2.0 ENVIRONMENTAL ASSESSMENT METHODS

This chapter provides a description of the methods used to conduct this environmental assessment. The work was completed with the objective of providing sufficient information to achieve conformance of the Environmental Impact Statement/Environmental Assessment Report (EIS/EA Report) with requirements of the Environmental Impact Statement Guidelines (EIS Guidelines) and the Terms of Reference (ToR) issued by the Canadian Environmental Assessment Agency (CEA Agency) and the Ontario Ministry of the Environment (MOE) Environmental Approvals Branch (EAB).

As stated in the EIS Guidelines issued for the Hammond Reef Gold Project (Project), environmental assessment is a planning tool used to ensure that projects are considered in a careful and precautionary manner in order to avoid or mitigate the possible adverse effects of development on the environment. It also serves the purpose to encourage decision makers to take actions that promote sustainable development and thereby achieve or maintain a healthy environment and a healthy economy. This EIS/EA Report was conducted to meet the purposes above and further requirements outlined in the EIS Guidelines as well as ToR.

2.1 Overall Assessment Approach

The approach presented within the EIS/EA Report includes the following key steps:

- An initial Project was scoped and a Project Site was defined, within which development activities are planned to take place. Initial study areas were defined for each EA component based on the geographic range over which potential effects of the Project are anticipated to occur.
- Baseline studies were conducted within the defined study areas. Studies are focussed on potential interactions with mine development activities. These studies provide an understanding of the existing environment, and provide the baseline conditions against which potential effects of the Project are assessed. The existing environmental and social conditions are described in Chapter 3.
- Alternative means for carrying out the Project were described and evaluated. The alternatives assessment is described in Chapter 4.
- A Project Description was developed that describes the activities to be undertaken during each Project phase. Project phases include construction, operations, closure and post-closure. The activities to be undertaken in each phase are described in detail in Chapter 5.
- Likely effects of the Project on the environment were assessed for those components where there is a direct or indirect linkage between Project activities and an environmental or social component. The approach to assessing these effects is described in this chapter and the assessment is presented in Chapter 6.
- Significance of effects was determined for effects identified as being adverse. In-design mitigation measures are considered and residual effects are identified (Chapter 6).
- Consultation with Aboriginal communities, government regulators and Project stakeholders is ongoing throughout the environmental assessment. Details of consultation activities are provided in Chapter 7.

- Preliminary or conceptual environmental and social management plans were developed to enhance benefits to local communities and minimize potential effects (Chapter 8).

2.2 Definition of the Project

The Project was defined in two stages (1) an initial Project scoping, and (2) the detailed description of the Project used in the effects assessment. Once the alternatives assessment had been completed, preferred alternatives were identified and the Project was fully defined. A detailed description of the Project is provided in Chapter 5.

2.2.1 Scope of the Project

The scope of the Project identifies the nature and extent of the Project to be assessed. The scope of the Project is provided in Chapter 1.

2.2.2 Scope of the Factors

The scope of the factors to be considered in the environmental assessment are listed in paragraphs 16(1)(a) to (d) and subsection 16(2) of the *Canadian Environmental Assessment Act* (CEAA), as stated in Chapter 1.

2.2.2.1 Temporal Boundaries

The Project will be undertaken in four distinct phases:

- **Construction Phase:** During the construction phase all of the activities associated with preparing the Project Site and supporting infrastructure for operation of the Mine will be carried out. This phase includes the decommissioning of facilities that will not be required beyond the construction phase. The construction phase is assumed to last 2.5 years.
- **Operations Phase:** During the operations phase, all of the activities associated with mining, ore processing and extraction of the gold will be carried out for the life of mine. The operations phase is assumed to continue for 11 years.
- **Closure Phase:** During the closure phase all of the activities required to close and stabilize the Mine and associated facilities are carried out, as well as the activities required to monitor the effectiveness of closure. Potential for long-term effects is considered during this phase. The closure phase is assumed to last 2 years.
- **Post-closure Phase:** During the post-closure phase no further activities take place at the Project Site. Long-term monitoring of some environmental components is undertaken. The post-closure phase extends from the completion of all closure activities until such time as no further monitoring of the Project Site is required. The post-closure phase is assumed to last for 10 years except for the flooding of the open pits, which is estimated to take an additional 208 years (i.e., 218 years in total).

2.2.2.2 Spatial Boundaries

The Project Site encompasses all the Project components except for Aggregate Sites which are subject to a separate permitting process and are not further addressed in this EIS/EA Report. The Project Site delimits the physical boundary of the Project, as shown in Figure 1-3.

The study areas considered in the environmental assessment encompass the environment that can reasonably be expected to be affected by the Project, or which may be relevant to the assessment of cumulative effects.

Four general study areas were considered with respect to assessment of potential effects:

- **Mine Study Area:** The Mine Study Area (MSA) is the area located within the Project Site that encompasses all of the physical works and activities related to the Project. The MSA encompasses the Mine, the Waste Rock Management Facility (WRMF), the Ore Processing Facility, the Tailings Management Facility (TMF), the Water Management System, and the Support and Ancillary Infrastructure (including but not limited to the worker accommodation camp, communications tower and weather station). The MSA is shown in Figure 2-1.
- **Linear Infrastructure Study Area:** The Linear Infrastructure Study Area (LISA) encompasses the footprints of the access road (Hardtack/Sawbill) and the project transmission line. The LISA is represented by a Y-shaped area that extends on either side of the central line of the access road (Hardtack/Sawbill) and the project transmission line. The width of the LISA depends on the environmental component that is being described. The LISA is shown on Figure 2-1.
- **Local Study Area:** The Local Study Area (LSA) is the immediate vicinity of the Project Site that could be directly affected by the Project. The LSA includes the MSA and an area surrounding the Project Site that varies depending on the environmental component that is being described. The Project's LSAs are shown in Figures 2-2A to 2-K.
- **Regional Study Area:** The Regional Study Area (RSA) is an area that provides regional context and environmental setting for the assessment. Some socio-economic effects may be expected within the Regional Study Area, but biological and physical effects are generally not expected to extend into the RSA. The Project's RSAs are shown in Figures 2-3A to 2-3G.

While the MSA is common to all of the disciplines, the LSA and RSA have been modified to recognise the differences inherent in the assessment of effects for each environmental component. Therefore, individual environmental components will have slightly different study areas as a result of the Valued Ecosystem Components (VECs) considered, the natural physical features of the landscape, and the expected extent of potential effects from the Project.

These study areas are used for each environmental component unless modified. A description of any modifications is provided in the respective TSDs and summarized in Chapter 3.

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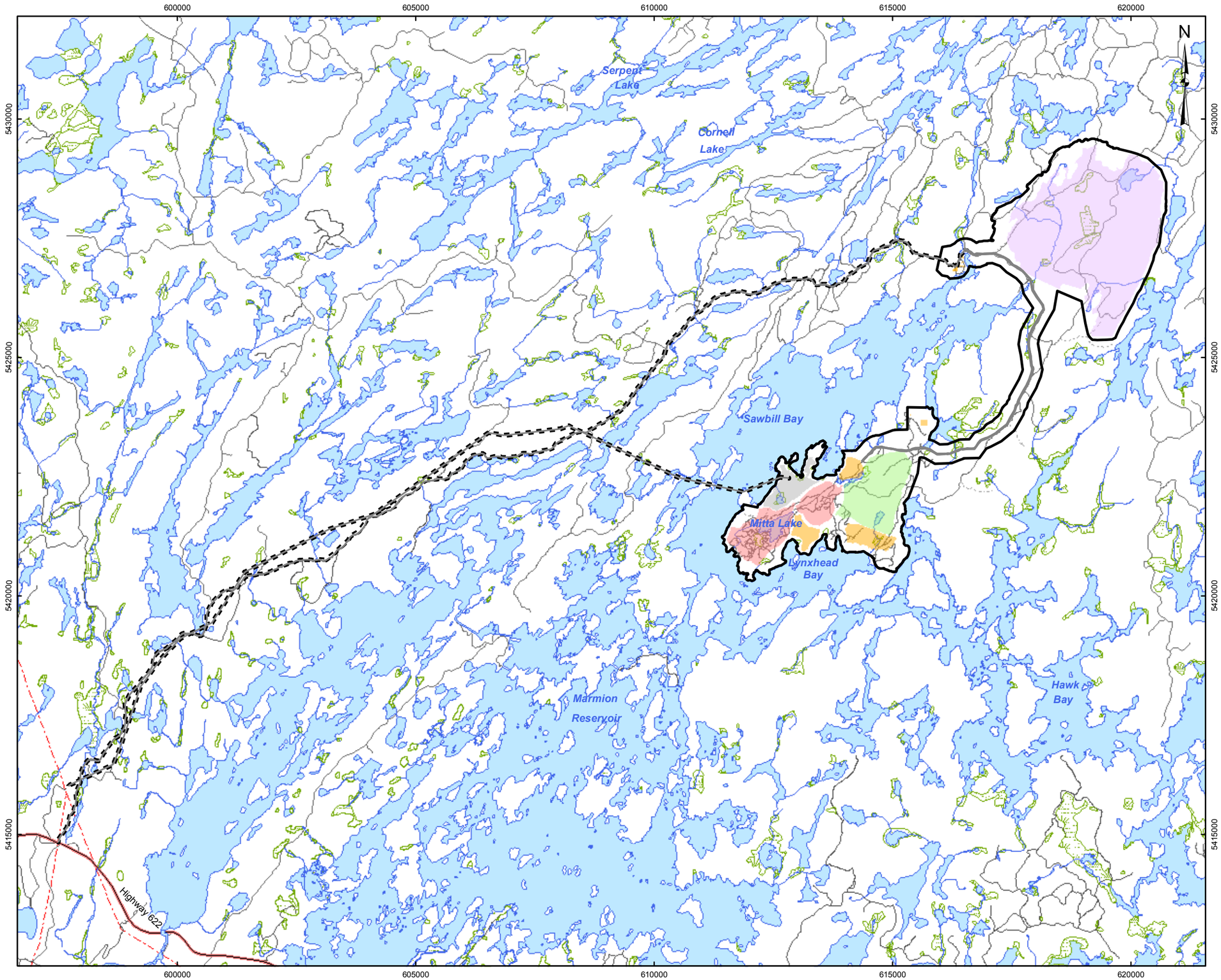

LEGEND

- Provincial Highway
- Road
- Power Transmission Line
- River/Stream
- Lake
- Wetland
- Linear Infrastructure
- Mine
- Waste Rock Management Facility
- Ore Processing Facility
- Tailings Management Facility
- Support and Ancillary Infrastructure
- Linear Infrastructure Study Area
- Mine Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd.
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

1,000 0 1,000 2,000 3,000 4,000
SCALE 1:80,000 METERS

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
MINE STUDY AREA AND LINEAR INFRASTRUCTURE STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-1

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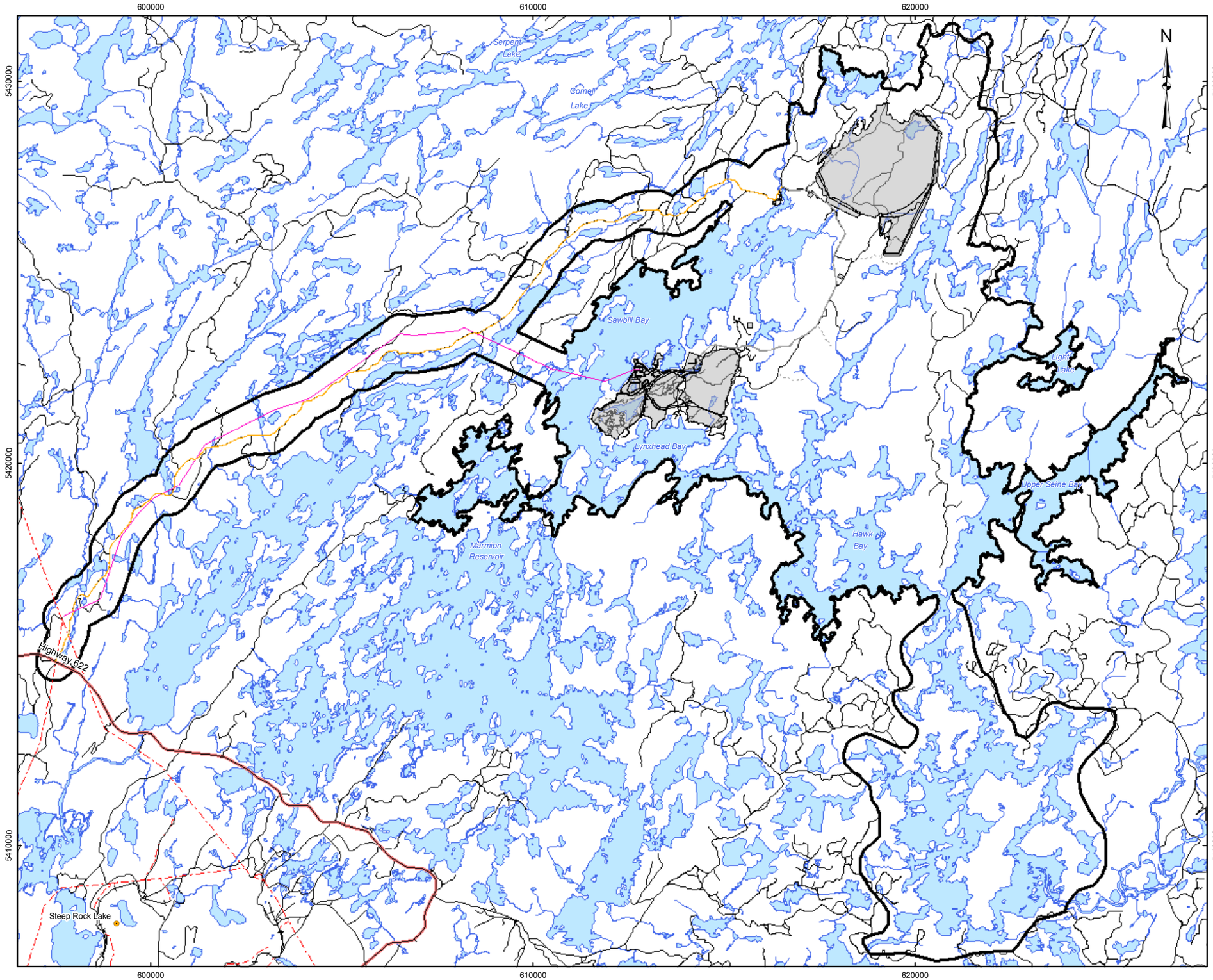

LEGEND

- Small Community
- Road
- River/Stream
- Lake
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Aboriginal Interests Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

1 0.5 0 1 2 3 4
KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
ABORIGINAL INTERESTS LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	8 Jan. 2013		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2A

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610000
620000
630000
5430000
5420000
5410000

Serpent Lake
Cornell Lake
Sawbill Bay
Lynxhead Bay
Marmion Reservoir
Hawk Bay
Upper Seine Bay
Light Lake
Highway 622
Steep Rock Lake

