FINAL

Core Receiving Environment Monitoring Program (CREMP): 2015 Plan Update – Whale Tail Pit Expansion Addendum_NWB

Prepared for:

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1. INTRODUCTION

Azimuth Consulting Group Partnership (Azimuth) was originally retained by Agnico Eagle Mines Limited (Agnico Eagle) in 2015 to update the core receiving environment monitoring program (CREMP) plan (Azimuth, 2015a) to include monitoring of the aquatic receiving environment for the Whale Tail Pit Project. The original addendum to the CREMP 2015 plan was updated in May 2018 to address conditions outlined in Nunavut Impact Review Board (NIRB) Project Certificate No .008 (the Approved Project) and the associated Nunavut Water Board (NWB) Type A Water Licence (2AM-WTP18262). Subsequent to Approval of the Project, Agnico Eagle proposed an expansion that includes development of a larger Whale Tail open pit, IVR Pit (and associated waste rock storage facility and attenuation pond) and an underground mining operation. These additions to the Approved Project, collectively termed the "Expansion Project", required an update of the CREMP for the Whale Tail Pit Project to align with the Addendum to the Final Environmental Impact Statement (Golder, 2018) submitted to the Nunavut Impact Review Board. This CREMP has been updated in May 2019 for the Expansion Project in support of the Nunavut Water Board (NWB) Type A Water License Amendment Process.

This updated addendum outlines aspects of the CREMP that are specific to the Whale Tail Pit Expansion Project and does not repeat what is already stated in the CREMP 2015 plan update for Meadowbank and Baker Lake (see Azimuth, 2015a).

2. WHALE TAIL PIT CREMP MONITORING

2.1. Overview

The Amaruq property is a 408 square kilometre (km^2) site located on Inuit Owned Land approximately 150 kilometres (km) north of the hamlet of Baker Lake and approximately 50 km northwest of Meadowbank Mine in the Kivalliq Region of Nunavut (**Figure 2–1**). The deposit will be mined as an open pit (i.e., Whale Tail Pit), and ore will be hauled to the approved infrastructure at Meadowbank Mine for milling. The aspects of water management plan in the Approved Project directly relevant for the Whale Tail Pit CREMP were not significantly altered to accommodate proposed changes in the Expansion Project. The Expansion will expand the footprint of the Project, generating water requiring management, treatment, and discharge during the operations phase, and will extend the duration of the closure phase to refill the pits and underground mine. Treated effluent will still be discharge to Mammoth Lake, and are proposed into Whale Tail Lake South basin, but alternate locations (Lake D1 and D5) are being considered as part of the Expansion. Details of the water management plan for the Expansion Project are provided in Golder (2018).

Baseline sampling was conducted between 2014 and 2017 (Azimuth, 2017) to support the FEIS (Agnico Eagle, 2016) and to characterize pre-mining "before" conditions for the development of a long-term receiving environment monitoring program consistent with the Meadowbank CREMP (Azimuth, 2016). On-going baseline sampling was completed in 2018 at the routine monitoring locations, as well as two additional areas identified as alternate discharge locations and potential long-term CREMP monitoring locations for the Expansion Project.

2.2. Study Design

The study design is based on a before-after-control-impact (BACI) approach, but has also incorporated the concept of gradients in exposure; the study design mirrors the approved Meadowbank Mine CREMP. Tracking spatial and temporal differences related to mining activities relied on categorizing areas using two factors:

- *Area Type* – this concept relates to an area's spatial proximity to the planned mine development (i.e., whether built or not); categories include near-field, mid-field, far-field, and reference (see **Section 2.2.2**).
- *Area Status* – this concept is temporal and has two levels: control (not exposed to mine-related activity) or impact (exposed to mine-related activity). The term "impact" is taken from the BACI statistical study design approach and does not mean that an actual impact has taken place; rather, it designates a time period when potential mine-related impacts may occur for an area (i.e., that an area has been exposed to one or more mining activities).

