



# **AGNICO EAGLE**

**Meadowbank Division**

## **WHALE TAIL PIT EXPANSION PROJECT**

**Interim Closure and Reclamation Plan**

**MAY 2019**

**VERSION\_2 NWB**

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**DOCUMENT CONTROL**

Version	Date	Section	Page	Revision	Author
WT	June 2016	All	n/a	Interim Closure and Reclamation Plan for the Type A Water Licence Amendment	Golder Associates Ltd.
2_NWB	May 2019	All	n/a	Includes updates for the Whale Tail Pit Expansion Project	Golder Associates Ltd.

## 1.0 SECTION 1 • PLAIN LANGUAGE SUMMARY

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Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) would like to mine and mill for four more years by expanding the Whale Tail Pit Project (Approved Project), located on the Amaruq Exploration Property, approximately 50 km north of the Meadowbank Mine. Agnico Eagle is proposing to expand the Whale Tail open pit, develop another open pit called the IVR Pit, and include underground mining operations. These new mining operations are referred to as the “Expansion Project” in this summary (See Figure 1.1-1).

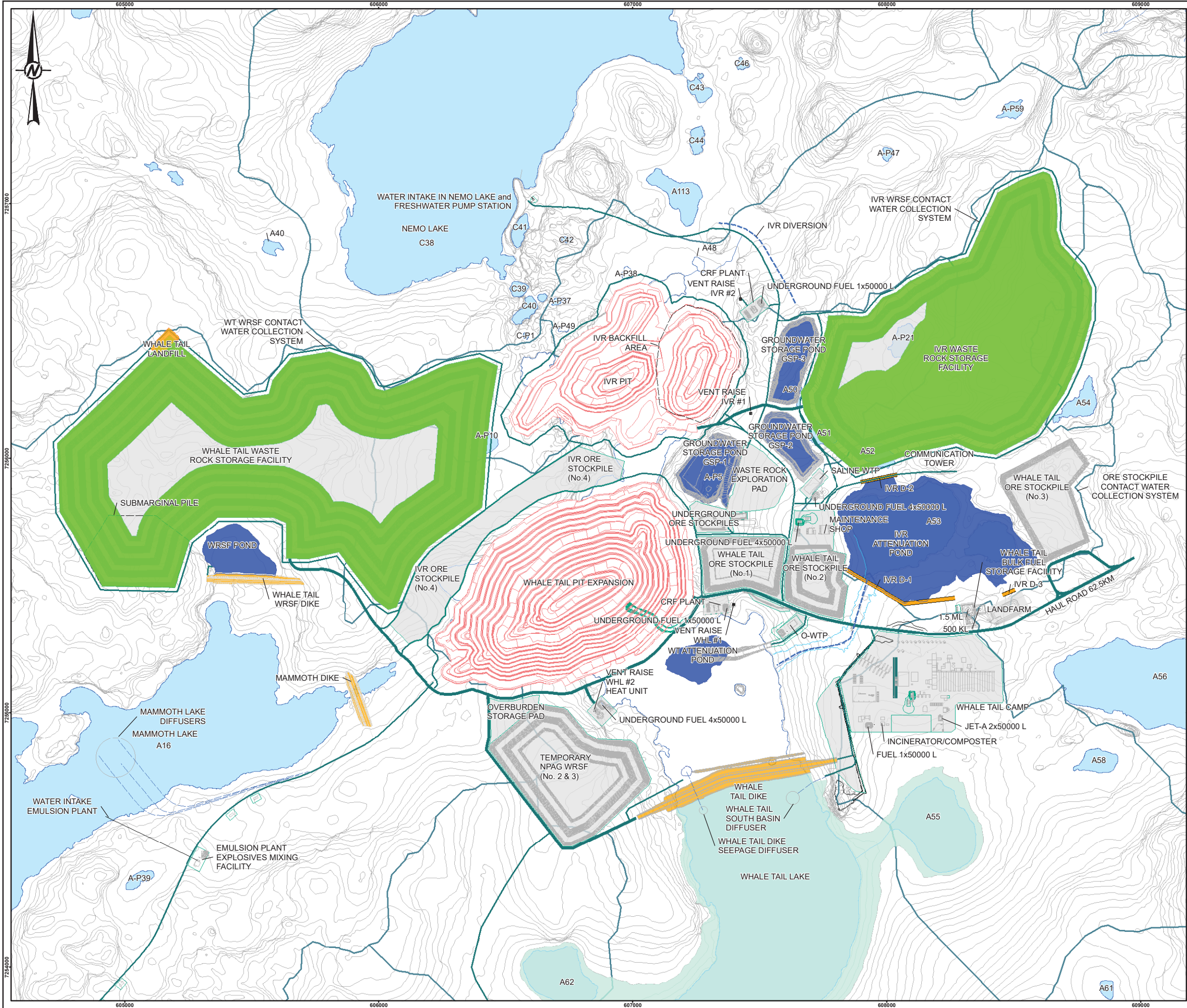
Agnico Eagle is asking the Nunavut Water Board (NWB) to reconsider the Whale Tail Pit Type A Water Licence No. 2AM-WTP1826 to allow for the Expansion Project. Agnico Eagle is providing this Interim Closure and Reclamation Plan (ICRP) Addendum in support of the NWB review of the Type A Water Licence Amendment.

Agnico Eagle has already provided financial security for the closure and reclamation of the Meadowbank Mine facilities and for the Approved Project. Refer to the existing Meadowbank Mine and Approved Project ICRPs for details (Agnico Eagle 2015a,b; 2016a).

The Whale Tail site currently has in place an open pit, a camp for people, a power plant, a heli-pad, a maintenance shop, a tank farm, a place to store the ore, a place to store the waste rock, a pond for mine site water (i.e., the water that comes into contact with various parts of the mine), a system to treat water and sewage, haul roads, access roads, and collection ponds, channels, dikes, dams, and culverts to manage on-site water. Some of these facilities will be expanded to support the Expansion Project (See Figure 1.1-1). For closure and reclamation of existing facilities refer to the Approved ICRP submitted in accordance with the Type A Water Licence (2AM-WTP1826) Part B, Item 14 (c).

Initially, Agnico Eagle planned to mine 8.3 million tonnes (Mt) of ore, the rock containing the gold, over a three to four-year period. With the proposed expansion, Agnico Eagle proposes to mine for an additional four years for an additional 15.2 Mt of ore. The total tonnage for the Approved and Expansion Project will be 23.5 Mt of ore. During the mining process, waste rock, which is the rock and soil removed to gain access to the ore, will be generated at the Whale Tail site and this rock and soil will be kept at the site. The ore, the rock containing the gold, will be transported by truck over a haul road to Meadowbank Mine to be milled and turned into gold. Tailings and the waste generated from the milling process at the Meadowbank Mine, will be stored in existing facilities at the Meadowbank Mine. To support the Expansion Project, the width of the haul road between the Meadowbank Mine and the Whale Tail Project site will be upgraded to double lanes from 9.5 m wide to 15 m wide for improved safety.

Agnico Eagle commenced the construction of the Approved Project in 2018 and expects to ultimately achieve full production in 2019. Construction upgrades to support the Expansion Project will begin as soon as approval and permits for the amendment applications are received (anticipated for early 2020). With the expansion, the Project operational phase will span seven years (including the Approved Project), from Year 1 (2019) to Year 7 (2025). Mining activities are expected to end in Year 7 (2025) and ore processing is expected to end during Year 8 (2026).



