is a pre-engineered steel structure supported on concrete foundations. This building provides offices, a warehouse, medical and emergency services area, and serves as the facility for maintenance of large mobile equipment. A coverall, near the Ore Dome and Mill, is used as a warehouse.

The contractor area, located between the fuel storage area and Mill, hosts infrastructure supporting activities by contractors hired for the Project. Infrastructure components in these areas include trailers, coveralls, and temporary structures providing garages, tool shops and storage space.

Roads: The road network at the mine site consists of a series of service and haulage roads. The total length of these roads is approximately 20 km. Service and haulage roads to and around the Vault deposit are approximately 12 km in length. The roads are constructed above grade using NPAG rock from the pit or the Airstrip Quarry. Road width varies from 10 to 20 m for service roads, and up to 40 m for haulage roads.

Airstrip: The mine site is accessible via overland travel on the AWPAR and via chartered aircraft to the airstrip. The airstrip was commissioned for use in January 2009, transporting personnel and freight, such as food and cargo, to the mine site. The airstrip is entirely overland and is located immediately north of the supporting infrastructure on the peninsula that separates 2PL and 3PL.

In April 2013, the airstrip was extended from 1495 m long to 1750 m long to accommodate a Boeing 737 jet. This reduced the approximate number of flights per week from 9 to 4.

Airstrip Quarry (Q23): This quarry is located north of the airstrip and provided material for the rockfill foundation of the building infrastructure at the mine site and for the construction of the dikes. It is now used for storage of drill core and associated equipment.

Emulsion Plant area: This area is approximately 5 km north of the accommodation facilities and includes the Emulsion Plant and two warehouses installed on a rockfill pad for the storage of ammonium-nitrate. Four explosive magazine storages on rockfill pads are also located along the access road between the AWPAR and Emulsion Plant. A freshwater intake at the nearby lake is in place to supply water to the Emulsion Plant.

Vault area: A separate mobile power plant was installed in 2013 to service a small maintenance shop, office, and emergency accommodation facilities in the vicinity of the Vault Pit.

2.5.9 Waste Management Facilities

This section describes the facilities at the mine site used to store and dispose of hazardous and non-hazardous wastes. The facilities include the components detailed below.

Landfill: Landfill #1 is currently being used for the disposal of non-hazardous, non-putrescible, non-salvageable solid waste material that cannot be incinerated. This landfill is operated as multiple ‘sub-landfills’ that have been, or will be, built and buried within the footprint of Portage WRSF (AEM 2013d). The elevation and location of these sub-landfills will change as the WRSF evolves throughout the operations phase of the Project. The sub-landfill area is bounded by a rock fill berm, to act as a wind shield. These sub-landfills will be closed and encapsulated in the Portage WRSF at the end of active mining activities.

A second landfill will be developed in a 4 m deep depression at the top of the Portage WRSF and will serve as the non-hazardous waste disposal site for the closure phase of the Project. It is expected that demolition waste from the plant site removal/reclamation will be disposed of in Landfill #2. This landfill will have an estimated waste capacity of 3,600 m^3, the equivalent of 7 years of waste disposal plus an allowance for demolition materials (AEM 2013d).

Incinerator: The incinerator is located inside a building adjacent to the fuel storage facility. The unit is a dual chamber high temperature incinerator (Figure 1.2). The primary objective of the incinerator is to dispose of on-site putrescible materials (such as paper, cardboard, food waste and other organic type materials), thus diverting materials from the landfill that could create odours, attracting wildlife to the mine site. The mine site has implemented a waste disposal segregation program to ensure wastes are disposed of in the appropriate manner.

Hazardous material storage area: An area adjacent to the primary incinerator has been set up for the storage of hazardous wastes and other liquid waste and solid materials (Figure 1.2), including used waste oil, batteries, and tires. Materials are segregated and stored in drums inside closed secured seacans. Annually materials are transported to the Baker Lake Site Facilities and barged to a southern location for disposal or recycling at a licensed facility (AEM 2012).

Landfarm: Constructed in 2012, the landfarm is used to treat petroleum contaminated soils at the mine site. It is located adjacent to the North Cell TSF, with a surface area of 3,712 m^2. The landfarm has the capacity to store and treat up to 11,136 m^3 of contaminated soil, well in excess of estimated volumes for the Project (AEM 2013e).

3.0 PERMANENT CLOSURE AND RECLAMATION

3.1 Definition of Permanent Closure

Permanent closure is defined as the final closure of the mine site after mining has ceased. Permanent closure is typically a planned event, the timing of which is dependent on the mine life of the project. Permanent closure could also occur on an unplanned basis. While this is not anticipated, such a closure would likely follow a temporary long-term closure (see Section 5). In that case, AEM would make a final decision not to restart operations, and permanent closure activities would be implemented.

At permanent closure, AEM would not anticipate further exploration, mining, or processing activities at the site. The site would therefore be closed and reclaimed based on objectives and designs set out in the final Closure and Reclamation Plan. In accordance with Part J of the water license (NWB 2008), AEM will prepare and submit the final Closure and Reclamation Plan 12 months prior to the expected end of mining activities (currently scheduled for early 2018). Detailed closure designs will be available in that plan for mine components that, due to the level of development to date, are currently described in this ICRP at a conceptual level.

3.2 Permanent Closure Objectives and Criteria

There are a number of environmental and safety considerations to address when mines are closed. Environment Canada's *Environmental Code of Practice for Metal Mines* summarizes the key objectives of mine closure as follows (adapted from EC 2009):

- Ensure public and wildlife safety by preventing inadvertent access to mine openings and other infrastructure;
- Provide for the stable, long-term storage of waste rock and tailings;
- Ensure that the site is self-sustaining and prevent or minimize environmental impacts; and
- Rehabilitate disturbed areas for a specified land use (e.g., return of disturbed areas to a natural state or other acceptable land use).

While the general objectives above apply to the project as a whole, there are also closure considerations specific to the different mine components. A summary of relevant aspects is shown in Table 3.1, with additional detail provided in the sub-sections of Section 3.3.

Table 3.1. Mine Components and Closure Considerations

Mine Component	Closure Considerations
Open Pits and Quarries	■ Slope and bench stability ■ Groundwater and rainwater management ■ Security and unauthorized access ■ Wildlife entrapment ■ Effects of drainage into and from the pit/quarry

Mine Component	Closure Considerations
Waste Rock Storage Facilities	■ Slope stability ■ Effects of leaching and seepage on surface and groundwater ■ Dust generation ■ Visual impact
Tailings Storage Facilities	■ Embankment stability ■ Changes in tailings geochemistry ■ Effects of seepage ■ Surface water management and discharge ■ Dust generation ■ Access and security
Water Management Facilities	■ Restoration or removal of dikes, settling ponds, sumps, pumps, pipelines, and/or culverts which are no longer needed ■ Site surface water drainage and discharge ■ Maintenance of closure water management facilities
Infrastructure at Mill and Camp	■ Removal of buildings and foundations ■ Clean-up of workshops, fuel and reagents ■ Removal of power and water supply ■ Removal of haul and access roads ■ Disposal of scrap and waste materials ■ Re-profiling of site
Landfill/Waste Disposal Facilities	■ Disposal or removal from site of hazardous wastes ■ Disposal and stability of treatment sludge ■ Removal of sewage and water treatment plants ■ Prevention of groundwater contamination

Source: adapted from EC 2009, Table 3.4

Closure criteria are used to measure the success of meeting closure objectives. Specific objectives and closure criteria have not been detailed and finalized for the Project to date; however, they will be developed as part of ongoing closure planning. The following are examples of the types of criteria that will be applied:

- Applicable water quality criteria or guidelines;
- Target surface water and/or permafrost levels;
- Evidence of post-closure wildlife and fish use; and
- Satisfactory inspections related to drainage and slope stability.

3.3 Permanent Closure and Reclamation Plan

3.3.1 End Land Use and General Site Rehabilitation

The selection of closure approach for the Project, as well as specific closure activities by mine component, is guided by the intended end land use of the area. Based on stakeholder and local community consultation to date, the intended end land use for project-affected areas is (a return to) the "natural" state. As such, closure activities are focused on decommissioning mine components so that they blend into the existing landscape to the extent possible.

As discussed in Section 2.4, the landscape in the mine area is dominated by water, wetlands, and rock and boulders. The main type of vegetation is sedge which tends to occur in areas of shallow water. Lichens, mosses, and grasses also occur in drier parts and among the boulder fields. Along the AWPAR, the terrain is predominantly heath tundra. Secondary vegetation and landscape types along the road route are characterized by lichens, birch and riparian shrubs, and areas of standing water.

AEM will re-contour and grade the general mine area, including roads, to promote proper drainage of surface runoff and to provide a ground profile consistent with the surroundings. Reclamation efforts will focus on providing conditions conducive to natural re-colonization of the site by the surrounding native vegetation. Large-scale re-vegetation of the site is not considered feasible at this time as there is no readily-available seed material for native plants. In addition, there is a lack of available organic soils in the Project area which, in conjunction with the tough climatic conditions (short cold and dry growing seasons), makes it difficult to establish vegetation over large areas.

The open pit areas will also be returned to a "natural" state by flooding and re-creating open water areas. This is consistent with the pre-development landscape in the mine area.

Figure 2.1 presents the post-closure concept for the Project. Visual representations of the final landscape, including maps and three-dimensional views of the area, will be developed in the final closure design.

3.3.2 Baker Lake Site Facilities

The Baker Lake Site Facilities consist of the Bulk Fuel Storage Facility, dry freight storage area, barge landing, office trailer, and interconnecting access roads.

3.3.2.1 Closure Objectives

General closure objectives related to site infrastructure, and applicable to the Baker Lake Site Facilities, are provided in INAC (2007). These include:

- Ensure buildings and equipment do not become a source of contamination or a safety hazard to wildlife and humans;
- Return area to its original state or to a condition compatible with the end land-use targets;
- Restore natural drainage patterns where surface infrastructure has been removed; and
- Restore the area for natural use by wildlife.

3.3.2.2 Closure and Reclamation Options

Generic closure options related to infrastructure, including the above ground Bulk Fuel (diesel and jet fuel) Storage Facility, are provided in INAC (2007). Options relevant to the Baker Lake Site Facilities include (adapted from INAC 2007):

- Dismantle all buildings that are not necessary to achieve the future land use target;
- Cover foundations with materials conducive to vegetation growth;
- Where approved, break or perforate concrete floor slabs and walls to create a free draining condition in order that vegetation can be established;
- Bury materials in the unsaturated zone or below the active layer;
- Decontaminate equipment (free of any batteries, fuels, oils, or other deleterious substances) and reuse or offer it to community interests;
- Cut, shred or crush and break demolition debris to minimize the void volume during disposal; and
- Remove all hazardous materials and chemicals prior to demolition to national approved hazardous material treatment facilities, or recycle, reuse, or dispose of in an appropriate manner upon approval from the regulatory authorities.

3.3.2.3 Planned Reclamation Approach and Activities

At closure, AEM will offer the infrastructure at the Baker Lake Site Facilities to local interests. If there is no local interest in the facilities or equipment it will be decommissioned and removed as appropriate.

To the extent possible, AEM will return the Baker Lake site to pre-development conditions. The site may also be left in a semi-industrial condition if consistent with a different end land use agreed upon with regulators, the Hamlet of Baker Lake, and other local interest.

At closure, all remaining bulk fuel on site will be removed and offered to local interests. The tanks will be cleaned and, again offered for local use. If there is no local interest in the tanks (or steel), they will be barged out of Baker Lake to a southern destination for sale or sold as scrap metal.

After removal of the Bulk Fuel Storage Facility, any contaminated soils from the facility will be removed and placed in sealed drums. This material will be transported to the mine site landfarm for biological treatment, or barged out of Baker Lake to a southern destination for treatment and disposal.

At closure, any buildings or infrastructure on site, including the office trailer and barge landing, will be emptied (if applicable) and offered for local use and/or relocation. If there is no local interest, the infrastructure will be demolished. Demolition waste will be transported to the mine site for landfill disposal or barged out of Baker Lake to a southern waste disposal or recycling facility.

Disturbed areas, including gravel pads and roadways, will be scarified to loosen the compacted material and facilitate natural re-colonization of vegetation from surrounding areas. The areas will be re-contoured to promote surface drainage, and culverts will be removed from the roadways to re-establish natural drainage patterns.

3.3.2.4 Uncertainties and Assessing Information Gaps

The main uncertainty related to closure of the Baker Lake Site Facilities is whether there will be any interest in maintaining the Bulk Fuel Storage Facility and/or Barge Landing areas for use by the local community. Should it be deemed in the public interest based on guidance and approval from the local community and regulatory agencies, the site facilities will be left intact. Once agreed upon, responsibility for the operation and maintenance of the facilities would then be transferred to the local interested party.

3.3.3 All-Weather Private Access Road

During the mine closure phase of the Project, the AWPAR will be used to demobilize equipment and backhaul materials to Baker Lake for transport to a southern location. The road will also be used for site access during the early post-closure monitoring period.

At closure, AEM will consider the option of leaving the AWPAR intact if it is deemed in the public interest based on guidance and approval from local communities and regulatory agencies. Once agreed upon, road operation and maintenance responsibility would then be transferred to the local party. If there is no local interest in maintaining the road, the year after the dikes are scheduled to be breached (2030), the AWPAR will be permanently decommissioned and the right-of-way reclaimed.

3.3.3.1 Closure Objectives

General objectives and recommendations related to the closure of roads and quarries include the following (adapted from INAC 2007 and EC 2009):

- Preserve the main access road to the site in a sufficient condition to allow post-closure access for monitoring, inspection and maintenance activities; and;

- Reclaim roads that will not be preserved for post-closure use (R519, EC 2009) by returning area to its original state or to a state compatible with the desired end use through;
  - Removing bridges, culverts and pipes; restoring natural stream flow and drainage patterns; stabilizing stream banks by using rip-rap;
  - Rehabilitating surfaces, shoulders, escarpments, steep slopes, regular and irregular benches, etc., to prevent erosion; and
  - Scarifying surfaces and shoulders and blend into natural contours.

Closure objectives specific to the AWPAR and quarries are as follows:

- To render the road right-of-way impassable to limit future access;
- To restore the natural drainage pattern;
- To reclaim quarries and borrow areas by providing safe long-term conditions; and
- To remove other infrastructure along the road route, including communication towers.

3.3.3.2 Closure and Reclamation Options

Generic options for road closure and the quarries are provided in INAC (2007). Options relevant to the Meadowbank Project include:

- Remove structures including bridges and culverts;
- Reclaim areas to the original topography and drainage or to a new topography or drainage compatible with end land use targets;
- Scarify road surfaces to promote re-vegetation of indigenous species;
- Allow gradual slope failure of pits involving rock masses or slope pit walls;
- Block quarry access routes with boulder fences, berms and/or inukshuks (guidance from local communities and elders would be sought); and
- Flatten berms and slopes at the side of roads to facilitate wildlife passage.

During the environmental assessment of the Project, significant concern was raised over the potential impact on wildlife populations from ease of hunting access over the AWPAR. Based on those concerns, and as a condition of the Project Certificate, AEM committed to manage the road as a private road with limited public access during the mine life and to fully decommission the road after closure. AEM will consider the option of leaving the AWPAR intact if it is deemed in the public interest based on guidance and approval from local communities and regulatory agencies. If agreed upon, road operation and maintenance responsibility would then be transferred to another party.

3.3.3.3 Planned Reclamation Approach and Activities

Reclamation of the AWPAR will involve re-establishing natural drainage courses and addressing the road surface and right-of-way so that it facilitates wildlife passage but is impassable to vehicles. Quarries and borrow areas along the route will be reclaimed, and any infrastructure will be removed.

Road Surface and Right-of-Way

At final decommissioning of the AWPAR, AEM will "rip" the entire road surface to make it as impassable as possible to motorized vehicles. The ripping of the road bed will be accomplished with successive passes by a dozer longitudinally along the road bed to eliminate the level road surface and make travel difficult. The abandoned road is not anticipated to be used (or be desirable for use) by snowmobile, ATV or other vehicles during either the snow-free or snow-cover period. Adjacent undisturbed tundra areas will offer easier access for such vehicles, as occurred pre-development and prior to construction of the road.

Ripping of the road bed will also provide more favourable conditions for natural vegetation re-colonization by loosening the compacted road material. Vegetation will be able to establish itself more easily given the finer material exposed, voids created, and increased potential to retain moisture in the typically dry conditions.

Road deactivation works will also include the stabilization of low cut and fill slopes where potential for slope erosion exists. Stabilization measures may involve pulling back of side cast fill on locally steep slopes, or buttressing and/or re-contouring of steepened cut slopes using non-acid generating material. The road embankments will be re-contoured to better blend with the existing topography and to allow for safe wildlife passage.

Natural Drainage

Decommissioning of the AWPAR will involve restoring, to the extent possible, the pre-development drainage patterns along the route. Natural drainage courses will be restored by removing the culverts and bridges, removing road fill material, and removing in-stream works down to the original channel bed. Cross-drain structures (cross-ditches) may also be installed where warranted. Banks at the crossing sites will be stabilized and, where possible, the natural grade of channels will be re-established. Back-grading of the crossing locations and/or armouring of the exposed or disturbed areas may be warranted. Any armouring rock (riprap) that is installed will be non-acid generating.

Where affected watercourses are fish-bearing, channel beds will be re-constructed similar to baseline conditions. Work at these sites will consider appropriate timing for in-stream works and will be completed in accordance with DFO operational statements. Details on the channel bed reclamation will be included in the detailed engineering for closure.

All in-stream works will be carried out using best management practices for erosion and sediment control and will follow DFO operational statements. In general, the following will be considered:

- activities within the channel areas and in other disturbed areas will be minimized and conducted during the fisheries window or winter period;
- any required stockpiles of materials will be located away from watercourses and stabilized against erosion (e.g., with geotextile cover or use of perimeter sediment control measures);

- if appropriate, silt fences will be installed along the reclamation area to control the release of eroded sediments until a permanent cover can be established;
- silt curtains (or suitable alternative) will be installed in areas of concentrated flow within the watercourse channels during closure and reclamation activities;
- upon completion of closure and reclamation activities, accumulated sediment, debris and other work-related material will be removed for proper disposal; and
- regular site inspections will be conducted during closure and reclamation.

Quarries and Borrow Sources

The AWPAR was constructed using material from 22 quarries (including borrow sources) along the route. Fill material produced by the quarries (rockfill and granular base) were determined to be non-potentially acid generating based on Cumberland (2005i). The quarries will remain active during operations to supply material for road maintenance. Decommissioning of the AWPAR quarries and borrow sources will involve the following activities:

- All equipment (e.g. crushers) will be decommissioned and removed from the quarries;
- All garbage and other debris will be removed from the quarries and transported either to the Meadowbank Project site or to the Baker Lake Site Facilities for appropriate disposal;
- Remaining quarried rock material will either be used for reclamation purposes elsewhere (e.g., erosion protection at decommissioned stream crossings) or spread over the base of the respective quarry site;
- The quarry high walls will be laid back to a 1H:1V side slope to promote long-term stability;
- The base of the quarries will be graded to provide unrestricted drainage of runoff to the surrounding tundra, and to prevent the ponding or collection of water on the sites;
- If acid generating bedrock is exposed in a rock cut or quarry, these areas will be covered with a minimum 2 m thick layer of non-acid generating cover, graded to direct water away from the bedrock exposure;
- The quarry access roads will be decommissioned by removing any culverts, back-grading the watercourse banks, and ripping the road surface; and
- Access into each quarry area will be blocked by placing a rock pile approximately 2 m in height across the entryway to prevent easy access by wheeled vehicles.

Infrastructure along the AWPAR

Decommissioning of the communication towers along the AWPAR will involve removal of equipment for transport back to the Baker Lake Site Facilities, scarifying of the rockfill foundation areas, and general grading of the areas to blend with the surrounding topography.

3.3.3.4 Uncertainties and Assessing Information Gaps

The current plan for closure of the AWPAR involves decommissioning of the road and right-of-way. There is some uncertainty regarding the transfer of ownership of the road to the local community. Should it be deemed in the public interest based on guidance and approval from the local community and regulatory agencies, the AWPAR will be left intact. Road operation and maintenance responsibility would then be transferred to another party.

3.3.4 Dikes and Saddle Dams

As described in Section 2.5.3, the Project includes a number of dikes that have been or will be built for both water management and tailings management purposes. The East, South Camp, Bay-Goose, and Vault dikes isolate mining activities from surrounding lakes, and the Stormwater and Central Dikes, and Saddle Dams 1 to 5 contain tailings.

After the mine pits are completed they will be flooded as part of the closure plan. Once the pits are full and acceptable water quality has been demonstrated, the Bay-Goose, South Camp, and Vault dikes will be breached. The pit "lakes" will then be reconnected to the existing lake and surface water system.

3.3.4.1 Closure Objectives

Closure objectives of the dikes are related to both the physical stability of the earth structures and the closure objectives of the mine pits. General objectives relevant to the Project include (adapted from INAC 2007):

- Ensure physical stability of residual earth structures for environmental, human, and wildlife safety;
- Stabilize slopes surrounding the tailings impoundment system;
- Minimize catastrophic and/or chronic release of tailings based on associated risk;
- Minimize the threat that the impoundment becomes a source of contamination;
- Blend with local topography and vegetation where appropriate;
- Allow emergency access and escape routes from flooded pits;
- Meet water quality objectives for any discharge from pits;
- Stabilize slopes to minimize erosion and slumping;
- Establish in-pit water habitat where feasible for flooded pits; and
- Dismantle and remove as much of the water management system as possible and restore natural or establish new drainage patterns.

Environment Canada also provides the following recommendations of relevance to the Project dikes (adapted from EC 2009):

- Conduct detailed inspections and assessments of tailings management facilities, particularly dams and other containment structures to evaluate the actual performance against design projections related to anticipated post-closure conditions (adapted from R524, EC 2009);
- Conduct a comprehensive risk assessment to evaluate long-term risks associated with possible failure modes for tailings management facilities, and associated impacts, parameters, and management strategies (adapted from R525, EC 2009); and
- Evaluate and revise water management plans; identify water management structures that are no longer needed, continue to be needed, or need to be modified.

For the Project, specific objectives for dike closure are closely related to the following:

- Controlled flooding rate of the open pits; and
- Resulting water quality in the completely flooded open pits.

Project specific closure and reclamation objectives options, approaches and activities, and closure gaps relating to the TSF are discussed in Section 3.3.7.

3.3.4.2 Closure and Reclamation Options

Generic options relevant to mine closure are provided in INAC (2007) and include:

- Stabilize embankments by removing weak or unstable materials from slopes and foundations and/or construct toe berms to flatten overall slope;
- Breach water retention dams and drain impoundments, avoid post closure impoundment of water when possible; and
- Conduct reclamation risk assessments for design criteria of dams, spillways, and covers.

The closure options noted above were reviewed for applicability to the Project. All of the dikes have been designed and have been / will be constructed for long-term stability. As such, no additional stabilization measures are anticipated at closure. If an unacceptable level of risk is identified, however, such measures will be implemented. The option for breaching water retention dikes will be employed once the mine pits are flooded and acceptable water quality has been demonstrated.

3.3.4.3 Planned Reclamation Approach and Activities

Once the Portage and Goose pits are completely flooded and monitoring and testing has determined that pit lake water meets MMER and drinking water quality criteria, the South Camp Dike and south end of the Bay-Goose Dike will be breached.

The location of breaching on the Bay-Goose Dike will be selected based on a desired attenuation period in which surface water runoff will mix with the pit lake water before discharge to Third Portage Lake. Currently, it is estimated that a total of about 200 m of the dike will be breached in two sections. The dike will be breached to 3 m below the average water level in Third Portage Lake (134.1 m elevation) to provide all-season aquatic access across the dike. Sides of the breached sections will be pulled back for long-term stability. Erosion control measures will be considered before breaching the dike, and could include backfilling the excavated till core with rockfill or placing rockfill on the inside of the dike to control inflow.

The South Camp Dike will be breached in a similar manner; however the depth of breach will be limited to the natural lake bed elevation in the region of the breach which may be less than 3 m below average water level. The Vault Dike will be breached in a similar manner to the South Camp Dike once Vault pit is flooded and water quality is demonstrated to be acceptable for mixing with Wally Lake. The East Dike will remain, preserving the 1 m difference in elevation between Third Portage and Second Portage Lakes. Similarly, the Central Dike will remain to contain the stored mine tailings.

Following demonstration that drainage from the TSF is of acceptable water quality, Saddle Dam 3 will be breached as part of closure of the TSF, as discussed in Section 3.3.7. This will allow surface runoff from the area to be directed to Third Portage Lake.

3.3.4.4 Uncertainties and Assessing Information Gaps

No uncertainties or information gaps have been identified related to closure of the dikes. Although detailed design of the dike breaches is not currently available, this will be completed during the later stages of operations prior to closure. Uncertainties related to water quality within the pit lakes, prior to dike breach, are addressed in Section 3.3.5.

3.3.5 Open Pits

Open pit development will be staged over the course of mining operations. The Portage and Goose pits will be mined first and mining of Vault pit will be undertaken starting in early 2014. The open pits are designed to have stable slopes during the mine life and post-closure. The slopes will be monitored as part of mine operations and will be progressively modified as required to maintain stability.

At the end of active mining operations, rock berms will be placed around exposed perimeters of the pits to restrict access and minimize hazards to people and wildlife. Flooding of Portage and Goose pits will commence prior to the completion of mining activities at Vault. All of the pits will be flooded over a period of several years, with an estimated completion by 2023/2024.

3.3.5.1 Closure Objectives

General objectives related to closure of open pits are provided in INAC (2007) and include:

- Minimize access to protect human and wildlife safety;
- Allow emergency access and escape routes from flooded pits;
- Implement water management strategies to minimize and control migration and discharge of contaminated drainage, and if required, collect and treat contaminated water;

- Meet water quality objectives for any discharge from pits;
- Stabilize slopes to minimize erosion and slumping;
- Meet end land use target for resulting surface expression;
- Establish original or desired new surface drainage patterns; and
- Establish in-pit water habitat where feasible for flooded pits.

Other recommendations are presented in the Code of Practice for Metal Mines as follows (adapted from EC 2009):

- If it is technically and economically feasible to do so, infrastructure (e.g., crushers, metal structures and air pipes) and equipment (e.g., pumps) should be removed from the site. Any equipment to be left in the pit should be inspected and remediated as appropriate to ensure that there is no risk of leakage of any contaminants (R506).
- During decommissioning, any contamination associated with vehicle and equipment operations and maintenance should be identified and remediated, as appropriate (R507).
- Open pits should be backfilled or flooded to the extent practicable to prevent unauthorized access and to protect public safety. In cases where backfilling or flooding is not practically feasible, fencing should be installed to protect the public. In all cases, signs should be posted warning the public of potential dangers associated with the site (R510).
- The potential for mine water discharges should be assessed. For open pit mines, this may be done using water balance calculations and, in some cases, hydrogeological assessment. Where mine water discharge is predicted, the flow rate should be estimated (R511).
- Where there is the potential of mine water discharge after mine closure, the quality of the discharge should be predicted. Mine water quality should be assessed once closure has been completed to verify the accuracy of the predictions (R512).
- Where there is the potential of mine water discharge of poor quality, measures should be implemented to prevent or control that discharge and to collect the mine water for treatment. Prevention methods may include capping of mine openings to prevent mine water discharge (R513).

3.3.5.2 Closure and Reclamation Options

Generic options for open pit closure are provided in INAC (2007). Options relevant to the Project include:

- For multiple pits, sequentially backfill with waste rock as operations proceed;
- Backfill open pits with appropriate materials (e.g. waste rock);
- Flood the open pits (natural or accelerated);
- Allow gradual slope failure of pits involving rock masses, or slope pit walls;

- Block open pit access routes with boulder fences, berms, and/or inukshuks (guidance from local communities and Elders should be sought);
- Post warning signs (with visible symbols placed close enough so they are visible from one to another) and fences or berms around the perimeters for actively managed sites (not acceptable for remote sites into the long-term);
- Long-term fencing to prevent access may only be appropriate if the mine site is located close to a community where regular access for maintenance is possible and where there is a higher risk of access by the general population;
- Cover slopes with rip rap thick enough to provide insulation or stabilization to minimize erosion or permafrost degradation;
- Stabilize exposed soil along the pit crest or underlying poor quality bedrock that threatens to undermine the soil slope above the final pit water level;
- Back-brush area to improve visibility;
- Plug drill holes;
- Maintain an access/egress ramp down to water level for flooded pits;
- Contour to discourage or encourage surface water drainage into pits where appropriate;
- Cover exposed pit walls to control reactions where necessary;
- Collect waters in pit that do not meet the discharge criteria and treat passively (active treatment is not acceptable for the long term);
- Breach diversion ditches and establish new water drainage channel; and
- Promote and monitor the establishment of aquatic life in flooded pits.

The closure options noted above were reviewed for applicability to the Project. With a few exceptions, all of the closure options could potentially be applied. The use of safety berms to secure the pit perimeters would be preferable over fencing due to the lower maintenance requirements at this remote location. Pit walls will be designed for long-term slope stability; therefore AEM does not intend to establish long-term stable slopes by allowing gradual failure of rock masses. In addition, the option for covering slopes with rip rap will not be applied as the priority is for pit flooding given the end land use target of recreating open water areas.

3.3.5.3 Planned Reclamation Approach and Activities

At the end of mining, all pit equipment will be removed from the pits and closure activities will proceed. The mined-out Portage Pit will be used for the final placement and permanent storage of waste rock. The effects of waste rock disposal in pits have been considered in operational and post-closure water quality assessments, the results of which are described in the mine site water management plan (SNC 2013). After disposal of these materials, all pit access ramps will be blocked using rock barricades, safety berms will be constructed around the pit perimeters, and warning signs will be installed. Emergency egress routes will be provided. At the pit crest, exposed areas will be stabilized and surrounding area contoured so that runoff is directed into the pits.

The open pits will be flooded once mining activities in each open pit are complete. Flooding will occur by allowing the natural accumulation of seepage and surface water drainage reporting to the pit to remain in place, the transfer of water from ponds in the mine site, and the diversion of water at controlled rates from the surrounding lakes using high-capacity mechanical pump systems or siphons. The Goose Pit should begin flooding in 2015 by pumping water from Third Portage Lake and diverting Portage Pit and East Dike seepage water, and the Portage Pit would start to flood in 2017. Both pits are predicted to reach the same water level as Third Portage Lake (134.1 m) by 2023 (SNC 2013). Excess reclaim water from the North Cell of the TSF will also be used to re-flood the pits starting in 2015. Water quality modeling will be completed in 2014 and 2015 to determine if treatment is necessary. Likewise, Vault Pit will be flooded by pumping from Wally Lake once mining at Vault is complete. This is expected to commence in 2018.

To minimize impacts to aquatic habitat in the surrounding lakes, it is anticipated that transfers from Third Portage and Wally lakes will be done during periods of higher water in the spring and summer months. Maximum fill rates will depend on acceptable draw down levels in each source lake. Throughout the pit flooding phase, the dikes will remain in place, acting as barriers for water migration between the pit lake and the surrounding lakes and environment.

At closure, the walls of the mined-out open pits will have been exposed for several years during mine operation, and some oxidation will have occurred. During flooding, water quality will likely be affected by slightly increased concentrations of dissolved metals, potentially lower pH, and blasting residues. Water quality concentrations in the Portage and Goose pit lakes are predicted to meet Canadian Council of Ministers of the Environment (CCME) freshwater aquatic life guidelines, with the exception of copper (Portage and Goose pit lakes), iron (Goose Pit Lake) and potentially ammonia (SNC 2013). AEM will update the water balance and water quality model annually from 2013 to closure to evaluate pit water quality and verify if water treatment will be required. At this time it has been assumed that no further closure measures will be necessary to address exposed pit walls and pit water quality at closure.

As described in Section 3.3.4, breaching of the water retention dikes will not occur until acceptable water quality has been demonstrated.

3.3.5.4 Uncertainties and Assessing Information Gaps

The following uncertainties have been identified with respect to closure planning of the open pits:

- Water quality of the final pit lakes prior to breaching of the containment dikes and free mixing with adjacent water bodies; and
- Flood rate for filling the open pits at closure, and length of time to achieve target water levels.

Water quality monitoring will continue during operations to expand the available water quality database. Monitoring will include water quality in the open pits, the results of which will be used to annually review and update the water balance and water quality model to identify any concerns prior to closure.

3.3.6 Waste Rock Storage Facilities

Some of the waste rock generated from the open pit mining is considered potentially acid-generating (PAG). All iron formation, quartzite and a portion of intermediate volcanic rock are either PAG or have an uncertain potential to generate ARD, while the ultramafic rocks and most of the intermediate volcanic rocks are expected to be NPAG.

Waste rock from mining operations will be stored primarily at the Portage (64.6 Mt) and Vault (64.7 Mt) Waste Rock Storage Facilities (WRSF). In addition, from Years 2013 to 2015, approximately 12.4 Mt of waste rock generated from the Portage and Goose pits will be backfilled into the completed portion of the Portage Pit.

Suitable waste rock material will also be used for construction purposes associated with dikes and roads.

3.3.6.1 Closure Objectives

General objectives related to closure of waste rock storage facilities are provided in INAC (2007) and include:

- Minimize erosion, thaw settlement, slope failure, collapse or the release of contaminants or sediments;
- Build to blend in with current topography, be compatible with wildlife use, and/or meet future land use targets; and
- Build to minimize the overall project footprint.

Other recommendations are presented in the Code of Practice for Metal Mines as follows (adapted from EC 2009):

- Carry out detailed inspections and assessments of waste rock piles. The objective of these inspections and assessments is to evaluate the actual performance against design projections related to anticipated post-closure conditions (R524).
- Conduct a comprehensive risk assessment for mine closure to evaluate the long-term risks associated with possible failure modes for waste rock piles. Identify possible impacts and critical parameters, and develop control strategies (R525). If warranted, implement a long-term monitoring plan (R526).
- Re-evaluate, and revise as necessary, plans for the management of waste rock to prevent, and control and treat metal leaching and acidic drainage to ensure that they are consistent with the objectives and plans for mine closure and post closure (R527). If warranted, implement a long-term site-specific monitoring program (R538).

3.3.6.2 Closure and Reclamation Options

Generic options for closure of waste rock storage facilities are provided in INAC (2007). Options relevant to the Project include:

- Grade crest if required or construct toe berm to flatten the overall slope;
- Remove weak or unstable materials from slopes and foundations;

- Off-load materials from the crest of the slope;
- Leave waste piles composed of durable rock "as is" at the end of mining if there is no concern for deep-seated failure or erosion, and if the end land use targets can be achieved;
- Cover to control reactions and/or migration (re-slope to allow for cover placement if necessary);
- Place riprap insulation/stabilizing layer;
- Freeze waste into permafrost;
- Place Potentially Acid Generating (PAG) rock underwater or underground if viable;
- Place Potentially Acid Generating (PAG) rock within the centre of the waste pile so it is encapsulated by permafrost if conditions permit and underwater or underground disposal are not viable options;
- Construct collection systems to collect contaminated runoff or leachate;
- Construct diversion ditches to divert uncontaminated runoff;
- Install horizontal drains or pump leachate from relief wells at the toe of the slope;
- Passively treat contaminated waters where necessary, active treatment is not acceptable for the long term;
- Use benign waste rock as backfill in open pits, or for construction material such as ramps or covers;
- Re-vegetate using indigenous species or use other biotechnical measures (use of living organisms or other biological systems for environmental management) to reduce surface erosion;
- Re-slope, contour, and/or construct ramps to facilitate wildlife access; and
- Include records of construction drawings, as-built drawings, location of landfill sites, and potential ARD materials and other contaminated materials which are contained within the rock pile in the reclamation research plan.

The closure options noted above were reviewed for applicability to the Project. Many of the options are directly applicable and have been incorporated into the mine plan and closure design. Where a series of options is available to address a particular closure concern, one option or a subset of options is often preferred and can adequately address the concern. In these cases, the remaining options do not require further consideration. An example of this is the Waste Rock Storage Facilities which will be designed and constructed to ensure long-term stability. At closure, the landforms will also be consistent with the end-land use of “natural” conditions and the facilities will therefore be left “as-is”. No additional earthworks at the crest or base of the embankments (or re-vegetation of the slopes) will be required to ensure long-term stability or to meet end land use objectives.

The closure options related to collection and management of contaminated runoff or leachate (e.g., Waste Rock Storage Facilities runoff collection systems) are discussed in Section 3.3.8. Such water management infrastructure will be maintained until water quality monitoring indicates that they are no longer required.

3.3.6.3 Planned Reclamation Approach and Activities

The overall waste rock management approach involves a combination of above-ground storage and in-pit placement (backfill). A smaller volume will also be used for site development and construction purposes. Physical stability will be achieved by the design of acceptable slopes for the WRSFs, and geochemical stability, where warranted, will be achieved by covering PAG materials with suitable waste rock or water. Runoff diversions will also be implemented to limit contact with waste materials.

In the first years of mining, waste rock from Portage Pit that is not used for site development will be deposited in the Portage WRSF. The Portage WRSF has been designed for long-term stability in terms of rock lifts, bench heights, and overall slope. The ultimate slopes and crest elevations are comparable to the hills of surrounding areas, and the final profiles will be consistent with the final intended land-use of the area. Although all rock placed in the WRSFs is expected to freeze, facility design in terms of permanent physical stability is not dependent on freezing. At closure no additional measures are anticipated to be required to further stabilize the facilities. A risk assessment will be conducted to confirm these assumptions; if any risks are identified, they will be managed through monitoring and/or mitigation works which could include such options as flattening the overall slope or redirecting additional waste rock to in-pit storage.

Although no closure works are anticipated to address physical stability concerns, the Portage WRSF will be covered by a layer of NPAG rock to ensure geochemical stability by insulating PAG materials and keeping the waste rock frozen. The cover will also serve to control reactions and migration of runoff to PAG materials. Closure design plans and sections for the Portage WRSF, including the types and volumes of materials, are provided in the Updated Mine Waste Rock and Tailings Management Plan (AEM 2013a). Based on the plan, the assumed cover thickness is 4 m of NPAG rock placed over the whole WRSF. Investigations and cover trials will be conducted to verify this thickness layer, and adjustments to the closure design will be made as appropriate.

In the latter years of mining, some of the Portage and Goose Pit waste rock will also be backfilled into a completed portion of the Portage Pit, to be flooded at closure. The water cover will limit potential for Acid Rock Drainage (ARD) and Metal Leaching (ML).

Waste material from mining at Vault Pit will be deposited in the Vault WRSF. The same design principles as with the Portage WRSF have been (or will be) applied with respect to physical stability. Similar to the Portage WRSF, no additional measures will be required at closure to ensure long-term stability. A risk assessment will also be conducted to verify these assumptions.

The bulk of waste rock generated from Vault Pit is expected to be NPAG; therefore, no special handling or cover requirements will be required from a geochemical perspective. If PAG material is encountered, it will be placed strategically within the Vault WRSF so that it is adequately encapsulated and covered by NPAG materials. This will help maintain frozen conditions as well as provide potential for neutralization if leachate is generated. As mentioned above, closure design plans for the WRSFs are provided in the *Updated Mine Waste Rock and Tailings Management Plan* (AEM 2013a) and include material volumes and locations associated with the Vault WRSF.

Runoff water quality and water volume from the WRSFs will be monitored and assessed throughout the mine life, including operations, closure, and post-closure. During the closure period where cover systems are being installed and freeze back is occurring, surface water runoff may require treatment to meet discharge criteria. If necessary, a water treatment plant would be installed at the Mill to treat the water prior to release in the Portage

Pit Lake. After closure, when water quality satisfies regulatory limits, any seepage and runoff collection sumps will be drained and a layer of NPAG rock cover will be placed over any sediment in the sumps to prevent dust generation and erosion.

3.3.6.4 Uncertainties and Assessing Information Gaps

The main area of uncertainty related to closure of the Portage WRSF is the cover thickness required to ensure adequate aggradation of permafrost, insulation from thaw, and effective long-term encapsulation of the waste rock. Cover trials will be conducted during operations to evaluate the effectiveness of different cover thicknesses and designs. Thermistors have been installed to monitor temperature and permafrost aggradation within the Portage WRSF. Results of these trials and monitoring will be available as a basis for revised closure designs, if warranted.

During operations, information on type of waste and disposal location within the Portage WRSF will be recorded. This will be used to guide and verify cover requirements for different areas of the facility. Currently, it is assumed that the entire Portage WRSF will be covered; however, cover requirements could be reduced if waste rock is managed in such a manner as to concentrate PAG materials in certain areas. If NPAG material is stored in other areas to a sufficient depth from surface, then it will essentially function as cover and no additional material will need to be placed in these areas at closure.

3.3.7 Tailings Storage Facilities

All tailings will be deposited within the Tailings Storage Facilities (TSF), with containment provided by the Central Dike, along with a series of Saddle Dams (1 to 5) and rockfill road perimeter structures. The TSF will consist of two cells, each of which will include a Reclaim (water) Pond during operations. Deposition is anticipated to occur in the North Cell until early 2015 (or possibly in late 2014) and then in the South Cell to the end of operations (early 2018). AEM is currently assessing a Tailings Optimization Plan which could alter the deposition schedule for the North and South cells, with the potential to extend the life of the North cell.

3.3.7.1 Closure Objectives

General objectives related to closure of Tailings Storage Facilities are provided in INAC (2007) and include:

- Stabilize slopes surrounding the tailings impoundment or containment system for flooded and/or dewatered conditions;
- Minimize catastrophic and/or chronic release of the tailings based on associated risk;
- Minimize wind migration of tailings dust; and
- Minimize the threat that the impoundment becomes a source of contamination (e.g. tailings migration outside of contained area, contamination of water outside of contained area).

Other recommendations, similar to those for Waste Rock Storage Facilities, are presented in the Code of Practice for Metal Mines as follows (adapted from EC 2009):

- Carry out detailed inspections and assessments of Tailings Storage Facilities. The objective of these inspections and assessments is to evaluate the actual performance against design projections related to anticipated post-closure conditions (R524).
- Conduct a comprehensive risk assessment for mine closure to evaluate the long-term risks associated with possible failure modes for Tailings Storage Facilities. Identify possible impacts and critical parameters, and develop control strategies (R525). If warranted, implement a long-term monitoring plan (R526).
- Re-evaluate and revise as necessary plans for management of tailings to prevent; and control and treat metal leaching and acidic drainage to ensure that they are consistent with the objectives and plans for mine closure and post closure (R527). If warranted, implement a long-term site-specific monitoring program (R538).

3.3.7.2 Closure and Remediation Options

General options for Tailings Storage Facilities closure are provided in INAC (2007), as follows:

- Stabilize embankments by removing weak or unstable materials from slopes and foundations and/or construct toe berms to flatten overall slope;
- Breach water retention dams and drain impoundments, avoid post closure impoundment of water when possible;
- Use a natural body of water that has sufficient storage capacity to hold the tailings and allow a natural unimpeded flow via the drainage outlet if a permanent water cover is used (this may not be viable if the supernatant water quality does not meet discharge water quality standards);
- Increase freeboard and/or upgrade spillway to prevent overtopping and possible erosion by extreme events;
- Relocate and/or deposit tailings into underground mine workings or into flooded pits, depending on water quality considerations;
- Flood to control acid generation and related reactions;
- Cover to control acid generation and related reactions and surface erosion;
- Promote neutralization reactions by use of alkaline materials for acidic tailings;
- Divert non-contact runoff away from the tailings facility to avoid contamination;
- Promote freezing of tailings mass into permafrost if suitable conditions exist;
- Collect waters that do not meet the discharge criteria and treat passively, active treatment is not acceptable for the long term;
- Remove structures, decant towers, pipes, and drains where they already exist;

- Plug decant towers, pipes, and drains with high slump (relatively liquid concrete which will flow to fill all voids) or preferably, expansive concrete, as a last resort;
- Assess the soil around pipes for stability under the hydraulic gradients through the embankment, as this may be a potential zone of piping failure;
- Avoid using diversion structures and ditching, especially in permafrost soils (diversion structures are not the preferred option into the long-term);
- Where diversion dams and channels are necessary, maintain them indefinitely to meet long term stability and hydraulic design requirements; design diversions and spillways for extreme events suitable for long term stability;
- Provide frost protection cap over the phreatic surface for water-retaining dams;
- Ditch, berm, fence, or use alternative methods to deter access of motorized vehicles if compatible with end-use plans; and
- Establish indigenous vegetation, soil, riprap, or water cover to control erosion.

The closure options listed above were considered in the Project design. One of the primary issues addressed is the location for tailings disposal. Subaerial tailings disposal (i.e., within a dewatered lake basin) was selected as this provides a high degree of containment and facilitates monitoring of potential environmental effects on water quality as well as physical and geochemical stability. Subaqueous disposal was not considered an option due to lack of suitable water bodies (i.e., storage capacity, proximity, and potential impact on water quality and fish habitat). Similarly, underground disposal is not an option given the open pit development.

Other closure options presented in the bullets relate to control of ARD and are relevant to the Project. The options selected involve the freezing of tailings and applying a cover for insulation and erosion control. This is considered an effective control measure for ARD. Permanent diversions will be constructed where necessary to direct non-contact water to the natural environment. These diversions, as well as the TSF containment dikes, will be designed for long-term physical stability.

3.3.7.3 Planned Reclamation Approach and Activities

The overall tailings management approach for long term stability and control of ARD involves encapsulation of the tailings in permafrost. The tailings will be allowed to freeze after deposition and to remain frozen after closure. A closure cover will be placed to insulate the frozen tailings and to protect against erosion.

Thermal Conditions at Closure and Post Closure

The results of thermal modeling indicate that complete freezing of the tailings and bedrock beneath the TSF will occur with time (Golder 2007b). Long-term analyses indicate that the entire tailings body will freeze no later than 10 years after the end of operations, and that the tailings foundation will progressively freeze to a depth of 30 to 50 m after 100 years. These analyses included consideration of the potential effects of global warming, and therefore indicate that global warming will not be sufficient to prevent freezing beneath the tailings during the 100 year period analyzed.

Thermal modelling also indicates that the talik that currently exists below 2PL will freeze before seepage from the TSF reaches the groundwater below the permafrost. Thermistor monitoring results to date indicate that this is occurring (AEM 2013a). Consequently, the tailings and any constituent release are predicted to be encapsulated by permafrost. If it is determined by subsequent thermal monitoring that the tailings are freezing at lower rates than predicted, and if warranted, then mitigation will be implemented to enhance freezing.

Surface Rehabilitation and Water Management

The TSF will be closed progressively during the mine life as the tailings deposit reaches its ultimate elevation. Closure will include the placement of an erosion barrier consisting of a 4 m thick layer of NPAG ultramafic waste rock over the tailings. The surface of the final cover will be graded to blend into the existing topography to allow for surface drainage to the southwest portion of the site in the vicinity of Saddle Dam 3 and possibly to the southeast also allowing for drainage to the Portage pit lake.

Water quality will be monitored during closure to determine when the runoff from the reclaimed TSF can be directed to Third Portage Lake untreated. At that point the Reclaim Pond will be decommissioned and a layer of NPAG rock cover will be placed over any accumulated sediment to minimize dust generation and erosion of these materials. The area will be re-contoured and Saddle Dam 3 will be breached to allow uninterrupted drainage of surface runoff to the surrounding lakes. If water in the Reclaim Pond is not suitable for release, a water treatment plant may be necessary; this plant would be installed at the Mill to treat the water prior to release in the Portage Pit Lake.