N

LEGEND

- Small Community
- Provincial Highway
- Road
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Aquatic Environment Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

2.5 1.25 0 2.5 5 7.5
KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
AQUATIC ENVIRONMENT LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	8 Jan. 2013		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2B

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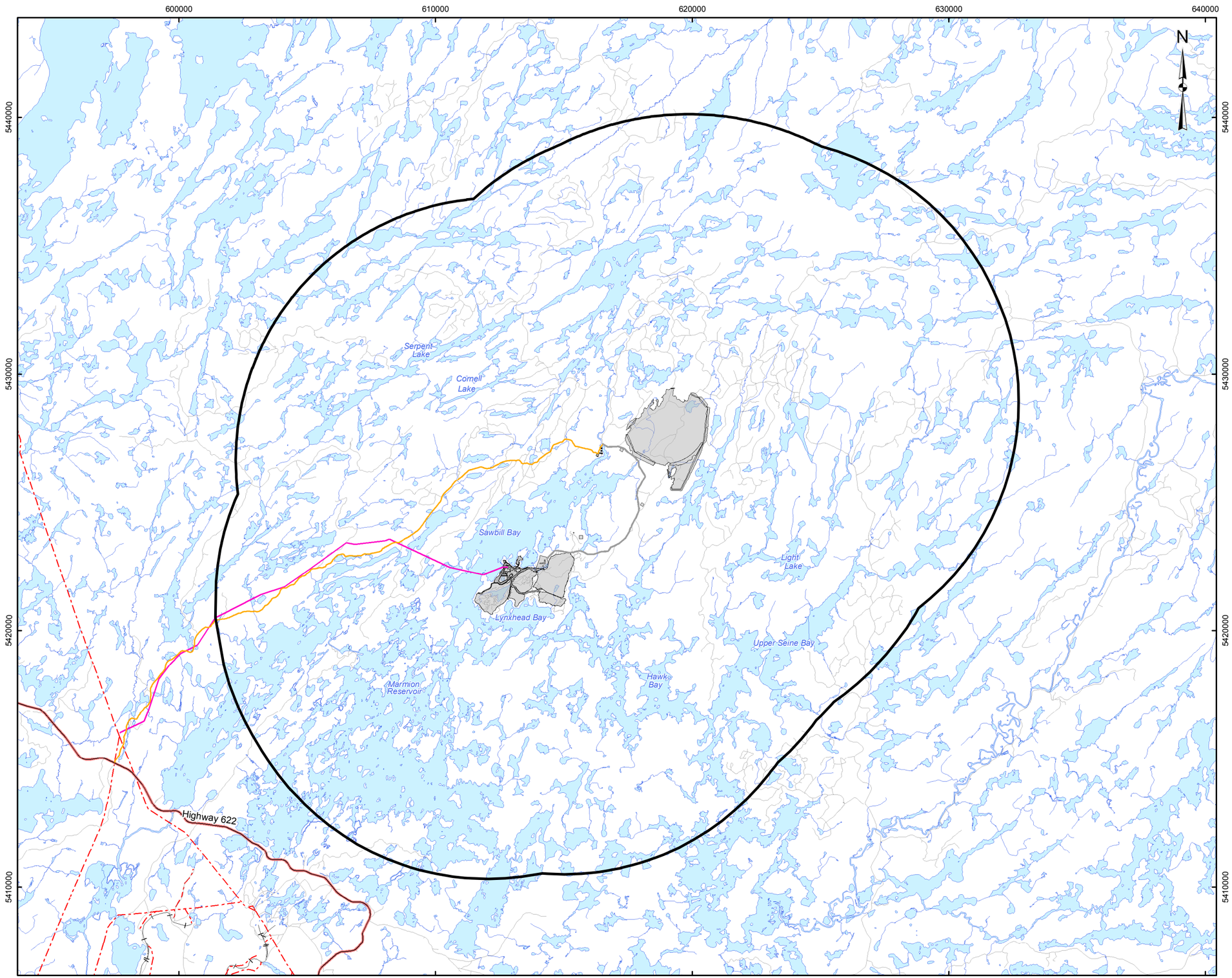

LEGEND

- Provincial Highway
- Road
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Air Quality and Human Health Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
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Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

2.5 1.25 0 2.5 5 7.5
KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
AIR QUALITY AND HUMAN HEALTH LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2C

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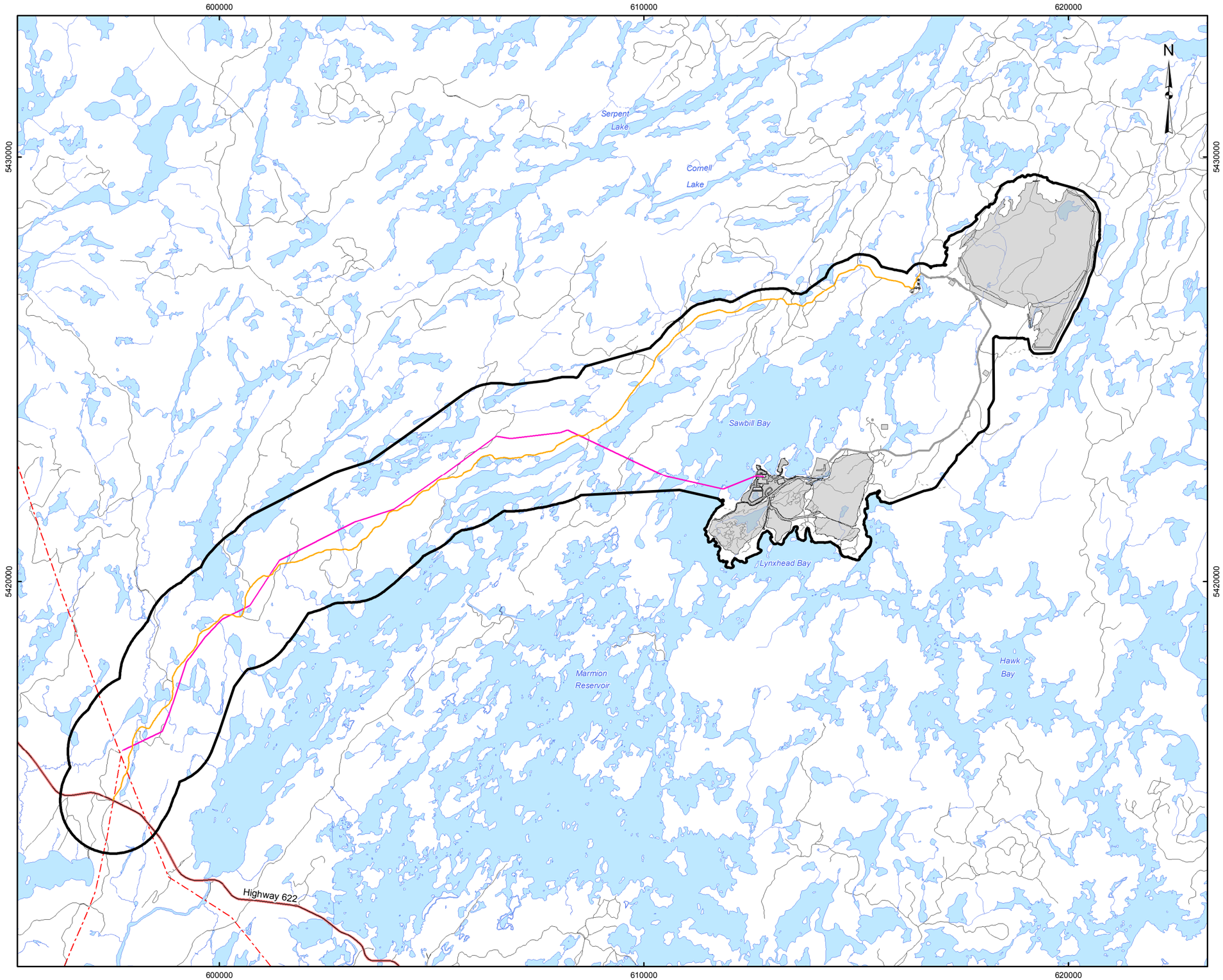

LEGEND

- Small Community
- Provincial Highway
- Road
- Existing Railway
- River/Stream
- Lake
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Cultural Heritage Resources Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

2 1 0 2 4
KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
CULTURAL HERITAGE RESOURCES LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2D

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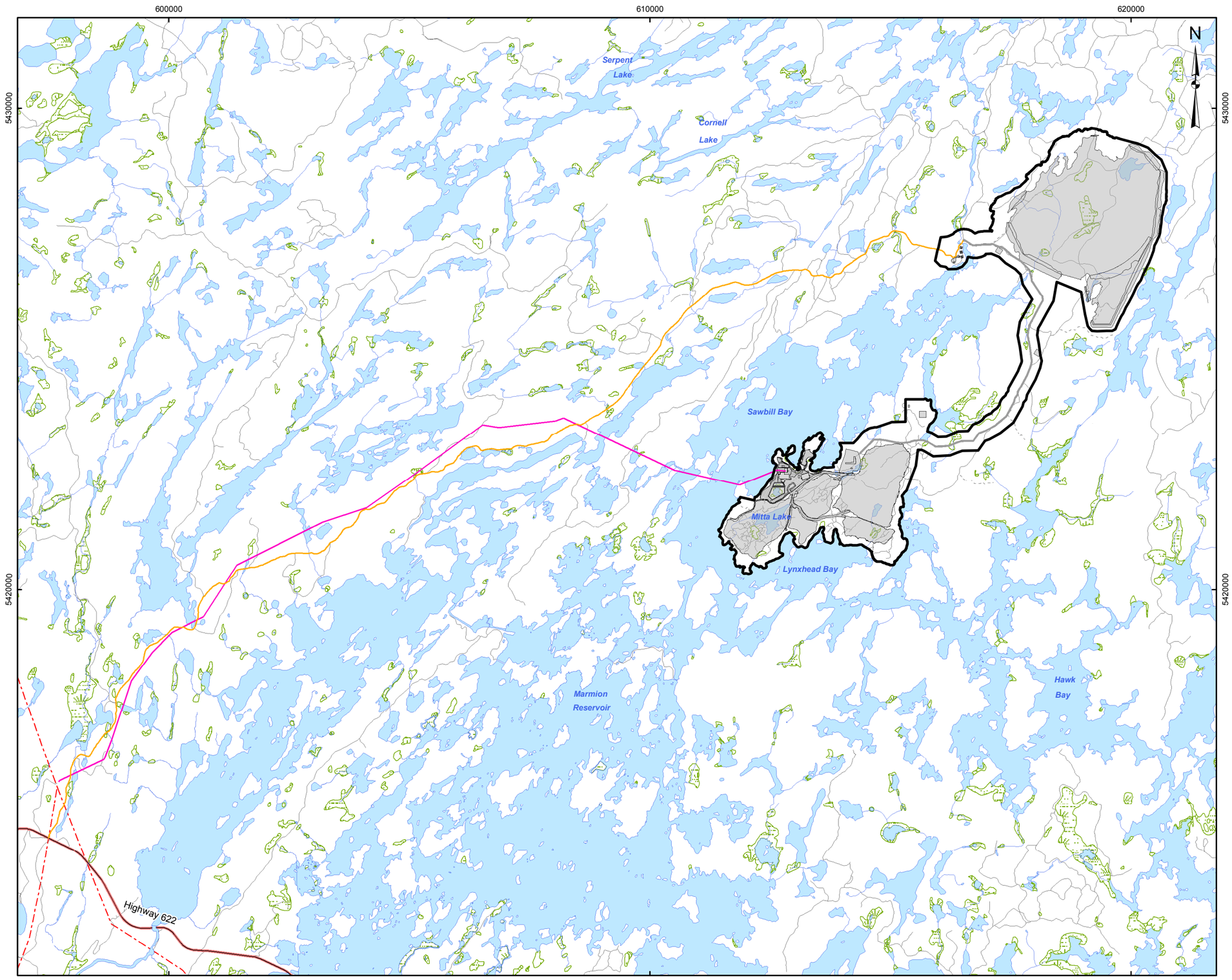

LEGEND

- Provincial Highway
- Road
- Trail
- Power Transmission Line
- River/Stream
- Lake
- Wetland
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Geochemistry Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd.
Base Data - MNR NRVIS, obtained 2004
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Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

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SCALE 1:80,000 METERS

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
GEOCHEMISTRY LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2E

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600000
610000
620000
5430000
5420000
N
Serpent Lake
Cornell Lake
Sawbill Bay
Mitta Lake
Lynxhead Bay
Marmion Reservoir
Hawk Bay
Highway 622

LEGEND

- Provincial Highway
- Road
- Trail
- Power Transmission Line
- River/Stream
- Lake
- Wetland
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Terrain and Soil Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

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SCALE 1:90,000 METRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
TERRAIN AND SOIL LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2F

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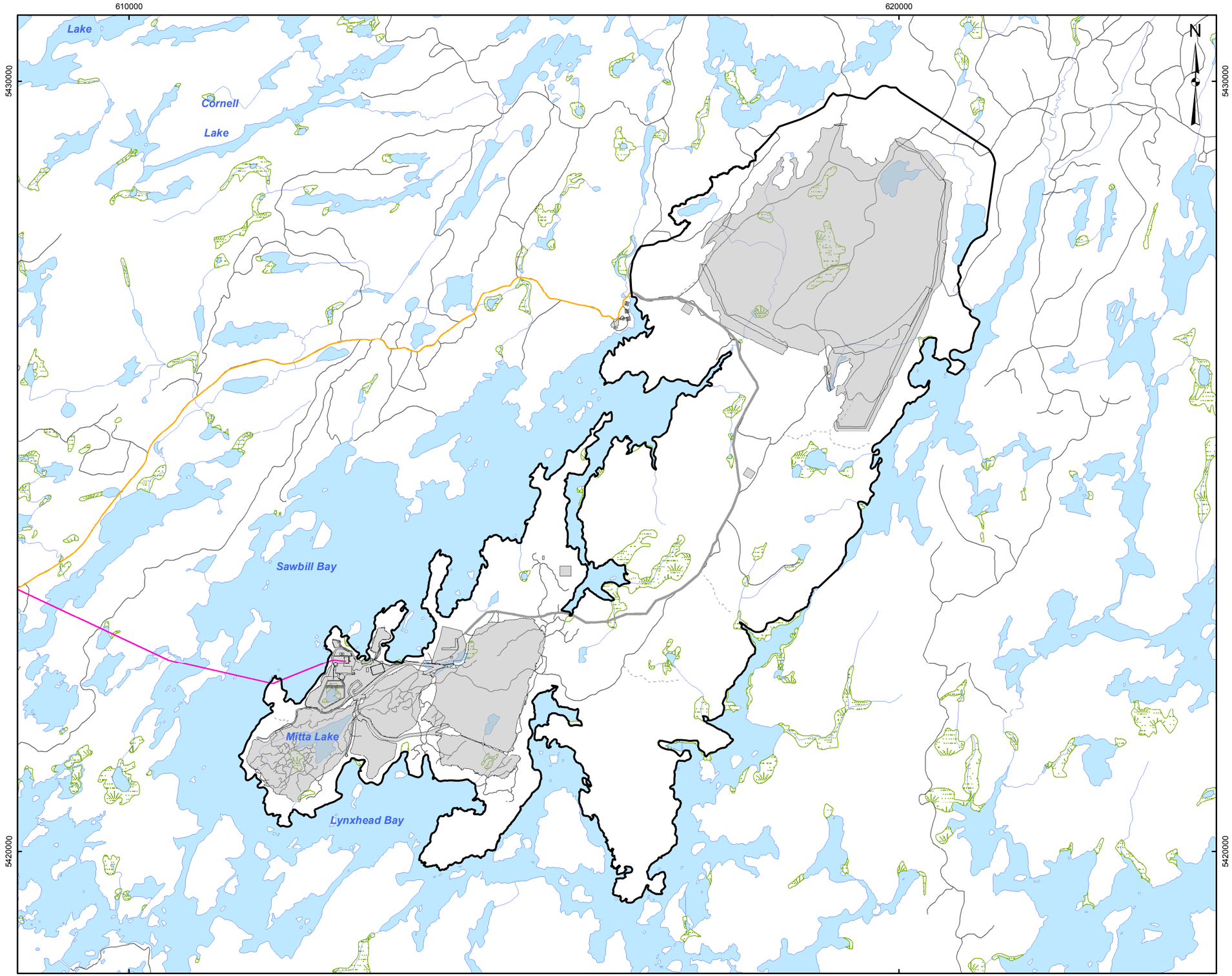

