



TECHNICAL MEMORANDUM

To: Department of Fisheries and Ocean (DFO)

Cc: Amaruq Permitting team

From: Pier-Eric McDonald, Patrice Gagnon

Date: Friday, June 15, 2018

Subject: Blasting Activities – Whale Tail Dike construction

1. Introduction

After the reception of Licence A, Agnico Eagle (AEM) plans to build the Whale Tail Dike that will allow for the mining of the Whale Tail pit. One of the construction activities consists of drill & blasting (D&B) the East and West abutments of the Whale Tail dike. Those abutments are located on the shoreline of Whale Tail Lake and this activity is critical for assuring the performance of the dike. Since this activity is close to a water body, AEM aims to comply with the DFO's Guidelines for Use of Explosives in or Near Canadian Fisheries Waters. This memo presents the proposed monitoring and mitigation measures in order to respect the above guidelines that are summarized in section 3.

2. Description of Blasting Activities

Drill and Blast of the Whale Tail Dike abutment is required as per the Design to minimize the risk of deformation of cut-off wall of the structure due to thaw settlement. Following the dike construction, thawing of the abutment is expected due the rise of the Whale Tail lake level which will change the thermal regime of the foundation. Removing the ice-rich till material and unsuitable foundation material under the cut-off wall on the abutments will remove this risk by ensuring that the cut-off of the dike is on a foundation not prone to thaw settlement. Due to the expected thickness of frozen material to remove, blasting is required for this activity. Drill and blast will be undertaken on each abutment and near the lake shore while respecting the distance allowed per the DFO's guideline. The blasting activities are planned to occur in the months of July to August 2018. The extent of the blasting area for both abutments are presented in Appendix A. These extents might change due to field observations and design adjustments.

3. Review of existing DFO guidelines

AEM intends to comply with the nine (9) guidelines of the document "Guidelines for Use of Explosives in or Near Canadian Fisheries Waters" summarize below:

1. Proponents considering the use of explosives are encouraged to consult the appropriate DFO Regional/Area authorities (Appendix I) as early as possible in their planning process to identify possible alternatives to the use of explosives, the biological resources and their habitats at risk, and/or effective mitigation measures.

2. Where provincial or territorial resource management agencies, or aboriginal resource management boards undertake the administration of fisheries, the proponent is encouraged to consult with the relevant authorities.

3. *The use of confined or, in particular, unconfined explosives in or near Canadian fisheries waters is discouraged, and proponents are encouraged to utilize other potentially less destructive methods wherever possible.*

4. *No use of ammonium nitrate-fuel oil mixtures occurs in or near water due to the production of toxic by-products (ammonia).*

5. *After loading a charge in a hole, the hole is to be back-filled (stemmed) with angular gravel to the level of the substrate/water interface or the hole collapsed to confine the force of the explosion to the formation being fractured. The angular gravel is to have a particle size of approximately 1/12th the diameter of the borehole.*

6. *All "shock-tubes" and detonation wires are to be recovered and removed after each blast.*

7. *No explosive is to be knowingly detonated within 500 m of any marine mammal (or no visual contact from an observer using 7x35-power binocular).*

8. *No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e., overpressure) greater than 100 kPa (14.5 psi) in the swimbladder of a fish.*

9. *No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than 13 mm•s⁻¹ in a spawning bed during the period of egg incubation.*

4. Proposed Monitoring Plan

AEM is committed to monitor blast vibrations with Instantel seismograph monitoring devices to be installed as indicated by the manufacturer at the same location every blast. Note that 2 stations per abutment are suggested depending on which side of the centerline the blast are occurring. Those locations are to be in a representative area on the shoreline and outside the footprint of dike construction. Refer to appendix A for proposed locations of STA-W1, STA-W2, STA-E1 and STA-E2. Such practices are consistent with the current application of the license at Meadowbank.

After each blast, the recorded values shall be analyzed and documented by competent personnel and adjustments on the next blasting sequences shall be brought forward should the vibration limits exceed the guidelines presented in section 3.

