December 2013



HAMMOND REEF GOLD PROJECT

Socio-economic Environment Technical Support Document

VERSION 2

Submitted to:
Osisko Hammond Reef Gold Ltd.
155 University Avenue, Suite 1440
Toronto, Ontario M5H 3B7

Project Number: 13-1118-0010
Document Number: DOC022
Distribution:

Alexandra Drapack, Director Sustainable Development
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Golder Associates

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Part A: **Introduction**

Part B: **Supplemental Information Package**

Part C: **Socio-economic Environment Technical Support Document, Version 1**

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PART A

Introduction

Version 1 of the Socio-economic Technical Support Document (TSD) was published on February 15, 2013 as part of Osisko Hammond Reef Gold's (OHRG) Draft Environmental Impact Statement/Environmental Assessment (EIS/EA) Report.

The Draft EIS/EA Report underwent a seven week public review comment period after which, on April 5, 2013, OHRG received comments from the public, Aboriginal groups and the Government Review Team (GRT) seeking clarification and requesting new information.

Approximately 10 comments regarding the Socio-economic TSD and the Socio-economic component of the EIS/EA Report were received from the GRT. Written responses were prepared for each comment and are provided in Appendix 1.IV of the EIS/EA Report. Some additional comments were received from members of the public and the GRT during follow up meetings.

Version 1 of the Socio-economic TSD has not been revised. Version 2 of the Socio-economic TSD is comprised of the following:

- Part A: Introduction
- Part B: Supplemental Information Package (attached) that provides an updated Appendix to the Socio-economic TSD.
- Part C: Version 1 of the Socio-economic TSD. Part C was issued in February 2013, and is available online on OHRG's website; it has not been re-printed as part of this Version 2 of the Socio-economic TSD. The Version 1 document should be reviewed within the context of this Version 2 document, and associated updated information as presented in Part A and Part B should be considered as correct should it differ from the information presented in Version 1.

Throughout the EIS/EA Report, unless otherwise noted, all references made to the Socio-economic TSD are to Part C.

Some minor changes and revisions to the socio-economic component of the EIS/EA Report have been undertaken based on comments received. Changes to the socio-economic component were related to providing further detail on the planned social committee, as described in Chapter 8 of the EIS/EA Report. Three new commitments were made with regards to the socio-economic component:

- Administer annual fishing questionnaires to the Osisko on site workforce
- Provide capacity support for promotion of local tourism and recreation
- Work with the downstream hydro-electric facilities to further understand the potential financial implications of the predicted changes to outflows from the Raft Lake Dam

Osisko is committed to continue working with the Town of Atikokan to maximize benefits from the Project. The planned Atikokan/OHRG Committee will be formed as the Project planning process moves forward and OHRG hits key milestones. The Committee will include representatives from the following sectors to provide a venue for two way communication and ongoing planning:

- Recreation and tourism
- Emergency response and preparedness

- Health and wellness
- Education and training
- Municipal infrastructure and services

The committee will also include two Osisko staff members. The committee is anticipated to meet on a quarterly basis and will be consulted throughout all phases of the Project.

Information Requests and Supplemental Information

One of the comments received from the GRT identified a Catholic school that was missing from Figure 3-48 of the EIS/EA Report. This same Figure appears as Figure 2-8 of the Socio-economic TSD. Figure 2-8 of the Socio-economic TSD has been updated and is attached in Part B.

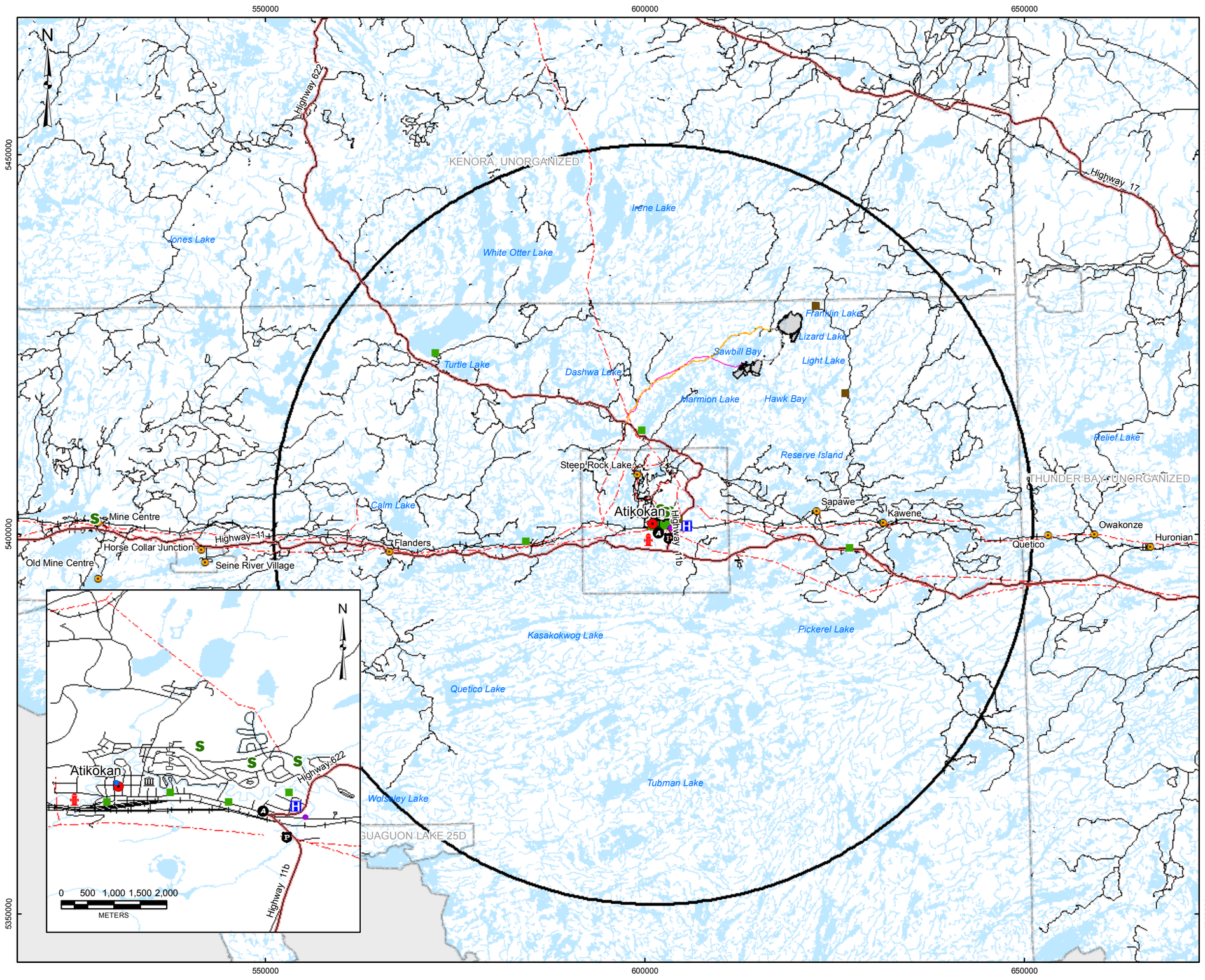
Appendix 3.I: Visual Impact Assessment has also been updated in response to a comment received from the GRT. Labels within Figure 1 of this Appendix have been updated to accurately identify the points of assessment, as have the titles of Figures 2, 3 and 6. An updated Appendix 3.I is attached in Part B.

Supplemental Information Provided in Part B

- Revised Figure 2-8
- Updated Appendix 3.1: Visual Impact Assessment

PART B

Supplemental Information Package



LEGEND

- Local Study Area City/Town
- Small Community
- Provincial Highway
- Road
- Existing Railway
- River/Stream
- Lake
- Daycare/Pre-School
- Library
- Recreation Facility
- Public Swimming Pool
- Hotel/Lodge
- Waste Disposal Site
- Ambulance
- Fire Station
- Hospital
- Police
- School
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- 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

5 2.5 0 5 10 15 20 25 30
SCALE 1:500,000 KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
SERVICES AND INFRASTRUCTURE IN THE LOCAL STUDY AREA

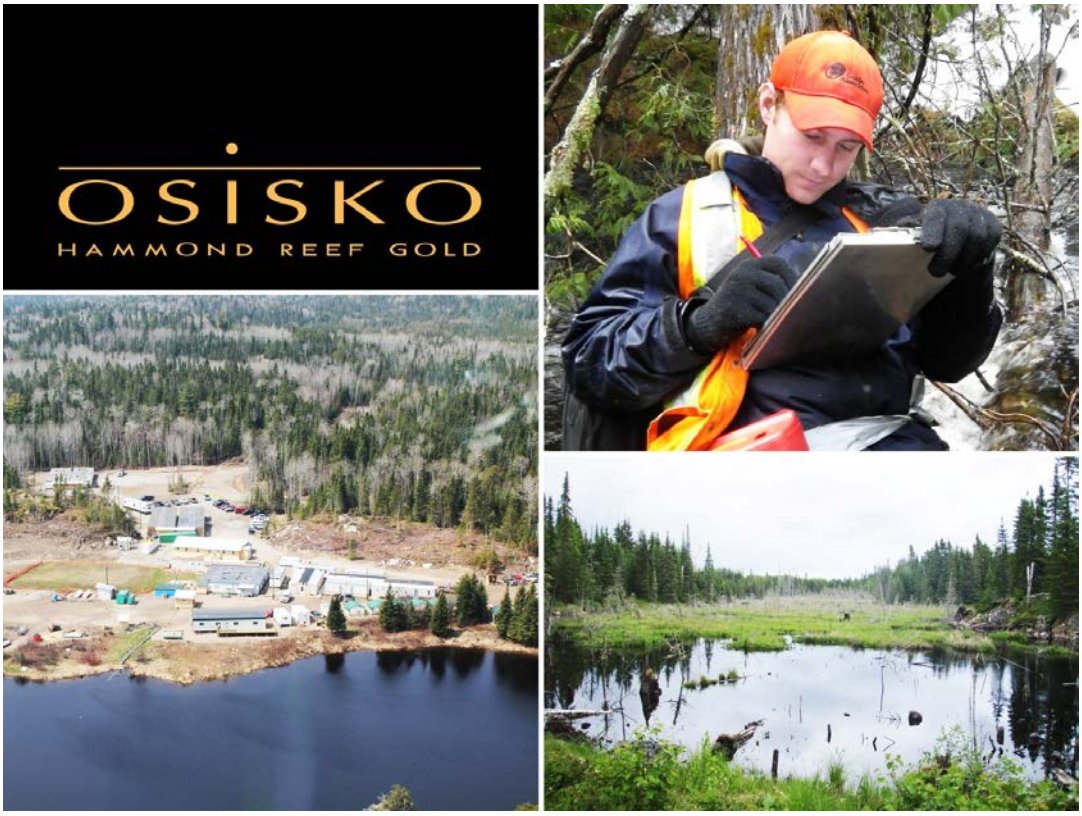
Golder Associates
Mississauga, Ontario

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DESIGN	CGE	14 Nov. 2008		
GIS	JO	6 Dec. 2013		
CHECK	PB	6 Dec. 2013		
REVIEW	PB	6 Dec. 2013		

FIGURE: 2-8

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December 2013



HAMMOND REEF GOLD PROJECT
APPENDIX 3.I
Visual Impact Assessment

Submitted to:
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Project Number: 13-1118-0010
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LEGEND

Photo Locations

Mine Facilities

REFERENCE

Visual Simulation - 3D Renderings Point of Views provided by Genivar on August 2, 2013.
File name: Hammond_Reef_Synthese_3.jpg

PROJECT

HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE

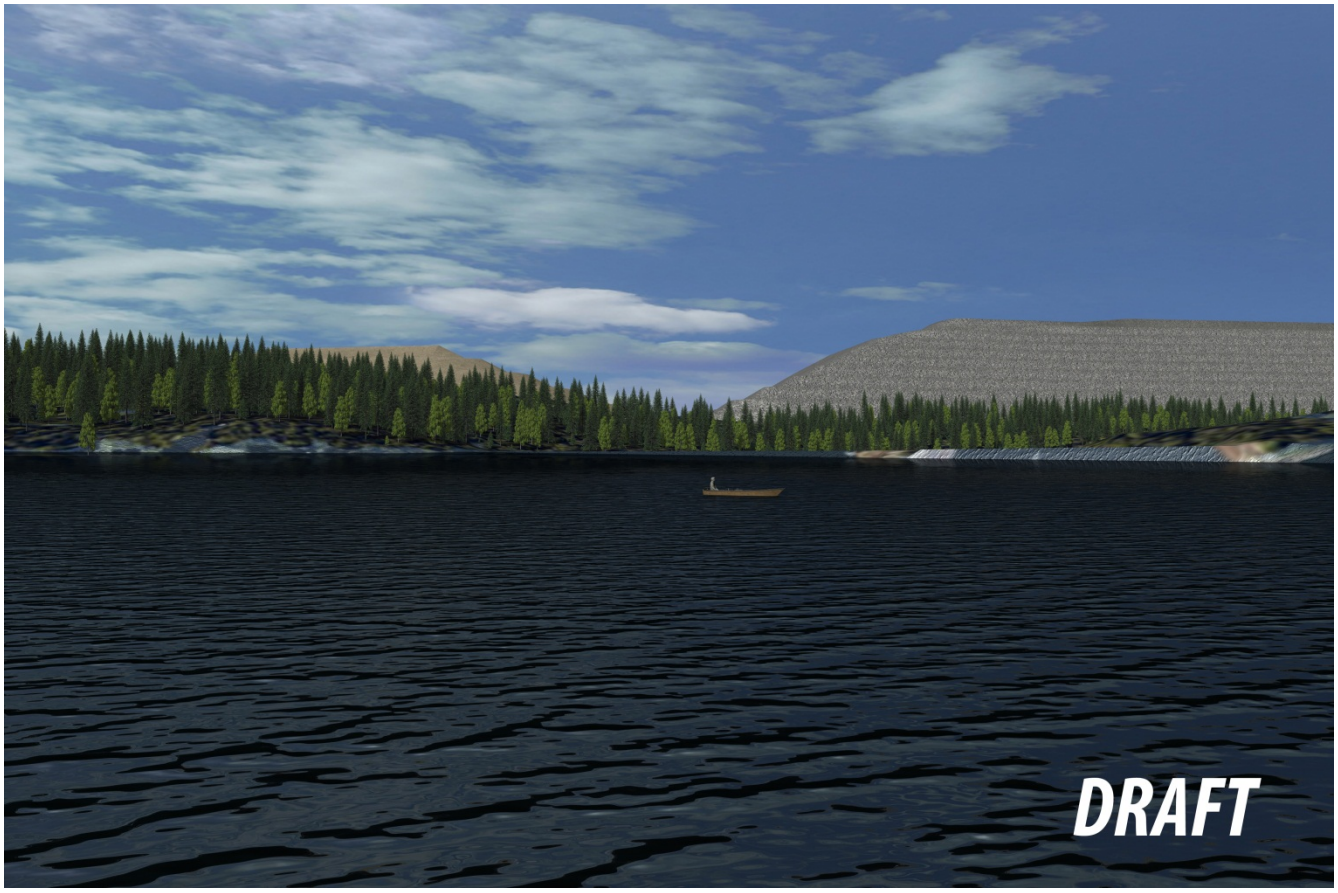
VISUAL SIMULATION -
3D RENDERINGS POINT OF VIEWS

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1118-0010			NOT TO SCALE	VERSION 2
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GIS	JO	2 Aug. 2013		
CHECK	PB	2 Aug. 2013		
REVIEW	PB	2 Aug. 2013		