LEGEND

- Provincial Highway
- Road
- Trail
- Power Transmission Line
- River/Stream
- Lake
- Wetland
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Hydrogeology Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
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SCALE 1:50,000 METRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
HYDROGEOLOGY LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2G

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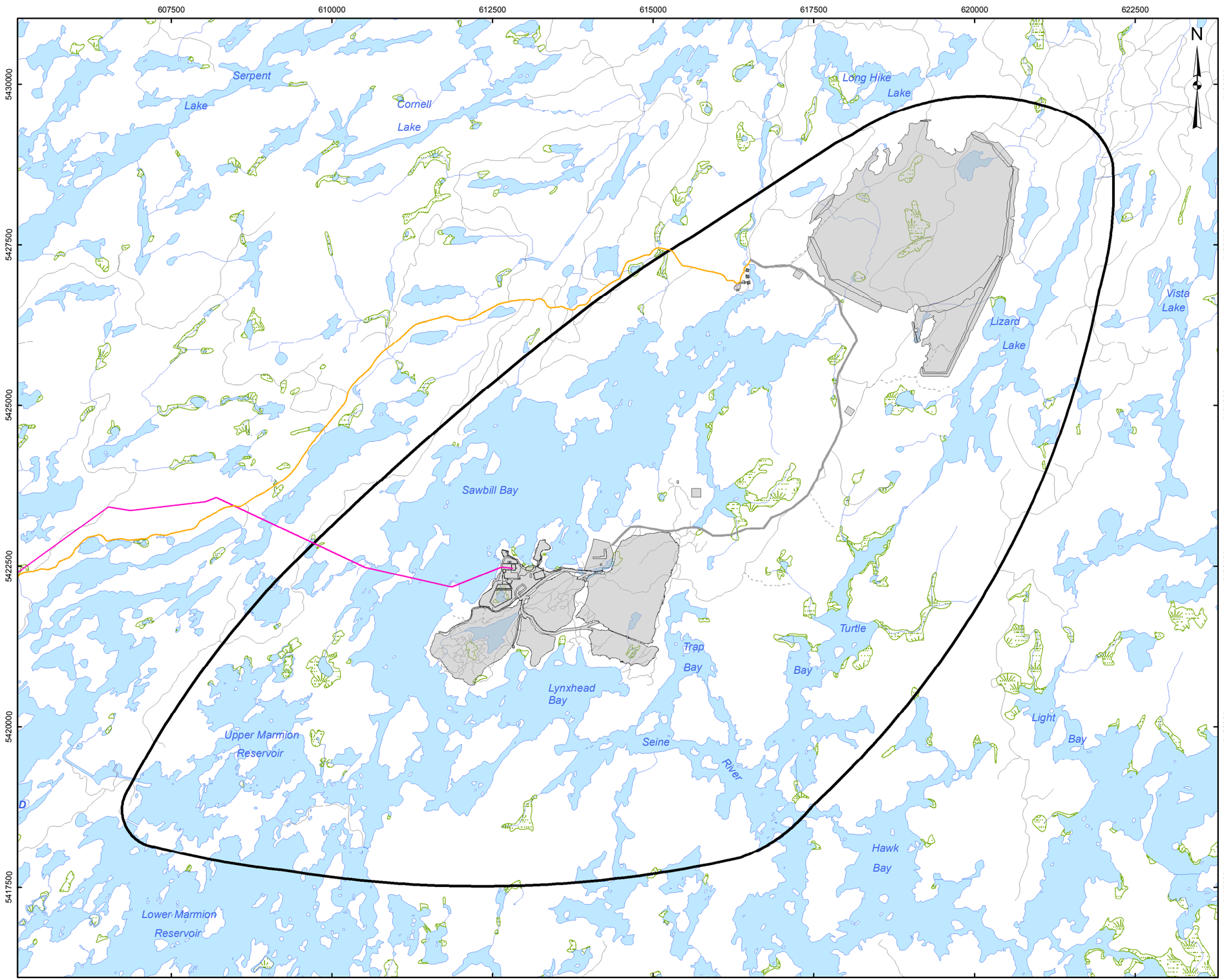

LEGEND

- Road
- Trail
- River/Stream
- Lake
- Wetland
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Hydrology Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd.
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SCALE 1:60,000 METERS

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
HYDROLOGY LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2H

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500000 600000 700000

5400000

N

Highway 17
Ignace
Raleigh Lake
Stormy Lake
Wawang Lake
TURTLE RIVER PROVINCIAL PARK
Irene Lake
Jones Lake
Highway 622
White Otter Lake
Lac Des Mille Lacs
Franklin Lake
Lizard Lake
Cowbill Bay
Lion Lake
Turtle Lake
Dashwa Lake
Marmion Lake
Hawk Bay
Pike Lake
Relief Lake
Reserve Island
Steep Rock Lake
Atikokan
Sapawe
Kawene
Owakonze
Huronian
Quetico
Kashabowie
Burchell Lake
Mine Centre
Horse Collar Junction
Seine River First Nation
Seine River Village
Flanders
Calm Lake
Highway 11
Old Mine Centre
Kasakokwog Lake
Pickerel Lake
Quetico Lake
QUETICO PROVINCIAL PARK
Namakan Lake
Wolseley Lake
Lac La Croix First Nation
Jones Lake
U. S. A.

LEGEND

- Local Study Area City/Town
- Small Community
- Provincial Highway
- Road
- Existing Railway
- River/Stream
- Lake
- Provincial Park
- First Nations Reserve
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Land Use and Resources Local Study Area
- Socio-Economic Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

10 5 0 10 20 30 40
SCALE 1:700,000 KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
SOCIO-ECONOMIC LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2I

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600000
610000
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5430000
5420000
N
Serpent Lake
Cornell Lake
Sawbill Bay
Mitta Lake
Lynxhead Bay
Marmion Reservoir
Hawk Bay
Highway 622

LEGEND

- Provincial Highway
- Road
- Trail
- Power Transmission Line
- River/Stream
- Lake
- Wetland
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Terrestrial Ecology Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
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Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

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SCALE 1:90,000 METRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
TERRESTRIAL ECOLOGY LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2J

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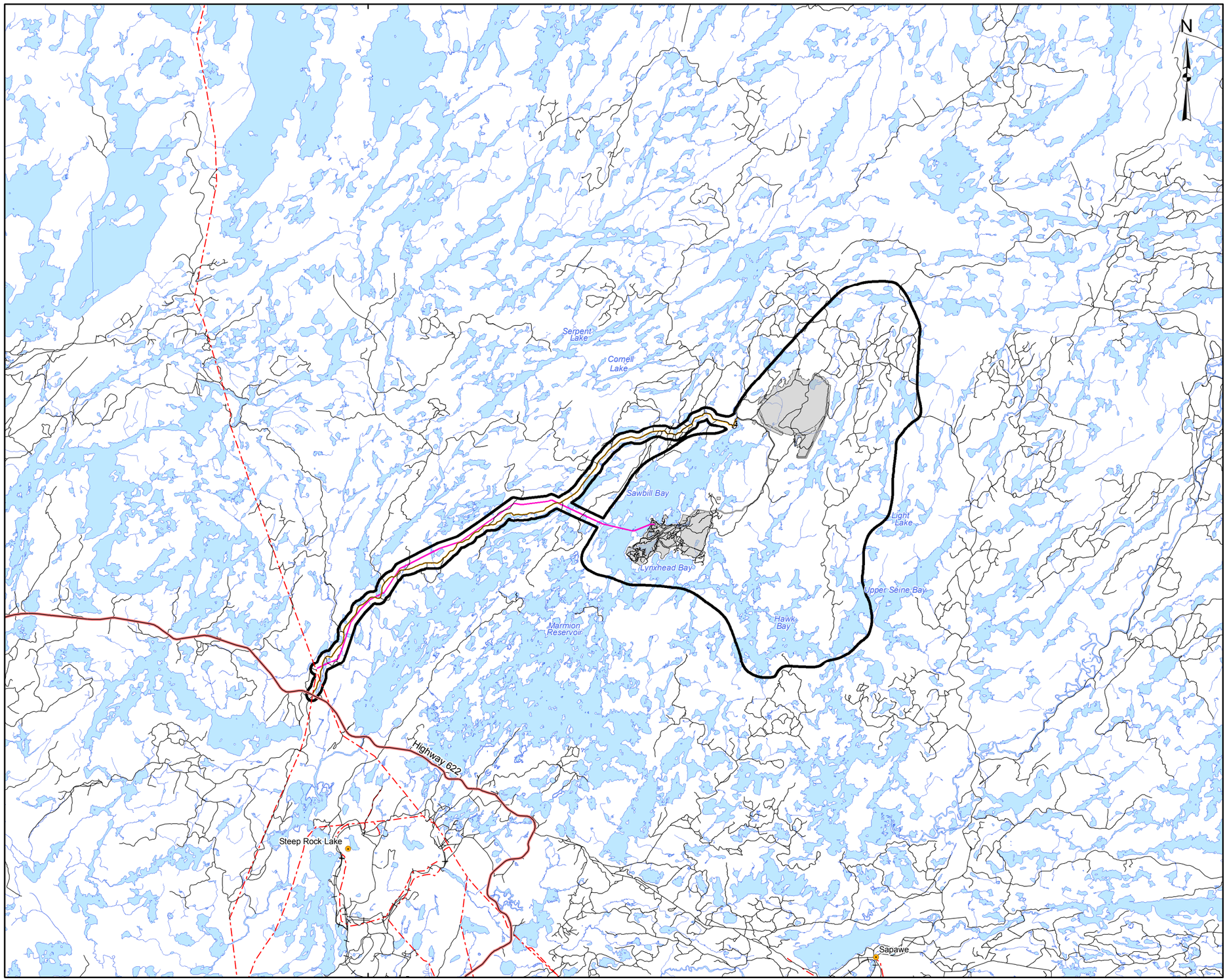

600000

LEGEND

- Small Community
- Provincial Highway
- Road
- Existing Railway
- River/Stream
- Lake
- Mine Site Road
- Access Road
- Project Transmission Line
- Mine Facilities
- Water Quality Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

2.5 1.25 0 2.5 5 7.5
KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
WATER QUALITY LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	27 Jun. 2012		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-2K

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5600000 5500000 5400000 5300000

N

ONTARIO

LAKE NIPIGON

LAKE SUPERIOR

U. S. A.

Kenora

Dryden

Eagle Lake

Lac Seul

Ojibway Nation of Saugeen (Savant Lake)

Northwest Métis Nation of Ontario Council

Wabigoon Lake Ojibway Nation

Northwest Angle No.37

Naotkamegwanning

Ojibways of Onigaming

PROJECT LOCATION

Atikokan

Atikokan Métis Council

Lac Des Mille Lacs

Naicatchewenin

Nigigoonsiminikaaning

Mitaanijigaming

Seine River

Rainy River

Couchiching

Fort Frances

Sunset Country Métis Council

Lac La Croix

Thunder Bay

Thunder Bay Métis Council

LEGEND

- City/Town
- Road
- Existing Railway
- River
- Waterbody
- First Nation Community
- First Nation Community within the Regional Study Area
- Métis Community Council
- Métis Community Council within the Regional Study Area
- First Nation Reserve
- First Nation Reserve within the Regional Study Area
- Regional Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Historical Indian Treaties obtained from Natural Resources Canada,
The Atlas of Canada (2010).
First Nations Communities from Indian and Northern Affairs Canada.
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

30 15 0 30 60
SCALE 1:1,750,000 KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
ABORIGINAL INTERESTS REGIONAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	11 Nov. 2010		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-3A

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5430000 5420000 5410000

N

Serpent Lake
Cornell Lake
Sawbill Bay
Lynxhead Bay
Marmion Reservoir
Hawk Bay
Upper Seine Bay
Highway 622
Steep Rock Lake

LEGEND

- Small Community
- Provincial Highway
- Road
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Aquatic Environment Regional Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd.
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd. under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

2.5 1.25 0 2.5 5 7.5
KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
AQUATIC ENVIRONMENT REGIONAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	8 Jan. 2013		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-3B