Additional discussion related to closure of containment dikes and saddle dams is provided in Section 3.3.4. In summary, the TSF structures will be designed for long-term stability using NPAG material; therefore, no additional actions are expected at closure to ensure long-term physical or geochemical stability.

3.3.7.4 Uncertainties and Assessing Information Gaps

The main area of uncertainty related to closure of the TSF is permafrost encapsulation and the cover thickness required to ensure adequate aggradation of permafrost, insulation from thaw, and effective encapsulation of tailings. Cover trials, which are planned in 2014 – 2015, will be conducted during operations to evaluate the effectiveness of different cover thicknesses and designs. Thermistors have been installed to monitor temperature and permafrost aggradation within the TSF. By closure, results of these trials and monitoring will be available and will be incorporated into revised designs, if warranted.

There is a risk that surface runoff from the TSF covered areas may not be of sufficient quality for release to the environment. This could delay decommissioning of the Reclaim Pond and breaching of Saddle Dam 3, and/or require additional mitigation such as passive or active treatment.

3.3.8 Water Management Facilities

The water management facilities, which are described in Section 2.5.7, were designed to support construction and operations activities of the mine development. Permanent closure activities for these facilities will involve removal of structural components (i.e., pumps, pipelines and active treatment systems) and establishment of natural drainage conditions.

3.3.8.1 Closure Objectives

Closure and reclamation objectives stated by INAC (2007) for water management infrastructure are as follow:

- Dismantle and removal of as much of the system as possible (i.e., structural components) and restore natural drainage or establish new natural drainage patterns;
- Stabilize and protect from erosion and failure for the long term;
- Maintain controlled release from water dams, ditches and all points of water discharge to the environment; and
- Achieve approved water quality limits, and in the case of existing mines, implement long term treatment only if necessary and ensure that minimal maintenance is required.

As recommended by EC (2009, R531), a final water management plan would be evaluated at or near the end of mine operation and adjusted to meet the objectives and plans for mine closure and post closure. This final plan will determine the infrastructure components that will be removed, those that will be left in place, and those that will be modified, as well as the monitoring requirements to measure compliance with the closure and reclamation objectives.

3.3.8.2 Closure and Reclamation Options

Generic options for water management infrastructure are provided in INAC (2007). Options relevant to the Project include:

- Draining of water management facilities including ditches and settling ponds that are not required for long-term use (water to be treated if needed);
- Removal and proper disposal of sediment;
- Breaching of embankments, dams or culverts that are no longer needed;
- Draining, dismantling and removal of tanks and pipelines from the site; and
- Armouring of remaining embankments, ditches, culverts, and other drainage channel slopes with erosion resistant material (e.g. riprap or vegetation).

All the options listed above will be required to address closure and reclamation of Project water management infrastructure. Armouring has been recommended as needed in the design studies conducted for the construction of the water management infrastructure. Details on the implementation of other options are provided as applicable to each infrastructure component in the following section.

3.3.8.3 Planned Reclamation Approach and Activities

Dewatering systems

The Second Portage Lake dewatering system was used to pump water from the north arm of Second Portage Lake and the Bay-Goose impoundment area into Third Portage Lake to permit operations at the Portage and Goose pits and Tailings Storage Facilities. The system consisted of two pumps in parallel connected to a surface pipeline that conveyed water to a treatment facility for the removal of suspended solids prior to discharge to Third Portage Lake. The dewatering system is no longer in operation. The pumps and water treatment plant have been re-purposed to discharge water from the Attenuation Pond to Third Portage Lake (see Attenuation ponds description below for more information). The pipelines used for the Second Portage dewatering system have been decommissioned.

Following the conversion of the Portage Attenuation Pond into the Reclaim Pond, all of the dewatering equipment (i.e. dewatering pipelines, effluent diffuser pipelines, pumps and water treatment equipment) will be dismantled and either shipped from the mine site or disposed of in the on-site landfill.

A similar dewatering system was implemented in Vault Lake in September 2013 to pump water from Vault Lake to Wally Lake to permit operations in the Vault Pit. Once dewatering is complete, the pumps and treatment plant will be re-purposed to discharge water from the Attenuation Pond to Wally Lake (anticipated in the summer of 2014). The pipelines used for the Vault dewatering system will be decommissioned. Once mining operations are complete and the Attenuation Pond is no longer active, all of the dewatering equipment will be dismantled and either shipped from the mine site or disposed of in the on-site landfill.

Flooding systems

Similar to dewatering systems, the flooding system equipment (i.e., pumps and piping) will be removed once pit flooding is complete. All pieces will either be shipped from the mine site at closure or disposed of in the on-site landfill.

Waste Rock Storage Facilities runoff collection systems

Water collected by any seepage and runoff collection sumps will be monitored during the operations, closure and post-closure phases of the Project. These systems will be removed and the landscape will be re-contoured to allow natural drainage when the runoff water quality is demonstrated acceptable for release to the receiving environment without further management.

Water Diversion Systems

The two water diversion systems in the Portage area were designed to be permanent features of the natural landscape, and will therefore remain in place after closure. The diversion system in the Vault area incorporates an engineered channel to Phaser Lake that was designed to be a permanent feature of the natural landscape and will remain in place following closure. The Vault water diversion system, if deemed necessary (depends on freshet volumes), will consist of pumps and piping to divert outflows from Phaser Lake to Turn Lake. The pumps are required while the natural outlet of Phaser Lake to Vault Lake is blocked to allow mining in Vault Pit. Following closure in the Vault Pit area, the original outlet of Phaser Lake will be restored to allow water releases into Vault Lake, and the pumps and piping will either be shipped from the mine site or disposed of in the on-site landfill.

Pit sump and pumping systems

Pumps and piping used for the conveyance of water from the pit sumps to the attenuation ponds will be removed before flooding of the pits occurs. These pieces of equipment will ultimately be either shipped from the mine site or disposed of in the on-site landfill.

Tailings pipelines

The tailings slurry pipelines will be flushed and drained following completion of ore processing at the Mill, in accordance with International Cyanide Management Code requirements (Section 3.3.9). The pipelines and related components (i.e., valves) will then either be shipped from the mine site or disposed of in the on-site landfill.

Attenuation ponds

The Portage Attenuation Pond will be active in the Tailings Storage Facilities South Cell while tailings are being deposited in the North Cell. Once tailings deposition is initiated in the South Cell, the Portage Attenuation becomes the Reclaim Pond. The Attenuation Pond water is pumped to a treatment plant for removal of suspended solids prior to discharge to Third Portage Lake through the outfall diffuser. Following the conversion of the Portage Attenuation Pond into the Reclaim Pond, the dewatering pipelines, pumps and water treatment equipment will be dismantled and either shipped from the mine site or disposed of in the on-site landfill.

The Vault Attenuation Pond occupies deeper portions of Vault Lake while mining is occurring at Vault Pit. This Attenuation Pond water is also pumped to a treatment plant for removal of suspended solids prior to discharge to Wally Lake through the outfall diffuser. This pond will be flooded following completion of mining in the Vault Area to restore Vault Lake.

Reclaim Ponds

The Reclaim Pond is initially located in the Tailings Storage Facilities North Cell. Once tailings deposition shifts from the North Cell to the South Cell (in early 2015 [or possibly late 2014]), the Portage Attenuation Pond becomes the Reclaim Pond. Any water remaining in the North Cell will be drained to the South Cell and the tailings will be re-contoured. Following completion, and during tailings deposition in the South Cell, excess water in the Reclaim Pond will be treated, if deemed necessary, prior to being discharged to the Portage and Goose pit lakes to assist with pit flooding. When the runoff water quality from the TSF is demonstrated to be acceptable for release without further treatment, it will flow to Third Portage Lake.

Stormwater Management Pond (Tear Drop Lake)

The outlet of this pond has been blocked. Excess water is pumped to the Reclaim Pond, usually in the Spring. Following completion of mining in the Portage and Goose pits, water from the Stormwater Management Pond (Tear Drop Lake) will be treated (if deemed necessary) and directed to the Portage Pit to assist with flooding. The natural outlet of Tear Drop Lake to the Portage Pit Lake will be restored following closure when the water quality is demonstrated acceptable for release to the Pit Lake without treatment. Treatment of this water is not anticipated at this time.

Freshwater intake and treatment system and wastewater treatment system

Following ore processing and the bulk of the closure activities are completed, the freshwater intake and treatment, and wastewater treatment systems will be decommissioned. Structural components (i.e., pumps, tanks and piping) will either be shipped from the mine site or disposed of in the on-site landfill. Sludge from the wastewater treatment will be buried in the Tailings Storage Facilities.

3.3.8.4 Uncertainties and Assessing Information Gaps

Water quality and treatment requirements of the Reclaim Pond water, prior to discharge to the pit lakes, are an area of uncertainty. Treatment of the Reclaim Pond water may be required for copper and iron, and possibly ammonia (SNC 2013). Actions are being taken to improve the treatment systems in place in the Mill, prior to transfer to the Reclaim Pond. These actions include the use of the Sulphur dioxide (SO_2)/air cyanide destruction system, which is more efficient than the sodium metabisulfite cyanide destruction system in the precipitation of copper and iron. Treatment methodologies exist for the removal of metals (copper, iron) and ammonia, should this be deemed necessary. Updates to the water balance model, and water quality predictions, will be completed prior to mine closure to determine the need for and the type of treatment requirements, if any.

3.3.9 Infrastructure at Mill and Camp Areas

This section addresses closure of the infrastructure at the mine site. It includes the accommodation facilities, service and maintenance facilities, the Mill, and other infrastructure related to power, site services, the airstrip, the Emulsion Plant, and the Vault area.

3.3.9.1 Closure Objectives

The following general closure objectives related to ore processing facilities (the Mill) and infrastructure are provided in INAC (2007):

- Ensure infrastructure does not become a source of contamination;
- Return area to its original state or to a state compatible with the desired end use;
- Restore natural drainage patterns where surface infrastructure has been removed;
- Prevent inadvertent access; and
- Restore the natural use by wildlife.

The Code of Practice for Metal Mines also provides the following recommendations related to the closure of ore processing facilities and infrastructure, when infrastructure is not to be preserved for post-closure land use (adapted from EC 2009):

- On-site facilities and equipment that are no longer needed should be removed and disposed of in a safe manner. Efforts should be made to sell equipment for reuse elsewhere or to send equipment for recycling, rather than disposing of it in landfill facilities. (from R514)

- The walls of on-site buildings should be razed to the ground. Foundations should be removed or covered with a sufficiently thick layer of soil to support re-vegetation. (from R515)
- Any remaining structures and foundations should be inspected to ensure that no contamination is present. If contamination is found, it should be remediated as necessary to ensure public health and safety for post-closure land use. (from R516)
- Support infrastructure, such as fuel storage tanks, pipelines, conveyors and underground services, should be removed. (from R517)
- The main access road to the site (or runway in the case of remote sites) and other on-site roads, as appropriate, should be preserved in a sufficient condition to allow post-closure access for monitoring, inspection and maintenance activities. (from R518)
- Roads, runways or railways that will not be preserved for post-closure use should be reclaimed. Bridges, culverts and pipes should be removed, natural stream flow should be restored, and stream banks should be stabilized by re-vegetating or by using rip-rap. Surfaces, shoulders, escarpments, steep slopes, regular and irregular benches, etc., should be rehabilitated to prevent erosion. Surfaces and shoulders should be scarified, blended into natural contours, and re-vegetated. (from R519)
- Electrical infrastructure, including pylons, electrical cables and transformers, should be dismantled and removed. (from R520)

3.3.9.2 Closure and Reclamation Options

Generic closure options for infrastructure are provided in INAC (2007) as follows:

- Dismantle all buildings that are not necessary to achieve the future land use target;
- Raze/level all walls to the ground and remove foundations;
- Cover remaining foundations with materials conducive to vegetation growth;
- Remove buildings and equipment during the winter to minimize damage to the land where appropriate;
- Remove floor structures over basements and cellars;
- Remove and dispose concrete in an approved landfill if it contains contaminants such as hydrocarbons or PCBs that may pose a hazard over time;
- Where approved, break or perforate concrete floor slabs and walls to create a free draining condition in order that vegetation can be established;
- Backfill all excavations below final grade to achieve the final desired surface contours to restore the natural drainage or a new acceptable drainage;
- Cover excavated sites which have exposed permafrost with a rock cap to prevent thermokarst erosion;

- Reduce dust emission during demolition of buildings that contain or contained asbestos, hazardous chemicals or other deleterious material;
- Remove buried tanks, where they already exist, to prevent subsidence;
- Dispose of wastes in quarries, borrow pits, underground mine workings, tailings impoundments, and waste rock piles;
- Decontaminate equipment (free of any batteries, fuels, oils, or other deleterious substances) and reuse or sell (local communities may have interests in some of the materials);
- Remove structures including bridges, culverts, pipes, buried wires and power lines and fill ditches in if no longer required and evaluate the area for potential contaminants;
- Reclaim areas to the original topography and drainage or to a new topography or drainage compatible with end land use targets;
- Scarify abandoned road/runway surfaces to promote re-vegetation of indigenous species;
- Leave roads, airstrips, bridges, or railways intact if it is in the public interest to do so (ownership liability will need to be considered); and
- Flatten berms and slopes at the side of roads to facilitate wildlife passage.

The information above address closure options related to buildings, foundations, and general site reclamation. Buildings will be completely removed at closure to meet the intended post-closure land use for the area. The end land use will also be achieved by breaking up existing concrete foundations to a suitable depth; therefore, the options of removal and/or covering of foundations are not considered. Closure options related to foundations below grade are also not applicable as all buildings are on or above grade.

3.3.9.3 Planned Reclamation Approach and Activities

Buildings and Structures

All buildings and structures, including the Mill, will be decommissioned and dismantled at closure. If required, the process plant may be temporarily converted to treat water in the Reclaim Pond so that the pond can be drained and the water released. Demolition waste that cannot be reused, recycled or provided to local interests (salvageable) will be disposed of in the Landfill (Portage WRSF). Salvageable material will be removed off site.

Closer to the mine closure, detailed plans will be developed to address the following considerations:

- Use and reduction of on-site consumables leading up to closure;
- Off-site shipping requirements for equipment and/or waste, and opportunities to do so prior to closure;
- Segregation of salvageable materials, and potential for re-sale;
- Scheduling, sequencing and optimization of closure activities and equipment; and

- Identification of structures and equipment to be decommissioned and dismantled for re-sale, as opposed to demolished; requirements for detailed electrical decommissioning and/or dismantling.

Equipment that may have come into contact with Cyanide

As AEM is a signatory of the International Cyanide Management Code, they are required to manage their cyanide from source to site, thus assuming “cradle to grave” responsibility for all cyanide and associated equipment used at their operation (AEM 2012a). All equipment that may have come into contact with the Cyanide reagent will be flushed and triple rinsed to dissolve any residual cyanide. Rinse water from the flushing process will be recovered into the Cyanide mix tank and used in the gold recovery plant, and/or discharged under controlled conditions to the Tailings Storage Facilities. If necessary, contaminated material will be packaged and shipped south to a licensed disposal facility in accordance with applicable Transportation of Dangerous Goods legislation.

Power, Electric Grid and Fuel

The Power Plant will remain functional as required until the end of closure activities. It will then be dismantled. Transmission lines will be removed in a progressive manner as closure activities are completed in different areas.

All remaining bulk fuel on site that is not required for reclamation activities will be transported back to the Baker Lake Site Facilities and offered to community interests. The empty portable fuel storage tanks will also be hauled back to the Baker Lake Site Facilities and either offered locally or shipped south as steel scrap. The 5.6 Ml tank will be emptied, cleaned, and dismantled for disposal in the site landfill or shipped south as steel scrap. After removal of the larger tank, the underlying geomembrane liner will be cut into manageable pieces and placed in the Landfill. The material beneath the liner will be inspected for evidence of contamination. Any contaminated soil will be excavated and taken to the Landfarm for treatment or shipped south for disposal at an approved facility.

Foundations and Site Grading

Concrete foundations will be broken up to a depth of a least 1 m below ground surface to facilitate drainage and natural re-colonization of vegetation from surrounding areas.

All disturbed areas will be re-graded to suit the surrounding topography. In areas where the original ground surface was lowered for site grading or structural requirements, the slopes will be stabilized and contoured. Cover materials may be required for erosion and dust control. Where appropriate, drainage will be directed onto land and away from water bodies to prevent mobilization of sediments to the aquatic environment.

Roads and Rockfill Pads

All of the on-site roads will be decommissioned by scarifying the surface to facilitate natural re-colonization of vegetation. Decommissioning will also involve grading of any roadside berms and re-contouring of the road surface to direct runoff away from water bodies and toward surrounding tundra. In this way, flow will be attenuated over land and sediments, if any, will be filtered prior to runoff reaching the aquatic environment. Pre-existing drainage patterns will be re-established by removing culverts and opening the roadway to accommodate the natural watercourse. Soil embankments will be laid back at slopes of 3H:1V or greater (due to the finer nature of the material, as opposed to the 1H:1V slope used for rock walls) and armoured with rock to minimize stability risks during high rainfall or freshet events.

Wildlife travel corridors will be provided at suitable intervals along the Vault Haul Road by re-grading the embankment shoulders to flatter slopes.

Rockfill pads have been developed to ensure level supporting surfaces for such infrastructure as the fuel tanks, accommodation facilities, and lay down areas. The rockfill pads will be decommissioned in a manner similar to that of the roads, with the surfaces scarified and embankments re-contoured.

Airstrip and Airstrip Quarry

The Airstrip is expected to be closed near the end of the closure phase. Access to the site to support the post-closure monitoring program will be via the AWPAR; therefore the Airstrip will not be needed. The actual timing of closure will depend on the progress of mine reclamation and closure monitoring. Airstrip reclamation will involve removing culverts, re-contouring fill slopes for wildlife access, and ripping the gravel surface to facilitate natural re-vegetation.

The Airstrip quarry rock walls will be laid back to a 1H:1V slope for long-term stability and to minimize the risk of human or wildlife injury from falls over a high wall. Other relevant closure measures for quarries and borrow sources are discussed in Section 3.3.3 and include:

- Removing equipment, garbage, and debris from the quarry for appropriate disposal;
- Use remaining quarried rock or spread over the base; and
- Contouring the base of the quarries to provide unrestricted drainage of runoff to the surrounding tundra, and to prevent the ponding or collection of water on the sites.

Emulsion Plant

Consumable materials will be used up toward the end of mining operations in an attempt to limit the volume of supplies that need to be removed from site at closure. The Emulsion Plant will be decommissioned and removed by the blasting contractor. Any spills that occur will be contained and affected materials either removed from site or disposed of in an approved manner.

3.3.9.4 Uncertainties and Assessing Information Gaps

No major uncertainties have been identified with respect to closure of the Project infrastructure.

3.3.10 Waste Management Facilities

3.3.10.1 Closure Objectives

The following general closure objectives related to waste disposal areas are provided in INAC (2007):

- Control erosion and effects to the ground thermal regime;
- Prevent inadvertent access;
- Ensure waste disposal areas do not become a source of contamination; and
- Return area to its original state or to a state compatible with the desired end land use.

The Code of Practice for Metal Mines also provides the following recommendations related to the closure of waste facilities and to the handling of contaminated materials (adapted from EC 2009):

- Waste from the decommissioning of ore processing facilities and site infrastructure, such as waste from the demolition of buildings and the removal of equipment, should be removed from the site and stored in an appropriate waste disposal site or disposed of on site in an appropriate manner in accordance with relevant regulatory requirements. If material is disposed of on site, the location and contents of the disposal site should be documented. (from R522)
- Sampling and analysis of soils and other materials should be conducted to ensure that none of the material is contaminated, e.g., with asbestos and mercury from buildings. If contaminated materials are identified, they should be handled and disposed of in an appropriate manner in accordance with all applicable regulatory requirements. (from R523)

3.3.10.2 Closure and Reclamation Options

Generic closure options for waste disposal areas and contaminated materials are provided in INAC (2007) as follows:

- Bury materials in the unsaturated zone or below the active layer;
- If sale or salvage of equipment is not possible, dispose of decontaminated equipment in an approved landfill or as recommended by the regulatory authorities;
- Cut, shred or crush and break demolition debris to minimize the void volume during disposal;
- Maintain photographic records of major items placed into landfills, as well as a plan showing the location of various classes of demolition debris (e.g. concrete, structural steel, piping, metal sheeting and cladding);
- Remove all hazardous materials and chemicals prior to demolition to national approved hazardous material treatment facilities, or recycle, reuse, or dispose of in an appropriate manner upon approval from the regulatory authorities (check for PCBs in fluorescent light fixtures, lead-based paints, mercury switches or radioactive instrumentation controls);
- Backhaul materials for recycling or disposal to a southern location;
- Burn domestic waste in an incinerator during operation and at closure as part of camp maintenance;
- Burn waste oils, solvents and other hydrocarbons on-site with an incinerator if approved;
- Cover landfills and other waste disposal areas with erosion resistant material (e.g. soil, riprap, vegetation);
- Divert runoff with ditches or covers;
- Ditch, berm, fence, or use alternative methods to limit access to waste storage areas; and
- Consider surface application of sewage for re-vegetation.

Various waste disposal options are applicable to the Project and are included in the closure design. Primary options for inert waste are disposal in the Landfill that will be encapsulated in the Portage Waste Rock Storage Facility. Hazardous or contaminated waste will be disposed of in the TSF in an approved manner or transported off-site for disposal at an approved facility. The disturbed areas will be scarified to loosen compacted materials and will be contoured to be consistent with surrounding topography. Natural re-colonization of disturbed areas will be promoted; no amendments (including sewage) will be applied to surfaces to support re-vegetation, seeding, or planting.

3.3.10.3 Planned Reclamation Approach and Activities

Incinerator: Domestic and Organic Waste

At closure, the incinerator will be decommissioned and barged out of the Baker Lake Site Facilities to a southern destination for re-use or sale. The incinerator building will be emptied and offered for local use and/or relocation. If there is no local interest, the infrastructure will be demolished and taken to the on-site landfill for disposal or barged out of the Baker Lake Site Facilities to a southern waste disposal facility.

Landfill: Non-hazardous Waste & Demolition Landfill

Landfill #1, currently in operation at the mine site, consists of multiple sub-landfills that have been, or will be, built in the Portage WRSF. As these sub-landfills are filled, or the WRSF evolution causes the landfill to be moved, the waste is compacted and then encapsulated in the WRSF (AEM 2013d). Landfill #1 will cease operating at the end of active mining activities.

During the closure phase of the Project, demolition and non-hazardous waste (not including organic matter) will be deposited in the demolition Landfill (Landfill #2). Equipment and materials with a net salvage value will be removed from the mine site along with materials that can be cost-effectively recycled or re-used. This landfill will be located in an estimated 4 m deep depression on the top of the Portage WRSF, with an estimated waste capacity of 3,600 m^3, the equivalent of 7 years of waste disposal plus an allowance for demolition materials (AEM 2013d).

According to the *Landfill Design and Management Plan* (AEM 2013d), the following types of materials will be accepted at the demolition Landfill (and at Landfill #1 as well):

- Plastic (except expanded polystyrene);
- Metals (steel, copper, aluminum, iron);
- White goods and small appliances;
- Building materials (wire, wood, fiberglass insulation, fiberglass, roofing, bricks, ceramics, empty caulking tubes, hardened caulking, glass, gyproc, bricks);
- Surface materials (asphalt, concrete, carpet);
- Vehicles and machinery provided all liquids, grease, batteries, and electronics have been removed; and
- Other materials (ceramics, rubber, clothing, cooled ash).

In addition to domestic and organic waste, the following materials will not be accepted at the demolition Landfill:

- Food containers and wrappings (unless cleaned);
- Whole tires;
- Hazardous waste;
- Electronics;
- Petroleum products, and petroleum-contaminated products; and
- Expanded polystyrene.

Details and the exact location of the demolition Landfill in the top of the Portage WRSF are not currently available, but will be determined closer to the end of operations as the WRSF approaches its final as-built elevation. The Landfill will ultimately be closed and encapsulated within the Portage WRSF. It will also be covered by a 4 m layer of coarse NPAG rock that is planned as part of closure of the Portage WRSF.

The protocol for materials placement within the demolition Landfill includes dismantling, stacking in a stockpile, cutting to manageable sizes, and transport and placement (AEM 2013d). Waste will be compacted in layers and covered. Procedures will be developed to ensure materials segregation, placement, and closure are conducted in an appropriate manner.

Hazardous Materials

As presented in the Hazardous Material Management Plan (AEM 2012a), hazardous materials that will be used during mine site operations include:

- Fuel and Lubricants – diesel fuel, oils, greases, anti-freeze, and solvents used for equipment operation and maintenance;
- Mill Consumables – sodium cyanide, sulphur (or metabisulphide), hydrochloric acid, lime, flocculants, and anti-scalants used in mineral extraction;
- Explosives – ammonium nitrate and high explosives used for blasting in the mine; and
- Laboratory Wastes – various by-products classified as hazardous waste and chemicals used in the assay laboratory.

These materials will be managed so that there are minimal quantities remaining on site at closure. Any hazardous material that does remain and cannot be used during closure activities will be transported to licensed disposal facilities in the south in accordance with the *Hazardous Material Management Plan* (AEM 2012a). Used oil is an exception and, similar to during operations, will be incinerated on site or utilized in waste oil heating equipment. Any remaining Cyanide reagent will be packaged and transported to a licensed facility in the south in accordance with the International Cyanide Management Code, and the AEM *Hazardous Materials Management Plan* (AEM 2012a).

Landfarm: Contaminated Soils

Throughout the mine lifespan, all reasonable efforts will be taken to minimize and mitigate soil, snow, and ice contamination caused by spills of petroleum hydrocarbons, and known areas of contamination areas will be remediated in a progressive manner.

At and during the closure phase of the Project, any remaining soils contaminated with petroleum hydrocarbons will be excavated and remediated at the on-site Landfarm. Following treatment, soils will be analyzed for BTEX and petroleum hydrocarbon fractions and compared to the Tier 1 GN Environmental Guidelines for Site Remediation (March 2009). Soils that meet Industrial criteria will be placed in the Portage WRSF and encapsulated during closure of the Portage WRSF, while soils that meet Agricultural/Wildland criteria will be suitable for use at on-site works or reclamation activities (AEM 2013e). Water that accumulates within the Landfarm berm will be analyzed prior to discharge to the adjacent TSF (AEM 2013e). Should landfarm treatment not be successful, contingency measures have been identified in the *Landfarm Design and Management Plan* (AEM 2013e); these include:

- Adjustment of soil amendments;
- Development of Tier 2 modified criteria;
- Thermal desorption; and
- Direct placement of contaminated soil in TSF or Portage WRSF.

After removal of all remediated materials, and prior to closure of the Landfarm, the berm and base will be sampled on a 10 m grid, to a depth of 1 m in representative locations, to determine if soils are free from petroleum hydrocarbons (AEM 2013e). Results of these analyses will be compared to GN criteria and soils will be handled as appropriate. Since this area will form part of the TSF at closure, which will be capped with up to 4 m of NPAG rock to ensure freeze back encapsulation, no excavation is necessary if Industrial criteria are not met (AEM 2013e).

3.3.10.4 Uncertainties and Assessing Information Gaps

No major uncertainties have been identified with respect to closure of the Project waste management facilities.

3.4 Progressive closure activities

Progressive closure reflects actions that can be taken during mining operations to close and reclaim various mine components, either when operations in an area are complete or when supporting infrastructure is no longer needed. Progressive closure can reduce overall reclamation costs by incorporating closure activities in the mine plan, and enhances environmental protection by addressing concerns sooner and allowing more time for reclamation objectives and goals to be achieved.

The Code of Practice for Metal Mines includes the following recommendations related to progressive reclamation (adapted from EC 2009):

- Progressive reclamation, including that of waste rock piles, tailings management facilities and mine site infrastructure, should be undertaken during the mine operations phase to the extent feasible.
- Progressive reclamation activities should be consistent with the site-specific objectives and intended post-closure land use for the site. Planning and implementation should consider final contouring, final drainage, cover requirements, and re-vegetation.
- The project schedule should be used to monitor the status of progressive reclamation, and the schedule should be updated on a regular basis.

Best management practices, including progressive closure, have been incorporated in the Project design. The current mine plan includes progressive closure associated with the following mine components:

- Portage and Goose open pits;
- Portage WRSF;
- Tailings Storage Facilities;
- water management infrastructure; and
- site infrastructure (limited structures).

Progressive closure activities for these mine components are described in the following sections. Details related to schedule are provided in Section 3.7.

3.4.1.1 Open Pits

Based on the current plan, mining at Portage and Goose pits will be completed prior to the end of mining at Vault pit, which corresponds to the end of mine operations in early 2018. The Portage and Goose pits will be progressively closed as follows:

- Once mining at Portage Pit is completed in 2016, the pit sump and pumping system will be decommissioned, and rainwater and groundwater inflows will be allowed to accumulate (a portion of the Portage Pit will also be used for backfill of waste rock from mining of Goose Pit);
- Water collected in the Stormwater Management Pond (Tear Drop Lake) will be redirected to the Portage Pit following completion of mining in 2016 to assist with pit flooding, while the discharge of excess Reclaim Pond water from the North Cell, treated if required, to the pit will commence in 2015.
- After mining in Goose Pit has ceased in 2015, the pit sump and pumping system will be decommissioned; and
- Filling of the Portage and Goose pits will be supplemented by active water contributions (i.e., pumping or siphons) from Third Portage Lake.

Active water contributions for filling the Portage and Goose pits is expected to be ongoing from 2015 (Goose Pit) and 2017 (Portage Pit) until 2023, which is into the closure phase of the Project.

The end of mining at Vault Pit will coincide with the end of overall mine operations. As such, there is no opportunity for progressive closure of the Vault Pit, and flooding will occur as part of the closure phase.

3.4.1.2 Waste Rock Storage Facilities

The Portage WRSF will be used for waste rock deposition from Portage Pit and part of Goose Pit until mid-2015, after which additional waste rock will be backfilled to a mined-out portion of the Portage Pit. The Portage WRSF has been designed for long-term stability in terms of rock lifts, bench heights, and overall slope.

Progressive closure activities at the Portage WRSF are ongoing and will be completed prior to the end of overall mine operations in 2018. Progressive closure for the Portage WRSF involves (or will involve) the following:

- Placement of a NPAG rock cover over the exterior slopes as the WRSF is filled in lifts, including development of internal cells to encapsulate PAG materials by NPAG rock; as of January 2013, 42% of the ultimate area of the Portage WRSF had been covered with NPAG rock (AEM 2013a);
- Capping of the WRSF with a NPAG rock cover after the WRSF has been filled; and
- Final contouring of the WRSF to ensure adequate drainage and profiles consistent with surrounding topography.

Thermistors have been (and more are scheduled to be) installed within the Portage WRSF to monitor the rock cover freezing and performance. The results will be used to evaluate the predicted thermal response of the WRSF with the actual thermal response. Results to date from the thermistors indicate that freeze back is occurring in the WRSF structures (AEM 2013a).

No progressive closure activities are associated with the Vault WRSF since a cover will not be required. Furthermore, rock deposition at Vault WRSF will not be completed prior to the end of overall mine operations (i.e., beginning of closure phase).

3.4.1.3 Tailings Storage Facilities

In accordance with the mine site's tailings management plan (AEM 2013a), AEM will utilize two distinct tailings areas; the North Cell until early 2015 (or possibly late 2014) and the South Cell to the end if mine life, currently projected to early 2018.

Progressive closure of the TSF will involve reclaiming the North Cell over a two-year period once deposition in that area has ended. Progressive closure of the North Cell will include the following:

- Grading to blend with the existing topography and to promote drainage of surface runoff toward the South Cell;
- Cover with up to 4 m of NPAG materials; and
- Cover trials to assess suitability and design of cover materials for erosion protection, thermal insulation, and freezing.

Thermistors have been (and more are scheduled to be) installed in strategic locations within the TSF to monitor the talik temperatures underneath the facility as freezing progresses and to monitor future tailings cover performance. Results to date from the thermistors indicate that freeze back is occurring in the North Cell TSF (AEM 2013a). This information will be used in conjunction with cover trials to determine final cover requirements for both the TSF North and South cells.

3.4.1.4 Water Management Infrastructure

Mining of the open pits required dewatering areas of Second Portage, Third Portage and Vault Lakes.

The Portage dewatering system was used to pump water from the north arm of Second Portage Lake and the Bay-Goose impoundment area into Third Portage Lake to permit operations at the Portage and Goose pits and Tailings Storage Facilities. While the dewatering system is no longer in operation, the pumps and water treatment plant have been re-purposed to discharge water from the Attenuation Pond to Third Portage Lake. The pipelines used for the Second Portage dewatering system have been decommissioned. Following the conversion of the Portage Attenuation Pond into the Reclaim Pond, all of the dewatering equipment (i.e. dewatering pipelines, effluent diffuser pipelines, pumps and water treatment equipment) will be dismantled and either shipped from the mine site or disposed of in the on-site landfill.

While there are no specific progressive closure activities associated with the Portage WRSF water collection system (i.e. seepage and runoff collection sumps), this infrastructure will enter a non-active stage once the WRSF and North Cell TSF have been closed and freeze-back has occurred. Activities during this time, before overall mine closure, will focus on water quality monitoring and possible pumping to the South Cell reclaim pond. Closure and decommissioning of the Portage WRSF water collection system will be implemented after monitoring demonstrates acceptable water quality.

3.4.1.5 Site Infrastructure

Certain site infrastructure will be closed progressively during the life of the mine, such as camps, temporary workspace, marshalling yards, quarries and storage areas. Buildings that are no longer required will be dismantled and the areas contoured to restore natural drainage or new acceptable drainage. The disturbed areas will also be scarified to promote natural re-colonization of vegetation from surrounding areas.

3.5 Closure Contingency activities

The Project Closure and Reclamation Planning team will have access to AEM resources and external consultants and advisors to resolve any unforeseen events or conditions identified during the closure period.

The closure plan currently incorporates a water treatment plant as a contingency measure should water in the Reclaim Pond or in the Portage Pit not be suitable for release to the environment. In this case, water would only need to be treated for a short period in order to drain the pond or until pit water meets closure criteria.

The WRSFs are designed for long-term stability, and are not anticipated to require additional earthworks at closure to stabilize the slopes. A risk assessment will be conducted to confirm these assumptions; if any risks are identified, they will be managed through monitoring and/or mitigation works which could include such options as flattening the overall slope (e.g., constructing toe berms or pulling back material at the crest) or redirecting additional waste rock to in-pit storage.

The Tailings Storage and Portage Waste Rock Storage Facilities will be covered with NPAG rock. Cover trials conducted during the operations phase of the Project will determine the required cover thickness for these facilities. The current plan is to cover these structures with up to 4m of NPAG cover. Upon approval from regulatory agencies, the determined cover thickness will be incorporated into the closure plan.

The dikes are also designed for long-term stability. After closure and breaching, the water differential across the dewatering dikes surrounding the open pits (i.e., East, Bay-Goose, South camp and Vault dikes) will be minimal (e.g., less than approximately 1 m). Therefore, no stability issues are anticipated for these dikes.

Seepages from the tailings containment dikes (Central Dike and Saddle dams 1 to 5) may affect closure and post-closure conditions. However, seepages are controlled by freezing of the tailings mass and dike foundations, and the use of a geomembrane liner on the upstream faces of these retention structures. Should the degree or timing of freezing of the dike foundations or tailings not occur as anticipated, and containment is required to manage seepage and water quality, a passive cooling system could be implemented to increase the rate and extent of freezing.

3.6 Permanent closure monitoring and reporting

Approach to Closure Monitoring

Many of the monitoring activities conducted during operations will continue during the closure and post-closure phases of the project. Where appropriate, the monitoring programs will be modified to reflect specific closure activities and conditions related to the different mine components. Monitoring will be conducted to “ensure that closure activities and any associated environmental effects are consistent with those predicted in the closure plan and to ensure that the objectives of mine closure are being met” (EC 2009, R536). In particular, monitoring according to the Core Receiving Environment Monitoring Plan (Azimuth 2012b) will continue until all work associated with mine closure is complete. The data collected during closure monitoring will allow the procedures and activities to be adjusted or modified as necessary to confirm ongoing environmental protection. Post-closure monitoring will also be conducted to confirm that closure and rehabilitation measures are functioning as designed.

Closure and Post-Closure Monitoring Phases

The closure phase for the Project will commence after mining operations have ceased (currently scheduled for early 2018). The closure period includes reclamation activities over a two to three-year period, as well as the extended period associated with pit flooding and stabilization of water levels and water quality. Progressive closure activities, as described in Section 3.4, will have already been initiated. Monitoring will be conducted over the closure period to evaluate stability of mine components and water quality across the site and in the receiving environment. It is anticipated that this closure phase will last approximately 10 years (to 2028), after which the dikes will be breached allowing mixing of pit and lake water, and the Project will enter the post-closure phase. During post-closure, there will not be any full-time personnel on site. Environmental monitoring will continue at a reduced frequency for approximately 5 additional years to ensure that closure objectives continue to be met.

Assuming acceptable conditions can be demonstrated, AEM will then apply to regulators to terminate the post-closure program.

The following sections describe the planned closure and post-closure monitoring activities associated with each mine component. A summary of the monitoring activities is provided in Table 3.2. Further details related to schedule are provided in Section 3.7.

Table 3.2. Monitoring during Closure and Post-Closure

Mine Component	Description / Location	Station Numbers*	Type of Sampling*	Frequency - Duration
Baker Lake Site Facilities	Secondary containment sump at bulk fuel storage facility	ST-40.1 ST-40.2 ST-40.3	Water quality	Prior to discharge to environment or transfer – Closure
AWPAR	All crossings		Visual inspections for erosion	Twice annually (pre and post freshet) – Closure and Post-closure
	HADD crossings		Water quality	Every 5 years - Post-closure
Dikes and Saddle Dams	Geotechnical inspection		Stability	Annually – Closure and Bi-annually – Post-closure
	Seeps	ST-S-1 ST-S-2 ST-S-3 ST-S-4	Water quality	Monthly or as found – Closure and Post-closure
Open Pits/Pit Lakes	Portage and Goose Pit Lakes	ST-17/ST-20	Water quality	Bi-annually during open water – Closure
	Vault Pit Lake	ST-26	Water quality	Monthly during open water (flooding) – Closure and Quarterly (fully flooded) – Post-closure
	Portage/Goose and Vault Pit Lakes	ST-12, ST-13	Water quality	Annually during open water – Post-closure
	Groundwater wells	ST-GW	Water quality	Annually - Closure
Waste Rock Storage Facilities	Portage	ST-16	Water quality	Annually during open water and once annually immediately following spring freshet – Closure Post-closure

Mine Component	Description / Location	Station Numbers*	Type of Sampling*	Frequency - Duration
	Vault	ST-24	Water quality	Monthly during open water and once annually immediately following spring freshet – Closure and Annually - Post-closure
	Seeps at Portage and Vault	ST-S	Water quality	Monthly or as found – Closure and Annually – Post-closure
	Geotechnical inspection		Stability	Annually – Closure and Bi-annually – Post-closure
Tailings Storage Facilities	Drainage runoff	ST-22	Water quality	Bi-annually during open water and once annually immediately following spring freshet - Closure
	Drainage runoff	ST-11	Water quality	Annually during open water – Post-closure
	Groundwater wells	ST-GW	Water quality	Annually - Closure
	Geotechnical inspection		Stability	Annually – Closure and Bi-annually – Post-closure
Water Management Facilities	Water Intake at Accommodation Complex, Mill, reclaim water and Emulsion Plant	ST-1, ST-2/4, ST-3	Water volume	Monthly - Closure
	Water diversion ditches at Portage and Vault areas	ST-5, ST-6, ST-7, ST-15	Water quality	Monthly during open water - Closure
	Receiving lakes near Portage and Vault Pits, and Baker Lake	ST-AEMP; ST-37	Water quality	Various Sampling Events per year – Closure and Post-closure
			Plankton	3 times per year – Closure and Post-closure

Mine Component	Description / Location	Station Numbers*	Type of Sampling*	Frequency - Duration
			Fisheries Habitat	Every 5 years – Closure and Post-closure
Waste Management Facilities	Landfarm	ST-14	Water quality and volume	Prior to discharge and weekly during discharge - Closure

* As per NWB 2008.

3.6.1 Baker Lake Site Facilities

General recommendations related to closure and post closure monitoring of infrastructure are provided in INAC (2007). The following recommendations are relevant to the Project:

- Maintain access infrastructure to support on-going reclamation and closure monitoring;
- Monitor wildlife/fish use of area to ensure mitigation measures are successful; and
- Check stream crossing remediation and any degradation associated with decommissioned roads such as erosion or ponding of water.

A detailed closure monitoring and maintenance plan specific to the Baker Lake Site Facilities has not been developed to date; however, such a plan is anticipated to be similar to the monitoring developed for the operations phase.

Water quality monitoring of surface water runoff from the Bulk Fuel Storage Facility that collects within a sump in the tank's secondary containment system is currently conducted prior to discharge. This monitoring would continue until the tanks are decommissioned and removed from the site or responsibility for the tanks is transferred to a new owner (to be determined at a later date). The water contained in the secondary containment system is released in a controlled manner to the environment once confirmed it meets regulatory criteria. Water quality results would be reported to the inspector prior to discharge, as required by the NWB water license, and in the Annual Report.

Water quality monitoring in Baker Lake, adjacent to the Baker Lake Site Facilities, conducted in accordance with the NWB Water License 2AM-MEA0815 (NWB 2008) and the Core Receiving Environment Monitoring Plan (Azimuth 2012b), will continue through closure. A detailed plan will be developed for the closure and post closure phases of the Project prior to the closure phase.

3.6.2 All-Weather Private Access Road

General recommendations related to closure and post closure monitoring of infrastructure are provided in INAC (2007). The following recommendations are relevant to the Project:

- Maintain access infrastructure to support on-going reclamation and closure monitoring;

- Monitor wildlife/fish use of area to ensure mitigation measures are successful; and
- Check stream crossing remediation and any degradation associated with decommissioned roads such as erosion or ponding of water.

A detailed closure monitoring and maintenance plan for the AWPAR has not been developed to date; however, such a plan is anticipated to be similar to the monitoring developed for the operations phase. This will involve periodic confirmation that rehabilitated stream crossing locations are functioning as expected, and there are no water quality concerns associated with runoff from the disturbed areas. The AWPAR will be inspected to meet conditions of the DFO authorization.

Monitoring would consist of visual inspections of erosion and turbidity at the former stream crossing locations, with access provided along the AWPAR route by helicopter. Areas prone to excessive erosion or experiencing instabilities will be identified and, if required, maintenance may be conducted to reduce the risk of additional materials movement at these locations. Surface water quality samples may be collected upstream and downstream of the erosion source, if deemed necessary, to evaluate the effects to water quality at fish bearing watercourses where permitted Habitat Altered, Destructed or Disturbed (HADD) for bridge and road construction had occurred (as per DFO Authorization).

Given the stability of the quarry structures along the AWPAR, and that monitoring results of 2011 and 2012 have not indicated any geochemical issues, water quality sampling at the quarries is not recommended. If turbidity issues in flowing or pooled water are visually observed, or there are significant changes to water drainage patterns during reclamation, detailed monitoring will be conducted. This monitoring will include, at a minimum, a single water chemistry sample upstream and downstream of the source.

3.6.3 Dikes and Saddle Dams

General recommendations related to closure and post closure monitoring of dikes and dams are provided in INAC (2007). The following recommendations are relevant to the Project:

- A consistent monitoring record from a constant point of observation from pre-mining through to post closure should be maintained; and
- Inspect to ensure there are no ongoing deformations that could lead to instability, unsafe conditions or compromise the post-closure land use.

Closure and post-closure monitoring of the dikes will involve geotechnical reviews and reports on thermal conditions, similar to those associated with the waste rock and Tailings Storage Facilities. A detailed monitoring program has not been developed to date, but is expected to involve annual or biannual inspections over the 10-year closure period, terminating with a final dam safety review in 2028. Water quality sampling will be conducted monthly for identified seeps in the dikes and saddle dams, and reported annually to interested stakeholders. Upon satisfactory results related to both stability and pit lake water quality, relevant dike sections will be breached. Post-closure monitoring will continue on an annual basis for an additional five years for the breached Bay-Goose Dike and Saddle Dam 3, at which point a final dam safety review will be conducted. The other breaches (South Camp and Vault) will involve complete removal of the dike and therefore no additional monitoring will be required for those mine components. Reporting will be on an annual basis following the assessments.

3.6.4 Open Pits

General recommendations related to closure and post closure monitoring of open pits are provided in INAC (2007). The following recommendations are relevant to the Project:

- Identify areas that are not stable;
- Check ground conditions to confirm permafrost conditions are being re-established as predicted;
- Sample surface water and profiles of flooded ponds/pits;
- Ensure that there is sufficient water supplied to maintain an appropriate water depth for flooded pits;
- Sample quality of groundwater seeping from pit walls to assess potential for contamination of mine water due to melting permafrost and ARD/ML from pit walls;
- Identify and test water management points (including seepage) that were not anticipated; and
- Inspect barriers such as berms, fences, signs, and inukshuks.

The closure phase for each open pit will include 6 to 8 years of pit flooding associated with direct rainfall and snowfall, runoff and seepages, Stormwater Management Pond (Tear Drop Lake) and Reclaim Pond (treated if required) water inputs (Portage and Goose pits only), and pumped water from Third Portage Lake (for Portage and Goosepits) and from Wally Lake (for Vault pit). The closure phase will also include a number of years following filling where water quality is monitored prior to breach of the dikes.

A detailed closure monitoring program has not been developed for the open pits to date; however, surface water quality monitoring (parameters to be sampled and frequency) and sampling locations will comply with the NWB Water License 2AM-MEA0815 (NWB 2008) monitoring requirements. In addition, groundwater quality will continue to be monitored while the pits are flooding. Reporting will occur annually during pit filling, as well as annually for the period between complete filling and dike breach. The dikes will only be breached after acceptable water quality has been demonstrated over a period of two years and in agreement with regulatory authorities. Following breaching of the dikes, post-closure monitoring and reporting will be conducted every two years for an additional five years, to ensure ongoing compliance and that the pit lakes are functioning as expected. If water quality continues to be acceptable at that point, then application will be made to regulators to terminate the monitoring program.

In addition to water quality, closure monitoring of the open pits will include a stability and safety component. Visual inspections will be carried out to check for signs of instability, rockfall, changes to groundwater inflows and overall integrity. Safety berms and signage will also be inspected and maintained as required. No specific structural maintenance activities are planned for the open pits during closure or post-closure periods. If required, however, the safety berms will be re-graded or adjusted to ensure adequate safety.

3.6.5 Waste Rock Storage Facilities

General recommendations related to closure and post closure monitoring of Waste Rock Storage Facilities (WRSFs) are provided in INAC (2007). The following recommendations are relevant to the Project:

- Periodically inspect areas where stabilization measures may be required;
- Periodic inspections by a geotechnical engineer to visually assess stability and performance of waste pile(s) and cover(s);
- Periodically inspect ditches and diversion berms;
- Examine ground conditions to confirm permafrost conditions are being established as predicted;
- Check thermistor data to determine thermal conditions within waste piles to confirm predicted permafrost aggradation/encapsulation where applicable;
- Test water quality and measure volume from controlled discharge points of workings to confirm that drainage is performing as predicted and not adversely affecting the environment;
- Identify water discharge areas (include volume and quality) that were not anticipated; and
- Evaluate/confirm success of closure activities in meeting end land-use targets.