Together, area categorization by type and status provide a logical framework to facilitate the identification of real mining-related changes to the aquatic receiving environment (as opposed to natural regional changes due to climate or other factors). According to NIRB Project Certificate No .008, the objective of the CREMP is to monitor the freshwater environment, evaluate against FEIS predictions and inform mitigation measures specifically outlined in Condition 19 and 23. The CREMP is designed to include sufficient sampling and monitoring determine the short and long-term effects on the aquatic environment related to the site and to assess the impact predictions made in the Environmental Impact Statement for the Whale Tail Pit Project.

The onset of construction activities in proximity to a CREMP monitoring area formally end the baseline phase and changes the status of that area from "control" to "impact". Status changes are also important for any statistical analyses, as they dictate how data are grouped when assessing potential trends. The status of the Whale Tail Pit CREMP areas dating back to 2014 is provided in **Table 2–1**. Construction commenced in July 2018 with dike construction in Whale Tail Lake. All other stations remain in "control" status, given no construction activities were initiated that had the potential to impact water quality.

Table 2–1. Status of Whale Tail Pit and Meadowbank reference areas.

	Meadowbank Reference Areas		Routine Whale Tail Pit Monitoring Areas						Alternate Monitoring Areas	
	REF	REF	NF	NF	NF	MF	MF	FF	na	na
Year	INUG	PDL	WTS	MAM	NEM	A20	A76	DS1	D1	D5
2015	C	C	C	C	C					
2016	C	C	C	C	C	C	C	C		
2017	C	C	C	C	C	C	C	C		
2018	C	C	I (August)	C	C	C	C	C	C	C

Notes:
REF=reference (in grey shading); NF=near-field (in blue shading); MF=mid-field (in pink shading); FF=far-field (in teal shading)
Area designations: C=Control; I=Impact
Area IDs: INUG=Inuggugayualik Lake; PDL=Pipedream Lake; WTS=Whale Tail Lake South; MAM=Mammoth Lake; NEM=Nemo Lake
Blank denotes that the area was not part of the monitoring program that year
Alternate Monitoring Areas: LK1=Lake 1; LK5=Lake 5. These areas are not formally part of the long-term monitoring program (see text for details), but may be included in the Whale Tail Pit CREMP if an alternate discharge location is chosen for the Expansion Project.

2.2.1. Approach

The 2015 AEMP describes a two-tiered approach for decision criteria based on 'trigger' and 'threshold' level concentrations (Azimuth, 2015b). These are defined as:

- *Triggers* are early warning criteria that may lead to action. Exceedance of a trigger value does not necessarily imply that an adverse effect may be expected. The triggers may be based on absolute numbers (e.g., an increases half-way from baseline to an identified effects-based threshold) or statistical criteria (e.g., statistically significant difference from baseline-reference conditions; these are used in the absence of an effects-based threshold for a substance and may be very conservative).
- *Thresholds* are legal requirements, regulatory guidelines (e.g., CCME), or other discrete benchmarks, below which unacceptable adverse effects are not expected and above which adverse effects may occur. If effects-based thresholds do not exist or are not warranted for a particular variable, then early warning triggers (based on statistical criteria) will be developed without thresholds. In such cases, if triggers are exceeded then the implications of such exceedances can only be understood through the integration of results from other AEMP monitoring programs, or, if important information gaps still exist, through prescribed EEM studies or targeted studies.

Thus, comparison of the data to the early warning trigger values is the initial analytical focus; only if trigger values are exceeded are data then compared to the applicable thresholds (if available). Similar to what was done for the Meadowbank CREMP (Azimuth, 2012), area-specific trigger/threshold (as appropriate) values will be developed to support management of the Whale Tail Pit Study Area.