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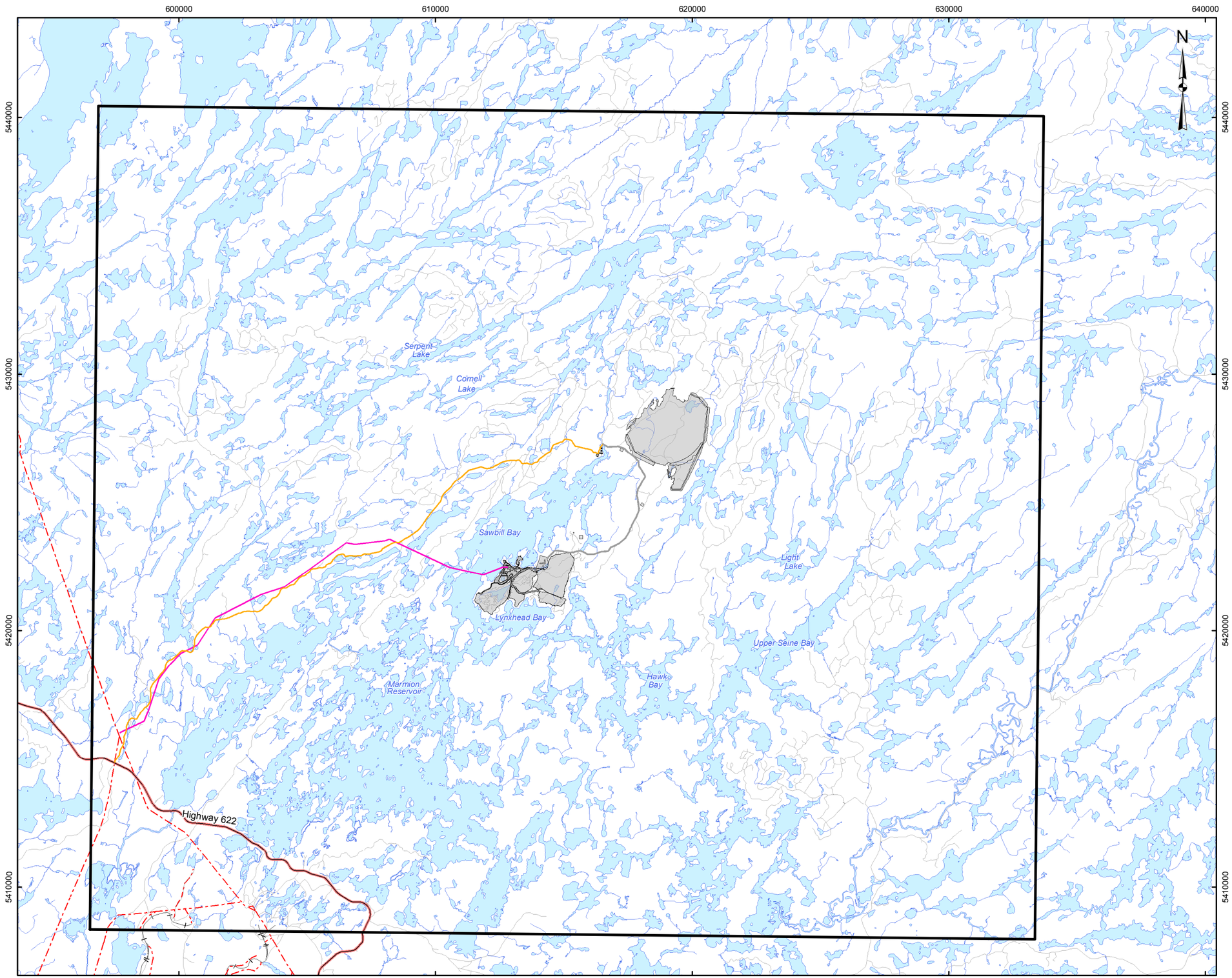

LEGEND

- Provincial Highway
- Road
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Air Quality and Human Health Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

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KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
AIR QUALITY AND HUMAN HEALTH REGIONAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-3C

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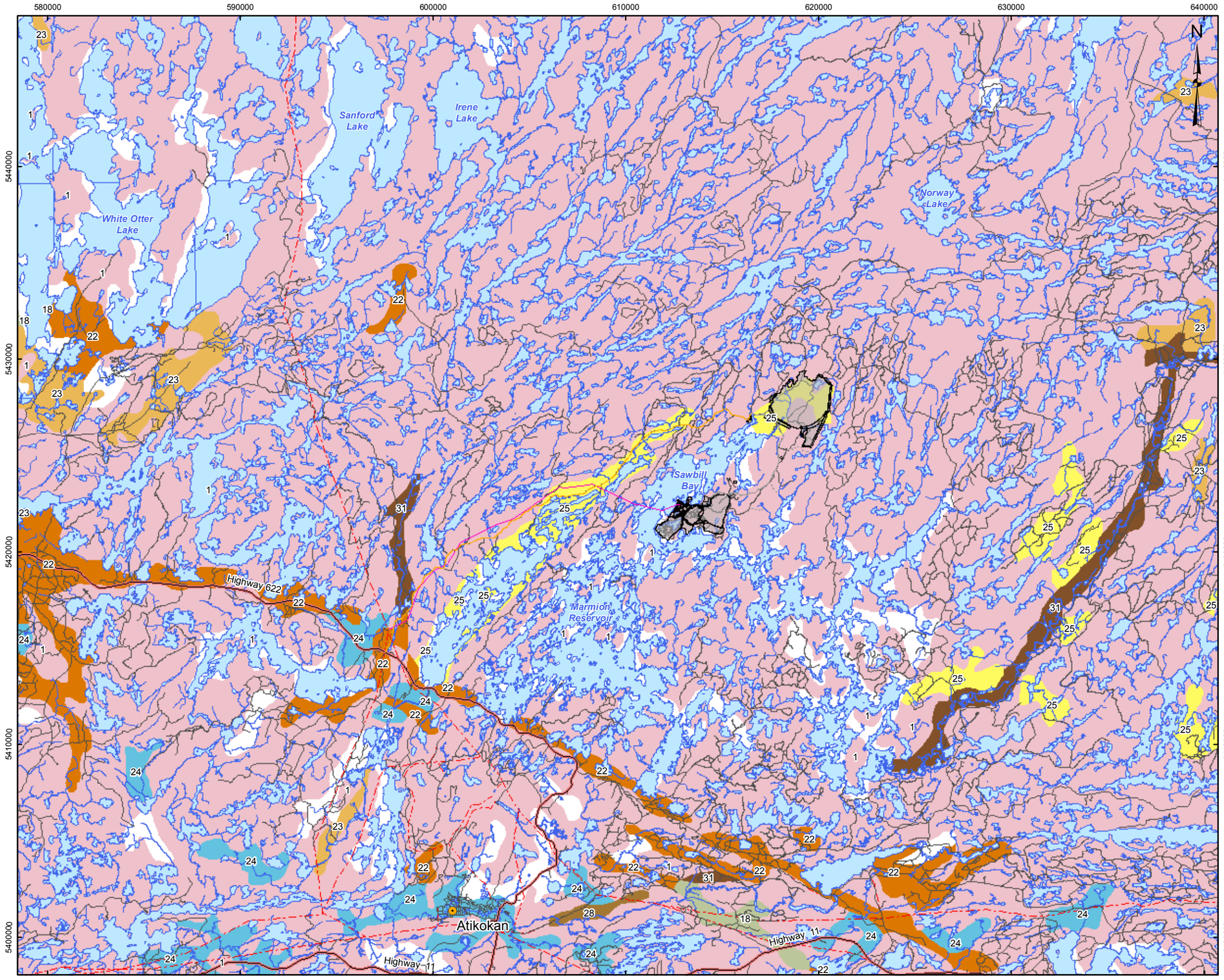

LEGEND

- City/Town
- Provincial Highway
- Road
- Trail
- Power Transmission Line
- River/Stream
- Lake

Surficial Geology

- 1 Bedrock
- 18 Till
- 22 Glaciofluvial Ice
- 23 Glaciofluvial Outwash deposits
- 24 Glaciolacustrine deposits: silt and clay, minor sand; basin and quiet water deposits
- 25 Glaciolacustrine deposits: sand, gravelly sand and gravel; nearshore and beach deposits
- 28 Fluvial deposits
- 31 Fluvial deposits
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd.
Base Data - MNR NRVIS, obtained 2004
Surficial Geology - Ontario Geological Survey, 1997. Quaternary geology, seamless coverage of the province of Ontario: Ontario Geological Survey, Data Set 14.
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

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SCALE 1:200,000 METRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
GEOLOGY REGIONAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-3D

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LEGEND

- Project Location
- City/Town
- Provincial Highway
- Road
- Existing Railway
- Far North Border
- River/Stream
- Lake
- Region of Kenora
- Region of Rainy River
- Region of Thunder Bay
- Socio-Economic Regional Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd (April, 2010)
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

25 0 25 50 75 100 125
SCALE 1:2,500,000 KILOMETERS

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
SOCIO-ECONOMIC REGIONAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-3E

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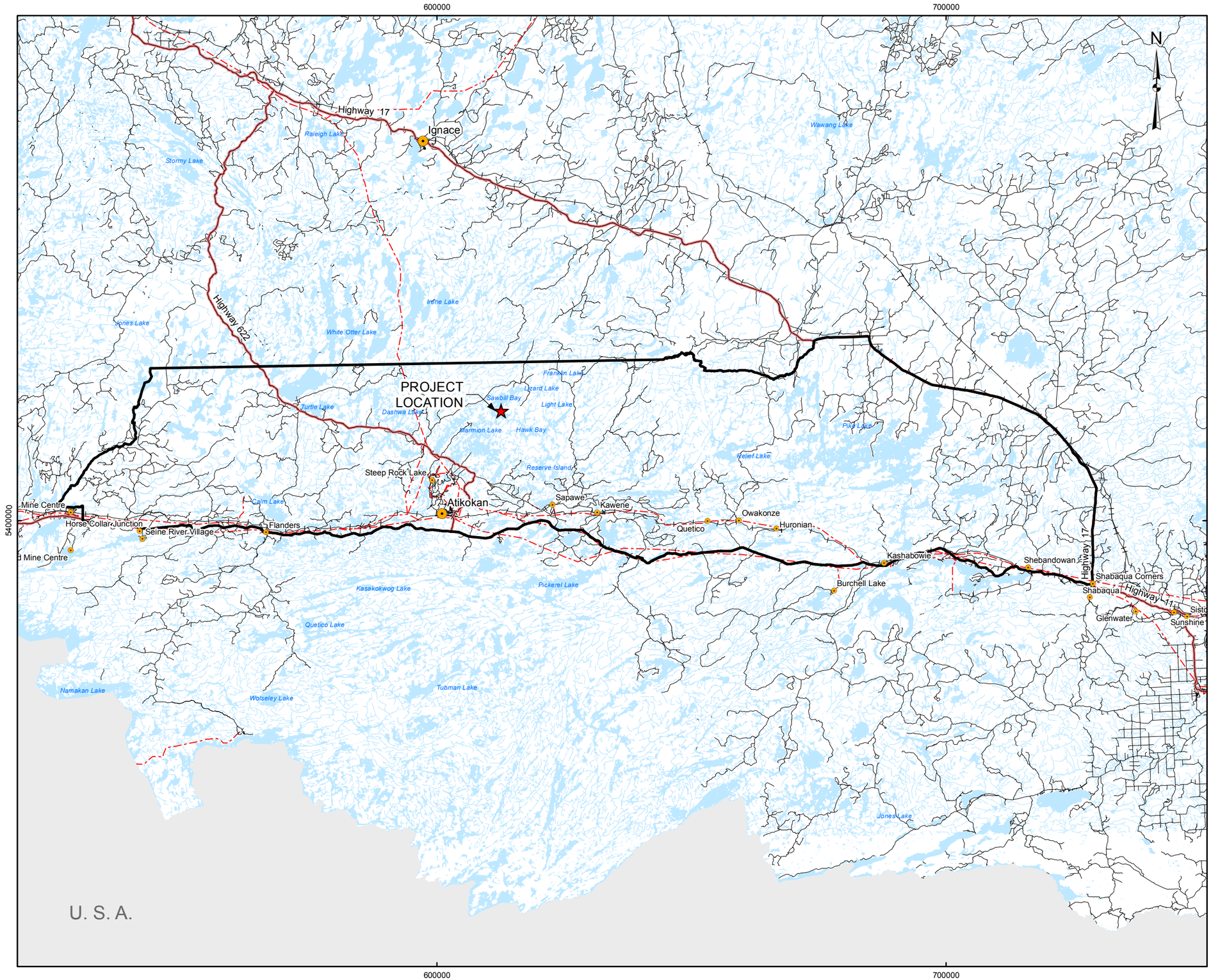

LEGEND

- Project Location
- City/Town
- Small Community
- Provincial Highway
- Road
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake
- Terrestrial Ecology Regional Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

5 2.5 0 5 10 15 20 25 30 35
SCALE 1:750,000 KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
TERRESTRIAL ECOLOGY REGIONAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008	**FIGURE: 2-3F**	
GIS	JO	2 Dec. 2013		
CHECK	AVS	2 Dec. 2013		
REVIEW	KT	2 Dec. 2013		

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600000
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Serpent Lake
Cornell Lake
Sawbill Bay
Lynxhead Bay
Upper Marmion Reservoir
Lower Marmion Reservoir
Hawk Bay
Light Lake
Upper Seine Bay
Highway 622
Steep Rock Lake
Atikokan
Sapawe

N

LEGEND

- City/Town
- Small Community
- Provincial Highway
- Road
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Water Quality Regional Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2008
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

2 1 0 2 4 6 8
KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
WATER QUALITY REGIONAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			SCALE AS SHOWN	VERSION 2
DESIGN	CGE	14 Nov. 2008		
GIS	JO	2 Dec. 2013		
CHECK	SP	2 Dec. 2013		
REVIEW	SP	2 Dec. 2013		

FIGURE: 2-3G

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2.3 Approach to Baseline Studies

Baseline studies were initiated in April 2010 to provide an understanding of the existing physical, biological and socio-economic conditions in the area containing and surrounding the Project. The baseline studies were conducted using standard protocols and scientifically defensible methods, as described in the individual Technical Support Documents (TSDs).

The objectives of the baseline studies were to:

- Describe the physical, biological and socio-economic conditions and trends in areas potentially affected by the Project. This description is provided in Chapter 3.
- Provide the baseline against which the effects of the Project are predicted and assessed. The assessment is provided in Chapter 6.
- Describe the geochemical characteristics of the mineral resource extraction process and the mine wastes that will be generated by the Project in order to develop an understanding of the factors that could affect the project description and hence the environment. This description is provided in Chapter 5.
- Inform the selection of alternatives to minimize environmental effects of the Project and compare the alternative means for carrying out the Project. Alternatives are identified and described in Chapter 4.
- Establish benchmarks for monitoring programs that will be implemented during the construction, operations, closure and post-closure phases of the Project, such that Project effects can be iteratively addressed if necessary as the Project proceeds. The proposed monitoring program is described in Chapter 8.
- Interact with potentially affected communities, in the course of baseline data collection, in order to exchange information on the Project and to provide people the opportunity to express their concerns and preferences with regard to Project development. The community consultation and Aboriginal engagement programs are described in Chapter 7.

2.4 Identifying and Assessing Alternatives

The purpose of the Project is to extract gold ore for processing at an ore processing facility and to produce gold for sale worldwide. This purpose can only be accomplished through the mining and processing of the ore as proposed for the Project.

The only feasible alternative to the Project is the “do nothing” alternative, which is considered as a benchmark, and will help determine the extent to which the alternatives address the opportunity and the advantages/disadvantages of proceeding with the Project.

A number of technically and economically feasible alternative means or methods of carrying out the Project were identified and are described in Chapter 4. Alternative means were determined through professional experience and consultation with Project stakeholders, including government, public and Aboriginal communities. A mine waste alternative assessment was also carried out as required by Environment Canada’s *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (September 2011).

Alternative means were evaluated by characterizing the potential method and evaluating the alternative against the environmental, technical, socio-economic and Project-economics characterization as provided in Table 2-1.

