



MEMORANDUM

TO Ryan Vanengen, Agnico Eagle Mines Ltd.

DATE April 18, 2017

CC Dionne Filiatrault, Jen Range, Damian Panayi

FROM Corey De La Mare, P.Biol.

PROJECT No. Doc 110-1658927.3200_Rev0

WHALE TAIL VIEWSHED ANALYSIS

Introduction

During the development and revisions of the Terrestrial Ecosystem Management Plan (TEMP) for the Whale Tail Project (the Project), which is an expansion of the existing Meadowbank Mine, several discussions revolved around caribou detection within and around the mine site and these observations triggering mitigation actions. It became apparent that although caribou are regularly observed from roadside surveys along the existing Meadowbank All Weather Access Road (AWAR), the sightability limit (i.e., maximum distance at which caribou could be observed based on topography) is largely unknown. This sightability distance is required to understand how much time Agnico Eagle Mines Limited (Agnico Eagle) may have to respond to caribou encountering the Project based on receiving GPS collar data and the lag time between receiving that data and caribou approaching the Project. The notion is that a greater distance of visible detection will allow for better caribou mitigation preparedness by Agnico Eagle.

The proposed Whale Tail haul road is a 65 km all weather haul road between the existing Meadowbank Operations (i.e., Vault Pit) and Whale Tail Pit. As part of the caribou monitoring component for this haul road, five height of land (HOL) survey locations are proposed in areas where caribou have been observed based on collar data, presence of caribou trails, caribou sign, and where topographic relief is greatest. The main methods for collecting caribou observation data are through roadside surveys along the existing Meadowbank AWAR and the proposed Whale Tail haul road, and at the five HOL survey locations.

To determine the extent of visibility from these locations, a viewshed analysis was completed within a GIS platform.

Methods

The viewshed analysis is simply a line of sight based evaluation from elevations within the landscape, the observer height and the height of the target, in this case caribou. Visual aids, such as binoculars and spotting scopes, aid the observer to see at the extreme ends of the lines of sight so that caribou can be detected but the line of sight is not changed based on visual aids. The following assumptions were included in this viewshed analysis:

- An observer height of 2.0 m was added to each of the height of land locations.
- A surface offset to simulate the height of caribou was added at 1.5 m.
- The observer height is set as: 2 m for the points and 1 m (default value) for the road; however, for the Whale Tail haul road the proposed road elevations based on the CAD profile was used.

The viewshed was required for the Regional Study Area; however, the availability of datasets was not consistent for the entire Regional Study Area in terms of data format and data resolution. Consequently, the datasets used and methods for harmonization are as follows:



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- Road centerlines: Whale Tail haul road centerline and elevations (profile) provided by CAD, all weather road centerline generated semi-automatically using its footprint and linking its northern extremity to the Whale Tail haul road.
- 2016 HOL survey locations are only general and may have a high error range in their location precision, more specific coordinates will be acquired in 2017.
- Digital Elevation Model (DEM) for the haul road and the HOL survey points used a high resolution DEM that may have originated from LiDAR but the source is currently unknown. The DEM was down-sampled to 3 m resolution and merged with CDEM that has a 20 m resolution and then re-sampled back to 3 m resolution, but this is only to keep the 3 m precision where it exists and it does not make the CDEM more precise. Using a merging process avoiding edge effects and creates a smooth transition from one DEM source to the other.
- The high resolution DEM only covers the haul road (approximately 500 m on each side) and a large portion of the Whale Tail Pit and development area.
- For the AWAR, no high resolution DEM coverage exists, consequently we only used the CDEM (20 m resolution) for this.

The viewshed analysis was run on an ESRI ArcGIS 10.4.1 platform using the 3D analyst tool – Viewshed. The visibility analysis does not take into account any potential vegetation or any other obstructions (natural/human) that are not part of the bare ground. A viewshed was developed for the existing Meadowbank AWAR, the proposed Whale Tail haul road, and the five HOL survey locations.