**LEGEND**

- CLOSED FACILITY
- WHALE TAIL WASTE ROCK STORAGE FACILITY
- WHALE TAIL LAKE (SOUTH BASIN)  
FLOODED LIMIT (WATER LEVEL 156.0m)
- NATURAL WATERSHED
- DIKE
- POND/SUMP
- ROAD
- WATERCOURSE
- WATERBODY


0 300 600  
1:15,000 METRES

**REFERENCE(S)**

1. INFRASTRUCTURE OBTAINED FROM AGNICO EAGLE MINES LIMITED FROM AMQ\_2025Q4V7.DWG  
2. WATERCOURSE AND WATERBODY DATA OBTAINED FROM PHOTOSAT

DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

CLIENT



AGNICO EAGLE MINES LIMITED:  
MEADOWBANK DIVISION


PROJECT

WHALE TAIL PIT - EXPANSION PROJECT

TITLE

GENERAL ARRANGEMENT PLAN AT END OF PROJECT OPERATIONS

CONSULTANT	YYYY-MM-DD	2019-05-14
	DESIGNED	AP
	PREPARED	CDB/MH
	REVIEWED	AP/IM
	APPROVED	KAB



PROJECT NO.  
19120635

CONTROL  
2000/2020

REV.  
0

FIGURE  
1.1-1

R:\TH\_C\Temp\Bunabhi\19120635\_2000\_FIG\_1.1\_1\_General Arrangement Plan at End of Project Operations.mxd PRINTED ON: 2019-05-14 AT: 10:05:33 AM

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As part of the exploration drilling program, some infrastructure has already been developed at the Project site and it will be developed further. The exploration program is being carried out following the approved Type B Water Licence and Land Use Permits. The exploration facilities include:

- an exploration camp;
- an exploration portal, ramp and two vent raises;
- a small airstrip;
- 10 km of exploration roads;
- a Groundwater Storage Pond (referred to in this document as GSP-1 at former AP-5 pond);
- a waste rock storage facility (WRSF);
- two borrow pits;
- a 1,900,000 L fuel storage tank to support the underground development; and
- the access road and associated seven borrow pits.

The exploration facilities at the Project site are not covered in this ICRP Amendment as they are already covered under the Exploration Facilities Conceptual CRPs (Agnico Eagle 2015a,b). In relation to the existing exploration facilities, only the works related to upgrading the GSP-1 and WRSF for the proposed underground mine workings are covered in this ICRP.

The existing two vent raises have been renamed for the Expansion Project as WHL #1 and WHL #2.

To support the Expansion Project, Agnico Eagle proposes to upgrade the permitted haul road from 9.5 m width to 15 m width to ensure safe passage of haul trucks. The first stage of the haul road (i.e., the upgrade of the access road from 6.5 m width to 9.5 m width) is covered under the Approved Project. The second stage of the haul road (i.e., the widening of the haul road from 9.5 m width to 15 m width) is part of the Expansion Project. The water management infrastructure required for the haul road upgrade (i.e., bridges and culverts) have already been assessed and construction is underway under existing authorization. No additional authorizations are required for this item. No changes are proposed for the existing Meadowbank All Weather Access Road (AWAR) to Baker Lake, or to any winter road.

The Whale Tail Pit at its ultimate configuration will extend across the northern edge of Whale Tail Lake. The IVR open pit will be located northeast of Whale Tail Pit (See Figure 1.1-1).

The area that will be disturbed during construction and operations for the entire Project is approximately 635 hectares (ha) which includes the 325.1 ha permitted under the Approved Project.

The Approved Project facilities are not covered in this ICRP Amendment as they are already covered under the Type A Water Licence 2AM-WTP1826 CRPs (Agnico Eagle 2016a). The new or expanded on-site infrastructure proposed for the Expansion Project is covered under this ICRP Amendment, and it includes the following:

- expansion of the Whale Tail Pit;
- mining of an additional open pit, the IVR Pit;
- underground mining workings below Whale Tail and IVR pits including a temporary main ventilation system, two new vent raises (IVR #1 and IVR#2) and associated underground water management system;
- one new stockpile for ore from underground;
- expansion of the underground WRSF;
- expansion of the GSP-1;

- two new Groundwater Storage Ponds (referred to in this document as GSP-2 and GSP-3);
- a new Salt Water Treatment Plant Saltmaker (S-WTP) or low Total Dissolved Solids (TDS) treatment plant for brackish water;
- a new Salt Water Treatment Plant Saltmaker (S-WTP) or high TDS treatment plant for brine water;
- installation of a larger maintenance shop and additional wings to the Main Camp;
- an additional freshwater intake in Mammoth Lake to support explosive mixing;
- a new emulsion plant;
- an additional above ground fuel storage tank (500,000 L capacity);
- five additional fuel storage locations (with a total capacity of 700,000 L);
- expansion of Whale Tail Ore Stockpile No. 1;
- relocation and expansion of Whale Tail Ore Stockpiles No. 2 and No. 3;
- a new IVR Ore Stockpile No.4;
- a new IVR WRSF including a contact water collection system;
- two new water discharge diffusers into Whale Tail South Basin;
- a new alternate water discharge diffuser (adaptive management);
- expansion of the Whale Tail WRSF and a new contact water collection system;
- two new temporary non-potentially acid generating (NPAG) WRSFs (No. 2 & 3);
- relocation of the overburden stockpile;
- two new Cemented Rock Fill (CRF) plants;
- three new water retention dikes (IVR-D-1, IVR D-2, and IVR D-3);
- a new Whale Tail Dike seepage pump station;
- a new IVR Diversion;
- a new IVR Attenuation Pond in the basin of Lake A-53 and associated pond pump station;
- new incinerator, composter, and landfarm;
- new transportation routes to expansion facilities including internal access roads;
- widening of the haul road from 9.5 m to 15 m; and
- additional haul road quarries and eskers borrow sources.

Figure 1.1-1 shows the locations of the Project infrastructure.

A key goal of Agnico Eagle’s public consultation and engagement program has been to ensure that Agnico Eagle has the support of many interested parties who could be affected by the mine. Agnico Eagle has met with the community and with local stakeholders within the Kivalliq Region regularly to discuss the Approved Project and Expansion Project activities and will continue to do so.

Much of the Inuit Qaujimajatuqangit (IQ) collected for the Project has been collected over time through consultation, formal IQ workshops, community meetings, and through informal acquisition of IQ by working with local field staff. The IQ collected included knowledge on the existing conditions, concerns on the various project impacts, and recommendations for the Expansion Project.

Agnico Eagle plans to leave Whale Tail Pit Project, including the proposed Expansion Project, in a physically and chemically stable project footprint for the long-term protection of the environment and people of Nunavut. When the mine closes, all the dikes and water diversions will be removed, and lakes will have similar amounts of water as they do now. The open pits

will be flooded. Some waste rock will be returned to the underground mined out areas as backfill during the underground mining activities. The waste rock remaining on surface will be capped with clean rock.

Most active on-site closure activities will occur over a three-year period with passive closure until around Year 24 (2042). Monitoring will continue until it is confirmed that the water is safe for release to the natural environment and to ensure that the natural environment is protected.

Agnico Eagle strongly believes that considering its past performance and the current design of the Expansion Project, the company is able to complete the mining of the Whale Tail Pit and IVR Pit, to lessen any negative impacts, and to maintain and restore the site at the time of closure.

This report outlines the ICRP for the Project and it has been prepared in terms of an amendment to the current existing ICRP and financial security for the Approved Project. It has been submitted to the NWB for review and approval in support of the Type A Water Licence Amendment.

The “*Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories*”, issued by the Mackenzie Valley Land and Water Board (MVLWB) and Aboriginal Affairs and Northern Development Canada (AANDC, now Crown-Indigenous Relations and Northern Affairs Canada [CIRNAC]) in 2013 (MVLWB/AANDC 2013), were used to prepare the ICRP. The ICRP will be updated through the detailed design and operational phases of the Project, as new information (such as monitoring results) become available.

The Project ICRP describes the plan to carry out the required closure activities, and to establish self-sustaining ecosystems with land uses similar to pre-development conditions. Progressive closure activities will take place during mining. Areas that have been disturbed by mining will be reclaimed once operations in that area are complete. The mining operation has been designed with final closure in mind. Where possible, the designs of the WRSF and water management facilities have been chosen to reduce the overall impact of the Project on the area.

If operations stop temporarily with the intent of resuming mining activities in the near future, the Project site would be placed in a care and maintenance phase. The Project may need to shut down for a short-term or indefinitely (long-term) due to economic, environmental and/or social factors. The plans for both of these closure periods are discussed in this ICRP.

Ultimately, the mining operations will stop as these pits and underground mine workings are completed and the Project site will be closed. The work that will take place when the Project site is placed in closure is described in this ICRP.

Environmental design features and mitigation, as well as current wildlife management practices used in other mining projects in Nunavut and the Northwest Territories (e.g., Meadowbank, Ekati, Diavik, and Snap Lake mine sites) for closure, will also be used at the Project as much as possible.