Table 2-1: Characterization Used in Evaluating Alternatives

Environmental Characterization	Technical Characterization	Project-economics Characterization	Socio-economic Characterization
■ Distance from the Mine/Ore Processing Facility. ■ Topography. ■ Stockpile footprint and dimensions. ■ Failure/poor performance consequences. ■ Removal of vegetation. ■ Effects on aquatic ecology. ■ Effects on terrestrial ecology. ■ Effects on hydrogeology. ■ Effects on hydrology. ■ Effects on water quality. ■ Effects on air quality	■ Topography/ watershed considerations. ■ Hydrological/ hydrogeological/ watershed considerations. ■ Geotechnical design considerations. ■ Storage capacity. ■ Dumping techniques. ■ Haul distances. ■ Sedimentation and pollution control dam requirements. ■ Tailings discharge methods. ■ Pipeline grades and routes. ■ Closure design. ■ Long-term stability and safety ■ Extent of water treatment infrastructure. ■ Supporting infrastructure (access roads). ■ Ease of construction.	■ Capital Cost. ■ Operating Cost. ■ Closure Cost. ■ Fish Habitat Compensation. ■ Land use or lease fees	■ Aesthetics. ■ Community safety. ■ Presence of archaeological sites. ■ Cultural significance. ■ Employment/ training opportunities. ■ Effects on cultural heritage sites. ■ Effects on land use.

The mine waste alternatives evaluation included the additional steps of developing a multiple accounts ledger which measures sub-accounts through the use of weighted indicators. A value-based decision for the siting of mine waste was made by comparing the overall rating of each alternative. A sensitivity analysis was also included to check the results of the evaluation if all weightings are changed to be equal.

The alternatives assessment is summarized in Chapter 4 and detailed in the Alternatives Assessment Report.

2.5 Selection of Valued Ecosystem Components

The potential effects of the Project are considered with respect to specific criteria and indicators that can be used to measure changes to attributes of the environment. These include both ecological and socio-economic attributes, and are referred to as Valued Ecosystem Components and Valued Social Components respectively. These are collectively referred to Valued Ecosystem Components (VECs).

The VECs provide structure and focus for the environmental assessment. A VEC can be an individual component of the environment (e.g., a species), or a collection of components that represent one aspect of the environment (e.g., a wetland ecosystem). VECs for the Project were selected through an issues scoping exercise that identified the particular components of the environment for which there is public, Aboriginal, regulatory or scientific concern.

Since the VECs are assessment endpoints, it is important that the selected VECs as evaluated will provide an appropriate and meaningful indication of the potential effects of the Project. The VECs were selected based on the following considerations:

1. What major or special ecological features of the Project Site or surrounding area should be protected from adverse effects from the Project?
2. What aspects of the physical environment (i.e., air, water or land) could be sensitive to the effects of the Project?
3. What individual species or range of species, of wildlife and plants could be sensitive to the effects of the Project?
4. What aspects of the socio-economic environment should be considered in assessing the Project?

From an ecological perspective, VECs can represent features of the natural environment considered to be culturally or scientifically important (e.g., a local wetland or stream). These ecological feature VECs are complex, comprising several ecological aspects, and affected by a range of pathways (i.e., routes of exposure or effect). Thus, ecological feature VECs may include:

- An aspect of the physical environment (e.g., air or water quality).
- An individual plant or animal species (e.g., wild rice or snapping turtle).

VECs are characterized using indicators; where indicators are the attributes of the VEC that might be affected by the Project. Each indicator requires specific measures that can be quantified and assessed.

2.5.1 Identification of Key Issues

The selection of VECs is based on the identification of key issues as determined from a review of baseline environmental and socio-economic conditions, consultations with Aboriginal groups and the public, and consultations with regulatory agencies.

The key ecological issues identified relate to water, air, and biological resources, and particularly include the following:

- **Water quality and quantity** due to discharges from the processing plant and seepage from the waste rock stockpile and low-grade ore stockpile, TMF, and stormwater runoff from disturbed areas.
- **Groundwater quality and flow** (quantity) from mining and infrastructure footprint.
- **Loss of physical habitat** (aquatic and terrestrial) due to infrastructure footprint.
- Effects on **aquatic life** from mining activities, including stormwater runoff, seepage from stockpiles and the TMF, and discharge of domestic sewage.
- **Disruption of wildlife** in the larger local area (e.g., 2 km radius around the Mine).
- **Soil erosion, and slope stability**.
- **Air quality and noise** due to ore processing, dust from vehicles and blasting, vehicle and equipment operation.
- Effects of the **access road** (Hardtack/Sawbill) and **project transmission line**.

2.5.2 Physical Environment Valued Ecosystem Component Selection Criteria

Physical components of the environment consist of the following:

- Geology and geochemistry.
- Soils and soil quality.
- Hydrogeology and groundwater quality.
- Hydrology, surface water and sediment quality.
- Air quality, noise and vibration.

The selection of VECs includes physical factors as described in the relevant TSDs. The physical criteria were chosen because they were:

- Measurable and quantifiable.
- Representative of the physical environment.
- Identified as important during consultation activities.
- Susceptible to effects within the spatial context of the Project.

Physical components of the environment are those which lead to or influence the assessment of effects of the Project, but are not in and of themselves the endpoints of the assessment. As such, the effects assessment on the endpoints of changes to the physical environment is presented in the EIS/EA Report through the biological and social components.

2.5.3 Biological Environment Valued Ecosystem Component Selection Criteria

Biological components of the environment include:

- Aquatic habitat (e.g., creeks and rivers).
- Aquatic biota (e.g., algae, plants, invertebrates and fish).
- Terrestrial habitat (e.g., described as forests, grasslands, wetlands, riparian corridors).
- Terrestrial biota (e.g., plants, and "wildlife" including invertebrates, amphibians, reptiles, birds and mammals).

Effects of the Project on biological communities were assessed through the selection of specific receptor species. Since it is usually not possible to consider all of the species that could be affected, it was necessary to choose surrogates from among the environmental receptors present that would provide the best means of measuring effects. This includes species that are most representative of certain ecological functions or resource uses, are particularly sensitive to the effects of certain operations or processes of the Project and/or are socially or culturally important.

Based on existing environmental data, the most suitable biological receptors were those that made extensive use of the most important habitat areas, including: Marmion Reservoir, Lizard Lake and the upland habitats directly affected by the Project Site. VEC species were selected based on their susceptibility to the effects of the Project and their use of the LSA or RSA, particularly during critical life stages (e.g., spawning and rearing). The selection criteria stressed sensitivity and exposure to effects, and are presented in Table 2-2.

Table 2-2: Biological Criteria for the Selection of Valued Ecosystem Components

Biological Criteria	Rationale
Range	Selection focused on those species with local populations, since these would be more likely to suffer adverse effects at the population level. Broadly distributed populations could withstand localized effects with little or no effect on the population as a whole, and therefore, would not be as sensitive to Project-related effects.
Abundance of the species within the local aquatic community	Effects would be more readily measured and therefore, more readily apparent in those organisms that form a major component of the local community.
Status of the species	Native species (i.e., those that have been well established in the area over a long time period) provide the greatest opportunity to show responses to environmental effects. The responses would not be clouded by population dynamics that may not have reached equilibrium, or that may be influenced by anthropogenic actions such as stocking or management programs.
Habitat use by the species	Species that are permanent residents are more likely to show a response since they are subject to the effect(s) for a much greater percentage of their life history.

Table 2-2: Biological Criteria for the Selection of Valued Ecosystem Components (Continued)

Biological Criteria	Rationale
Residency sensitivity	The relative effect would be greatest for those organisms using the area during critical life history stages such as those associated with reproduction, or during critical growth periods. Those organisms that use the area only during infrequent periods or as part of a broader feeding range would be less likely to suffer and hence demonstrate effects.
Exposure potential and duration	Those organisms that are closer to the sources of effect, and that are exposed to the effect for extended periods of time would be more suitable for measuring potential effects.
Sensitivity	Those species that are known to be most sensitive to the potential effects would provide the most sensitive measure of effects.
Role of the species in the local food web	While certain species may not be significant under the above selection criteria, they may nonetheless be significant locally as a food source for other organisms. As such, the viability of their populations locally may affect the viability of other species.
Socio-economic importance	Those organisms that are socially or economically important could result in effects that extend beyond the aquatic ecosystem to ultimately affect human uses.
Information availability	Determination of effects depends on detection of changes in an organism's response, either at the level of the individual or the population. In order to reliably detect such changes, the life history of the organism in the area needs to be known in detail. Furthermore, the natural variability of population-level or community-level parameters must be known if Project-related effects are to be distinguished from natural variability.

The effects on biological communities were typically addressed through consideration of changes that occur at the population level. These effects are typically manifest either through changes in habitat that render certain components of the habitat unavailable or unusable, or through potential direct effects on the organisms, such as increased lethality or reduced fecundity. Effect assessments strive to consider the effects on all of the components of the natural ecosystem. Given the large number of species that could potentially occur within the study area habitats, it is neither possible, nor particularly useful, to attempt to measure effects on all possible receptors.

Given the lack of site specific data for the biological resources in the Project area, the assessment is currently undertaken at the level of biological communities. As such, the effects assessment considers effects on the level of terrestrial plant and animal communities that could reasonably be expected to occur in the area, based on the existing data.

The VECs selected for the biological environment are provided in Table 2-3, along with summary of the rationale for their selection. The detailed rationale for the selection of the VECs is provided in the respective TSDs.

2.5.4 Socio-economic Valued Social Components Selection Criteria

Valued Social Components (VSCs) for the socio-economic environment were selected using the following information sources:

- Review of Project information and mapping.
- Consideration of the EIS Guidelines and ToR for this and other similar Projects.
- Initial understanding of communities in the LSA and RSA.
- Professional experience and understanding of socio-economic and land use issues pertaining to other mining projects in Northern Ontario (e.g., Musselwhite Mine, Victor Diamond Mine).
- Input from regulatory and public consultation, and engagement with Aboriginal communities.

Based on these criteria, the VSCs selected are provided in Table 2-3. The detailed rationale for the selection of the VSCs is provided in the Socio-economic Environment TSD.

2.5.5 Aboriginal Interests Valued Social Components Selection Criteria

Aboriginal interests VSCs were selected through an issues scoping exercise that identifies the particular components of the environment for which there is public, Aboriginal, regulatory or scientific concern.

The VSCs for the Aboriginal Interests effects assessment were selected based on the following considerations:

- Engagement with Aboriginal communities, as detailed in Chapter 7.
- Literature pertaining to Aboriginal treaties, land claims, fishing and harvesting rights.
- Previously published environmental assessments for mining projects with Aboriginal interests accepted by CEA Agency.

The VSCs were characterized using indicators; where indicators are the attributes of the VSC that might be affected by the Project. Indicators typically are associated with specific measures that can be quantified and assessed.

Based on these criteria, the VSCs selected are provided in Table 2-3. The detailed rationale for the selection of the VSCs is provided in the Aboriginal Interests TSD.

2.5.6 Summary of Valued Ecosystem Components used in the Environmental Assessment

Table 2-3 provides a list of the VECs and VSCs selected for the Project. As noted, the table also includes a summary of the rationale for selection of each VEC/VSC and the indicators which were used to measure and predict potential effects of the Project on the identified VEC/VSCs.

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Table 2-3: Hammond Reef Gold Project Valued Ecosystem Components/Valued Social Components

VEC/VSC		Rationale for Selection	Indicators
TERRESTRIAL ENVIRONMENT			
Habitat VECs			
Wetlands		■ Support's the ecological integrity of the boreal region ■ Important as wildlife habitat ■ Support migratory waterfowl breeding ■ Supports critical habitats for beaver, moose, others ■ Hydrological functions ■ Supports traditional use plants (e.g., wild rice)	■ Extent of wetland habitat ■ Composition/diversity of wetland plant communities ■ Hydrological function
Forest Cover		■ Dominant forest plant community that supports the ecological integrity of the boreal region ■ Important as wildlife habitat ■ Supports populations of large carnivores such as black bear, wolves and lynx, as well as prey animals such as hare, marten and red squirrel ■ Abundance of migratory birds utilize habitat for breeding ■ Socio-economic importance	■ Extent of forested habitat ■ Composition of forest plant community ■ Suitability of habitat in supporting wildlife populations
Group VECs			
Species at Risk	Bald Eagle	■ Observed in the vicinity of the Project Site ■ Cultural significance ■ Provincially, bald eagles are designated as Special Concern under Ontario's *Endangered Species Act*	■ Habitat suitability and availability for bald eagle
	Common Nighthawk	■ Bird SAR observed on and in the vicinity of the Project Site ■ Provincially, Common nighthawk is designated as Special Concern under Ontario's *Endangered Species Act* ■ Breeding habitat occurs on the Project Site	■ Habitat suitability and availability for common nighthawk
	Canada Warbler	■ Bird SAR observed on and in the vicinity of the Project Site ■ Provincially, Canada warbler is designated as Special Concern under Ontario's *Endangered Species Act* ■ Breeding habitat occurs on the Project Site	■ Habitat suitability and availability for Canada warbler
	Little Brown Myotis	■ Observed in the vicinity of the Project Site ■ Cultural significance ■ Provincially, little brown myotis are designated as Special Concern under Ontario's *Endangered Species Act*	■ Habitat suitability and availability for little brown myotis
	Northern Myotis	■ Observed in the vicinity of the Project Site ■ Cultural significance ■ Provincially, northern myotis are designated as Special Concern under Ontario's *Endangered Species Act*	■ Habitat suitability and availability for northern myotis

Table 2-3: Hammond Reef Gold Project Valued Ecosystem/Social Components (Continued)

VEC/VSC		Rationale for Selection	Indicators
TERRESTRIAL ENVIRONMENT (CONTINUED)			
Group VECs (Continued)			
Species at Risk (Continued)	Snapping Turtle	■ Herpetofaunal SAR observed on and in the vicinity of the Project Site ■ One of few reptile species in this northern ecosystem ■ Indicator of wetland function	■ Habitat suitability and availability for snapping turtle
Furbearers	Marten Muskrat	■ Common and abundant in the Project Site ■ Important prey species for many carnivores in northern environments ■ May be tolerant of human activities, but may be affected by habitat loss ■ Traditional and non-traditional uses	■ Presence/persistence of furbearers ■ Habitat suitability and availability for furbearers
Upland Breeding Birds		■ Small territory size and high bird density means large numbers of upland birds may be affected by habitat loss ■ Migratory birds are susceptible to population declines as a result of changing environmental conditions on breeding and overwintering habitats	■ Relative abundance of breeding birds ■ Habitat suitability and availability for upland breeding birds
Species VECs			
Moose		■ Observed on and in the vicinity of the Project Site ■ Important subsistence and cultural species ■ Large herbivorous mammal requiring a large home range ■ Prey species for large carnivores	■ Presence/persistence of moose in the area ■ Habitat suitability and availability for moose
Wild rice		■ Traditional use plant (culturally significant to Aboriginal communities) ■ Sensitive to fluctuating water levels	■ Potential presence/persistence of wild rice in the area ■ Habitat suitability and availability for wild rice
AQUATIC ENVIRONMENT			
Lower reaches (e.g., downstream) of small streams draining footprint including any mainstem ponds, and stream crossings		■ Potentially affected (altered, diverted) by Project infrastructure ■ Alteration may result in loss of fish and productivity (e.g., critical habitats, food resources for fish) ■ Changes can be measured using a variety of standard indicators available (e.g., provincial and federal government criteria)	■ Benthic invertebrate community ■ Fish habitat suitability ■ Fish community (resident assemblages/species present)
Upper Marmion Reservoir (receiver)		■ Socio-economic importance (tourism, angling) ■ Sensitive receiving water environment ■ Receiving Bays (mouths of small streams) potentially affected (altered, diverted) by Project infrastructure ■ Receiving Bays may represent significant habitat for locally important fish species. Alteration of habitats may result in loss of fish and productivity (e.g., critical habitats, food resources for fish) ■ Changes can be measured using a variety of standard indicators available (e.g., provincial and federal government criteria)	■ Benthic invertebrate community ■ Fish habitat suitability (receiving bays) ■ Fish community (resident assemblages/species present in receiving bays) ■ Contaminants in fish tissue.