2.2.2. Sampling Areas

The core monitoring program is intended to detect changes at a basin or lake scale of inference and to help define the extent (both spatially and temporally) of any adverse effects identified and designed to meet NIRB Project Certificate No. 008 conditions 19 and 23. The CREMP for the Whale Tail Pit program will be comprised of 8 sampling areas (6 new monitoring areas and continued use of the two existing reference areas), each categorized into one of the four main types of areas described below. An overview of the Whale Tail Pit sampling areas is shown in **Figure 2–2**.

- Near-field (NF) areas – Near-field locations provide the first line of early-warning for introductions of stressors into the receiving environment. These areas are situated in close proximity to the development, in particular near dikes, dewatering discharge, and proposed effluent sources. As per NIRB PC No.008 condition 23, Agnico Eagle will conduct analysis to evaluate the potential impacts to freshwater ecosystem productivity and have designed NF stations in Mammoth Lake (**Figure 2–4**). As determined by academic researchers and DFO, further studies will leverage the CREMP data and as needed, collect additional biological data to evaluate productivity and change in trophic status in Mammoth Lake as outlined in the complementary measures (Agnico Eagle, 2018). The NF areas in the Whale Tail Pit Study Area include Whale Tail Lake South (**Figure 2–3**) and Mammoth Lake (**Figure 2–4**), due to their placement in relation to the planned development and in the watershed[1]. Nemo Lake (**Figure 2–5**) is also considered a NF area due to its proximity to Whale Tail and Mammoth Lakes even though it is located in an adjacent watershed. Nemo Lake is the source of drinking water for the exploration camp, and routine water quality monitoring is scheduled for this location. Additional CREMP sampling at Nemo Lake is proposed only in the event that increased parameter concentrations are observed in the routine drinking water quality monitoring samples.

[1] The north basin of Whale Tail Lake (WTN) was sampled in 2014 and 2015 to support the FEIS, but will not be part of the routine CREMP sampling plan as it lies within the pit footprint.

- Mid-field (MF) areas – This area designation includes two lakes: Lake A20 and Lake A76. Sampling at Lake A20 and A76 will be undertaken according to the strategy outlined in the CREMP 2015 plan update for MF areas (Azimuth, 2015a). In the case of Lake A20, the start of the "impact" monitoring period would coincide with back-flooding of Whale Tail Lake into Lake A20, and the diversion of water towards Mammoth Lake through the Northwest Channel. Lake A76 is situated at the junction of the two flow paths leading to Lake DS1. Given its morphology and location, it represents an ideal mid-field exposure area for both flow paths.
- Far-field (FF) area – The intent of this area (Lake DS1) is to monitor water and sediment quality downstream of project infrastructure to provide insights into the spatial extent of any effects observed at the near-field areas. Lake DS1 will be the key location that will ultimately determine whether or not contaminants are detectable downstream of the entire mine development (**Figure 2–2**)[2]. Beyond the baseline period, the sampling strategy for Lake DS1 will follow the same approach for FF stations outlined in the CREMP 2015 plan update (Azimuth, 2015a).
- Reference (Ref) areas – By definition, reference areas are sufficiently removed from mine activities that they are presumed to be unaffected by any infrastructure and point sources (e.g. aerial deposition and effluent) associated with mine development and activities. Inuggugayualik Lake (INUG) and Pipedream Lake (PDL) are external reference areas chosen for the purposes of making comparisons with the Meadowbank project lakes (EVS, 1999; BAER, 2005). INUG has been the core reference area since formal monitoring began in 2006. PDL was added to the Meadowbank CREMP in 2009. In relation to the Whale Tail Pit Study Area, INUG is located about 41 km southeast of the Whale Tail Pit Study Area, while PDL is located 40 km to the southeast (**Figure 2–1**). Pipedream Lake is located northeast of INUG, and the exploration access road runs along the northeast shore of this lake. INUG and PDL satisfied the requirements of an external reference lake for the Meadowbank CREMP from a physical/chemical perspective because they are at similar latitude, have similar geology, relief and climate, do not have any significant inflows and has generally similar limnology, water chemistry and aquatic biological community structure to the project lakes (BAER, 2005). It should be noted that their proximity to the proposed access road may lead to dust deposition into each of the lakes under certain conditions. However, both lakes are quite large and the sampling locations for each are away from the road (i.e., approximately 2 km for PDL and 10 km for INUG), so while road-related trends will be tracked they are not anticipated.
- Alternate CREMP areas – Lake D1 and Lake D5 were identified as potential alternate discharge locations and were added to the baseline sampling program in August 2018. Additional baseline data collection is planned for 2019 to provide a better understanding of the temporal variability in water quality and biological communities in each lake; however, long-term monitoring will not be undertaken unless there is actual discharge of treated water at either location.