There will be three main stages of closure at the Project. The main activities that take place during each stage are:

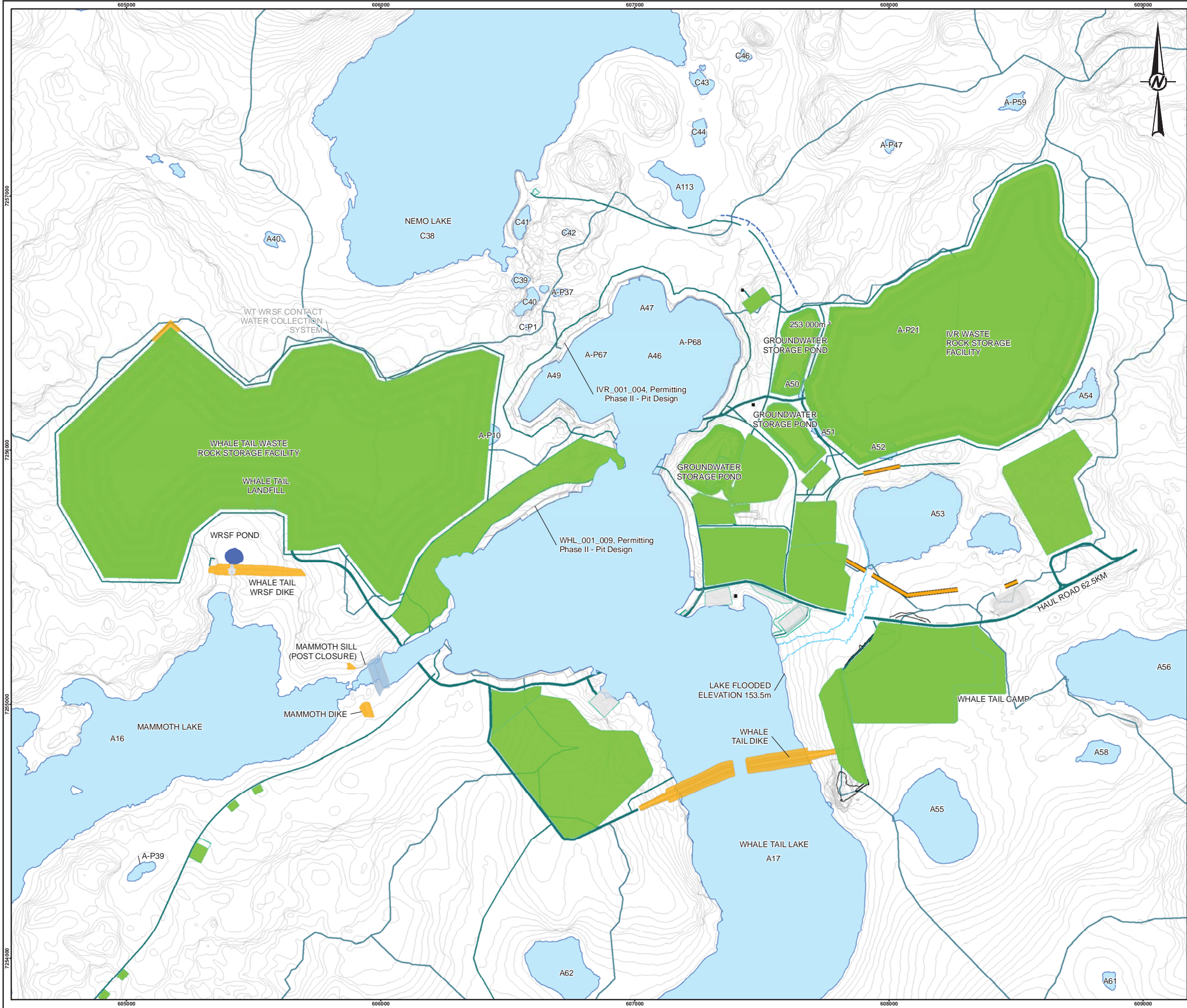
- **Progressive Reclamation Stage** (Operating Year 1 [2019] to Year 7 [2025]): during which reclamation of the WRSFs through cover placement will occur progressively during operation (Figure 1.1-1). Active care, maintenance, and monitoring will be required for the reclaimed areas of the WRSFs throughout this stage.
- **Closure Stage** (Year 8 [2026] to Year 24 [2042]): during which WRSF covers will be completed after completion of mine operations and processing of ore stockpiles, mining equipment will be removed, redundant infrastructure will be demolished and the flooding of the mined-out open pits and underground mine workings will occur (Figure 1.1-2) with a combination of natural runoff, seepage and contact water from the entire site, and water pumped from Whale Tail Lake (South Basin). The underground mine workings will be flooded in about 5 months (Year 8 [2026]). Flooding of the Whale Tail Lake (North Basin including the mined-out IVR Pit) to elevation 153.5 m (1 m above the original water level) is estimated to take approximately 16 years. Active care, maintenance, and monitoring will be required for the decommissioned and remaining facilities throughout this stage. Dikes will be decommissioned when water quality meets the regulatory closure objectives.
- **Post-closure Stage:** (Year 25 [2043] onwards), will commence in Year 24 (2042) after flooding of the pits is completed and water quality is acceptable for direct discharge to the environment. During this stage, continued monitoring and maintenance will be carried out at a reduced frequency, depending on the results of the monitoring and measures of success selected for closure (Figure 1.1-3).

The closure stage may be reduced dependent upon water quality results through operations and treatment levels and adaptive management measures implemented that may lead to improved water quality sooner than predicted during the closure stage, thereby allowing for the decommissioning of the dikes prior to Year 24 (2042). A reduction in timeline for the closure stage may also trigger reductions in monitoring, and financial assurances (i.e., security deposits) posted for the Project.

At closure, it is expected that the residual disturbances derived from the Project will be minor.

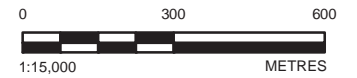


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#### LEGEND

- CLOSED FACILITY
- WHALE TAIL LAKE (SOUTH BASIN) FLOODED LIMIT (WATER LEVEL 156.0m)
- NATURAL WATERSHED
- DIKE
- POND/SUMP
- ROAD
- WATERCOURSE



#### REFERENCE(S)

- INFRASTRUCTURE OBTAINED FROM AGNICO EAGLE MINES LIMITED FROM AMQ\_2029\_AFTER\_MINEV7.DWG
- WATERCOURSE AND WATERBODY DATA OBTAINED FROM PHOTOSAT

DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

CLIENT



AGNICO EAGLE MINES LIMITED:  
MEADOWBANK DIVISION

**AGNICO EAGLE**

PROJECT

WHALE TAIL PIT - EXPANSION PROJECT

TITLE

**GENERAL ARRANGEMENT PLAN AT END OF  
CLOSURE STAGE YEAR 24 (2042)**

CONSULTANT



YYYY-MM-DD 2019-05-13

DESIGNED ER/AP

PREPARED CDB/MH

REVIEWED AP/IM

APPROVED KAB

PROJECT NO.

19120635

CONTROL

2000/2020

REV.