Table 2-3: Hammond Reef Gold Project Valued Ecosystem/Social Components (Continued)

VEC/VSC	Rationale for Selection	Indicators
AQUATIC ENVIRONMENT (CONTINUED)		
Lizard Lake (receiver)	■ Socio-economic importance (tourism, angling) ■ Sensitive receiving water environment ■ Receiving Bays (mouths of small streams) potentially affected (altered, diverted) by Project infrastructure ■ Receiving Bays may represent significant habitat for locally important fish species. Alteration of habitats may result in loss of fish and productivity (e.g., critical habitats, food resources for fish) ■ Changes can be measured using a variety of standard indicators available (e.g., provincial and federal government criteria)	■ Benthic invertebrate community ■ Fish habitat suitability (receiving bays) ■ Fish community (resident assemblages/species present in receiving bays) ■ Contaminants in fish tissue
Walleye	■ Socio-economic importance (angling) ■ Traditional resource use (First Nation concern ■ Long lived, top predator species (piscivorous), will accumulate contaminants ■ Human health; consumed by anglers, subsistence fishers	■ Walleye habitat ■ Contaminants in walleye flesh
Smallmouth Bass	■ Socio-economic importance (angling, Bass Classic fishing derby)	■ Smallmouth Bass habitat
Northern Pike	■ Socio-economic importance (angling) ■ Long lived, top predator species (piscivorous), will accumulate contaminants ■ Human health; consumed by anglers, subsistence fishers	■ Northern Pike habitat
Baitfish species	■ Socio-economic importance (commercial baitfish fishery) ■ Important food resource for large fish species (e.g., walleye)	■ Baitfish habitat
CULTURAL HERITAGE RESOURCES		
Archaeological Sites	■ Possible affect to archaeological sites	■ Project related changes to archaeological sites and artifacts
Built Heritage	■ Possible affect to late 19th and early 20th century mine sites	■ Project-related changes to 19th to mid-20th century mine sites
Cultural Heritage Landscapes	■ Possible affect to cultural heritage landscapes	■ Project-related changes to cultural heritage landscapes
ABORIGINAL INTERESTS		
Aboriginal community characteristics	■ Potential changes to economic base and educational attainment of Aboriginal communities	■ Project Aboriginal employment ■ Project contracts awarded to Aboriginal businesses ■ Education and training of Aboriginal people
Aboriginal heritage resources	■ Importance of Aboriginal heritage resources such as archaeological sites ■ Importance of specific cultural or spiritual sites	■ Identified archaeological sites and artefacts ■ Identification of Cultural or spiritual sites
Traditional use of land and resources	■ Aboriginal people have traditionally made use of lands and resources for their personal and community needs ■ Importance of plants, animals and fish that have been traditionally harvested and consumed by Aboriginal people	■ Changes or effects identified on the aquatic environment ■ Changes or effects identified on the terrestrial environment ■ Availability and quality of country foods

Table 2-3: Hammond Reef Gold Project Valued Ecosystem/Social Components (Continued)

VEC/VSC	Rationale for Selection	Indicators
SOCIO-ECONOMIC ENVIRONMENT		
Population and demographics	■ Direct job opportunities will attract workers to area for short-term (i.e. construction) and longer term (i.e. operations) ■ Population change may result in changes in demand on social and physical services and infrastructure ■ The influx of workers due to the Project could benefit long-term economic and community development, supporting community vibrancy and improved social infrastructure (e.g., housing, organized recreation, support for local business, etc.)	■ Population change (historical and projections) ■ Mobility ■ Age and Gender ■ Dependency ratios
Economics		
Labour market (employment and training)	■ Sustainable employment and training opportunities can develop transferable skills, and long-term regional and local economic benefits ■ Communities are interested in local recruitment, training and employment ■ Timing and number of employment opportunities could offset layoffs in other sectors ■ Loss of employment and income generation at closure may require mitigation measures to avoid adverse effects	■ Labour force by industry and occupation ■ Employment and Unemployment rates ■ Median Income ■ High school/post-secondary completion rates
Economic development	■ The Project would contribute to diversification of the regional and local economies and either directly or indirectly encourage investment in other business activities, namely through: ■ Creation of opportunities for local contractors and suppliers ■ Encouraging new investment in service capacity ■ Encouraging business creation and expansion ■ Creation of competitive local suppliers ■ Loss of business opportunities at closure (~2030) may require mitigation measures to avoid adverse effects	■ Regional and local economic base ■ Regional and local supplier base
Local government finances	■ Governments will benefit through increased tax and fee for service revenues ■ Governments may incur costs related to the provision of services	■ Local government revenues and expenditures

Table 2-3: Hammond Reef Gold Project Valued Ecosystem/Social Components (Continued)

VEC/VSC	Rationale for Selection	Indicators
SOCIO-ECONOMIC ENVIRONMENT (CONTINUED)		
Services and Infrastructure		
Public services and infrastructure	■ Population increase in the LSA may increase demand on services (health, emergency and protection, education, recreation) and water and waste infrastructure ■ Project activities may increase demand for health, emergency services and waste/water infrastructure	**Protection and Emergency:** ■ Police capacity ■ Ambulance capacity ■ Fire protection capacity **Health Services:** ■ Number/type of facilities, services and programs ■ Number of medical practitioners per population ■ Capacity/capacity utilization **Social Services:** ■ Capacity/capacity utilization **Education:** ■ School enrolment ■ Capacity utilization **Recreation:** ■ Number/type of recreational facilities ■ Capacity utilization **Water, Wastewater and Waste Management:** ■ Capacity and capacity utilization of infrastructure ■ Solid waste management sites and capacity utilization **Utilities:** ■ Capacity and capacity utilization
Housing and accommodation	■ Influx of workers and families may lead to changes in demand for, availability and cost for temporary and permanent housing, and tourism accommodation	■ Permanent and temporary housing supply ■ Occupancy rates ■ Housing costs and availability
Transportation	■ The Project may strain existing road and transportation network due to movement of Project workers, equipment, supplies and products	■ Traffic volumes (average annual daily traffic counts) and levels of service on relevant access roads and intersections (traffic study to be completed) ■ Existing transportation network
Land Use and Resources		
Outdoor tourism and recreation	■ The Project may affect tourism and recreation activities and opportunities ■ Loss of employment and income generation by tourist operators may require mitigation measures to avoid adverse effects	■ Crown land and other tenures ■ Tourism activities and specific-use areas ■ Number and types of visitors to the study area ■ Tourism revenue generation

Table 2-3: Hammond Reef Gold Project Valued Ecosystem/Social Components (Continued)

VEC/VSC	Rationale for Selection	Indicators
SOCIO-ECONOMIC ENVIRONMENT (CONTINUED)		
Land Use and Resources (Continued)		
Hunting	■ The Project may occupy or affect the land base which supports hunting ■ Loss of employment and income generation by hunters may require mitigation measures to avoid adverse effects	■ Hunting areas ■ Wildlife management (e.g., moose, deer, bear) management areas ■ License sales ■ Harvest volumes
Trapping	■ The Project may occupy or affect the land base which supports trapping ■ Loss of employment and income generation by trappers may require mitigation measures to avoid adverse effects	■ Tenured trapline areas ■ Harvest volumes
Fishing	■ The Project may occupy land base which supports fishing activities ■ Loss of fishing opportunity may require mitigation measures to avoid adverse effects	■ Recreational fishing participation (e.g., Atikokan Bass Classic) ■ Recreational and commercial fishing areas, licence sales and harvest volumes ■ Baitfish areas and harvest volumes ■ Conduct a biannual fishing questionnaire of the project workforce to estimate the level of fishing pressure resulting from the Project
Water use and access	■ The Project has the potential to influence the use of and access to water bodies such as the Marmion Reservoir ■ The Marmion Reservoir is an important resource for recreational fisheries and tourism, hydro-electric power and other commercial and industrial uses	■ Recreational fishing participation (e.g., Atikokan Bass Classic) ■ Water use for hydro-electric power and other industrial and commercial uses
Mining	■ The Project may affect current and future mining and aggregate resource activity	■ Exploration and development projects (current and potential resources) ■ Mining land use, plans
Forestry	■ The Project occupies forested land ■ Disrupting access to existing or future harvest land may require mitigation measures to avoid adverse effects	■ Timber harvesting land base (harvest area, tenure)
ATMOSPHERIC ENVIRONMENT		
Air Quality		
Ambient air quality	■ Air quality is selected as a VEC since it has been identified as an important aspect of the environment by both public and regulators. In addition, emissions from the Site activities have the potential to alter the existing air quality	The following compounds have been identified, which are expected to be emitted in measureable amounts from the Site, and for which air quality criteria against which the Site effects can be compared are available: ■ Particulate matter, including suspended particulate matter (SPM), particles nominally smaller than 10 µm in aerodynamic diameter (PM10), and particles nominally smaller than 2.5 µm in aerodynamic diameter (PM2.5) ■ Oxides of nitrogen (NOX) and the resulting nitrogen dioxide (NO2) ■ Sulphur dioxide (SO2) ■ Carbon monoxide (CO) ■ Metals, including antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, tellurium, tin and vanadium

Table 2-3: Hammond Reef Gold Project Valued Ecosystem/Social Components (Continued)

VEC/VSC	Rationale for Selection	Indicators
ATMOSPHERIC ENVIRONMENT (CONTINUED)		
Noise		
Ambient noise levels	■ Noise levels are selected as a VEC since it has been identified as being important to regulators and stakeholders. In addition, Site activities have the potential to affect existing noise levels.	■ The effect of the on Site noise sources will be evaluated using the 1-hour equivalent noise level (Leq). The 1-hour Leq is the energy equivalent continuous sound level, which has the same energy as the time varying signal over a one hour period at the same location. ■ Other noise indicators are available that are not appropriate for the evaluation of the Site noise levels, but are appropriate for evaluating the indirect effects of changes in noise levels on other VECs (e.g., ecological effects).
Vibration from Blasting		
Vibration Levels	■ Vibration levels are selected as a VEC since they have been identified as being important to regulators and stakeholders. In addition, Project Site activities have the potential to affect existing vibration levels.	■ The effect of blasting on air vibrations will be evaluated using Peak Air Pressure Level in dBL. ■ The effect of blasting on ground vibrations will be evaluated us Peak Particle Velocity in mm/s
HYDROLOGY		
Surface water quantity	■ The Project may result in changes to surface water quantity within the MSA.	■ Seasonal stream flow in creeks ■ Seasonal water levels in Marmion Reservoir and Lizard Lake ■ Catchment areas
Navigability	■ The Project may result in the partial obstruction or change to navigable watercourses or waterbodies. ■ Potential for changes in flow, width, depth or gradient of watercourses or waterbodies.	■ Presence of obstruction. ■ Flow, width, depth or gradient of waterbody or watercourse.
HYDROGEOLOGY		
Groundwater quantity	■ Potential of groundwater flow change within the MSA.	■ Changes in groundwater levels.
WATER QUALITY		
Surface Water Quality and Quantity	■ Potential changes in surface water quality due to water intake and discharge and/or from alteration of runoff processes within the MSA.	■ Substrate metal content. ■ Amount of organic material. ■ Dissolved oxygen. ■ pH. ■ Temperature. ■ Total phosphorous. ■ Total and dissolved metal concentrations in water. ■ Nutrient content in water. ■ Total Dissolved Solids. ■ TKN, TP. ■ Anions, cations. ■ Conductivity.

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2.5.7 Environmental and Social Components Considered

The environmental and social components that are considered in the EIS/EA Report are provided in Chapter 1.

2.6 Assessment Methodology

The effects assessment followed a stepwise methodology as follows:

- Screening of Project activities with the potential to have interactions with the VECs of the socio-economic environment.
- Prediction (i.e., identification and description) of likely effects of the Project.
- Identification of suitable mitigation measures to reduce or eliminate the identified adverse effects.
- Assessment of whether adverse effects are likely after mitigation (i.e., residual effects).
- Determination of the significance of residual effects. If there is uncertainty of whether an effect remains after mitigation, the effect is forwarded for determination of significance.

The effects assessment is completed within the framework of temporal and spatial boundaries described in Section 2.2.2. The assessment takes into account a precautionary approach and incorporates Aboriginal traditional knowledge, where available.

The effects assessment identifies potential effects of the Project on the environment following a source-pathway-receptor approach. Project activities represent sources of effects, measurable changes to the environment represent pathways, and VECs represent receptors. In some cases, VECs may act as both pathways and receptors.

Project effects may occur through direct or indirect pathways. Direct pathways occur when a VEC is affected by an effect resulting from a Project activity, such as an increase in local employment through Project hiring. Indirect pathways occur when a VEC is affected by an effect on another VEC, for example the resulting change in hunting and fishing as a result of changes to the aquatic environment. The effects assessment recognizes the widest, reasonable range of potential direct and indirect effects without specific regard for their probability of occurrence.

When a likely Project effect is judged as being positive it is not assessed further and no evaluation of significance is conducted. All positive effects are included in Chapter 11 as part of the benefits of the Project.

The identification of potential environmental effects was undertaken on the basis of the identified Project activities and the likely interactions of these with the natural environment, including issues that have been identified in consultation with local communities, regulators and other stakeholders. The process recognizes that only where there is a potential interaction could there be a potential effect.

2.6.1 Screening Project and Environment Interactions

Project activities identified in the screening were assessed against existing or baseline attributes of the natural and social environment, including the physical, biological and socio-economic criteria identified for the selection of study areas.

Particular attention was given to surface water resources, and rare or endangered species. Project activities that are not expected to not interact with the environment were not considered further.

The assessment of environmental effects was performed using the following procedure to identify the Project activities that have the potential to be affected by the Project. The approach used in the initial screening was to:

- Identify Project activities based on the detailed project description (Chapter 5).
- Those Project activities that could have an effect on, or interact with, the natural environment were identified and assessed further.