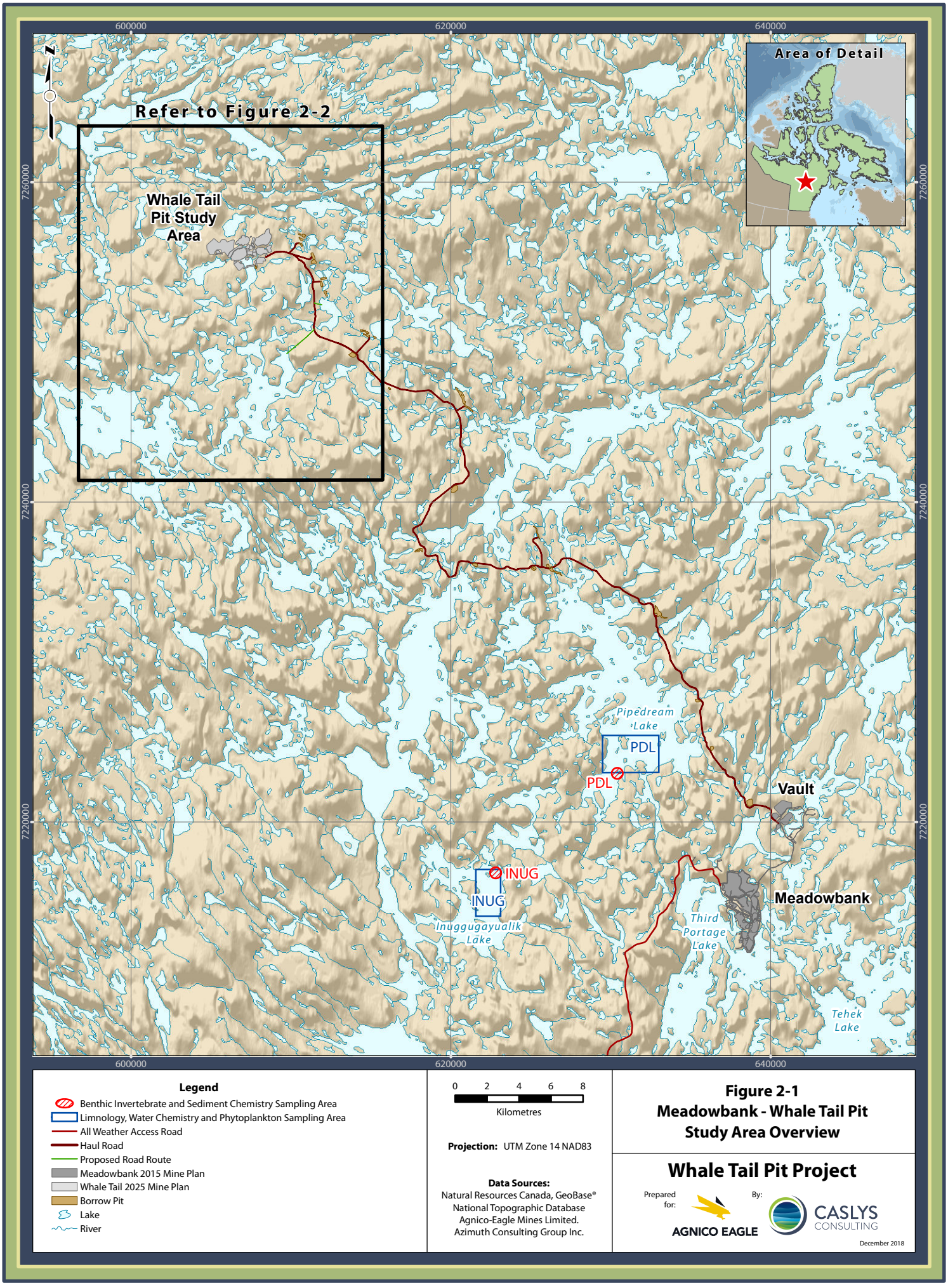
[2] According to Golder (2016), the downstream flow of water splits into two paths. Downstream path 1 follows Lake A12 (immediately south of Lake A76) to Lake A76 and then flows west to the southern tip of Lake DS1. Downstream path 2 flows north from Lake A76 and A11 (east of Lake 76) through a series of small lakes and eventually enters Lake DS1 along the east shore (approximately 2/3 of the way up the bounded area shown on **Figure 2–2**). At present, Lake DS1 is shown as a single station; however, the area may be split into two stations to monitor the contribution of each flow paths.