5. Potential mitigation measures

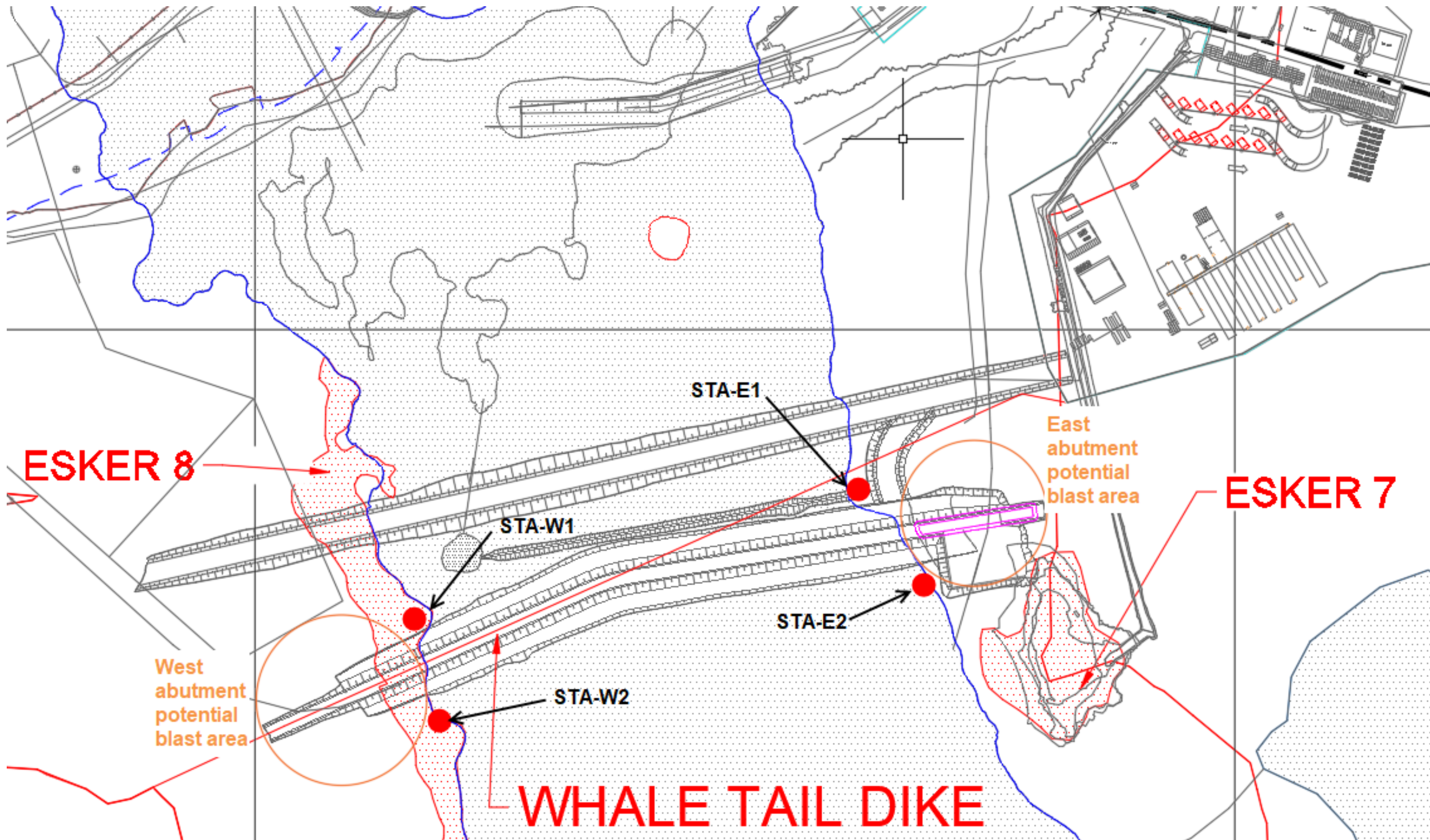
AEM has identified a handful of potential mitigation measures that could be applied in Drill & Blast practices in order to comply with the above mentioned DFO guidelines. Those are developed from a combination of literature and past experiences at Meadowbank that have proven to be successful, namely:

- This document will be reviewed by all parties involved in the D&B activities ;
- Drill on small diameters hole as low as 3" to limit vibrations ;
- The explosive charge in each hole (powder factor) shall be reduced to the minimum judged practical in the design phase of the blast ;

- Number of holes blasting per delay shall be reduced to a minimum as much as practical in the tying plan produced by the D&B engineer to limit vibrations ;
- The blasting area will be broken down to small blast patterns to be blasted in a sequential manner.
- The blaster will perform a visual inspection of the area around the blast after each blast and remove any shock tubes or detonators close to the shoreline. If visual inspection reseals blasting accessories in the water, the blaster will advice the Geotechnical engineer so that the material is removed by boat via appropriate procedures ;
- Every hole will be backfilled with angular gravel as per current AEM practices ;
- The explosive used will be emulsion which is not water soluble.
- In the event where projections are judged problematic, blasting mats or geotextile could be applied over the whole blasting sequence with an appropriate amount of aggregates over it in such a way that the energy is kept in the rock mass as opposed to sending projections and deleterious blasting material in the air.