As discussed in Section 3.3.6, closure of the Portage WRSF will involve capping the facility with a layer of NPAG rock. This closure activity is expected to occur progressively during operations, with the final areas being covered in 2015 after waste rock deposition has ended. The only closure activity at the Vault WRSF is expected to be general grading, since no capping of the facility is planned. Post-closure geotechnical (stability) monitoring will be conducted at the Portage and Vault WRSFs on a biannual basis for a 10-year monitoring period. Results of the monitoring will be documented in inspection reports which will also include recommendations for corrective actions and changes to the monitoring program, if required. At the end of the monitoring, a safety review will be conducted. Assuming acceptable long-term stability is demonstrated in the review, AEM will apply to regulators to discontinue the monitoring program.

A detailed post-closure monitoring program for water quality has not been developed for the WRSFs to date; however, the sampling program is associated with water management infrastructure at the WRSFs. The water quality monitoring (parameters to be sampled and frequency), including any identified seeps, and sampling locations will comply with the monitoring requirements outlined in the NWB Water License 2AM-MEA0815 (NWB 2008). The post-closure monitoring program will commence after the WRSFs have been closed, and will end with the decommissioning of water management infrastructure when acceptable runoff water quality has been demonstrated. Runoff can then be discharged to the environment without further management.

3.6.6 Tailings Storage Facilities

General recommendations related to closure and post closure monitoring of Tailings Storage Facilities are provided in INAC (2007). The following recommendations are relevant to the Project:

- Conduct periodic dam safety and stability reviews of structures that remain after closure;

- Check for degradation or aggradation of permafrost for tailings containment structures where permafrost was used in the design;
- Monitor pond water level and quality to confirm closure targets; and
- Evaluate/confirm success of closure activities in meeting end land-use targets.

Closure of the TSF involves capping and re-contouring the surface. Once water collecting in the Reclaim Pond is of acceptable quality to discharge to the environment without treatment, Saddle Dam 3 will be breached to allow free drainage to Third Portage Lake. Throughout closure, water quality will be monitored to determine when the Reclaim Pond can be decommissioned and to confirm acceptable runoff quality from the reclaimed TSF surface. A detailed closure monitoring program has not been developed for the TSF to date; however, water quality monitoring (parameters to be sampled and frequency) and sampling locations will comply with the monitoring requirements outlined in the NWB Water License 2AM-MEA0815 (NWB 2008). In addition, groundwater quality will continue to be monitored annually through closure to assess water quality underneath the tailings basin in the former taliks.

Thermal monitoring will continue to assess the aggradation of permafrost within the TSF. Reporting frequency will depend on results of the monitoring, but is expected to be annual for the first 10 years of the post-closure period, followed by monitoring every two years for an additional five years. If thermal conditions are considered acceptable, AEM will apply to regulators to discontinue the monitoring program.

It should be noted that AEM is conducting an optimization assessment for the disposal of tailings on site. This would involve maximizing deposition in the North Cell. The assessment is expected to be completed in mid-2014. If AEM proceeds with this optimization regulators will be notified and any requirements to amend permits will be met prior to any alteration of the concepts presented in this *Interim Closure and Reclamation Plan*.

3.6.7 Water Management Facilities

General recommendations related to closure and post closure monitoring of water management facilities are provided in INAC (2007). The following recommendations are relevant to the Project:

- Periodic inspections in the post-closure period to assess the performance of the existing water management structures;
- Check the performance of erosion protection on embankment structures such as rip rap or vegetation, and the physical stability of water management systems including permafrost integrity where applicable;
- Check water quality and flows to ensure system is working as predicted;
- Conduct ongoing inspection and maintenance of passive or active water treatment facilities associated with non-compliant mine water or runoff discharges; and
- Sample surface and groundwater if site specific conditions dictate.

Water management infrastructure will be decommissioned at various times in the overall closure phase of the Project depending on the function and location of the infrastructure. During closure, the frequency of monitoring will be the same as during operations, and will focus on the physical state and performance of structures and components. Once the water management infrastructure is no longer needed it will be decommissioned and natural drainage patterns will be re-established. In a few areas, permanent diversions may be required. Post-closure monitoring will involve annual inspections of permanent diversions as well as general site grading and establishment of proper/natural drainage patterns for a ten-year period, including 3 years during closure and reclamation.

In addition, monitoring of receiving lakes would be conducted in accordance with the *Core Receiving Environment Monitoring Plan* (CREMP, Azimuth 2012b) to confirm Project activities do not contribute to long term adverse effects on the natural ecosystem. A detailed plan will be developed prior to the mine closure that provides details on the locations, frequencies and parameters that are to be monitored. As per the CREMP, it is currently expected to include 5 or 6 sampling events per year (3 during open water and 3 under frozen conditions) with a focus on water quality and plankton in the receiving lakes and re-flooded basins (sediment and benthic monitoring will coincide with CREMP monitoring), and monitoring of fisheries habitat once every 5 years through the closure and post-closure phases of the Project. Reporting will be on an annual basis following the assessments.

3.6.8 Infrastructure at Mill and Service Areas

General recommendations related to closure and post closure monitoring of site infrastructure (i.e. buildings) and the Mill are provided in INAC (2007). The following recommendations are relevant to the Project:

- Monitor wildlife/fish use of area to ensure mitigation measures are successful;
- Check stream crossing remediation and any degradation associated with decommissioned roads such as erosion or ponding of water; and
- Identify any unpredicted sources of potential contamination.

Post-closure monitoring related to the infrastructure will focus on identifying general environmental effects that occur or persist after decommissioning and removal of all buildings and infrastructure. A detailed post-closure monitoring plan has not been developed to date; however, it will comply with water management monitoring requirements outlined in the NWB Water License 2AM-MEA0815 (NWB 2008).

3.6.9 Waste Management Facilities

General recommendations related to closure and post closure monitoring of contaminated soils and waste management facilities are provided in INAC (2007). The following recommendations are relevant to the Project:

- Carry out periodic inspections to investigate the quality of air, groundwater, discharge water, and water body sediment where contaminated soils have occurred;
- Carry out periodic inspections to investigate thermal degradation, and physical stability where contaminated soils have occurred;
- An assessment of residual contamination should be carried out to confirm the success of the remediation;

- Sample water treatment sludge periodically to determine the chemical characteristics, sludge stability, and leach-ability under the proposed long-term storage conditions;
- Test water quality and quantity to measure the success of the mitigation measures for waste disposal areas;
- Identify any unpredicted sources of potential contamination;
- Check for cracking or slumping of the landfill cover and for underlying waste material pushing its way up through the cover; and
- Inspect landfill disposal areas periodically to establish if buried materials are being pushed to the surface as a result of frost heaving.

A detailed post-closure monitoring program for the waste management facilities has not been developed to date; however, such a plan is anticipated to be similar to the monitoring developed for the operations phase and will comply with the monitoring requirements outlined in the NWB Water License 2AM-MEA0815 (NWB 2008).

The landfills are, or will be, constructed at the Meadowbank mine within the Portage WRSF. Only inert waste material consisting primarily of construction and non-organic domestic waste is disposed of at these facilities. Hazardous wastes are stored on-site in designated sea cans, and transported annually during the sea lift to a licensed hazardous waste disposal facility in southern Canada. Further details for these waste facilities can be found in the *Landfill Design and Management Plan* (AEM 2013d) and the *Hazardous Material Management Plan* (AEM 2012a). Water quality monitoring for the landfills is incorporated as part of the seepage monitoring of the Portage WRSF.

A Landfarm was constructed on-site to treat petroleum hydrocarbon contaminated soils and designed to direct contact water to a sump area. The water contained in the sump is released in a controlled manner to the TSF once confirmed it meets regulatory criteria (while not a regulatory requirement, this is a commitment AEM made in the *Landfarm Design and Management Plan* (AEM 2013e)). At closure, all remediated soils in the Landfarm will be removed and handled as appropriate (see Section 3.3.10.3). Soils remaining in the berm and base of the Landfarm will be sampled for petroleum hydrocarbons (AEM 2013e) and compared to GN Environmental Guidelines for Site Remediation (March 2009). Since this area will form part of the TSF at closure, no excavation is necessary if Industrial soil criteria are not met (AEM 2013e).

3.7 Permanent Closure and Reclamation Schedule

3.7.1 Planned Schedule with Progressive Closure

Figure 4.1 presents the Project schedule for each mine component for the closure and post-closure phases. The schedule includes progressive closure activities and indicates the type and timing of closure and post-closure monitoring that will be conducted.

As shown in the schedule, the pits will be flooded sequentially as mining is completed. It is expected to take six to eight years to fill each pit via a combination of passive and active flooding. Water quality monitoring will be conducted throughout this period. The updated water balance (SNC 2013) predicts that Portage and Goose pits will be fully flooded by 2023. Flooding of Vault pit is expected to take about six years and is scheduled to be completed in 2024. After the pits are full, it may take additional years of monitoring and/or water treatment to demonstrate acceptable water quality in the pit lakes. At that point the dikes will be breached and the pit waters will be allowed to mix with surrounding lake water. This ICRP assumes a minimum ten-year closure monitoring program for the pit lakes (to 2028), based on six years of monitoring as the Vault pit is filled and an additional four years of monitoring prior to breaching of the dikes. If acceptable water quality is demonstrated in a lesser time frame, it may be possible to breach the dikes earlier which would result in a shorter monitoring program. Post-closure monitoring following breaching of the dikes will be conducted bi-annually over a five year period to confirm that closure objectives continue to be met.

Closure monitoring of the dikes relates primarily to assessment of long-term stability. The monitoring period will coincide with the timing of pit flooding, acceptable water quality demonstrated in the pit and at the TSF, and subsequent breaching of the containment dikes. As discussed above, this ICRP assumes a ten-year monitoring period from 2018 to 2028, starting at the end of mining. It is also assumed that acceptable water quality in the Reclaim Pond will be achieved in the same 10-year period, at which point Saddle Dam 3 can be breached to allow natural drainage toward Third Portage Lake. If the dikes can be breached earlier than shown in the schedule, the annual monitoring requirements will be reduced. In either case, post-closure monitoring will be conducted at Bay-Goose dike and Saddle Dam 3 to confirm continued long-term stability following the dike breach activities.

Closure activities associated with the WRSFs are limited to final capping and re-contouring of the Portage WRSF, and re-contouring only of the Vault WRSF. Post-closure stability and water quality monitoring of the Portage WRSF will commence in 2015 and at the Vault WRSF in 2018, after waste rock deposition has ended. The post-closure monitoring period for both WRSFs is assumed to be 10 years.

The project schedule indicates progressive decommissioning of some of the water management infrastructure, as well as closure of site facilities in the two years following the end of operations (2018 to 2020). The AWPAR and road network, including access to the Vault area, will be maintained until the end of the 10-year closure period to facilitate monitoring as well as equipment access for final reclamation and/or contingency reclamation activities. The roads are scheduled to be decommissioned in 2030, after which site access for post-closure monitoring activities will be provided by helicopter.

A detailed implementation schedule for completing the closure work will be developed as part of the final Closure and Reclamation Plan. The schedule will include an evaluation of equipment requirements, timing and length of closure works (e.g., placement of covers, dike breaches), and management and coordination responsibilities.

3.7.2 Alternate Schedules without Progressive Closure

A similar schedule to the one presented in Figure 4.1 would apply if progressive closure activities are not incorporated in the mine plan and project schedule. The main impact on schedule would be a shifting of closure activities related to the Portage and Goose pits, the Portage WRSF, and/or the North Cell of the TSF by two to four years. In the case of the Portage and Goose pits, however, the closure water quality monitoring period (between complete filling of the pits and breaching of the dikes) could be reduced from six years to four years. This would result in a flooding and monitoring schedule coincident with what is already assumed for Vault pit.

The main disadvantage of not incorporating progressive closure is the loss of opportunity to better understand how closure measures will function over time and their ability to meet closure objectives. For example, if the North Cell of the TSF is not closed progressively, there will not be an opportunity to conduct cover trials to confirm appropriate cover design in terms of materials and thickness. Similarly, if the open pits are not flooded sequentially as mining ends, there would be a lost opportunity to monitor water quality that could support improved characterization for flooded conditions.

3.7.3 Alternate Schedule with Contingency Measures

In general, the Project schedule includes a 10-year closure monitoring period for each mine component. If risks to closure objectives are identified during this period, it is anticipated that there will be sufficient time to implement the proposed contingency measures with little (e.g., 1 to 2 years) to no impact on the schedule.

Should water treatment be required to attain acceptable quality in the pit lakes and/or Reclaim Pond, this could be implemented during either pit filling or the closure monitoring period prior to breaching of the dikes. There are over ten years in the schedule during which the pits will be flooded and water retained. The water quality monitoring conducted through operations (Reclaim Pond) and into the initial stages of pit flooding, and annual water quality modelling, will provide a good indication as to what treatment may be required and at what point it can or should be initiated.

If the tailings mass and Saddle Dams and Central Dike foundations do not freeze to the extent or in the timeframe that is anticipated, the contingency measure associated with additional cooling may be warranted. This could be implemented during the planned 10-year closure monitoring period. Depending on monitoring results and decisions to implement the contingency plan, closure of the North Cell of the TSF could extend beyond 2030; however, it would still likely occur within the overall post-closure monitoring period (to 2034 for the open pits and south cell of the TSF, and to 2040 for the roads).

In the unlikely event that the WRSF slopes have to be adjusted to ensure long-term stability, the earthworks could be conducted over a one or two year period. This could be done within the allocated 10-year monitoring period, including follow up assessments and safety reviews.

3.8 Permanent Closure Costs

A detailed financial security cost estimate has been prepared for the planned reclamation approach and activities described in Section 3.3 above. The cost estimate is summarized in Section 4.0, with a detailed description of assumptions included in Appendix I1 and a breakdown of individual reclamation activity costs in Appendix I2.

3.9 Permanent Closure Management and Accountability Structure

Final closure of the Baker Lake Site Facilities, AWPAR and mine site will be conducted by a dedicated team of internal staff, or by an external contractor, that is specifically tasked with implementing the final Closure and Reclamation Plan. All persons on the team will report directly or indirectly to AEM's closure and reclamation planning team (Section 1.3).

3.10 Projected Environmental Conditions after Closure and Reclamation

AEM is committed to responsible mining practices for the protection of human, wildlife and aquatic life health, and for minimizing impacts on the environment. AEM intends to leave behind a positive community and environmental legacy. Based on stakeholder and local community consultation to date, the intended end land use for Project-affected areas is (a return to) the "natural" state. As such, closure activities are focused on decommissioning mine components so that they blend into the existing landscape to the extent possible.

As discussed in Section 2.4, the landscape in the mine area is dominated by water, wetlands, and rock and boulders. The main type of vegetation is sedge which tends to occur in areas of shallow water. Lichens, mosses, and grasses also occur in drier parts and among the boulder fields. Along the AWPAR, the terrain is predominantly heath tundra. Secondary vegetation and landscape types along the road route are characterized by lichens, birch and riparian shrubs, and areas of standing water.

Following decommissioning activities, AEM will re-contour and grade the general mine site, Baker Lake Site Facilities and AWPAR areas to promote natural drainage of surface runoff and to provide a ground profile consistent with the surroundings. Reclamation efforts will focus on providing conditions conducive to natural re-colonization of the site by the surrounding native vegetation. Large-scale re-vegetation of the site is not considered feasible at this time as there is no readily-available seed material for native plants. In addition, there is a lack of available organic soils in the Project area which, in conjunction with the tough climatic conditions (short cold and dry growing seasons), makes it difficult to establish vegetation over large areas.

The TSF and Portage WRSF will be capped and re-contoured with a layer of NPAG rock to encapsulate the tailings and waste rock in permafrost and promote natural surface drainage to Third Portage Lake. The Vault WRSF does not require capping, but will be contoured to promote natural surface drainage to Vault Lake.

The open pit areas will be returned to a "natural" state by flooding and re-creating open water areas. This is consistent with the pre-development landscape in the mine area. Bay-Goose, South Camp and Vault Dikes will be breached and/or removed to connect the pit lakes to Third Portage and Wally Lakes, respectively.

Surface water runoff from the TSF will be monitored to determine requirements for treatment (if necessary). Water quality will meet CCME guidelines for the protection of aquatic life prior to discharge to the natural environment.

Figure 2.1 presents the closure concept for the Project. Visual representations of the final landscape, including maps and three-dimensional views of the area, will be developed in the final closure design.

3.11 Assessment of Post-Reclamation Risks to Human Environmental Health

Post-reclamation risks to human and environmental health will be identified and evaluated closer to mine closure, once the final closure designs are determined. An assessment of the post-reclamation risks will be provided in the final Closure and Reclamation Plan.

To date, the only physical post-reclamation hazard identified is the open pits. Access to the open pits will be secured by placement of rock berms around the pit perimeters prior to flooding to minimize hazards to human and wildlife.

Based on results of data collected in 2011, there does not appear to be any risks to wildlife from contaminant exposure in and around the Meadowbank Project site while the mine is in operations (Baxter 2012a). No risks to wildlife are expected from the Project post closure.

In 2011, AEM commissioned a human health risk assessment on the consumption of country foods in the vicinity of the Meadowbank Project site. Potentially unacceptable risks from the consumption of caribou muscle, caribou kidney, and Canada goose muscle were determined at reference sites and mine site locations, but risks did not appear to be mine-related (Baxter 2012b). Further evaluations are recommended to refine the risk assessment model to determine human health risks in post-closure.

4.0 FINANCIAL SECURITY

4.1 Schedule of Key Project Milestones for Financial Security Planning

Reclamation of the Meadowbank Gold Project facilities can be divided into the following three general stages:

- *Operations*: during which time progressive rehabilitation measures may be undertaken;
- *Active Closure*: during which time the major reclamation measures are undertaken; and
- *Post Closure*: all major construction activities have been completed and ongoing monitoring and maintenance is required, with minimal activity on-site.

Figure 3.1 provides a schedule detailing the closure stages of major components of the Meadowbank Gold Project.

4.2 Closure and Reclamation Cost Liability Schedule Through the Mine Life

During the remaining operating life of the mine, progressive reclamation measures may be undertaken as discussed in Section 3.4. Completing these reclamation measures provides a basis for reducing the required financial security. Progressive closure measures undertaken to date, which are reflected in the financial security cost estimate, include:

- Portage WRSF outer slopes have been progressively capped with NPAG material. As of January 2013, approximately 42% of the anticipated capping material has been placed (AEM 2013a).

The financial security cost estimate has been conservatively developed assuming no further progressive rehabilitation activities are completed through the remaining life of the mine, and all remaining reclamation costs are incurred at the onset of permanent closure. For this reason the financial security cost estimate should be revisited as progressive reclamation measures are completed. The following progressive closure measures are scheduled to be completed during the active mine life:

- Progressive Portage and Goose Pit flooding;
- Progressively cover Portage WRSF with NPAG material;
- Implement cover trials on the TSF North Cell;
- Progressively cover the TSF North Cell while depositing tailings in the South Cell; and
- Progressive reclamation of obsolete infrastructure.

The active closure measures account for the majority of the financial security which are primarily scheduled to be completed within the first two to three years of permanent closure (or progressively during the mining life of the project), with the exception of open pit flooding. Pit flooding is scheduled to occur over a nine year period for Portage and Goose Pits and a seven year period for Vault Pit. Upon successful completion of the active portion of permanent closure, the financial security should be adjusted to reflect the completed works, with the only remaining post-closure financial security costs associated with monitoring and maintenance requirements.

Upon successful completion all monitoring and maintenance requirements, as described in Section 3.6, AEM will apply to regulators to terminate the post-closure monitoring and maintenance program. At this time it is expected that no further financial security will be required.

4.3 Basis of Financial Security

A permanent closure and reclamation financial security cost estimate has been prepared using the RECLAIM template (Version 6.1, March 2009) for permanent closure of the Meadowbank Gold Project; the results of this estimate are summarized below. A detailed description of the cost estimate and assumptions used as well as a printout of the linked EXCEL spread-sheets from the RECLAIM template is provided in Appendix I.

The cost estimate has been developed assuming third party contractor rates, on the basis that AEM is unable to fulfill its closure and reclamation obligations, and the government is required to take over reclamation of the Meadowbank Gold Project. The cost estimate covers closure and reclamation of all facilities within the Meadowbank Gold Project property as described in Section 3.3. Closure and post closure monitoring and maintenance costs, as described in Section 3.6, have been calculated to their present value at the commencement of closure, with a discount rate of 5% applied.

The cost estimate provided assumes that hazardous materials are removed from all structures and equipment and disposed of appropriately. Closure and reclamation cost estimates do not normally permit the use of credit for salvaged materials or equipment; therefore no salvage values were incorporated into the estimate. The cost of non-hazardous waste disposal was estimated assuming onsite disposal within the Portage Waste Rock Storage Facility (WRSF).

A contingency for operating a temporary water treatment plant within the Mill building for five years during closure has been provided for in the cost estimate. If deemed necessary, this water treatment plant would treat any residual contact water, such as Portage WRSF runoff and seepage water and/or runoff water collected within the TSF, during the period where cover systems are being installed and freeze back is occurring.

Pricing of required earthworks construction materials assumes they are readily available in quantities required at no additional cost to the contractors, other than for excavation, processing (where required), loading, hauling, grading, and compaction to the desired lines and grades.

4.4 Financial Security Schedule Assuming No Progressive Reclamation

Due to the current advanced level of development of the Meadowbank Gold Project, a detailed financial security cost estimate has been provided based on the current end of mine life configuration. A detailed breakdown of closure costs, by mine component, for the Meadowbank Gold Project is included in Appendix I2; a summary is provided in Table 4.1 below.

Table 4.1: Summary Financial Security Cost Estimate

Cost Item	Subtotal
Direct Costs	
Open Pit	$4,930
Tailings Storage Facilities	$32,601,912
Portage Waste Rock Storage Facility	$4,895,039
Buildings and Infrastructure	
Meadowbank	$7,183,919
Baker Lake	$1,526,529
AWPAR	$1,061,664
Chemicals and Soil Management	$1,116,487
Water Management	$6,963,875
Post Closure Monitoring and Maintenance	$1,639,130
Subtotal Direct Costs	**$56,993,484**
Indirect Costs	
Mobilization/Demobilization	$2,424,791
PROJECT MANAGEMENT (5% of direct costs)	$2,849,674
ENGINEERING (5% of direct costs)	$2,849,674
CONTINGENCY (15% of direct costs)	$8,549,023
GRAND TOTAL	**$73,666,647**

5.0 TEMPORARY CLOSURE

5.1 Definition of Temporary Closure

Temporary closure is defined as the cessation of mining and processing operations for a finite period with the intent to resume mining activities as soon as possible after the cause for the temporary closure has been resolved. Temporary closure may last for a period of a few weeks (short-term) to several years (long term), based on economic, environmental and/or social factors (INAC 2007).

Short-term temporary closure is defined for a period of less than one year. Possible causes for short-term temporary closure may include major mechanical equipment failure, a fire, late delivery of critical equipment or supply, or a labour conflict.

Long-term closure consists of cessation of mining and processing operations for an indefinite period greater than one year. In this scenario, the site is placed into a mode of minimal operating expense while maintaining safety and environment stability. Possible causes for long-term temporary closure may include prolonged adverse economic conditions or extended labour dispute.

During a temporary closure, all construction and development activity at the Project site would cease. Regional exploration programs, if any, may continue. The site buildings and infrastructure would be secured against vandalism, and would be regularly inspected and maintained. They would not be demolished or decommissioned as they would be needed for operations once mining activities resume.

5.2 Temporary Closure Principles and Objectives

The objectives of temporary closure activities are to protect humans, wildlife and the environment, and maintain regulatory compliance until mining operations can resume. All facilities necessary to achieve the temporary closure objectives must be maintained operational.

Care-and-maintenance staff will be present at the site in sufficient number and expertise to care for the site and any potential problems that may arise as recommended in INAC (2007). Sufficient equipment and supplies/reagents will be left on site for any maintenance and monitoring activities that may need to take place. The required amount and type of staff, equipment and supplies/reagents will be dependent upon the specific site conditions at the time of the temporary closure, and would be evaluated on an ongoing basis as the temporary closure progresses.

Compliance with all applicable federal and territorial laws and regulations, in addition to the operator's Land Use Permits, Land Leases and Water Licenses, will be ensured.

5.3 Temporary Closure Activities

Temporary closure activities for the Project would include winterizing and securing equipment, fuel facilities and buildings, where necessary, and placing the site in a care-and-maintenance mode until the project was able to resume. The following activities may be implemented or completed upon temporary closure (INAC 2007):

- Access to the site, buildings, and all other infrastructures will be secured and restricted to authorized personnel only;
- Compliance with licenses, permits, and leases for all physical, chemical and biological treatment and monitoring programs will be maintained;
- All waste management systems, including the site incinerator, will be secured;
- An inventory of chemicals and reagents, petroleum products, and other hazardous materials will be conducted. All materials will be secured appropriately or removed off site if required;
- Fluid levels in all site and Baker Lake fuel tanks will be recorded and monitored regularly for leaks;
- All explosives will be relocated to the main powder magazine at the Emulsion Plant and secured, disposed of, or removed from the site;
- The Portage and Vault Waste Rock Storage facilities, ore stockpiles, Tailings Storage Facilities, open pits, dewatering dikes, mine site roads, Reclaim Pond, Portage and Vault Attenuation ponds, Stormwater Management Pond (Tear Drop Lake), and any other mine water and other impoundment structures will be inspected and maintained in an appropriate manner;
- Drainage ditches and sumps will be inspected and maintained regularly (e.g. seasonally depending on snow and ice accumulation and melting) as part of geotechnical inspections;
- Facilities and infrastructure will be inspected regularly; and
- The reclamation security deposit will be kept up to date.

The extent to which the activities listed above will be implemented depends on the site conditions at the time of the temporary closure, and the anticipated length of the closure (short-term or long-term).

In most circumstances, planned temporary closure activities are expected to occur as described above and in the following sections. Should a situation arise in which temporary closure cannot be executed as planned (e.g. major fire at the processing Mill, dam break/breach, etc.), the affected features will be subject to alternative temporary closure measures, with the planned temporary closure activities resuming as soon as practical. Temporary closure will occur as planned for features not affected by the situation. Such extreme cases of temporary closure will most likely be short in duration.

5.3.1 Baker Lake Site Facilities

The Baker Lake Site Facilities consist of the Bulk Fuel Storage Facility, dry freight storage area, office trailer, barge landing and interconnecting access roads. Power for the facility, including the office trailer, is supplied by portable generators and yard lighting is provided by portable, diesel powered light towers. These facilities will remain functional during short-term and long-term temporary closure periods in support of care-and-maintenance activities.

The following activities will be undertaken:

- Access to the Baker Lake Site Facilities will be secured and restricted to authorized personnel only. The roads will be regularly inspected and maintained for safe operation by regular grading, repair of potholes, application of additional surfacing material, if required, and snow clearing.
- The Bulk Fuel Storage Facility and dispensing area will remain functional in support of care-and-maintenance activities. The bulk fuel tanks will be regularly inspected and tank levels will be monitored throughout the closure period to identify potential fuel leaks.
- The office trailer will be placed into a care-and-maintenance mode, when not in use, to minimize operating costs. The trailer will be secured against unauthorized access (vandalism, etc.). Power and heating will be kept to a minimum to prevent the freezing of office furniture and electronic equipment.
- Operational monitoring procedures for water management will continue as necessary.

5.3.2 All-Weather Private Access Road

Temporary closure will not affect the AWPAR as it is used as the overland transportation route from Baker Lake to the mine site for supplies. Regular maintenance and monitoring activities will be maintained at the same frequency as that of operations during short-term temporary closure and at a reduced frequency as required during long-term temporary closure.

The following activities will be undertaken:

- The Guard house will be maintained and access to the AWPAR will be restricted to authorized personnel only;
- The communication towers will be maintained and monitored;
- The AWPAR will be maintained for safe operation by regular grading, repair of potholes, application of additional surfacing material if required, and snow clearing;
- Stream crossings will be maintained and monitored; and
- The wall stability of the 22 quarries will be inspected and maintained as required.

5.3.3 Dikes and Saddle Dams

Dike construction is progressive over the course of the project. The construction of the various dikes and dams was, or will be, completed in: the East Dike (2008), West Channel Dike (2008), South Camp Dike (2009), Bay-Goose Dike (2009-2011), Stormwater Dike (2009-2013), Central Dike (2012-2016), Vault Dike (2013), and Saddle Dams 1 (2009-2010), 2 (2010-2011), 3 (2015-2016), 4 (2015-2016), and 5 (2015-2016).

The following will be undertaken for all existing dikes (i.e., partially or completely constructed) during temporary closure:

- Maintenance of water management infrastructure supporting the dikes to operational levels;
- Implementation of warning signs at access areas to the dikes; and

- Installation of boulders and/or berms to block access roads to the dikes (these blockages must however allow access to authorized personnel for dike inspections).

All dikes will be subject to routine geotechnical stability monitoring and maintenance during temporary closure. Monitoring will be at the same frequency as that of operations during temporary closure. Maintenance will be completed as required. Monitoring will include checks for slope stability, changes to inflows and overall integrity.

Construction activities on dikes will typically cease on partially completed dikes during temporary closure. However some construction activities may be pursued in the early stage of temporary closure if they are required to ensure the stability and overall integrity of the partially completed dikes.

Water management will continue during temporary closure, although at a possibly reduced rate from operations. The objective during temporary closure will be to prevent affected dikes from being overtopped with water and therefore to preserve the stability and overall integrity of these retention structures.

The mine plan includes the breaching of the Bay-Goose and Vault dikes following flooding of the Portage, Goose and Vault pits. These dikes will not be breached until permanent closure and the water quality within the dikes has been found suitable for mixing with neighbouring lakes. Both the flooding of pits and breaching of dikes are permanent closure activities.

5.3.4 Open Pits

Open pit development will be staged over the course of mine operations. The Portage and Goose pits will be mined in the early stages of the development, while mining of Vault Pit will be undertaken at the later stages.

A pit will not be flooded if further development is expected according to the mine plan at the time of temporary closure. For such a pit, the following will be undertaken during temporary closure:

- Continued dewatering of the pit, as conducted during operations, since flooding and subsequent pit water removal may adversely impact pit wall stability;
- Maintenance of water management infrastructure supporting the pit to operational levels;
- Implementation of warning signs around the perimeter of the pit;
- Installation of boulders and/or berms to block access roads to the pit (these blockages must however allow access to authorized personnel for pit inspections);
- Removal and storage in designated areas of all mobile equipment from the pit, except for components required for the operation of the dewatering system and water management infrastructure. All vehicles will be regularly inspected for any potential oil or other fluid leaks; and
- Removal and storage in designated areas of all fuel, lubricants, hydraulic fluids and any other chemical compounds from the pit.

The pits will be subject to routine geotechnical stability monitoring and maintenance. Monitoring during temporary closure will be at the same frequency as that of operations. Maintenance will be completed as required. Monitoring will entail checks for rock falls, changes to groundwater inflows and overall integrity.

Deposition of waste rock in the Portage Pit is planned in the later stage of development for this facility. Waste rock deposition will cease during temporary closure. The routine geotechnical monitoring of Portage Pit will include stability of any waste rock deposits.

Pit flooding initiated at the time of a temporary closure may continue during the closure via direct precipitation, groundwater inflows, contributory runoff, and transfers of treated water from the Reclaim Pond (Portage and Goose only). This permanent closure activity is predicted to take approximately eight years (SNC 2013) and would normally be completed after cessation of all mining and processing operations for the project, if no temporary closure occurs. The mine site water balance (SNC 2013) will have to be revised during temporary closure to assess water requirements at the mine facilities following resumption of mining and processing operations (e.g., remaining volume of water required to complete flooding, or process water make up requirements from the flooded pits, if any).

5.3.5 Waste Rock Storage Facilities

The Portage and/or Vault Waste Rock Storage Facilities may be in a state of active development at the time of temporary closure. Development activities will cease during temporary closure, and the following will be undertaken:

- Maintenance of water management infrastructure collecting runoff and seepage from the facilities;
- Installation of boulders and/or berms, with warning signs, to block access roads leading to the rock storage facilities (these blockages must however allow access to authorized personnel for inspections); and
- Removal and storage in designated areas of all mobile equipment from the rock storage facilities. All vehicles will be regularly inspected for any potential oil or other fluid leaks.

The rock deposits will be re-graded as required to ensure their physical stability. The Waste Rock Storage Facilities will be subject to routine geotechnical stability monitoring and maintenance. Monitoring will be at the same frequency as that of operations. Maintenance will be completed as required.

5.3.6 Tailings Storage Facilities

The Tailings Storage Facilities consists of two deposition cells (i.e., North and South) operated in succession. The North cell is operated first and filled to capacity before deposition in the South cell is initiated. Tailings deposition will cease during temporary closure, and the following will be undertaken:

- The tailings slurry pipe distribution system will be purged, flushed and drained;
- Maintenance of water management infrastructure supporting the Tailings Storage Facilities to operational levels;
- Installation of boulders and/or berms, with warning signs, to block access roads leading to the Tailings Storage Facilities (these blockages must however allow access to authorized personnel for inspections); and

- Removal and storage in designated areas of all mobile equipment from the Tailings Storage Facilities. All vehicles will be regularly inspected for any potential oil or other fluid leaks.

The tailings surface area will be re-graded, if needed, to promote slope stability. Erosion control measures will be implemented, if required, to reduce the potential mobilization of tailings by wind. The measures may include one or a combination of the following:

- Spraying water to keep the tailings surface wet; and/or
- Covering the tailings surface with a layer of gravel.

The Tailings Storage Facilities will be subject to routine geotechnical stability monitoring and maintenance. Monitoring will be at the same frequency as that of operations. Maintenance will be completed as required.

5.3.7 Water Management Facilities

The water management facilities will be actively operated during temporary closure. Activities at these facilities are described below.

Dewatering systems: Any dewatering at Vault Lake will continue during temporary closure. Upon the completion of the dewatering process, pit sump(s) and pumping system(s) will be put in place for collecting water draining from pit areas.

Flooding systems: Flooding of pits is a permanent closure activity that might be ongoing prior to temporary closure at the Portage and Goose pits as part of progressive reclamation. This activity, if occurring, will continue during temporary closure.

Waste rock storage runoff collection systems: The topography on the Southwest side of the Portage Waste Rock Storage Facility naturally conveys surface water runoff to the Tailings Storage Facilities North Cell, which will continue during temporary closure. On the Northeast side of the Portage WRSF seepage and surface water runoff is collected in a sump and monitored. During temporary closure, this collection system would be maintained and, if deemed necessary, the water would be pumped or transported to the TSF North Cell. The topography surrounding the Vault Waste Rock Storage Facility is anticipated to convey runoff into the Vault Attenuation Pond (SNC 2013).

Water Diversion Systems: These systems will be in operation during temporary closure to minimize the amount of non-contact water entering contact water storages (i.e., Reclaim Pond and Vault Attenuation Pond). The operational inspection and maintenance program for these systems will be maintained during temporary closure.

Pit sump and pumping systems: Sumps will be in place for collecting water draining from pit areas. During temporary closure, stored water will be pumped as needed (e.g. preserving pit slope stability) to the Reclaim Pond and/or Portage Attenuation Pond (Portage and Goose pits) or Vault Attenuation Pond (Vault Pit).

Tailings pipelines: The tailings pipelines will be purged, flushed and drained for temporary closure following the shutdown of the Mill.

Attenuation ponds: The pumping system in place at these water bodies will remain operational during temporary closure in order to maintain water levels below dike crests. Collected water at Portage and Vault

Attenuation ponds will be treated for removal of suspended solids and discharged as needed to Third Portage and Wally lakes through their respective effluent outfall diffusers.

Reclaim Ponds: The Reclaim Pond will only collect precipitation and runoff and seepage water from the Portage WRSF during temporary closure. No tailings slurry water will be discharged to the facility. As required to maintain water levels below dike crests, the pumping system will be utilized to direct excess water in the Reclaim Pond to Portage Pit Lake or directly to Third Portage Lake (dependent on the Project phase). Water treatment may be necessary prior to transfer to meet with Project discharge criteria.

Stormwater Management Pond (Tear Drop Lake): Water from this lake will periodically be directed to the Reclaim to prevent overtopping of surrounding infrastructure.

Freshwater intake and treatment system: Operation of this system will be decided at the time of temporary closure with respect to human consumption requirements. Temporary measures (i.e., water from other sources brought to site and stored) will be in place to supply water for consumption if the amount of site staff does not justify the operation of the existing system. A shut down, if needed, will be completed in an orderly fashion to ensure that the systems can be restarted with minimal delay when mining and processing operations resume.

Waste water treatment system: Operation of this system will be decided at the time of temporary closure with respect to the anticipated presence of site personnel. Temporary measures (i.e., the incineration of sewage) will be in place to manage human waste at the mine site if the amount of site staff does not justify the operation of the existing system. A shut down, if needed, will be completed in an orderly fashion to ensure that the system can be restarted with minimal delay when mining and processing operations resume.

5.3.8 Infrastructure at Mill and Service Areas

Accommodations: The accommodation facilities will be placed in a care-and-maintenance mode during temporary closure to minimize operating costs and ensure environmental stability. With the exception of the areas used by care-and-maintenance personnel, all non-essential areas and offices within the accommodation facilities (including administration/maintenance areas) will be closed off to reduce power, heating and ventilation during temporary closure. Closed off areas will be securely locked and access will be restricted to authorized personnel only. All necessary support facilities and services for care-and-maintenance personnel will remain in operation. Any hazardous materials located within closed off areas of the accommodation facilities will be collected, inventoried and securely stored.

Ore processing: Any ore stockpiled at the start of a temporary closure will be processed before plant operations are halted. In the event where this is not possible and the ore stockpile cannot be processed, such as in the case of a fire or mechanical breakdown preventing further ore processing activity, the remaining ore stockpile will be left in place and drainage from the stockpile will be monitored, collected and directed to active water management facilities until operation activities resume. These cases are typically of short duration. During temporary closure, the Mill will be temporarily shut down in a planned and orderly sequence to prevent damage to equipment, piping, and instrumentation. At the initiation of temporary closure, the following preparatory measures will be taken:

- The Mill will be purged of all ore materials;

- All gold dore bars will be removed from the site; and
- All slurry lines will be flushed of solids.

Short-term temporary closure measures at the Mill will include the following:

- Minimal heating to the facility will be maintained to prevent equipment from freezing;
- Power supply to the Mill will be maintained;
- Raw water supply to the Mill will be turned off;
- An inventory of all chemical reagents will be undertaken and maintained;
- Tank levels will be monitored to identify potential leaks;
- All non-critical equipment will be shut down; and
- All major equipment will be run periodically to ensure lubrication and integrity of the rotating parts (e.g., conveyors would be run every other day and slurry pumps operated with water once per week).

If long-term temporary closure is anticipated, measures to be undertaken will include:

- Equipment and gearboxes would be drained of lubricants and coolants, which in turn would be stored in sealed drums at a designated area on the mine site. The drums will be regularly inspected for potential leaks;
- Sensitive electronic devices such as instrumentation control cards, personal laptop computers and control system computers will be removed;
- All chemical reagents would be inventoried and transferred to secure storage within the mine site;
- Heavy rotating equipment will be lifted off bearings and safely supported;
- All heating and power will be turned off and power lines to the Mill will be discharged and left open; and
- The entire Mill will be winterized and locked up with emergency access restricted to authorized personnel only.

AEM is a signatory of the International Cyanide Management Code (the Code). The Code represents a voluntary commitment on the part of all signatories to identify and follow basic principles and guidelines for safe cyanide use at gold mining operations. Under the Code, gold mines are required to manage their cyanide from source to site, thus assuming “cradle to grave” responsibility for all cyanide used at their operation (AEM 2012). Specific procedures relating to the management of cyanide during a temporary closure include:

- Cyanide reagent will be stored within sealed seacans with access by authorized personnel only; and
- All equipment that comes into contact with the cyanide reagent will be flushed triple rinsed to dissolve any residual cyanide and decontaminate the equipment. Rinse water from the flushing process will be recovered into the Cyanide mix tank and used in the gold recovery plant before discharge under controlled and permitted conditions to the Tailings Storage Facilities.

Power, electric grid and fuel: The Power Plant would remain functional during short-term and long-term shutdown periods in order to supply power to, and heating requirements for, care-and-maintenance personnel. All non-essential power lines would be discharged and left open during long-term shutdown as power and heating to non-critical plant and infrastructure will be turned off. The Power Plant would be configured to operate at maximum efficiency under reduced loading conditions.

The fuel storage areas will remain functional during short-term and long-term shutdown periods in support of care-and-maintenance activities. All tank levels would be monitored throughout the temporary closure period, and the tanks would be regularly inspected for potential fuel leaks.

Services: During short-term and long-term temporary closure, the infrastructure related to services (e.g., Service Building, warehouses, contractor area) would be placed in a care-and-maintenance mode to minimize operating costs while maintaining conditions that would permit the safe mechanical resumption of operations at reasonable cost and schedule. No buildings or other surface infrastructure will be demolished, removed or decommissioned during temporary closure. Buildings not in use by the care-and-maintenance personnel would be secured against unauthorized access.

Temporary closure strategies for the site infrastructure include:

- Materials and equipment sensitive to temperature and moisture will either be removed and stored off site or relocated to a protected on-site area. In some cases this equipment and material will be protected against moisture by shrink wrapping or packing with moisture absorbing material.
- Minimal heating to critical facilities will be maintained during a short-term closure period to prevent equipment from freezing. However, in the event of a long-term shutdown, all heating and power will be turned off. These facilities will be winterized and locked up with emergency access restricted to authorized personnel only.
- All non-critical facilities and equipment will be shut down. Computing facilities including networks and databases will be backed-up. The equipment within the accommodation and service facilities that are not required by the care-and-maintenance personnel will be closed off so that heating and ventilation can be reduced to minimum levels.
- Any hazardous materials stored within the site facilities will be collected and stored in a secured fashion, or transferred off site. An inventory will be prepared of all hazardous materials stored on site, including fuel levels within each storage tank. Fuel levels will be regularly checked against the inventory to ensure that no unexpected loss of fuel has occurred.
- Most surface mobile equipment will be relocated to a secured, common parking area and periodically inspected for any potential oil or other fluid leaks. Emergency response vehicles will be kept available for use as required.

Roads and airstrip: Regular maintenance and monitoring activities will be maintained at the same frequency as that of operations. Monitoring will consist of checking for signs of damage and deterioration, such as cracks, potholes, sloping or erosion.

Airstrip Quarry: The Airstrip Quarry will be regularly inspected, and maintained as required, during temporary closure.

Emulsion plant area: Explosive materials will be inventoried and stored within the ammonium-nitrate and explosive magazine storage areas or transferred off site. The Emulsion Plant and ammonium-nitrate and explosive magazine storage areas will be locked securely with emergency access restricted to authorized care-and-maintenance personnel only.

Vault area: The separate mobile power plant, the small maintenance shop, office, and emergency accommodation facilities in the Vault area will be shut down and locked. Where necessary, material and mobile infrastructure and equipment will be moved to designated areas at the mine site.

5.3.9 Waste Management Facilities

The waste management facilities will be actively operated during temporary closure. Activities at these facilities are described below.

Landfill: Operation of this facility will be decided at the time of temporary closure with respect to the anticipated length of time of temporary closure, the number of care-and-maintenance personnel on site, and amount of waste expected to be produced. Temporary measures (i.e., carrying waste out of the mine site for disposal) will be in place to manage waste at the mine site should temporary closure activities not justify the operation of the existing system. Temporary closure of the facility will involve the installation of boulders and/or berms, with warning signs, to block access to the landfill (these blockages must however allow access to authorized personnel for inspections), and cover to prevent windblown debris. Inspection activities will be conducted on the same frequency as that of operations.

Incinerator: Operation of this system will be decided at the time of temporary closure with respect to the number of care-and-maintenance personnel on site and amount of waste expected to be produced. Temporary measures (i.e., carrying waste out of the mine site for disposal) will be in place to manage waste at the mine site should temporary closure activities not justify the operation of the existing system. A shut down, if needed, will be completed in an orderly fashion to ensure that the system can be restarted with minimal delay when mining and processing operations resume. The incinerator will be maintained and inspected, and all reporting will be completed on the same frequency as that of operations in accordance with regulatory requirements.

Hazardous material storage area: An inventory will be prepared of all hazardous materials stored on site. The hazardous materials will be stored inside locked seacans, or transferred off-site if transportation (a barge heading south during the open water season) is available. Inspection activities will be conducted on the same frequency as that of operations.

Landfarm: The Landfarm will remain in operation and ready to receive contaminated soils and snow should an accidental spill occur during care and maintenance activities. The soils will be mixed with earth-moving equipment two to four times per year, as per normal operational requirements, during the summer months to promote soil aeration and bioremediation.

5.4 Temporary Closure Contingency Program

The Project closure and reclamation planning team and the care-and-maintenance staff assigned to the Project during temporary closure will have access to AEM resources and external consultants and advisors to resolve any unforeseen events or conditions identified during the closure period.

5.5 Temporary Closure Monitoring, Maintenance and Reporting

The temporary closure monitoring, maintenance and reporting will typically be similar to the procedures carried out during operations in order to meet licensing and permitting requirements (Section 2.3). Adjustment of monitoring frequencies for long term temporary closure will be made only following approval from the licensing and permitting authorities concerned. Further details on monitoring, maintenance and reporting for the components of the Project in temporary closure are provided below.

Baker Lake Site Facilities: Inspections of the access roads and Bulk Fuel Storage Facility will be conducted at the same frequency as that of operations. Maintenance of the access roads will be conducted as required. Tank levels will be monitored regularly to identify potential fuel leaks. Water quality monitoring will be conducted as stipulated in AEM (2009) for all as-built facilities.

All-Weather Private Access Road: Temporary closure will not affect the AWPAR as it is used as the overland transportation route from Baker Lake to the mine site for supplies. Regular maintenance and monitoring activities will be maintained at the same frequency as that of operations during short-term temporary closure and at a reduced frequency as required during long-term temporary closure.

Dikes: Dike monitoring activities and frequencies will be the same as that of operations, described in the *Dewatering Dikes Operation, Maintenance and Surveillance Manual* (AEM2013g). Monitoring activities include daily and monthly routine inspections by care-and-maintenance staff for any signs of instability of these structures (e.g., cracks, erosion and sloping).

A geotechnical inspection by a professional engineer will be conducted annually between July and September (NWB 2008). Geotechnical instrumentation is required on the dikes to provide early warnings of potentially adverse trends such as excessive pore water pressure, seepages and/or deformations. The instrumentation consists of piezometers, thermistor lines, inclinometers and survey monuments (seismographs are also considered as part of blasting activities during operations). All existing instruments on dikes will remain in place and will be maintained in working order during temporary closure. Measured data will be collected, compiled and reviewed as part of geotechnical inspections.

Open Pits: Open pits will be inspected by care-and-maintenance staff on a monthly basis during temporary closure, in conjunction with the water quality monitoring undertaken in accordance with the water license requirements (NWB 2008). These inspections will check for signs of instability, rock fall, changes to groundwater inflows and overall integrity. A geotechnical inspection will also be conducted by a professional engineer on an annual basis.