2.2.3. Sampling Components

As described in the CREMP 2015 plan update (Azimuth, 2015a), CREMP monitoring includes the following components, which apply to Whale Tail Pit Study Area lakes: limnology, water chemistry, sediment chemistry, phytoplankton, and benthic invertebrates.

2.2.4. Sampling Effort and Frequency

As described in the 2015 CREMP plan update (Azimuth, 2015a), CREMP sampling effort (i.e., number of replicates per event) and frequency (i.e., number of events per year) follows the recommendations from the CREMP Design Document 2012 (Azimuth, 2012). NWB interveners were consulted over several years during the re-design of the CREMP that was resubmitted following the Type A renewal in 2015 and subsequently approved by regulators. CREMP sampling at Whale Tail Pit Study Area will follow the same level of effort and frequency by area type; refer to Azimuth (2015a) for details on the decision-making strategy for initiating sampling at the MF and FF stations.


600000
620000
640000
7260000
7240000
7220000
Refer to Figure 2-2
Whale Tail Pit Study Area
Area of Detail
Pipedream Lake
PDL
PDL
Vault
INUG
INUG
Inuggugayualik Lake
Meadowbank
Third Portage Lake
Tehek Lake
Legend
Benthic Invertebrate and Sediment Chemistry Sampling Area