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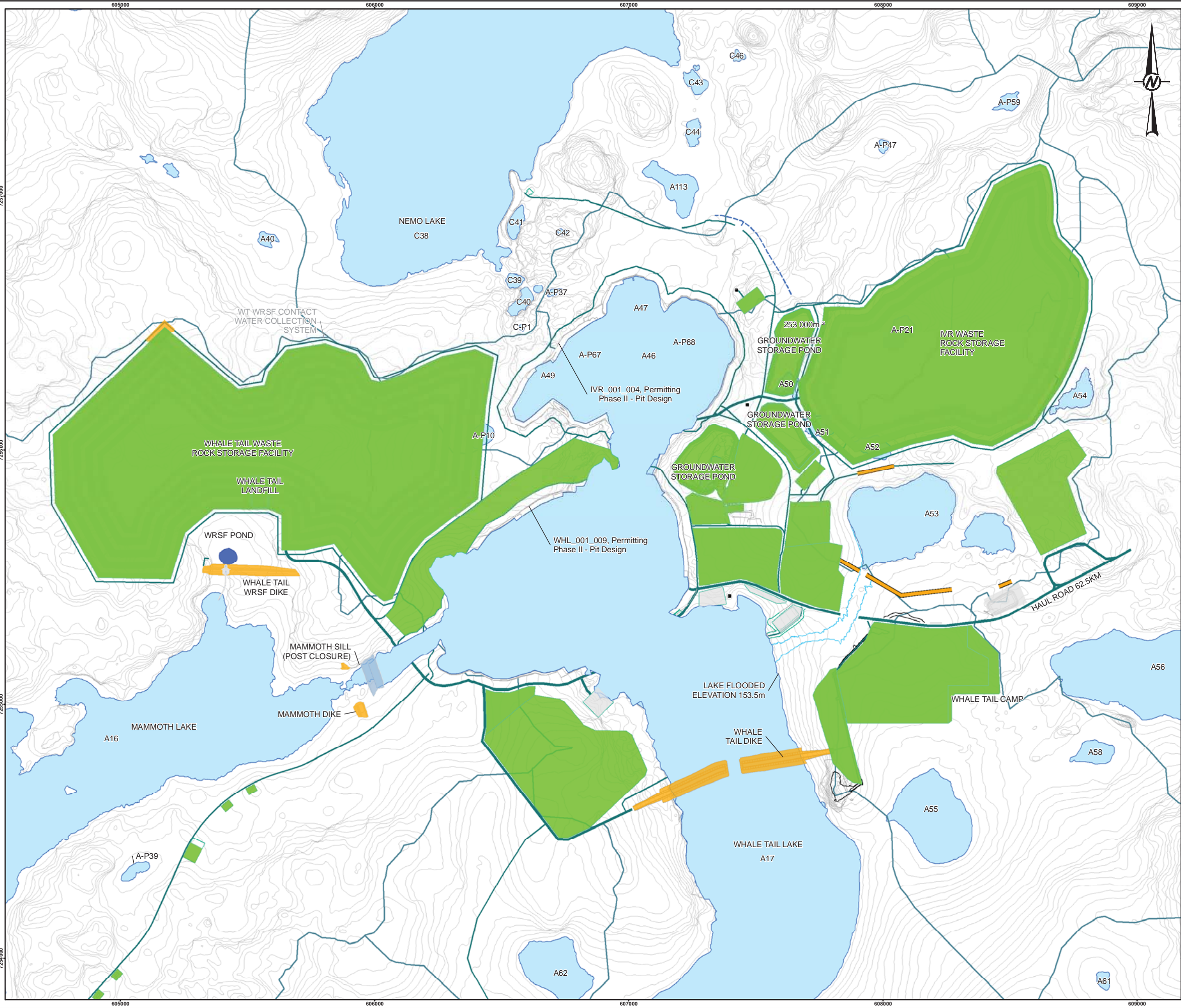
FIGURE

1.1-2

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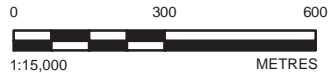


R:\TH\_Yibumab\CAD-GIS\Client\Agnico Eagle\_Mines\_Ltd\Whale\_Tail\00\_Productions\2000\MXD\Report\CRP\19120635\_2000\_FIG\_1.1\_3\_General\_Arrangement\_Plan\_Post\_Closure\_Sage.mxd PRINTED ON: 2019-05-13 AT: 5:08:37 PM



LEGEND

- CLOSED FACILITY
- WHALE TAIL LAKE (SOUTH BASIN)
- FLOODED LIMIT (WATER LEVEL 156.0m)
- NATURAL WATERSHED
- DIKE
- POND/SUMP
- ROAD
- WATERCOURSE



REFERENCE(S)

- INFRASTRUCTURE OBTAINED FROM AGNICO EAGLE MINES LIMITED FROM AMQ\_2029\_AFTER\_MINEV7.DWG
- WATERCOURSE AND WATERBODY DATA OBTAINED FROM PHOTOSAT

DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

CLIENT



AGNICO EAGLE MINES LIMITED:  
MEADOWBANK DIVISION

**AGNICO EAGLE**

PROJECT

WHALE TAIL PIT - EXPANSION PROJECT

TITLE

**POST-CLOSURE GENERAL ARRANGEMENT PLAN**

CONSULTANT



**GOLDER**

YYYY-MM-DD 2019-05-13

DESIGNED ER/AP

PREPARED CDB/MH

REVIEWED AP/IM

APPROVED KAB

PROJECT NO.

19120635

CONTROL

2000/2020

REV.

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FIGURE

1.1-3

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

28mm

### **1.1 Closure and Reclamation Activities**

The major closure and reclamation activities planned for the Project are expected to occur during the first two years of closure. The underground mining will be flooded in about 5 months Year 8 (2026). It is expected that the water level of 153.5 m of the Whale Tail Lake (North Basin including the mined-out IVR Pit) will be reached over a 16 year-period (Year 24 [2042]).

### **1.2 Monitoring and Maintenance Plans**

Monitoring and maintenance of the reclaimed facilities will be carried out during operations and into closure. It is planned that the haul road would be maintained for a sufficient period to enable access to the site for minor maintenance required in the initial years of the post-closure period. The post-closure phase could be reduced if water quality becomes acceptable for direct discharge to the environment at an earlier date. The haul road, if not assumed by the community or a third party, will be decommissioned once future maintenance requirements at the site are anticipated to be minor such that they could be achieved with small crews sent to site via helicopter in the summer.

### **1.3 Cost Estimate**

The cost estimate covers the closure and reclamation of all Project facilities as described in this ICRP and was prepared using RECLAIM Version 7.0, March 2014, for permanent closure of the Project.

## 2.0 SECTION 2 • INTRODUCTION

### 2.1 Background

Agnico Eagle Mines Limited – Meadowbank Division (Agnico Eagle) would like to mine and mill for four more years by expanding the Whale Tail Pit Project (Approved Project), located on the Amaruq Exploration Property, approximately 50 km north of the Meadowbank Mine. Agnico Eagle is proposing to: expand the Whale Tail open pit, develop another open pit called the IVR Pit, and include underground mining operations. These new mining operations are referred to as the “Expansion Project” in this ICRP. Agnico Eagle is asking the Nunavut Water Board (NWB) to amend the Whale Tail Pit Project Type A Water Licence NWB 2AM-WTP1826 to allow for the expansion.

The Whale Tail site currently has in place an open pit, a camp for people, a power plant, a heli-pad, a maintenance shop, a tank farm, a place to store the ore, a place to store the waste rock, a pond for mine site water (i.e., the water that comes into contact with various parts of the mine), a system to treat water and sewage, haul roads, access roads, and collection ponds, channels, dikes, dams, and culverts to manage on-site water. Some of these facilities will be expanded to support the Expansion Project (See Figure 1.1-1).

The Project involves construction, operations, and closure, including decommissioning and the rehabilitation of the Project facilities. The Project is 100% owned by Agnico Eagle.

The Amaruq property is located in the Kivalliq Region of Nunavut, Canada, centered at approximately latitude 65° 24' 36" N, longitude 96° 41' 41" W. The property was acquired by Agnico Eagle in April 2013 subject to a mineral exploration agreement with Nunavut Tunngavik Incorporated. The Amaruq property is a 408 km<sup>2</sup> site located on Inuit Owned Land approximately 150 km north of the hamlet of Baker Lake and northwest of the Meadowbank Mine (**Error! Reference source not found.**). Inuit Owned Land is governed under the Nunavut Agreement.

The Approved Project will generate approximately 8.3 Mt of ore, 46.1 Mt of waste rock, and 5.6 Mt of overburden (with very limited organic material) for a total of 51.7 Mt of waste. The Expansion Project will generate an additional approximately 15.2 Mt of ore, 121.7 Mt of waste rock, and 5.7 Mt of overburden soil, (with very limited organic material) for a total of 127.4 Mt of waste. The combined Approved Project and Expansion Project will generate approximately 23.5 Mt of ore, 167.8 Mt of waste rock and 11.3 Mt of overburden (with very limited organic material) for a total of 179.1 Mt of waste.

To support the Expansion Project, Agnico Eagle proposes to upgrade the permitted haul road from 9.5 m width to 15 m width to ensure safe passage of haul trucks. No changes are proposed for the existing Meadowbank All Weather Access Road (AWAR) to Baker Lake, or to any winter road.

Underground mining will be mainly, long hole mining (95 %) with some mechanized cut and fill in flat areas. The configuration will be a mix of transverse and longitudinal stoping. Ore will be extracted by truck and scoop and hauled to surface through main access ramp. Waste rock from the underground mine will be temporarily stored on surface in a surface WRSF until it is used in its entirety for underground backfill. Stopes will be filled with cemented rock fill and rock fill. Excess water volumes from the underground mine will be managed through the Underground Mine Stope and Groundwater Storage Pond 1 (GSP-1) for high salinity water, and through GSP-2 for low salinity water. If necessary, excess water volumes may also be managed in GSP-3. Water will be treated through the S-WTPs and discharged to Mammoth Lake or Whale Tail Lake (South Basin).