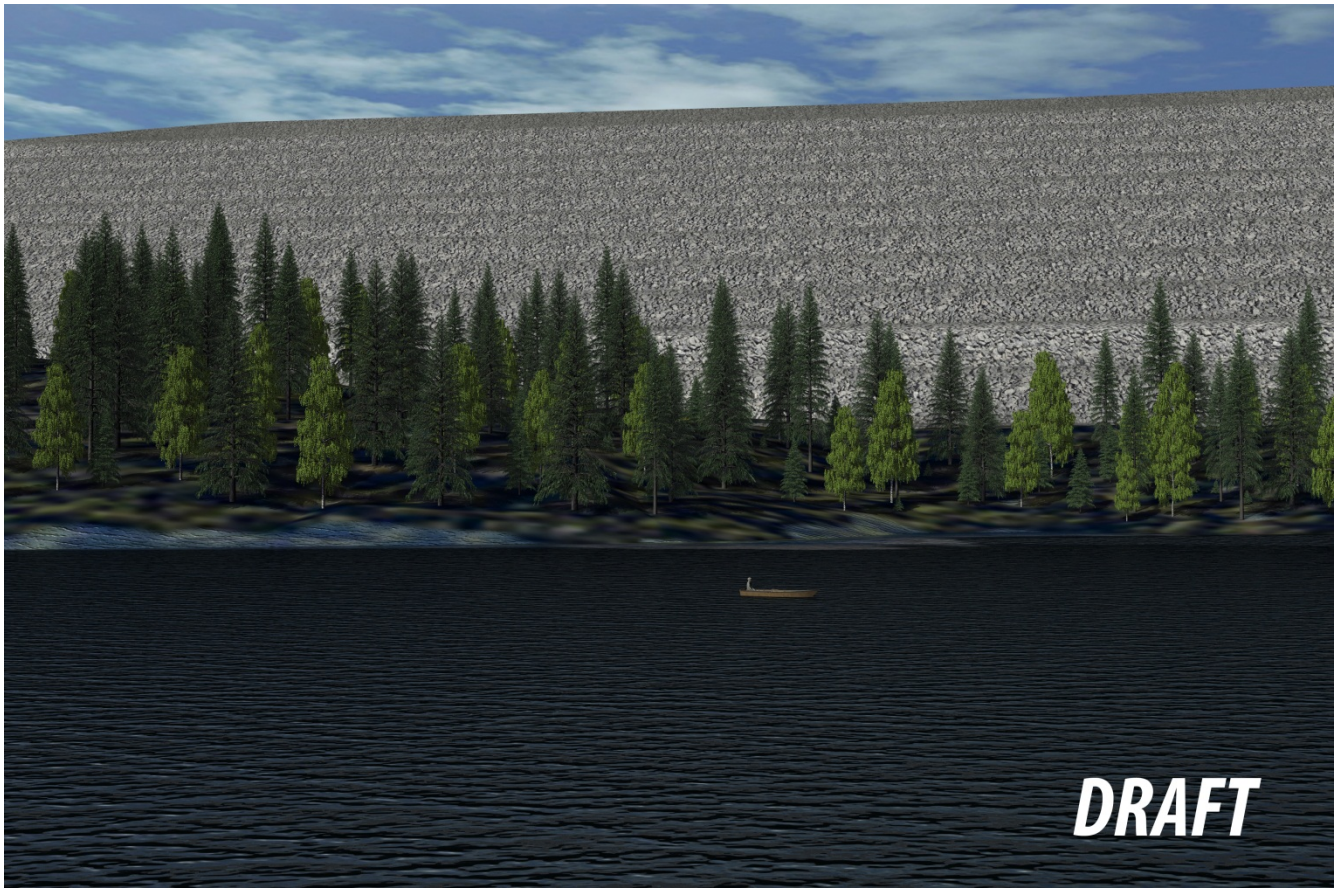
FIGURE: 1

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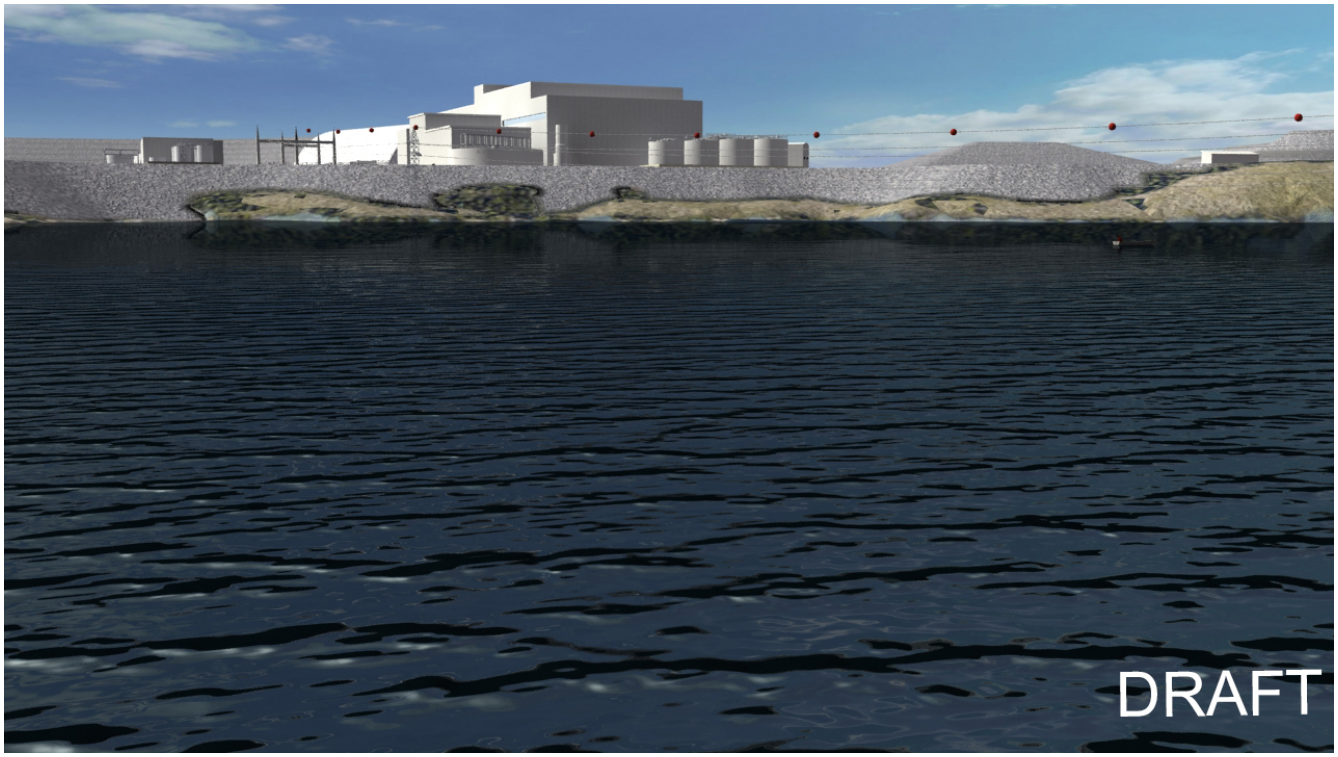
Source: Genivar 2013

Figure 2: View 1 Visual Simulation - View of Overburden and Waste Rock Stock Piles from Trap Bay of Upper Marmion



Source: Genivar 2013

Figure 3: View 2 Visual Simulation - View of Waste Rock Stock Pile from Trap Bay of Upper Marmion



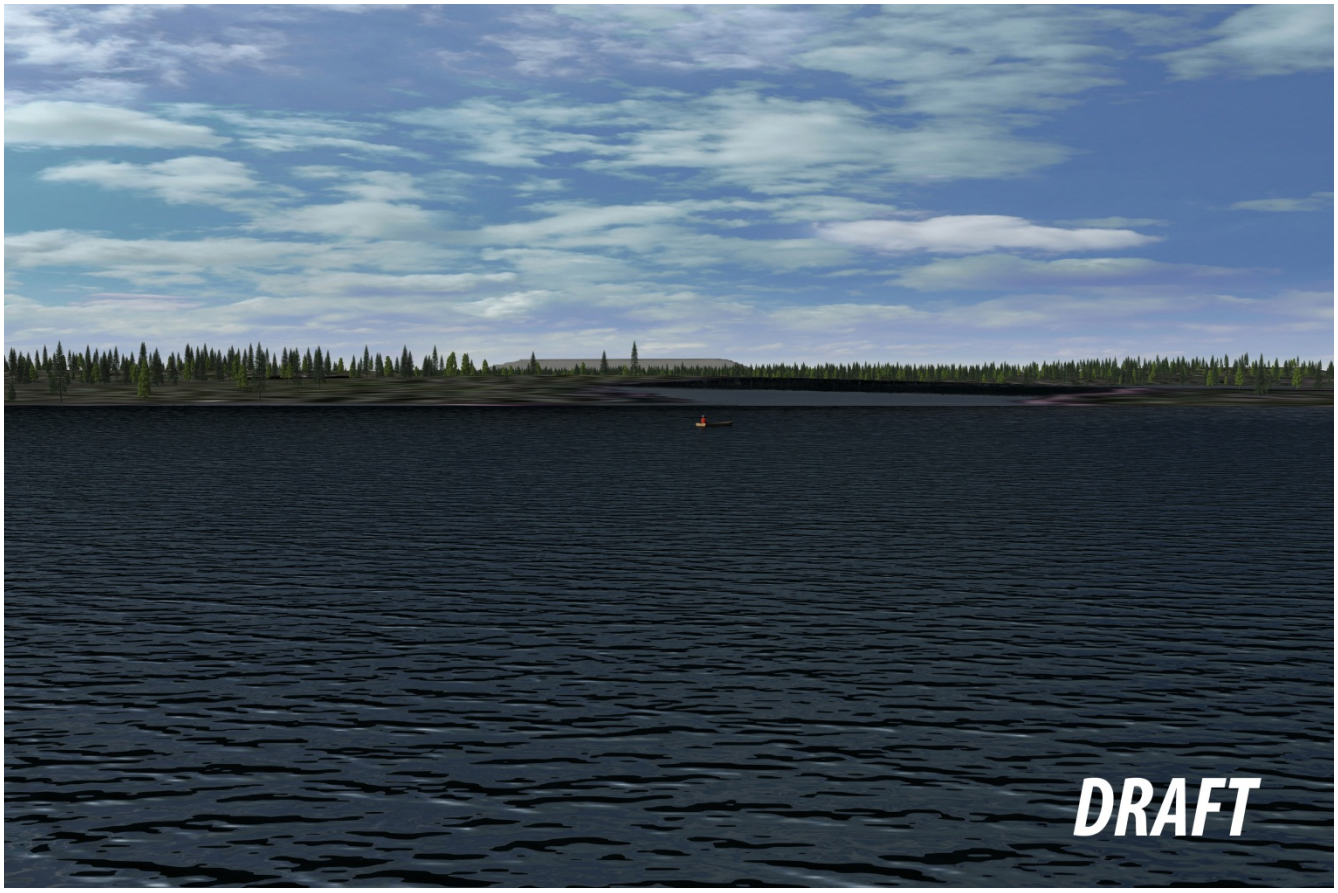
Source: Genivar 2013

Figure 4: View 3 Visual Simulation - View of Process Plant from Sawbill Bay



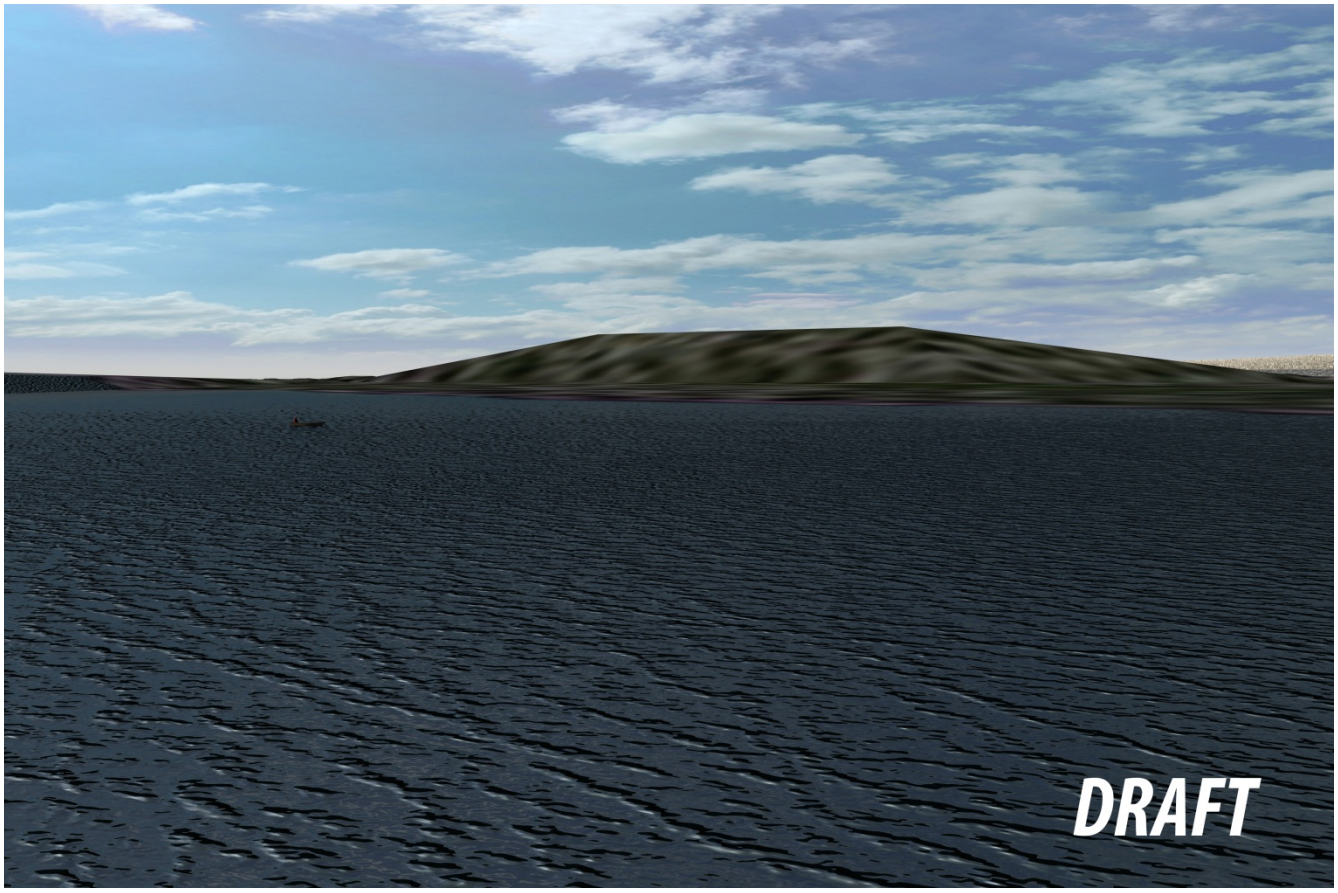
Source: Genivar 2013

Figure 5: View 4 Visual Simulation - View of Process Plant from Sawbill Bay



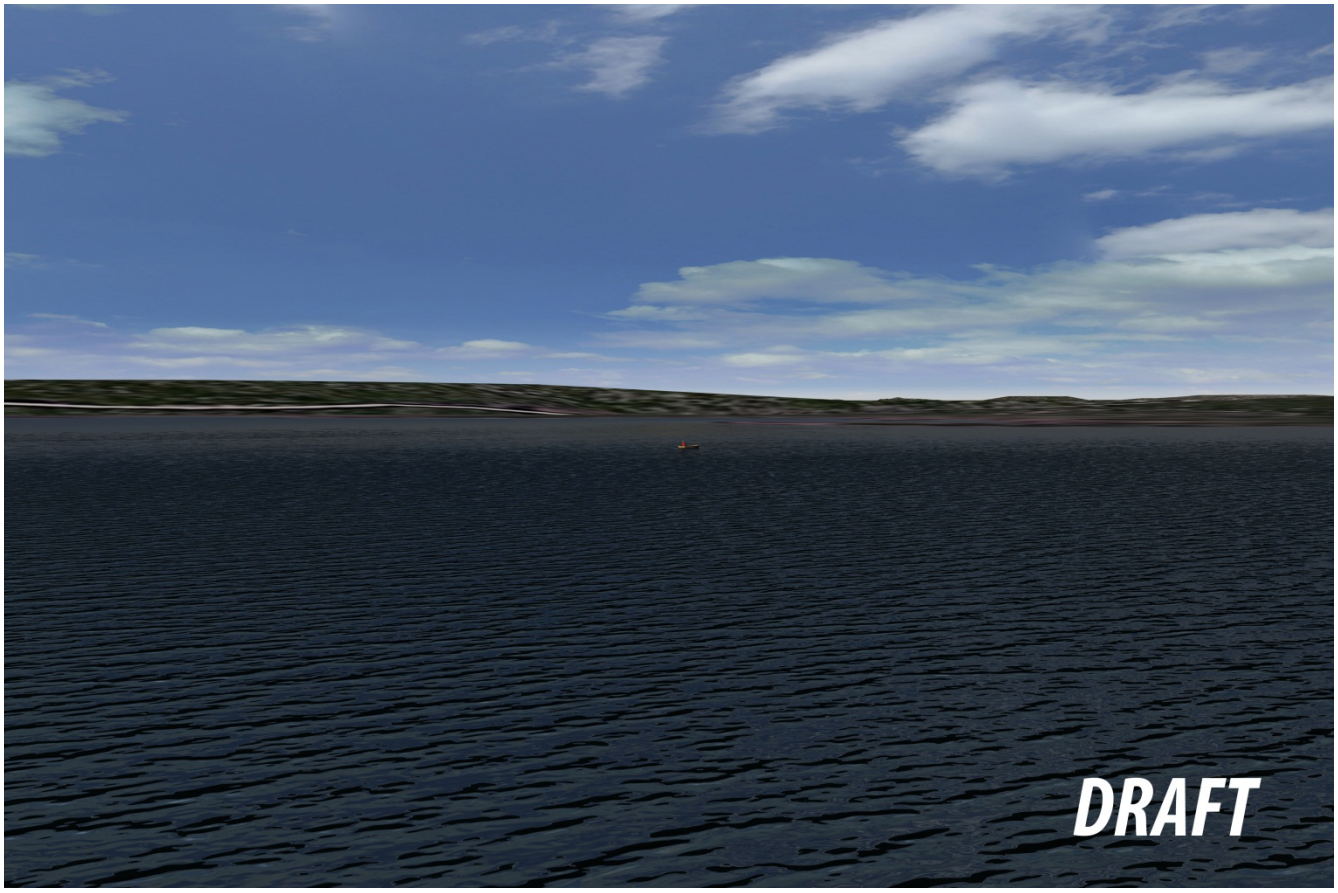
Source: Genivar 2013

Figure 6: View 5 Visual Simulation - View of Waste Rock Stock Pile from Tourist Outfitter on Light Lake



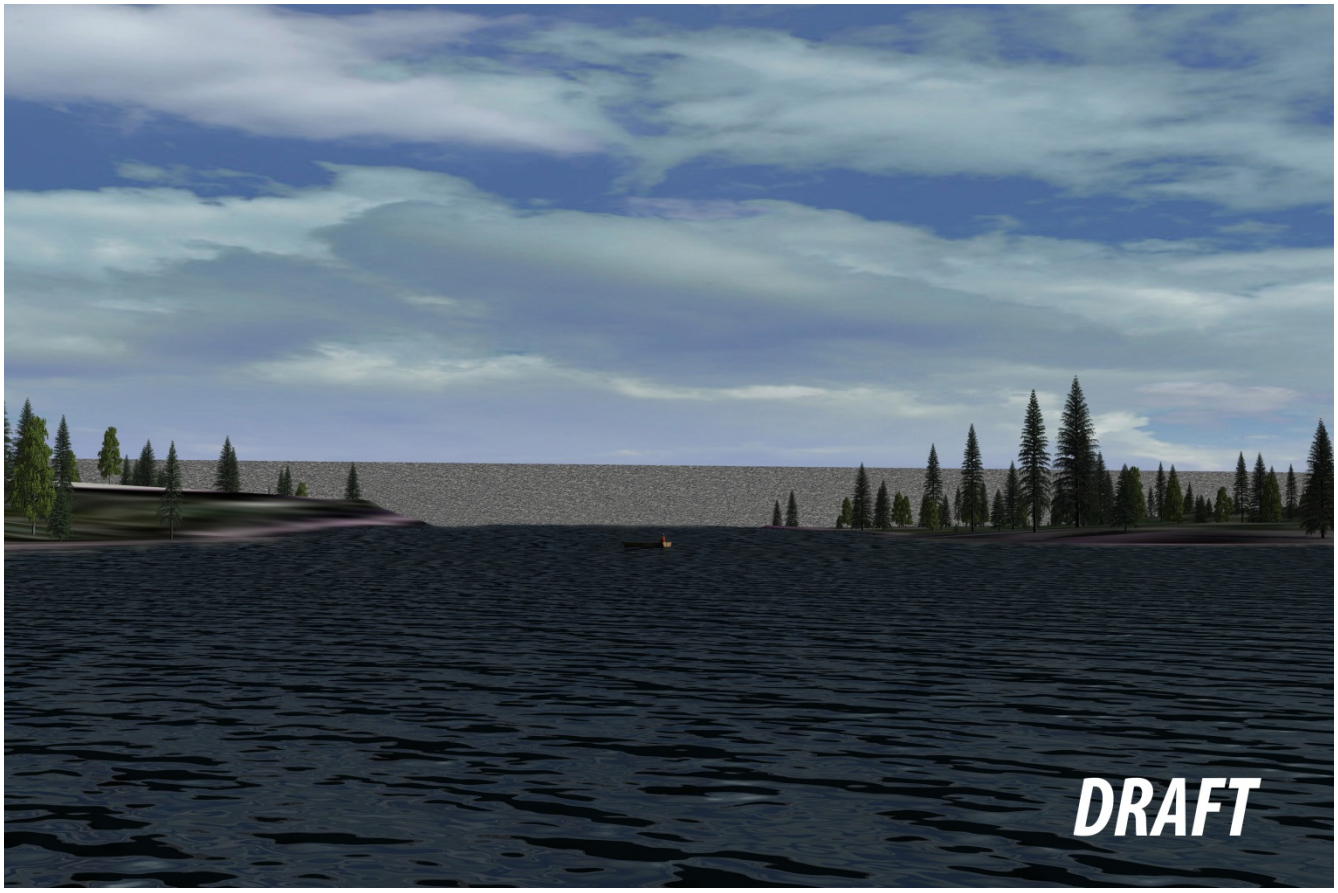
Source: Genivar 2013

Figure 7: View 6 Visual Simulation - View of Tailings Management Facility from Trapper Cabin