The results of the initial screening helped focus the effects assessment on sensitive and locally significant species or groups of species, with the understanding that effects on other components of the ecosystem would be similar.

2.6.2 Prediction and Assessment of Likely Effects

A systematic and consistent approach was employed in the assessment of environmental issues and potential effects. The assessment of potential effects was assessed in consideration of different categories of effect. The categories were:

- **Direction:** The direction of an effect may be positive, neutral or negative with respect to a given issue (e.g., enhancement of a wildlife movement corridor would be classed as a positive direction, whereas habitat loss or fragmentation would be considered a negative direction).
- **Extent:** The spatial area affected by the potential effects of the Project. For the purposes of this assessment *Extent* was classified as: within the MSA, within the LSA, or within the RSA.
- **Magnitude:** The amount of change in a measurable parameter or the predicted/actual level of change relative to an existing or specified condition. *Magnitude* was defined according to the specific nature of the effect. For the purposes of this assessment, magnitude was classified as: low, moderate and high. The definition of magnitude differs for each environmental component.
- **Duration:** This refers to the length of time over which an effect occurs. For the purpose of this assessment, duration was classified as: short-term (i.e., lasting only during the construction period), medium-term (i.e., lasting the entire operational period) and long-term (i.e., extending beyond the closure of the Project, sometimes in perpetuity).
- **Reversibility):** This considers the potential for recovery of a given receptor from the effect. For the purpose of this assessment, reversibility of a potential effect (or degree of irreversibility) was classified as Low for effects that reverse to the pre-effect condition after the source of the effect is removed, Moderate for effects that reverse to achieve 50% or greater of the pre-effect condition, and High for effects in which a greater than 50% change occurs such that the pre-effect condition cannot be substantially achieved.

Magnitude for physical disciplines, such as hydrology, water quality and air quality was assessed relative to existing regulatory standards, criteria or guidelines. Accordingly, physical components, such as air quality, surface water and groundwater quality, and soils and sediment quality were assessed with respect to the environmental standards presented in Chapter 6.

2.6.2.1 Assessment Measures

Assessment methods specific to each environmental component are briefly described in the following sections.

Assessment measures for extent, duration, frequency and reversibility are common to all environmental components, and these are defined in Table 2-4. Measures for magnitude differ among each component and are defined separately for each component as provided in Tables 2-5 through 2-8 and Table 2-10. Magnitude is defined only for the biological, cultural heritage resources, and socio economic components.

For the physical environment components, the results of predictive modelling are used as direct inputs into the assessment on biological receptors, since the effects of changes in physical conditions have significance only with respect to effects on biological indicators. For example, the magnitude of a change in water level can only be assessed with respect to the terrestrial and aquatic biological resources that would be affected by such a change. Similarly, changes in water quality parameters are assessed directly with respect to the potential for adverse effects on aquatic life, wildlife and human health.

Table 2-4: Assessment Measures Common to Environmental Components

Assessment Criteria	Level	Environmental Component				
Geographic Extent (of effect)	**Low**	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	**Terrestrial Ecology**
		Effect is within the Project Site (i.e. Mine Study Area or Linear Infrastructure Study Area)		Effect extends into the Local Study Area		Effects limited to the Mine Study Area
	Medium	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	**Terrestrial Ecology**
		Effect extends into the Local Study Area		Effect extends into Regional Study Area		Effects limited to the Local Study Area
	High	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	**Terrestrial Ecology**
		Effect extends into the Regional Study Area		Effect extends beyond Regional Study Area		Effects limited to the Regional Study Area
Frequency (of effect)	**Low**	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	**Terrestrial Ecology**
		Conditions or phenomena causing the effect to occur infrequently (i.e., several times per year				N/A
	Medium	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	**Terrestrial Ecology**
		Conditions or phenomena causing the effect to occur at regular, although infrequent intervals (i.e., several times per month)				N/A
	High	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	**Terrestrial Ecology**
		Conditions or phenomena causing the effect to occur at regular and frequent intervals (i.e., daily or continuously)				N/A

Table 2-4: Assessment Measures Common to Environmental Components (Continued)

Assessment Criteria	Level	Environmental Component				
Duration (of conditions causing effect)	**Low**	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	**Terrestrial Ecology**
		Conditions causing effect are evident during site preparation and construction phase, or closure phase				Duration of effects, which includes reversibility, is a function of ecological resilience, and these ecological principles are applied to the evaluation of significance. Although difficult to measure, resilience is the capacity of the system to absorb disturbance, and reorganize and retain the same structure, function, and feedback responses. Resilience includes resistance, capability to adapt to change, and how close the system is to a threshold before shifting starts (i.e., precariousness).
	Medium	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	
		Conditions causing effect are evident during the operations phase				
	High	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	
		Conditions causing effect extend beyond any one phase				

Table 2-4: Assessment Measures Common to Environmental Components (Continued)

Assessment Criteria	Level	Environmental Component				
Degree of Reversibility (of effect)	**Low**	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	**Terrestrial Ecology**
		Effect is readily (i.e., immediately) reversible				Included within Duration criteria
	Medium	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	
		Effect is reversible with time				
	High	**Aquatic Environment**	**Cultural Heritage Resources**	**Human Health and Ecological Risk**	**Socio-Economic Environment**	
		Effect is not reversible (i.e., permanent)				

2.6.2.2 Magnitude Levels for Specific Environment Components

Tables 2-5 through 2-8 provide the magnitude levels for the selected VECs.

Table 2-5: Magnitude Levels for Aquatic Environment Valued Ecosystem Components Indicator Measures

Valued Ecosystem Components	Magnitude		
	Low	**Medium**	**High**
Fish species habitat	Less than 10% of the waterbody lengths/surface area lost or disturbed in the LSA and/or 5% to 10% change in stream flow/ discharge	10% to 25% of the waterbody lengths/surface are lost or disturbed in the LSA and/or 10% to 25% change in streamflow/ discharge/contributing drainage	Greater than 25% of the waterbody lengths/surface area lost or disturbed in the LSA and/or greater than 25% change in streamflow/ discharge/contributing drainage
Contaminants in fish tissue	Magnitude is assessed in the Human Health and Ecological Risk Assessment		
Benthic Indices	N/A	N/A	Significant difference from existing conditions for parameters
Aquatic species, populations and communities (including species with special designation)	Less than 10% change	10% to 25% change	Greater than 25% change

Table 2-6: Magnitude Levels for Terrestrial Ecology Valued Ecosystem Components

Valued Ecosystem Components	Magnitude			
	Negligible	**Low**	**Medium**	**High**
Wetlands	Effect is <1% change from baseline conditions (in the VEC relevant spatial area)	1-10% change from baseline conditions (in the VEC relevant spatial area)	Greater than10% to 25% change from baseline conditions (in the VEC relevant spatial area)	Effect is >25% change from baseline conditions (in the VEC relevant spatial area)
Forest Cover	Effect is <1% change from baseline conditions (in the VEC relevant spatial area)	1-10% change from baseline conditions (in the VEC relevant spatial area)	Greater than10% to 25% change from baseline conditions (in the VEC relevant spatial area)	Effect is >25% change from baseline conditions (in the VEC relevant spatial area)
Species At Risk	Effect is <1% change from baseline conditions (in the VEC relevant spatial area)	1-10% change from baseline conditions (in the VEC relevant spatial area)	Greater than10% to 25% change from baseline conditions (in the VEC relevant spatial area)	Effect is >25% change from baseline conditions (in the VEC relevant spatial area)

Table 2-6: Magnitude Levels for Terrestrial Ecology Valued Ecosystem Components (Continued)

Valued Ecosystem Components	Magnitude			
	Negligible	**Low**	**Medium**	**High**
Furbearers	Effect is <1% change from baseline conditions (in the VEC relevant spatial area)	1-10% change from baseline conditions (in the VEC relevant spatial area)	Greater than10% to 25% change from baseline conditions (in the VEC relevant spatial area)	Effect is >25% change from baseline conditions (in the VEC relevant spatial area)
Upland Breeding Birds	Effect is <1% change from baseline conditions (in the VEC relevant spatial area)	1-10% change from baseline conditions (in the VEC relevant spatial area)	Greater than10% to 25% change from baseline conditions (in the VEC relevant spatial area)	Effect is >25% change from baseline conditions (in the VEC relevant spatial area)
Moose	Effect is <1% change from baseline conditions (in the VEC relevant spatial area)	1-10% change from baseline conditions (in the VEC relevant spatial area)	Greater than10% to 25% change from baseline conditions (in the VEC relevant spatial area)	Effect is >25% change from baseline conditions (in the VEC relevant spatial area)

Table 2-7: Magnitude Levels for Human Health

Valued Ecosystem Components	Magnitude			
	Negligible	**Low**	**Medium**	**High**
Non-Carcinogenic Compounds	No change from baseline conditions, below applicable guidelines, or HQ ≤ 1	1 < HQ ≤ 10	10 < HQ ≤ 100	HQ > 100
Carcinogenic Compounds	No change from baseline conditions, below applicable guidelines, or ILCR ≤ 1×10^{-6}	1×10^{-6} < ILCR ≤ 1×10^{-5}	1×10^{-5} < ILCR ≤ 1×10^{-4}	ILCR > 1×10^{-4}

Note:

HQ = Hazard Quotient; represents the target ratio of the predicted chemical exposure relative to its health-based benchmarks.

ILCR = Incremental Lifetime Cancer Risks represents additional risk of developing cancer due to chemical exposure (from the Project) incurred over the lifetime of an individual.

Table 2-8: Magnitude Levels for Cultural Heritage Resources Valued Ecosystem Components

Valued Ecosystem Component	Magnitude			
	Negligible	**Low**	**Medium**	**High**
Population and Demographics	Predicted change in population and demographic indicators < 1% of existing conditions	Predicted change in population and demographic indicators of 1% - 4.9% of existing conditions	Predicted change in population and demographic indicators of 5% - 19.9% of existing conditions	Predicted change in population and demographic indicators of ≥20% of existing conditions

2.6.2.3 Risk Assessment Framework

The assessment of effects was based on established frameworks for predicting the potential for adverse effects on the environment.

Various agencies including the CCME, MOE and the U.S. EPA have developed risk assessment frameworks that provide a standard approach for assessing effects based on a simple assessment of three factors:

- **Source:** the source of a potential effect must be present. This includes physical disturbances of the environment and exposure to potentially harmful substances.
- **Pathway:** Some means by which the source of the potential effect can affect environmental attributes (attributes can be physical, chemical or biological) must be present.
- **Receptor:** there must be an environmental attribute that the pathway leads to, and thereby can potentially affect.

While risk assessment frameworks were originally developed to specifically assess the effects of exposure to chemical substances on biological receptors, the risk assessment framework is applicable to assessing physical effects as well, since in all cases, the three components defined above must be present in order for a potential effect to occur. Sources of potential effect from the Project include land disturbance that can result in loss of habitat, either temporarily or permanently, exposure to human activity including noise, and potential exposure to emissions and discharges of substances to the environment. These typically include air emissions and discharges of storm water, process water and/or domestic waste water to the environment.

Only where there is a source of a potential effect, a receptor that could be exposed, and a reasonable pathway by which the receptor can be exposed is there a potential for an effect.

The effects are then assessed against established benchmarks associated with a specific adverse response in the environment. The benchmarks are typically based on the scientific literature and experience at other similar sites in order to determine the degree of risk that the source presents to the environmental attributes.

2.6.3 Identification of Mitigation Measures

Mitigation measures have been included in the design of the Project where potential effects can be anticipated during the engineering design phase. These design measures are termed “in-design mitigation”. As a result, many Project components include inherent mitigation measures, and the effects assessment assumes that these measures will be in place.

However, in some cases, potential effects cannot be anticipated until the effect assessment has been completed. Where additional mitigation measures were needed to modify the effects of a potential effect, these are identified, and the assessment was repeated with the additional mitigation measures.

2.6.4 Identification of Residual Effects

The Project is a complex undertaking that will occur in four phases which differ in their potential interactions with the natural and socio-economic environments and in the potential for occurrence of residual effects. In order to focus the effects assessment, the Project's effect assessment addresses the physical components of the environment identified in Section 2.5.2.

While the effects assessment included predictions of changes to physical environmental components, the focus of determination of significance was generally based on the biological receptors that were subject to those changes. Numerical guidelines are readily available for many physical parameters such as water and air quality, but the significance of any exceedance lies in determination of effects on, or risks to, biological receptors or components of the environment.

Consequently, the environmental assessment focuses on biological resources. Many of the pathways of effects relate to changes in the physical environmental components listed above. Potential effects may also arise from Project activities such as site clearing that physically displace or alter habitat and also from indirect socio-economic factors such as increased human population density and improved access that can result in changes in exploitation of local biological resources. Biological components of the environment are identified in Section 2.5.3.

Human and ecological health was evaluated using a risk assessment approach described in Section 2.6.2. Risk assessment is a scientific tool used to characterize the nature and magnitude of potential risks, if any, associated with the exposure of receptors (e.g., humans, wildlife and aquatic life) to substances.

A Conceptual Site Model was developed by the risk assessors, using physical and biological data provided by the other environmental assessment disciplines. The Model was used to understand which substances (i.e., substances present at concentrations in excess of the applicable guidelines/standards or COPCs) are present in the study area, how receptors may use the areas, and the pathways of contact that are possible between these substances and the receptors. These substances, receptors, and pathways (the environmental risk components) are examined in detail to identify the "reasonably anticipated" combinations corresponding to potentially complete exposure pathways.

Taken together, the physical and biological effect assessments comprise the environmental assessment, and were used to predict any changes to the quality and availability (quantity) of resources in the study areas.

The process of assessing and evaluating the effects of the Project, as described in the following sections, was based on an integration of a number of criteria and sources of information. The process includes both an evaluation of site-specific information, in the form of empirical data from the site, modeling studies and consultation with Aboriginal communities, stakeholders and regulators, as well as a review of the broader technical and scientific literature. The latter includes the published scientific literature, effects assessments and environmental effects studies at similar sites, published best management practices and professional judgement and experience.

2.6.5 Significance of Residual Effects

The effects assessment is based on the Project Description detailed in Chapter 5, and includes all mitigation measures currently incorporated into the design. Where adverse effects to the environment were identified, additional mitigation measures have been incorporated, where feasible, to minimize or avoid entirely any residual effects. All residual adverse effects were then re-evaluated to determine the final significance of the likely effect.

As noted, residual effects are assessed after all mitigation measures have been identified, including in-design mitigation incorporated into the Project design and further mitigation identified in the assessment. Where mitigation is not possible, for example, the permanent loss of aquatic habitat, compensation measures are identified.

2.6.5.1 Method for Determining Significance

Determination of the significance of an effect is based on an integration of the assessment measures. For example, an effect that has high magnitude, but is confined to the MSA, is of short duration, and is reversible, would be considered to have low significance. In addition, significance is often modified by mitigation measures that serve to lessen the effects, and for many of the components, these are inherent in the engineering design.