Results

The results of the viewshed analysis can be found in Figures 1 to 3, which each show the viewshed from the five HOL survey locations (Figure 1), the proposed Whale Tail haul road (Figure 2), and the existing Meadowbank AWAR (Figure 3). All three figures illustrate that with the naked eye, the sightlines from all three sources (HOL, Whale Tail haul road, AWAR) range from less than 1 km to greater than 8 km with a range of 3 to 5 km in several different directions from each location. When HOL locations are combined with the Whale Tail haul road as a point of observation, the visibility in general for all locations is around 5 km, with several vantage points of greater than 5 km.

Closure

We trust this meets your needs, if you have any questions or concerns, feel free to contact the undersigned.

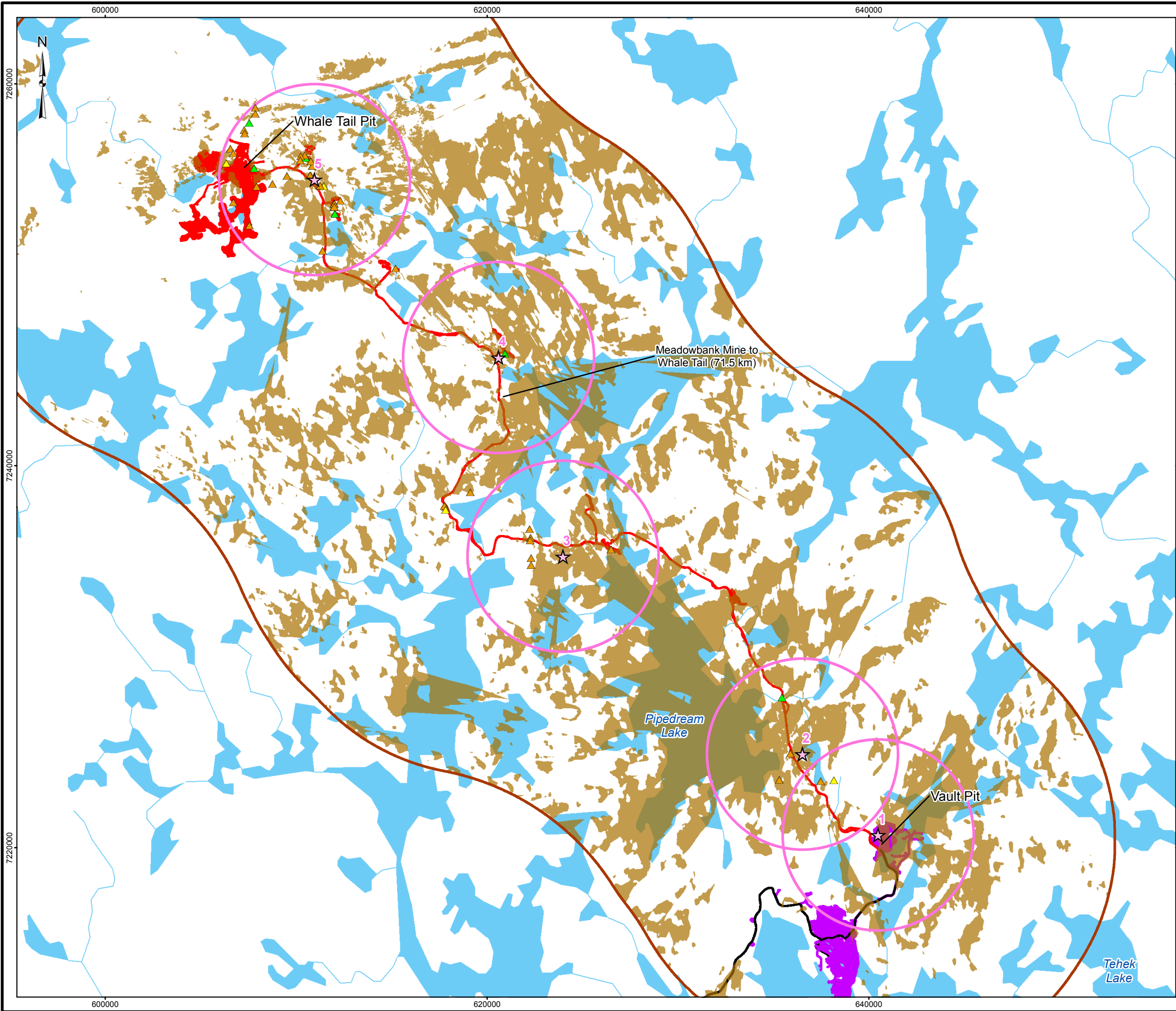
Regards,

GOLDER ASSOCIATES LTD.