Tailings and Waste Rock Storage Facilities: These facilities will be inspected by care-and-maintenance staff on a monthly basis during temporary closure to check for signs of slope instability. A geotechnical inspection will also be conducted by a professional engineer on an annual basis.

A thermal monitoring plan has been prepared for the Tailings Storage and Portage Waste Rock Storage Facilities (AEM 2013a). The objective of this plan is to characterize thermal profiles that would support reclamation strategies, notably the cover, of these storage facilities. Thermistor lines installed as part of this plan will remain in place and will be maintained in working order during temporary closure. Data from these instruments will be collected, compiled and reviewed as part of geotechnical inspections.

Water Management Facilities: Ponds, ditches, culverts and pumps during temporary closure will be inspected and maintained on a frequency that is similar to that during operations. Regular monitoring during the snowmelt and ice-free season, during heavy or prolonged rainfall will be conducted as described in the *Water Quality and Flow Monitoring Plan* (AEM 2009). Water quality and quantity monitoring will be performed on the same frequency as that of operations in accordance with water license requirements (NWB 2008).

The *Water Quality and Flow Monitoring Plan* is currently being updated and will be submitted as part of the 2013 Annual Report to the NWB.

Infrastructure at Mill and Service Areas: The necessary support facilities and services within the Mill and service areas during short-term temporary closure will be maintained and inspected on the same frequency as that of operations, and at a reduced frequency during long-term temporary closure. All tank levels and hazardous materials will be monitored throughout the closure period to identify potential leaks and risk to the facilities and the environment. Reduced monitoring is expected on non-critical facilities that will be shut-down during temporary closure.

Waste Management: Inspections of the Landfill and Hazardous Material Storage Area will be conducted on the same frequency as that of operations. The Incinerator will be maintained and inspected, and all reporting will be completed on the same frequency as that of operations in accordance with regulatory requirements. Water and snow-melt monitoring and management activities at the landfarm during temporary closure will be maintained on the same frequency as that of operations.

Receiving Environment: Monitoring in accordance with the water license requirements (NWB 2008) will remain in effect during temporary closure; this includes the *Aquatic Effects Management Program* (Azimuth 2012a), the *Core Receiving Environment Monitoring Plan* (Azimuth 2012b), and the *Water Quality and Flow Monitoring Plan* (AEM 2009).

5.6 Temporary Closure Schedule

Establishing a temporary closure schedule inherently contains uncertainty as this is not a planned activity, and the duration of a temporary closure will vary based on the cause for closure. As a result, the schedule will be progressive.

Mining activities during short-term closure are typically stopped. However, activities such as care-and-maintenance, monitoring, intermittent testing, periodic operation of equipment and appropriate facilities will be on-going as described above. Activities related to ensuring public and wildlife safety would be a priority, and would focus upon maintenance and monitoring of all facilities and equipment to maintain physical and chemical stability. A sufficient number of care-and-maintenance staff would be present on site, and an appropriate level of security would be implemented at selected facilities. Access to temporarily inactive facilities would be restricted to authorized personnel only. Boulders and/or berms and warning signposts to deny access would be erected where appropriate, such as on dikes, pit entrances, etc.

Should temporary closure occur during pit development, water management activities from the pit sumps would continue to maintain pit wall and dike stability. Pit flooding that has been initiated at Portage and Goose pits at the time of temporary closure will continue, as it is a component of permanent closure and reclamation. The initiation of flooding at Vault Pit marks the completion of all mining activities and the period when only permanent closure and reclamation activities are ongoing.

Non-emergency and non-essential vehicles will be relocated to a secured, common parking area and regularly inspected for any potential oil or other fluid leaks. Emergency response vehicles will be kept available for use as required. All non-essential power lines would be discharged and left open during long-term shutdown as power and heating to non-critical plant and infrastructure will be turned off. All tank levels would be monitored throughout the temporary closure period, and the tanks would be regularly inspected for potential fuel leaks. Any hazardous materials located within closed off areas of the site will be collected, inventoried and securely stored.

Monitoring during short-term temporary closure will be at the same frequency as that of operations, and at a reduced frequency during long-term temporary closure. Maintenance will be completed as required. All necessary support facilities and services for care-and-maintenance personnel will remain in operation.

5.7 Temporary Closure Costs

Specific temporary closure costs cannot be developed due to the uncertainty associated with the timing and duration of a temporary closure. Cost estimates will be prepared at the time of temporary closure based on the expected duration of closure. Costs would be necessarily progressive as the duration of closure progresses. As such, regular updates will be conducted.

5.8 Temporary Closure Management and Accountability Structure

Care-and-maintenance staff will be assigned to the Project during temporary closure, to undertake required maintenance and monitoring activities at the Baker Lake Site Facilities, the AWPAR and mine site. This staff will be under the supervision of the Project closure and reclamation planning team (Section 1.3).

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Report Signature Page

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FIGURES

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AGNICO EAGLE MINES LIMITED

MEADOWBANK GOLD PROJECT
INTERIM CLOSURE AND RECLAMATION PLAN

PROJECT LOCATION

FIGURE 1.1

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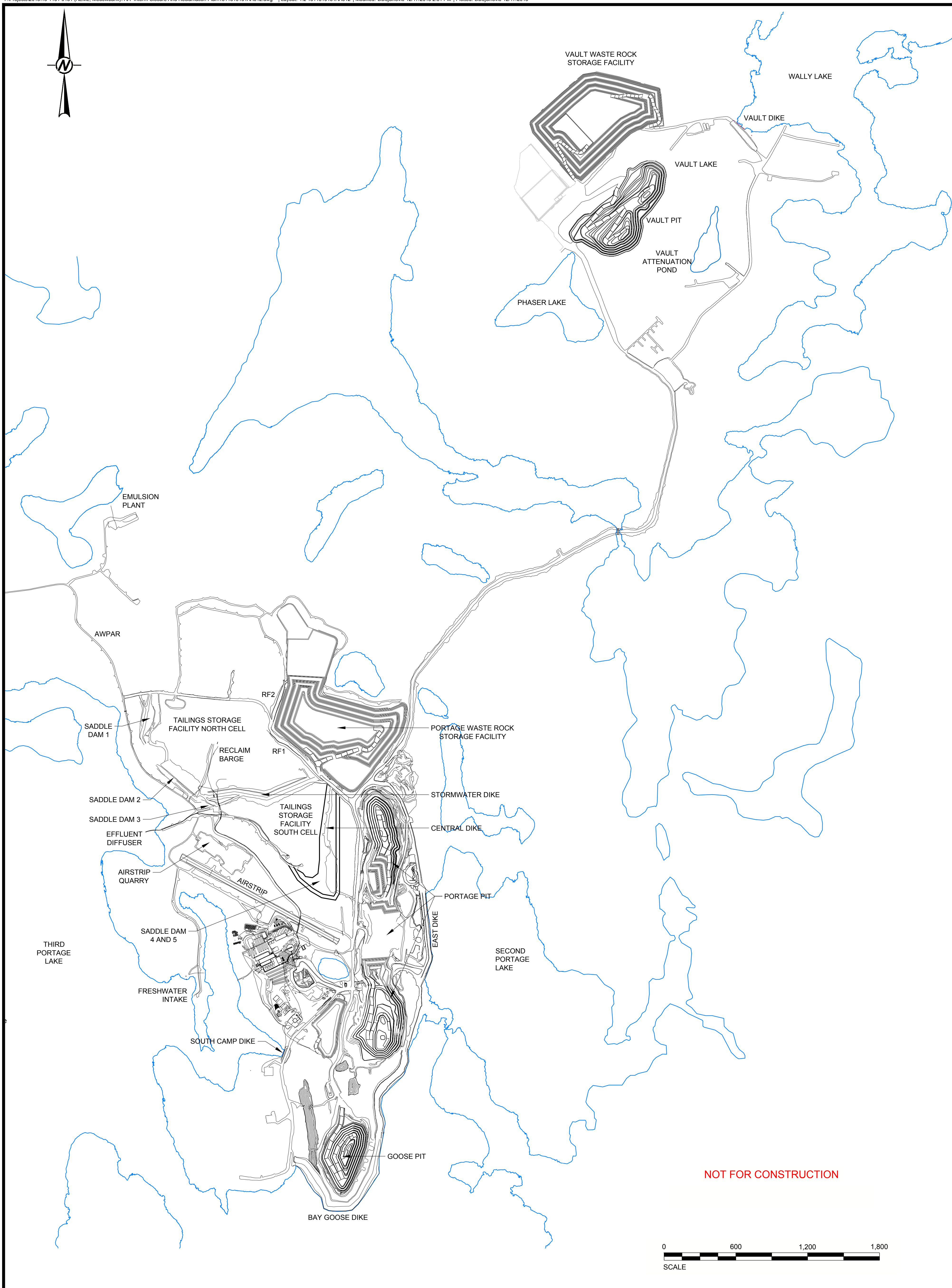

PROJECT

AGNICO EAGLE MINES LTD.
MEADOWBANK GOLD PROJECT
INTERIM CLOSURE AND RECLAMATION PLAN

TITLE

GENERAL MINE LAYOUT

Golder Associates

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CHECK	BR	2013-12-17		1.2
REVIEW	RG	2013-12-17		

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REFERENCE

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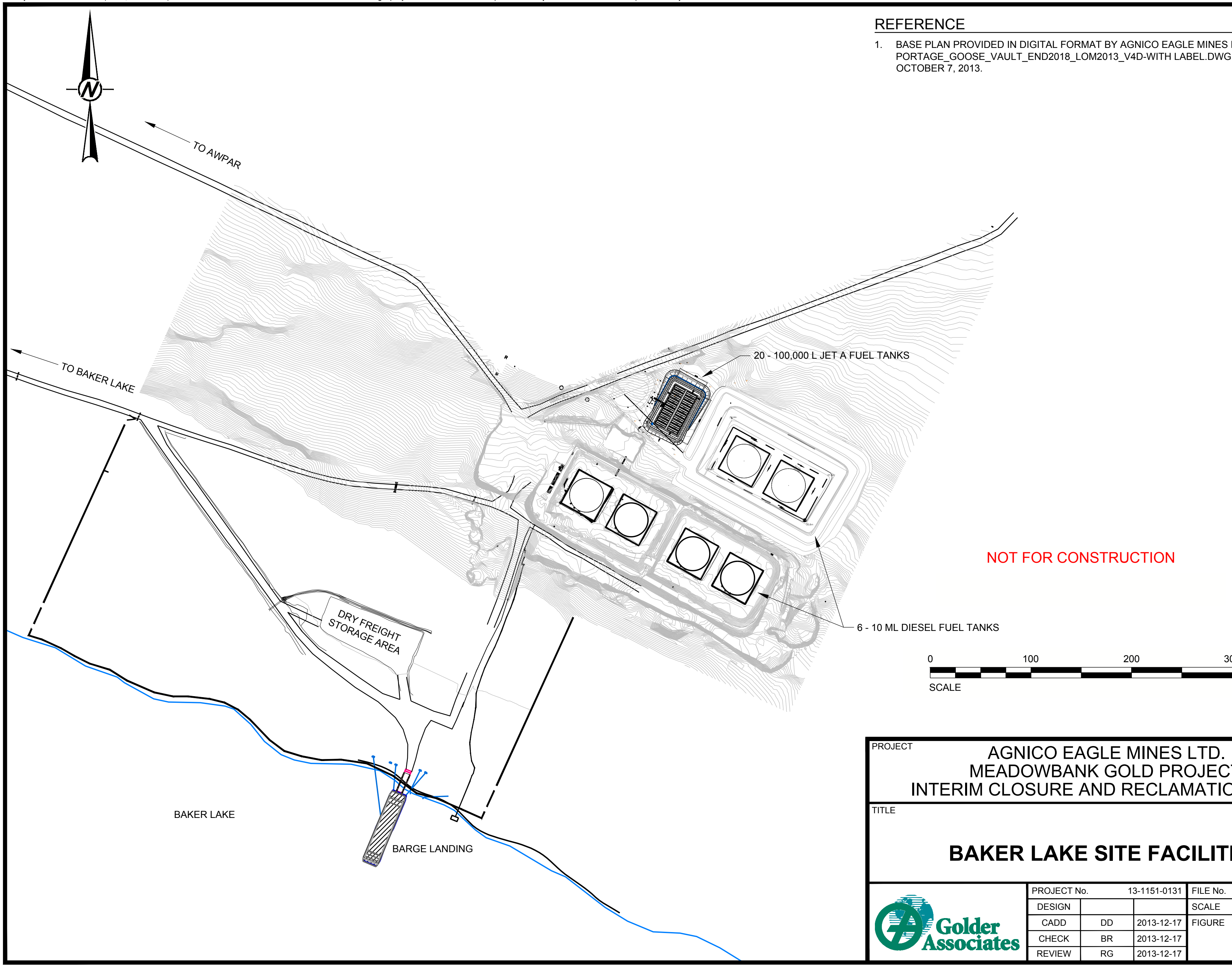

PROJECT

AGNICO EAGLE MINES LTD.
MEADOWBANK GOLD PROJECT
INTERIM CLOSURE AND RECLAMATION PLAN

TITLE

BAKER LAKE SITE FACILITIES

PROJECT No.		13-1151-0131	FILE No.	1311510131AA013
DESIGN			SCALE	AS SHOWN
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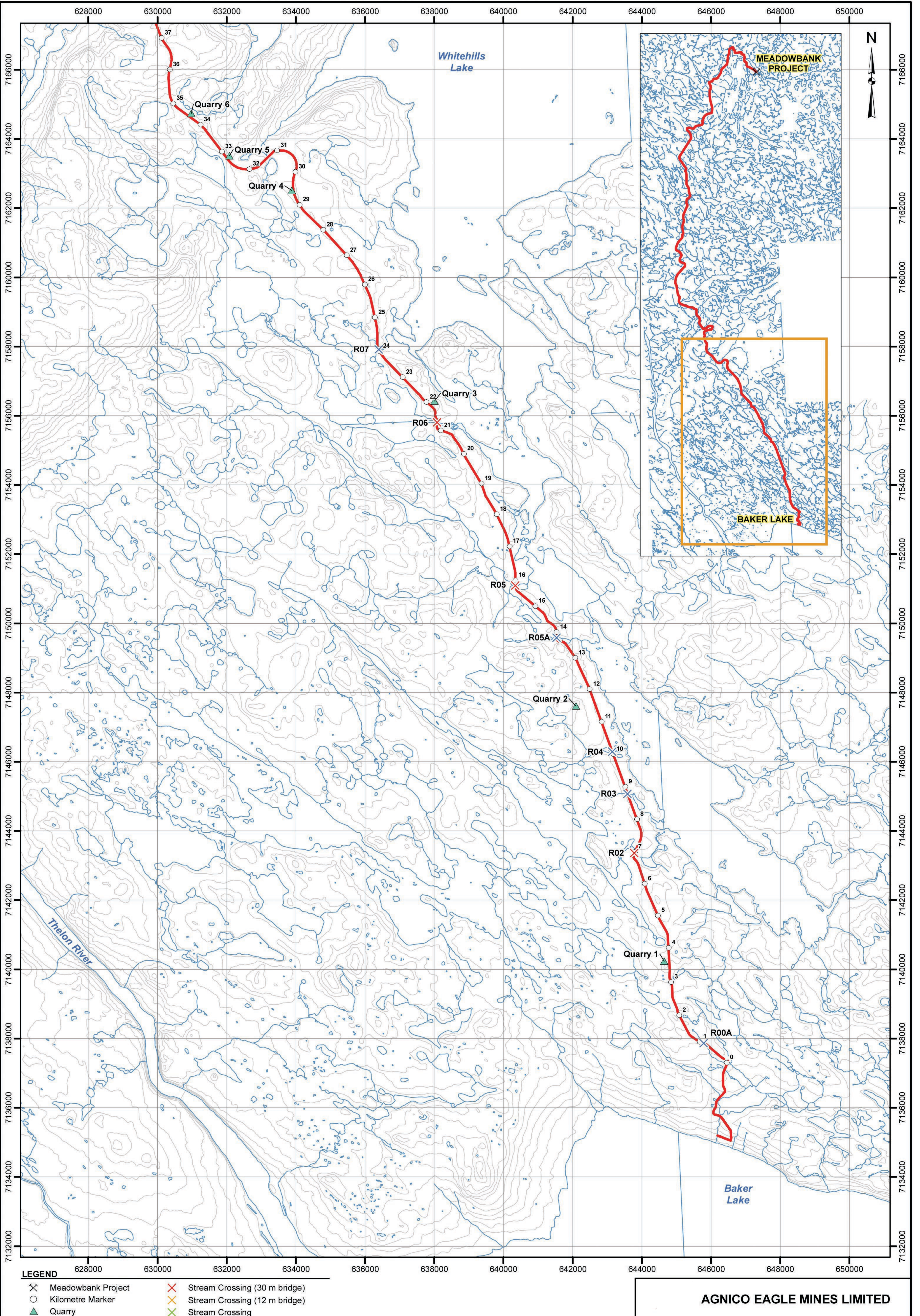
Golder Associates



LEGEND

- Meadowbank Project
- Kilometre Marker
- Quarry
- Proposed Route
- Contour (10 m interval)
- Watershed Boundary
- Stream Crossing (30 m bridge)
- Stream Crossing (12 m bridge)
- Stream Crossing (multiple culverts at bottom)
- Stream Crossing (single culvert at bottom)
- Watercourse
- Waterbody

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Scale - 1:100,000

REFERENCE

Cumberland Resources Ltd.

Datum: NAD 83 Projection: UTM Zone 14

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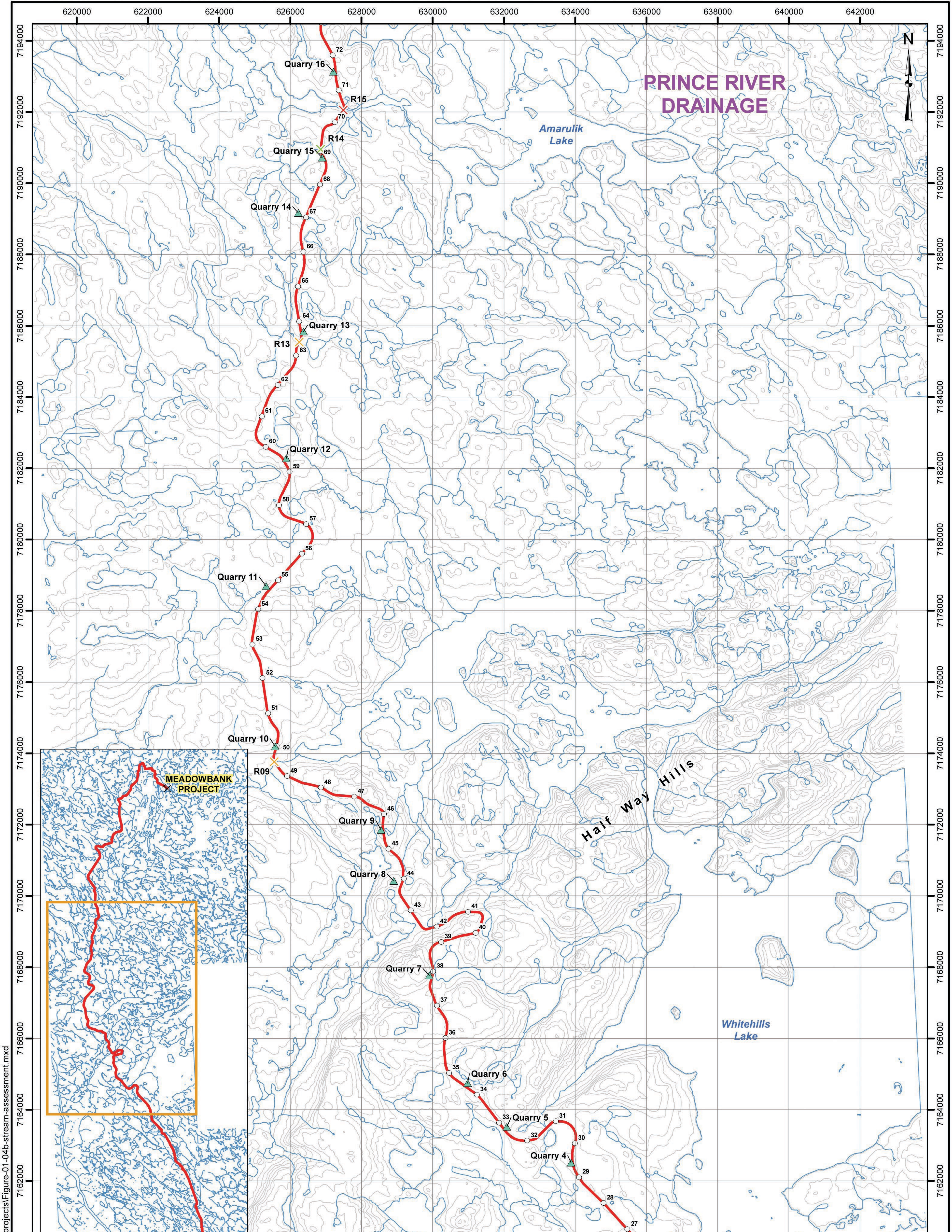
AGNICO EAGLE MINES LIMITED

MEADOWBANK GOLD PROJECT
INTERIM CLOSURE AND RECLAMATION PLAN

ALL-WEATHER PRIVATE ACCESS ROAD, WITH STREAM CROSSINGS (1 of 3)

FIGURE 1.4a



LEGEND

- ✕ Meadowbank Project
- ○ Kilometre Marker
- ▲ Quarry
- Proposed Route
- Contour (10 m interval)
- Watershed Boundary
- ✕ Stream Crossing (30 m bridge)
- ✕ Stream Crossing (12 m bridge)
- ✕ Stream Crossing (multiple culverts at bottom)
- ✕ Stream Crossing (single culvert at bottom)
- Watercourse
- Waterbody

REFERENCE

Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

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AGNICO EAGLE MINES LIMITED

MEADOWBANK GOLD PROJECT
INTERIM CLOSURE AND RECLAMATION PLAN

ALL-WEATHER PRIVATE ACCESS ROAD, WITH STREAM CROSSINGS (2 of 3)

FIGURE 1.4b

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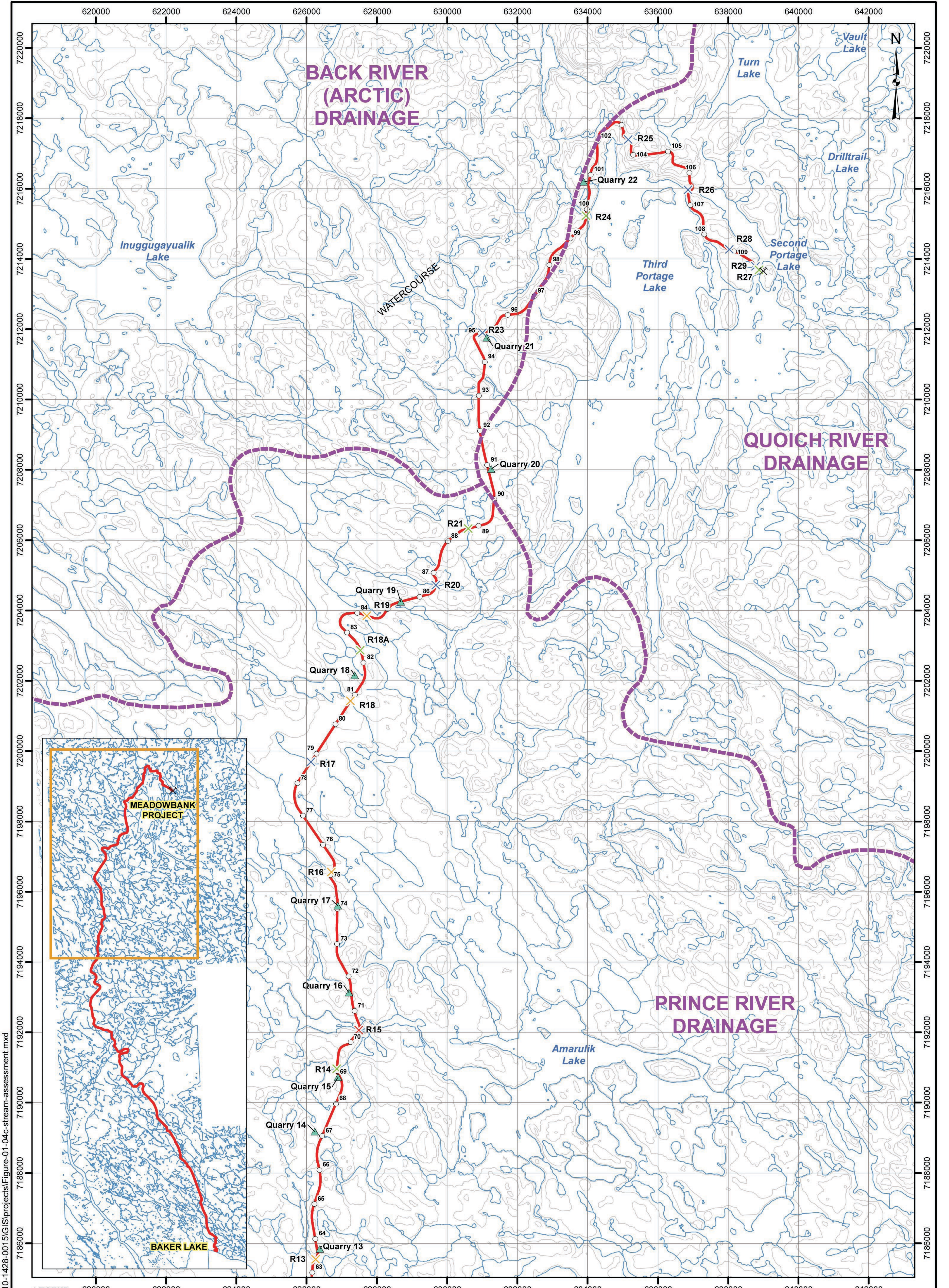

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LEGEND

- Meadowbank Project
- Kilometre Marker
- Quarry
- Proposed Route
- Contour (10 m interval)
- Watershed Boundary
- Stream Crossing (30 m bridge)
- Stream Crossing (12 m bridge)
- Stream Crossing (multiple culverts at bottom)
- Stream Crossing (single culvert at bottom)
- Watercourse
- Waterbody

2,000 1,000 0 2,000 Metres

Scale - 1:100,000

REFERENCE

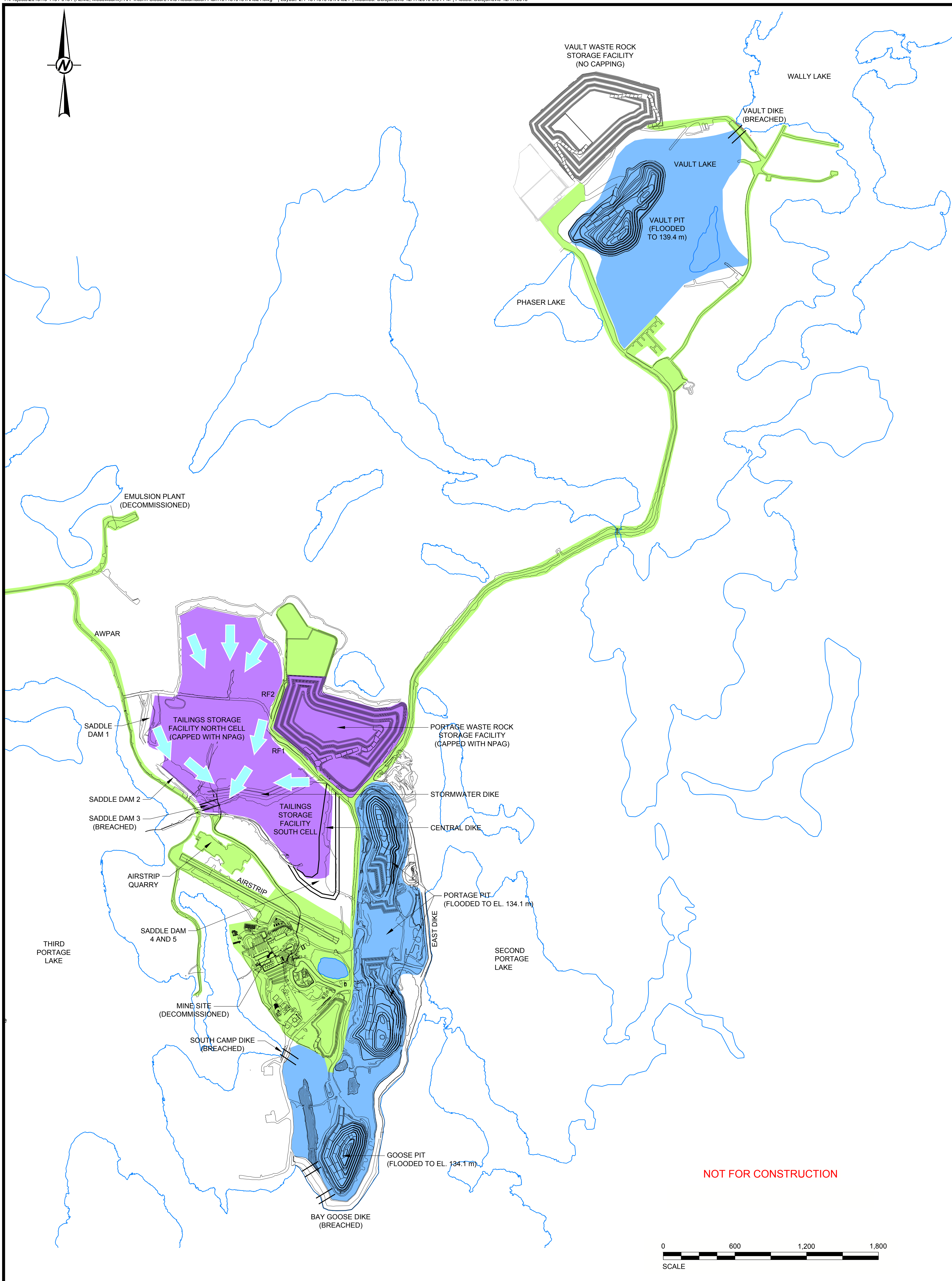
Cumberland Resources Ltd.
Datum: NAD 83 Projection: UTM Zone 14

AGNICO EAGLE MINES LIMITED

MEADOWBANK GOLD PROJECT
INTERIM CLOSURE AND RECLAMATION PLAN

ALL-WEATHER PRIVATE ACCESS ROAD, WITH STREAM CROSSINGS (3 of 3)

FIGURE 1.4c



REFERENCE

- NPAG COVER
- REHABILITATED DISTURBED AREA
- PIT LAKES/POND
- BREACHED DIKES/DAMS
- DIRECTION OF SURFACE RUNOFF FLOW

NOTES

1. BASE PLAN PROVIDED IN DIGITAL FORMAT BY AGNICO EAGLE MINES LTD., FILE NO. PORTAGE_GOOSE_VAULT_END2018_LOM2013_V4D-WITH LABEL.DWG, RECEIVED OCTOBER 7, 2013.

PROJECT

AGNICO EAGLE MINES LTD.
MEADOWBANK GOLD PROJECT
INTERIM CLOSURE AND RECLAMATION PLAN

TITLE

GENERAL MINE LAYOUT
POST - CLOSURE

Golder Associates

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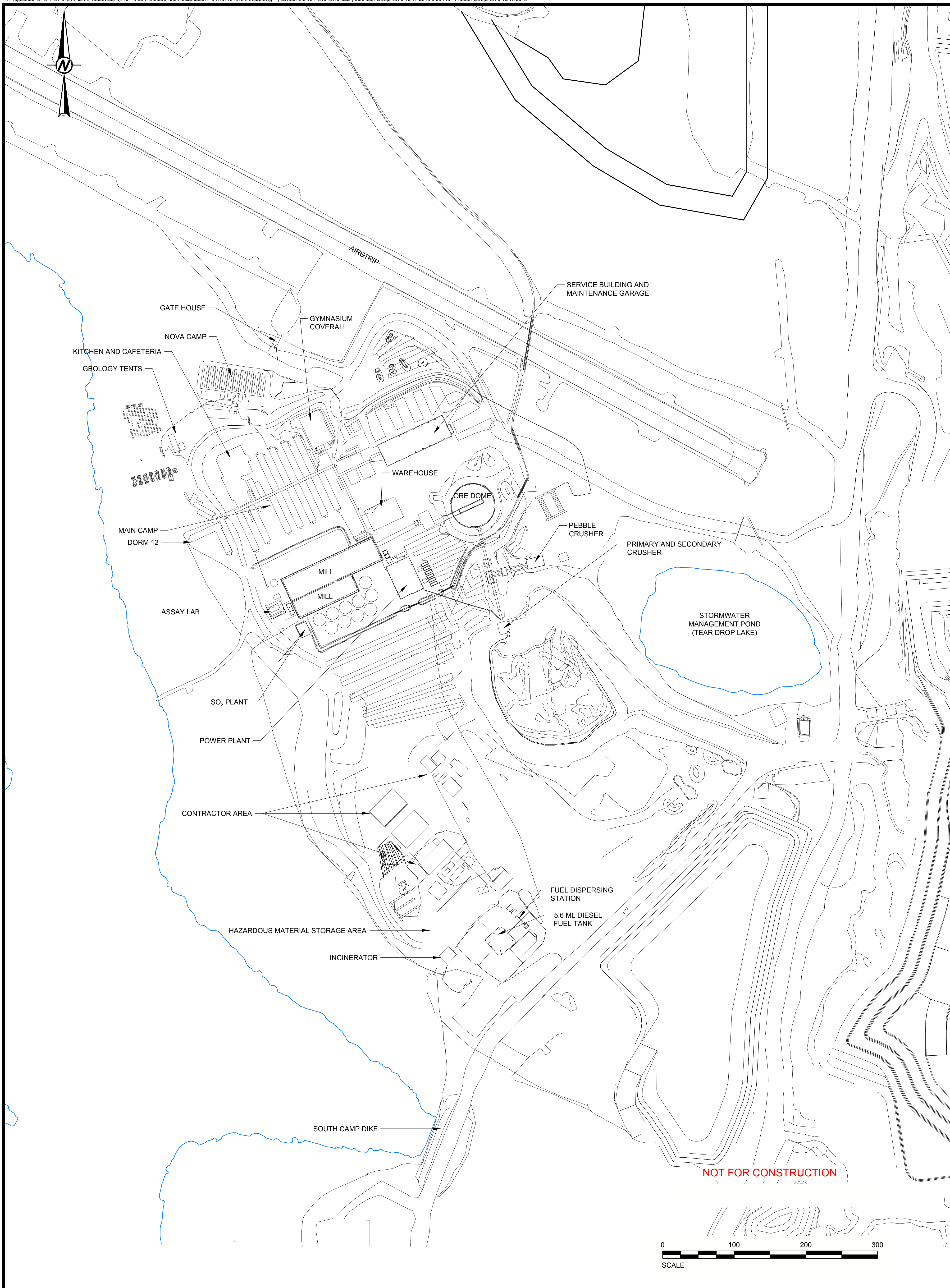

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PROJECT

AGNICO EAGLE MINES LTD.
MEADOWBANK GOLD PROJECT
INTERIM CLOSURE AND RECLAMATION PLAN

TITLE

MINE SITE INFRASTRUCTURE

Golder Associates

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REVIEW	RG	2013-12-17		

Figure 3.1: Project Schedule

Mine Component	2013	2014		2015			2016	2017	2018		2019	2020	2021	2022	2023	2024		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
		Q1/Q2	Q3/Q4	Q1	Q2	Q3/Q4			Q1/Q2	Q3/Q4						Q1/Q2	Q3/Q4																
Baker Lake Site Facilities																																	
Baker Lake Marshalling Facility										Closure			Closure monitoring - WQ										Closure										
Roads																																	
AWPAR																							Closure	Post-closure monitoring - WQ & Stability									Review
Vault road																							Closure	Post-closure monitoring - WQ & Stability									Review
Dikes & Dams																																	
East Dike										Closure monitoring - Stability											Review												
South Camp Dike										Closure monitoring - Stability											Review	Breach	Dike removed; monitoring not applicable										
Bay-Goose Dike										Closure monitoring - Stability											Review	Breach	Post-closure monitoring - Stability				Review						
Stormwater Dike										Closure monitoring - Stability											Review												
Central Dike	Active construction									Closure monitoring - Stability & Thermal											Review												
Saddle Dam 1										Closure monitoring - Stability											Review												
Saddle Dam 2										Closure monitoring - Stability											Review												
Saddle Dam 3				Active Construction						Closure monitoring - Stability											Review	Breach	Post-closure monitoring - Stability				Review						
Saddle Dam 4				Active Construction						Closure monitoring - Stability											Review												
Saddle Dam 5				Active Construction						Closure monitoring - Stability											Review												
Vault Dike										Closure monitoring - Stability											Review	Breach	Dike removed; monitoring not applicable										
Open Pits																																	
Portage[(a)]	Mining							Flooding / Closure monitoring - WQ								Continued closure monitoring - WQ					Review		Post-closure monitoring - WQ				Review						
Goose [(a)]	Mining					Flooding / Closure monitoring - WQ										Continued closure monitoring - WQ					Review		Post-closure monitoring - WQ				Review						
Vault		Mining								Flooding / Closure monitoring - WQ							Continued closure monitoring - WQ				Review		Post-closure monitoring - WQ				Review						
Waste Rock Storage Facilities																																	
Portage[(a)]	Waste rock deposition					Closure	Post-closure monitoring - WQ & Stability											Review															
Portage Pit backfill	Waste rock deposition																																
Vault				Waste rock deposition						Closure	Post-closure monitoring - WQ & Stability										Review												
Tailings Storage Facility																																	
Tailings north cell [(a)]	Tailings Deposition				Closure			Post-closure monitoring - Thermal															Review										
Tailings south cell					Tailings Deposition						Closure		Post-closure monitoring - Thermal														Review						
Reclaim Pond (North Cell)					Water to Pit																												
Reclaim Pond (South Cell)											Water transfer to Pit		Post-closure monitoring - WQ								Review												
Water Management Facilities																																	
Freshwater intake system										Closure																							
Sewage treatment system										Closure																							
Diversions and site grading										Closure & Monitoring			Post-closure monitoring - drainage						Review														
Receiving Lakes										Closure monitoring - WQ & fisheries												Post-closure monitoring - WQ & fisheries					Review						
Infrastructure																																	
Mill/Power Plant/Service Building										Closure																							
Accommodations										Closure																							
Contractor Area										Closure																							
Airstrip										Closure																							
Bulk fuel tank										Closure																							
Waste Management Facilities																																	
Hazardous materials area										Closure																							
Landfill												Closure																					
Landfarm												Closure																					

Notes:
(a) Mine component associated with progressive closure
Operations phase — facilites remain operational for use
Active Closure phase — facilities decommissioned; includes flooding and monitoring water quality in pits & stability monitoring of dikes/dams
Active Closure phase (continued) — includes monitoring water quality of pits after flooding completed
Post Closure phase — monitoring to verify closure criteria achieved; includes monitoring after dikes/dam breached
All dikes/dams remain operational until flooding is complete and the structure is breached.

APPENDIX A

Glossary of Terms and Definitions

The following terms are utilized in this document following the definitions provided in the Mine Site Reclamation Guidelines for the Northwest Territories (INAC 2007) and the Meadowbank Gold Project Type "A" Water License Application (NWB 2008).

Abandonment: The permanent dismantlement of a facility so it is permanently incapable of its intended use. This includes the removal of associated equipment and structures.

Acid Rock Drainage (ARD): The production of acidic leachate, seepage or drainage from underground workings, open pits, ore piles, waste rock or construction rock that can lead to the release of metals to groundwater or surface water during the life of the Project and beyond closure.

Active layer: The layer of ground above the permafrost which thaws and freezes annually.

Adaptive management: A management plan that describes a way of managing risks associated with uncertainty and provides a flexible framework for mitigation measures to be implemented and actions to be taken when specified thresholds are exceeded

All Weather Private Access Road (AWPAR): The all weather access road and associated water crossings between the Hamlet of Baker Lake and the Meadowbank Gold Project mine site.

Aquatic Effects Monitoring Plan (AEMP): A monitoring program designed during the Environmental Impact Statement stage of the Project to determine the short and long-term effects in the aquatic environment resulting from the Project, to evaluate the accuracy of impact predictions, to assess the effectiveness of planned impact mitigation measures and to identify additional impact mitigation measures to avert or reduce environmental effects.

Backfill: Material excavated from a site and reused for filling the surface or underground void created by mining.

Background: An area near the site under evaluation not influenced by chemicals released from the site, or other impacts created by onsite activity.

Baker Lake Site Facilities: The facilities associated with the Meadowbank Gold Project, located within the Hamlet of Baker Lake, which includes the barge landing, a dry freight storage area, a fuel tank farm, and associated access roads.

Baseline: A surveyed condition and reference used for future surveys.

Bay-Goose Dike: The structure, along with South Camp Dike, designed to isolate the Portage and Goose Island open pit mining areas from Third Portage Lake.

Berm: A mound or wall, usually of earth, used to retain substances or to prevent substances from entering an area.

Best management practices: Any program, technology, process, operating method, measure, or device that controls, prevents, removes, or reduces pollution and impact on the environment.

Biodiversity: The variety of plants and animals that live in a specific area.

Bioremediation: The use of microorganisms or vegetation to reduce contaminant levels in soil or water.

Borrow pit: A source of fill or embanking material.

Canadian Council of the Minister of Environment (CCME): The organizations of Canadian Ministers of Environment that set guidelines for environmental protection across Canada such as the Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life.

Care and maintenance: A term to describe the status of a mine when it undergoes a temporary closure.

Central Dike: The structure designed to isolate the Tailings Storage Facility from Second Portage Lake for the purpose of retaining tailings.

Closure: When a mine ceases operations without the intent to resume mining activities in the future.

Closure criteria: Details to set precise measures of when the objective has been satisfied.

Commercial operation: In respect of a mine, an average rate of production that is equal to or greater than 25% of the design capacity of the mine over a period of ninety consecutive days.

Construction: Activities undertaken to construct or build any components of, or associated with, the development of the Meadowbank Gold Project.

Contact water: Any water that may be physically or chemically affected by mining activities.

Contaminant: Any physical, chemical, biological or radiological substance in the air, soil or water that has an adverse effect. Any chemical substance with a concentration that exceeds background levels or which is not naturally occurring in the environment.

Contouring: The process of shaping the land surface to fit the form of the surrounding land.

Cumulative Effects: The combined environmental impacts that accumulate over time and space as a result of a series of similar or related actions or activities.

Decommissioning: The process of permanently closing a site and removing equipment, buildings and structures. Rehabilitation and plans for future maintenance of affected land and water are also included.

Deleterious substances: A substance as defined in section 34(1) of the *Fisheries Act*.

Dike: Retaining structure designed for water control to enable safe open pit mining and for containing tailings impoundments.

Deposit: The placement of waste rock, tailings or other solids materials on land or in water.

Discharge: The release of any water or waste to the receiving environment.

Disposal: The relocation, containment, treatment or processing of unwanted materials. This may involve the removal of contaminants or their conversion to less harmful forms.

Domestic waste: All solid waste generated form the accommodations, kitchen facilities and all other site facilities, excluding those hazardous wastes associated with the mining and processing of ore.

Drainage: The removal of excess surface water or groundwater from land by natural runoff and permeation, or by surface or subsurface drains.

East Dike: The structure designed to isolate the Portage Pit area from Second Portage Lake.

Effluent: Treated or untreated liquid waste material that is discharged into the environment from a structure such as a settling pond or a treatment plant.

Emulsion plant: The facility designed for storage of Ammonium Nitrate, detonators, and explosives; and designed for the mixing and storage of Ammonium Nitrate Fuel Oil.

End land use: The allowable use of disturbed land following reclamation. Municipal zoning and/or approval may be required for specific land uses.

Engineered structure: Any facility, which was designed and approved by a Professional Engineer registered with the Association of Professional Engineers, Geologists and Geophysicists of Nunavut.

Environment: The components of the Earth, and includes: land, water and air, including all layers of the atmosphere; all organic and inorganic matter and living organisms; and the interacting natural systems that include the aforementioned components.

Environmental assessment: An assessment of the environmental affects of a project that is conducted in accordance with the Canadian Environmental Assessment Act and its regulations.

Environmental management system: A management system that incorporates environmentally and socially responsible practices into the project operations.

Erosion: The wearing away of rock, soil or other surface material by water, rain, waves, wind or ice; the process may be accelerated by human activities.

Final discharge point: In respect of an effluent, an identifiable discharge point of a mine beyond which the operator of the mine no longer exercises control over the quality of the effluent (Metal Mining Effluent Regulations).

Fish habitat: Areas used by fish for spawning, nursery, rearing, foraging and overwintering.

Freeboard: The vertical distance between the water line and the effective water containment crest on a dike or dam upstream slope.

Freshet: An increase in surface water flow during the late winter or spring as the result of rainfall, and snow and ice melt.

Frost heave: Annual ground displacements and differential ground pressures due to the freezing of water within soils.

Geotechnical Engineer: A professional engineer registered with the Association of Professional Engineers, Geologist and Geophysicists of Nunavut and whose principal field of specialization with the engineering properties of earth materials in dealing with man-made structures and earthworks that will be built on a site. These can include shallow and deep foundations, retaining walls, dams, and embankments.

Geothermal analysis: The analysis of temperature below the ground surface.

Glacial till: Unsorted and unlayered rock debris deposited by glacier.

Goose Island Pit: The open pit developed for mining the Goose Island ore deposit.

Ground thermal regime: Temperature conditions below the ground surface; a condition of heat losses and gains from geothermal sources and the atmosphere.

Groundwater: All subsurface water that occurs beneath the water table in rocks and geologic formations that are fully saturated.

Habitat: The place where animal or plant naturally lives and grows.

Hazardous materials: A contaminant which is a dangerous good that is no longer used for its original purpose and is intended for recycling, treatment, disposal or storage.

Hydrology: The science that deals with water, its properties, distribution and circulation over the Earth's surface.

In situ treatment: A method of managing or treating contaminated soils, sludges and waters "in place" in a manner that does not require the contaminated material to be physically removed or excavated from where it originated.

Incinerator: The dual chamber, high temperature facility designed with the capacity to service the camp.

Interim Closure and Reclamation Plan (ICRP): A conceptual detailed plan on the reclamation of mine components which will not be closed until the end of the mining operations, and operational detail for components which are to be progressively reclaimed throughout the mine life.

Inukshuk: A stone representation of a person, used as a milestone or directional marker by the Inuit of the Canadian Arctic.

Landfarm: The lined, engineered facility designed to treat petroleum hydrocarbon contaminated snow and soil that may be generated during mining activities using bioremediation.

Landfill: An engineered waste management facility at which waste is disposed by placing it on or in land in a manner that minimizes adverse human health and environmental effects.

Leachate: Water or other liquid that has washed (leached) from a solid material, such as a layer of soil or water; leachate may contain contaminants.

Metal leaching: The mobilization of metals into solution under neutral, acidic or alkaline conditions.

Metal migration: The movement of dissolved metals in flowing water or vapour.

Migration: The movement of chemicals, bacteria, and gases in flowing water or vapour.

Mine design: The detailed engineered designs for all mine components stamped by a design engineer.

Mine plan: The plan for the development of the mine, including the sequencing of the development.

Mine water: Any water, including groundwater, which is pumped or flows out of any underground workings or open pit.