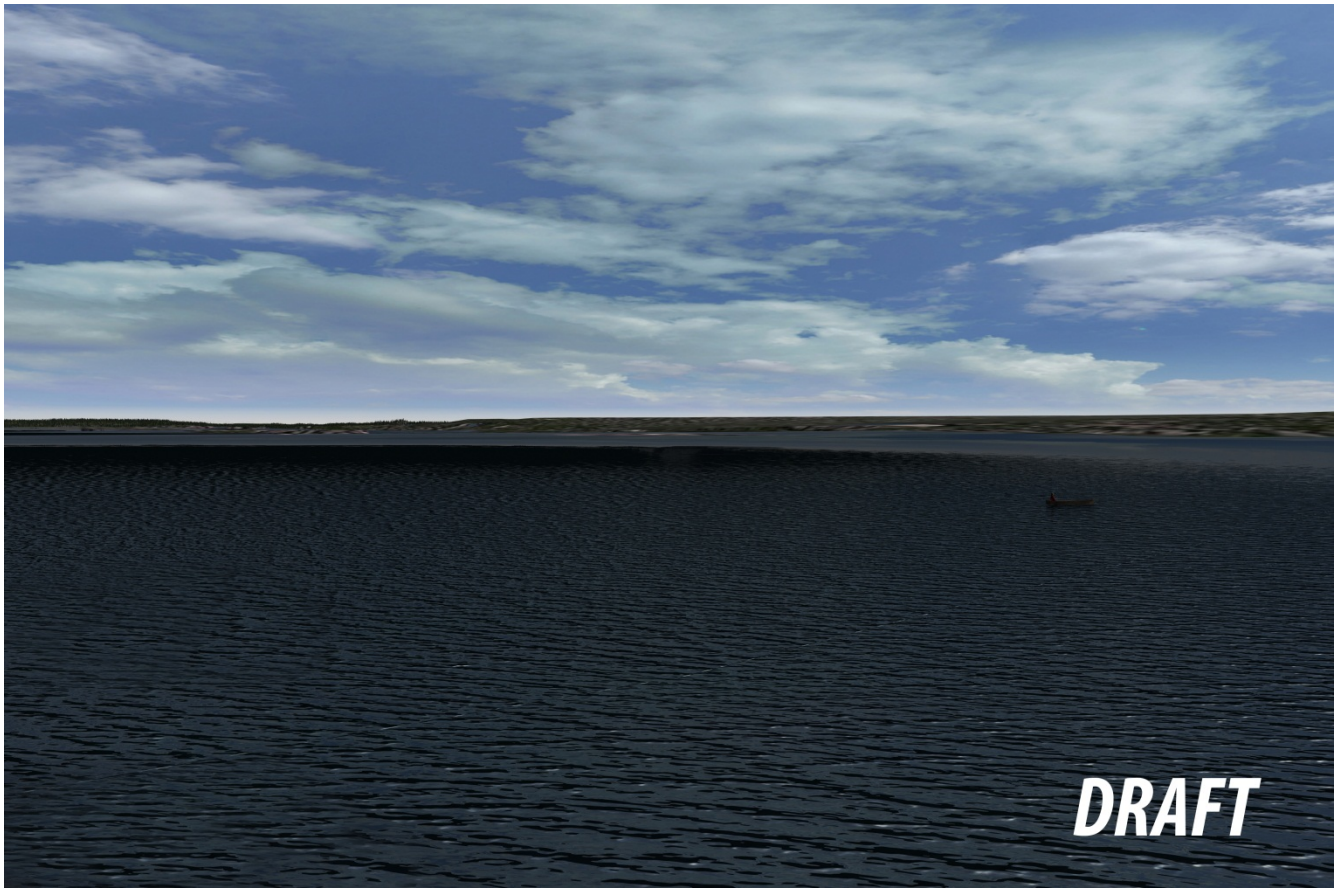
Source: Genivar 2013

Figure 8: View 7 Visual Simulation - View from Trapper Cabin



Source: Genivar 2013

Figure 9: View 8 Visual Simulation - View of Tailings Management Facility from Trapper Cabin



Source: Genivar 2013

Figure 10: View 9 Visual Simulation - View from Tourism Operator

PART C

Socio-economic Environment Technical Support Document, Version 1

December 2013
Project No. 13-1118-0010
Hammond Reef Gold Project

February 2013



HAMMOND REEF GOLD PROJECT
Socio-economic Environment Technical Support Document

VERSION 1

Submitted to:
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Document Number: 2012-072
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Hammond Reef Gold Project
Socio-economic Environment Technical Support Document



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APPENDICES

APPENDIX 2.I

Key Informant Interviews

APPENDIX 2.II

Economic Assessment Study

APPENDIX 2.III

Traffic Impact Study

APPENDIX 3.I

Visual Impact Assessment

1.0 INTRODUCTION

Osisko Hammond Reef Gold Ltd. (OHRG) proposes the development of an open pit gold mine in north-western Ontario, herein referred to as the Hammond Reef Gold Project (the Project). This Technical Support Document (TSD) is one of a series of reports in support of the Project's Environmental Impact Statement/Environmental Assessment Report (EIS/EA Report).

The following reports have been prepared to support the EIS/EA Report:

- Atmospheric Environment TSD.
- Geochemistry, Geology and Soil TSD.
- Hydrogeology TSD.
- Hydrology TSD.
- Water and Sediment Quality TSD.
- Site Water Quality TSD.
- Lake Water Quality TSD.
- Aquatic Environment TSD.
- Terrestrial Ecology TSD.
- Aboriginal Interests TSD.
- Cultural Heritage Resources TSD.
- Human Health and Ecological Risk Assessment TSD.
- **Socio-economic Environment TSD.**
- Alternatives Assessment Report.
- Conceptual Closure and Rehabilitation Plan.

The EIS/EA Report will summarize the findings of this TSD and of the above-listed supporting reports.

1.1 Purpose and Scope

The purpose of this TSD is to fulfill the assessment scope outlined in the Project's Terms of Reference (ToR) approved by the Ontario Minister of the Environment (July 2012), and in the Environmental Impact Statement Guidelines (EIS Guidelines) published by the Canadian Environmental Assessment Agency (CEA Agency) (December 2011).

This TSD describes the existing conditions of the socio-economic environment likely to be affected by the Project, focusing on Valued Ecosystem Components (VECs). The TSD provides sufficient detail to allow the prediction and assessment of the likely effects of the Project on the VECs of the socio-economic environment, and to determine the significance of these effects. The TSD also proposes practicable mitigation measures, and outlines monitoring programs to enable effective testing of predictions and monitoring of the implementation of the mitigation measures. An explanation of the assessment approach used for this TSD is provided in Section 3.1 of this report.

1.2 Report Organization

This TSD is structured as follows:

- Section 1 presents the purpose and scope of the TSD, an overview of the Project, the general environmental assessment approach, VECs, and assessment boundaries of the TSD, and other aspects of the Project relevant to the socio-economic environment.
- Section 2 describes the existing socio-economic environment conditions within the Project's spatial boundaries.
- Section 3 presents the assessment of likely Project effects on the socio-economic environment, focusing on VECs. The effects assessment includes the screening of effects, the identification of additional mitigation measures, the description of residual effects, and the assessment of significance of residual effects.
- Section 4 outlines the monitoring program requirements for the socio-economic environment during each of the Project's phases.
- Section 5 summarizes the findings of this report.

1.3 Project Overview

The Project overview and Project description are provided in Chapter 5 of the EIS/EA Report. Characteristics of the Project setting that are considered in the socio-economic evaluation are described in Sections 1.3 to 1.7.

1.3.1 Project Location

The Project is located within the Thunder Bay Mining District in north-western Ontario, approximately 170 kilometres (km) west of Thunder Bay and 23 km northeast of the town of Atikokan (Figure 1-1).

Access to the Hammond Reef property is currently via two routes: the Premier Lake Road, a gravel road that intersects Highway 623 near Sapawe and the Hardtack-Sawbill Road, a gravel road that intersects Highway 622 northwest of the Town of Atikokan. An exploration camp is currently located at the northern end of Sawbill Bay in Upper Marmion Reservoir. The Project Site is also accessible by water from the southwest end of the Marmion Reservoir at its access point from Highway 622. The existing Hardtack-Sawbill road located to the north of Finlayson Lake has been upgraded to provide an improved and more direct route to the Project Site in support of the expanded exploration program.



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 2012
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 15N

100 0 100 200 300 400
SCALE 1:10,000,000 KILOMETRES

Golder Associates
Mississauga, Ontario

PROJECT No.	10-1118-0020
SCALE	AS SHOWN
VERSION	1
DATE	February, 2013
DESIGN	CGE
GIS	JO
CHECK	CC
REVIEW	THW

TITLE

PROJECT LOCATION

PROJECT HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

FIGURE: 1-1

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The Hammond Reef deposit is primarily located on a peninsula of land extending into the north end of the Upper Marmion Reservoir. The peninsula containing the deposit is surrounded by the Upper Marmion Reservoir on three sides with Sawbill Bay to the northwest and Lynxhead Bay to the southeast. The property also contains a number of smaller lakes. Mitta Lake is a small, steep-sided waterbody located atop mineralized zones of the deposit. The proposed open pit mine will encompass Mitta Lake.

1.3.2 Climate

The Project is located in a typical boreal climate region, which is characterized by long, usually very cold winters, and short, cool to mild summers. The annual temperature average is 1.6 degrees Celsius (°C) for Atikokan with a seasonal maximum of 16.2°C (average) for summer and a minimum of minus 15.4°C (average) for winter. Temperatures lower than minus 37°C have been recorded during the fall and winter. The annual normal total for precipitation is 788 millimetres (mm) (568 mm of rainfall and 220 mm of snowfall) for Atikokan with a seasonal maximum of 299 mm for the summer period.

1.3.3 Project Phases

The Project comprises four phases: construction, operations, closure and post-closure. Socio-economic effects are considered for all four phases. With regards to the assessment of the socio-economic environment, the most relevant Project activities are related to Management, Permitting and Employment.

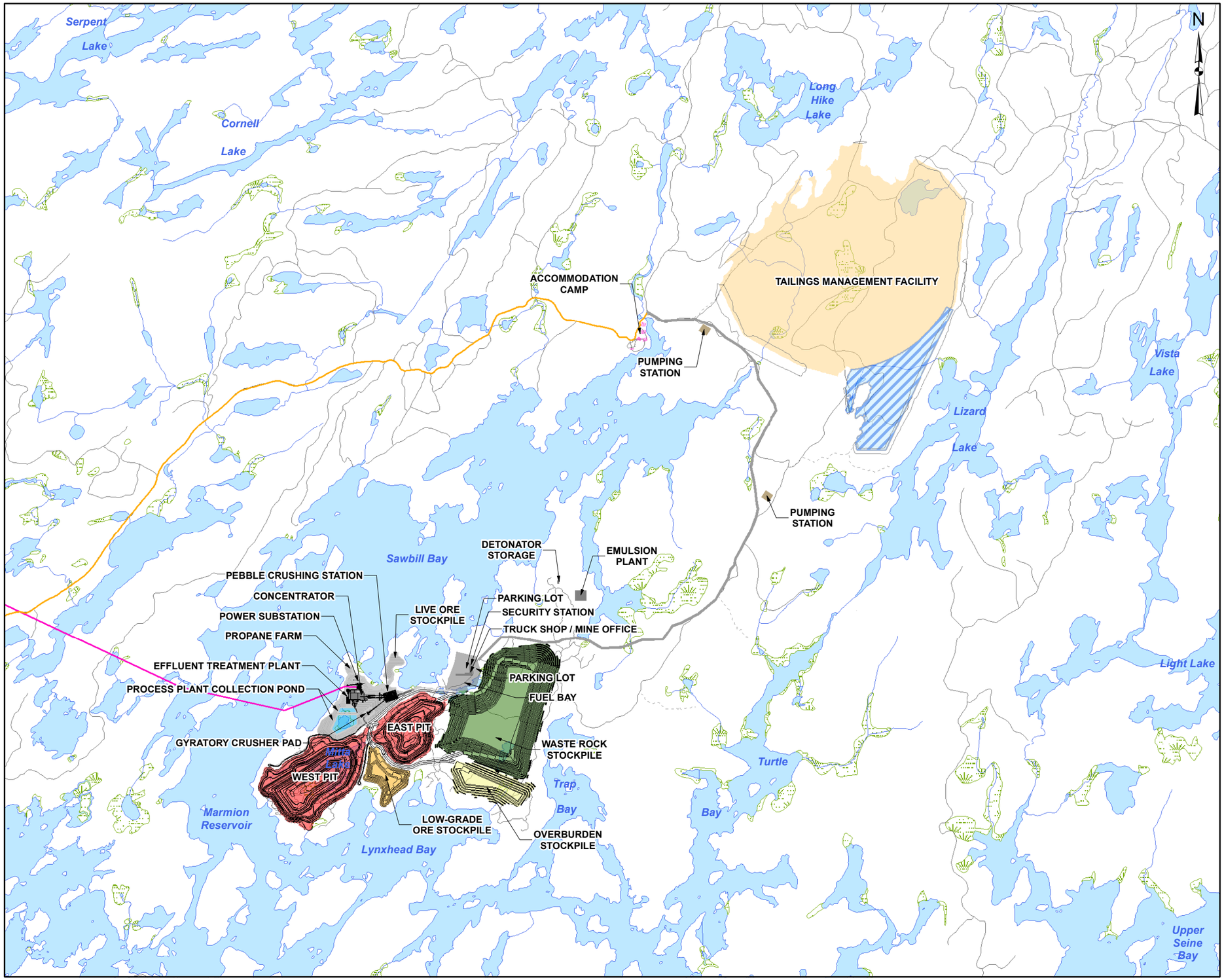
The schedule for each phase is provided in Section 1.7. Additional details regarding activities expected to take place in each phase of the Project are provided in Chapter 5 of the EIS/EA Report.

1.3.4 Project Components

The Project consists of the following eight main components:

- Mine, including two open pits (i.e., east pit and west pit).
- Waste Rock Management Facility.
- Ore Processing Facility.
- Tailings Management Facility.
- Support and Ancillary Infrastructure.
- Water Management System.
- Linear Infrastructure.
- Borrow Sites.

Project components are shown in Figure 1-2. A detailed description of Project components is provided in Chapter 5 of the EIS/EA Report.



LEGEND

- Road
- Trail
- River/Stream
- Lake
- Wetland
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Accommodation Camp
- Laydown Area
- Office and Truck Shop, Explosives Storage and Processing Plant
- Open Pits
- Ore Stockpile
- Overburden Stockpile
- Process Plant Collection Pond
- Pump Station
- Tailings Management Facility
- Tailings Management Facility Reclaim Pond
- Waste Rock Stockpile

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

500 0 500 1,000 1,500 2,000 2,500
SCALE 1:50,000 METERS

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
PROJECT LOCATION AND COMPONENTS

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	14 Nov. 2008		
GIS	JO	8 Feb. 2013		
CHECK	PB	8 Feb. 2013		
REVIEW	PB	8 Feb. 2013		

FIGURE: 1-2

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1.4 Incorporation of Traditional Knowledge

Traditional knowledge in combination with other information sources is valuable in achieving a better understanding of the Project's likely effects on the biophysical and socio-economic environment. It also contributes to the description of the existing biophysical and human environment, natural cycles, resource distribution and abundance, and the use of land and water resources. A detailed discussion on traditional knowledge, including any aspects relevant to the socio-economic environment, is included in the Aboriginal Interests TSD.

1.5 Precautionary Approach

Environmental assessments are forward-looking planning studies, used in early stages of project development. As such, environmental assessments generally use a precautionary approach. This approach is guided by judgement, based on values, and intended to address uncertainties in the assessment. This approach is consistent with the Canadian government's framework for applying precaution in decision-making processes.

This approach is also consistent with Principle 15 of the 1992 Rio Declaration on Environment and Development, which states that "where there are threats of serious or irreversible damage, lack of full scientific certainty must not be used as a reason for postponing cost effective measures to prevent environmental degradation" (United Nations Conference on Environment and Development 1992).

This TSD applies a precautionary approach to the assessment of potential Project effects. Specifically, the potential effects of the Project are conservatively considered, and likely effects are advanced through the assessment process if they cannot be systematically removed from consideration through rigorous scientific evidence. The evaluation of effects is based both on regulatory compliance and on predicted changes to the existing environment. This captures and assesses changes to the existing environment that may fall outside or below applicable regulatory frameworks. In addition, all likely residual effects are assumed to occur and are assessed for significance.

1.6 Selection of Valued Ecosystem Components

The purpose of this TSD is to determine whether the Project is likely to have effects on the socio-economic environment, the extent to which the Project may affect the socio-economic environment, and to identify means by which all likely effects can be mitigated. While all aspects of the socio-economic environment are important, it is neither practicable nor necessary to assess every potential effect of the Project on every aspect of the socio-economic environment. In order to focus the assessment on those components that are of greatest relevance in terms of value and sensitivity, Valued Ecosystem Components (VECs) have been identified and selected as endpoints for the assessment.

The CEA Agency describes VECs as:

"Any part of the environment that is considered important by the proponent, public, scientists and government involved in the assessment process. Importance may be determined on the basis of cultural values or scientific concerns." (Hegmann et al. 1999).

The VECs are typically 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 VECs provide structure and focus for the environmental assessment and ensure that the likely effects of a project are considered.

Since the VECs are assessment endpoints, it is important that the selected VECs can be used to meaningfully measure the likely effects of the Project. The VECs for this TSD 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 could be sensitive to the effects from 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?

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).

Specifically, socio-economic VECs represent economic, social and land and resource use features that can be measured and are considered to be important in relation to Project effects and cumulative effects. The identification of VECs for this TSD has been informed through the following information sources:

- Review of Project information and mapping.
- Consideration of the Environmental Assessment Guidelines and ToR for this and other similar Projects.
- Initial understanding of communities in the Local Study Area (LSA) and Regional Study Area (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.

The 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.

Table 1-1 provides the list of VECs selected for this TSD, the rationale for their selection, and proposed indicators and measures.