Limnology, Water Chemistry and Phytoplankton Sampling Area
All Weather Access Road
Haul Road
Proposed Road Route
Meadowbank 2015 Mine Plan
Whale Tail 2025 Mine Plan
Borrow Pit
Lake
River
0 2 4 6 8
Kilometres
Projection: UTM Zone 14 NAD83
Data Sources:
Natural Resources Canada, GeoBase®
National Topographic Database
Agnico-Eagle Mines Limited.
Azimuth Consulting Group Inc.
Figure 2-1
Meadowbank - Whale Tail Pit
Study Area Overview
Whale Tail Pit Project
Prepared for:
AGNICO EAGLE
By:
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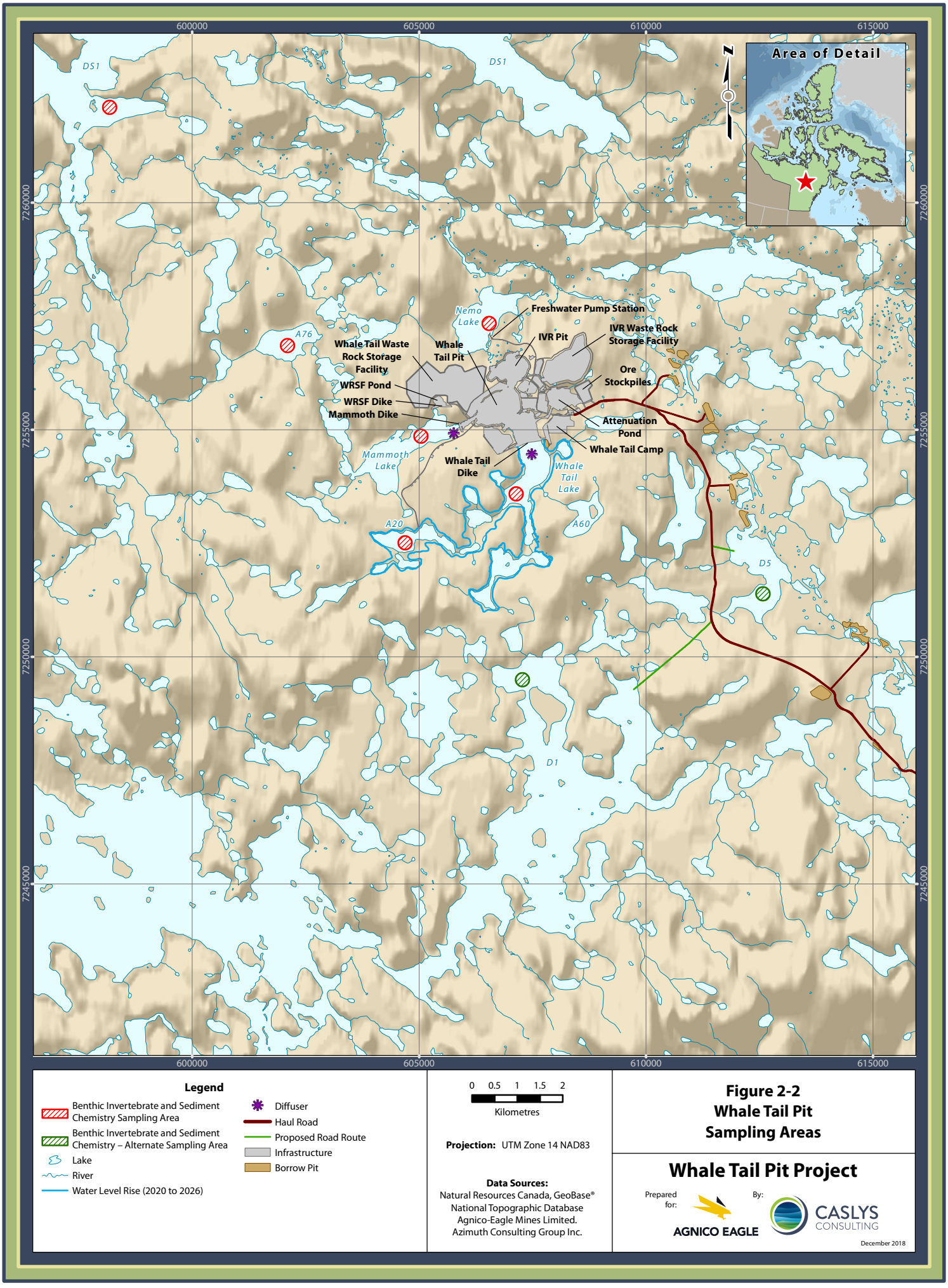
December 2018



Legend

- Benthic Invertebrate and Sediment Chemistry Sampling Area
- Benthic Invertebrate and Sediment Chemistry – Alternate Sampling Area
- Lake
- River
- Water Level Rise (2020 to 2026)
- Diffuser
- Haul Road
- Proposed Road Route
- Infrastructure
- Borrow Pit

0 0.5 1 1.5 2

Kilometres

Projection: UTM Zone 14 NAD83

Data Sources:
Natural Resources Canada, GeoBase®
National Topographic Database
Agnico-Eagle Mines Limited.
Azimuth Consulting Group Inc.

Figure 2-2
Whale Tail Pit
Sampling Areas

Whale Tail Pit Project

Prepared for: AGNICO EAGLE

By: CASLYS CONSULTING

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