**LEGEND**

- COMMUNITY
- HAUL ROAD
- ALL WEATHER ROAD
- WHALE TAIL PIT
- MEADOWBANK OPERATION AND INFRASTRUCTURE
- WATERCOURSE
- WATERBODY

**KEY MAP**

0 12 24  
1:600,000 KILOMETRES

**REFERENCE(S)**

1. HAUL ROAD OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. WATERCOURSE AND WATERBODY DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
3. INSET MAP DATA OBTAINED FROM ESRI.

DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

CLIENT

AGNICO EAGLE MINES LIMITED:  
MEADOWBANK DIVISION

PROJECT

WHALE TAIL PIT - EXPANSION PROJECT

TITLE

PROJECT LOCATION

CONSULTANT	YYYY-MM-DD	2019-04-15
	DESIGNED	JR/AP
	PREPARED	CDB/MH
	REVIEWED	AP/IM
	APPROVED	KAB

PROJECT NO.

19120635

CONTROL

2000/2020

REV.

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FIGURE

2.1-1

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

25mm

The Whale Tail deposit is partly located within Whale Tail Lake. The Whale Tail Pit at its proposed ultimate configuration will extend across the northern edge of Whale Tail Lake. As per the Approved Project the permitted approach to develop the Whale Tail Pit involves isolating the pit area with three dikes (Whale Tail Dike, Mammoth Dike, and Northeast Dike). The isolated area will then be dewatered for the development and operation of the pit. The proposed expansion of the Whale Tail Pit has not changed the concept for the dewatering of the Whale Tail Lake (North Basin). The dewatered water level will be maintained through the life of the Project by diverting most the fresh water that would otherwise come in contact with the mine site to other sub-watersheds using diversion channels and by pumping (operational dewatering) the contact water to the Operation Water Treatment Plant (O-WTP) for removal of total suspended solids and arsenic before discharge in Mammoth Lake. It is proposed that the treated water could also be discharged through two diffusers into Whale Tail Lake (South Basin) or other alternatives (adaptive management). The permitted Northeast Dike will be decommissioned sooner to support the Expansion Project.

The proposed approach to develop the IVR deposit involves isolating the pit area by controlling surface runoff. The isolated area will be dewatered in Year 2 (Year 2020) for the development and operation of the pit. The dewatered water level will be maintained through the life of the Project by diverting most of the clean runoff water to other sub-watersheds via the IVR Diversion, IVR D-1, IVR D-2, and IVR D-3 dikes and by pumping (operational dewatering) the contact water to the O-WTP for treatment before discharge through diffusers into the Mammoth Lake or Whale Tail Lake (South Basin) or other alternatives (Figure 1.1-1).

Consistent with the Approved Project, ore from the Expansion Project will be segregated by grade. The high grade ore will be transported from the Amaruq site to the Meadowbank Mine for milling as part of the run of mine operation, while the low grade ore will be temporarily stockpiled in the ore pads until the end of the mining operations and then transported to the Meadowbank Mine for milling and processing.

Also consistent with the Approved Project, Agnico Eagle proposes to dispose of the tailings slurry from the Expansion Project at the existing Meadowbank Mine tailing storage facility (TSF), which is authorized under Project Certificate (No. 004) and Type A Water Licence (2AM-MEA1826).

There are four phases to the development of the Project:

- **Construction Phase:** started in Year 2018 for the Approved Project and will focus on site preparation and the construction of infrastructure, with the development of the starter Whale Tail Pit to produce construction material. The duration of the construction phase will be about 2 years. Construction upgrades to support the Expansion Project will begin as soon as approval and permits for the amendment applications are received (anticipated for early Year 2 - 2020).
- **Operations Phase:** will span seven years, from Year 1 (2019) to Year 7 (2025). Mining activities are expected to end in Year 7 (2025) and ore processing is expected to end during Year 8 (2026). During this time, reclamation of the WRSFs will occur progressively through ongoing cover placement.
- **Closure Phase:** will commence after the completion of mining and will occur from Year 8 (2026) to Year 24 (2042) and will include removal of the non-essential site infrastructure and the flooding of the mined-out open pits and underground workings, as well as flooding of the Whale Tail Lake (North Basin including the mined-out IVR pit) to a water level of 153.5 m (1 m above the original water level) and decommissioning of dikes when water quality meets the regulatory closure objectives. Placement of the WRSFs cover will be completed early in this phase.
- **Post-closure Phase:** will commence after in Year 24 (2042) after flooding of the pits is completed and water quality is acceptable for direct discharge to the environment.

Infrastructure/activities at Meadowbank Mine that support the Expansion Project will be extended for another four years and will remain the same as already approved. On-site, existing facilities and infrastructure under the Approved Project will continue to be utilized for the Expansion Project. Proposed Expansion Project facilities to support the mining activities over the Project life are listed in Section 1.0.

The four phases of development may vary depending upon environmental, social, and economic conditions. For example, the operations phase may be expanded depending upon potential future phase development or decreased depending upon price of gold. Economics is a key driver to ongoing operations and mining. In addition, the closure phase may be reduced dependent upon water quality results through operations and treatment levels and adaptive management measures implemented that may lead to improved water quality sooner than predicted during the closure phase, thereby allowing for the decommissioning of the dikes prior to Year 24 (2042). It should also be noted a reduction in timeline for the closure phase may also trigger reductions in monitoring, and financial assurances (i.e., security deposits) posted for the project.

## 2.2 Regulatory Framework

The Project is regulated by the NWB; which is also responsible for approving Closure and Reclamation Plans in the Nunavut Territory. This report outlines the ICRP for the Project and it has been prepared in the form of an amendment to the current existing ICRP for the Approved Project.

The foundation of this document is the Approved ICRP under the Type A Water Licence (2AM-MEA1826) that was developed in accordance to the *“Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories”* issued by the Mackenzie Valley Land and Water Board (MVLWB) and Aboriginal Affairs and Northern Development Canada (AANDC, now Crown-Indigenous Relations and Northern Affairs Canada [CIRNAC]) in 2013 (MVLWB/AANDC 2013). It also addresses the Mine Site Reclamation Policy for Nunavut (AANDC 2002). The ICRP will be updated through the detailed design and operation phases as additional information and monitoring results become available and as additional community feedback is collected through ongoing public consultations.

For the purpose of development of this ICRP Amendment for the Type A Water Licence Amendment for the NWB, Agnico Eagle has assumed that Section 3 describing the existing Environment of this document is generally consistent with the Approved Project or as otherwise stated and updated.

Mine closure is integral to the mine design and this plan is a “living” document that will be modified as the Project progresses. Planning for permanent closure is an active and iterative process, in which the intent is to develop a final plan using adaptive management. The process begins in the mine design phase and continues through operations to closure implementation. Adaptive management enables the plan to evolve as new information becomes available through analyses, testing, monitoring, and progressive reclamation.

A general layout plan of the Project at end of operations is shown in **Error! Reference source not found..**

## 2.3 Purpose and Scope of the Closure and Reclamation Plan

The regulatory process for the closure and reclamation planning in the Nunavut Territory requires Agnico Eagle to amend the current existing Approved Project ICRP when changes to the mine planning are proposed and/or site-specific factors or new information resulting from reclamation research necessitate modifications to closure objectives. The Expansion Project will modify the mine plan and therefore this ICRP has been prepared as an Amendment to the Approved Project ICRP in support of the NWB Type A Water Licence Amendment.

This ICRP is intended to provide the NWB with a conceptual level description of all the closure concepts and related closure activities involved for the Expansion Project site following suspension of the mine operations, either temporarily or permanently. The permitted closure concepts and closure activities for the Approved Project are also presented in this document. Where the permitted closure activities will be modified due to the Expansion Project, this is duly noted.

The closure concepts and closure activities for the Project presented in this document will be refined through the detailed design and operation phases as additional information and monitoring results become available and as additional community feedback is collected through ongoing public consultations. The refined closure concepts and closure activities for the Project will be incorporated in future updates of the ICRP.

The current Type A Water Licence (2AM-WTP1826) requires the ICRP to be updated within twelve (12) months of Operations. The current Type A Licence also requires a Final Closure & Reclamation Plan (FCRP) to be submitted at least twelve (12) months prior to the expected end of planned mining. All closure plans submitted to the Board are subject to the approval of the Board prior to implementation.