Table 1-1: Valued Ecosystem Components Selected for the Socio-economic Environment

VEC	Rationale for Selection	Indicators	Measures
Socio-community			
Population and Demographics	▪ Direct job opportunities will attract workers to the area for short-term (i.e. construction) and longer term (i.e. operations) ▪ Population change will 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 (historical and projected) ▪ Mobility ▪ Age and gender ▪ Dependency ratios	▪ Predicted changes in population ▪ Predicted changes in mobility rates ▪ Predicted changes in age and gender distribution ▪ Predicted changes in dependency ratios
Labour Market (Employment, Income and Training)	▪ Sustainable employment and training opportunities can develop transferable skills, and long-term regional and local economic benefits ▪ Creation of opportunities for local contractors and suppliers ▪ Local recruitment, training and employment needs ▪ Timing and number of employment opportunities effect on labour market	▪ Regional and local supplier base ▪ Labour force by industry and occupation ▪ Employment and unemployment rates ▪ Median Income ▪ Education and training	▪ Predicted opportunities for growth of local supplier base ▪ Predicted capacity of, and changes, in labour force ▪ Predicted changes in employment and unemployment rates ▪ Predicted changes in median income ▪ Predicted changes in high school/post-secondary completion rates and other training opportunities
Government Finances	▪ Governments will benefit through increased tax and fee for service revenues ▪ Governments incur costs related to the provision of services	▪ Government revenues, expenditures and capital budgets	▪ Predicted changes in government revenues, expenditures and budgets

Table 1-1: Valued Ecosystem Components Selected for the Socio-economic Environment (Continued)

VEC	Rationale for Selection	Indicators	Measures
Public Services and Infrastructure	▪ Population increase in the LSA increases 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 if existing capacity is exceeded	**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	▪ Predicted changes in capacity of, and access to, protection and emergency services ▪ Predicted changes in capacity of, and access to, health services ▪ Predicted changes in capacity of, and access to, social services ▪ Predicted changes in capacity of, and access to, educational services ▪ Predicted changes in access to, and capacity of, recreational services and infrastructure ▪ Predicted changes in capacity of water, wastewater and solid waste management services and infrastructure ▪ Predicted changes in access to, and capacity of, public utilities

Table 1-1: Valued Ecosystem Components Selected for the Socio-economic Environment (Continued)

VEC	Rationale for Selection	Indicators	Measures
Housing and Accommodation	▪ Influx of workers and families leads 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	▪ Predicted changes in availability and cost of housing and accommodation
Transportation	▪ The Project affects existing road and transportation network due to movement of Project workers, equipment, supplies and products	▪ levels of service (LOS) and volume-capacity ratios (V/C) of relevant roads and intersections	▪ Predicted changes in LOS and V/C
Land and Resource Use			
Outdoor Tourism and Recreation	▪ The Project may affect tourism and recreation activities and opportunities ▪ The Project may affect employment and income generation by tourism operators	▪ Tourism activities and specific use areas ▪ Number and types of visitors to the study area ▪ Tourism revenue generation	▪ Predicted changes in use, access and availability of land and resources for outdoor tourism and recreation ▪ Predicted changes in numbers and types of visitors ▪ Predicted changes in tourism revenue generation
Hunting	▪ The Project may occupy or affect the land base which supports hunting	▪ Wildlife management areas (e.g. moose, deer, bear) ▪ License sales ▪ Harvest volumes	▪ Predicted changes in use, access and availability of land for hunting ▪ Predicted changes in licence sales and harvest volumes
Trapping	▪ The Project may occupy or affect the land base which supports trapping	▪ Tenured trapline areas ▪ Harvest volumes	▪ Predicted changes in use, access and availability of trapline areas ▪ Predicted changes in harvest volumes

Table 1-1: Valued Ecosystem Components Selected for the Socio-economic Environment (Continued)

VEC	Rationale for Selection	Indicators	Measures
Fishing	▪ The Project may occupy land and water which supports fishing activities	▪ Recreational fishing participation (e.g., Atikokan Bass Classic) ▪ Recreational and commercial fishing areas, licence sales and harvest volumes ▪ Baitfish areas and harvest volumes	▪ Predicted changes in recreational fishing participation ▪ Predicted changes in use, access and availability of recreational and commercial fishing resources ▪ Predicted changes in baitfish harvest volumes
Mining	▪ The Project may affect current and future mining activity	▪ Exploration and development projects (current and potential resources)	▪ Predicted changes in use, access and availability of land for resource extraction
Forestry	▪ The Project may occupy productive forest land ▪ The Project may affect existing or future land use for forestry	▪ Timber harvesting land base (harvest area, tenure)	▪ Predicted changes in use, access and availability of land for forestry
Water Use and Access	▪ The Project has the potential to directly affect 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.	▪ Water use for hydro-electric power and other industrial and commercial uses.	▪ Predicted changes in use, access and availability water resources for hydro-electric power and other industrial and commercial uses

The ToR for the environmental assessment identifies the criteria and indicators to be used for the assessment of effects on the socio-economic environment. All of these VECs are considered in the assessment. However, a number of minor changes have been made to the VECs identified in the ToR to better reflect the current understanding of the Project and study areas. The rationale for the minor revisions to the VECs provided in the ToR is provided in Table 1-2, which shows the concurrence between the VECs in the ToR and those used in this study.

Table 1-2: Concordance between Valued Ecosystem Components provided in Terms of Reference and Valued Ecosystem Components used in the Socio-economic Environment TSD

Terms of Reference	Socio-economic Technical Support Document	Rationale
Demographic Change	Population and Demographics	Provides focus on potential change in population, as well as demographic indicators mobility, age and gender, and dependency ratios
Local Employment, Income Generation and Training	Labour Market (Employment, Income and Training)	Provides focus, not just on local effects, but on regional as well as provincial and national benefits as described by economic modelling. Income is still considered as an indicator.
Economic Development	Labour Market (Employment, Income and Training)	Regional and local economic base (e.g., gross domestic product) cannot be accurately measured because Statistics Canada multipliers are only available at provincial and national scales. Effects on labour market (employment, income, etc.) provide an accurate indicator of effects on local and regional economics.
Outdoor Tourism and Recreation	Outdoor Tourism and Recreation	Additional VECs including hunting, trapping and fishing have been added to reflect the importance of these land uses for sustenance and livelihoods, in addition to tourism and recreation.
Extractive Resource Base	Mining	Reflects focus on primary resource extraction industry in the study areas.
Forestry	Forestry	No change
Water Use and Access	Water Use and Access	No change
	Housing and Accommodation	Reflects consideration of temporary accommodation needs for Project workers, as well as permanent housing stock
Transportation and Traffic	Transportation	Traffic is considered part of the transportation network
Public Services and Infrastructure	Public Services and Infrastructure	No change
Community Health, Safety and Well-Being	Captured under other VECs (e.g., Population and Demographics, Labour Market, Economic Development, Outdoor Tourism and Recreation, Public Services and Infrastructure, Housing and Accommodation, Transportation, etc.) as well as in Human Health and Ecological Risk Assessment TSD.	Changes to these VECs are measurable and are more appropriate to characterize changes in community character, community well-being and others which are subjective and difficult to predict and/or measure.

1.7 Temporal and Spatial Boundaries

Project activities and the likely changes that they may produce on the environment are subject to temporal and spatial boundaries. These boundaries are common to all environmental components but with some modifications. The temporal and spatial boundaries specific to the Socio-economic Environment TSD are described in the following sections.

1.7.1 Temporal Boundaries

The Project's temporal boundaries for the assessment of the socio-economic environment are directly related to the Project phases, namely:

- Construction phase: 30 months.
- Operations phase: 11 years.
- Closure phase: 2 years.
- Post-closure phase: 10 years.

1.7.2 Spatial Boundaries

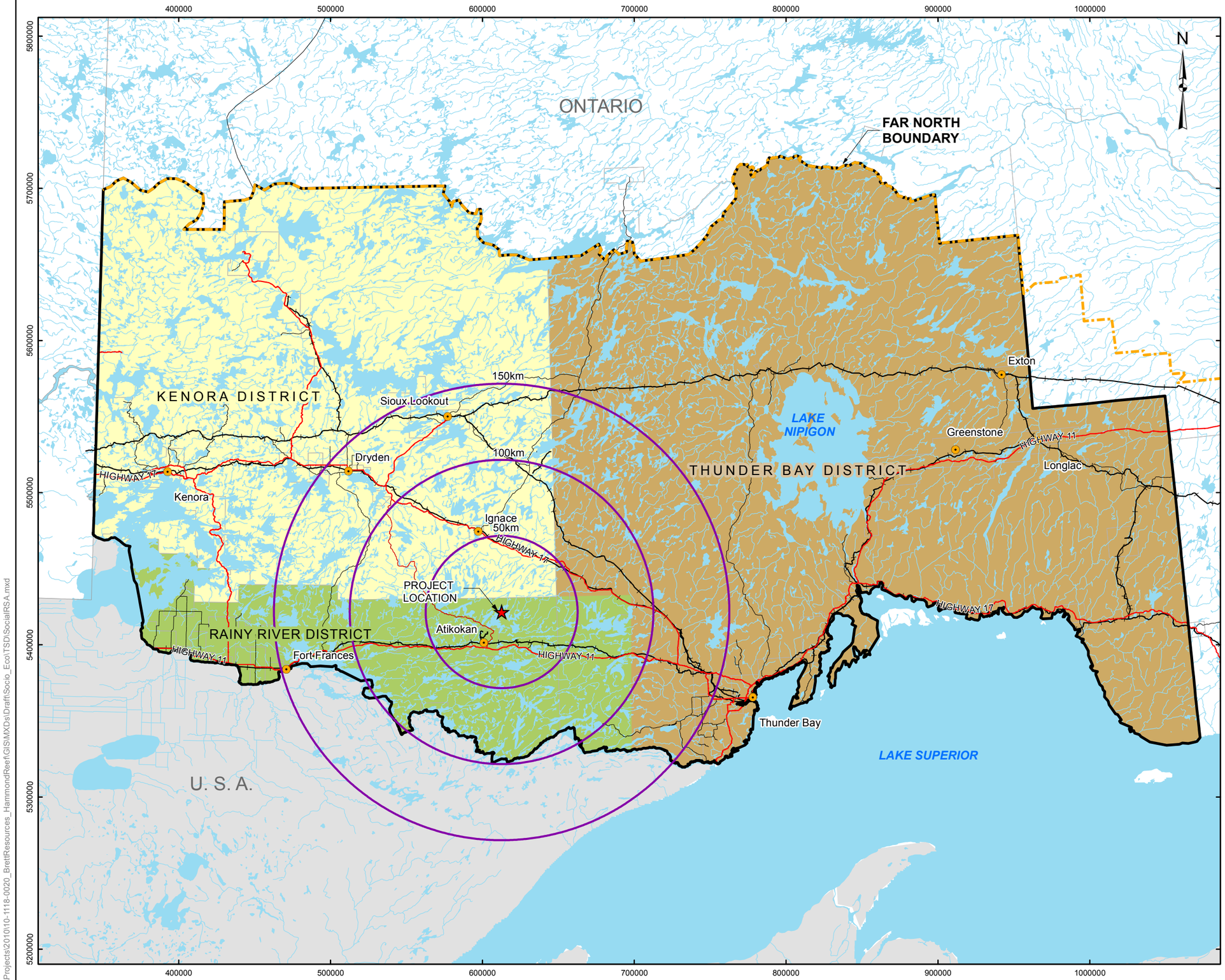
Spatial boundaries define the geographical extents within which potential environmental changes may occur. As such, spatial boundaries become the Project socio-economic study areas. The study areas for the socio-economic environment were selected based on the following factors:

- Generally correspond to Statistics Canada census boundaries for which data are available.
- Regional Study Area (RSA) to provide regional context and encompass the maximum geographic area within which effects from the Project are anticipated, including any cumulative effects.
- Local Study Area (LSA) to represent the area where direct effects could be expected.
- For the VECs identified for land and resource use, the LSA comprises the LSAs for aquatic and terrestrial biology, which represent the primary linkages between direct Project-related effects and potential effects on land and resource use.
- For all other socio-economic VECs, the LSA includes the Town of Atikokan and an area centred on Atikokan with a radius of 50 km, which is considered to be the area from which Project workers may reasonably be expected to commute daily.

Further information about the study areas is given in the following sections.

1.7.2.1 Regional Study Area

The RSA (Figure 1-3) is useful for characterizing socio-economic existing conditions over the broadest area that may experience measurable changes to the economy as a result of the Project in relation to employment, income and government revenues. This is also the area where cumulative effects are likely to occur.



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
- 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

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. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	14 Nov. 2008		
GIS	JO	8 Feb. 2013		
CHECK	PB	8 Feb. 2013		
REVIEW	PB	8 Feb. 2013		

FIGURE: 1-3

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The Project is located in the northeast of the Rainy River District. The Rainy River, Kenora, and Thunder Bay Districts, and the urban and rural communities within these districts, will provide the majority of the labour force and some goods and services required to construct and operate the mine and are therefore likely to experience Project-related effects in relation to employment opportunities, income benefits, business opportunities and government finances.

The RSA includes the Rainy River and Thunder Bay Districts, and that portion of the Kenora District south of the Far North boundary. Census data are available and presented for the Kenora District as a whole. About 90% of the population of this District live below the Far North boundary, and therefore, for the purposes of this assessment, data for the District as a whole are taken to be representative of the portion included in the RSA.

RSA data are presented for populations and demographics; economics, including the labour market; transportation; outdoor tourism and recreation; and mining.

The majority of the workforce will reside in Atikokan and nearby communities, either in a mine camp or in the community. Workforce and associated population, service and infrastructure effects will occur within the Local Study Area and background information is presented at this level. Direct effects on land and resource use such as hunting, trapping, fishing and forestry are anticipated at the LSA scale and therefore related existing information is not provided for the RSA.

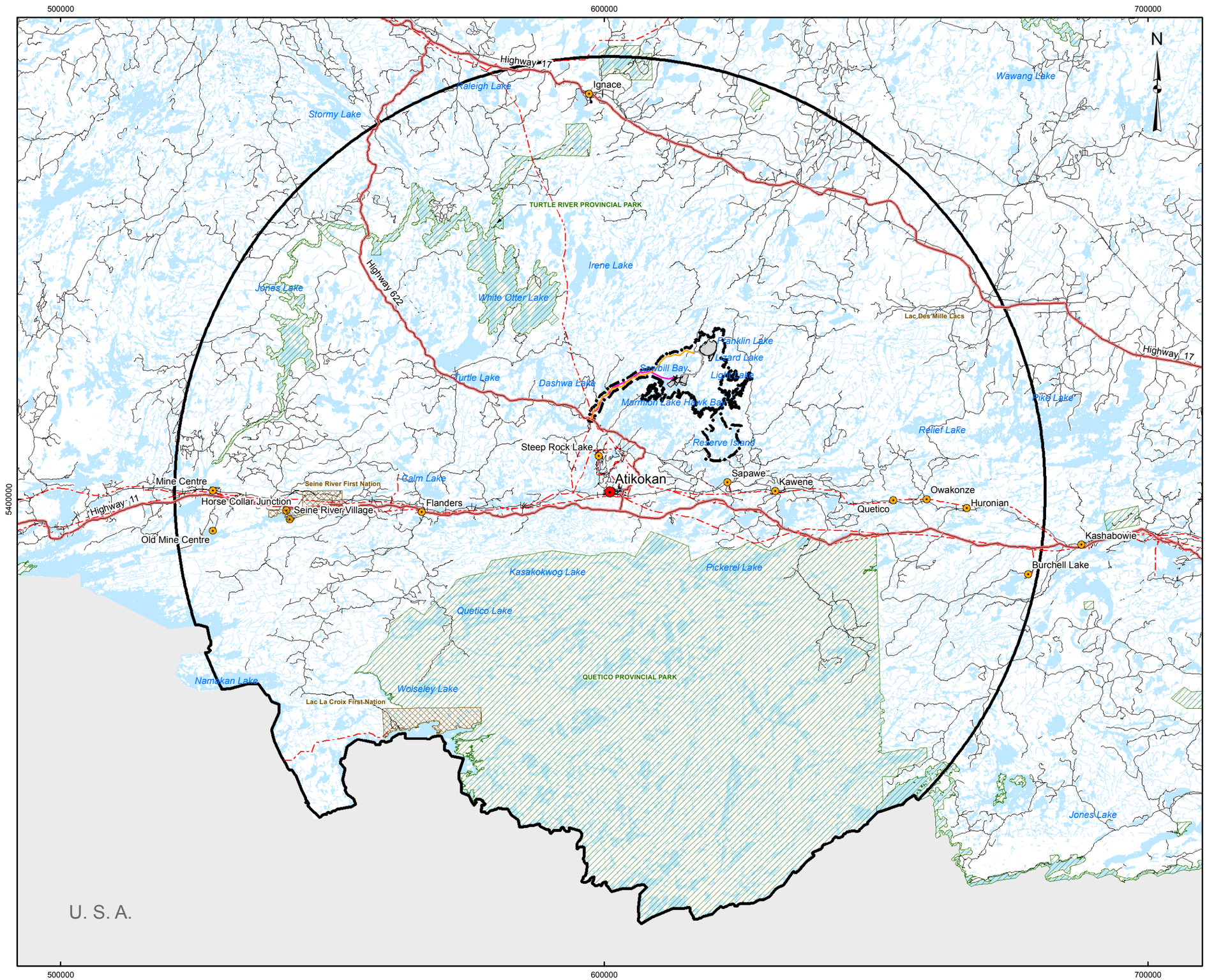
1.7.2.2 Local Study Area

The LSA covers a geographical area that will experience principal Project effects in relation to population and employment, economics, and services and infrastructure (Figure 1-4). This LSA includes the Town of Atikokan and an area centred on Atikokan with a radius of 50 km (~7,900 km^2). This area is expected to provide the majority of the labour force needed to construct and operate the mine – it would most likely experience Project-related direct and indirect effects in relation to population and demographics; economics; public services and infrastructure; housing and accommodation; and traffic and transportation infrastructure.

As shown on Figure 1-1, a number of smaller communities exist along Highway 11 within the Local Study Area. Census data are not reported by Statistics Canada for these smaller communities. Population and demographic data for the Town of Atikokan are used to represent the LSA.

As noted above, the LSA has been modified (dashed line on Figure 1-4) for the purpose of the land and resource use assessment. This allows a more focused consideration of the likely effects on land use, including hunting and trapping, fishing and forestry. The modified LSA corresponds to the LSAs selected for the aquatic environment (Aquatic Environment TSD) and terrestrial biology (Terrestrial Ecology TSD), which represents the primary linkages between direct Project-related effects and potential effects on land and resource use, including outdoor tourism and recreation, hunting, trapping, fishing, mining, and forestry.

For the LSA, information is reported on population and demographics; economics, including employment and income, and local government revenues; public services and infrastructure; housing and accommodation; traffic and transportation; and land and resource use, including outdoor tourism and recreation, hunting and trapping, fishing, mining, and forestry.



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
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

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. 10-1118-0020		SCALE AS SHOWN	VERSION 1
DESIGN	CGE	14 Nov. 2008	
GIS	JO	8 Feb. 2013	
CHECK	PB	8 Feb. 2013	
REVIEW	PB	8 Feb. 2013	

FIGURE: 1-4

G:\Projects\2010\10-1118-0020_BrettResources_HammondReef\GIS\MXDs\Draft\Socio_EcoTSD\SocialLSA.mxd

1.7.2.3 Mine Study Area

The Mine Study Area (MSA) (Figure 1-5) encompasses the footprints of the Mine, the Waste Rock Management Facility, the Ore Processing Facility, the Tailings Management Facility, and the Support and Ancillary Infrastructure. Borrow Pits are not included in the assessment, as they are subject to a separate permitting process.

All considerations of likely socio-economic effects within the MSA are included within the LSA.

1.7.2.4 Linear Infrastructure Study Area

The Linear Infrastructure Study Area (LISA) (Figure 1-6) encompasses the footprints of the access road and project transmission line. The LISA is represented by a Y-shaped area that extends 30 m on either side of the central line of the access road and the project transmission line.

For the purposes of the assessment of effects on the socio-economic environment, the MSA and LISA are considered as part of the LSA.

1.7.2.5 Summary of Study Area Information

As noted above, the VECs are organized into four broad categories: population and demographics, economics, services and infrastructure, and land and resource use. Table 1-3 below summarizes the information reported for the RSA and LSA study areas for the socio-economic environment.