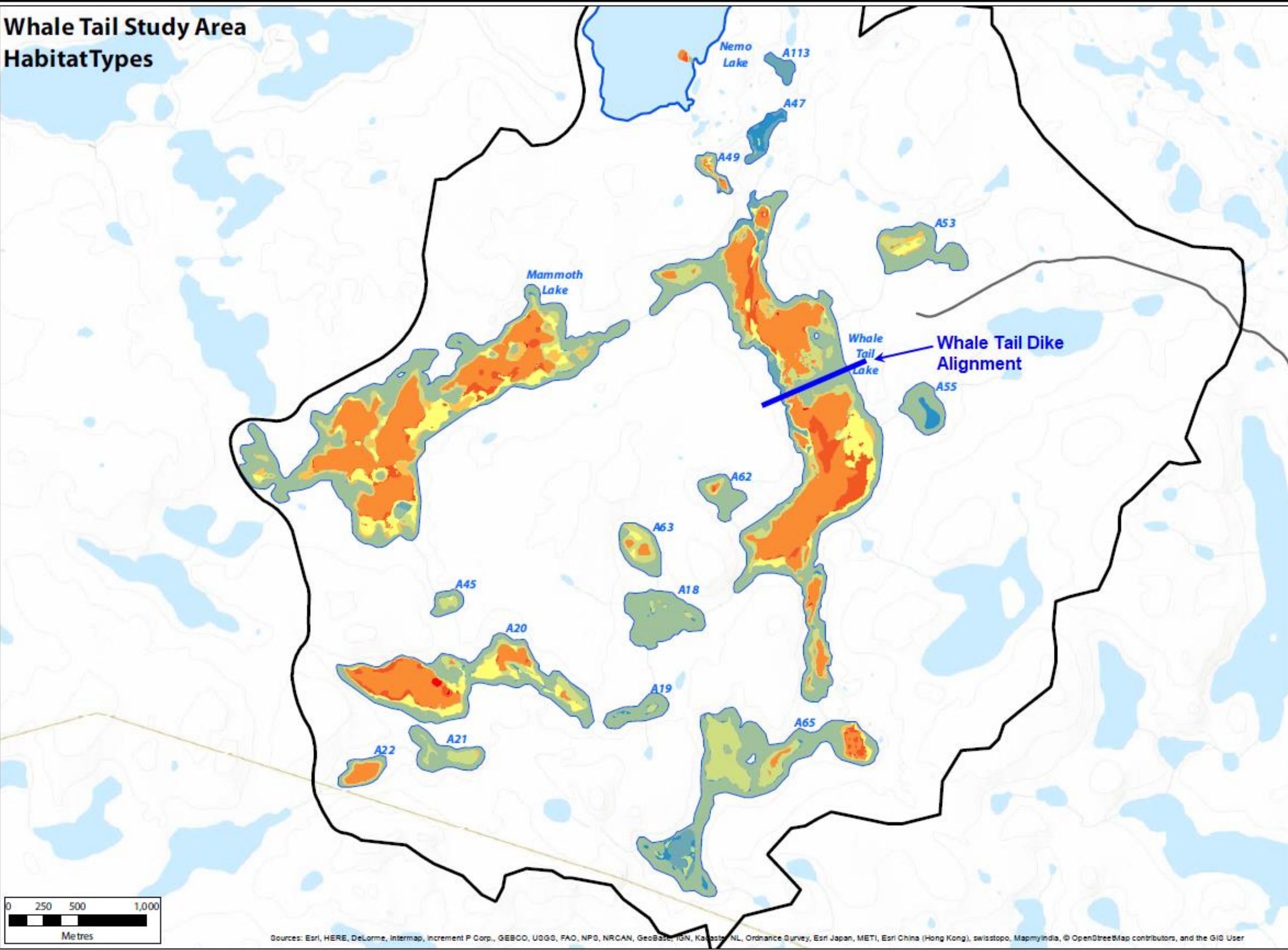
Additionally, AEM's D&B engineers have performed calculations as presented in Appendix II & III of the DFO's guidelines document to find the maximum setback distance from the shoreline to avoid a pressure on fish bladders exceeding 100kpa as per criteria number 8 and to have vibrations limit not exceeding 13 mm*s⁻¹ in spawning beds for criteria number 9. Furthermore, appendix B below presents the fish habitats type and it can be seen that the Whale Tail Dike's alignment and proposed blasting areas on the East and West abutments are in a low risk zone and more than 100m away from the critical areas. Nevertheless, AEM is committed to respect the criteria directed by DFO's Guidelines for Use of Explosives in or Near Canadian Fisheries Waters.

APPENDIX A – Proposed Blast Monitoring Stations



APPENDIX B – Fish Habitats Types

Whale Tail Study Area
Habitat Types



Legend

- Proposed Haul Road (AEM, Nov. 2015)
- Whale Tail Study Area
- Study Lake
- Freshwater Jetty

Habitat Type

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

Habitat Type	Criteria	
	Depth Zone	Substrate
1	<2 m	Fines
2	<2 m	Mixed
3	<2 m	Coarse
4	2-4 m	Fines
5	2-4 m	Mixed
6	2-4 m	Coarse
7	> 4 m	Fines
8	> 4 m	Mixed
9	> 4 m	Coarse

Whale Tail Habitat Types
Pre-Construction



PROJECT: DA14-053-07	
CLIENT: Agnico-Eagle Mines Ltd., Meadowbank Div.	
	DATE: APRIL 2016
	SCALE: 1:26,000
	DRAWN BY: LC
	CHECKED BY: C. Poit

FIGURE: 3.7

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