The focus of this ICRP Amendment is to:

- provide closure objectives for the Expansion Project components;
- describe closure options for temporary and permanent closure;
- identify modifications to the permitted closure and reclamation activities due to the Expansion Project;
- identify uncertainties related to the proposed closure objectives, options, or criteria;
- identify post-closure monitoring requirements and responsibilities for the selected closure activities;
- predict the likelihood of potential post-reclamation risks to the environment and human and wildlife health; and
- estimate the closure and reclamation liability costs and financial security.

Agnico Eagle has engaged Aboriginal groups and other stakeholders since the early stages of mine planning and closure and reclamation plan development. Their inputs have been considered in the preparation of this ICRP. Refer to Section 2.5 for additional information.

## 2.4 Goal of the Closure and Reclamation Plan

The overall goal of closure is to return the proposed Project site and affected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities. The overall closure goal is supported by the four closure principles of physical stability, chemical stability, no long-term active care requirements, and compatibility with future land uses for each component of the Project.

The closure goals of this ICRP are to:

- address applicable requirements under the Approved Project Type A Water Licence (No. 2AM-WTP1826);
- help protect traditional values;
- comply with applicable standards and guidelines requirements and objectives;
- protect public and employee health, safety and welfare using known, safe, and responsible reclamation practices;
- mitigate socio-economic impacts in the area where the mine is located following decommissioning and closure as practically possible;
- preserve shareholder value;
- ensure Agnico Eagle and shareholder goals are included in closure planning;

- give preference to closure solutions that do not require subsequent maintenance (i.e., “walk away” solutions) or else solutions that reduce maintenance requirements (example “passive water treatment”);
- progressive closure of facilities, whenever possible, spaced out over the operational life of the mine as activities in areas are completed;
- establish conditions that allow the natural environment to recover from mining activities and that are compatible with future uses (including aesthetics and values) as agreed with local government and communities if applicable; and
- reduce costs and long-term liabilities to Agnico Eagle, the government, and the public.

## **2.5 Closure and Reclamation Planning Team**

The proponent of the Project is: Agnico Eagle Mines Limited (Agnico Eagle)

The address for the proponent is: Agnico Eagle Mines Limited  
10200, Route de Preissac  
Rouyn-Noranda, Quebec JOY 1C0  
Canada

The Project site is located at: latitude 65° 24’ 36 ” N, longitude 96° 41’ 41” W  
Nunavut, Canada

Acting on behalf of the proponent: Golder Associates Ltd. (Golder)  
6925 Century Avenue, Suite #100  
Mississauga, Ontario  
L5N 7K2, Canada

The contact person for the Project is: Jamie Quesnel  
Superintendent Permitting and Regulatory Affairs – Nunavut  
Agnico Eagle Mines Limited  
Baker Lake, Nunavut, Canada, X0C 0A0  
Ph.: 819.759.3555 x6838  
M: 819.856.0821  
Email: jamie.quesnel@agnicoeagle.com

## **2.6 Consultation and Engagement**

Public consultation and engagement are legal requirements in Nunavut, an industry best practice, and an important corporate commitment. Agnico Eagle has engaged Aboriginal groups and other stakeholders since the early stages of mine planning and closure and reclamation plan development. Their inputs have been considered in the preparation of this ICRP. For additional information related to Agnico Eagles goals and objectives for Consultation refer to the Approved Project FEIS Volume 1, Section 1.1.10 and Volume 2, Section 2.3 (Agnico Eagle 2016b).

During the regulatory review process and upon receipt of the Project Certificate No. 008 and Type A Water Licence 2AM-WTP1826 for Whale Tail Pit, Agnico Eagle has continued public consultation by meeting with local employees that live throughout the Kivalliq region, meeting in the community and local stakeholders, and regulatory agencies routinely which has allowed a better general understanding of the rights, interests, values, aspirations, and concerns of the potentially affected stakeholders, with particular reference to the local population. Through this continued consultation, Agnico Eagle



has developed an operational culture that recognizes and respects these relevant interests in the planning and executing processes. For the Expansion Project consultations, hearings, community round-table, and meetings that were completed as part of the Approved Project have been integrated into the Amendment. Feedback from interveners, stakeholders, and community members since 2014 has been integrated into the FEIS and FEIS Addendum applications. The updated record of consultation including government engagement undertaken since June 2016 is provided in the FEIS Addendum Volume 2 (Agnico Eagle 2018a). Agnico Eagle has, and will continue to, engage with the Kivalliq Inuit Association (KivIA) and other stakeholders. FEIS Addendum Volume 2, Appendix 2-D also (Agnico Eagle 2018a) includes a summary of Project concerns raised by community members and approved project references to mitigation measures.

### 2.6.1 Incorporation of Inuit Qaujimajatuqangit

Inuit Qaujimajatuqangit was used in the FEIS to enhance the understanding of the environment through literature review, public interaction, and interviews.

Consistent with the Approved Project, Agnico Eagle has taken a holistic approach to collecting IQ for the Expansion Project through the LOM and is illustrated in the FEIS Addendum Volume 2 (Agnico Eagle 2018a).

Additional IQ and Project-related concerns and issues have been provided by community members and representatives (i.e., Hunters and Trappers Organization [HTO] and KivIA) since the FEIS submission was made in 2016 for the Approved Project. This information was identified through a review of the consultation record for the Approved Project and community consultation notes for the Expansion Project (Agnico Eagle 2018a). The IQ and Project concerns have been categorized by topic (e.g., wildlife, fish, water quality) and are included in each respective discipline sections, and integrated into the assessment, where appropriate. Project concerns and mitigation measures are also listed in the FEIS Addendum Appendix 2-D, Table 2-D-2 (Agnico Eagle 2018a).

## 2.7 Regulatory Instruments for Closure and Reclamation

The Whale Tail Pit Project is subject to the regulatory processes established under the applicable laws and regulations of Canada and of Nunavut. The Expansion Project is subject to an Environmental Assessment (EA) reconsideration established by the *Nunavut Planning and Project Assessment Act* and the Water Licence authorities under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act*. Agnico Eagle is seeking an amendment to the Whale Tail Pit Type A Water Licence (No. 2AM-WTP1826) to include mining of the expansion components and associated infrastructure from the NWB.

The regulatory organizations have not changed since the FEIS (Agnico Eagle 2016b), except that the name of AANDC has been changed to CIRNAC.

No new infrastructure is required at the existing Meadowbank Mine to support the Expansion Project.

On-site at Whale Tail, existing facilities and infrastructure under the Approved Project will continue to be utilized for the Expansion Project. Prior to construction and in support of development of the Approved Project, advanced exploration was undertaken in accordance with Type B Water Licence (2BB-MEA1828). Agnico Eagle intends to maintain its exploration water licence; however, some infrastructure associated with exploration may be more appropriately licensed under the proposed Type A Amendment. The current Type B Water Licence scope includes:

- an exploration camp;
- an exploration portal, ramp and two vent raises;
- a small airstrip;

- 10 km of exploration roads;
- a Groundwater Storage Pond (referred to in this document as GSP-1 at former AP-5 pond);
- a waste rock storage facility (WRSF);
- two borrow pits;
- a 1,900,000 L fuel storage tank to support the underground development; and
- the access road and associated seven borrow pits.

The exploration facilities at the Project site are not covered in this ICRP Amendment as they are already covered under the Exploration Facilities Conceptual CRPs (Agnico Eagle 2015a,b). In relation to the existing exploration facilities, only the works related to upgrading the GSP-1 and WRSF for the proposed underground mine workings are covered in this ICRP.

The existing two vent raises have been renamed for the Expansion Project as WHL #1 and WHL #2.

To support the Expansion Project, Agnico Eagle proposes to upgrade the permitted haul road from 9.5 m width to 15 m width to ensure safe passage of haul trucks. The first stage of the haul road (i.e., the upgrade of the access road from 6.5 m width to 9.5 m width) is covered under the Approved Project. The second stage of the haul road (i.e., the widening of the haul road from 9.5 m width to 15 m width) is part of the Expansion Project. The water management infrastructure required for the haul road upgrade (i.e., bridges and culverts) have already been assessed and construction is underway under existing authorization. No additional authorizations are required for this item. No changes are proposed for the existing Meadowbank All Weather Access Road (AWAR) to Baker Lake, or to any winter road.

The Whale Tail Pit at its ultimate configuration will extend across the northern edge of Whale Tail Lake. The IVR Pit will be located northeast of Whale Tail Pit (Figure 1.1-1).