Table 1-3: Study Areas for Socio-Economic Environment TSD

Category	RSA	LSA
Population and Demographics	Rainy River and Thunder Bay Districts, and that portion of the Kenora District south of the Far North boundary	Town of Atikokan plus area within 50 km radius
Economics	Rainy River and Thunder Bay Districts, and that portion of the Kenora District south of the Far North boundary	Town of Atikokan plus area within 50 km radius
Services and Infrastructure (protection and emergency, health, social, education, recreation, waste and water, housing)	None	Town of Atikokan plus area within 50 km radius
Services and Infrastructure (transportation)	Rainy River and Thunder Bay Districts, and that portion of the Kenora District south of the Far North boundary	Town of Atikokan plus area within 50 km radius
Land and Resource Use (hunting, trapping, fishing, forestry, water use and access)	None	LSAs used for aquatic and terrestrial biology
Land and Resource Use (outdoor tourism and recreation, mining)	Rainy River and Thunder Bay Districts, and that portion of the Kenora District south of the Far North boundary	LSAs used for aquatic and terrestrial biology

610000 612500 615000 617500 620000 622500

5430000 5427500 5425000 5422500 5420000

Serpent Lake
Cornell Lake
Sawbill Bay
Mitta Lake
Lynxhead Bay
Upper Seine Bay

N

LEGEND

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

500 0 500 1,000 1,500 2,000 2,500
SCALE 1:50,000 METERS

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

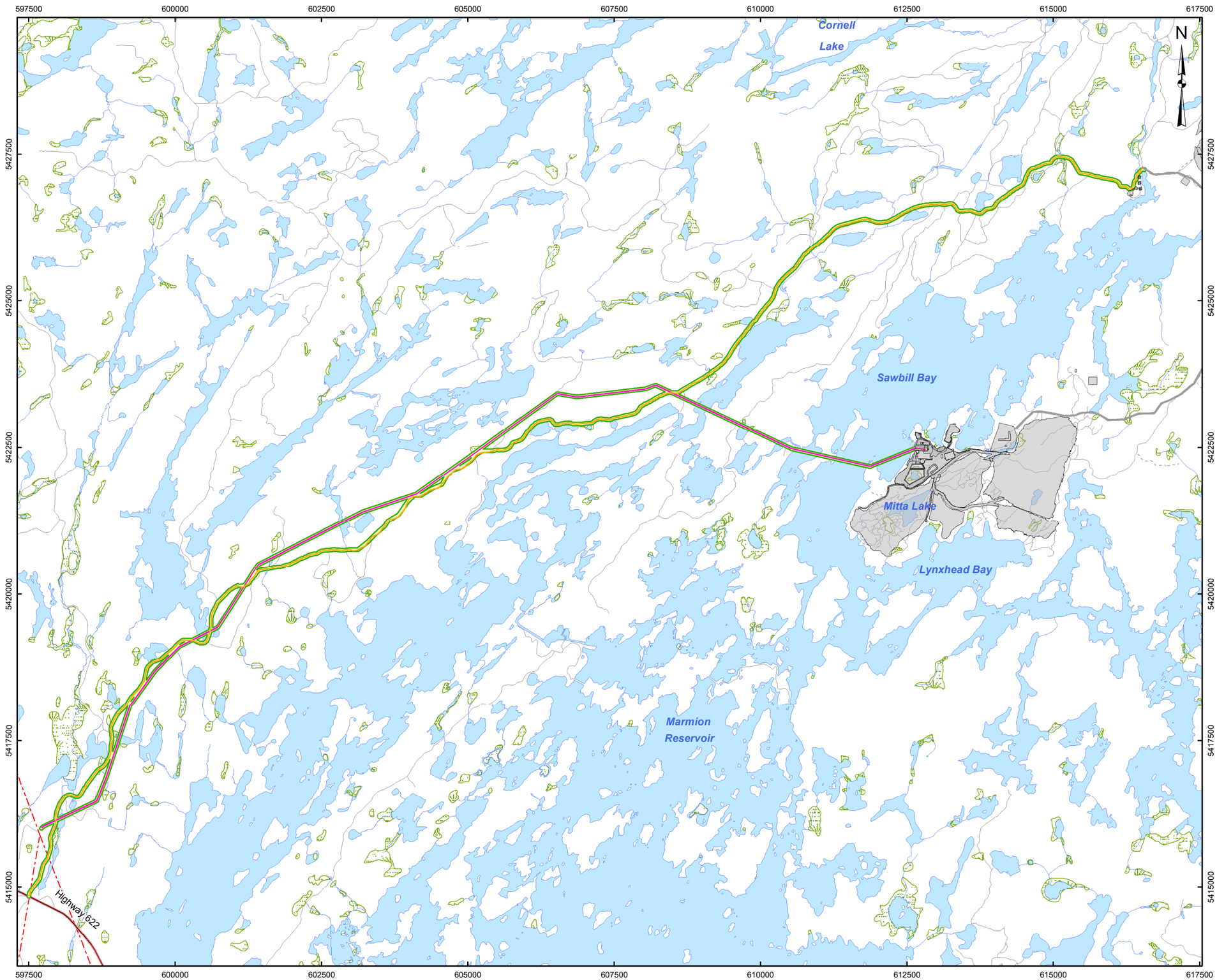
TITLE
MINE SITE STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERISON 1
DESIGN	CGE	14 Nov. 2008		
GIS	JO	8 Feb. 2013		
CHECK	PB	8 Feb. 2013		
REVIEW	PB	8 Feb. 2013		

FIGURE: 1-5

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LEGEND

- Road
- Trail
- River/Stream
- Lake
- Wetland
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Linear Infrastructure 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 1:65,000 METERS

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
LINEAR INFRASTRUCTURE STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	14 Nov. 2008		
GIS	JO	8 Feb. 2013		
CHECK	PB	8 Feb. 2013		
REVIEW	PB	8 Feb. 2013		

FIGURE: 1-6

G:\Projects\2010\10-1118-0020_Brett\Resources_HammondReef\GIS\MXDs\Draft\Socio_Eco\TSD\LinearInfrastructure_StudyArea.mxd

2.0 EXISTING CONDITIONS

2.1 Methods

The description of existing socio-economic conditions is provided in four broad categories: 1) population and demographics, 2) economics, 3) services and infrastructure, and 4) land and resource use. This provides focus of the study in order to:

- Establish the existing conditions against which effects of the Project are described and assessed.
- Identify likely socio-economic, and land and resource use effects of construction and operation of the Project.
- Identify need for and determine suitable mitigation and benefit enhancement measures.
- Identify residual effects remaining after proposed mitigation measures are applied.
- Evaluate the likely significance of any likely residual adverse effects once mitigation measures have been taken into account.

Socio-economic existing data collection and characterization involves the following tasks:

- Compilation and review of existing secondary data and information available through published data sources.
- Primary data collection, including:
  - Interviewing people with specific knowledge or interest in the study areas and the possible effects of the Project.
  - Traffic and transportation studies in the LSA.

2.1.1 Data Review

The review of existing (secondary) data is the principal source of information for the existing studies. Data sources include publicly available information including books, reports and websites. All sources are identified in the reference section (Section 6.0) of this report.

A desktop study was conducted to review census data, regional and local community and economic development plans and policies, land use plans and policies, mining reports, and community profiles of the study areas. Key sources of information include the following:

- Statistics Canada census community profiles (2011, 2006, 2001, and 1996 census data) were used to demonstrate regional and local economic and social trends[1].
- Ontario Ministry of Finance population projections.

[1] The characterization of socio-economic conditions is based on the most current data publically available and generally reflects historical trends, as well as projected conditions since the last census date. Where data are available, conditions since the last census date (2006) are presented.

- Training and Adjustment Board reports and statistics.
- Data and information from provincial ministries including Ministries of Community and Social Services, Community Safety and Correction Services, Health and Long Term Care, and Transportation.
- Ministry of Natural Resources (MNR) geographic information systems (GIS) data.
- Reports prepared for the Ontario Mining Association.
- District School Board reports and statistics.
- Other municipal, provincial and federal economic, housing, education, tourism, services, infrastructure and health reports and statistics.

Available information is supplemented and/or verified by primary data collection in the form of interviews.

2.1.2 Primary Data Collection

Secondary data collected from published sources is supplemented and/or verified by data collected through interviews with people having specific information or insights that could be useful in describing the existing socio-economic conditions and predicting the likely effects of the Project. Informant interviews represent a major source of primary information.

Interviews were conducted to verify and refine information and emerging observations obtained through the desktop study, and provide qualitative information on demographic and other characteristics of potentially affected communities and on community needs and aspirations.

Interviews were held with key stakeholders including local business representatives and associations, social service providers, representatives from non-governmental organizations, community based organizations, and local tourism operators. Throughout the study, opportunities were provided for the addition of further stakeholders as they were suggested or identified.

Ten meetings/interviews were held with fourteen key informants from October 18-21, 2011. Informants included representatives from Quetico Park, Town of Atikokan, Atikokan Chamber of Commerce, Niobe Lake Resort/Realtor, Atikokan Economic Development Corp., Canoe Canada Outfitters, Atikokan Family Health Team, Rainy River District Social Services Board, Rainy River Future Development Corp., and Fort Frances Chamber of Commerce. A complete list of interview participants is provided as Appendix 2.I. Information from interviews supplemented secondary data in terms of:

- Demographic characteristics of communities in the study area.
- Local economic development plans, challenges and opportunities.
- Use and capacity of public services and infrastructure.
- Land use activities, plans, challenges and opportunities.
- Perceptions of potential effects and benefits of the Project (i.e., effects on services and infrastructure, local economy, employment and income, business opportunities, and public health and safety).
- Concerns pertaining to mine closure.

Interviews used a semi-structured questionnaire. Results of interviews were analyzed to identify pertinent themes and integrated with desk-top study results. Some interviewees chose not to sign a declaration of informed consent form, indicating they do not wish for their comments to be attributed to them.

Information also considered the results from public consultation and Aboriginal engagement for the Project conducted to date.

2.1.3 Economic Analysis

The Project will generate major economic effects on the LSA and RSA throughout the construction and operations phases. These effects will include both direct and indirect employment and broad economic activity, including both purchasing, and tax revenues to various governments. The economic effects of the Project are predicted and described using an economic analysis. By considering the fundamental Project attributes (e.g., number of staff and hourly-paid employees, purchases of goods and services, taxation levels) the economic model will predict the resulting benefits in terms of:

- Direct and indirect employment.
- Economic activity.
- Tax revenues, to municipal, provincial and federal government.

Appendix 2.II contains the economic assessment report carried out for this study.

2.1.4 Traffic Impact Study

An analysis of existing, projected background, and site traffic was carried out by determining the influence of site traffic on the following roads (mainlines) and intersections:

- Highway 11 and 11B.
- Highway 11B and Highway 622.
- Highway 622 and Hardtack Road.

The following steps were undertaken to analyze the effects of the Project on these roads and intersections:

- Data collection.
- Model preparation.
- Trip generation.
- Future conditions modelling.
- Results analysis.

Traffic counts were projected to the existing year of 2012 and then analyzed for existing conditions using Synchro (intersections)[2] and Highway Capacity Software (mainlines)[2].

Appendix 2.III contains the traffic impact study.

[2] Synchro and High Capacity Software are state-of-the-art software programs that are extensively used in the transportation engineering industry to analyze traffic operations at intersections and along roadway segments.

2.1.5 Context for Socio-economic and Land Use Considerations

The Project could potentially change, alter, or modify various aspects of the social, economic and/or land use environment. These changes or modifications would be in the form of both benefits and/or adverse effects experienced by the Town of Atikokan, nearby communities (both Aboriginal and non-Aboriginal) and the region.

The existing conditions study considers the key socio-economic and land use issues that may be associated with the Project. This provides a point of focus for the collection of existing information on those elements of the socio-economic and land use environment that are important to the community and are potentially affected by the Project.

There will be opportunity for major economic benefits to the Town of Atikokan, nearby communities, Aboriginal communities, and the region as a result of the Project. A workforce with specific skills and abilities is required for Project construction and operations. There may be issues pertaining to how jobs are allocated (i.e., local versus non-local residents; Aboriginal versus non-Aboriginal persons) and how local sustainable employment can be supported via training, education and opportunities to develop transferable skills and experience. Procurement from local and regional suppliers can create additional jobs during Project construction and operations, beyond those that are the result of direct Project hires and can contribute to income generation and economic diversification within local and regional jurisdictions.

There will be increases to government (federal, provincial, local) revenues as a result of Project-related income, corporate, sales, commodity, and property taxes. Increases to Aboriginal revenues may also flow through Resource Sharing Agreements, where negotiated with OHRG.

Transportation of materials, supplies and workforce could affect local road access, usage and public safety. In-migration of people into Atikokan and nearby communities either temporarily or as permanent residents to take up construction and operational jobs could place incremental demands on housing availability, and affect property values. Increased demands on local services such as health, education, emergency (ambulance, fire), security (police) and transportation may result from both direct mine activities and an influx of a large operational workforce and their families.

Tourism is considered important in the vicinity of the Project. A number of provincial parks as well as various rivers and lakes used for fishing or recreational sports are located near the Project. Effects from the Project could affect the tourism industry in the region and local communities. Other land uses of consideration that may be affected by the Project include hunting, trapping, fishing, mining and forestry.

Mine closure will reduce benefits associated with generated employment, business opportunities, income and government revenues. The waste rock will remain during closure and post-closure, and is expected to be the only feature to be visible from publicly accessible areas, resulting in changes to the visual landscape.

2.1.5.1 Town of Atikokan

Many of the direct socio-economic effects of the Project would be experienced by the Town of Atikokan and its residents.

The Town of Atikokan is the closest municipality to the Project located approximately 30 km southwest of the Project Site. Access to the site is from provincial Highway 11 which links Atikokan with the provincial and North American highway system. Atikokan is also the commercial and social hub of the area.

The Town of Atikokan is located on Highway 11B, approximately 200 km west of Thunder Bay. Due to its proximity to the Project, Atikokan will likely experience socio-economic effects in relation to employment, business generation, and demand on services and infrastructure. With a population of 2,787 (StatsCan 2012), the town is governed by the Mayor and Town Council, which is composed of six councillors. Municipal elections are held every three years during the second week of November.

Atikokan was first settled in 1899 by Thomas Rawn as a railroad point for the Canadian National Railway. Beginning in the early 1900s, a central component of the economic health of Atikokan was based on the forest industry; however, following the closure of Fibratech Manufacturing and Atikokan Forest Products in 2007, the largest employers of Atikokan residents are currently the Ontario Power Generation Thermal Power Plant and Atikokan General Hospital. Many local residents are also employed in the tourism, recreation and service industries.

Industrial development in Atikokan has followed three main sectors: mining, forestry and electricity generation. Each of these sectors is briefly discussed below. In addition, Atikokan is an important centre for tourism activities, particularly boating, hunting and fishing. More recently, with the closure of many mines and forestry related industries in Northern Ontario, the primary focus is on the development of Atikokan as a centre for tourism.

2.1.5.2 Mining

Historically, the local economy centred around two iron ore mines: Steep Rock Iron Mines and Caland Ore. The area was first identified as having significant mining potential in the late 19th century; however, the discovery of a deposit beneath Steep Rock Lake in 1938 coupled with the increasing demand for steel during World War II resulted in a scheme to drain and dredge major portions of the lake, and to divert the Seine River system in order to extract the resource. Both mines commenced operations in the early-1950s and remained the main local employers for the next three decades. During the peak years of production, the Steep Rock Mine employed more than 700 workers and produced 1.0-1.5 million tonnes of ore annually. For every 100 jobs in the mine an additional 65 jobs were reportedly generated in the community, resulting in 40,000 person years of employment (Summary of Woods Gordon Report 1986).

Both mines closed in 1979 and the land was deeded back to the Ministry of Natural Resources. The closing of the mines led to a major local economic downturn in the 1980s.

2.1.5.3 Forestry

Forestry has traditionally been an important industry in Northwestern Ontario, including Atikokan. In the early 1900s there were numerous lumber mills in the area around Atikokan. Many lumber companies logged the Quetico area extensively before it was decided that there was no longer to be any commercial logging in Quetico Park. More recently, Atikokan Forest Products operated a mill in the Sapawe Lake area under the direction of Buchanan Forest Products, and Fibratech operated in Atikokan as one of North America's innovative engineered wood producers – manufacturing and designing quality orientated fibreboard panels. Both of these industries closed in 2007. Currently the only forestry-related industry in the Town of Atikokan is engaged in manufacturing fuel pellets.

2.1.5.4 Electricity Generation

The Ontario Power Generation (OPG) has managed portions of the local watershed since 1985 and took over many of the historic dam structures for the water control system associated with the Atikokan Electrical

Generating System. In 1994 a 10-megawatt hydroelectric generating station (Valerie Falls Power) was developed on the Seine River diversion that had facilitated the opening of the mines 40 years earlier. The former plant buildings associated with the Caland Ore Company now operate as a sawmill. Other developments of the old lake bed include a ski-hill, hydro line and transformer station, and a market garden operation (Sowa et al. 2001).

OPG's Atikokan Generating Station is located near the Town of Atikokan. It has one coal-fuelled generating unit that has a capacity of 211 megawatts of electricity. Plans are proceeding to convert this generating station from coal to wood-fibre biomass. The official start of the $170 million conversion project took place in October 2012; it will be completed in 2014. An estimated 200 construction jobs will be created.

2.1.5.5 Tourism

There have been recent efforts to refocus Atikokan's economy as an outdoor tourist destination, including the Municipal Cultural Planning and the Community Economic Diversification Initiative which promotes Atikokan as the *Canoeing Capital of Canada* and links local tourism with other Northwestern Ontario attractions through cultural mapping and regional cultural profiles. Atikokan's community identity is linked to its strong ties to the natural resources of the region through the symbol of the canoe, which also embodies the integrity, spirituality, artistry and innovation of Northern Ontario (Atikokan Chamber of Commerce 2010). Associated with this symbol is the community's relationship to Quetico Provincial Park, with Atikokan providing one of the main entry points to the park's vast interconnecting lake and river system, and 80 kilometres of motorboat-free routes. The Canadian Shield landscape, wildlife and mixed forest of Quetico Provincial Park have played a large role in the promotion of tourism of the region.

Atikokan also has a number of museums and cultural attractions which seek to promote, celebrate and educate the public on the mining history of the town. The theme of the Atikokan Museum is 'The little Town that could' and its exhibits highlight the early logging, railway and mining history of the town. Five public murals throughout downtown Atikokan provide a visual record of this history. The Atikokan Mining Attraction Association has preserved artefacts and archives, and created online exhibits which highlight the social and environmental changes to the landscape and the community as a result of mining.

2.1.5.6 Overview of Mining Economy in Ontario

The Project takes place within the context of a vital and growing mining sector in Ontario.

In 2007, the total value of Ontario mineral production was $10.7 billion, representing approximately 1.8% of Ontario's gross domestic product (GDP) (Ontario Mining Association 2009). Ontario produced 26% of Canada's total production of metallic and non-metallic minerals in 2007 (Ibid). As well as being the largest producer in the nation, Ontario ranked first as a destination for mineral exploration, with a total of $572 million spent on mineral exploration in 2007 (Ibid). Mining in Ontario consisted of 43% nickel, 13% copper and 12% gold. Total capital investment in Ontario mining was over $2.7 billion in 2007, an increase of $1.6 billion (or 58%) from 2004 (Ibid).

With the economic downturn in 2008, the total value of mineral production in Ontario declined to $9.6 billion, or 1.6% of Ontario's GDP (OMNDMF 2011) and stock market capitalization dropped almost 50%. However, Ontario was still responsible for 21.3% of Canada's total mineral production in 2008 (ranked 2nd next to Saskatchewan) and was also responsible for 31.4% of Canada's metals production (ranked 1st in Canada) (Natural Resources Canada 2009).

On average, 48% of Ontario mine project procurement is sourced from local suppliers (within 80 km of mine site), 33% from elsewhere in Ontario and 13% from other parts of Canada (OMA 2009). As only 6% of operational inputs are imported from outside the country, the Ontario mining industry is one of the largest contributors to Ontario's international trade balance.

In Ontario, mining operations also contribute to increasing employment and higher wages. In 2008, mining directly employed 28,800 persons (OMNDMF 2011). An additional 71,200 workers were indirectly employed by the mining sector (OMNDMF 2008). Overall, over $1 billion in labour income (wages, salaries and benefits) are paid annually by the mining sector in Ontario (Ontario Mineral Industry Cluster Council 2008). The mining sector is recognized as one of the highest paying industries in Ontario. In 2008, the average weekly earnings for the mining industry were 40% higher than the provincial average; that's $1,357 weekly (OMNDMF 2011) compared to $819 (HRSDC 2010).

The mining industry also generates government revenue through taxation. In 2007, the Ontario mining industry paid approximately $609 million in taxes to the various levels of government (OMA 2009). The impact on government revenues of opening of a new mine in Ontario is estimated at $49 million per year during construction and $84 million per year during operations. Ontario's share is of government revenue generated is approximately 38% (Dungan and Murphy 2007).