Mitigation: The process of rectifying an impact by repairing, rehabilitating or restoring the affected environment, or the process of compensating for the impact by replacing or providing substitute resources or environments.

Monitoring: Observing the change in geophysical, hydrogeological or geochemical measurements over time.

No net loss: A term found in Canada's Fisheries Act. It is based on the fundamental principle of balancing unavoidable losses of fish habitats with habitat replacement on a project-by-project basis in order to prevent depletion of Canada's fisheries resources.

Non-contact water: The runoff originating from areas unaffected by mining activity that does not come into contact with developed areas.

Nunavut Land Claims Agreement: The "Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in Right of Canada," including its preamble and schedules, and any amendments to that agreement made pursuant to it.

Objectives: Objectives describe what the reclamation activities are aiming to achieve. The goal of mine closure is to achieve the long-term objectives that are selected for the site.

Operations: The set of activities associated with mining, ore processing and recovery of gold; excluding construction and decommissioning activities.

Operator: The person who operates, has control or custody of, or is in charge of a mine or recognized closed mine.

Passive Treatment: Treatment technologies that can function with little or no maintenance over long periods of time.

Permafrost: Permafrost is defined as ground that remains at or below 0°C for at least two years. Permafrost does not necessarily contain ice; rather, the definition is based solely on temperature criteria of the mineral or organic parent material.

Permafrost Aggradation: A naturally or artificially caused increase in the thickness and/or area extent of permafrost.

Permanent Closure: Final closure of the mine site after mining has ceased, when no further exploration, mining, or processing activities are anticipated at the site.

Permeability: The ease with which gases, liquids, or plant roots penetrate or pass through soil or a layer of soil. The rate of permeability depends upon the composition of the soil.

pH: A measure of the alkalinity or acidity of a solution, related to hydrogen ion concentration; a pH of 7.0 being neutral.

Piezometer: An instrument used to monitor pore water pressure.

Pore water pressure: The pressure of groundwater held within the spaces between sediment particles.

Pore water: The groundwater present within the spaces between sediment particles.

Portage Attenuation Pond: The pond located in the South Cell of the TSF (prior to the start of tailings deposition in that cell) where mine site contact water will be discharged, and where water in the pond will be reclaimed to satisfy mill process water make up requirements with any excess water being treated if required and discharged to Third Portage Lake.

Portage Pit: The open pit developed for mining the Portage ore deposits.

Portage Waste Rock Storage Facility: The facility designed to store waste rock from the Portage and Goose Island open pits.

Post-closure: The period of time after active closure of the mine.

Progressive Reclamation: Actions that can be taken during mining operations before permanent closure, to take advantage of cost and operating efficiencies by using the resources available from mine operations to reduce the overall reclamation costs incurred. It enhances environmental protection and shortens the timeframe for achieving the reclamation objectives and goals.

Project: The Meadowbank Gold Project as outlined in the Final Environmental Impact Statement and supplemental information submitted by Cumberland Resources Limited, Meadowbank Mining Corporation and subsequently Agnico Eagle Mines Ltd. to the Nunavut Impact Review Board (NIRB) and the Nunavut Water Board. It comprises an open pit mine, an All Weather Private Access Road from Baker Lake to the mine site, and site facilities in the Hamlet of Baker Lake.

Quarry: The areas of surface excavation for extracting rock material for use as construction materials along the All Weather Private Access Road and facilities at the mine site.

Receiving environment: The aquatic and terrestrial environments that receive any discharge resulting from the Project.

Reclaim Pond: The pond located within the active zone of the Tailings Storage Facility, designed to contain process (tailings related) water, and where water in the pond will be used to satisfy mill process water make up requirements.

Reclamation: The process of returning a disturbed site to its natural state or one for other productive uses that prevents or minimizes any adverse effects on the environment or threats to human health and safety.

Rehabilitation: Activities to ensure that the land will be returned to a form and productivity in conformity with a prior land use plan, including a stable ecological state that does not contribute substantially to environmental deterioration and is consistent with surrounding aesthetic values.

Remediation: The removal, reduction, or neutralization of substances, wastes or hazardous material from a site in order to prevent or minimize any adverse effects on the environment and public safety now or in the future.

Restoration: The renewing, repairing, cleaning-up, remediation or other management of soil, groundwater or sediment so that its functions and qualities are comparable to those of its original, unaltered state.

Re-vegetation: Replacing original ground cover following a disturbance to the land.

Ripping: A method of loosening rock or soil using steel tynes attached to the rear of a bulldozer. The tynes are lowered into the ground and as the bulldozer moves forwards the soil or blocks of rock are displaced by the tynes.

Runoff: Water that is not absorbed by soil and drains off the land into bodies of water.

Saddle Dams 1 to 5: Structures located around the Tailings Storage Facilities.

Scarification: Seedbed preparation to make a site more amenable to plant growth. This is typically conducted with a grader.

Security deposit: Funds held by the Crown that can be used in the case of abandonment of an undertaking to reclaim the site, or carry out any ongoing measures that may remain to be taken after the abandonment of the undertaking.

Sediment: Solid material, both mineral and organic, that has been moved by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.

Seepage: Any water that drains through or escapes from any structure designed to contain, withhold, divert or retain water or waste. Seepage also includes any flows that have emerged through open pits, runoff from waste rock storage facilities, ore stockpile areas, quarries, landfill or landfarm areas.

Seismic: Relating to an earthquake or to other tremors of the Earth, such as those caused by large explosions.

Sewage: All toilet wastes and greywater.

South Camp Dike: The structure, along with Bay-Goose Dike, designed to isolate the Portage and Goose Island open pit mining areas from Third Portage Lake.

Stormwater Dike: The structure designed to divide the North and South cells of the Tailings Storage Facility.

Sump: An excavation in impermeable soil for the purpose of catching or storing water or waste.

Supernatant: The clear liquid that floats about the sediment or precipitate.

Surface water: Natural water bodies such as river, streams, brooks, ponds and lakes, as well as artificial watercourses, such as irrigation, industrial and navigational canals, in direct contact with the atmosphere.

Sustainable development: Industrial development that does not detract from the potential of the natural environment to ensure benefits for future generations.

Tailings: Material rejected from a mill after most of the recoverable valuable minerals have been extracted.

Tailings Storage Facility: The facility designed to permanently contain the solid fraction of the mill tailings, located in the northwest arm of the partially dewatered Second Portage Lake. The facility includes the Reclaim Pond, the Central Dike, Saddle Dams, and the Stormwater Dike.

Taliks: Unfrozen zones that can exist within, below, or above permafrost layers. They are usually located below deep water bodies.

Temporary closure: When a mine ceases operations with the intent to resume mining activities in the future. Temporary closures can last for a period of weeks, or for several years, based on economical, environmental, political, or social factors.

Thermokarst: A landscape characterized by shallow pits and depressions caused by selective thawing of ground ice or permafrost.

Third Portage Lake outfall diffuser: The effluent pipe located in low value fish habitat within Third Portage Lake, designed to discharge and enhance mixing of effluent from the Portage Attenuation Pond in the receiving environment.

Total dissolved solids: A measure of the amount of dissolved substances in a waterbody.

Total suspended solids: A measure of the particulate matter suspended in the water column.

Traditional knowledge: A cumulative, collective body of knowledge, experience, and values built up by a group of people through generations of living in close contact with nature. It builds upon the historic experiences of a people and adapts to social, economic, environmental, spiritual and political change.

Turbidity: The degree of clarity in the water column typically reflected as the amount of suspended particulate matter in a waterbody.

Vault Attenuation Pond: The pond located in the Vault mining area where contact water including pit water will be discharged and treated, if required, prior to final discharge to Wally Lake.

Vault Dike: The structure designed to isolate Vault Lake from Wally Lake, for the purpose of developing the Vault Pit and allowing for storage of effluent in the Vault Attenuation Pond.

Vault haul road: The road that connects the Portage mining area to the Vault mining area.

Vault haul road crossing: The crossing located at the outlet of Turn Lake to Drill Tail Lake along the road that connects the Portage mining area to the Vault mining area.

Vault Pit: The open pit developed for mining the Vault ore deposit.

Vault Waste Rock Storage Facility: The facility designed to store waste rock from the Vault Pit.

Wally Lake outfall diffuser: The effluent pipe located in low value fish habitat within Wally Lake, designed to discharge and enhance mixing of effluent from the Vault Attenuation Pond in the receiving environment.

Waste rock: All rock materials, except ore and tailings that are produced as a result of mining operations.

Wastewater: The water generated by site activities or originates on-site that requires treatment or any other water management activity.

Wastewater treatment system: A tertiary treatment plant designed to remove organic material and nutrients.

Watershed: A region or area bordered by ridges of higher ground that drains into a particular watercourse or body of water.

Water table: The level below where the ground is saturated with water.

APPENDIX B

List of Acronyms and Abbreviations

Appendix B: List of Acronyms and Abbreviations

Acronym/Abbreviation	Description
2PL	Second Portage Lake
3PL	Third Portage Lake
AEM	Agnico Eagle Mines Ltd. (current proponent of the Meadowbank Gold Project)
AEMP	Aquatic Environmental Management Plan
AANDC	Aboriginal Affairs and Northern Development Canada
ARD	Acid rock drainage
AWPAR	All-Weather Private Access Road
Azimuth	Azimuth Consulting Group Inc.
Baxter	Baxter Consulting
BGC	BGC Engineering Inc.
Brodie	Brodie Consulting Limited
CCME	Canadian Council of Ministers for the Environment
COSEWIC	Committee on the Status or Endangered Wildlife in Canada
Cumberland	Cumberland Resources Limited
DDMI	Diavik Diamond Mines Incorporated
DFO	Department of Fisheries and Oceans (Fisheries and Oceans Canada)
Dougan	Dougan & Associates
ELC	Ecological Land Classification
FMA	FMA Heritage Resources Consultants Inc.
GHG	Greenhouse gases
GN	Government of Nunavut
Golder	Golder Associates Ltd.
HADD	Harmful alteration, disruption or destruction (of fish habitat)
ICRP	Interim Closure and Reclamation Plan
IF	Iron formation rock
INAC	Indian and Northern Affairs Canada
IPCC	Intergovernmental Panel on Climate Change
IV	Intermediate volcanic (rock)
KIA	Kivalliq Inuit Association
LSA	Local study area
masl	Meters above sea level
Ml	Million litre
ML	Metal leaching
Mm^3	Million cubic metres
MMC	Meadowbank Mining Corporation
MMER	Metal Mining Effluent Regulations
MW	Mega-Watts
NEC	Nunavut Environmental Consulting
NIRB	Nunavut Impact Review Board
NO2	Nitrogen dioxide
NPAG	Non-potentially acid generating
NRC	Natural Resources Canada
NWB	Nunavut Water Board
PAG	Potentially acid generating
PM_{10}	Particulate Matter (concentrations less than 10 μg/m^3)
$PM_{2.5}$	Particulate Matter (concentrations less than 2.5 μg/m^3)
Project	Rockfill Road 1
RF1	Rockfill Road 2
RF2	Meadowbank Gold Project
RSA	Regional study area
SARPR	Species at Risk Public Registry
SO_2	Sulphur dioxide
SNC	SNC-Lavalin Group

TSF	Tailings Storage Facilities
TSP	Total Suspended Solids
UM	Ultramafic (rock)
WRSF	Waste Rock Storage Facility

APPENDIX C

Photos of Mine Site

Photo 1: Meadowbank Exploration Camp; Summer 2007

Photo 2: Construction of the East Dike; August 2008

Photo 3: Mine Site in 2011

Photo 4: Mine Site in 2012

Photo 5: Portage Pit in 2012

Photo 6: Portage Pit in 2013

Photo 7: Tailings Storage Facility in 2013; Portage Waste Rock Storage Facility in background

Photo 8: Vault Dike in 2013

APPENDIX D

Conformance With NWB License

The ICRP was prepared in accordance with the Mine Site Reclamation Guidelines for the Northwest Territories (INAC 2007) and consistent with the Mine Site Reclamation Policy for Nunavut (INAC 2002). Furthermore, Table C-1 provides the concordances between the sections of the ICRP and the requirements listed in Type-A Water License 2AM-MEA0815, Part J – Conditions Applying to Abandonment, Reclamation and Closure, Item 1 (NWB 2008).

Table C-1: Concordance Between the Water License Requirements and the ICRP Sections

Water License Requirements	Corresponding Sections in the ICRP
a. Detailed description, including maps and other visual representations, of the preconstruction conditions for each site, accompanied by a detailed description of the proposed final landscape, with emphasis on the reclamation of surface drainage over the restored area.	Sections 2.4 (Environmental Baseline Conditions) and 4.3.1 (End Land Use and General Site Rehabilitation)
b. A description of how progressive reclamation will be employed and monitored throughout the life of the mine, plus reclamation scheduling and coordination of activities with the overall sequence of the project; details of reclamation scheduling and procedures for coordinating reclamation activities within the overall mining sequence and materials balance.	Sections 4.4 (Progressive Closure Activities), 4.6 (Permanent Closure Monitoring and Reporting) and 4.7 (Permanent Closure and Reclamation Schedule)
c. Implications of any updated water balance and water quality model prediction results and any adaptive management measures that may be required.	Sections 4.3.5 (Permanent Closure and Reclamation Plan – Open Pits) and 4.7.1 (Planned Schedule with Progressive Closure)
d. An evaluation of closure and reclamation measures for each mine component, including the goals, objectives, closure criteria and the rationale for selection of the preferred measures.	Section 4.3 (Permanent Closure and Reclamation Plan)
e. A comprehensive assessment of materials suitability, including geochemical and physical characterization and a schedule of availability for reclamation needs. Particular attention to cover materials, including maps showing sources and stockpile locations of all reclamation construction materials	Sections 2.2 (Mine Plan) and 2.4.3 (Environmental Settings – Chemical Environment)
f. An assessment and description of any required post-closure treatment for pit water that is not acceptable for discharge	Sections 4.3.4 (Permanent Closure and Reclamation Plan – Dikes and Dams), 4.3.5 (Permanent Closure and Reclamation Plan – Open Pits) and 4.5 (Closure Contingency Activities)
g. Contingency measures for all reclamation components including action thresholds that are linked to the monitoring programs	Section 4.5 (Closure Contingency Activities)

Water License Requirements	Corresponding Sections in the ICRP
h. Monitoring programs to assess reclamation performance and environmental conditions including monitoring locations for surface water and groundwater parameters	Section 4.6 (Permanent Closure Monitoring and Reporting)
i. Monitoring schedules and overall timeframes	Sections 4.6 (Permanent Closure Monitoring and Reporting) and 4.7 (Permanent Closure and Reclamation Schedule)
j. QA/QC procedures for managing the demolition landfill and other waste disposal areas	Section 4.3.10 (Permanent Closure and Reclamation Plan – Waste Management Facilities)
k. A list of non-salvageable materials and disposal locations	Section 2.5.9 (Project Facilities - Waste Management Facilities Materials)
l. Rock storage facility closure design plans and sections including the types of material placed and volumes	Section 4.3.6 (Permanent Closure and Reclamation Plan – Waste Rock Storage Facilities)
m. Protocol for the disposal of any contaminated soil	Section 4.3.10 (Permanent Closure and Reclamation Plan – Waste Management Facilities)
n. An assessment of the long-term physical stability of all remaining project components including the central and east dike	Sections 4.3.4 (Permanent Closure and Reclamation Plan – Dikes and Saddle Dams) and 4.3.5 (Permanent Closure and Reclamation Plan – Open Pits)
o. Detailed criteria for the final breaching of dikes	Section 4.3.4 (Permanent Closure and Reclamation Plan – Dikes and Saddle Dams)
p. A revised closure and reclamation cost estimate	Section 4.8 (Permanent Closure Cost) and Appendix I
q. A detailed implementation schedule for completion of reclamation work	Section 4.7 (Permanent Closure and Reclamation Schedule)

APPENDIX E

Environmental Baseline Conditions

E1 Permafrost Map of Canada

Source: Cumberland 2005b

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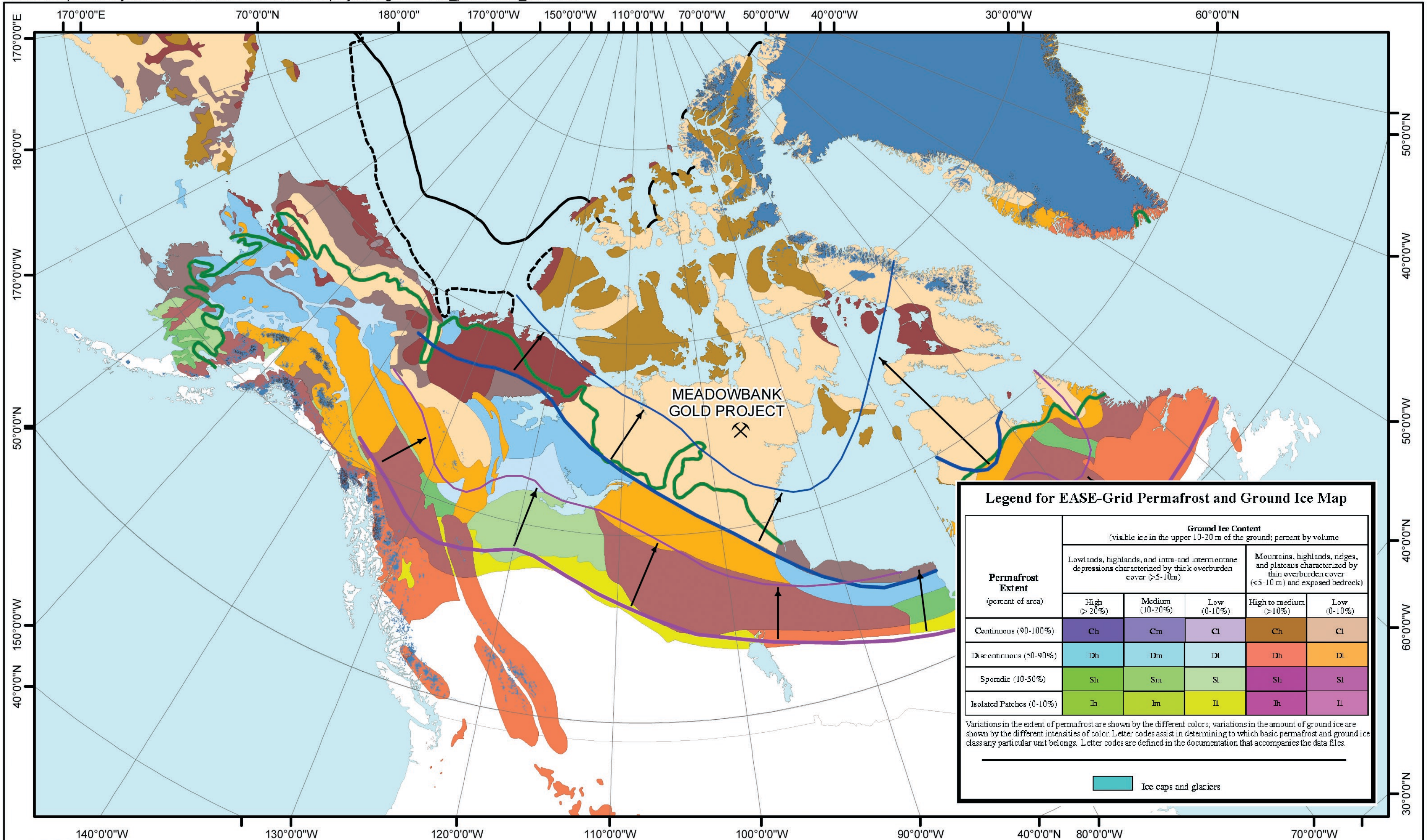

Permafrost Extent (percent of area)	Ground Ice Content (visible ice in the upper 10-20 m of the ground; percent by volume)				
	Lowlands, highlands, and intra-and intermontane depressions characterized by thick overburden cover (>5-10m)			Mountains, highlands, ridges, and plateaus characterized by thin overburden cover (<5-10 m) and exposed bedrock)	
	High (> 20%)	Medium (10-20%)	Low (0-10%)	High to medium (>10%)	Low (0-10%)
Continuous (90-100%)	Ch	Cm	Cl	Ch	Cl
Discontinuous (50-90%)	Dh	Dm	Dl	Dh	Dl
Sporadic (10-50%)	Sh	Sm	Sl	Sh	Sl
Isolated Patches (0-10%)	Ih	Im	Il	Ih	Il

Variations in the extent of permafrost are shown by the different colors; variations in the amount of ground ice are shown by the different intensities of color. Letter codes assist in determining to which basic permafrost and ground ice class any particular unit belongs. Letter codes are defined in the documentation that accompanies the data files.

Ice caps and glaciers

LEGEND

- TREELINE
- SEA-ICE EDGE LIMIT
- SUBSEA PERMAFROST LIMIT
- SOUTHERN BOUNDARY OF DISCONTINUOUS PERMAFROST - PRESENT
- SOUTHERN BOUNDARY OF DISCONTINUOUS PERMAFROST - PREDICTED
- SOUTHERN BOUNDARY OF CONTINUOUS PERMAFROST - PRESENT
- SOUTHERN BOUNDARY OF CONTINUOUS PERMAFROST - PREDICTED
- PREDICTED MOVEMENT OF PERMAFROST BOUNDARIES

NOTES

1) PROJECTION: LAMBERT AZIMUTHAL EQUAL AREA

0 300 600 900 1,200 1,500

Scale in Kilometres

REFERENCES

1) CIRCUM-ARCTIC MAP OF PERMAFROST AND GROUND-ICE CONDITIONS. BOULDER, CO: NATIONAL SNOW AND ICE DATA CENTER/WORLD DATA CENTER FOR GLACIOLOGY. DIGITAL MEDIA. (BROWN ET AL. 1998)
2) PREDICTED PERMAFROST BOUNDARIES. (WOO ET AL. 1992)

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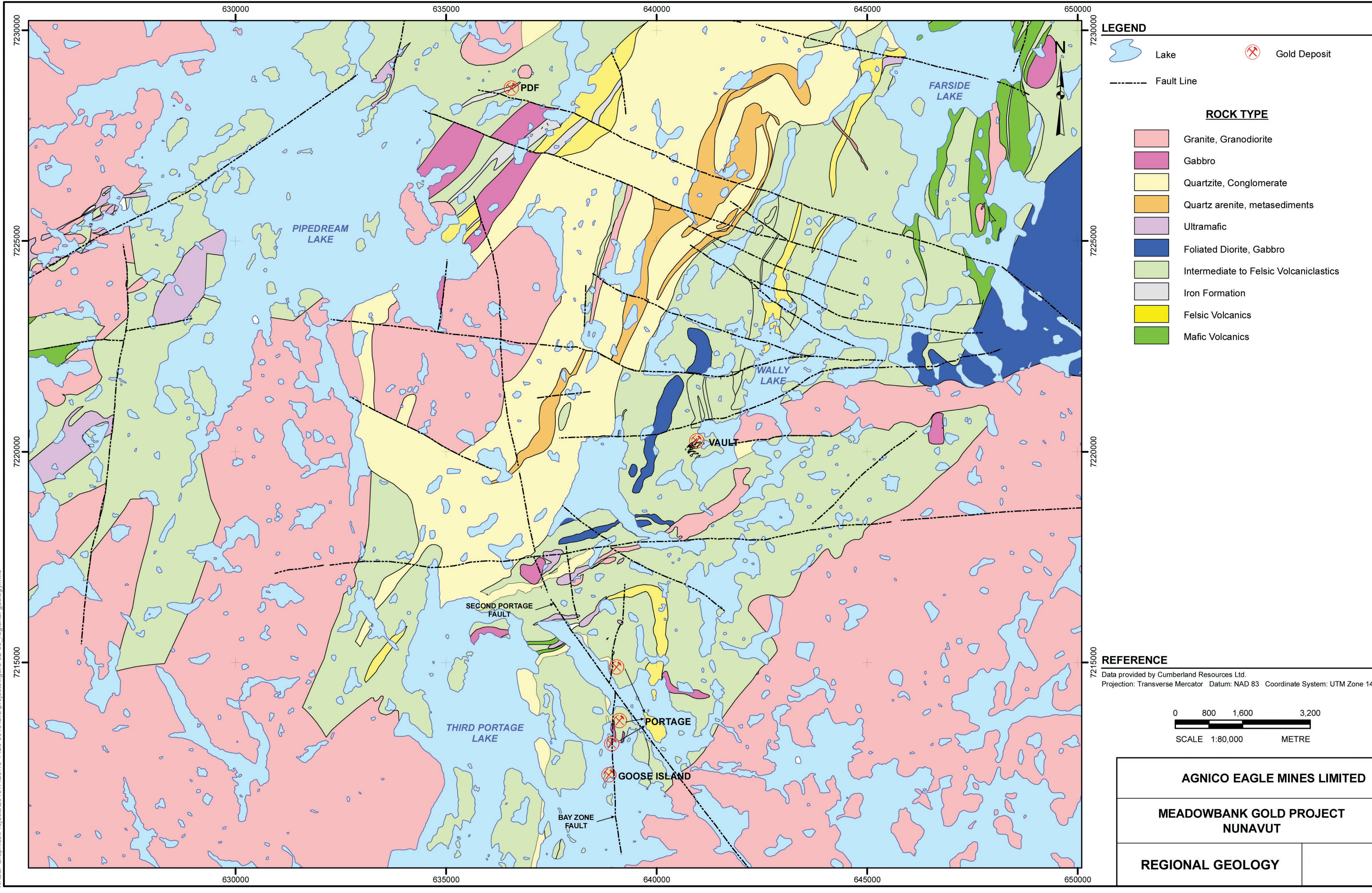
PERMAFROST MAP OF CANADA

E2 Regional Geology

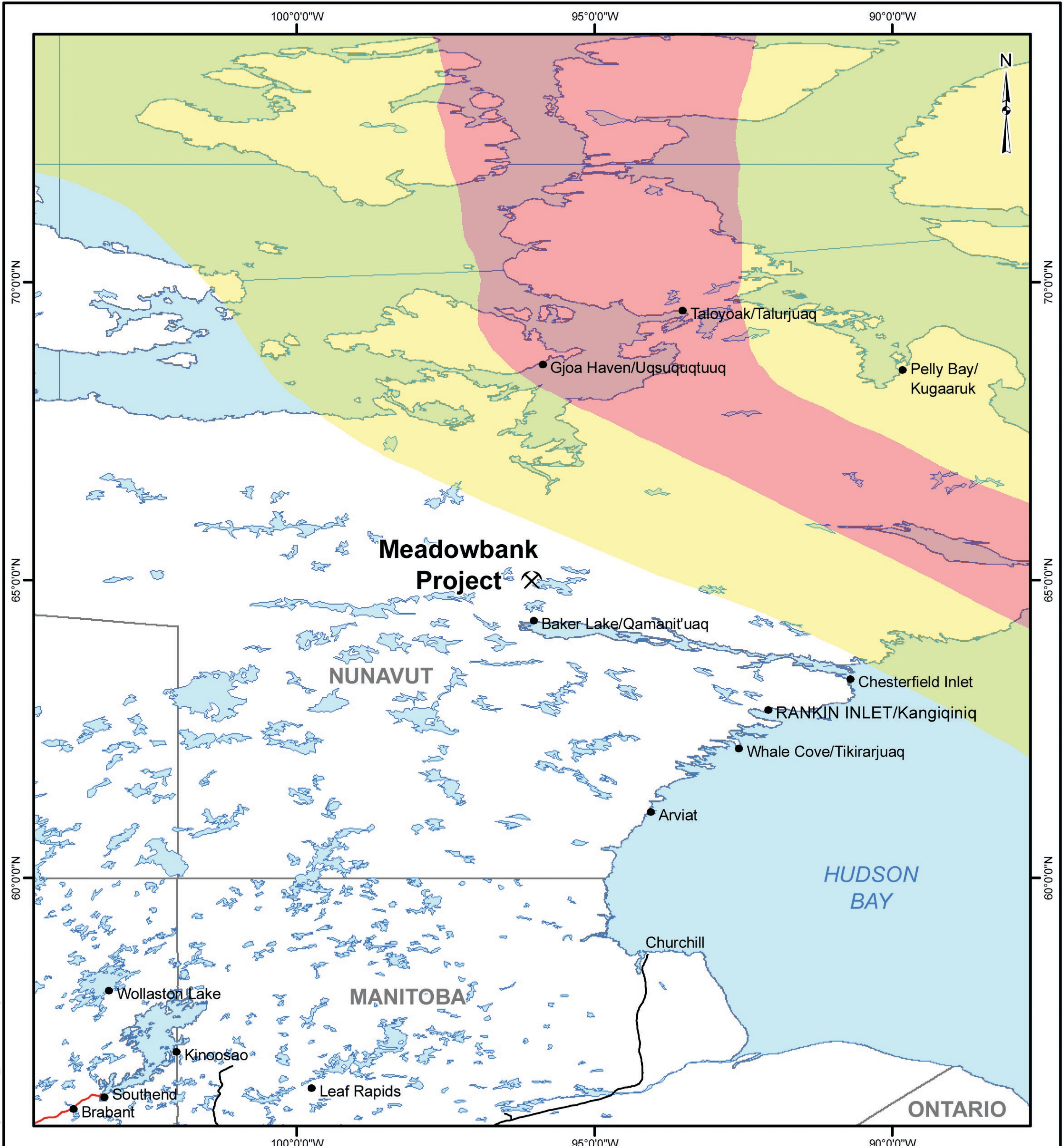
Source: Cumberland 2005b



N:\Bur-Graphics\Projects\2010\1428\10-1428-0015\GIS\projects\figure-02-09_regional-geology.mxd

E3 Seismic Zoning Map

Source: Cumberland 2005b



LEGEND

Meadowbank Project

Town/Village

Peak Horizontal Ground Acceleration (g), for a seismic event with a return period of 475 years

- 0 - 0.039
- 0.04 - 0.079
- 0.08 - 0.109
- Provincial Border
- Water
- Primary Highway
- Railroad

REFERENCE

Base digital data obtained from ESRI Inc.
Projection: Geographic Datum: WGS84

200 0 200
SCALE 1:10,000,000 KILOMETRES

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SEISMIC ZONING MAP

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E4 Inferred Regional Groundwater Flow

Source: Cumberland 2005b

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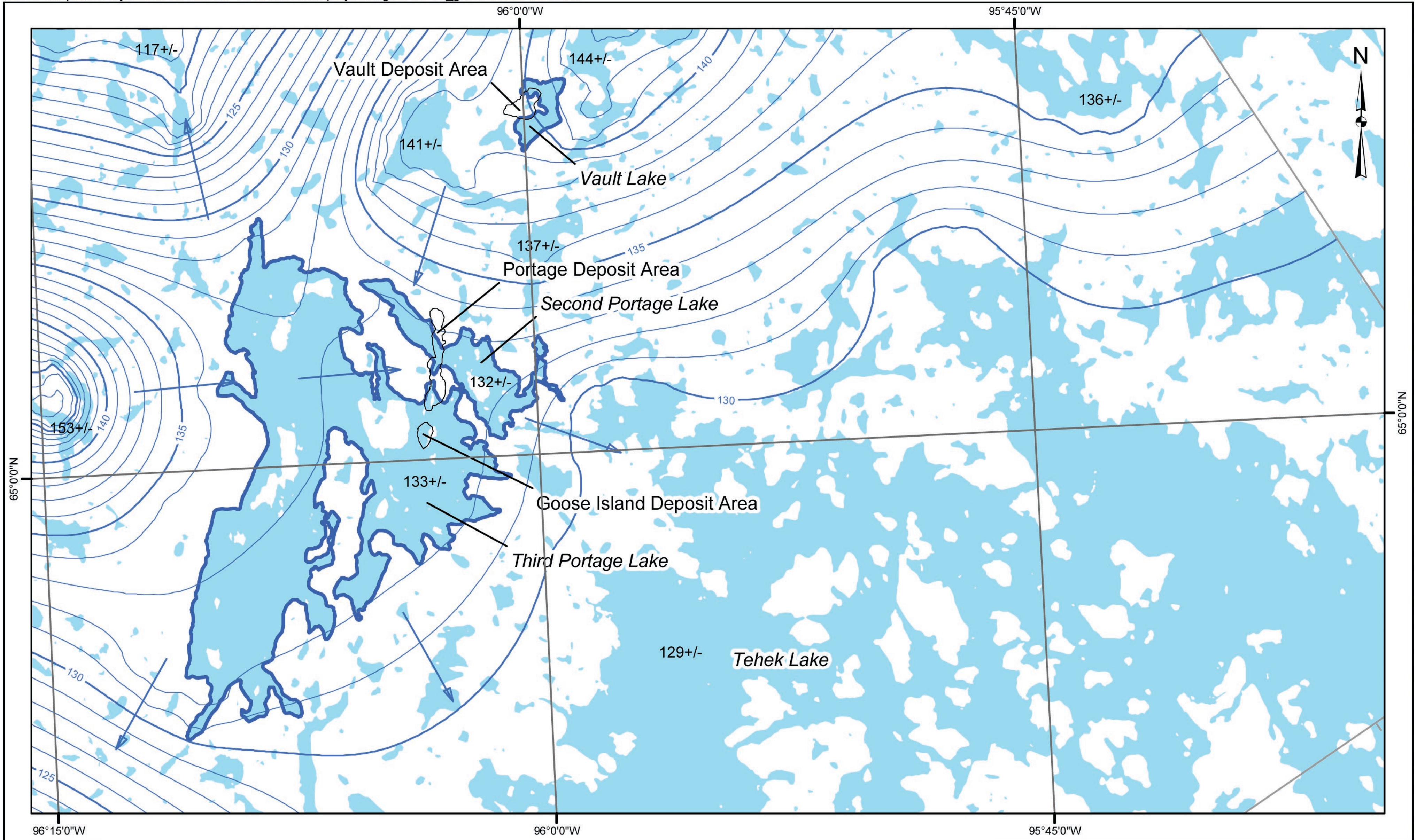

LEGEND

- Proposed Open Pit Crest
- Inferred Groundwater Contour (1 m interval)
- Inferred Groundwater Contour (5 m interval)
- Inferred Groundwater Flow Line
- 133 Waterbody (elevation in masl)

0 1,000 2,000 4,000 Meters

Scale - 1:125,000

REFERENCE

District of Keewatin, Northwest Territories, Department of Energy, Mines and Resources, Mapsheets 66A/16, 56E/04, 66H/01, 56D/13. Pit Footprint obtained from Golder Drawing 1.2.
Datum: NAD83 Projection: UTM Zone 14

NOTE

Water levels vary annually and may differ from recently surveyed elevations.

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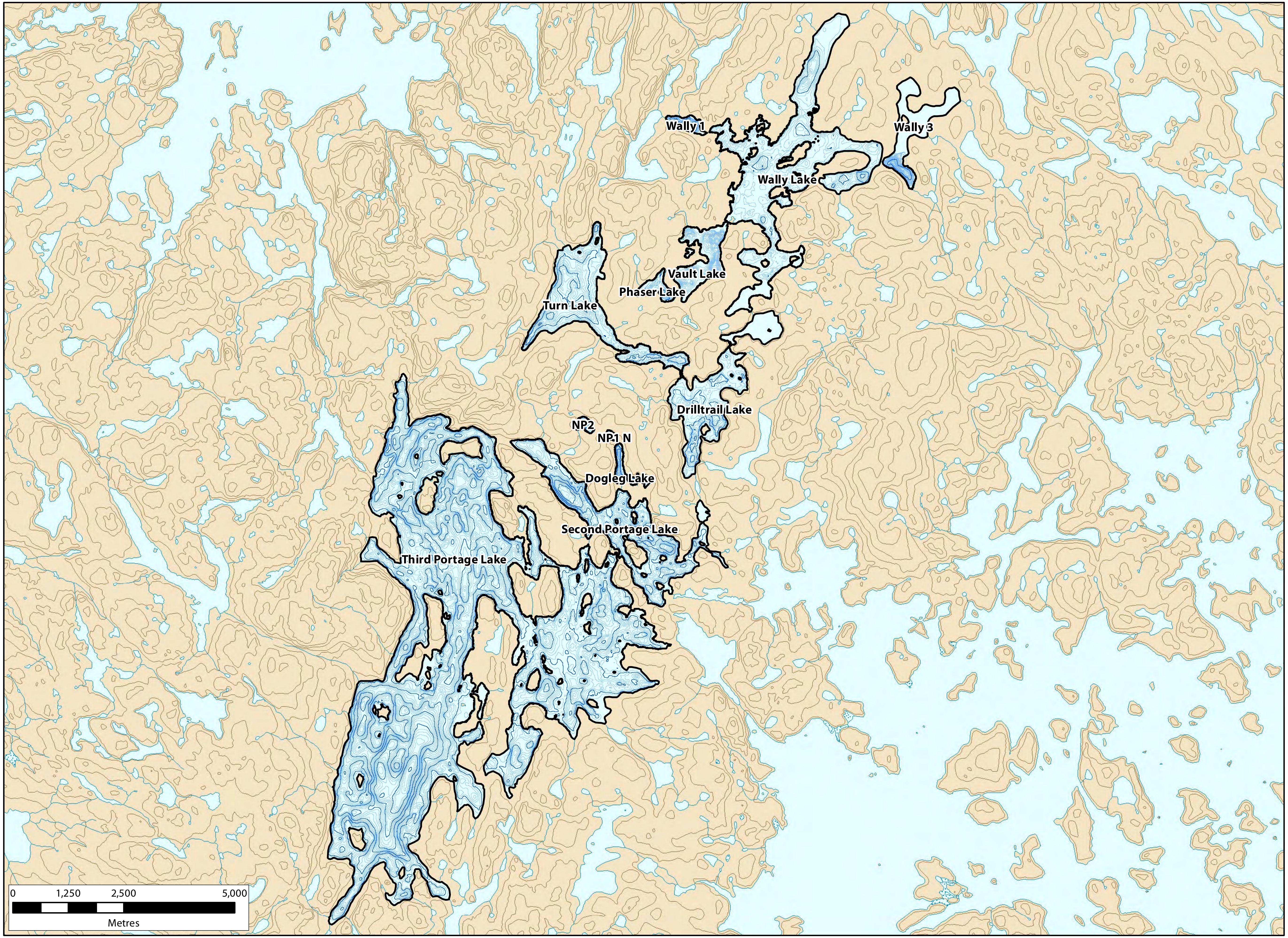
INFERRED REGIONAL GROUNDWATER FLOW

E5 Bathymetry Contours

Source: Dougan 2011



Legend

- Study Lakes
- Major Contour
- Minor Contour

Bathymetry Contours

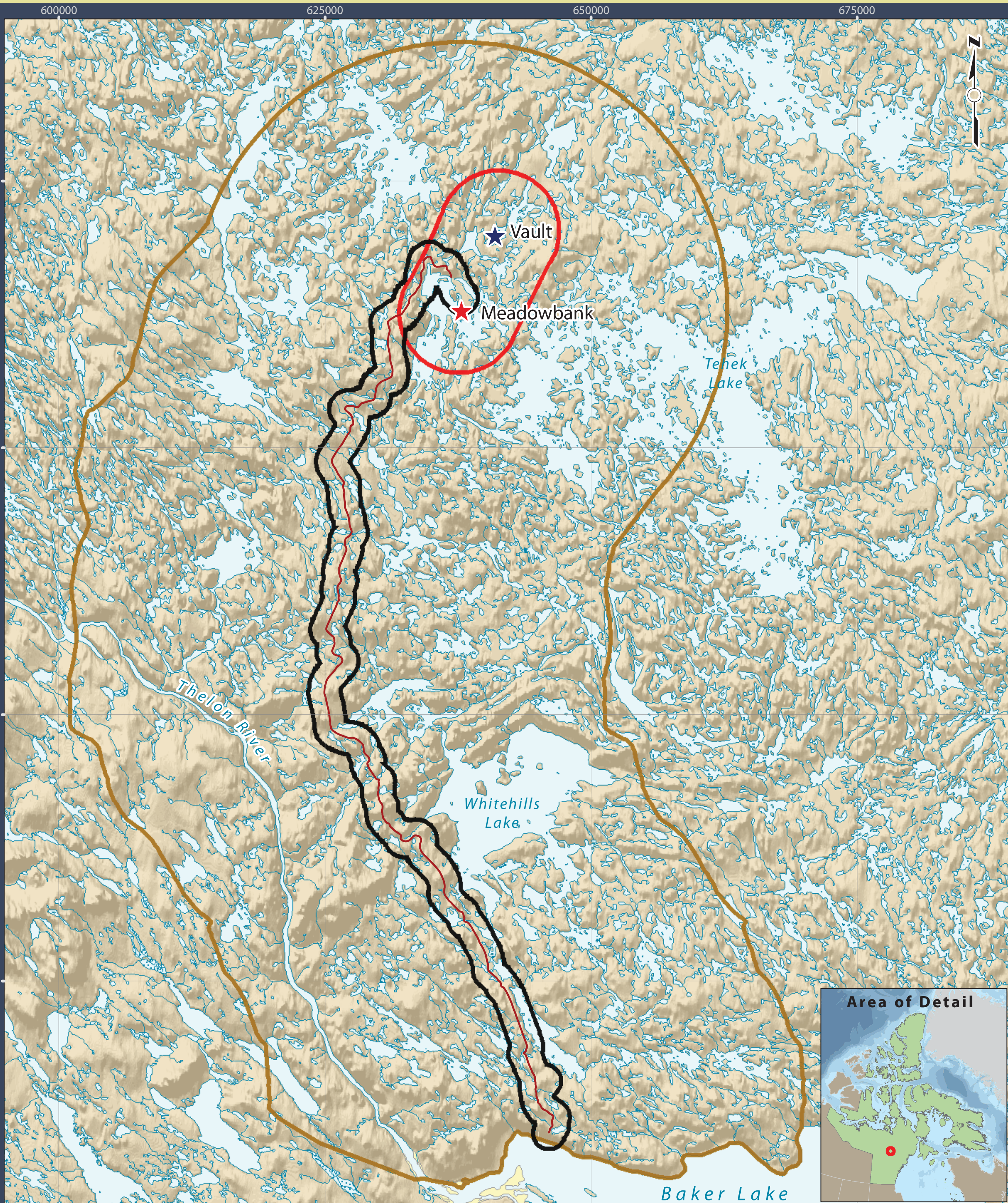
DOUGAN & ASSOCIATES
ECOLOGICAL CONSULTING & DESIGN
77 Wyndham Street South • Guelph ON N1E 5R3
T 519.822.1609 • F 519.822.5389 • www.dougan.ca

PROJECT: DA11-062-02	
CLIENT: Agnico-Eagle Mines Ltd., Meadowbank Div.	
N W E S UTM Zone 14 NAD83	DATE: FEBRUARY 2011
	SCALE: 1:80,000
	DRAWN BY: LW
	CHECKED BY:
FIGURE: A1	

The information displayed on this map has been compiled from various sources. While every effort has been made to accurately depict the information, this map should not be relied on as being a precise indicator of locations, features, or roads, nor as a guide to navigation. MNR data provided by Queen's Printer of Ontario. Use of the data in any derivative product does not constitute an endorsement by the MNR or the Ontario Government of such products.

E6 RSA and LSA Boundaries for Monitoring Studies

Source: NEC 2013



Legend

- All-Weather Access Road
- Local Study Area - All-Weather Road
- Local Study Area
- Regional Study Area

0 5 10 15 20

Kilometres

Projection: UTM Zone 14 NAD83

Data Sources:
Natural Resources Canada, GeoBase®
National Topographic Database
Agnico-Eagle Mines Limited.