Corey De La Mare, P.Biol.
Principal, Senior Wildlife Ecologist

https://capws.golder.com/sites/1658927RegulatoryAffairs/p3100_TEMP_and_Workshops/Viewshed_Memo/Doc 110-1658927_WhaleTail_Viewshed_Analysis_Rev0.docx

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LEGEND

- ☆ 2016 HEIGHT OF LAND SURVEY POINT (D&A, JULY 2016)
- 2016 HEIGHT OF LAND SURVEY POINT 5 KILOMETRE BUFFER
- VISIBILITY ANALYSIS AREA
- AREA VISIBLE FROM 2016 HEIGHT OF LAND SURVEY POINTS

BARREN-GROUND CARIBOU²

- ▲ SIGN
- ▲ OBSERVATION
- ▲ CARIBOU TRAIL
- ALL WEATHER ROAD
- PROPOSED HAUL ROAD
- MEADOWBANK OPERATION AND INFRASTRUCTURE
- WHALE TAIL PIT
- WATERCOURSE
- WATERBODY

DRAFT

REFERENCE

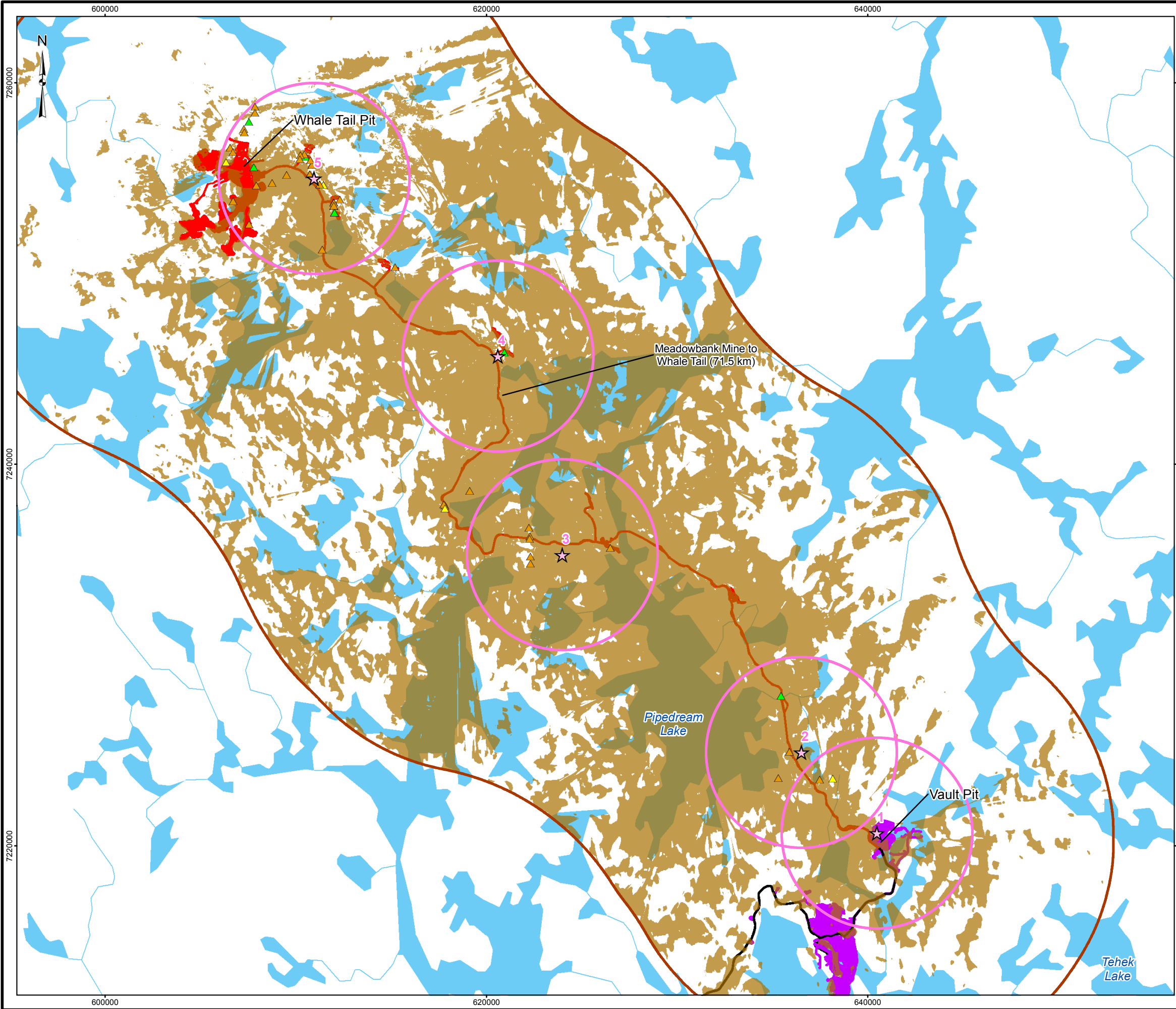
1. HAUL ROAD OBTAINED FROM AGNICO EAGLE MINES LIMITED. 2015-10-14 FROM 6103-117-230-200_R0.dwg
2. 2015/16 BARREN-GROUND CARIBOU OBSERVATIONS FROM THE GROUND RECONNAISSANCE SURVEYS, WATERBIRD NEST SURVEYS, BREEDING BIRD ROAD TRANSECT SURVEYS & HEIGHT-OF-LAND SURVEYS.
3. WATERCOURSE AND WATERBODY DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
4. INSET MAP DATA OBTAINED FROM ESRI.

DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

PROJECT		AGNICO EAGLE		AGNICO EAGLE MINES LIMITED: MEADOWBANK DIVISION WHALE TAIL PIT PROJECT	
TITLE		VIEWSHED FROM HEIGHT OF LAND LOCATIONS			
	PROJECT	1658927		FILE No.	
	DESIGN	CDM	6 Apr. 2017	SCALE AS SHOWN	REV. A
	GIS	SB	13 Apr. 2017		
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FIGURE 1

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LEGEND

- ☆ 2016 HEIGHT OF LAND SURVEY POINT (D&A, JULY 2016)
- 2016 HEIGHT OF LAND SURVEY POINT 5 KILOMETRE BUFFER
- ▭ VISIBILITY ANALYSIS AREA
- ▭ AREA VISIBLE FROM PROPOSED HAUL ROAD

BARREN-GROUND CARIBOU²

- ▲ SIGN
- ▲ OBSERVATION
- ▲ CARIBOU TRAIL

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

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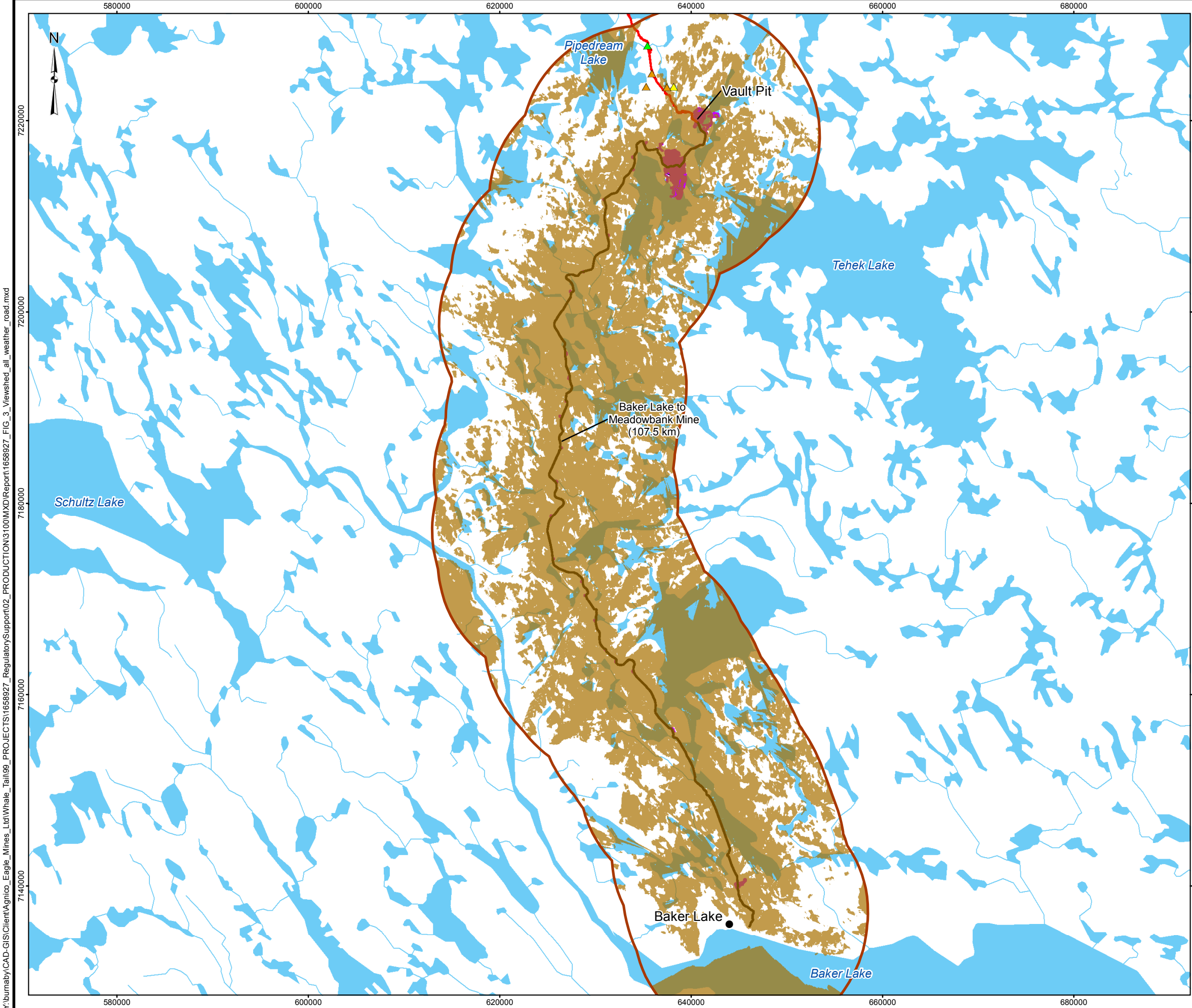
AGNICO EAGLE

**AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT**

TITLE
VIEWSHED FROM PROPOSED HAUL ROAD

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GIS		SB	13 Apr. 2017	
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FIGURE 2



LEGEND

- VISIBILITY ANALYSIS AREA
- AREA VISIBLE FROM ALL WEATHER ROAD

BARREN-GROUND CARIBOU²

- SIGN
- OBSERVATION
- CARIBOU TRAIL
- ALL WEATHER ROAD
- PROPOSED HAUL ROAD
- MEADOWBANK OPERATION AND INFRASTRUCTURE
- WHALE TAIL PIT
- COMMUNITY
- WATERCOURSE
- WATERBODY

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TITLE					
VIEWHSED FROM ALL WEATHER ROAD					
	PROJECT		1658927		FILE No.
	DESIGN	CDM	6 Apr. 2017	SCALE AS SHOWN	
	GIS	SB	13 Apr. 2017	REV. A	
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FIGURE 3					