Mineral production in Ontario represents an important export market, with approximately 80% being exported to foreign countries. The United States represents the largest foreign market, followed by Europe and China (OMA 2009).

2.2 Description of Existing Conditions

2.2.1 Population and Demographics Valued Ecosystem Component

For the purposes of this study, the population and demographics VEC is described using four indicators: population change, mobility, age and gender, and dependency ratios. Each of these indicators is described in the following sections.

2.2.1.1 Population Change

Northern Ontario is subdivided into Northwestern Ontario and Northeastern Ontario. Northwestern Ontario comprises the Thunder Bay, Kenora, and Rainy River Districts, while Northeastern Ontario consists of the Algoma, Sudbury, Cochrane, Timiskaming, Nipissing, and Manitoulin Districts and the municipality of Greater Sudbury. As identified in Section 1.7.2, the RSA includes all or parts of the Districts of Kenora, Rainy River and Thunder Bay south of the Far North boundary (Figure 1-3).

The total population of the RSA is 224,034 (StatsCan 2012), which represents approximately 1.7% of the population of the Province of Ontario (Table 2-1). The Thunder Bay District represents more than half of the RSA population, with the majority of the District's population concentrated in the City of Thunder Bay (population: 108,359). The second largest population centre in the RSA is the City of Kenora with 15,348 followed by the Town of Fort Frances (7,952) and the City of Dryden (7,617).

In 2011, the population of the RSA was 224,034, compared to 235,046 in 2006, 234,771 in 2001, and 244,117 in 1996 (StatsCan 2012, 2007, 2002 and 1997). From 1996 to 2011 the population fluctuated resulting in an overall decrease of 8.2%.

In 2011, the population of Atikokan was 2,787. Since 1996, the population of Atikokan has declined by 31%, including a 15.4% decline between 2006 and 2011. This decline can be attributed mostly to the downturn of the local economy resulting from the closure of a number of mining and forestry-related employers in the town.

Comparatively, the population of Ontario has demonstrated a growing trend since 1996, with a population increase of 19.5% over this period.

Table 2-1: Study Area Populations (1996 – 2011)

	Regional Study Area				Local Study Area	Province of Ontario
	Kenora District	Rainy River District	Thunder Bay District	Total RSA	Town of Atikokan	
2011	57,607	20,370	146,057	224,034	2,787	12,851,821
2006	64,419	21,564	149,063	235,046	3,293	12,160,282
2001	61,802	22,109	150,860	234,771	3,632	11,410,046
1996	63,335	23,163	157,619	244,117	4,043	10,753,573
2006-2011 Change (%)	-10.6	-5.5	-2.0	-4.7	-15.4	5.7
2001-2006 Change (%)	4.2	-2.5	-1.2	0.1	-9.3	6.6
1996-2001 Change (%)	-2.4	-4.6	-4.3	-3.8	-10.2	6.1
1996-2011 Change (%)	-9.0	-12.1	-7.3	-8.2	-31.1	19.5
Population Density 2011 (per km^2)	0.1	1.3	1.4	0.4	8.7	14.1

Source: StatsCan 1997, StatsCan 2002, StatsCan 2007; StatsCan 2012.

The population density in the RSA is low at 0.4 persons/km^2 compared to 8.7 persons/km^2 in Atikokan and 14.1 persons/km^2 for the Province.

Population data are not available for those smaller communities within the LSA that are part of the Organized District of Rainy River.

Population projections estimated by the Ontario Ministry of Finance are presented in Table 2-2. Population projections are not available from the Ministry of Finance for the Town of Atikokan; however, the Town of Atikokan Official Plan Review and Update Background Paper (Meridian 2012) states that if a number of economic investment initiatives proceed (including the Project), the permanent population of the Town could increase by over 1,000 residents over the next 20 years.

The numbers in Table 2-2 are projected using a standard demographic methodology, which assumes that the recent trends in migration, fertility and mortality will be reflected in the future population data within each census division. Projections in the table are given for year 2013 (prior to construction), 2015 (at the start of operations) and 2030 (during the post-closure phase) for both the RSA and the Province of Ontario as a whole.

Table 2-2: Regional Study Area Population Projections

	Regional Study Area	Province of Ontario
2013	239,110	13,960,475
2015	238,970	14,025,233
2030	237,660	16,671,113
2013-2015 Change (%/year)	-0.03	0.23
2016-2030 Change (%/year)	-0.04	1.39

Source: Ontario Ministry of Finance 2012

It is projected that the population of the RSA will experience a decrease in population from 2013 to 2015 (-0.03% per year) and from 2016 to 2030 (-0.04% per year), as compared to the projected increases for the province as a whole over these periods (0.23% per year and 1.39% per year, respectively). This projected population decline appears to be a conservative estimate compared to the observed population decline over the past five years. The Kenora District is expected to be the only district within the RSA to potentially experience population growth over the period to 2030.

The anticipated population decrease in the RSA will be due to the aging of the largest population cohorts (45-60), especially in regions where natural increase and net migration are projected to become or remain negative. In 2011, the median age of the RSA was 42.4 and of Atikokan it was 48.5, compared with the provincial median age of 40.4 years (StatsCan 2012).

2.2.1.2 Mobility

Population mobility indicates the amount of migration into or within an area, reflecting the stability of a community. Statistics Canada determines migration patterns by five-year mobility status, which refers to the relationship between a person's place of residence on Census Day and his or her usual place of residence one year and five years earlier. Figure 2-1 presents the 2006 census data on population mobility for the RSA and LSA.

In 2006, mobility rates for all three districts of the RSA were similar, with an average of 87.1% of residents residing at the same address one year prior, and 63.6% residing at the same address five years prior (StatsCan 2007). The RSA and LSA showed a lower rate of mobility in the past five years, than the Province.

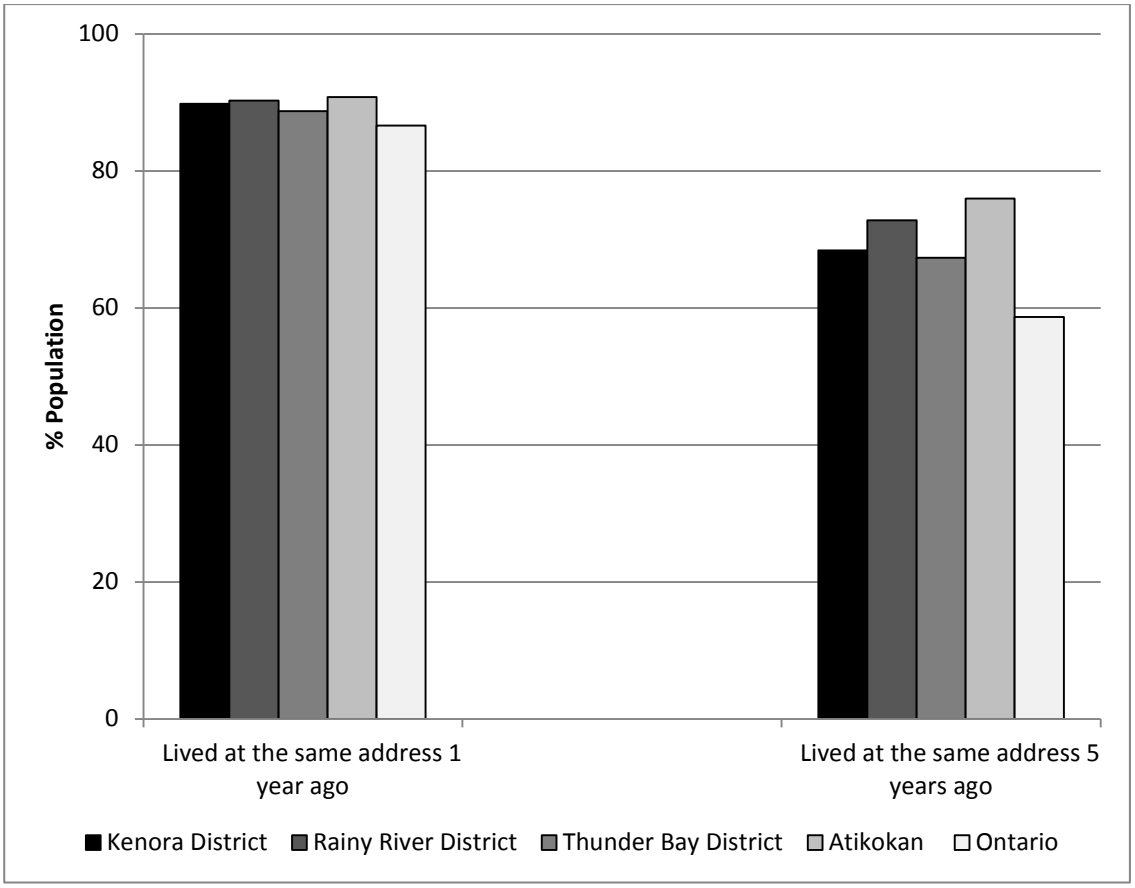


Figure 2-1: Mobility Status for the Regional Study Area and Atikokan

Atikokan has a lower rate of five-year mobility compared to the RSA, indicating a relatively lower percentage of migration into the community. This may be due to higher availability of education, training, employment and housing options within communities such as Thunder Bay, as compared to Atikokan. Furthermore, residents of the Town of Atikokan have a very strong sense of loyalty to their community. Despite the economic downturn, community members are more likely to travel for work while their families continue to reside in Atikokan rather than relocate for employment (J. Wood personal communication October 19, 2011).

2.2.1.3 Age and Gender

Figure 2-2 shows the Statistics Canada age and gender characteristics of the RSA. The figure illustrates the percentage of residents in each 5-year age cohort by males and females. The most distinct features of this figure compared with a similar figure for the Province as a whole are:

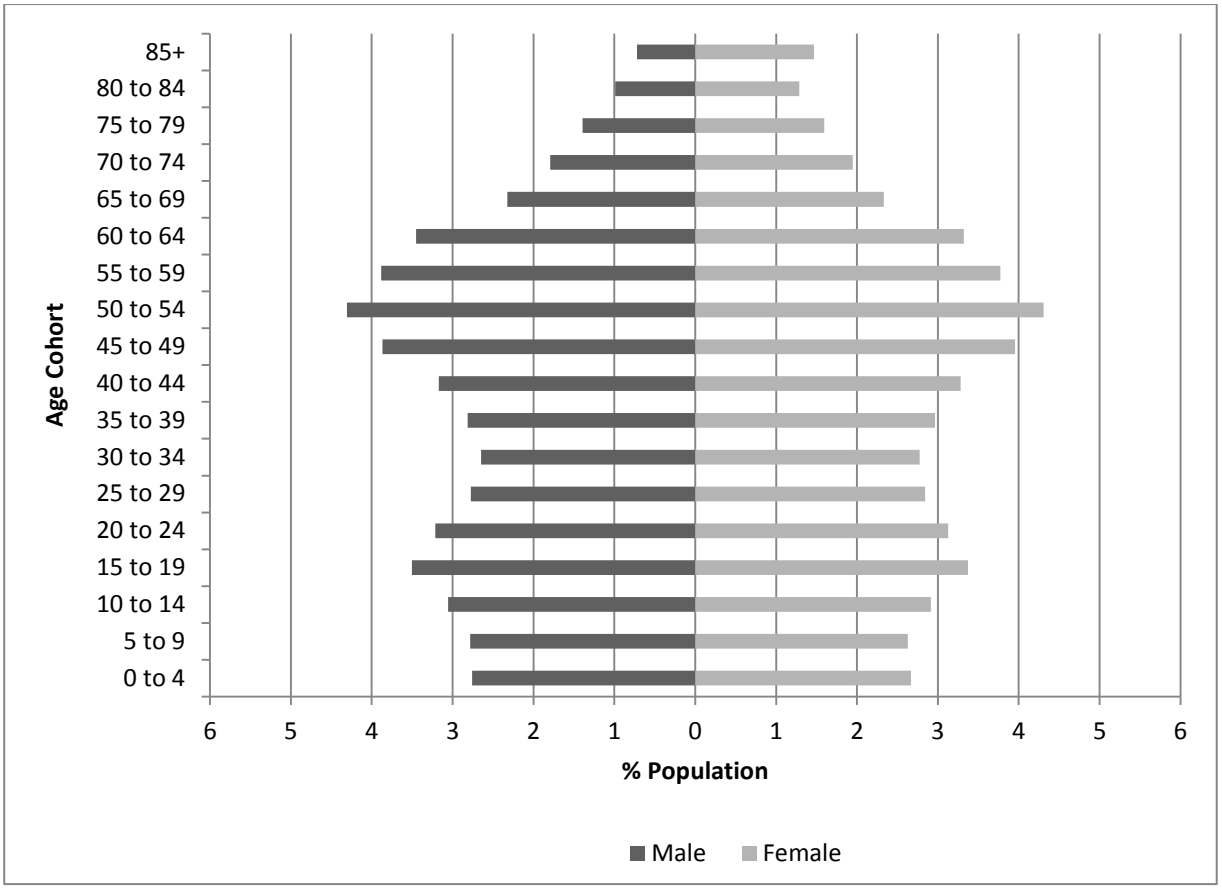
- Lower percentage of children (0 to 14 year cohorts).
- Lower percentage of younger working age adults (20 to 44 year cohorts).
- Higher percentage of retired persons (60 to 85 year cohorts).

Figure 2-3 presents the age and gender characteristics of the LSA. This figure shows a more pronounced difference from the Province as a whole. The smallest cohorts are the 20 to 34 year categories, as well as the 70 to 85+ categories. The largest cohorts are between the ages of 40 and 64. This reflects the declining population of Atikokan and the loss of youth following secondary education to seek employment or further education elsewhere. Without in-migration of younger individuals into the LSA, the population can be expected to decrease further over the next 20 to 40 years.

Although the population of Atikokan is almost equally divided between women and men (50.8% and 49.2% respectively), certain age cohorts are not equally represented. Noticeably, the cohorts between 25 and 34 are predominantly female and between 50 and 59 years are predominantly male. This gender distribution may be due to the cycles of trade industry employment over the past 40 years; men are more likely to remain in the community having secured employment in the 1970s, while women are more likely to go away for school and not return (A. Morin. personal communication 19 October 2011).

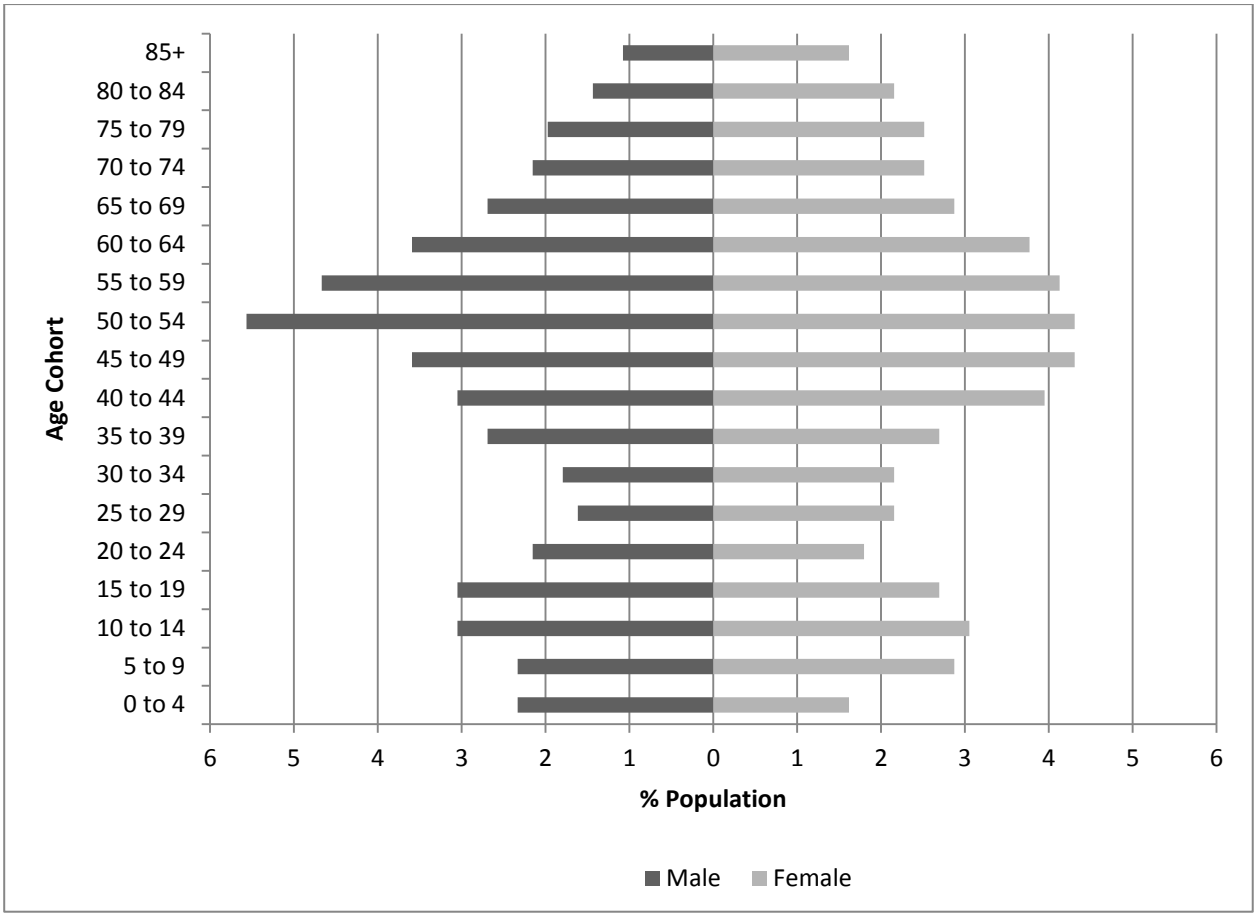
The proportion of the population between the ages of 20 and 49, reflecting the bulk of the likely labour force pool required for the Project, is 37.4% in the RSA and 32.0% in the LSA, compared to 41.2% for the Province as a whole (StatsCan 2012).

Ontario's median age has been increasing over the past few decades as the post-World War II baby-boom generation ages. Additionally, families are having fewer children and often later in life, so the generation that represents the children of the baby boomers (approximately ages 10-29) is not as large as the baby-boomers (approximately ages 40-59). The fact that the largest cohort is nearing retirement age will prove to be a challenge to labour force supply province-wide. This problem may be exacerbated in the RSA and LSA where, due to the lack of post-secondary educational and employment opportunities, young people may leave the region to pursue career and job training elsewhere.



Source: StatsCan 2012.

Figure 2-2: Age Profile for the Regional Study Area (2011)



Source: StatsCan 2012.

Figure 2-3: Age Profile for Atikokan (2011)

2.2.1.4 Dependency Ratios

Dependency ratios for the RSA and LSA are presented in Table 2-3. The children dependency ratio is the ratio of children (0 to 14 years of age) to the working age population (15 to 64 years of age). The elderly dependency ratio is the ratio of elderly (65 and older) to the working age population. The ratios are expressed as the number of dependents for every 100 persons in the working age population. Dependency ratios are important to consider in the socio-economic existing study, as they provide information on the pressure placed on working age persons as caretakers and financial supporters of dependants. Long term changes in dependency ratios provide information on future demand for healthcare and other services.

In 2006, the dependency ratio for Atikokan (53.0) was higher than Ontario as a whole (46.5) mainly due to the higher percentage of elderly in Atikokan as compared to the province. Due to the aging population of the LSA, it is anticipated that dependency ratios will increase in the future, potentially putting social and financial strain on income earners and their families, as well as on the municipal tax base, community services and infrastructure, including senior's care, healthcare and childcare (StatsCan 2007).