Figure 2.2: RSA and LSA Boundaries for Monitoring Studies

Meadowbank Gold Project

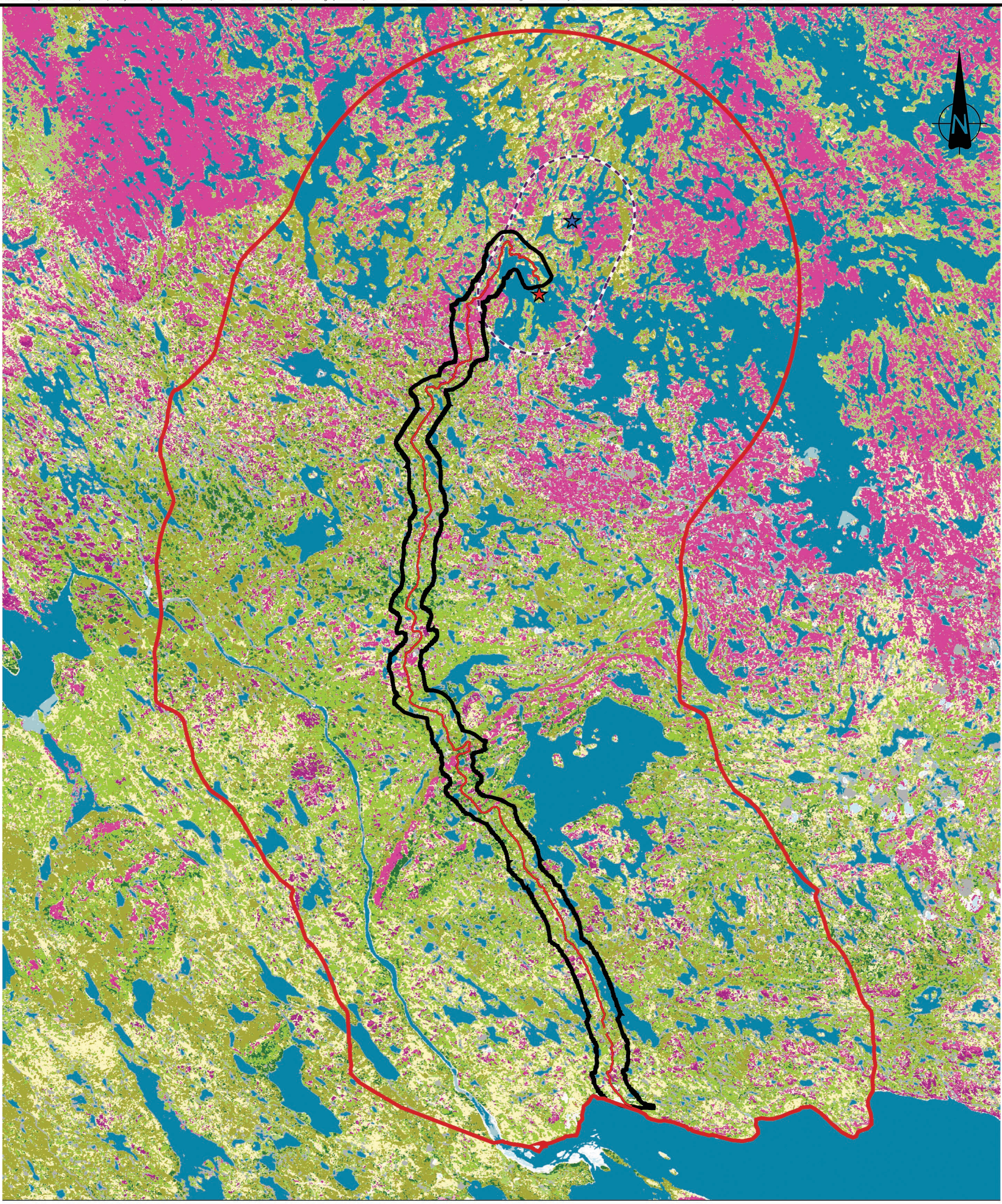
Prepared for: AGNICO-EAGLE

By: CASLYS CONSULTING

E7 Ecological Land Classification for the Regional Study Area

Source: Cumberland 2005e

Drawing File: N:\Bur-Graphics\Projects\2010\1428\10-1428-0015\Drafting\5000\10-1428-0015-5000-02.15.dwg Tuesday, June 29, 2010 5:10:02 PM By: NSmirnova



Legend

Meadowbank Camp	Betula	Lichen Moss	Carex Moss	Moss Gravel	Boulder Water
Vault	Betula Carex	Lichen Shrub Moss	Grass	Shrub Gravel	Boulder Shrub
Local Study Area	Betula Grass	Moss	Shrub	Rock Shrub	Sand
Access Road	Betula Moss	Moss Carex Water	Shrub Grass Moss	Rock	Sand Water
LSA Access Road	Lichen	Carex	Lichen Boulder	Boulder	Water
Regional Study Area	Lichen Grass	Carex Shrub	Lichen Cobble	Boulder Moss	

Ice

Shadow

6 0 6 12

Kilometers

NOTE

PRELIMINARY ACCESS ROAD ALIGNMENT SHOWN (CUMBERLAND 2005e)

REFERENCES

BASELINE TERRESTRIAL ECOSYSTEM REPORT, MEADOWBANK GOLD PROJECT (CUMBERLAND 2005e)

AGNICO EAGLE MINES LIMITED

MEADOWBANK GOLD PROJECT NUNAVUT

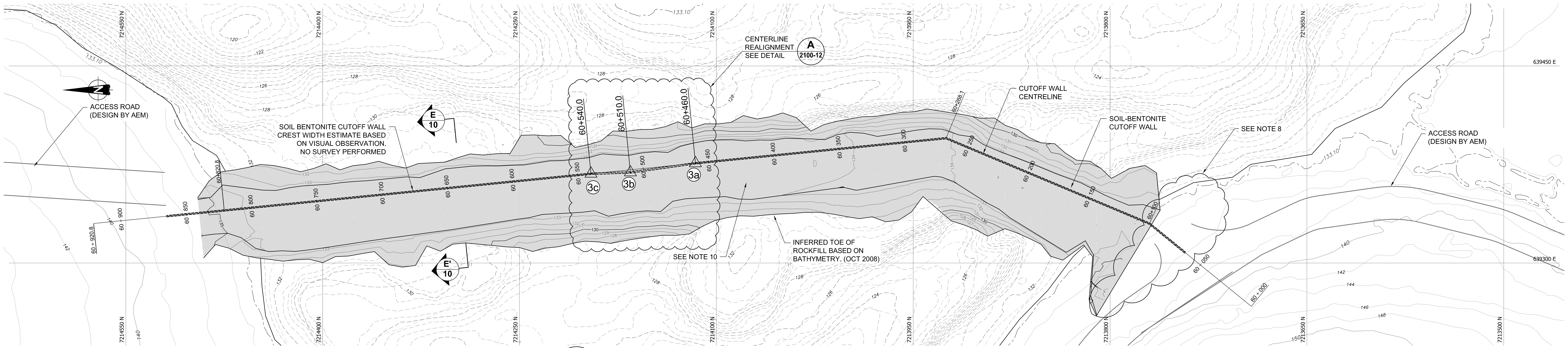
ECOLOGICAL LAND CLASSIFICATION FOR THE REGIONAL STUDY AREA

APPENDIX F

Dikes and Dams

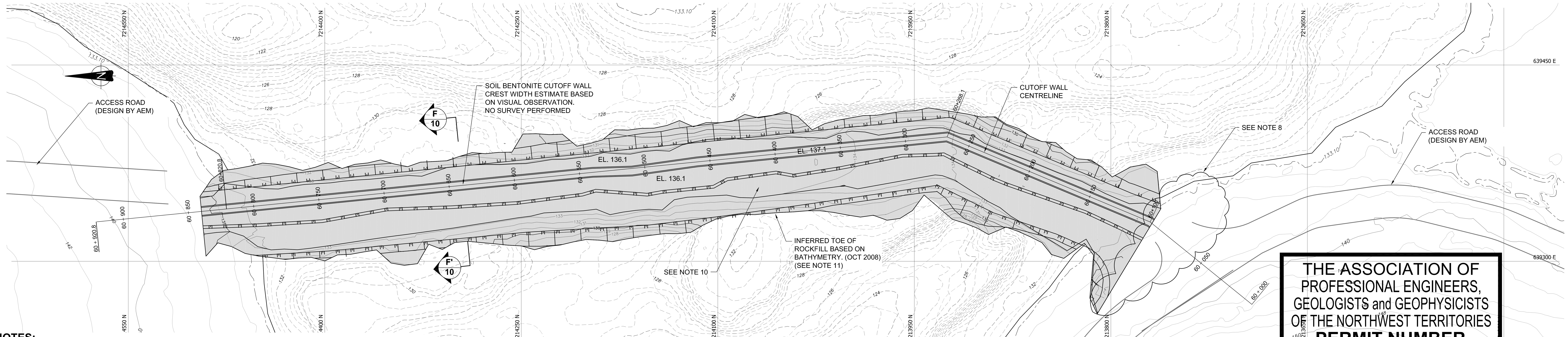
F1 East Dike As-Built Plan View

Source: Golder 2009



E - GRANULAR CAP AND CUTOFF WALL PLACEMENT PLAN

SCALE 1:1500



F - ROCKFILL SURFACING AND THERMAL CAP PLACEMENT PLAN

SCALE 1:1500

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER
P 049
GOLDER ASSOCIATES LTD.

NOTES:

1) ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2) ALL ELEVATIONS ARE IN METRES ABOVE SEA LEVEL (MEASL) UNLESS OTHERWISE NOTED.
3) GRID REFERENCE: NAD 83, UTM ZONE 14.
4) CONTOUR INFORMATION ON LAND SUPPLIED BY AGNICO-EAGLE MINES LIMTED (AEM), MEADOWBANK DIVISION.
5) LAKEBED SURFACE INTERPOLATED FROM 2006 BATHYMETRY DATA. DETAILED BATHYMETRY (0.5m INTERVAL) BASED ON 2008 SURVEY.
6) LAKE CONTOURS ARE BASED ON SURVEY LAKE SURFACE ELEVATIONS: SECOND PORTAGE LAKE = 133.1m.
7) TRAFFIC BERMS NOT SHOWN FOR CLARITY. A 1.9m HEIGHT REQUIRED FOR CAT 777 SIZE HAUL TRUCK TRAFFIC.
8) SURVEY OF ACCESS ROAD TIE-IN NOT PROVIDED AT THE TIME OF ISSUE OF THIS DRAWING.
9) EAST DIKE SURVEY ABOVE 133.1 masl PROVIDED BY AEM ON AUGUST 21, 2008 AND FERNAND GILBERT LIMITÉ ON AUGUST 15, SEPTEMBER 18 & 23, 2008. IN AREAS OF COMMON COVERAGE, THE MOST RECENT DATA IS PRESENTED. EAST DIKE SURVEY BELOW 133.1 masl BY GOLDER ASSOCIATES LTD. ON OCT 28, 2008. INTERPRETATION WAS USED IN AREAS OF NON-SURVEYED AREAS.
10) THERMAL CAP AND GRANULAR CAP SURVEY DATA NOT PROVIDED AT THE TIME OF ISSUE OF THIS DRAWING. THE DESIGN LAYOUT HAS BEEN ASSUMED FOR THESE DRAWINGS. AS-BUILT SURVEY DATA SHOULD BE PROVIDED AND THESE DRAWINGS UPDATED ONCE AVAILABLE.
11) AEM WIDENED DOWNSTREAM ROCKFILL IN MAY 2009 TO ALLOW FOR TWO-WAY HAUL TRUCK TRAFFIC. SURVEY DATA NOT PROVIDED AT THE TIME OF DRAWING ISSUE AND IS NOT SHOWN.
12) UM ROCKFILL SURFACING REQUIRED ON FINAL ROCKFILL SURFACE ABOVE 134.1 masl.

LEGEND:

- LAND-BASED TOPOGRAPHIC MAJOR CONTOURS INTERVAL 10m
- LAND-BASED TOPOGRAPHIC MINOR CONTOURS INTERVAL 2m
- BATHYMETRIC MAJOR CONTOURS INTERVAL 10m
- BATHYMETRIC MINOR CONTOURS INTERVAL 2m
- SHORE LINE
- ASSUMED WALL OF SOIL BENTONITE CUTOFF CRESTS BASED ON EXCAVATOR BUCKET WIDTH.
- GRANULAR CAP
- ROCKFILL
- UM ROCKFILL NOT YET PLACED (SEE NOTE 12)
- SOIL BENTONITE BACKFILL

REDUCED SIZE NOT TO SCALE

PROJECT: AGNICO-EAGLE MINES LIMITED
MEADOWBANK GOLD PROJECT
NUNAVUT

DRAWING NO.	REFERENCES
2100-12	CENTERLINE REALIGNMENT
2100-10	TYPICAL SECTIONS AND DETAILS

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW
1	30OCT09	JEK	AS-BUILT	SWD		
0	01AUG08	BW	ISSUED FOR CONSTRUCTION	EA	BW	TLE

STAMP

ORIGINAL SIGNED AND SEALED

TITLE

EAST DIKE
ROCKFILL LAYOUT PLAN (3 OF 3)

Golder Associates

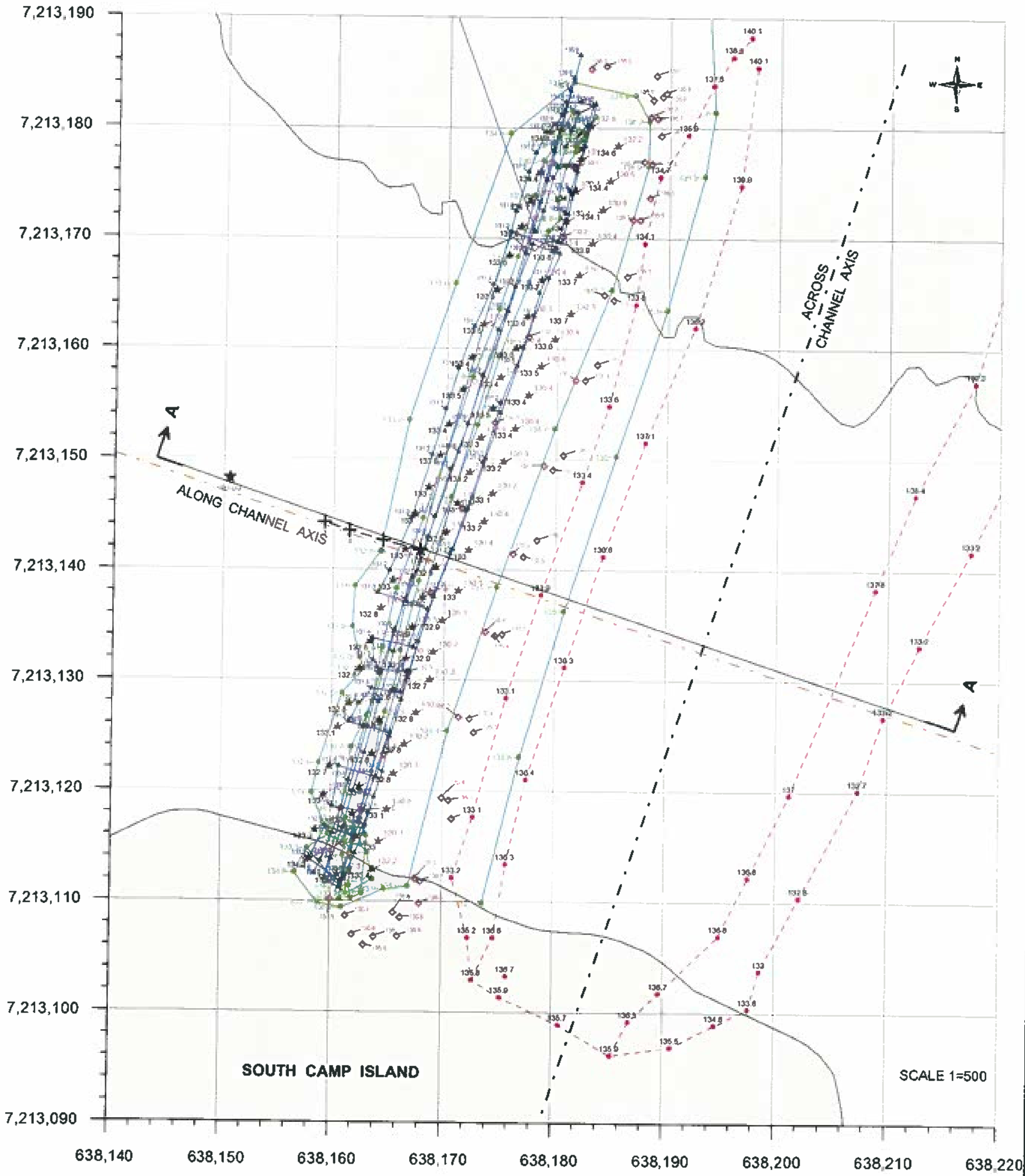
PROJECT No. 07-1413-0074/2800		
DESIGN	BW	04JUL08
CADD	MJH	04JUL08
CHECK	BW	25JUL08
REVIEW	TLE	25JUL08

FILE No. 0814280028-4200-ASBUILT-06
SCALE AS SHOWN
REV. 1

2100-06

F2 South Camp Dike As-Built Plan View

Source: AEM 2012

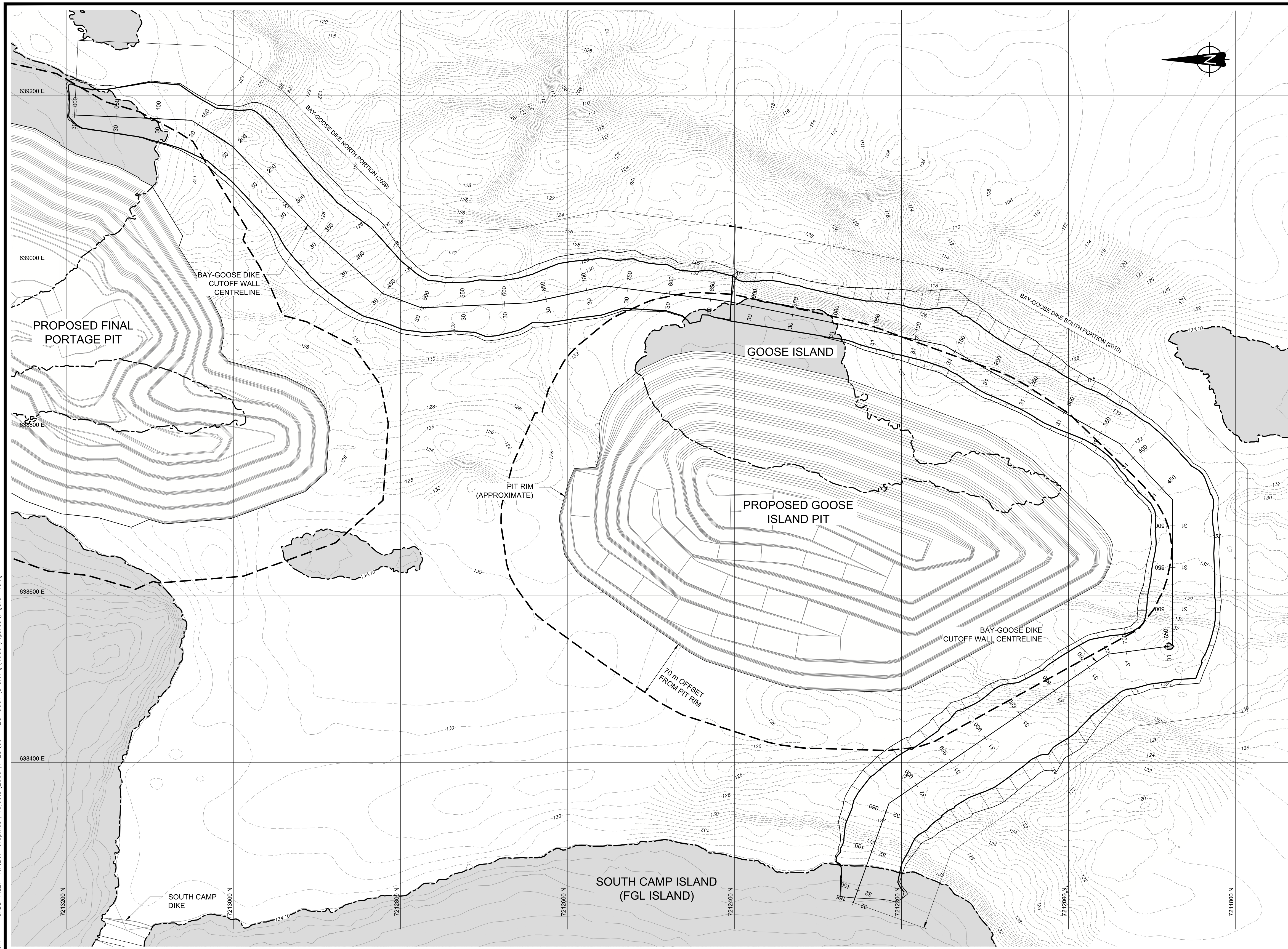


AGNICO-EAGLE MINES LIMITED - MEADOWBANK DIVISION
SOUTH CAMP DIKE - CONSTRUCTION GENERAL PLANVIEW FIGURE 1

REFERENCE.GRF

F3 Bay Goose Dike As-Built Plan View

Source: Golder 2013



LEGEND

- PIT RIM
- MINOR BATHYMETRY CONTOUR
- MAJOR BATHYMETRY CONTOUR
- MINOR TOPOGRAPHIC CONTOUR
- MAJOR TOPOGRAPHIC CONTOUR
- SHORELINE
- 70m OFFSET FROM PIT RIM
- ROCKFILL PLATFORM CREST
- TURBIDITY BARRIER

NOTES

1) ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2) ALL ELEVATIONS ARE IN METRES ABOVE SEA LEVEL (MASL), UNLESS OTHERWISE NOTED.
3) GRID REFERENCE: NAD 83, UTM ZONE 14.
4) SURVEYED LAKE SURFACE ELEVATION: THIRD PORTAGE LAKE = 134.1m (2008).
5) REFER TO DRAWING PACKAGE 4200 FOR BAY-GOOSE NORTH PORTION AS-BUILT DETAILS.

REFERENCE

1) PORTAGE PIT DESIGN BY AEM, MARCH, 2009.
2) GOOSE ISLAND PIT DESIGN BY AEM, MAY, 2010.
3) TOPOGRAPHIC CONTOUR INFORMATION ON LAND SUPPLIED BY AEM.
4) LAKEBED SURFACE BASED ON BATHYMETRIC SURVEYS BY GOLDER ASSOCIATES LTD., 2006 AND DETAILED (0.5m CONTOUR INTERVAL) 2008.
5) ROAD AND MINE FACILITIES PROVIDED BY AEM, JANUARY, 2009.

0 25 50 75 100 125
SCALE IN METRES

PROJECT
AEM
AGNICO-EAGLE MINES LIMITED
MEADOWBANK GOLD PROJECT
NUNAVUT

TITLE

BAY-GOOSE DIKE SITE PLAN

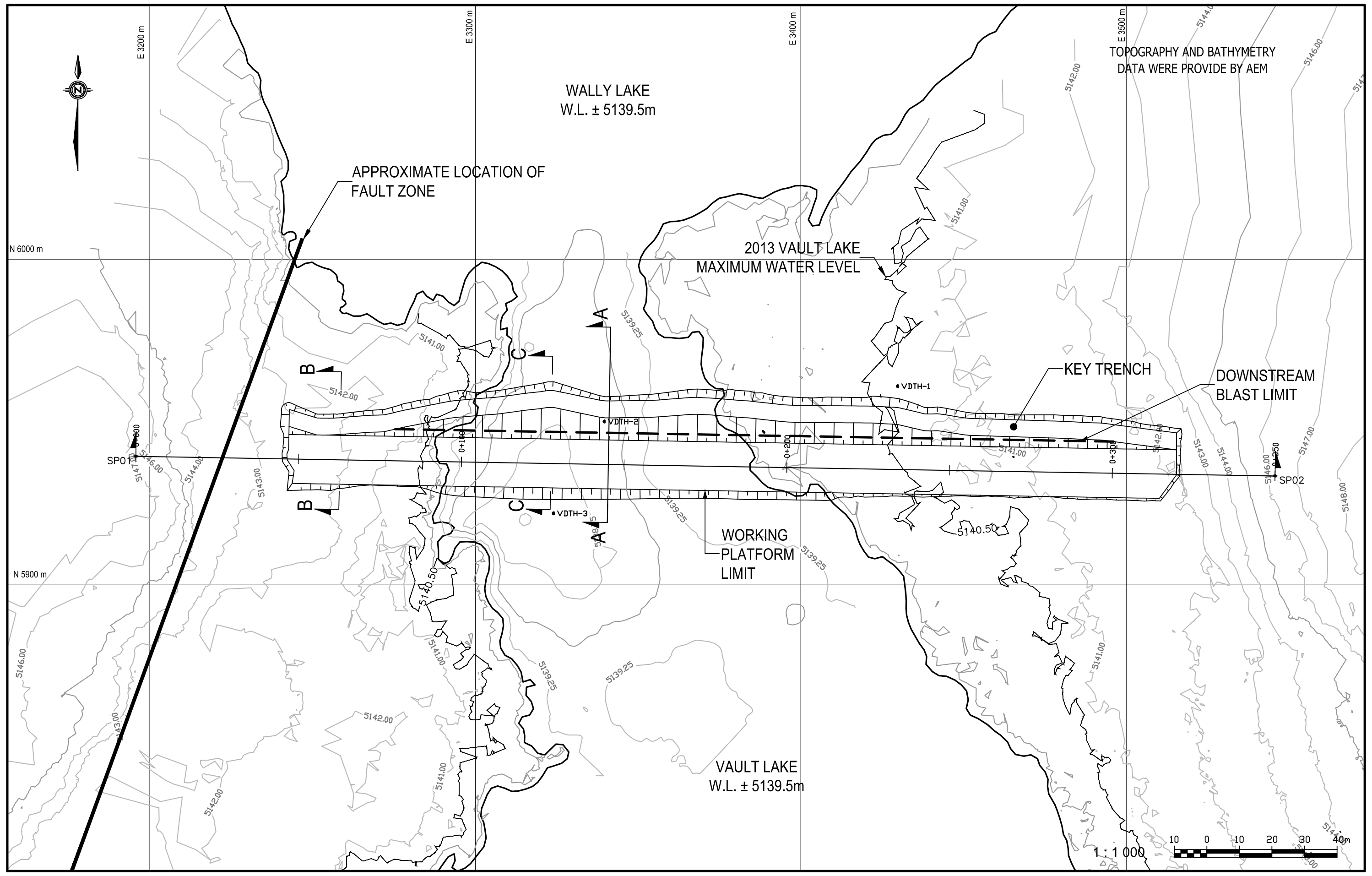
Golder Associates

PROJECT No.		09-1428-5007	FILE No.	FIGURE 1
DESIGN	FA	22FEB12	SCALE AS SHOWN	REV. 0
CADD	JD	22FEB12	FIGURE 1	
CHECK	GRB	APRIL13		
REVIEW	FE	APRIL13		

REVISION DATE: 10/07/02 03:09PM By: jkownacki CADD FILE: N:\Bur-Graphics\Projects\2009\1428\09-1428-5007\Drafting\4000\Figures\Figure 1.dwg

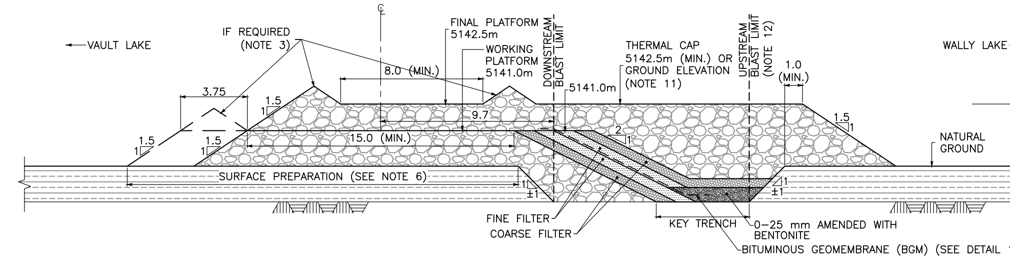
F4 Vault Dike As-Built Plan View

Source: AEM 2013c



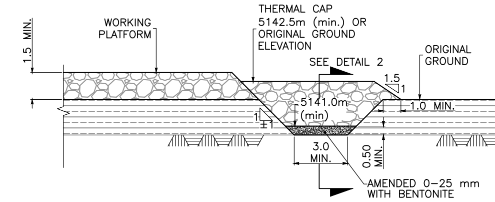
PLAN VIEW - VAULT DIKE

SCALE 1:1000



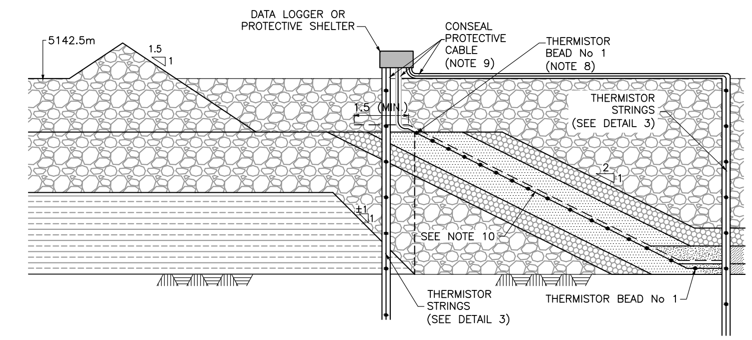
TYPICAL SECTION A-A
BEDROCK ELEVATION BELOW 5140.5m

SCALE 1:200



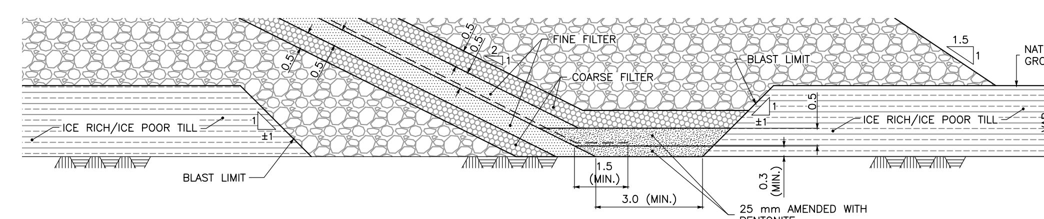
TYPICAL SECTION B-B
BEDROCK ELEVATION ABOVE 5140.5 m

SCALE 1:200



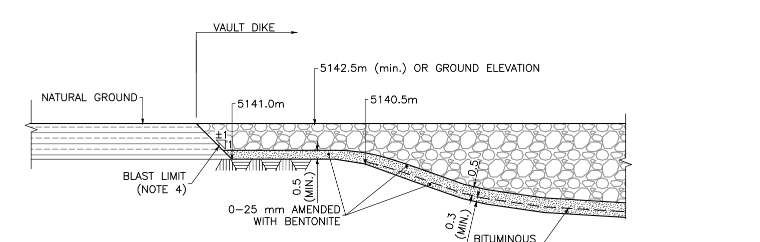
TYPICAL SECTION C-C
THERMISTOR STRINGS INSTALLATION

SCALE 1:100



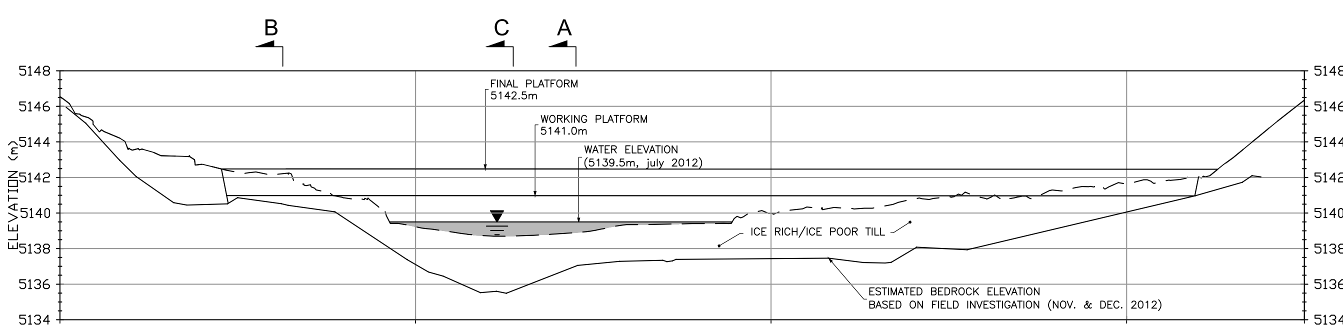
DETAIL 1 - ANCHORING LINER

SCALE 1:100

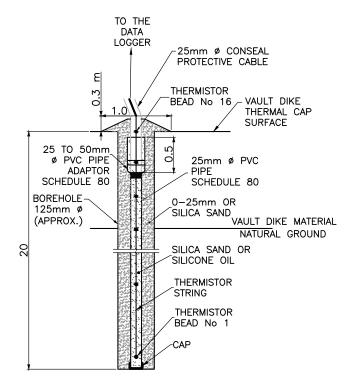


DETAIL 2
DIKE ABUTMENT ALONG THE KEY TRENCH

N.T.S.



PROFIL OF VAULT DIKE
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:200



DETAIL 3
VERTICAL THERMISTOR STRING INSTALLATION

SCALE 1:50

LEGEND

- ROCKFILL
- ICE RICH/POOR TILL
- COARSE FILTER (0–150 mm)
- FINE FILTER (0–25 mm)
- 0–25 mm AMENDED WITH BENTONITE
- BEDROCK

NOTES:

1. ALL COORDINATES AND ELEVATIONS SHOWN RELATE TO THE MINE SYSTEM. TOPOGRAPHY AND BATHYMETRY DATA WERE PROVIDED BY AEM.
2. ALL DIMENSIONS ARE IN METERS (EXCEPT DETAIL 3)
3. SAFETY BERMS WILL BE REQUIRED IN THE VICINITY OF WATER OR IF PLATFORM IS HIGHER THAN 3.0 m. HEIGHT OF THE SAFETY BERMS WILL BE FIXED ACCORDING TO THE SIZE OF THE HAULING TRUCK USED FOR THE CONSTRUCTION AND WILL BE SPECIFIED BY AEM DURING CONSTRUCTION.
4. BLAST SHOULD REACH BEDROCK AND A MINIMUM DEPTH OF 2.0m.
5. LINER BEDDING AND COVER FILTERS MATERIALS (0–20 mm AND 0–150 mm) SHALL BE PLACED PRIOR TO ALLOW ANY VEHICLE CIRCULATION.
6. SURFACE PREPARATION INCLUDE ICE REMOVAL PRIOR THE PLACEMENT OF FILLS WITHIN THE FOOTPRINT AREA OF THE DIKE.
7. LINER SHALL BE INSTALLED HORIZONTALLY AFTER THE APPROVAL OF THE CONTRACTOR'S PLAN BY THE DESIGNER.
8. SHOWN THERMISTOR BEAD SPACING IS NOT REPRESENTATIVE.
9. SPECIAL CARE SHALL BE TAKEN DURING THE FILL PLACEMENT AROUND THE CONSEAL.
10. INCLINED THERMISTOR STRING SHALL BE BURIED INTO A FINE SAND FILL.
11. THERMAL CAP SHALL BE PLACED BEFORE THE THAW SEASON.
12. UPSTREAM BLAST LIMIT SHALL BE VALIDATED ON FIELD BASED ON BEDROCK DEPTH DURING DRILLING OPERATION.
13. NO ACCESS ROAD SHALL BE CONSTRUCTED OVER THE BITUMINOUS GEOMEMBRANE.
14. THIS DRAWING SHALL BE READ WITH THE TECHNICAL SPECIFICATION REPORT.

SETTING OUT POINTS		
SP01	3195.74	5939.51
SP02	3545.69	5933.46

ISSUE REGISTER

No EMIS.	REV.	DATE (Y/M/D)	PURPOSE OF ISSUE	TRANSMISSION LETTER No
1	00	2013/02/01	ISSUED FOR CONSTRUCTION	

REVISION REGISTER

No	REVISION DESCRIPTION	DATE (Y/M/D)	DESIGNED	VERIFY	APPROVED	REVISOR ENG.	OIQ No

THIS DRAWING IS REPRESENTATIVE OF THE ORIGINAL WORK OF THE DESIGN ENGINEER AND REVISOR ENGINEERS

REFERENCE DRAWINGS NUMBER

No	
1	VAULT DIKE INVESTIGATION -TAMROCK - NOV. 2012.XLSX

PROFESSIONAL SEAL

ORIGINAL HAS BEEN SEALED.

SNC·LAVALIN — Sustainable Mine Development, Global Mining & Metallurgy, SNC LAVALIN INC., 5500, boul. des Galeries, bureau 200, Québec (Québec), Canada G2K 2E2

PREPARATION	APPROVAL
DESIGNED: Y. JALBERT	PROJECT DISCIPLINE ENGINEER: G. HAILE
DRAWN: E-V. STAICU	CLIENT: AEM
CHECKED: J-F. ST-LAURENT	DATE: 2012/10/22
SCALE: AS SHOWN	

CLIENT: AGNICO-EAGLE

PROJECT: VAULT DIKE

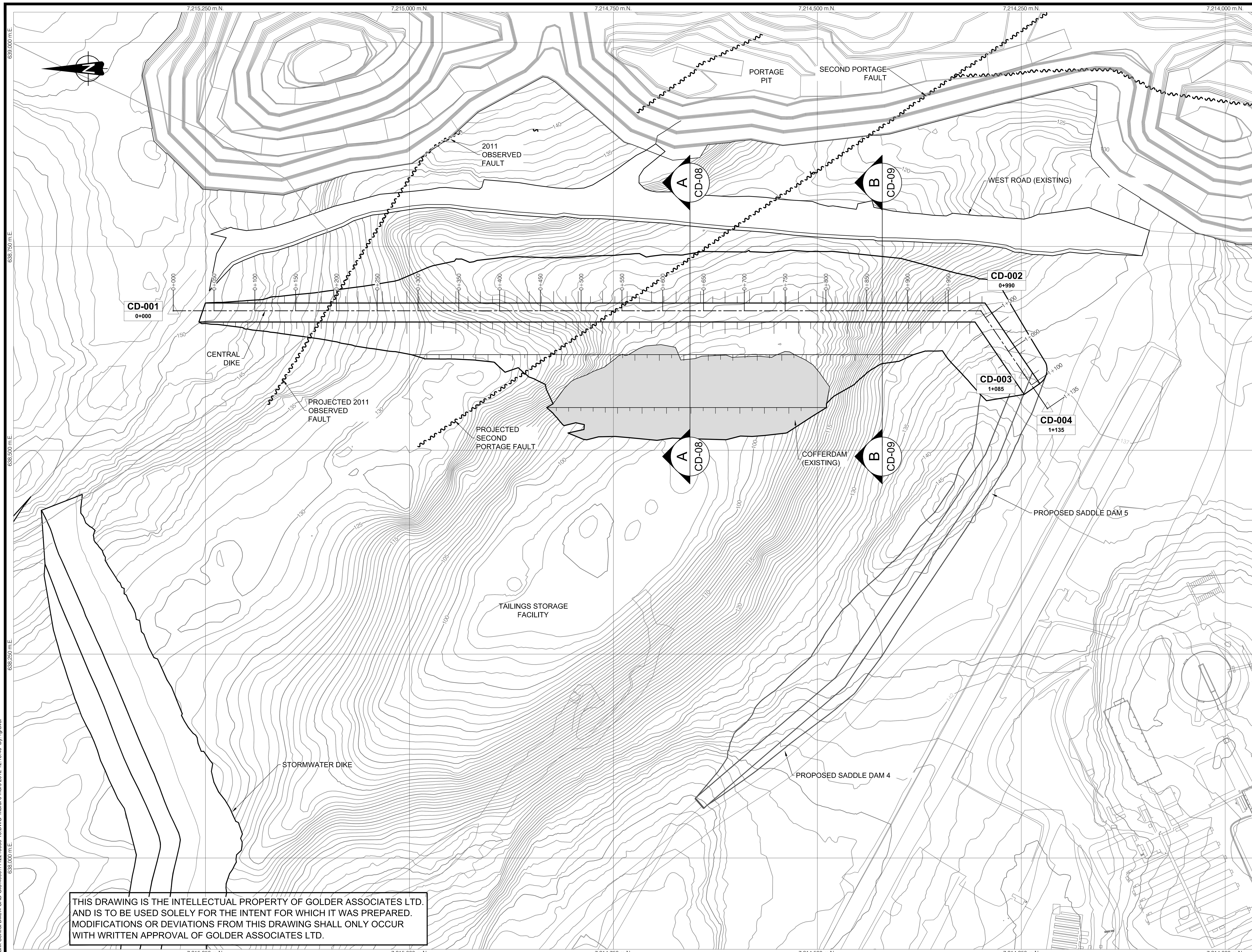
TITLE: CONSTRUCTION OF VAULT DIKE

PROJECT No	SUBDIVISION	SUBJECT	SERIAL	REV.
610548	2020	4G DD	0002	00

STDSLIATHEN – FRAME A1 HORIZONTAL ENGLISH

F5 Central Dike Detailed Design Plan View

Source: Golder 2012a



THIS DRAWING IS THE INTELLECTUAL PROPERTY OF GOLDER ASSOCIATES LTD. AND IS TO BE USED SOLELY FOR THE INTENT FOR WHICH IT WAS PREPARED. MODIFICATIONS OR DEVIATIONS FROM THIS DRAWING SHALL ONLY OCCUR WITH WRITTEN APPROVAL OF GOLDER ASSOCIATES LTD.

LEGEND

- MAJOR CONTOURS INTERVAL 5 m
- MINOR CONTOURS INTERVAL 1 m
- DIKE FOOTPRINT
- FAULT

NOTES

1) IT IS THE RESPONSIBILITY OF THE USER OF THIS DRAWING TO ENSURE THAT THE MOST RECENT REVISION IS BEING USED.
2) THE INFORMATION PROVIDED ON THE DRAWINGS SHALL BE READ IN CONJUNCTION WITH THE MOST RECENT REVISION OF THE TECHNICAL SPECIFICATIONS LISTED ON DWG CD-01. PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL BE FAMILIAR WITH THE SCOPE OF WORK, THE DRAWINGS, AND THE TECHNICAL SPECIFICATIONS.
3) GROUND SURFACE CONTOUR INFORMATION PROVIDED BY AGNICO-EAGLE MINES LIMITED (AEM), MEADOWBANK DIVISION.
4) ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED. COORDINATE SYSTEM IS NAD83 UTM ZONE 14.
5) ALL DIMENSIONS AND ELEVATIONS ARE IN METRES UNLESS OTHERWISE NOTED. COORDINATE SYSTEM IS NAD83 UTM ZONE 14.
6) UPDATED PITS OUTLINE PROVIDED BY AEM.
7) PROPOSED ROCK STORAGE FACILITY TO BE UPDATED BY OTHERS.
8) FINAL DIKE ROCKFILL FOOTPRINT SHOWN.
9) THE CONTRACTOR SHALL COMPLETE CONSTRUCTED SURFACES TO THE LINES AND GRADES SHOWN ON THE DRAWINGS AND AS DESCRIBED IN THE TECHNICAL SPECIFICATION LISTED ON DWG CD-01.
10) THE CONTRACTOR SHALL VERIFY THE COORDINATES AND ELEVATIONS BEFORE COMMENCING CONSTRUCTION.
11) IN THE EVENT OF DISCREPANCY BETWEEN THE DRAWINGS AND THE TECHNICAL SPECIFICATIONS, CLARIFICATION AND/OR DIRECTION SHALL BE PROVIDED AS OUTLINED IN THE TECHNICAL SPECIFICATIONS.
12) THE 2ND PORTAGE FAULT PROJECTION ACROSS THE CENTRAL DIKE FOOTPRINT IS BASED ON ITS ORIGINAL GENERAL ALIGNMENT.
13) THE PROJECTION OF THE FAULT OBSERVED IN 2011 ON WEST SIDE OF PORTAGE PIT IS BASED ON STRUCTURAL MEASUREMENTS COMPLETED WITH A COMPASS. DUE TO THE IRON FORMATION ROCK OCCURRENCE ON THE SITE, THE PROJECTED ALIGNMENT IS NOT CONSIDERED TO BE ACCURATE.
14) PHASED CONSTRUCTION OF THE CENTRAL DIKE IS PLANNED. AEM WILL PROVIDE THE CONTRACTOR WITH THE PHASE CONFIGURATION TO BE CONSTRUCTED AS WELL AS AS-BUILT DOCUMENTATION OF PREVIOUS CONSTRUCTION PHASES.

CENTRAL DIKE CONTROL POINTS

POINT ID	STATION	NORTHING	EASTING	ELEVATION
CD-001	0+000	7215289.51	638671.01	-
CD-002	0+990	7214299.51	638671.01	150.00
CD-003	1+085	7214246.09	638592.46	150.00
CD-004	1+135	7214217.97	638551.11	-

0 25 50 75 100 125
SCALE 1:2,500

REV	DATE	DES	REVISION DESCRIPTION	CADD	CHK	RVW
0	7 MARCH 2012	YB/PMB	ISSUED FOR CONSTRUCTION	RG		
B	24 FEB 2012	YB/PMB	ISSUED FOR CLIENT REVIEW	RG	YB	PMB
A	23 DEC 2011	YB/PMB	ISSUED FOR CLIENT REVIEW	RG	YB	PMB

DRAWING NO.	REFERENCES

STAMP

ORIGINAL SIGNED AND SEALED

PROJECT

AGNICO-EAGLE MINES LIMITED
MEADOWBANK GOLD PROJECT
TAILINGS STORAGE FACILITY CENTRAL DIKE

TITLE

CENTRAL DIKE
GENERAL ARRANGEMENT PLAN

Golder Associates

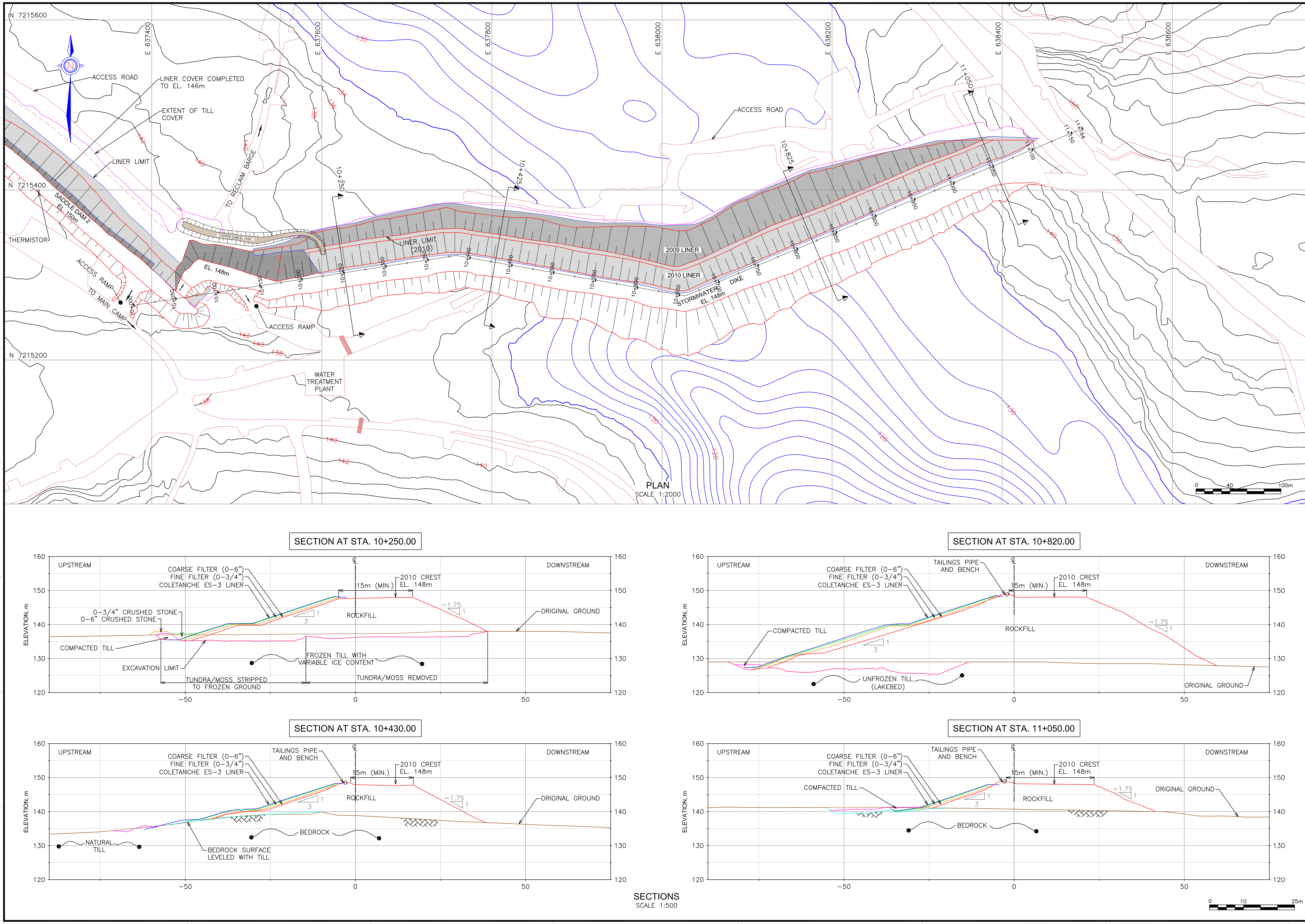
PROJECT No.		11-1221-0035	FILE No.	1112210035-15
DESIGN	YB/PMB	23DEC11	SCALE AS SHOWN	REV. 0
CADD	RG	23DEC11	CD-04	
CHECK	YB	23DEC11		
REVIEW	PMB	23DEC11		

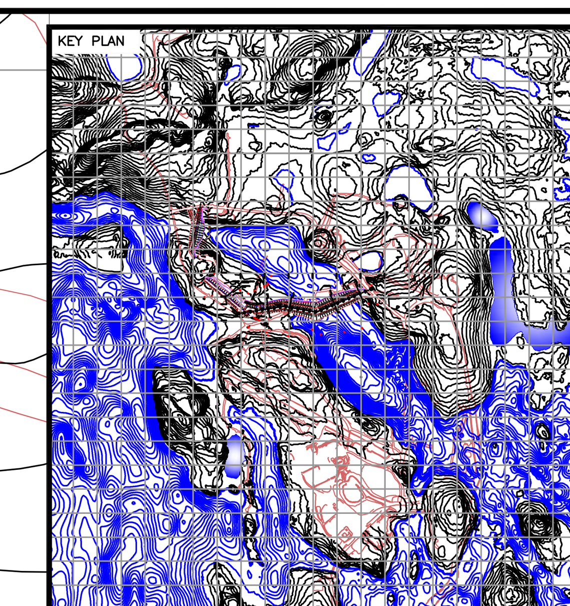
F6 Stormwater Dike As-Built Plan View

Source: AEM 2013f

DRAWING NO.