Exceedance of a regulatory criterion is not necessarily an indication of a significant effect, and it does not automatically provide a measure of significance to biological receptors. Each environmental change must be interpreted according to the degree of risk of effect to the biological communities based on specific attributes of pathway, exposure and receptor characteristics, as well as the likelihood of measurable effects on populations or communities. This approach recognizes that effects at the community or population level can have much longer lasting effects than effects on individuals.

The significance of an effect is usually assessed relative to a biological endpoint, such as effects on biological communities (VECs) or human health. The determination of significance is based on the potential effects on biological receptors, rather than the physical environment. Since the effects on physical components, such as water quality, are determined with respect to their potential biological effects (e.g., water quality guidelines have been developed with the purpose of protecting biological resources), the assessment of significance is considered within this context.

The assessment was conducted with the use of tables that organized and summarized the process described above into comparable and intuitive presentations for each of the construction, operations, and closure and post-closure phases. The assessment tables are provided in Chapter 6.

The effects assessment uses six criteria to assess the significance of an adverse effect, as following:

- Direction: the direction of the effect as positive or negative.
- Magnitude: the size or degree of the effect for a given parameter.
- Geographic extent: the spatial area over which the effect may occur.
- Duration: the length of time over which the effect may occur.

- Frequency: the rate of recurrence of the effect (or conditions causing the effect).
- Degree of Irreversibility: whether the effect may or may not be reversed.

In order to assess effects, levels are associated to each criterion except direction. Criteria such as geographic extent, duration, frequency and degree of irreversibility use three levels: low, medium and high, as shown in Table 2-9.

Table 2-9: Assessment Criteria and Levels for Determining Significance

Assessment Criteria	**Level**		
Geographic Extent (of effect)	**Low**	**Medium**	**High**
	Effect extends into the Local Study Area	Effect extends into the Regional Study Area	Effect extends beyond Regional Study Area
Frequency (of effect)	**Low**	**Medium**	**High**
	Conditions or phenomena causing the effect to occur infrequently (i.e., several times per year)	Conditions or phenomena causing the effect to occur at regular, although infrequent intervals (i.e., several times per month)	Conditions or phenomena causing the effect to occur at regular and frequent intervals (i.e., daily or continuously)
Duration (of conditions causing effect)	**Low**	**Medium**	**High**
	Conditions causing effect are evident during the site preparation and construction phase, or decommissioning phase	Conditions causing effect are evident during the operations phase	Conditions causing effect extend beyond any one phase
Degree of Irreversibility (of effect)	**Low**	**Medium**	**High**
	Effect is readily (i.e., immediately) reversible	Effect is reversible with time	Effect is not reversible (i.e., permanent)

A modification of the magnitude levels was used in the socio-economic assessment. VSC-specific magnitude levels were determined as shown in Table 2-10. Four levels are associated to the magnitude criterion: negligible, low, medium and high.

Table 2-10: Magnitude Levels for Socio-economic Valued Ecosystem Components

VECs	**Magnitude**			
	Negligible	**Low**	**Medium**	**High**
Population and Demographics	Predicted change in population and demographic indicators < 1% of existing conditions	Predicted change in population and demographic indicators of 1% - 4.9% of existing conditions	Predicted change in population and demographic indicators of 5% - 19.9% of existing conditions	Predicted change in population and demographic indicators of ≥20% of existing conditions

Table 2-10: Magnitude Levels for Socio-economic VECs (Continued)

VECs	Magnitude			
	Negligible	**Low**	**Medium**	**High**
Labour Market	Predicted change in labour market indicators < 1% of existing conditions	Predicted change in labour market indicators of 1% - 4.9% of existing conditions	Predicted change in labour market indicators of 5% - 19.9% of existing conditions	Predicted change in labour market indicators of ≥20% of existing conditions
Government Finances	Predicted change in indicators < 1% of existing conditions	Predicted change in indicators of 1% - 4.9% of existing conditions	Predicted change in indicators of 5% - 19.9% of existing conditions	Predicted change in indicators of ≥20% of existing conditions
Public Services and Infrastructure	Utilization does not exceed 75% of capacity	Utilization is between 75% and 90% of capacity	Utilization is greater than 90% of capacity	Utilization exceeds capacity
Housing and Accommodation	Utilization does not exceed 75% of capacity	Utilization is between 75% and 90% of capacity	Utilization is greater than 90% of capacity	Utilization exceeds capacity
Transportation	Level of service (LOS) 'A' or 'B', or volume to capacity ratio (V/C) < 0.10	LOS 'C' or V/C 0.10 – 0.49	LOS 'D' or V/C 0.50 – 0.90	LOS 'E' or 'F', or V/C > 0.9
Outdoor Tourism and Recreation	Predicted change in indicators < 1% of existing conditions	Predicted change in indicators of 1% - 4.9% of existing conditions	Predicted change in indicators of 5% - 19.9% of existing conditions	Predicted change in indicators of ≥20% of existing conditions
Hunting	Predicted change in indicators < 1% of existing conditions	Predicted change in indicators of 1% - 4.9% of existing conditions	Predicted change in indicators of 5% - 19.9% of existing conditions	Predicted change in indicators of ≥20% of existing conditions
Trapping	Predicted change in indicators < 1% of existing conditions	Predicted change in indicators of 1% - 4.9% of existing conditions	Predicted change in indicators of 5% - 19.9% of existing conditions	Predicted change in indicators of ≥20% of existing conditions
Fishing	Predicted change in indicators < 1% of existing conditions	Predicted change in indicators of 1% - 4.9% of existing conditions	Predicted change in indicators of 5% - 19.9% of existing conditions	Predicted change in indicators of ≥20% of existing conditions
Water Use and Access	Predicted change in indicators < 1% of existing conditions	Predicted change in indicators of 1% - 4.9% of existing conditions	Predicted change in indicators of 5% - 19.9% of existing conditions	Predicted change in indicators of ≥20% of existing conditions
Mining	Predicted change in indicators < 1% of existing conditions	Predicted change in indicators of 1% - 4.9% of existing conditions	Predicted change in indicators of 5% - 19.9% of existing conditions	Predicted change in indicators of ≥20% of existing conditions

Table 2-10: Magnitude Levels for Socio-economic VECs (Continued)

VECs	Magnitude			
	Negligible	**Low**	**Medium**	**High**
Forestry	Predicted change in indicators < 1% of existing conditions	Predicted change in indicators of 1% - 4.9% of existing conditions	Predicted change in indicators of 5% - 19.9% of existing conditions	Predicted change in indicators of ≥20% of existing conditions

The assessment of significance of an effect was determined using a decision tree specific to the socio-economic environment. In a decision tree magnitude, geographic extent, frequency, duration, and degree of irreversibility are combined to determine the overall significance of the effect. Four levels of significance are differentiated: Negligible, Low, Moderate and High. As noted previously, only adverse residual effects are assessed for significance.

In general for socio-economics and land use, a residual adverse effect was considered of negligible significance if geographic extent is low or magnitude is negligible. If geographic extent was moderate or high and magnitude is low or medium, significance is moderate. If geographic extent was medium or high, and magnitude was high, the level of significance was assesses as being high. Generally frequency, duration and degree of irreversibility were not used to evaluate the significance of an effect on VSC.

The decision tree for the socio-economic environment is shown in Figure 2-4.

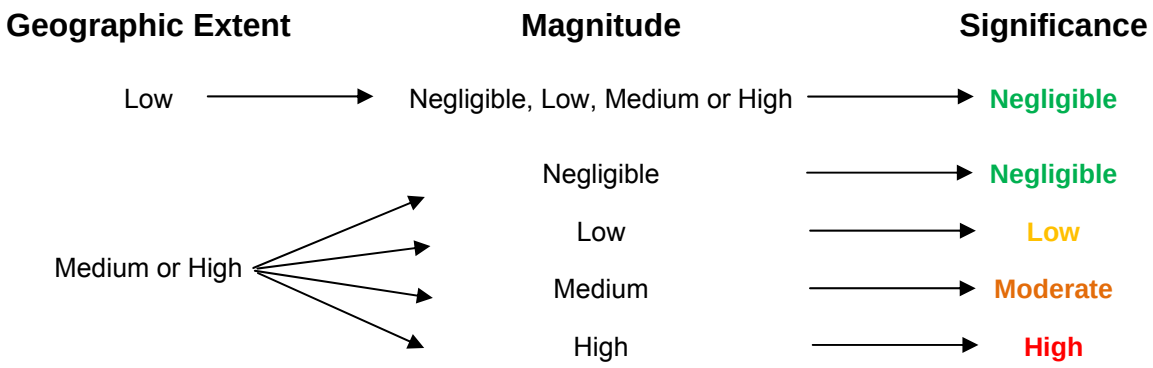

Figure 2-4: Decision Tree for Assigning Significance to Residual Effects on the Socio-economic Environment

2.7 Environmental and Social Management Plans

Environmental and Social Management Planning (ESMP) is provided in Chapter 8 and defines the management framework, processes and monitoring requirements for the Project. Analysis of the data obtained through environmental monitoring would be used to confirm predictions included in the EIS/EA Report and make corrective plans where necessary.

The ESMP has been developed to cover all Project phases, including construction, operations and closure/ post-closure and may be updated and revised as the Project is implemented. The ESMP will apply to all Project personnel and contractor/subcontractor personnel as well as visitors to the Project Site.

The ESMP was developed based on the effects summary provided in Chapter 6.

2.8 Community Consultation and Aboriginal Engagement

The Government Review Team (GRT), public, and Aboriginal communities have been actively engaged and informed on an ongoing basis through the environmental assessment process. Interested parties will have the ongoing opportunity to comment on the Project and the EIS/EA Report.

Consultation activities were carried out by OHRG's Sustainable Development group as part of the Project planning process. OHRG's approach is to be inclusive with information sharing and listen to concerns from all interested parties. Further, OHRG sought to identify and use a variety of communications methods to provide a range of means for people to be informed about the Project and have the opportunity to provide their input.

2.8.1 Government

Provincial and federal government agencies have been working together to provide a streamlined consultation process where possible. Key contacts for the environmental assessment from provincial and federal governments have been identified as Ministry of Northern Development Mines, Ministry of Environment - Environmental Assessment and Approvals Branch and the Canadian Environmental Assessment Agency. Regular meetings took place with the lead agencies and they were kept informed of consultation with other stakeholders, particularly with a focus on Crown Oversight of Aboriginal consultation.

The GRT was invited to comment on OHRG's approach throughout the environmental assessment process. The GRT was provided the Project description overview and baseline studies results prior to report publications. A Draft EIS/EA Report was published and presentations of the EIS/EA Results were delivered to the GRT. Discusssions took place on clarification of details, description of assumptions and justification of approach.

The GRT provided over 700 comments on the Draft EIS/EA Report. These comments were reviewed, responses were prepared and presentations were provided to the GRT with draft responses to comments. Additional discussion took place on recommended report revisions and requests for new work. Formal responses to comments on the Draft EIS/EA Report were compiled and are issued as part of the Final EIS/EA Report.

A series of meetings/workshops were held with the GRT to discuss a number of issues specifically related to Aquatic Biology including collection of baseline data, development of fish habitat accounting methodology, discussions regarding federal and provincial regulatory requirements and preliminary discussions regarding compensation for loss of fishing opportunities. OHRG worked with the government review team to finalize a Fish Habitat Accounting methodology for use in the No Net Loss Plan included in the Aquatic Biology TSD Supplemental.

2.8.2 Public

OHRG has used a variety of methods to engage with the public including publication of Community News Briefs, Community Open Houses, meetings and presentations.

A newspaper column has been published online and in local newspapers (the Atikokan Progress, the Thunder Bay Chronicle Journal, the Ignace Driftwood and the Fort Frances Times) on a bi-weekly basis since November 2010. The objective of the Community News publication is to keep the public and Aboriginal communities with an interest in the Project informed through regular updates.

Six public open houses have been held in Atikokan and Fort Frances throughout the environmental assessment process. The timing of these community events has been tied to regulatory milestones including the Commencement of the EA Process and the Publication of a Draft EIS/EA Report. A community open house is also planned to share the findings of the Final EIS/EA Report publication.

Presentations have been given to the Town of Atikokan and other interested stakeholders on topics including the Project Description, the results of the Baseline Studies, Alternatives Assessment, Closure, Social Management Planning and the Results of the Environmental Assessment.

The Draft EIS/EA Report was circulated and responses have been provided to comments from stakeholders in written form and through presentations and meetings.

A local monitoring committee will be established which will be modelled after the existing Malartic/Osisko Community Committee. The details of the planned committee structure and potential meeting topics are provided in Chapter 8 Social Management Planning.

2.9 Aboriginal

The Project is located within Treaty 3 lands, the traditional territory of the Anishinaabe people. OHRG has developed a relationship with the local First Nations people through ongoing information sharing and the signing of a Resource Sharing Agreement. The First Nations communities with an interest in the Project include the seven-member nations of the Fort Frances Chiefs Secretariat, the Lac de Mille Lacs First Nation and the Wabigoon Ojibway Nation. The closest First Nations community is located approximately 40 km away from the Project site.

The Project is also located within an area recognized by the Métis Nation of Ontario as the Treaty 3/Lake of the Woods/Lac Seul/Rainy River/Rainy Lake traditional harvesting territories. In March 2012, OHRG signed a Memorandum of Understanding with the Métis Nation of Ontario, including four identified Métis community councils (Kenora, Sunset Country, Northwest and Atikokan). The agreement allowed for the formation of a Métis consultation committee for the Project. As of November 2012, the deliverables identified in the agreement were fulfilled and committee members agreed that adequate consultation on the Project had taken place. OHRG is actively planning ongoing communications and partnerships with the Métis Nation of Ontario.

All three key Aboriginal groups have provided letters to government stating that OHRG has provided clear and ongoing communications throughout the Project planning process.

OHRG has used a variety of methods to engage with interested Aboriginal groups including publication Community Visits, Presentations to Chiefs, Elders Forums, Committee Meetings and Community Feasts. Draft and Final Reports have been circulated and responses have been provided to comments from Aboriginal groups.

Traditional knowledge has been incorporated into the environmental assessment through the provision of capacity for traditional protocols during the consultation process and the consideration of information provided into the Project design. OHRG has routinely followed advice provided by elders to include drumming and dancing in Project meetings.

Information provided by First Nations and Metis have allowed OHRG to avoid placing infrastructure in areas that are recognized as being special or sacred sites. The effluent treatment plant discharge location and tailings management facility location have both been adjusted to minimize potential impacts to areas with environmental value as identified by Aboriginal communities. OHRG also plans to use traditional knowledge to inform the development of appropriate fish relocation plan for Mitta Lake and other fish-bearing water bodies that will be affected by the Project.

A detailed record of consultation with public, Aboriginal communities and government review team to date is provided in Chapter 7, as well as details regarding ongoing consultation commitments.

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