Table 2-3: Dependency Ratios (2006)

	RSA	Atikokan	Ontario
Child (0-14 years)	23.0	26.1	26.6
Elderly (65 years and older)	17.0	27.0	19.9
Combined Total	41.0	53.0	46.5

Source: StatsCan 2007

2.2.2 Labour Market Valued Ecosystem Component

The quality and number of employment opportunities is integral to quality of life and the economic well-being of a community. These aspects influence the way a community is perceived including its attractiveness as a place to live and do business. The labour force indicators presented in this section are illustrative of the overall economic performance of the RSA and LSA and reflect overall status of the labour market with respect to the availability of workers.

The labour market VEC is characterized by five indicators: regional and local supplier base, labour force by industry and occupation, employment and unemployment rates, median income, and education and training. Each of these indicators is discussed below. The discussion of labour market is within the context of the economy of Northwestern Ontario.

The economy of Northwestern Ontario has been declining over the past decade. The Gross Domestic Product for Northwestern Ontario declined by 6.7% between 2001 and 2006, while it increased by 3.5% for Northeastern Ontario and 13.6% for the rest of Ontario over the same period of time (Rosehart 2008).

The economy of Northwestern Ontario has traditionally been dominated by a small number of large companies that hire large numbers of workers, which in turn has created service industries dependent on large employers and communities (Rosehart 2008). Approximately 76% of employment in Northwestern Ontario (excluding Thunder Bay) is in the service sector (Northwest Training and Adjustment Board 2010). The decline of the forestry sector in Ontario in recent years and the subsequent closures of pulp and paper and lumber mills have had a negative effect on the economic conditions in the region. This coincides with the decline of the goods-

producing sector in the region and the province as a whole, with only 24% of employment in Northwestern Ontario being in the goods-producing sectors in 2009 (Northwest Training and Adjustment Board 2010). However, ongoing mineral exploration activities and discoveries of substantial mineral reserves in the region may open up new economic opportunities for increased exploration, mining services and aggregate exportation. Mining will continue to play an important role in the regional economy particularly with recent discovery of large deposits of metals including chromite, platinum and palladium in the "Ring of Fire" area in the Northeastern part of the Kenora District. This discovery has renewed interest in mining in the region and represents a major opportunity for economic development. Aside from the direct employment opportunities and income that new mining construction and operations entail, there are many indirect economic effects associated with mining. Economic opportunities that could be a result of increased mining activity in the region may include increased exploration, mining services, aggregate exportation, and procurement of goods and services. Thunder Bay will continue to be a source of goods and services to mining projects in the region due to its size and importance as a mining service centre.

The forestry industry in the region has experienced a major decline in recent years, a trend that has had major consequences on the economy of the region. The Ontario Ministry of Northern Development, Mines and Forestry has a number of forest sector competitiveness programs in place as a means to strengthen the forestry industry. These programs are intended to stimulate new development in value-added manufacturing and co-generation and make the industry more competitive going forward. Along those lines, new areas for market growth within the forestry sector include bio-composites and nanotechnology, biofuels from wood pellets, environmentally sustainable products, and green building components.

Realizing that resource-based sectors are based on cyclical employment driven by the price of commodities, the region has been pursuing knowledge-based and value-added employment in order to bring more stability to the economy. This has led to the emergence of new sectors such as health, bioeconomy, and renewable energy, which are expected to experience substantial growth in the future (Government of Ontario 2009). Tourism also plays an important role in the economy of Northwestern Ontario, with hunting, fishing, boating and other outdoor recreational activities attracting people from more populated areas of Canada and the United States.

The City of Thunder Bay is located approximately 230 km southeast of the Project Site and is Northwestern Ontario's commercial and administrative centre. The local economy is historically rooted in resource based industries, and today there is an emphasis on maintenance and further development of a diverse knowledge based economy. The majority of its current top employers are in the public sector, although mining exploration and operations do play an important role in the economy through direct mining service and supply of goods and service firms to support mining activities (Thunder Bay CEDC 2012). Thunder Bay receives substantial air, rail and shipping traffic. The Port of Thunder Bay is the largest outbound port on the St. Lawrence Seaway System and the sixth largest port in Canada.

Historically, the Town of Atikokan (the closest community to the Project) developed around the mining and forestry industry, with the economy being heavily dependent on these sectors. After the closure of the Steep Rock Iron Mines, and the Caland Ore Company Limited in the 1970s, the forestry sector became the primary employer in the community.

Today, the local economy is based on mining, forestry, the Atikokan Generating Station, government and retail services, light manufacturing, and tourism (Ontario Ministry of Economic Development and Tourism 2010). A Municipal Economic Development Plan approved in 2007 identifies tourism, small manufacturing (particularly

wilderness related), and the forestry and mineral development sector as the targeted sectors for economic development (OMEDT 2010).

The Atikokan Economic Development Commission (AEDC) has noted a recent increase in activity in the mining and mineral resources and the energy generation sector, and is optimistic that this activity will aid in the stabilization of the local economy. Positive economic developments include the establishment of Atikokan Renewable Fuels, the present conversion of the Atikokan Generating Station from coal to wood pellets, and the possible development of the Bending Lake Iron Ore Mine. These developments are expected to preserve existing jobs, and could lead to the creation of new jobs in the mining and energy generation sectors. The Atikokan Renewable Fuels facility will require 8 additional workers per shift.

The AEDC 2011 undertook a Mining Sector Impact Analysis to determine potential effects to the community for the proposed Project and the Bending Lake Iron Ore project. This analysis included the identification of direct services required to support these operations if both projects are approved.

2.2.2.1 Regional and Local Supplier Base

As of 2006, there were 13,217 businesses registered in the RSA, including 176 with 100 or more employees (NWTAB 2012). There was a slight decrease of 0.5% in the number of businesses from 2001. As discussed above, numerous businesses across Northwestern Ontario, including in Thunder Bay, supply the mining industry with goods and services. As of 2011 there were 152 businesses associated with Construction, Mining and Utilities in the Rainy River District; with just three of these identified as providing support activities for mining (NWTAB 2012).

There are 83 businesses in Atikokan (AtikokanOnline 2012), only a small number of which would be able to service a mining industry. It is estimated that there is opportunity for up to about 30 new businesses to support the mining industry if the Project and other initiatives are realized (AEDC 2011).

In 2012, the main employers in Atikokan were OHRG, Ontario Power Generation, the Rainy River Board of Education, and Atikokan General Hospital, with each organization employing over 80 workers. Additionally, each year Quetico Provincial Park employs 100 people in the summer and 8 people year round. A listing of both public and private sector employers compiled by the Atikokan Economic Development Corporation for the Ontario Ministry of Economic Development is provided in Table 2-4 and Table 2-5 (OMEDT 2010). Where relevant, these numbers have been updated with information collected from the AEDC during key informant interviews conducted in 2011.

Table 2-4: Private Sector Employers in the Local Study Area

Name	Product or Service	Sector	No. of Employees (approximate)
Osisko Hammond Reef Gold Ltd.	Mining Exploration	Mining	130
Atikokan Foodland	Grocery store	Retail	30
Tramin	Construction / Trades	Construction / trades	25
Souris River Canoes	Canoes	Manufacturing	8
Atikokan Home Hardware	Merchandise	Retail	6
Atikokan Renewable Fuels	Wood pellet manufacturer	Manufacturing	5

Source: OMEDT 2010, G.McKinnon personal communication October 20, 2011.

Table 2-5: Public Sector Employers in the Local Study Area

Name	Sector	No. of Employees (approximate)
Quetico Provincial Park (summer)	Administration	100
Rainy River District Board of Education	School Board	90
Ontario Power Generation	Power	90
Atikokan General Hospital	Healthcare	88
Town of Atikokan	Municipal	52
Government of Ontario	Government	36
Community Living Atikokan	Service	27
Atikokan Native Friendship Centre	Service	14
Atikokan & District Association for Development	Service	27
Atikokan Family Health Team	Healthcare	21
Rainy River District Women's Shelter of Hope	Service	15
Ontario Provincial Police	Government	15
Atikokan Hydro	Electricity	8

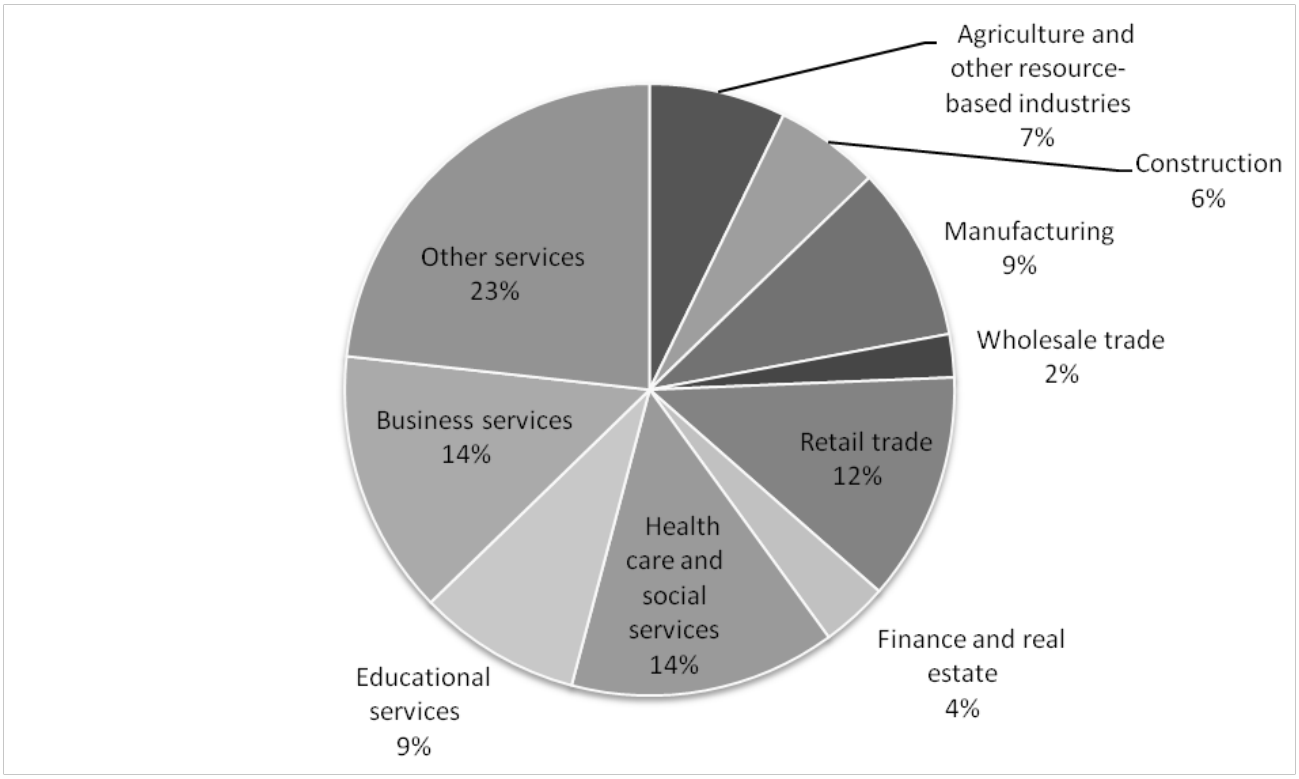
Source: OMEDT 2010.

2.2.2.2 Labour Force by Industry and Occupation

Consideration of the labour force by industry and occupation characterizes the current state of employment in the RSA and LSA as well as providing an indication of the skills available in the community and their applicability to the Project.

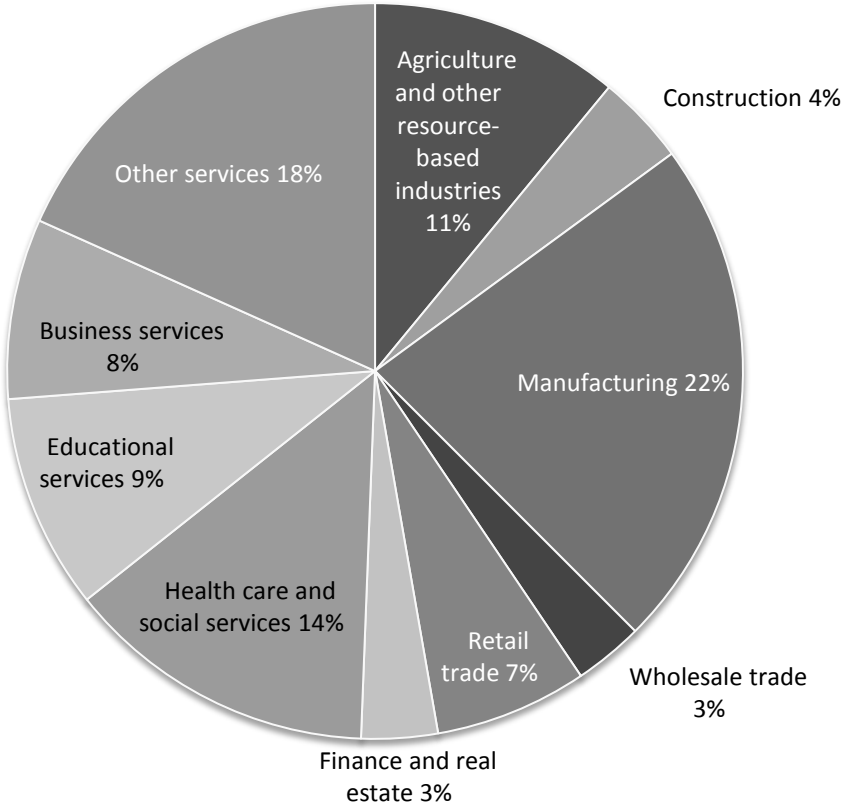
In 2006, the RSA had an experienced labour force of 117,865 (or 1.8% of the provincial labour force). Figure 2-4 presents a breakdown of employment by industry for the RSA. In 2006, other services (23.3%), health care and social services (14.1%), business services (14.0%), and retail trade (12.1%) represent the largest employment sectors in the RSA. Manufacturing, construction and resource-based employment comprise 22% of the workforce (StatsCan 2007).

In 2006, the LSA had an experienced labour force of 1,650. Figure 2-5 presents a breakdown of employment by industry for the LSA. In 2006, manufacturing (22.4%), other services (18.2%), health care and social services (13.6%), agriculture and other resource-based industries (10.9%) and educational services (9.4%) represent the largest employment sectors in the LSA (StatsCan 2007). The percentage of workers employed in manufacturing has declined since 2006, with the closures of Fibratech and Atikokan Pulp and Paper in 2007. The proportion of the labour force employed in agriculture and other resource-based industries is higher in the LSA than in the RSA (7.2%) and the province as a whole (2.9%) (StatsCan 2007). This indicates importance of resource-based industries such as mining and forestry to the local and regional economy. Primary industries of employment are still forestry and mining; however, a number of workers are employed outside of Atikokan. Many of the families of these workers still reside in Atikokan. Tourism constitutes approximately 15% of Atikokan's employment (G. McKinnon personal communication 20 October 2011).



Source: StatsCan 2007.

Figure 2-4: Labour Force Distribution by Industry in the Regional Study Area (2006)



Source: StatsCan 2007.

Figure 2-5: Labour Force Distribution by Industry in the Local Study Area (2006)

Employment by industry in the RSA varies by gender. In 2006, the number of men employed in the agriculture and resource-based sectors and the manufacturing and construction sectors was more than six times that of women. Conversely:

- The number of women employed in the health care and social services was almost five times that of men.
- The number of women employed in the education sector was double that of men.
- The number of women employed in the finance and real estate sector was 1.5 times that of men.

In the LSA, industry labour force distribution varies between men and women. The manufacturing, construction, agriculture and resource-based industries are male dominated. The retail trade, finance and real estate, health and social services, and educational services industries are female dominated. In Atikokan, the construction and manufacturing industries employ the most men (19.3% and 12.5%). Health care is the primary industry of employment for women (12.4%) (StatsCan 2007).

The local labour force can also be analyzed according to occupation. Atikokan has a higher percentage of people employed in processing and trades occupations, and a lower percentage of people employed in business. As with industry distributions, there are gender differences in the distribution of the population across occupations. Men dominate occupations unique to primary industry, natural and applied sciences, processing and trades, while women primarily occupy positions in business, health, social science, and sales and service (StatsCan 2007).

2.2.2.3 Employment and Unemployment Rates

Participation rate refers to the number of persons in the labour force (either employed or unemployed but looking for a job) expressed as a percentage of the population 15 years of age and over (excluding institutional residents). Employment rate is the number of persons employed, expressed as a percentage of the total population 15 years of age and over, while unemployment rate refers to the number of persons unemployed expressed as a percentage of the labour force.

Table 2-6 indicates that participation (63.7%) and employment rates (58.6%) in the RSA were lower than those of the province of Ontario (67.1% and 62.8%, respectively) in 2006, while the unemployment rate was higher in the RSA at 8.3% (StatsCan 2007). The employment rates for females in the RSA are similar to that of the province, whereas the male unemployment rate in the RSA is 3.6 percentage points higher than that of the Province. For the RSA and the province the female median income is lower than that for males.

In 2006, the unemployment rate in Atikokan was 9.0%, which was greater than the provincial average of 6.4%, but less than Atikokan's unemployment rates recorded in 2001 (11.9%) and 1996 (13.2%). The labour force participation rate was low at 62.7% compared to 67.1% provincially. Since 1996, Atikokan's participation rate has generally been lower than RSA communities and the province. In 2007, approximately 350 Atikokan residents were laid off due to the Fibratech closure, and from Atikokan Pulp and Paper (AEDC 2008). Based on the number of residents who reported being employed in the 2006 census (1,520), these lay-offs resulted in a loss of 23% of the jobs at that time. Due to this decrease in jobs, the employment rates for Atikokan have changed significantly since the 2006 census.

Table 2-6: Regional and Local Study Area Labour Force indicators (2006)

	Regional Study Area				Local Study Area	Province of Ontario
	Kenora District	Rainy River District	Thunder Bay District	Total RSA	Atikokan	
Total population 15 years and over in the labour force	31,340	10,935	77,775	120,050	1,670	6,587,580
Participation rate (%)	64.1	64.2	63.7	63.9	62.4	67.1
Employment rate (%)	58.5	59.1	58.5	58.6	56.8	62.8
Unemployment rate (%)	8.8	7.9	8.1	8.3	9.0	6.4
Medium income – persons 15 years and over ($)	23,667	25,470	27,638	26,410	25,718	27,258

Source: StatsCan 2007.

The 2010 unemployment rate for Northern Ontario as a whole is available through Human Resources and Skills Development Canada (2010). This information is helpful to understand trends in unemployment for the larger region. Figure 2-6 shows the unemployment rate for Northern Ontario from January 2006 to September 2010.

In 2006, the unemployment rate for Northern Ontario was 10.3% compared to 8.3% for the RSA and 6.4% for the Province. In 2009, Northern Ontario's unemployment rate had increased to 12.1% (HRSDC 2010), mainly due to the global economic downturn in 2008 and 2009.

As of June 2011, the unemployment rate for Northwestern Ontario was 7.8%, which rose to 8.1% by June 2012. By comparison, the unemployment rate for Ontario as a whole was 7.9% in June 2011 and in June 2012 (StatsCan 2012a).