FORMAT ARCHD–LANDSCAPE





GENERAL NOTES

LEGEND:

- LINER COVER 2010
- LINER COVER 2009
- LINER COVER TO BE COMPLETED
- COFFERDAM
- CREST / TOE LINE
- EXTENT OF TILL
- ROADS

FOR SECTIONS:

- FINE FILTER
- COARSE FILTER
- BEDROCK
- FOUNDATION
- LINER
- GEOTEXTILE
- ORIGINAL GROUND
- ROCKFILL
- TILL

TITLE	# DWG

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	APP.	CLIENT

REVISIONS

AGNICO-EAGLE MEADOWBANK DIVISION

TITLE
AGNICO–EAGLE – MEADOWBANK DIVISION
STORMWATER DIKE
PLAN
AS BUILT 2010

DRAWN BY	K. Mologuine	DATE	2010/09/28
CHECKED BY	Y.Jolbert		
APPROVED BY	Y.Jolbert		
SCALE	AS SHOWN	DATE	
DRAWING NO.			
PROJECT NO.		REVISION	SHEET 1 / 1

X:\Stormwater Dike\AS-BUILT DWG\2010\Konstantin\ACAD\SWD AS-BUILT 2010 ALTERNATIVE PLAN.dwg, 08 Dec 2010

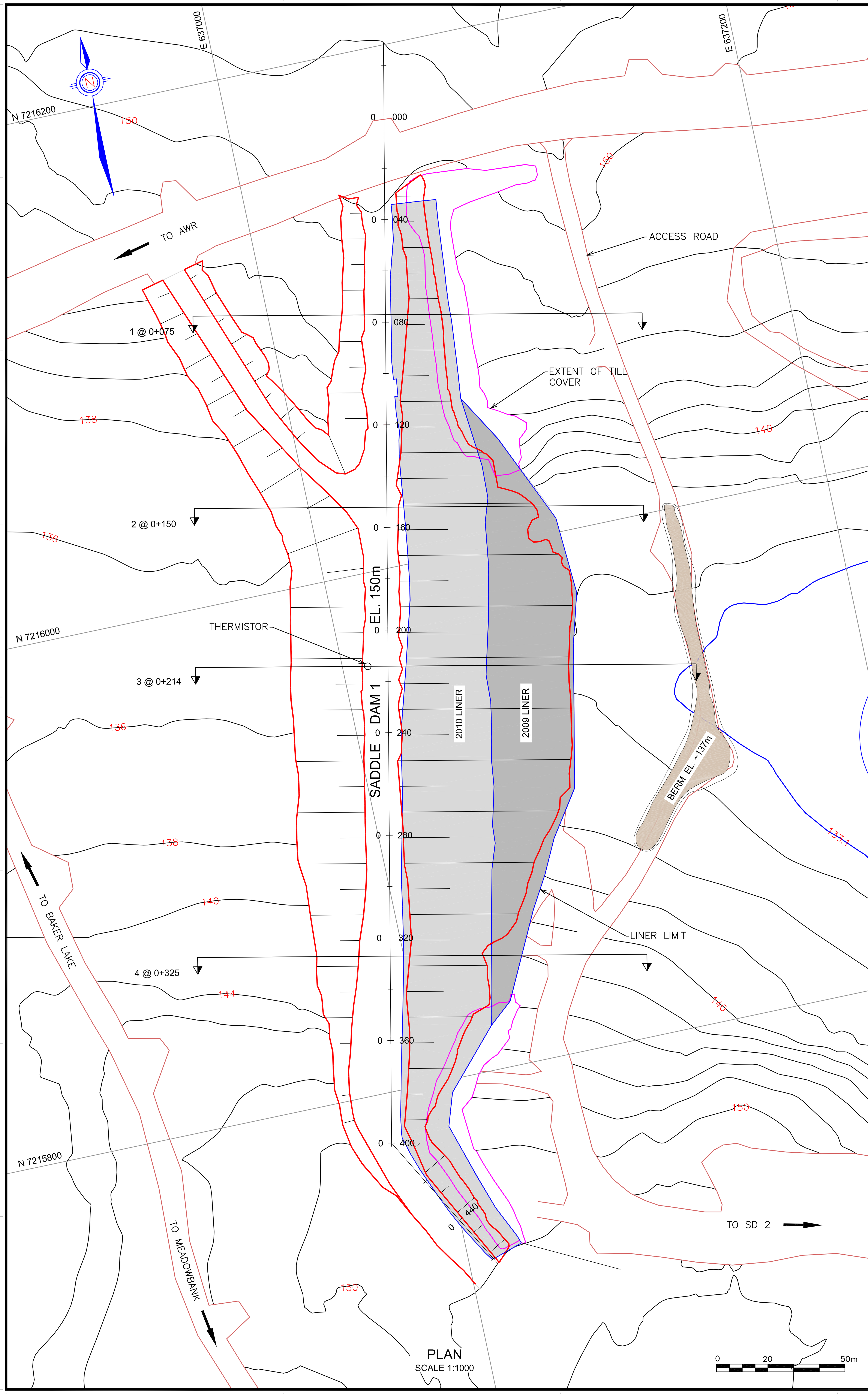
FILE NO. .DWG

F7 Saddle Dam 1 As-Built Plan View

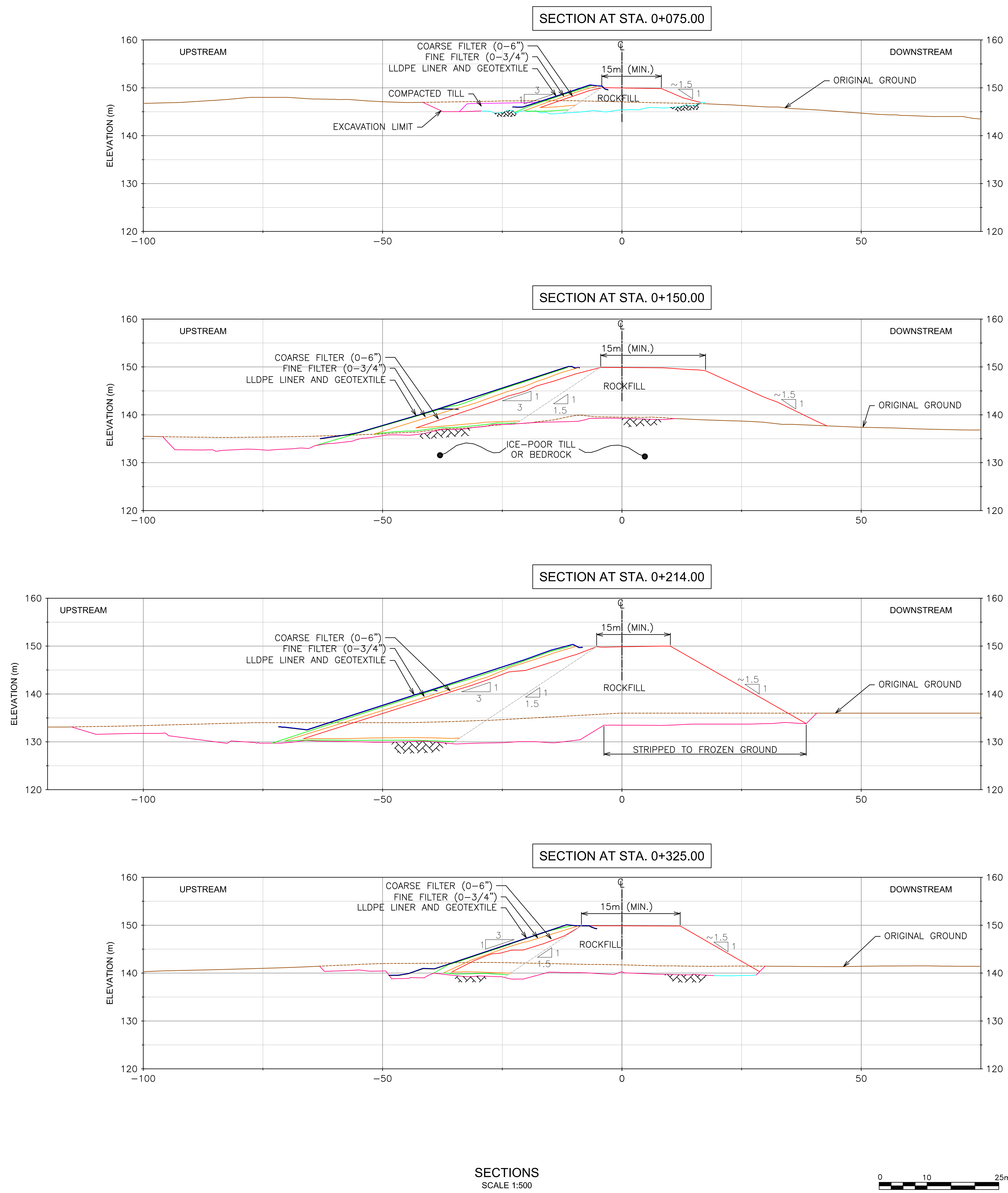
Source: AEM 2013f

DRAWING NO.

FORMAT ARCHD–LANDSCAPE

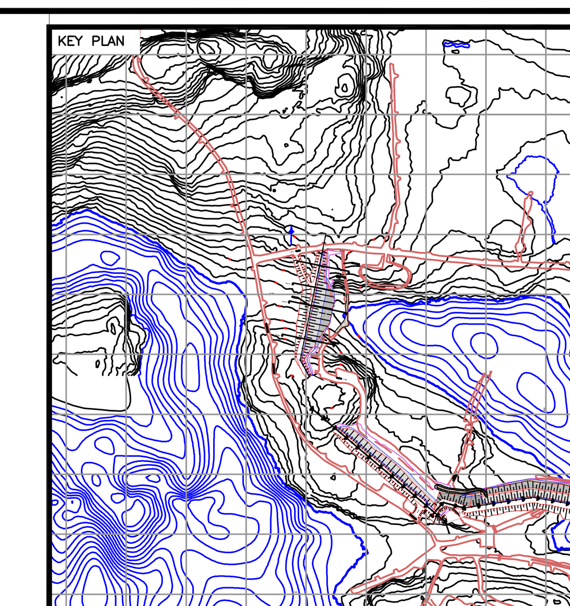


PLAN
SCALE 1:1000



SECTIONS
SCALE 1:500

KEY PLAN



GENERAL NOTES

LEGEND:

- LINER COVER 2010
- LINER COVER 2009
- COFFERDAM
- CREST / TOE LINE
- EXTENT OF TILL
- ROADS

FOR SECTIONS:

- FINE FILTER
- COARSE FILTER
- BEDROCK
- FOUNDATION
- LINER
- GEOTEXTILE
- ORIGINAL GROUND
- ROCKFILL
- TILL

TITLE	# DWG

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	APP.	CLIENT

REVISIONS

AGNICO-EAGLE
MEADOWBANK DIVISION

TITLE
AGNICO–EAGLE – MEADOWBANK DIVISION
SADDLE DAM 1
PLAN
AS BUILT 2010

DRAWN BY	K. Mologuine	DATE	2010/09/28
CHECKED BY	Y.Jolbert		
APPROVED BY	Y.Jolbert		
SCALE	AS SHOWN	DATE	
DRAWING NO.			
PROJECT NO.		REVISION	SHEET 1 / 1

X:\Saddle Dam 1\AS BUILT\AS_BUILT 2010\Konstantin\ACAD\SD 1 AS–BUILT 2010 ALTERNATIVE PLAN 1.dwg, 08 Dec 2010

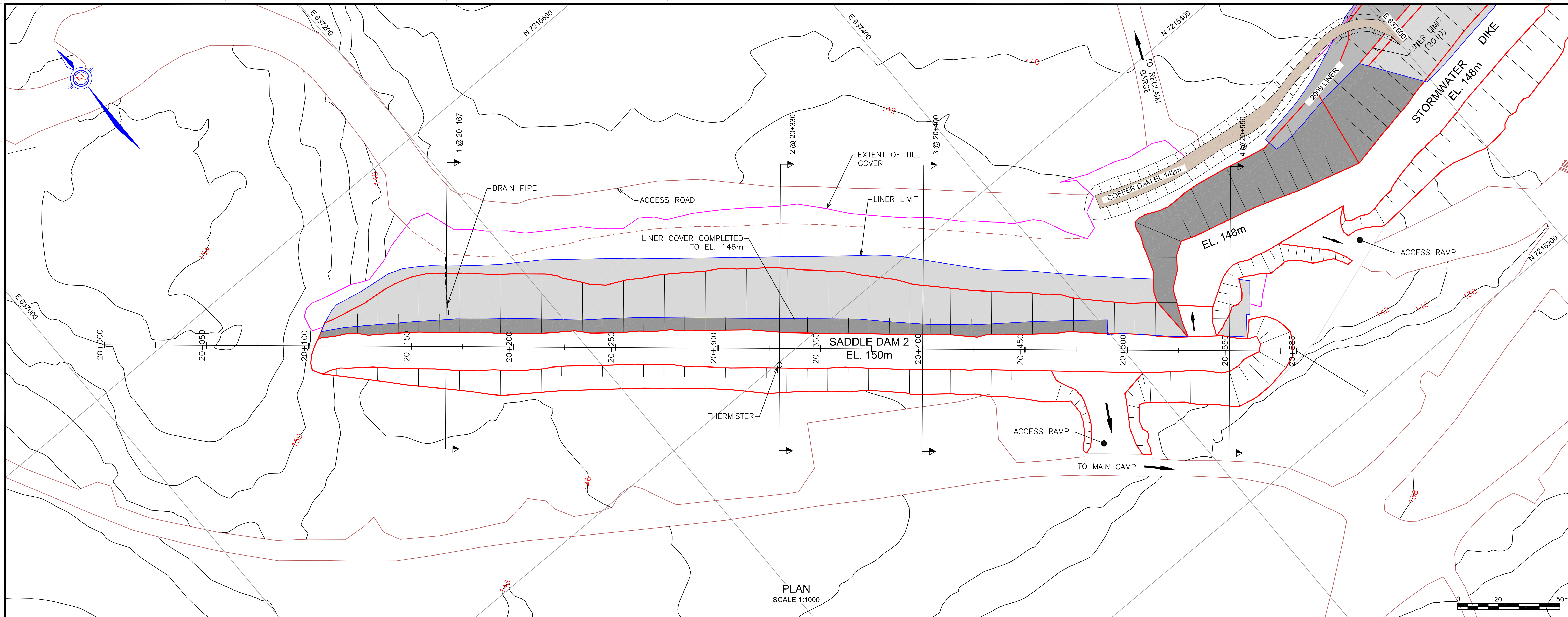
FILE NO. .DWG

F8 Saddle Dam 2 As-Built Plan View

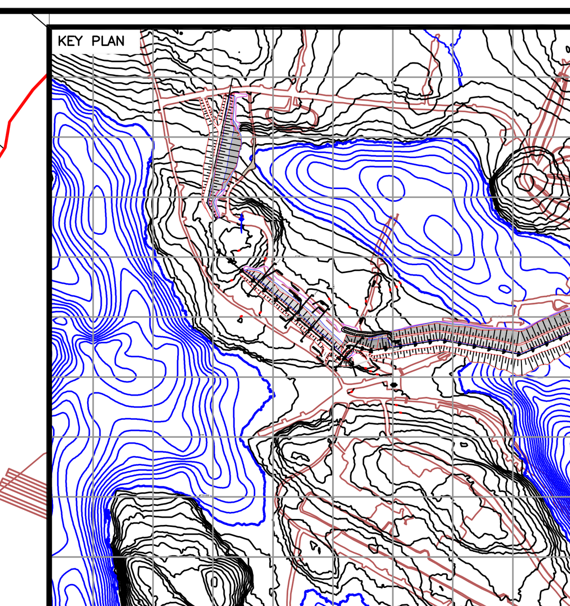
Source: AEM 2013f

DRAWING NO.

FORMAT ARCHD-LANDSCAPE



PLAN
SCALE 1:1000



KEY PLAN

GENERAL NOTES

LEGEND:

- LINER COVER 2010
- LINER COVER 2009
- LINER COVER TO BE COMPLETED
- COFFERDAM
- CREST / TOE LINE
- EXTENT OF TILL
- ROADS

FOR SECTIONS:

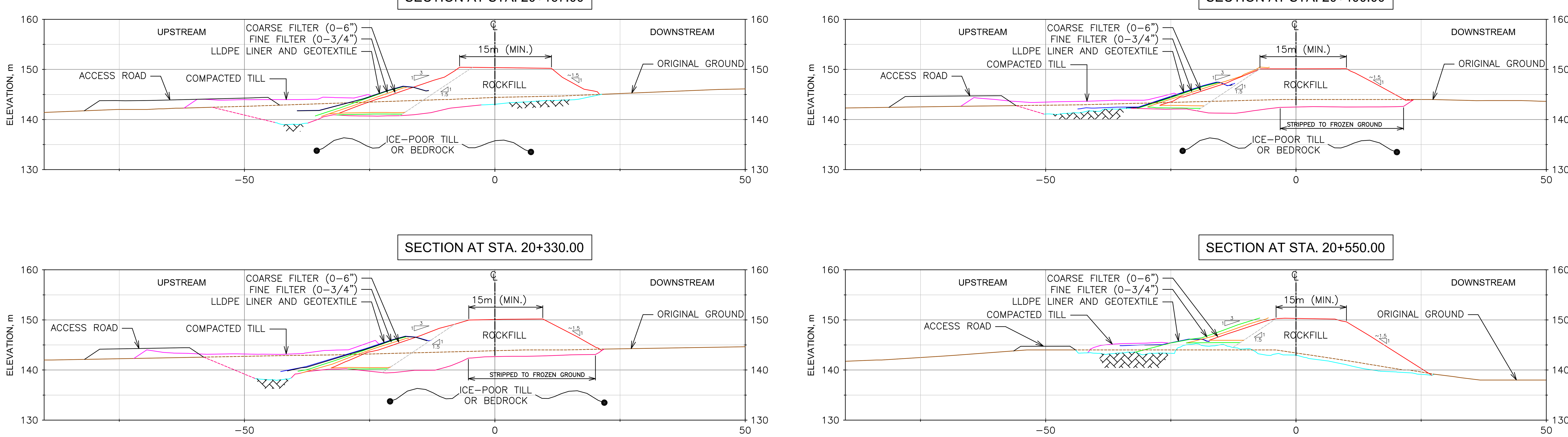
- FINE FILTER
- COARSE FILTER
- BEDROCK
- FOUNDATION
- LINER
- GEOTEXTILE
- ORIGINAL GROUND
- ROCKFILL
- TILL

SECTION AT STA. 20+167.00

SECTION AT STA. 20+400.00

SECTION AT STA. 20+330.00

SECTION AT STA. 20+550.00



SECTIONS
SCALE 1:500

REFERENCE DRAWINGS

REV.	DATE	DESCRIPTION	BY	APP.	CLIENT

REVISIONS

AGNICO-EAGLE
MEADOWBANK DIVISION

TITLE
AGNICO-EAGLE - MEADOWBANK DIVISION
SADDLE DAM 2
PLAN
AS BUILT 2010

DRAWN BY: K. Mologuine	DATE: 2010/09/28
CHECKED BY: Y.Jalbert	
APPROVED BY: Y.Jalbert	
SCALE: AS SHOWN	DATE
DRAWING NO.	
PROJECT NO.	REVISION / SHEET: 1 / 1

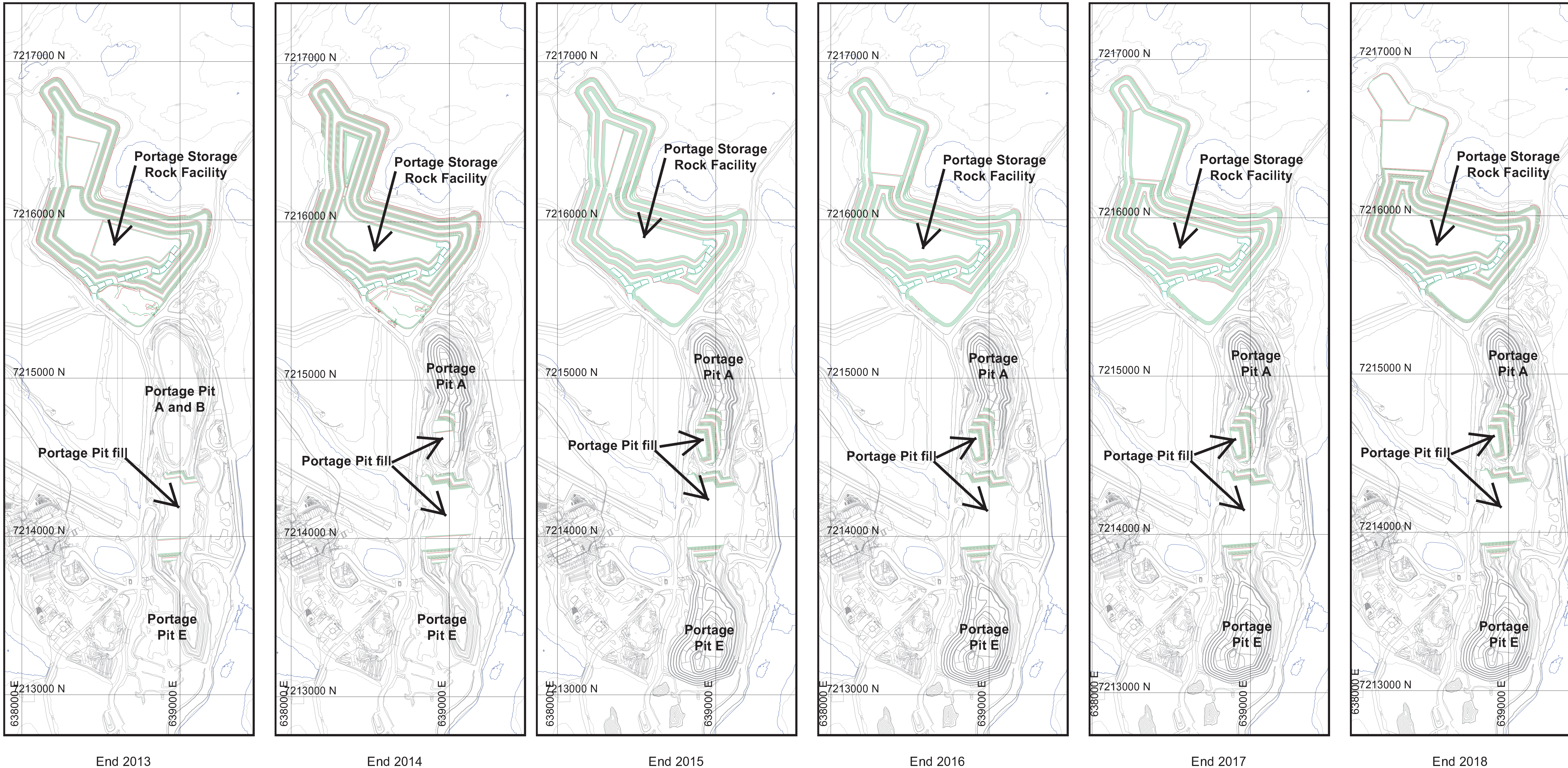
FILE NO. .DWG

X:\Saddle Dam 2\As Built 2010\Konstantin\ACAD\SD 2 AS-BUILT 2010 ALTERNATIVE PLAN 1.dwg, 08 Dec 2010

APPENDIX G

Waste Rock Deposition Plans

Source: AEM 2013a



Grid Reference: NAD 83, UTM zone 14

-1000 0 1000

Scale 1:24000

By : Jose Gabriel Condoretty

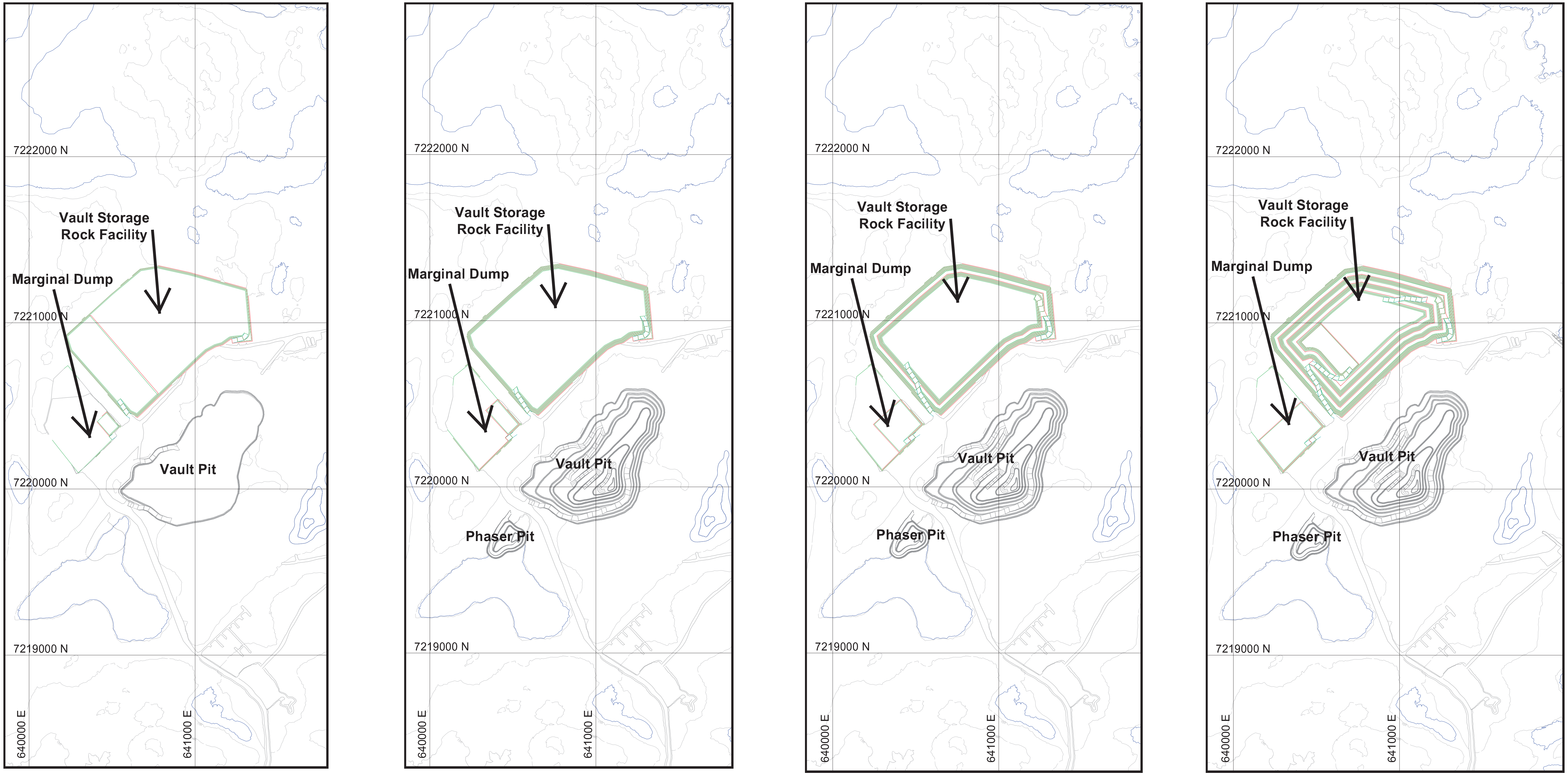
Date: 2013/03/04

AEM AGNICO-EAGLE MINES LIMITED

MEADOWBANK GOLD MINE NUNAVUT

CONCEPTUAL WASTE ROCK DEPOSITION PLAN PORTAGE ROCK STORAGE FACILITY

FIGURE 6.1



End 2014 | End 2015 | End 2016 | End 2017

Grid Reference: NAD 83, UTM zone 14

-1000 0 1000
Scale 1:24000

By : Jose Gabriel Condoretty
Date: 2013/03/04

AEM AGNICO-EAGLE MINES LIMITED

MEADOWBANK GOLD MINE
NUNAVUT

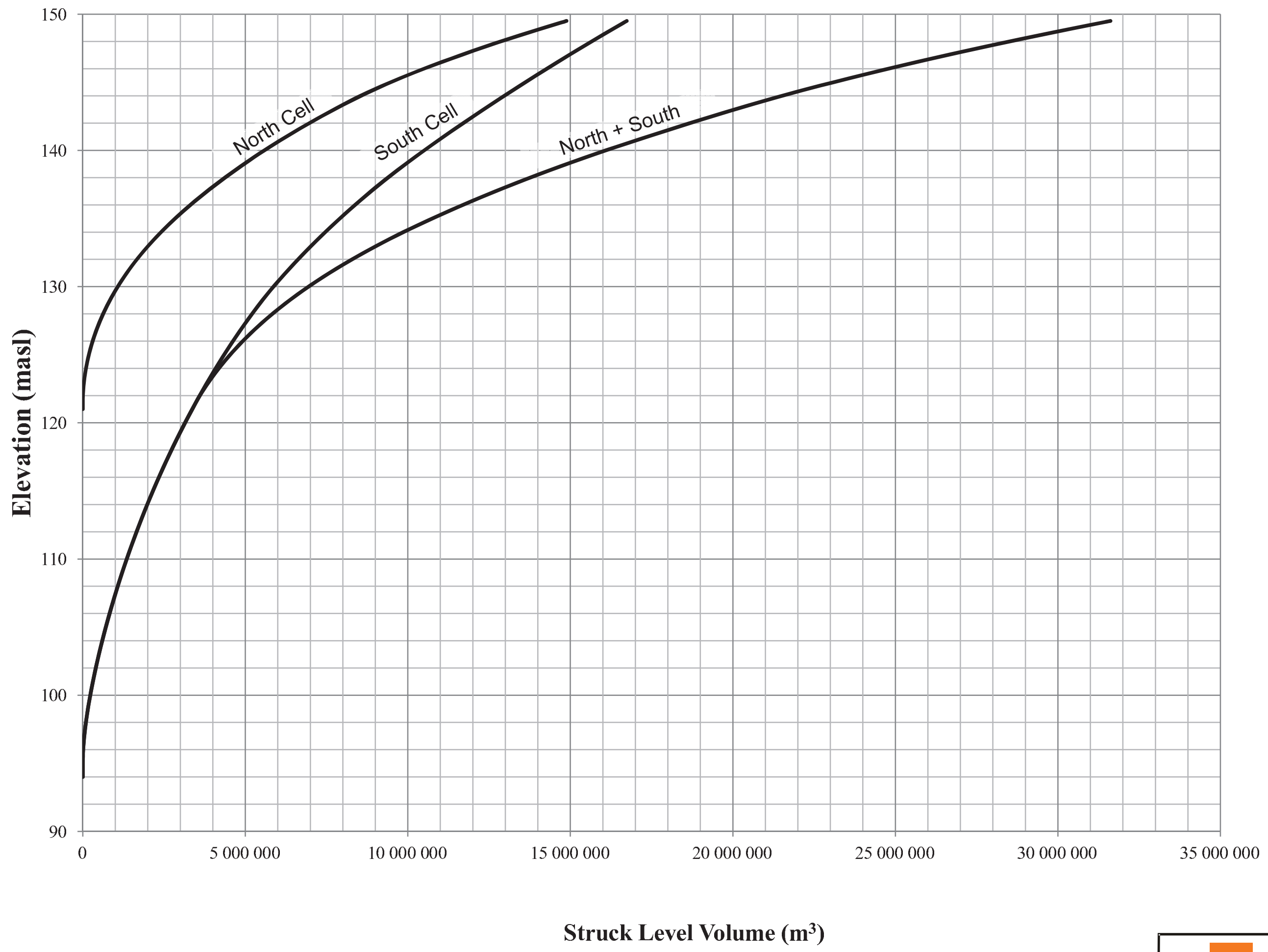
CONCEPTUAL WASTE ROCK DEPOSITION PLAN VAULT ROCK STORAGE FACILITY

FIGURE 6.2

APPENDIX H

Tailings Storage Curve

Source: AEM 2013a



REFERENCE

FROM THE TSF FILLING SCHEME MODEL (GOLDER 2011a)

AEM AGNICO-EAGLE MINES LIMITED	
MEADOWBANK GOLD MINE NUNAVUT	
TAILINGS STORAGE FACILITY STAGE STORAGE CURVE	FIGURE 7.2

REVISION DATE: 8JUL09 BY: DRW FILE:O:\Active_2008\1428\08-1428-0029 Meadowbank TSF Dike Design\7000 Updated Water Management Plan\GoldSim 2008\Updated Figures\Figure 3.18.ppt

APPENDIX I

Financial Security

I1 Financial Security Cost Estimate Assumptions

1.0 INTRODUCTION

Agnico Eagle Mines Ltd. (AEM) Meadowbank Gold Project is currently in operation roughly 70 km north of Baker Lake, Nunavut. AEM is required to submit a detailed financial security cost estimate for the Meadowbank Gold Project Interim Closure and Reclamation Plan (ICRP) to Aboriginal Affairs and Northern Development Canada (AANDC) to support land use and water licensing requirements. AANDC recommends that the RECLAIM workbook be used for such estimates (INAC 2002).

A closure and reclamation financial security cost estimate has been prepared using the RECLAIM template (Version 6.1, March 2009) for permanent closure of the Meadowbank Gold Project. A printout of the linked EXCEL spread-sheets from the RECLAIM template is provided in Appendix I2.

2.0 CLOSURE MEASURES AND SCHEDULE

The cost estimate covers closure and reclamation of all facilities currently identified within the Meadowbank Gold Project property, including the: Open Pits, Process Plant, Tailings Storage Facility (TSF), Waste Rock Storage Facilities (WRSF) and support facilities on the property, including: Accommodations (dorms, cafeteria and kitchen, dry room, dispatch office, drinking water treatment facility, gymnasium, and housekeeping and building maintenance facilities), Power Plant, Bulk Fuel Storage Facility, Service Building, contractor facilities, warehouses and cold storage, Assay Lab, Emulsions Plant, Incinerator, Airstrip, borrow areas, on site roads and laydown areas. The Baker Lake Site Facilities and All Weather Private Access Road (AWPAR) are also included in this cost estimate. Due to the current level of development of the Meadowbank Gold Project, the cost estimate has been developed based on the current concept for the end of mine life configuration of facilities only.

This cost estimate provides for the closure measures described in detail in the ICRP text. Most closure measures occur within the first two to three years of closure. For the purpose of this financial security cost estimate, only progressive rehabilitation measures which have already been completed are considered. All other closure measures are assumed to take place at the onset of permanent closure, including pit flooding. Active pit flooding is assumed to occur over a period of nine years. Periodic closure and post-closure monitoring is expected to occur, at a decreasing frequency, over a period of 22 years.

3.0 COST ESTIMATE

3.1 Direct Cost Assumptions

Where applicable, costs have been developed using unit rates provided by the RECLAIM template and calculated quantities. Where an appropriate RECLAIM supplied rate was not available, an independent rate was used from precedent data for similarly sized projects located in similar conditions. Unit rates used assume third party contractor pricing.

The cost estimate provided assumes that hazardous materials are removed from all structures and equipment and disposed of appropriately. Closure and reclamation cost estimates do not normally permit the use of credit for salvaged materials or equipment; therefore no salvage values were incorporated into the estimate. The cost of non-hazardous waste disposal was estimated assuming onsite disposal within the Portage Waste Rock Storage Facility (WRSF).

Reclamation of the Tailings Storage Facilities (TSF) and Portage WRSF are scheduled to occur progressively during the active mining life of the Meadowbank Gold Project. This cost estimate does not include the cost of any progressive closure measures which have not yet taken place, to account for the worst case scenario of the full closure cost being incurred by a third party. Presently, the only progressive rehabilitation work deducted from this cost estimate is the application of 42% of the NPAG cover over the Portage WRSF (as reported in AEM 2013a). As progressive rehabilitation activities are completed, the cost estimate should be updated to reflect the completed works.

It should be noted that field cover trials scheduled to commence in 2014 for the TSF and Portage WRSF. This cost estimate assumes a 4 m thick cover of NPAG waste rock is applied over the full surface of both facilities. As cover trials progress it may be justifiable to reduce the assumed cover thickness from 4 m. TSF cover thickness has a significant impact on the estimated closure costs, with a reduction of 1 m or 2 m in cover thickness resulting in $8.1M or $16.2M in direct closure cost savings, respectively. This cost estimate should be re-evaluated as the cover designs are refined.

Pricing of required waste rock construction materials assumes they are readily available in quantities required at no additional cost to the contractors, other than for excavation, processing (where required), loading, hauling, grading, and compaction to the desired lines and grades.

Post closure monitoring and maintenance activities have been calculated using a net present value, calculated at the commencement of closure, with a discount rate of 5%. An allowance for bi-weekly site visits 5 months of the year from a site caretaker located in Baker Lake, as well as rental of equipment for site maintenance, has been provided for the post closure monitoring and maintenance period. In addition to site maintenance, it is assumed post closure water quality sampling will be conducted by this site caretaker; however external laboratory testing and annual summary reporting costs have been accounted for separately.

Specific assumptions and quantities used for the financial security cost estimate are provided for each closure component in Sections 3.1.1 to 3.1.7.

3.1.1 Open Pits

Berms along exposed Portage Pit crest following pit flooding:

- 500 m long x 1.5 m tall with 2H:1V side slopes = 2250 m^3.
- Berm material reused from dyke breach, only dozing unit cost used.

Notes: Pit flooding and associated dyke breach calculations are described under 3.1.6 Water Management.

No berms are proposed for the Vault Pit at closure.

3.1.2 Tailings Storage Facility

Cover Tailings Storage Facility – 4 m thick NPAG cover:

- North Cell = 1,410,000 m^2 x 4 m = 5,640,000 m^3 at short haul from stockpile (~500 m).
- South Cell = 450,000 m^2 x 4 m = 1,800,000 m^3 at long haul from stockpile (~1500 m).

Saddle Dam 3 Breach:

- Assumed 50 m wide breach, 5 m depth, 3H:1V side walls, 50 m average dam width.
- Assumed breach lined with waste rock from breach excavation.
- Breach Excavation = 40 m x 5 m x 35 m = 7,000 m^3.

Removal of Tailings Discharge Line:

- Provided for removal of 10 km of HDPE, with on-site disposal
- Lump sum allowance for decommissioning of associated booster pump system.

3.1.3 Waste Rock Storage Facilities

Cover Portage Waste Rock Storage Facility – 4 m thick NPAG cover:

- Portage WRSF (220 m elev. configuration) total cover area = 630,140 m^2, completed progressive reclamation area = 238,001 m^2 (approximated from AEM 2013a), therefore remaining cover area = 392,139 m^2. Remaining cover volume = 1,568,556 m^3.
- Assuming 25% of exterior surface covered in NPAG while stockpiling, 1,176,417 m^3 of cover remaining.
- Additional 1000 m^3 of cover provided for backfilling/covering sumps.

Vault Rock Storage Facility:

- Vault Waste Rock primarily NPAG material therefor has no cover requirement.

3.1.4 Buildings and Equipment

Decontaminate and Dispose Mobile Equipment in Landfill:

- Assumed 8 hours to decontaminate typical piece of heavy construction equipment, with 50% of equipment taken by local community.

Remove Buildings and Puncture Foundations:

- Building footprints are listed in Table 1 below, with demolition areas scaled for height assuming 3 m stories. Buildings with concrete foundations requiring puncturing assumed.

Reclaim Roads and Laydown Areas:

- Road/Laydown areas for the mine site and Baker Lake listed in Table 1 will be scarified and the AWPAR will be ripped to promote natural re-vegetation and re-contoured to promote natural drainage.

Table 1: Building List and Dimensions

Building/Infrastructure	Footprint[1] (m^2)	Stories (3 m height)	Total Demolition Area Scaled for Height (m^2)	Concrete Foundation Area (m^2)
Mill Building	7560	5	37800	7560
Leech Tanks (10)	2500	5	12500	2500
Primary & Secondary Crusher	246	3	740	246
Pebble Crusher	325	2	650	325
Conveyors	975	2	1950	
Assay Lab	440	1	440	
Accommodations and Misc. (Inc. Nova Camp)	11744	1	11744	
Kitchen and Cafeteria	2630	2	5259.4	
Site Services Building	500	1	500	
Services Building	3270	4	13080	3270
Warehouse	1427	2	2854	
Power Plant	2485	3	7455	2485
Ore Dome	3000	7	21000	3000
Cat Warehouse	1345	2	2690	1345
Toromont Facilities	925	1	925	925
Fountain Tire	330	1	330	330
White Coverall	1395	2	2790	
Batch Plant	1050	2	2100	
Environmental Office	140	1	140	
Dike Dewatering Shop	755	1	755	755
Incinerator	280	1	280	280
Talbon Shop	235	1	235	235
Blue Coverall	354	2	708	
Gate House	100	1	100	
Fuel Dispensing Station	165	1	165	
5.6ML Bulk Fuel Tank	955	2	1,910	955
Emulsion Plant	1,000	2	2,000	1,000
Airstrip	35,000			
Haul Roads (25 m x 14.5 km)	363,000			
Access Roads (10 m x 10 km)	100,000			
Portage/Goose Disturbed Area	406,000			
Vault Disturbed Area	65,000			

Building/Infrastructure	**Footprint[1] (m^2)**	**Stories (3 m height)**	**Total Demolition Area Scaled for Height (m^2)**	**Concrete Foundation Area (m^2)**
Baker Lake				
10 ML Bulk Fuel Tanks (6)	5,295	4	21,180	5,295
100,000 L Jet Fuel Tanks (20)	800	1	800	800
Baker Lake Disturbed Area	50,000			
AWPAR				
Road surface (8 m x 105 km)	840,000			

Notes: [1]Building footprints taken from "Portage_Goose_Vault_End2018_LOM2013_v4d-with LABEL.dwg" provided by AEM October 7, 2013

Reclaim Quarries:

- Quarry slopes set back to 1H:1V slope, assuming cut/fill with blasted rock from upper slope used to form lower slope.
- Quarry wall heights, lengths, and existing slopes taken from "AWPR.dwg" provided by AEM October 7, 2013. 14,319 m^3 of blasted rock required.

AWPAR Water Crossing Removal:

- Lump sum allowances of $10,000 per culvert removal and $25,000 per Rapid Span Bridge removal assumed.

3.1.5 Chemicals and Soil Management

Hazardous materials to be removed from site:

- Fuel dregs assumed to be 0.5% of bulk fuel storage capacity (338,000 L) and burned on site with waste oils.
- Quantity of Waste Oils/Oily Water (332,903 L) and Glycol (15,484 L) at closure estimated from HAZMAT seacans inventory, assuming 6 months of stockpiled Hazardous Materials inventory with 10 pallets per 20' sea can and 1000 L per pallet.
- Mill and Water Treatment reagents at closure assumed to be 5% of annual consumption and are summarized in Table 2.
- Assumed 10 pallets of assay lab and environmental reagents at closure.

Table 2: Mill and Water Treatment Reagent Consumption

Assuming 5% of annual consumption:	Annual usage (t)	5% assumed at closure (t)
Activated Carbon	140	7.00
Anti-Scalant	10	0.50
Borax	22	1.10
Silica	11	0.55
Calcium Oxide (Quicklime)	3150	157.50
Calcium Peroxide	1	0.05
Copper Sulphate	585	29.25
Flocculant	120	6.00
Hydrochloric acid	75	3.75
hydrofluoric acid[1]	1825 gallons	0.35
Hydrogen Peroxide	1	0.05
Lead acid batteries	24	1.20
nitric acid	18	0.90
Paints[1]	100 gallons	0.02
sodium cyanide	1540	77.00
sodium hydroxide	8	0.40
	Total	**286**

Notes: [1]Where annual usage is reported in gallons an assumed density of 1 kg/L was used.

Source: AEM 2012a

Contaminated Soils:

- An allowance of $7,500 and $50,000 has been provided for ESA Phase 1 and 2 investigations, respectively.
- A contingency of 1,500 m^3 of hydrocarbon contaminated soil requiring on-site remediation at closure has been provided for.

3.1.6 Water Management

Portage and Goose Pit Flooding:

- Total 36.44 Mm^3 water pumped to Portage and Goose Pit over nine years, as shown in Table 3.
- Remaining volume assumed to come from seepage, runoff and direct precipitation (at no additional cost).
- Two labourers working 12 hour days, 7 days per week, during active pumping period (4 months/year for 10 years), with associated accommodation costs.

- Annual pump servicing provided by two manufacturer consultants for 1 week site visit.
- Assumed pumping unit cost of \$0.02 / m^3.

Table 3: Annual Pumped Water Volumes to Portage and Goose Island Pits

Year	Annual Water Volume Pumped from Third Portage Lake[1] (m^3)	Annual Water Volume Pumped from Reclaim Pond[1] (m^3)
2015	450,000	-
2016	450,000	-
2017	4,970,000	-
2018	4,970,000	750,000
2019	4,970,000	-
2020	4,970,000	-
2021	4,970,000	-
2022	4,970,000	-
2023	4,970,000	-
9 years	**35,690,000**	**750,000**

Notes: [1]Annual Pumping rates from SNC (2013)

Vault Pit Flooding:

- 4.18 Mm^3 pumped to Vault Pit annually over 7 years (2018-2024), totaling 29 Mm^3 (SNC 2013).
- Labour and accommodation costs for Vault Pit flooding are included with the labour and maintenance described above in Portage and Goose Pit flooding.
- Assumed pumping unit cost of \$0.02/m^3.

Bay-Goose Dike Breach – 200 m long to Elev. 131.1 masl (3 m below water level at 134.1 masl):

- Thermal Cap excavation width ~70 m, crest at 134.1 masl (Golder 2013).
- Cut off and Dike Crest excavation width ~70 m, crest at 136 masl (Golder 2013).
- Assumed breach lined with waste rock from breach excavation.
- Breach Excavation = 200 m x 30 m x 1.9 m + 200 m x 70 m x 3 m = 53,400 m^3.

South Camp Dike Breach – 100 m long to Elev. 131.1 masl (3 m below water level at 134.1 masl):

- Access Road (upstream and downstream) excavation width ~35 m, crest at 136.6 masl (AEM 2012b).
- Dike Crest excavation width ~20 m, crest at 136.0 masl (AEM 2012b).
- Assumed breach lined with waste rock from breach excavation.
- Breach Excavation = 100 m x 35 m x 5.5 m + 100 m x 20 m x 4.9 m = 29,050 m^3.

Vault Dike Breach – 100 m long to Elev. 5136.5 m (3 m below water level at 5139.5 m):

- Dike Crest excavation width ~50 m, crest at 5142.5 m (AEM 2013c).
- Assumed breach lined with waste rock from breach excavation.
- Breach Excavation = 100 m x 50 m x 6 m = 30,000 m^3.

Temporary Water Treatment Plant:

- As the water quality of any residual water at closure is currently unknown, a contingency cost for installing, operating for 5 years, and dismantling a temporary water treatment plant has been provided for. Due to current uncertainties in closure water quality from Portage WRSF runoff and seepage water and/or runoff water collected within the TSF, a lump sum allowance has been provided based on precedent data.
- Installation assumes repurposing an existing structure. Piping, electrical, instrumentation and controls, and equipment installation costs have been estimated as a percentage of the total tanks and equipment cost.
- A lump sum allowance of $100,000 for reagents is provided.
- One full time skilled labourer, with additional annual maintenance site visits from a skilled contractor is assumed.
- Decommissioning provided for through an assumed scaled building area of 1000 m^2, with decontaminated equipment and building debris disposed of on site.
- Scarifying of the building footprint (0.1 ha) following demolition provided for.

3.1.7 Post Closure Monitoring and Maintenance

Water Quality Monitoring:

- Water Quality monitoring sample locations, frequency and laboratory testing parameters have been developed based on current water license and management plan requirements. Unit costs are based on grouped testing parameters (AEM 2009) as described in Table 4.
- Water quality sampling is assumed to be carried out by site caretakers, with outside laboratory testing and annual water quality reporting.