The area that will be disturbed during construction and operations for the entire Project is approximately 635 ha which includes the 325.1 ha permitted under the Approved Project. The Expansion Project covers the same spatial boundaries as those defined for the Approved Project. The regional study area (RSA) for the Expansion Project is consistent with the Approved Project.

The Approved Project facilities are not covered in this ICRP Amendment as they are already covered under the Type A Water Licence 2AM-WTP1826 CRPs (Agnico Eagle 2016a). A summary of the new or expanded on-site infrastructure and operations proposed for the Expansion Project covered under this ICRP are outlined in Section 4.4.

Using a natural water body frequented by fish for mine waste disposal also requires a federal legislative action, specifically an Amendment under the Metal and Diamond Mining Effluent Regulations (MDMER). The MDMER was developed under subsections 34(2), 36(5), and 38(9) of the Fisheries Act to regulate the deposit of mine effluent, waste rock, tailings, low-grade ore, and overburden into natural waters frequented by fish. These regulations, administered by Environment and Climate Change Canada, apply to both new and existing metal mines. Schedule 2 of the MDMER lists waterbodies designated as tailings impoundment areas, where a water body is added to that Schedule through a regulatory amendment. Section 27.1 of the MDMER requires the project proponent to develop and implement a fish habitat compensation for the listed water body. For additional information to the potential use of fish-bearing waters for the deposition of deleterious substances at the Project refer to the Main Application Document, Section 1.9.6 (Agnico Eagle 2019a). If waste disposal is not deemed deleterious to fish or a waterbody is affected from other mining operations, then a *Fisheries Act* Authorization would then be required under Section 35. Both the application for a Schedule 2 Amendment to the MDMER and the application for a Section

35 *Fisheries Act* Authorization requires a compensation (or offsetting) plan. The proposed fisheries offsetting compensation activities for the Project are described in Appendix G.16 of Agnico Eagle (2019a).

As per Type A Water Licence 2AM-WTP1826, Agnico Eagle will complete the dewatering of Whale Tail Lake (North Basin) in 2019 following the construction of the dike and the fish out. The proposed expansion of the Whale Tail Pit has not changed the dewatering of the Whale Tail Lake (North Basin); however, small waterbodies and ponds within the footprint of the IVR Pit and IVR Attenuation Pond will require DFO approved fish outs followed by dewatering during the open water seasons of 2020 to 2022.

In the preparation of this ICRP, Agnico Eagle has taken into account the following:

- comments received during public consultations;
- current existing Meadowbank Mine and Approved Project ICRPs, including the progressive reclamation activities carried out to date at the Meadowbank Mine site;
- Mine Site Reclamation Policy for Nunavut (AANDC 2002);
- Mine Site Reclamation Guidelines for the Northwest Territories (AANDC 2007);
- Abandonment and Reclamation Policy for Inuit Owned Lands; and
- guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories issued by the MVLWB and AANDC (MVLWB/AANDC 2013).

The overall approach to closure and reclamation planning for the Project conforms to accepted practices for mine closure. Selected aspects of closure and reclamation planning completed for other mining operations in the Nunavut Territory have been reviewed and incorporated, where applicable, in the development of this ICRP.

Table A-1 in Appendix A lists the known Federal and Territorial Acts and Regulations applicable to the ICRP. A list of existing authorizations for Meadowbank Mine and the Approved Project is found in Table A-2 in Appendix A. Table A-3 in Appendix A outlines the list of primary approval requirements for the Project that Agnico Eagle has identified to date which are also relevant to this ICRP.

## 2.8 Related Management Plans

This ICRP should be read in conjunction with the following key plans:

- Whale Tail Pit – Landfill Design and Management Plan (Appendix G.4; Agnico Eagle 2019a);
- Whale Tail Pit – Haul Road Management Plan (Appendix G.6; Agnico Eagle 2019a);
- Landfarm Design and Management Plan (Appendix G.7; Agnico Eagle 2019a);
- Whale Tail Pit – Water Management Plan (Amendment; Agnico Eagle 2019b);
- Whale Tail Pit – Waste Rock Management Plan (Appendix G.1; Agnico Eagle 2019c); and
- Conceptual Whale Tail Pit Offsetting Plan (Appendix G.16; Agnico Eagle 2019a).

An updated Meadowbank Tailings Management Plan will be provided to NWB in accordance with the existing water licence.

### 3.0 SECTION 3 • ENVIRONMENT

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For a comprehensive summary of environmental conditions applicable to the Expansion Project refer to the FEIS Addendum Volumes 4 to 7 (Agnico Eagle 2018a). A summary of the pre-disturbance conditions of the Project in relation to the Expansion Project is presented in the following sections.

#### 3.1 Atmospheric Environment

##### 3.1.1 Climatic Conditions

Climatic conditions for the Expansion Project are consistent with the Approved Project given the expansion is at the same location as the Approved Project. Refer to the FEIS Addendum Volume 4 (Agnico Eagle 2018a).

Based on years with complete records, the mean annual temperature at the site is about -11.3 °C. According to Boyd (1973), the freezing index in the area was about 5600 °C-days.

##### 3.1.2 Climate Change

Climate change characteristics for the Expansion Project are consistent with the Approved Project given the expansion is at the same location as the Approved Project. Environment and Climate Change Canada (CanRCM4 climate model) predicts that the mean annual temperature will increase about 4°C to 5°C by 2085 due to climate change. The current mean annual temperature is -11.3 °C; therefore, continuous permafrost will persist in the region around the Whale Tail site notwithstanding the predicted increase. The depth of the active zone is expected to increase. Refer to FEIS Addendum Volume 4 (Agnico Eagle 2018a).

##### 3.1.3 Air Quality

Air quality characteristics for the Expansion Project are consistent with the Approved Project given the Expansion Project is at the same location and spatial boundary on regional air quality as the Approved Project. Refer to FEIS Addendum Volume 4 (Agnico Eagle 2018a).

##### 3.1.4 Noise

Noise and vibration characteristics for the Expansion Project are consistent with the Approved Project given the expansion is at the same location as the Approved Project. Refer to FEIS Addendum Volume 4 (Agnico Eagle 2018a).

#### 3.2 Physical (Terrestrial) Environment

##### 3.2.1 Topography and Lake Bathymetry

The topographic conditions for the Expansion Project are consistent with the Approved Project.

The topography surrounding the Project is generally flat with local surface relief of up to 20 m. The low terrain of the area has resulted in a diffuse drainage pattern. High flows are observed during spring runoff, while low flows and dry stream channels are typical in late summer. Whale Tail Lake drains to the south via a network of low lying lakes.

Mean annual temperatures from the bottom of the lakes in Nunavut and North West Territories (that do not freeze in winter) are 4°C.

Regional lake ice characteristics were reviewed using the Canadian Ice Database. The closest reference to Whale Tail Lake is Baker Lake (120 km to the south), which records a mean maximum lake ice thickness of 2.25 m (data from 1957 to 1990). It is expected that the mean ice thickness over Whale Tail Lake is within this range.

### 3.2.2 Terrain and Soil

Terrain and soil conditions for the Expansion Project are consistent with the Approved Project given the expansion is at the same location as the Approved Project. Refer to FEIS Addendum Volume 5 (Agnico Eagle 2018a).

### 3.2.3 Geotechnical Characteristics

Geotechnical characteristics for the Approved Project area presented herein were extracted from the Amaruq Dikes Pre-Feasibility Study – Geotechnical Investigation Report (Agnico Eagle 2015c), the Geotechnical and Water Management Infrastructure Report (SNC 2015) and the Geochemistry report (Golder 2016). A geotechnical site investigation program was carried out in May 2015 in the areas of the proposed alignment for the Whale Tail Dike and the Mammoth Dike.

A total of 14 geotechnical boreholes were drilled. Of these, eleven were in the Whale Tail Dike area, and these holes were drilled from the ice on Whale Tail Lake. The other three boreholes were located in the Mammoth Dike area. Three thermistors were installed (i.e., two on Whale Tail Dike area and one on Mammoth Dike area) during the site investigation program.

The results from the geotechnical investigation revealed that the bedrock is encountered at shallow depth along the proposed alignment of both structures. An esker at the west abutment of the Whale Tail Dike has been identified.

The underlying overburden material encountered a till deposit underlain by bedrock in most of boreholes. The till deposit consisted mainly of a sand and gravel some silt matrix, with cobbles and boulders. The till thickness ranged between 0.4 m and 3.7 m. The bedrock was encountered at depths between 1.9 m and 6.6 m under Whale Tail Lake.

Knight Piesold completed a geomechanical site investigation program and prefeasibility open pit slope design for the IVR deposit (Knight Piesold 2017). The geomechanical site investigation included six oriented drillholes at the IVR deposit, one oriented drillhole at the Whale Tail deposit and thermistors installations in two of the drillholes. The overburden layer in the vicinity of the IVR Pit is generally expected to be thin, with observed thicknesses typically less than 10 m.

Overburden in the Project area is expected to be similar to that of the Meadowbank Mine. At the Meadowbank Mine, overburden consists of glacial till having an average thickness of 2.75 m, with local deposits over 10 m thick (CRL, 2003). The glacial till varies from silty sand to gravel with minor boulders (Golder 2002). In a previous report (Golder 2005), overburden is described as silty to sand-sized with 25 to 50% pebble to boulder-sized particles. Where sampled at Whale Tail Pit (in July), the overburden was frozen below 1 metre depth, and samples were collected in the surficial unfrozen zone only.

### 3.2.4 Permafrost

The Terrain, Permafrost, and Soils Baseline Report for the Whale Tail Pit Project (Approved Project Volume 5, Appendix 5-A; Agnico Eagle 2016b) describes the existing terrain, permafrost, and soils conditions in the Project area, including methods used to collect baseline data and to generate terrain and soil data and maps required to support the assessment of Project effects. Subsequent work was completed by Golder (2017, 2018a).

The Project site is located within a region of continuous permafrost. Permafrost refers to subsurface soil or rock where temperatures remain at or below 0°C for at least two consecutive years. This is synonymous with perennally cryotic ground, which may be frozen, partially frozen, or non-frozen depending on the ice/water content of the ground, and the salinity of

the groundwater. The base of the permafrost is expected to be an undulating surface and the actual depth to permafrost is variable.

The land surface of the Project is underlain by permafrost except under the Whale Tail Lake where water is too deep to freeze to the bottom during winter. Taliks (areas of unfrozen ground) are expected beneath a water body where the water depth is greater than the ice thickness. Closed talik formations show a depression in the permafrost table below relatively shallower and smaller lakes. Open talik formations that penetrate through the permafrost and connect the lake waterbody with the sub-permafrost regime are to be expected for relatively deeper and larger lakes in the Project area.

Golder has carried out thermistor data review and numerical modelling of the lake talik formations for the Whale Tail Lake area (Golder 2019d). Based on the latest thermistor data available, the permafrost characteristics in the Project area are summarized below:

- The depth of permafrost in the Project site is estimated to be between 452 m and 522 m based on thermal gradients and ground temperatures at the lowest portions of the thermistor strings.
- The estimated depth of zero amplitude from the temperature profiles ranges from 18 m to 35 m.
- The temperatures at the depths of zero amplitude are in the range of -3.1 °C to -8.6 °C for on land thermistors.
- Temperatures in depth at the locations of the thermistors' tip vary between -0.35 °C and -3 °C.
- The geothermal gradient estimated based on the lowest 70 to 100 m of the thermistor strings is in the range of 0.004 °C/m to 0.052 °C/m.

The results of numerical modelling thermal assessment indicate that:

- Under the northern portion of the lake along the proposed ramp area, there is likely a closed talik formation.
- Open talik formations are probable in the southern portion of the lake where the Whale Tail Lake becomes wider.
- Permafrost depth between 480 m and 550 m for ground away from the Whale Tail Lake, and between 350 m and 450 m below surface in portions beneath the Whale Tail Lake.

The thermal model indicated that the lower 25 to 50 m of the proposed exploration ramp alignment in the northern portion of the lake may be in unfrozen ground. This range might be extended depending on salinity levels in the water that will result in depression of the water freezing point. A depression of the freezing point of about 0.2 °C (i.e., water freezing at temperature of -0.2°C instead of 0 °C) would result in about an additional 20 to 35 m of the ramp being subject to groundwater inflow based on predictions of the extent of the cryopeg zone.

The minimum ground temperature measured by thermistor below the closed talik portion in the Whale Tail Lake is about -1°C, while ground temperature at the tip of the thermistor is -0.35°C. The increasing salinity levels will cause the freezing point of water to depress; the higher the salinity the greater the extent groundwater can flow through frozen ground. An estimation based on Andersland O.B. (2004) shows that groundwater salinity would need to be about 1.8% for the freezing point to depress to -1°C, in which condition water could potentially flow through frozen ground beneath the Whale Tail Lake and into the ramp. The average water salinity is currently estimated as 0.37% with a freezing point depression of -0.21°C, suggesting that water would not flow through the closed talik under the Whale Tail Lake at current salinity conditions. Nevertheless, close monitoring of groundwater salinity levels during operation will be required to assess the extent of groundwater flow.

The thermistors installed within the proposed footprint of the IVR Pit, which will have an ultimate base elevation of 46 masl, show that the permafrost limits will be below the base of the IVR Pit.

Based on the thermal model results and thermistor data, it is interpreted that the ultimate base of the Whale Tail open pit (i.e., -129 masl) is expected to be within the permafrost regime, and the upper portion in the talik zone beneath the lake.

There currently are no deep thermistors installed in the south portion of the Whale Tail Lake, where the existence of open or closed talik is uncertain.

### 3.2.5 Hydrology

Hydrology characteristics for the Project presented herein are based on the Hydrology Baseline Study for the Approved Project (Refer to Volume 6 of the Approved FEIS (Agnico Eagle 2016b) and FEIS Addendum (Agnico Eagle 2018a). The Hydrology Baseline Study included characterization of local watersheds and drainage patterns, flow regimes, and lake shoreline and outlet channel geomorphology, based on a desktop review of available data and five field visits in May (during frozen conditions), June, July, August, and in September 2015 (Approved Project FEIS Volume 6, Appendix 6-C; Agnico Eagle 2016b). Subsequent work was completed in 2016 (FEIS Addendum Volume 6, Appendix 6-C; Agnico Eagle 2018a).

The Project site, including the haul road, is located within the Meadowbank River, Quoich River, and Thelon River watersheds. Four distinct watersheds within the Freshwater Environment local study area were defined as (Figure 3.2-1):

- the A watershed (i.e., where Whale Tail and Mammoth Lake are located) with a total drainage area of 110 km<sup>2</sup>,
- the B watershed (i.e., located just north of the A watershed, and west of Nemo Lake) with a total drainage area of 7.1 km<sup>2</sup>,
- the C watershed (i.e., where Nemo lake is located) with a total drainage area of 17.6 km<sup>2</sup>, and
- the D watershed (i.e., the watershed located immediately south of the A watershed) with a total drainage area of 110.6 km<sup>2</sup>. The D watershed is a sub-watershed of the Thelon River watershed. The D watershed was added to the Project to account for potential effects from the proposed alternate discharge location (adaptive management).

The proposed Mine Site is located within the A watershed and Lake A16 (i.e., Mammoth Lake) and the water management activities are planned in the A watershed, and the C watershed. Watersheds A, B and C each drain into Lake DS1, which drains north to the Meadowbank River (Figure 3.2-1). These watersheds comprise an extensive network of lakes, ponds, and interconnecting streams, and have lake water surface fractions (i.e., the ratio of lake surface area to watershed area) of 16% (A watershed) and 23% (C watershed).

Two types of hydrometric stations were installed in 2015, including six continuous hydrometric stations equipped with data loggers and 16 manual hydrometric stations, primarily reliant on discrete discharge and water level measurements and visual observations.

Derived mean annual water yields for lakes varied between 86 mm (i.e., Lake C38 – Nemo Lake) and 230 mm (Lake A69). The lower water yields at Lake C38 may be attributed to proportions of ineffective areas in the watersheds and the potential for shallow subsurface flow to convey water outside the assumed drainage boundaries.

The majority of the shorelines surveyed exhibit a consistent terrain type related to shorelines that have developed in morainal material. These morainal shorelines were observed at all lakes visited during the field survey. Limited areas of bedrock and shallow sloped sandy shorelines were also observed. As a general characteristic for the surveyed shorelines, the predominant materials are boulder gardens with cobbles with very limited soils or organic materials on top. The outlet channels are short relative to lake dimensions, with a low sinuosity and exhibit the same characteristics for streambed materials. This results in interstitial flow between large boulders or below the surface likely close to the bedrock, making low and moderate flows difficult to observe and measure.