Table 4: Water Quality Laboratory Testing Cost by Group

Water Quality Test Parameters	Laboratory Testing Cost per Sample
Group 1 & 2	$150
Group 3	$125
Group 4	$275
Group 5	$150
Group 6 & 7	$225
Full Suite	$350
Sediment Quality	$300
Phytoplankton density and biomass	$100
Benthos abundance and richness	$200

Geotechnical Inspections:

- Geotechnical inspections assumed to be performed annually for the first 10 years of closure, and every other year following that. Inspections are assumed to be carried out by senior qualified consultant (at $200 per hour) for 56 billable hours (3 days on site plus 20 hours travel time) with a travel/accommodation and annual report allowance of $2,000 and $5,000 respectively.

Post Closure Site Maintenance:

- Two site caretakers provided for with bi-weekly overnight visits of two, twelve hour days, 5 months of the year, along with annual allowances for a site vehicle and equipment ($20,000) and site maintenance ($10,000).

3.2 Indirect Costs

In addition to the direct demolition/rehabilitation costs described in Section 3.1, the financial security cost estimate accounts for costs associated with mobilization and demobilization, project management, engineering and a contingency allowance.

During the active closure stage, mobilization costs have been accounted for by allowing for a seasonal work force of 100 people over three 5 month demolition/rehabilitation seasons, in addition to one barge trip into and out of Baker Lake. Longer term closure activities, such as active pit flooding and post closure monitoring and maintenance, have separate worker accommodation costs built into their estimates.

Project management and engineering fees have been assumed as 5% each of the direct closure costs.

Finally, due to the current level of engineering and uncertainties within the ultimate mine site and facility layout, a contingency of 15% of the direct closure costs has been provided for.

3.3 Summary of Closure Cost Estimate

A detailed breakdown of closure costs by mine component for the Meadowbank Gold Project is included in Appendix I2. The estimated closure costs have been divided between Land Liability and Water Liability costs following the breakdown of the previous cost estimate prepared by Brodie Consulting Ltd. in 2008 (Brodie 2008).

The updated closure and reclamation cost estimate for the Meadowbank Gold Project is $73,666,647. Of this, the direct costs for demolition and rehabilitation total $56,993,484. The remaining cost is comprised of mobilization and demobilization ($2,424,791), a 5% allowance for project management and 5% for engineering ($2,849,674, each) and a 15% contingency allowance on direct closure costs ($8,549,023).

3.4 Comparison with 2008 Estimate

Table 5 lists key differences between this cost estimate and the cost estimate prepared by Brodie Consulting Ltd. in 2008 (Brodie 2008).

The more recent version of the RECLAIM Excel template used to develop this updated cost estimate uses higher unit rates than the version used in 2008 by Brodie, to better match current demolition and rehabilitation costs. In general, the unit rates have been increased by approximately 10% of those reported in the Brodie cost estimate, resulting in an expected increase of 10% to the overall closure costs with no other factors considered.

Table 5: Summary of Estimated Closure Costs

Component Type	Differences	2014 Cost Estimate	Brodie 2008 Cost Estimate
Open Pit	- Current estimate places pit flooding and dyke breaches under water management (Brodie cost has been split into its direct open pit and water management components for comparison purposes) - Brodie uses low unit rate for dozing berm around exposed pit wall. Golder uses high unit rate due to low quantities.	$4,930	$2,441,495 ($2,081 Open Pit Closure + $2,439,414 Water Management)
Tailings Storage Facility	- Current TSF configuration significantly larger area than assumed by Brodie (1.86Mm^2 vs. 1.4Mm^2). - Brodie used undocumented unit rate of $3.67; Golder using standard bulk earthworks unit rate of $4.16.	$32,601,912	$20,573,794
Portage Waste Rock Storage Facility	- Current Portage WRSF surface area significantly larger than assumed by Brodie (630,140 vs. 349,062 m^2); however progressive cover placement mitigates difference.	$4,895,039	$4,174,265
Buildings and Infrastructure			
Meadowbank	- Current estimate accounts for breaking foundation slabs, as per closure plan; Brodie assumed 1m cover. - Additional buildings accounted for in current estimate.	$7,183,919	$6,057,562
Baker Lake	- Not included in Brodie estimate.	$1,526,529	N/A
AWPAR	- Not included in Brodie estimate.	$1,061,664	N/A
Chemicals and Soil Management	- Quantities based on current inventories and consumptions; Brodie had a minimal allowance for waste oils and “other chemicals”. - Current estimate assumes hydrocarbon contaminated soil remediated in on-site landfarm (low unit cost); Brodie assumed shipped off site (high unit cost).	$1,116,487	$538,754
Water Management	- Brodie water management costs grouped under Open Pit (Pit flooding and breaching dykes). - Water Treatment Contingency	$6,963,875	N/A

Component Type	Differences	2014 Cost Estimate	Brodie 2008 Cost Estimate
	not included in Brodie estimate. - Brodie assumed a lower cost for labour and accommodation to maintain pumping. - Current estimate uses updated pit flooding volumes from current water management plan (SNC, 2013). - Current estimate calculated smaller dike breach excavation volumes using as-built drawings.		
Post Closure Monitoring and Maintenance[1]	- Current estimate assumes monitoring schedule consistent with those laid out in management plans and licensing and as direct closure cost, calculated to net present value at commencement of closure using a discount rate of 5%; Brodie accounts for monitoring for only 8 years and as an indirect closure cost.	$1,639,130	$0
	SUBTOTAL	**$56,776,906**	**$33,785,869**
Mobilization/Demobilization	- Current estimate assumes accommodation for 100 people working over three 5 month demolition/rehabilitation seasons, roughly four times what was assumed in Brodie estimate.	$2,424,791	$802,207
Post Closure Monitoring and Maintenance[1]	- Current estimate assumes monitoring schedule consistent with those laid out in management plans and licensing and as direct closure cost, calculated to net present value at commencement of closure using a discount rate of 5%; Brodie accounts for monitoring for only 8 years and as an indirect closure cost.	$0	$840,000
PROJECT MANAGEMENT	5% - Same assumption	$2,849,674	$1,689,293
ENGINEERING	5% - Same assumption	$2,849,674	$1,689,293
CONTINGENCY	15% - Same assumption	$8,549,023	$5,067,880
GRAND TOTAL - CAPITAL COSTS		**$73,666,647**	**$43,874,543**

Notes: [1]Current estimate assumes post closure monitoring and maintenance to be a direct closure cost, allowing for contingency, project management, and engineering; Brodie assumes it to be an indirect cost.

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I2 Reclaim Model Spreadsheets

SUMMARY OF COSTS

CAPITAL COSTS

COMPONENT TYPE	COMPONENT NAME	TOTAL COST	LAND LIABILITY	WATER LIABILITY
OPEN PIT	Portage/Goose	$4,930	$4,930	$0
	Vault	$0	$0	$0
UNDERGROUND MINE	0	$0	$0	$0
TAILINGS	0	$32,601,912	$8,142,652	$24,459,260
ROCK PILE	Portage	$4,895,039	$0	$4,895,039
	Vault Area	$0	$0	$0
BUILDINGS AND EQUIPMENT	Meadowbank	$7,183,919	$7,024,639	$159,280
	Baker Lake	$1,526,529	$1,526,529	$0
	AWPAR	$1,061,664	$686,664	$375,000
CHEMICALS AND SOIL MANAGEMENT		$1,116,487	$66,504	$1,049,983
WATER MANAGEMENT		$6,963,875	$0	$6,963,875
POST-CLOSUREMONITORING AND MAINTENANCE		$1,639,130	$516,779	$1,122,351
	SUBTOTAL	**$56,993,484**	**$17,968,697**	**$39,024,788**
		PERCENTAGES	**32%**	**68%**
MOBILIZATION/DEMOBILIZATION		$2,424,791	764,479	1,660,312
PROJECT MANAGEMENT	5%	$2,849,674	$898,435	$1,951,239
Bonding	0%	$0	$0	$0
Taxes (GST on supplies) - est.	allowance	$0	$0	$0
Insurance	0%	$0	$0	$0
ENGINEERING	5%	$2,849,674	$898,435	$1,951,239
CONTINGENCY	15%	$8,549,023	$2,695,304	$5,853,718
Market Price Factor Adjustment	0%	$0	$0	$0
GRAND TOTAL - CAPITAL COSTS		**$73,666,647**	**$23,225,350**	**$50,441,297**

Open Pit Name: *Portage/Goose* **Pit # *1***

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
OBJECTIVE: CONTROL ACCESS								
Berm at crest and Rock barricade at ramp	m3	2250	DRH	2.19	$4,930	100%	$4,930	$0
Other			#N/A		$0		$0	$0
OTHER ITEMS								

	Cost	Pct	Land Total	Water Total
Subtotal	$4,930	100%	$4,930	$0

Open Pit Name: ***Vault*** **Pit #** ***2***

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
				Subtotal	$0	0%	$0	$0
						Pct Land	Total	Total Water

Tailings Impoundment Name: Pond # 1

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
OBJECTIVE: CONTROL ACCESS								
Other			#N/A	0	$0		$0	$0
OBJECTIVE: COVER TAILINGS - North Cell			#N/A					
NPAG UM waste rock cover (4 m thick)	m3	5,640,000	SB3L	4.16	$23,447,953	25%	$5,861,988	$17,585,964
OBJECTIVE: COVER TAILINGS - South Cell			#N/A					
NPAG UM waste rock cover (4 m thick)	m3	1,800,000	SB4L	5.06	$9,101,419	25%	$2,275,355	$6,826,064
OBJECTIVE: BREACH SADDLE DAM 3			#N/A					
Excavate Channel	m3	7000	SB2L	4.47	$31,304	0%	$0	$31,304
OBJECTIVE: REMOVE TAILINGS DISCHARGE								
Removing Piping	m	10000	PPLL	1.12	$11,236	25%	$2,809	$8,427
Dismantle Booster Pump	Allow	1	#N/A	10000.00	$10,000	25%	$2,500	$7,500
				Subtotal	$32,601,912	25%	$8,142,652	$24,459,260
						Pct Land	Total Land	Total Water

Rock Pile Name: *Portage* Rock Pile #: *1*

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
OBJECTIVE: STABILIZE SLOPES								
Other			#N/A	0	$0		$0	$0
OBJECTIVE: COVER DUMP			#N/A					
NPAG UM waste rock cover (4 m thick)	m3	1176417	SB3L	4.1574	$4,890,881	0%	$0	$4,890,881
Other			#N/A	0	$0		$0	$0
OBJECTIVE: COVER SUMPS			#N/A					
NPAG UM waste rock cover (4 m thick)	m3	1000	SB3L	4.1574	$4,157	0%	$0	$4,157
Other			#N/A	0	$0		$0	$0
SPECIALIZED ITEMS			#N/A					
install permanent instrumentation			#N/A	0	$0		$0	$0
install permanent instrumentation, drilling			#N/A		$0		$0	$0
other			#N/A	0	$0		$0	$0
Subtotal					$4,895,039	0%	$0	$4,895,039
						% Land	Total Land	Total Water

Rock Pile Name: *Vault Area* Rock Pile #: *2*

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
OBJECTIVE: STABILIZE SLOPES								
Other			#N/A	0	$0		$0	$0
OBJECTIVE: COVER DUMP			#N/A					
NPAG UM waste rock cover (4 m thick)	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
OBJECTIVE: COVER SUMPS			#N/A					
NPAG UM waste rock cover (0.5 m thick	m3		#N/A	0	$0		$0	$0
Other			#N/A	0	$0		$0	$0
SPECIALIZED ITEMS			#N/A					
install permanent instrumentation			#N/A	0	$0		$0	$0
install permanent instrumentation, drilling			#N/A		$0		$0	$0
other			#N/A	0	$0		$0	$0
				Subtotal	$0		$0	$0
						% Land	Total Land	Total Water

Building / Equip Name: *Meadowbank* **Bldg / Equip #: *1***

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
OBJECTIVE: DISPOSE MOBILE EQUIPMENT								
Decontaminate and dispose on site	manhours	988	LAB-USL	60.00	$59,280	0%	$0	$59,280
OBJECTIVE: REMOVE BUILDINGS - **ALL BUILDING AREAS SCALED TO ACCOUNT FOR HEIGHT**								
Mill Complex:								
Mill	m2	37800	BRS1H	59.33	$2,242,590	100%	$2,242,590	$0
Leech Tanks	m2	12500	BRS1H	59.33	$741,597	100%	$741,597	$0
Primary and Secondary Crusher	m2	740	BRS1H	59.33	$43,903	100%	$43,903	$0
Pebble Crusher	m2	650	BRS1H	59.33	$38,563	100%	$38,563	$0
Conveyors	m2	1950	BRS1H	59.33	$115,689	100%	$115,689	$0
Assay Lab	m2	440	BRS1L	39.55	$17,403	100%	$17,403	$0
Accomodation Complex (Inc. Nova Camp)	m2	17005	BRS1L	39.55	$672,579	100%	$672,579	$0
Services Building	m2	13080	BRS1L	39.55	$517,338	100%	$517,338	$0
Site Services Building	m2	500	BRS1L	39.55	$19,776	100%	$19,776	$0
Dome Warehouse	m2	2854	BRS1L	39.55	$112,881	100%	$112,881	$0
Ore Dome	m2	21000	BRS1L	39.55	$830,589	100%	$830,589	$0
Power Plant	m2	7455	BRS1H	59.33	$442,289	100%	$442,289	$0
Cat Warehouse	m2	2690	BRS1L	39.55	$106,394	100%	$106,394	$0
Toromont Facilities	m2	925	BRS1L	39.55	$36,585	100%	$36,585	$0
Fountain Tire	m2	330	BRS1L	39.55	$13,052	100%	$13,052	$0
White Coverall	m2	2790	BRS1L	39.55	$110,350	100%	$110,350	$0
Batch Plant	m2	2100	BRS1L	39.55	$83,059	100%	$83,059	$0
Environmental Office	m2	140	BRS1L	39.55	$5,537	100%	$5,537	$0
Dike Dewatering Shop	m2	755	BRS1L	39.55	$29,862	100%	$29,862	$0
Incinerator	m2	280	BRS1L	39.55	$11,075	100%	$11,075	$0
Talbon Shop	m2	235	BRS1L	39.55	$9,295	100%	$9,295	$0
Blue Coverall	m2	710	BRS1L	39.55	$28,082	100%	$28,082	$0
Gate House	m2	100	BRS1L	39.55	$3,955	100%	$3,955	$0
Fuel Dispensing Station	m2	165	BRS1H	59.33	$9,789	100%	$9,789	$0
Emulsion Plant	m2	2000	BRS1H	59.33	$118,656	100%	$118,656	$0
Bulk Fuel Tank	m2	1910	BRS1H	59.33	$113,316	100%	$113,316	$0
OBJECTIVE: Break Basement Slabs								
Puncture Concrete Foundations	m2	25211	BRCS	6.61	$166,635	100%	$166,635	$0
OBJECTIVE: RECLAIM ROADS, LAYDOWN AREA & AIRSTRIP								
Remove culverts/Install Water Breaks	allow	1	#N/A	100000	$100,000	0%	$0	$100,000
Scarify airstriip	ha	3.5	SCFYL	3960.8	$13,863	100%	$13,863	$0
Scarify access roads (~10 m x 10 km)	ha	10	SCFYL	3960.8	$39,608	100%	$39,608	$0
Scarify haul roads (~25 m x 14.5 km)	ha	36.3	SCFYL	3960.8	$143,777	100%	$143,777	$0
Scarify Portage/Mill Disturbed Area	ha	40.6	SCFYL	3960.8	$160,809	100%	$160,809	$0
Scarify Vault Disturbed Area	ha	6.5	SCFYL	3960.8	$25,745	100%	$25,745	$0
SPECIALIZED ITEMS								
Dispose of misc. debris and laydown area refuse	m3		#N/A	0	$0		$0	$0
				Subtotal	$7,183,919	98%	$7,024,639	$159,280
						Pct Land	Total Land	Total Water

Building / Equip Name: *Baker Lake* **Bldg / Equip #: *2***

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
OBJECTIVE: DISPOSE MOBILE EQUIPMENT								
Decontaminate and ship off-site	each		#N/A	0	$0		$0	$0
OBJECTIVE: REMOVE BUILDINGS - **ALL BUILDING AREAS SCALED TO ACCOUNT FOR HEIGHT**								
10,000,000L Diesel Fuel Tanks	m2	21180	BRS1H	59.33	$1,256,562	100%	$1,256,562	$0
100,000L Jet Fuel Tanks	m2	800	BRS1L	39.55	$31,641	100%	$31,641	$0
OBJECTIVE: Break Basement Slabs								
Puncture Concrete Foundations	m2	6095	BRCS	6.61	$40,286	100%	$40,286	$0
OBJECTIVE: RECLAIM ROADS								
scarify laydown areas	ha	50	SCFYL	3960.8	$198,040	100%	$198,040	$0
				Subtotal	$1,526,529	100%	$1,526,529	$0
						Pct Land	Total Land	Total Water

Building / Equip Name: *AWPAR* **Bldg / Equip #: *3***

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
OBJECTIVE: RECLAIM QUARRIES								
Drill and Blast slopes to 1:1	m3	14319	DBH	24.7199	$353,956	100%	$353,956	$0
OBJECTIVE: RECLAIM ROADS								
Remove culverts	each	15	#N/A	10000	$150,000	0%	$0	$150,000
Remove bridges	each	9	#N/A	25000	$225,000	0%	$0	$225,000
Scarify and install water breaks	ha	84	SCFYL	3960.8	$332,707	100%	$332,707	$0
				Subtotal	$1,061,664	65%	$686,664	$375,000
						Pct Land	Total Land	Total Water

1 Chemicals and Soil Contamination:

Note: The procedures, equipment and packaging for clean up and removal of chemicals or contaminated soils are highly dependent on the nature of the chemicals and their existing state of containment. Government guidelines should be consulted on an individual chemical basis. Any estimate made here should be considered very rough unless specific evaluations have been conducted.

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ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
HAZARDOUS MATERIALS TO BE REMOVED FROM SITE								
Fuel - Type 1, eg fuel dregs (1% storage)	litre	338000	OBL	0.39	$132,926	0%	$0	$132,926
Mill & Water Treatment Reagents	kg	285614	PCRH	2.30	$657,897	0%	$0	$657,897
Waste oils	litre	325161	OBL	0.39	$127,877	0%	$0	$127,877
Waste Oils/Oily Water	litre	7742	OBL	0.39	$3,045	0%	$0	$3,045
Glycol	kg	15484	PCRH	2.30	$35,666	0%	$0	$35,666
Assay & environmental lab reagents	pallet	10	LCRH	2606.8	$26,068	0%	$0	$26,068
CONTAMINATED SOILS								
ESA Phase 1 Investigation	each	1	#N/A	7500	$7,500	50%	$3,750	$3,750
ESA Phase 2 Investigation	each	1	#N/A	50000	$50,000	50%	$25,000	$25,000
CONTAMINATED SOIL REMEDIATION								
Excavate, load, haul to landfarm	m3	1500	SC4I	7.08	$10,618	50%	$5,309	$5,309
. Remediate on-site in landfarm	m3	1500	CSRL	43.26	$64,890	50%	$32,445	$32,445
. OTHER								
.			#N/A	0	$0		$0	$0
Subtotal					$1,116,487	6%	$66,504	$1,049,983
						Pct Land	Total Land	Total Water

1 Water Management :

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	OBJECTIVE: Flood Pits								
	Repurpose/Install dewatering pumps and piping for pit flooding	Allow	1	#N/A	100000	$100,000	0%	$0	$100,000
	Operate/Maintain Pumps								
	Pumped pit flooding water (Third portage Lake and Reclaim Pond)	m3	36440000	#N/A	0.02	$728,800	0%	$0	$728,800
	Pumped pit flooding water (Wally Lake)	m3	29260000	#N/A	0.02	$585,200	0%	$0	$585,200
	Maintain pumps (2 skilled labourer x 12hr days, 4months/yr, 10yrs)	manhours	29280	LAB-SL	65.00	$1,903,200	0%	$0	$1,903,200
	Annual Pump Servicing (2 x Manufacturer Consultant x 7days/year)	manhours	1680	LAB-SS	120.00	$201,600	0%	$0	$201,600
	Pump Servicing Travel Allowance (Round Trip Flight/person)	visits	20	#N/A	2500.00	$50,000	0%	$0	$50,000
	Camp Accomodations	months	84.59	ACCML	1483.19	$125,464	0%	$0	$125,464
	Other			#N/A	0	$0		$0	$0
B	OBJECTIVE: Breach Dykes								
	Breach Bay-Goose Dike	m3	53400	SB2L	4.47	$238,808	0%	$0	$238,808
	Breach South Camp Dike	m3	29050	SB2L	4.47	$129,913	0%	$0	$129,913
	Breach Vault Dike	m3	30000	SB2L	4.47	$134,162	0%	$0	$134,162
C	OBJECTIVE: Install Temporary Water Treatment Plant (If Necessary)								
	Storage, Prep and Reactor Tanks/Silos	Allow	1		450000	$450,000	0%	$0	$450,000
	Mech. Equip. (Metering Pumps and Air)	Allow	1		200000	$200,000	0%	$0	$200,000
	Piping	%	30		195000	$195,000	0%	$0	$195,000
	Electrical	%	15		97500	$97,500	0%	$0	$97,500
	Instrumentation and Controls	%	15		97500	$97,500	0%	$0	$97,500
	Equipment Installation Costs	%	35		227500	$227,500	0%	$0	$227,500
D	OBJECTIVE: Operate Temporary Water Treatment Plant (for 5 years, if Necessary)								
	Annual Reagent Allowance	years	5	#N/A	100000	$500,000	0%	$0	$500,000
	Pump Water	m3	1100000	#N/A	0.02	$22,000	0%	$0	$22,000
	Skilled Labourer (1 skilled labourers X 12hr/day, 6 Months/year)	manhours	10980	LAB-SL	65.00	$713,700	0%	$0	$713,700
	Annual Treatment Plant Servicing (2 Consultants x 7days/year)	manhours	840	LAB-SS	120.00	$100,800	0%	$0	$100,800
	Treatment Plant Servicing Travel Allowance (Round Trip Flight/persor	visits	10	#N/A	2500.00	$25,000	0%	$0	$25,000
	Camp Accomodations	months	62.30	ACCML	1483.19	$92,396	0%	$0	$92,396
E	OBJECTIVE: Decommision Temporary Water Treatment Plant (if Necessary)								
	Decontaminate and dispose equipment on site	manhours	50	LAB-USL	60.00	$3,000	0%	$0	$3,000
	Camp Accomodations	months	1.50	ACCML	1483.19	$2,225	0%	$0	$2,225
	Demolish Structure	m2	1000	BRS1L	39.55	$39,552	0%	$0	$39,552
	Scarify Footprint	ha	0.1	SCFYH	5561.98	$556	0%	$0	$556
					Subtotal	$6,963,875	0%	$0	$6,963,875
							Pct Land	Total Land	Total Water

1 **Mobilization:**

	ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A	MOBILIZE HEAVY EQUIPMENT								
	Equipment to regional centre								
.	Barge to/from Baker Lake	each	2	#N/A	100000	$200,000	32%	$63,055	$136,945
C	MOBILIZE AND HOUSE WORKERS								
.		manmths	1500	accml	1483.19	$2,224,791	32%	$701,424	$1,523,367
					Subtotal	$2,424,791	32%	$764,479	$1,660,312
							Pct Land	Total Land	Total Water

Post-Closure Monitoring & Maintenance:

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
A OBJECTIVE: MONITORING AND INSPECTIONS								
Water Quality Monitoring								
Baker Lake - Group 6 & 7	each	3	#N/A	$225	$675	32%	$213	$462
AWPAR - Group 1	each	1.6	#N/A	$150	$240	32%	$76	$164
Dikes - Seeps - Goup 1	each	48	#N/A	$150	$7,200	32%	$2,270	$4,930
Pits/Pit Lakes - Portage and Goose - Groups 3	each	2	#N/A	$125	$250	32%	$79	$171
Pits/Pit Lakes - Vault - Groups 3 & 4	each	6	#N/A	$275	$1,650	32%	$520	$1,130
Pits/Pit Lakes - Groundwater - Group 3	each	3	#N/A	$125	$375	32%	$118	$257
WRF Portage - Group 3 & total metals	each	1	#N/A	$275	$275	32%	$87	$188
WRF Vault- Group 3 & total metals	each	12	#N/A	$275	$3,300	32%	$1,040	$2,260
WRF Vault and Portage seeps - Group 1	each	24	#N/A	$15	$360	32%	$113	$247
TSF - Runoff - Group 3 & total metals & cyanide	each	0.5	#N/A	$275	$138	32%	$43	$94
TSF - Groundwater - Group 3	each	2	#N/A	$125	$250	32%	$79	$171
Water Diversion Ditches - Group 5	each	24	#N/A	$150	$3,600	32%	$1,135	$2,465
Receiving Lakes - Approx group 4	each	124	#N/A	$275	$34,100	32%	$10,751	$23,349
Receiving Lakes - Phytoplankton	each	24	#N/A	$100	$2,400	32%	$757	$1,643
Receiving Lakes - Sediment Quality	each	21.666667	#N/A	$300	$6,500	32%	$2,049	$4,451
Receiving Lakes - Benthic Community	each	21.666667	#N/A	$200	$4,333	32%	$1,366	$2,967
Landfarm - BTEX, Pb, oil & grease)	each	1	#N/A	$75	$75	32%	$24	$51
Annual Water QualityReporting	each	1	RPTS	10000.00	$10,000	32%	$3,153	$6,847
Geotechnical Stability Monitoring								
Annual Geotechnical Inspections	each	1	#N/A	$13,200	$13,200	32%	$4,162	$9,038
Annual Geotechnical Reporting	each	1	RPTL	5000.00	$5,000	32%	$1,576	$3,424
.								
Subtotal, Annual Baker Lake Facilities costs					$93,921		$29,611	$64,310
Discount rate for calculation of net present value of post-closure cost, '			5.00%					
Start Year / End Year		2018	2020					
Number of years of post-closure activity			2	years				
Present Value of payment stream (at year 2018)					$174,637	32%	$55,059	$119,578
B OBJECTIVE: MONITORING AND INSPECTIONS								
Water Quality Monitoring								
AWPAR - Group 1	each	1.6	#N/A	$150	$240	32%	$76	$164
Dikes - Seeps - Goup 1	each	48	#N/A	$150	$7,200	32%	$2,270	$4,930
Pits/Pit Lakes - Portage and Goos - Groups 3	each	1	#N/A	$125	$125	32%	$39	$86
Pits/Pit Lakes - Vault - Groups 3 & 4	each	6	#N/A	$275	$1,650	32%	$520	$1,130
Pits/Pit Lakes - Groundwater - Group 3	each	3	#N/A	$125	$375	32%	$118	$257
WRF Portage - Group 3 & total metals	each	1	#N/A	$275	$275	32%	$87	$188
WRF Vault- Group 3 & total metals	each	2	#N/A	$275	$550	32%	$173	$377
WRF Vault and Portage seeps - Group 1	each	2	#N/A	$15	$30	32%	$9	$21
TSF - Runoff - MMER & Nitrogen	each	1	#N/A	$150	$150	32%	$47	$103
TSF - Groundwater - Group 3	each	2	#N/A	$125	$250	32%	$79	$171
Receiving Lakes - Approx group 4	each	124	#N/A	$275	$34,100	32%	$10,751	$23,349
Receiving Lakes - Phytoplankton	each	24	#N/A	$100	$2,400	32%	$757	$1,643
Receiving Lakes - Sediment Quality	each	21.666667	#N/A	$300	$6,500	32%	$2,049	$4,451
Receiving Lakes - Benthic Community	each	21.666667	#N/A	$200	$4,333	32%	$1,366	$2,967
Annual Water QualityReporting	each	1	RPTS	10000.00	$10,000	32%	$3,153	$6,847
Geotechnical Stability Monitoring								
Annual Geotechnical Inspections	each	1	#N/A	$13,200	$13,200	32%	$4,162	$9,038
Annual Geotechnical Reporting	each	1	RPTL	5000.00	$5,000	32%	$1,576	$3,424
.								
Subtotal, Annual Baker Lake Facilities costs					$86,378		$27,233	$59,145
Discount rate for calculation of net present value of post-closure cost, '			5.00%					
Start Year / End Year		2020	2028					
Number of years of post-closure activity			8	years				
Present Value of payment stream (at year 2018)					$506,378	32%	$159,649	$346,729

Post-Closure Monitoring & Maintenance:

ACTIVITY/MATERIAL	Units	Quantity	Cost Code	Unit Cost	Cost	% Land	Land Cost	Water Cost
C OBJECTIVE: MONITORING AND INSPECTIONS								
Water Quality Monitoring								
AWPAR - Group 1	each	1.6	#N/A	$150	$240	32%	$76	$164
Pits/Pit Lakes - Vault - Groups 3 & 4	each	4	#N/A	$275	$1,100	32%	$347	$753
Pits/Pit Lakes - Portage, Vault - Full suite	each	2	#N/A	$350	$700	32%	$221	$479
Receiving Lakes - Approx group 4	each	124	#N/A	$275	$34,100	32%	$10,751	$23,349
Receiving Lakes - Phytoplankton	each	24	#N/A	$100	$2,400	32%	$757	$1,643
Receiving Lakes - Sediment Quality	each	21.666667	#N/A	$300	$6,500	32%	$2,049	$4,451
Receiving Lakes - Benthic Community	each	21.666667	#N/A	$200	$4,333	32%	$1,366	$2,967
Annual Water QualityReporting	each	1	RPTS	10000.00	$10,000	32%	$3,153	$6,847
Geotechnical Stability Monitoring								
Annual Geotechnical Inspections	each	0.5	#N/A	$13,200	$6,600	32%	$2,081	$4,519
Annual Geotechnical Reporting	each	0.5	RPTL	5000.00	$2,500	32%	$788	$1,712
.								
Subtotal, Annual Baker Lake Facilities costs					$68,473		$21,588	$46,885
Discount rate for calculation of net present value of post-closure cost, '			5.00%					
Start Year / End Year		2028	2030					
Number of years of post-closure activity			2	years				
Present Value of payment stream (at year 2018)					$78,163	32%	$24,643	$53,520
D OBJECTIVE: MONITORING AND INSPECTIONS								
Water Quality Monitoring								
AWPAR - Group 1	each	1.6	#N/A	$150	$240	32%	$76	$164
Pits/Pit Lakes - Vault - Groups 3 & 4	each	4	#N/A	$275	$1,100	32%	$347	$753
Pits/Pit Lakes - Portage, Vault - Full suite	each	2	#N/A	$350	$700	32%	$221	$479
Annual Water QualityReporting	each	1	RPTS	10000.00	$10,000	32%	$3,153	$6,847
Geotechnical Stability Monitoring								
Annual Geotechnical Inspections	each	0.5	#N/A	$13,200	$6,600	32%	$2,081	$4,519
Annual Geotechnical Reporting	each	0.5	RPTL	5000.00	$2,500	32%	$788	$1,712
.								
Subtotal, Annual Baker Lake Facilities costs					$21,140		$6,665	$14,475
Discount rate for calculation of net present value of post-closure cost, '			5.00%					
Start Year / End Year		2030	2034					
Number of years of post-closure activity			4	years				
Present Value of payment stream (at year 2018)					$41,741	32%	$13,160	$28,581
E OBJECTIVE: MONITORING AND INSPECTIONS								
Water Quality Monitoring								
AWPAR - Group 1	each	1.6	#N/A	$150	$240	32%	$76	$164
Annual Water QualityReporting	each	1	RPTS	10000.00	$10,000	32%	$3,153	$6,847
Geotechnical Stability Monitoring								
Annual Geotechnical Inspections	each	0.5	#N/A	$13,200	$6,600	32%	$2,081	$4,519
Annual Geotechnical Reporting	each	0.5	RPTL	5000.00	$2,500	32%	$788	$1,712
.								
Subtotal, Annual Baker Lake Facilities costs					$19,340		$6,097	$13,243
Discount rate for calculation of net present value of post-closure cost, '			5.00%					
Start Year / End Year		2034	2040					
Number of years of post-closure activity			6	years				
Present Value of payment stream (at year 2018)					$44,970	32%	$14,178	$30,792
E OBJECTIVE: POST CLOSURE MAINTENANCE AND SURVEILLANCE								
Site care-taker	manhou	480	LAB-USL	60.00	$28,800	32%	$9,080	$19,720
Site Vehicle and equipment	allow	1	#N/A	20000.00	$20,000	32%	$6,306	$13,694
Accommodations	manmo	0.658	ACCMH	2224.79	$1,463	32%	$461	$1,002
Site Maintenance	allow	1	#N/A	10000.00	$10,000	32%	$3,153	$6,847
.								
Subtotal, Annual Baker Lake Facilities costs					$60,263		$18,999	$41,263
Discount rate for calculation of net present value of post-closure cost, '			5.00%					
Start Year / End Year		2018	2040					
Number of years of post-closure activity			22	years				
Present Value of payment stream (at year 2018)					$793,240	32%	$250,090	$543,150
Subtotal					$1,639,130	32%	$516,779	$1,122,351
						Pct Land	Total Land	Total Water

Unit Cost Table this version updated 5/1/2011 - 2% added to all costs for inflation

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Alberta Road Builders & Heavy Construction Association
BC Road Builders Blue Book at : www.roadbuilders.bc.ca

ITEM	Detail	COST CODE	UNITS	LOW $	HIGH $	SPECIFIED $	COMMENTS
excavate Rock, Bulk							COMMENTS
	drill, blast, load short haul (<500m) Dump	RB1	m3	10.51	15.73	#N/A	quarry operations for bulk fill
	RB1 + long haul, up to 1500 m	RB2	m3	11.12	16.41	#N/A	
	RB1 + spread and compact	RB3	m3	11.12	16.41	#N/A	
	RB1 + long haul + spread and compact	RB4	m3	11.74	28.37	#N/A	
	RB1 + Specified activity	RBS	m3	12.0865	#N/A	#N/A	use low and add 15% premium for work done in winter
excavate Rock, Controlled							
	drill, blast, load short haul (<500m) Dump	RC1	m3	26.01	37.08	#N/A	low - foundation excavation, high - spillway excavation
	RC1 + long haul, up to 1500 m	RC2	m3	11.74	16.97	#N/A	
	RC1 + spread and compact	RC3	m3	11.12	16.41	#N/A	
	RC1 + long haul + spread and compact	RC4	m3	12.47	17.67	#N/A	
	RC1 + Specified activity	RCS	m3	#N/A	#N/A	159.73	$145/M3-drift excavation
excavate Soil, Bulk							
	clear & grub	SBC	m2	3.12	0.00	0.00	
	excavate, load short haul (<500m) dump	SB1	m3	3.96	5.45	#N/A	LOW cost: excavation of loose soil, high volume
	SB1 + long haul, up to 1500 m	SB2	m3	4.47	6.71	#N/A	LOW cost: excavation of loose soil, 1.5 km haul, high volume
	SB1 + spread and compact	SB3	m3	4.16	5.97	#N/A	
	SB1 + long haul + spread and compact	SB4	m3	5.06	10.06	#N/A	LOW cost: excavation of loose soil, 1.5 km haul, high volume, const. of simple soil cover
				0.00	0.00	0.00	
	SB1 + Specified activity	SBS	m3	2.60	7.17	12.06	LOW cost: rehandle waste rock dump into pit, >500,000 m3, 2 km haul
	other			0.00	0.00	0.00	SPECIFIED cost: rehandle waste rock, haul 3 km, place & compact on dam
	Soil, tailings	SBT	m3	1.25	3.40	14.28	LOW cost: doze frost heaves HIGH cost: contour - wet or frozen, Specialized - haul/place wet infill
excavate Soil, Controlled							
	excavate, load short haul (<500 m), dump	SC1	m3	6.30	8.60	#N/A	
	SC1 + long haul, up to 1500 m	SC2	m3	7.81	10.83	#N/A	
	SC1 + spread and compact	SC3	m3	6.30	13.10	#N/A	HIGH cost: for simple soil covers
	SC1 + long haul + spread and compact	SC4	m3	7.08	21.41	#N/A	HIGH cost: for complex covers & dam construction, spillway repair, LOW volume
	SC1 + Specified activity	SCS	m3	#N/A	22.89	17.35	SPECIFIED cost: backfill adit with waste rock, High - sand bedding layer for liners
Geo-synthetics							
	geotextile, filter cloth	GST	M2	1.11	3.44	#N/A	high - Faro
	geogrid	GSG	M2	5.31	0.00	#N/A	
	liner, HDPE	GSHDPE	M2	6.62	0.00	#N/A	faro 3.44 supply and 3.16 place
	liner, ES3	GSES3	m2	18.62	0.00	0.00	low, FOB Yellowknife
	liner, PVC	GSPVC	M2	0.00	0.00	#N/A	
	geosynthetic installation	GSI	m2	0.93	13.01	#N/A	low, geotextile, high - ES3 or HDPE
	bentonite soil ammendment	GSBA	tonne	284.28	321.36	#N/A	FOB Edmonton, add shipping & mixing
Shaft, Raise & Portal Closures							
	Shaft & Raises	SR	m2	595.52	1966.36	#N/A	LOW cost: pre-cast concrete slabs, little site prep. HIGH cost: for hand construction, remote site
	Portals	POR	m3	0.00	230.34	1101.60	HIGH cost: for excavate & backfill collapsed portal SPECIFIED cost: installed pressure plug
Concrete work							
	Small pour, no forms	CS	m3	333.72	668.56	#N/A	
	Large pour, no forms	CL	m3	264.05	393.27	#N/A	
	Small pour, Formed	CSF	m3	393.27	1966.36	#N/A	
	Large pour, Formed	CLF	m3	325.85	460.69	#N/A	
Vegetation							
	Hydroseed, Flat	VHF	ha	1792.19	5561.98	#N/A	
	Hydroseed, Sloped	VHS	ha	2076.47	6241.78	#N/A	faro 4000/ha
	veg. Blanket/erosion mat	VB	ha	12359.95	14831.94	#N/A	
	Tree planting	VT	ha	12359.95	14831.94	#N/A	
	Wetland species	VW	ha	61799.76	92699.64	#N/A	
Pumps							
	Small, <	PS	each	3370.90	6741.79	#N/A	
	Large, >	PL	each	5618.16	112363.20	#N/A	large - 250 hp Gould w/diesel motor
PiPes							

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Small, < 6 inch diameter	PPS	m	0.56	5.62	#N/A	LOW cost: pipe removal, HIGH cost: supply new pipe
Large, > 6 inch diameter	PPL	m	1.12	202.25	#N/A	LOW cost: pipe removal, HIGH cost: supply 24" 100 psi HDPE pipe, FOB Edm.
			0.00	0.00	0.00	add shipping & installation
pump sand BackFill	BF	m3	6.18	18.54	#N/A	
Fence	F	m	12.48	187.27	#N/A	
Signs	S	each	12.36	37.08	#N/A	
rock, Drill and Blast only	DB	m3	12.36	24.72	#N/A	
excavate Rip Rap						
drill, blast, load short haul (<500 m) dump and spread	RR1	m3	12.30	18.37	#N/A	
RR1 + long haul	RR2	m3	12.47	19.05	#N/A	HIGH cost: quarry & place rip rap in channel
excavate rock from waste dump, short haul, spread	RR3	m3	4.72	6.49	#N/A	LOW cost: removal of 18 in minus from dump, long haul and spread
RR3 + long haul	RR4	m3	5.26	7.02	#N/A	
specified rip rap source	RR5	m3	#N/A	#N/A	#N/A	
Import LimeStone	ILS	tonne	9.89	14.83	#N/A	
Import LiMe	ILM	tonne	187.27	556.61	#N/A	LOW cost: bulk shipping, high volume, FOB Vancouver/Edmonton
			0.00	0.00	0.00	HIGH cost: bags delivered to central Yukon, small volume
Grouting	G	m3	218.12	264.38	#N/A	HIGH cost: cement, FOB Yellowknife
Dozing						
doze Rock piles	DR	m3	0.96	2.19	#N/A	LOW cost: doze crest off dump
doze overburden/Soil piles	DS	m3	0.88	3.49	#N/A	HIGH cost: push up to 300 m
		each	0	0	#N/A	
		each	0	0	#N/A	
Buildings - Decontaminate						
Chemicals	BDC	m3	#N/A	#N/A	#N/A	
Asbestos	BDA	m2	23.60	47.19	#N/A	LOW cost: removal of asbestos siding & flooring HIGH cost: removal of insulated pipes, friable
			0.00	0.00	0.00	
Buildings - Remove						
areas are per floor on 3 m average height			0.00	0.00	0.00	LOW cost: removal and on-site disposal - small wooden structures
Wood - teardown	BRW1	m2	24.16	37.08	#N/A	
Wood - burn	BRW2	m2	6.18	11.24	#N/A	**high cost: wooden tent structures**
Masonry	BRM	m2	26.57	37.08	#N/A	
Concrete	BRC	m2	37.08	55.62	6.61	SPECIFIED: break basement slabs
Steel - teardown	BRS1	m2	39.55	59.33	264.38	
Steel - salvage	BRS2	m2	61.80	92.70	#N/A	
Power & Pipe Lines						
Power lines, remove	POWR	each	23.48	5191.18	#N/A	
		kg	0.00	1.77	#N/A	
Laboratory Chemicals						
Remove from site	LCR	pallet	1966.36	2606.83	#N/A	
Dispose on site	LCD	each	#N/A	#N/A	#N/A	
PCB - Remove from site	PCBR	litre	37.08	43.26	#N/A	LOW cost: shipping, handling & disposal from Yellowknife
Fuel						
Remove from site	FR	kg	1.23	1.77	#N/A	
Burn on site	FB	kg	#N/A	#N/A	#N/A	
Oil						
Remove from site	OR	litre	0.39	1.15	#N/A	
Burn on site	OB	litre	0.39	0.62	#N/A	
Process Chemicals			0.00	0.00	0.00	
Remove from site	PCR	kg	0.39	2.30	#N/A	
Dispose on site	PCD	kg	#N/A	#N/A	#N/A	
Explosives						
Remove from site	ER	kg	0	2.47	#N/A	
Dispose on site	ED	kg	#N/A	#N/A	#N/A	

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Contaminated Soils						
Remediate on site	CSR	m3	43.26	134.84	#N/A	LOW cost: bio-remediate on-site. HIGH cost: ship off-site to landfil as haz. waste
environmental investigation	CSEI	each	2080.80	0.00	0.00	
consolidate & cover	Use cost code items 1 - 4					
cover in place	Use cost code items 1 - 4					
Mobilize Heavy Equipment						
Road access	MHER	$/km	3.16	9.46	363.10	SPECIFIED cost: Mob/Demob from/to baker lake (115km)
Air access	MHEA	each	#N/A	#N/A	1514.7	SPECIFIED cost: helicopter cost, $/hr of operation
Mobilize Camp						
<20 persons Road access	MC<R	each	#N/A	#N/A	#N/A	
<20 persons Air access	MC<A	each	1530	#N/A	#N/A	**cost of tents and equipment**
Mobilize Workers						
mobilize	MM<	person	3121.20	6138.36	0.00	**crew flight from yellowknife low:turbo beaver, high helicopter/twin otter**
>20 persons	MM>	person	3121.20	6138.36	#N/A	
crew travel time	MTT	hr	39.33	42.66	0.00	
ACCoModation	ACCM	month	1483.19	2224.79	#N/A	LOW cost, accom in existing camp, per man, HIGH cost: - supply new camp
Mobilize Misc. Supplies	MMS	each	#N/A	#N/A	1473.90	**removal of 20 kw generator 404 kg; 10 100lb propane**
Winter Road	WR	km	1483.19	2943.92	1890.06	Speicalized winter road to 40,000 kg capactiy
Visual site Inspection	VI	each	3955.18	7977.79	11016.00	
Survey site Inspection	SI	each	#N/A	#N/A	#N/A	
Water Sampling	WS	each	6179.98	10112.69	#N/A	
site inspection RePorT	RPT	each	5000.00	12359.95	10000.00	LOW:annual monitoring report SPECIFIED: annual water quality report
Security Guard	SG	pers/mon	6179.98	8651.97	#N/A	
Maintain Pumping	MP	month	3707.99	#N/A	#N/A	
Clear SpillWay	CSW	each	2101.19	5932.78	#N/A	
Build Treatment Plant			0	0	0.00	
Small (< 1000 m3/d)	BTPS	lump sum	1123632	2247264	#N/A	
Large (> 1000 m3/d)	BTPL	lump sum	2247264	3932712	#N/A	
Operate Treatment Plant	OTP	m3	0.32585	1.853993	#N/A	
SCariFY road and install water breaks	SCFY	ha	3960.8	5561.978	1982.88	
Water Treatment Chemicals						
ferric sulphate	ferric	kg	0.75	0.00	0.00	
ferrous sulphate	ferrous	kg	0.49	0.00	0.00	
lime	lime	kg	0.34	0.00	0.00	
hydrogen peroxide, 50%	hperox	kg	1.61	0.00	0.00	
Sodium Metabisulfate	Nametab	kg	1.11	0.00	0.00	
Caustic soda, 50%	caustic	kg	0.70	0.00	0.00	
Sulfuric acid, 93%	sulfuric	kg	0.29	0.00	0.00	
flocculant	flocc	kg	6.06	0.00	0.00	
copper sulphate	copper	kg	0.00	0.00	0.00	
typical shipping, to Whitehorse or Yellowknife		kg	0.08	0.00	0.00	
			0.00	0.00	0.00	
Typical Labour & Equipment Rates						updated may 2011
Site manager	Sman	$/hr	77.11	88.13	0.00	
Mine superintendent	super	$/hr	57.12	66.10	0.00	
Environmental coordinator	env-co	$/hr	57.12	66.10	0.00	
Journeyman (mech, elec, weld)	trade	$/hr	60.00	66.10	0.00	
surveyor/mech		$hr	63.75	0.00	0.00	
Equipment operator	oper	$/hr	58.65	60.59	0.00	
labour - skilled	lab-s	$/hr	65.00	75.00	120.00	Specified - Skilled Manufacturer Mechanic
labour - unskilled	lab-us	$/hr	60.00	70.00	0.00	Specified - Skilled Manufacturer Mechanic
Security / first aid	safety	$/hr	38.66	52.88	0.00	
Admin.	admin	$/hr	46.27	53.98	0.00	
			0.00	0.00	0.00	
Front end loader, ?, Cat992	loader	$/hr	282.54	363.53	0.00	low - 988 loader, high - 992 loader
excavator, Cat325	excav	$/hr	193.80	192.78	0.00	fuel and operator
dump truck - tandem	dumpt	$/hr	0.00	0.00	0.00	
dump truck off road, Cat 777	dumpo	$/hr	291.92	0.00	0.00	
dozer, D8, D10	dozer	$/hr	229.50	330.48	0.00	fuel & oper. Incl.
smooth drum compactor, Cat CS563	comp	$/hr	96.90	0.00	0.00	fuel & oper. Incl.
scooptram, 6 yd3 bucket	scoop	$/hr	150.96	0.00	0.00	
flat bed truck with hiab	hiab		133.62	0.00	0.00	fuel & oper NOT included
certified mech with truck		$hr	204.00	0.00	0.00	
			0	0	0	

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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