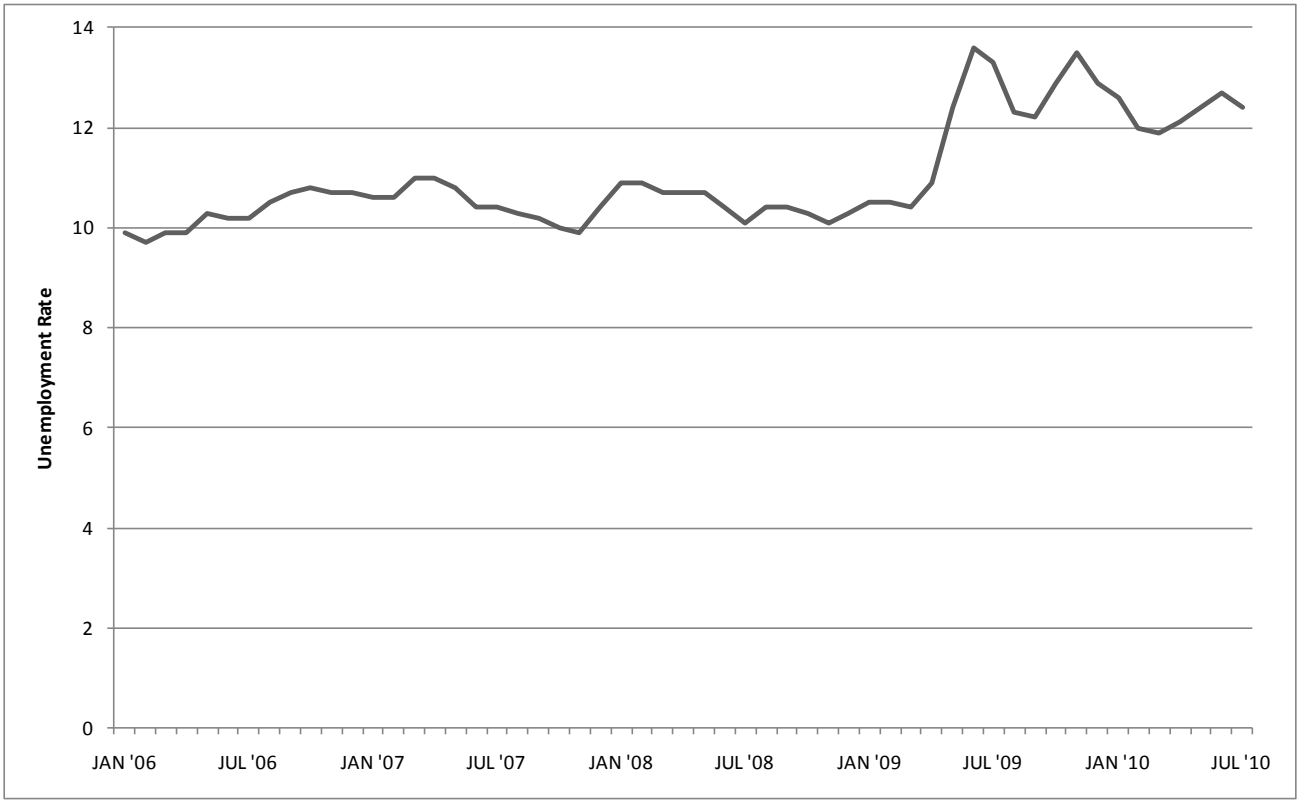
2.2.2.4 Median Income

The median personal income for persons 15 years and over in the RSA in 2006 was $26,410, slightly lower than the provincial median of $27,258. The Kenora District had the lowest median income in the RSA at $23,667 (StatsCan 2007). The median personal income for Atikokan in 2006 was $25,718, also slightly below the provincial median of $27,258. In Atikokan the median income of $18,791 for women compared to $39,133 for men. This is due in part to the heavy influence of the resource based industries in the region, which tend to be male dominated and higher paying, while support, service and retail jobs are secured by women which tend to pay less.

In 2006, 13.8% of persons residing in Atikokan were deemed of low income status compared to 14.7% in the Province. 12.7% of youth and children in Atikokan were deemed low income, compared to 13.7% in the Province (StatsCan 2007).

2.2.2.5 Education and Training

The level of education within a community helps characterize its socio-economic status and reflects the potential pool from which future workers are drawn. These aspects influence the way a community is perceived including its attractiveness as a place to live and do business.



Source: Human Resources and Skills Development Canada 2010.

Figure 2-6: Unemployment Rate for Northern Ontario – January 2006 to September 2010

Figure 2-7 illustrates educational attainment in the RSA and LSA for the population over 15 years of age in 2006. The RSA has a greater proportion of persons with no certificate, diploma or degree (at 17.5%) than the province as a whole (at 8.7%). This may be indicative of the reduced skills training required for the predominant industries in the RSA. The RSA has a lower rate of persons with a university certificate, degree or diploma (at 19.3%) than the province as a whole (at 32.7%). However, the percentage of persons with a college, CEGEP or other non-university certificate or diploma is slightly higher (at 25.7%) in the RSA than in the whole province (at 24.3%). This may be indicative of the types of industries that employ residents of the RSA such as agriculture and manufacturing. Within the RSA, the Kenora District generally has a lower level of education than the Rainy River District or Thunder Bay District (StatsCan 2007).

In 2006, Atikokan's high school non-completion rate was lower than that of the province (Figure 2-7). While the percentage of those with college certificate/diploma and apprenticeship and trades certificates was higher than the provincial average, there were a lower percentage of individuals holding university degrees. The level and type of educational attainment in Atikokan reflects the major industries providing employment in the community (i.e., resource-based industries and tourism) which often do not require a college or university level of education.

Out of 24 colleges of applied arts and technology in Ontario, only one is located in the RSA (Confederation College in Thunder Bay) and out of 20 publically funded universities in Ontario, only one is within the RSA (Lakehead University in Thunder Bay). This may contribute to lower education levels compared to the provincial average, as well as contribute to out-migration of residents for educational opportunities outside of the RSA.

Confederation College as well as other universities and colleges offer courses remotely in Atikokan through Contact North. The following Universities and Colleges offer one or more courses through Contact North:

- Canadore College.
- College Boreal.
- Confederation College.
- Northern College.
- Algonquin College.
- Cambrian College.
- Centennial College.
- Conestoga College.
- Durham College.
- Georgian College.
- Lambton College.
- St. Lawrence College.
- Brock University.
- Lakehead University.

- Laurentian University.
- Nipissing University.
- Queen's University.
- University of Ontario Institute of Technology.
- University of Waterloo.

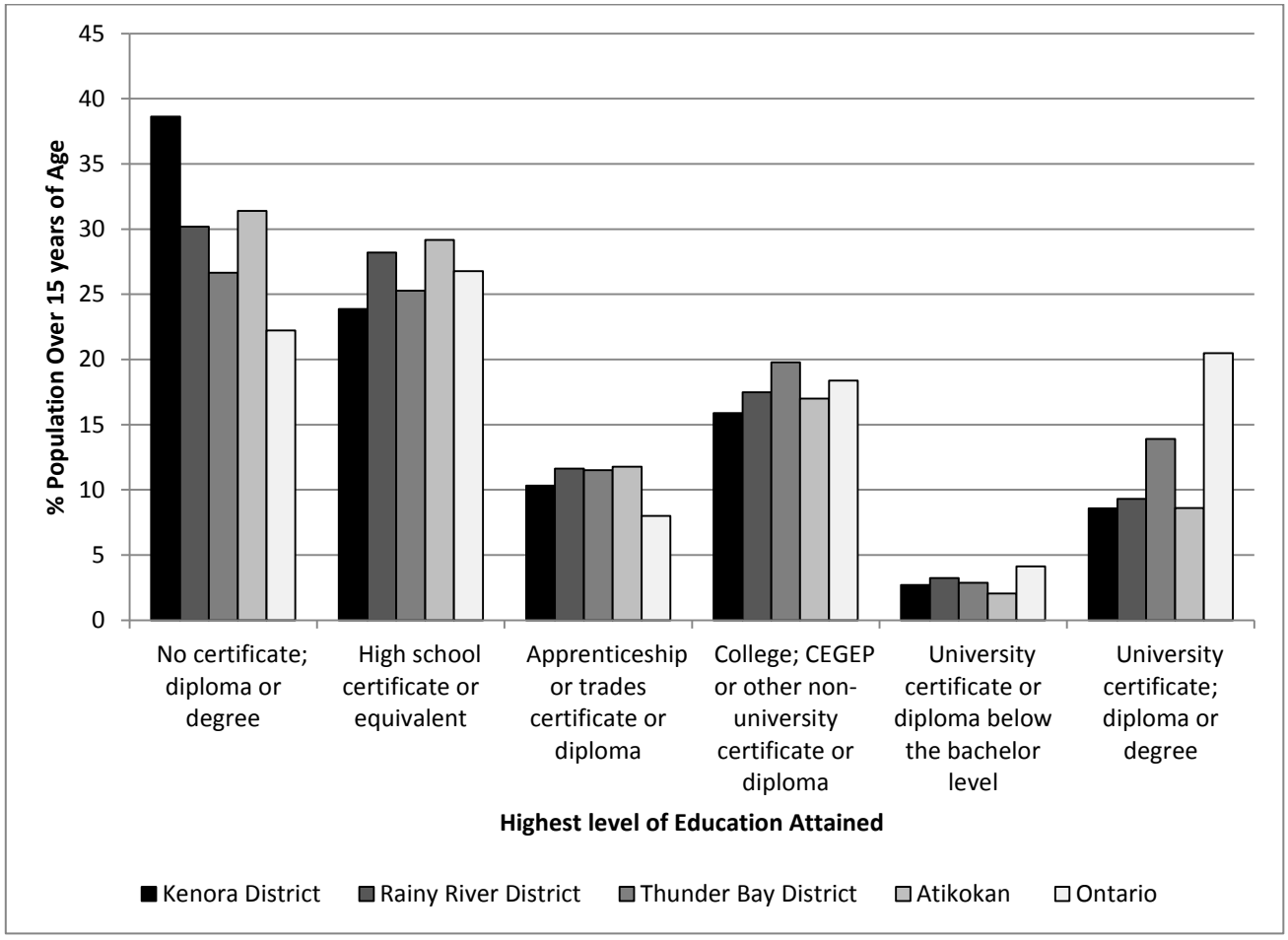
Confederation College specifically offers the following programs through Contact North in Atikokan:

- Educational Assistant Diploma.
- Developmental Services Worker Diploma.
- General Arts and Science Certificate.
- Office Administration – General Certificate.
- Personal Support Worker Certificate.
- Pre-Health Sciences Certificate.
- Social Services Worker Diploma.

2.2.3 Government Finances Valued Ecosystem Component

As noted in Section 2.1, the Town of Atikokan will be the major beneficiary of economic benefits related to the Project. The government revenues and expenditures VEC is characterized by a single indicator which describes the municipal government revenues and expenditures for the Town of Atikokan.

The amount and source of municipal government revenues and expenditures for Atikokan is shown in Tables 2-7 and 2-8. Property taxes are the largest contributor to government revenue, contributing 47% of total revenue for Atikokan (Town of Atikokan 2009). Provincial and federal government grants were the second largest contributors to municipal revenue (36% of the total revenue). The largest amount of government expenditures was for transportation and utilities, and constituted 33% of total expenditures. General government (17%) and protective services (16%) constituted the next largest expenditures for the town. More recent figures and discussions with municipal government officials indicate that declining tax base will place increasing burden on maintaining aging infrastructure.



Source: StatsCan 2007.

Figure 2-7: Educational Attainment in the Regional Study Area for Population over 15 years of age (2006)

Table 2-7: Municipal Government Revenues for Town of Atikokan (2009)

Taxation	Fees and User Charges ($)	Provincial and Federal Government Capital Grants ($)	Total Other Revenue ($)	Total Revenue ($)
7,087,284	1,428,783	5,469,130	1,073,581	15,058,778

Source: Town of Atikokan 2009.

Table 2-8: Municipal Government Expenditures for Town of Atikokan (2009)

General Government ($)	Protective Services ($)	Health, Social Services and Housing ($)	Planning and Development ($)	Transportation and Utilities ($)	Parks, Recreation and Culture ($)	Total Capital Expenditures ($)	Total ($)
1,713,366	1,622,312	1,323,521	997,458	3,271,812	1,107,181	4,295,448	14,331,098

Source: Town of Atikokan 2009.

2.2.4 Public Services and Infrastructure Valued Ecosystem Component

This VEC is characterized by seven indicators: protection and emergency services; health services; social services; education; recreation; water, wastewater and waste management; and utilities. Each of these indicators is described below.

Northern Ontario is divided into organized municipalities as well as districts; each district having a District Service Board responsible for overseeing the provision of services to areas outside organized municipalities. The service boards present in the RSA are:

- The District of Thunder Bay Social Services Administration Board.
- The Rainy River District Social Services Administration Board (RRDSSAB).
- The Kenora District Services Board.

These service boards are responsible for the management and/or delivery of social programs, including Ontario Works, Children's Services, Social Housing and Land Ambulance.

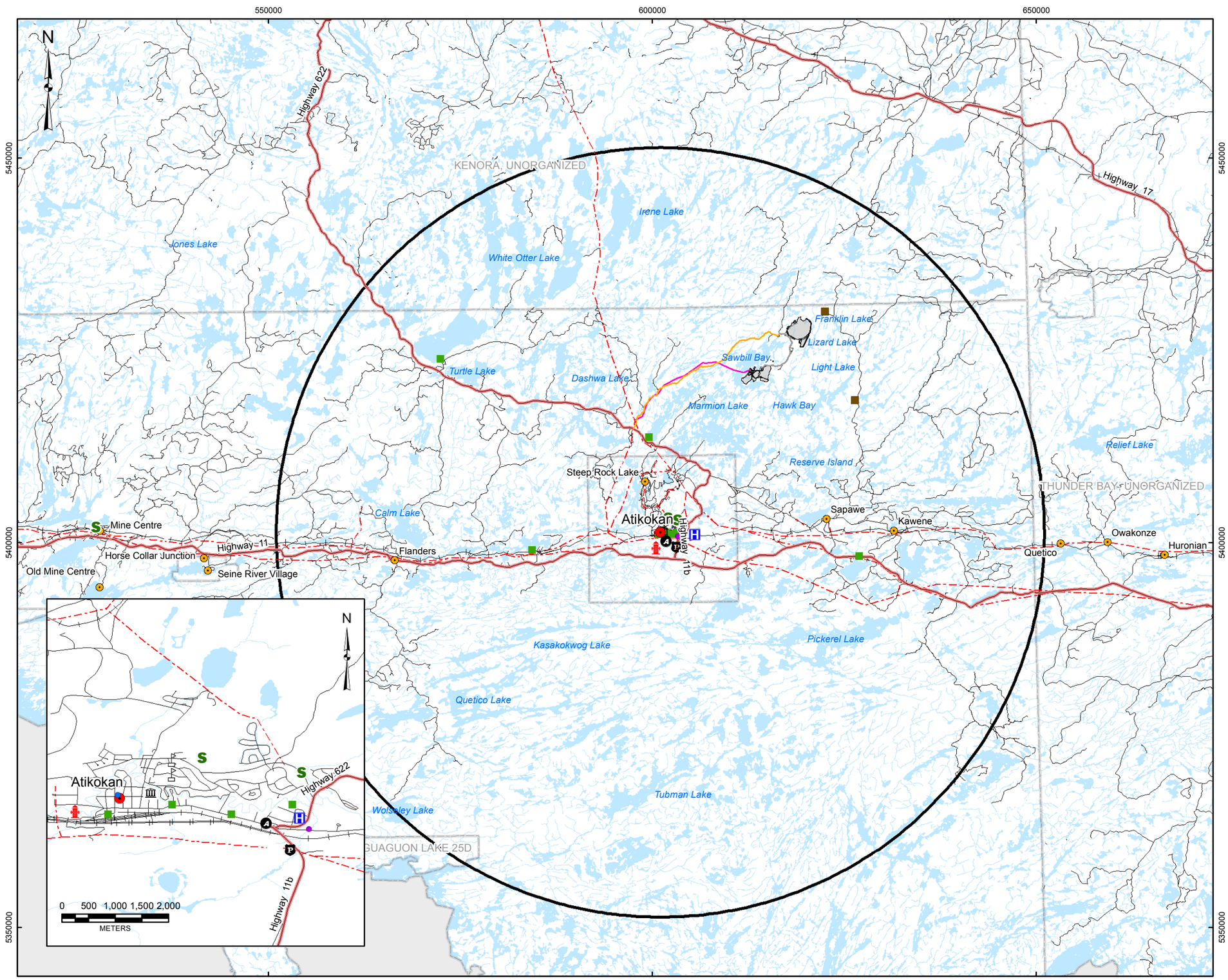
- The provincial government is generally responsible for funding of Education, Health and Social Programs.
- The Rainy River District School Board (RRDSB) is responsible for delivery of primary and secondary education.
- The RRDSSAB is responsible for delivery of social services.
- The Northwest Health Unit (NWHU) is responsible for delivery of health services to Kenora and Rainy River Districts.

Municipalities are generally responsible for the provision of the majority of services that are used daily by citizens including: protection and emergency services (police, ambulance and fire services); water, sewage and waste management; electric distribution; public transit; and recreational and library services.

The operational workforce for the Project is expected to reside predominantly in Atikokan or at the Mine, resulting in potential impacts to services and infrastructure on this community. For this reason, the services and infrastructure section will focus on the LSA.

Figure 2-8 shows the location of services and infrastructure in the LSA.

The Town of Atikokan provides a range of services to residents and property owners such as sewer and water, road maintenance, building inspection and fire protection within the municipal boundaries. The Atikokan Public Works Department is responsible for design and maintenance of municipal infrastructure, transportation infrastructure (including sidewalks, streets and laneways, snow removal, and airport operation) as well as grass cutting, tree planting and garbage disposal (Town of Atikokan 2006). Operational funding for these services is mainly through municipal property taxes, while capital works are mainly funded through provincial and federal grants.



LEGEND

- Local Study Area City/Town
- Small Community
- Provincial Highway
- Road
- Existing Railway
- River/Stream
- Lake
- Daycare/Pre-School
- Library
- Recreation Facility
- Public Swimming Pool
- Hotel/Lodge
- Waste Disposal Site
- Ambulance
- Fire Station
- Hospital
- Police
- School
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- 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

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SCALE 1:500,000 KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
SERVICES AND INFRASTRUCTURE IN THE LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	14 Nov. 2008		
GIS	JO	8 Feb. 2013		
CHECK	PB	8 Feb. 2013		
REVIEW	PB	8 Feb. 2013		

FIGURE: 2-8

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2.2.4.1 Protection and Emergency Services

2.2.4.1.1 Police

Policing of Atikokan is provided by the Ontario Provincial Police (OPP). There is one OPP detachment in the municipality (Ontario Provincial Police 2009). Previously Atikokan had a municipal community based police service, but it has been disbanded. The community and the OPP are presently in year one of a five-year contract. The Atikokan detachment is one of four detachments in the Rainy River District Detachment Cluster, with the host detachment located in Fort Frances. The North West OPP Headquarters is located in the City of Thunder Bay (OPP 2009). No service or capacity issues with respect to policing in the RSA or LSA were reported.

The Atikokan Detachment provides policing services to the Town of Atikokan as well as to part of the surrounding unorganized territory including Quetico Provincial Park and Provincial Highways 11, 622, 623 and 633. The Atikokan Detachment provides 24-hour service with an authorized strength of twelve provincial constables, one sergeant, one civilian administrator and one caretaker. The detachment is equipped with five marked patrol vehicles, including one four-wheel drive vehicle, two motorized snow vehicles and a 16-ft marine vessel (P. Brown personal communication 7 Aug 2012).

Trends in offenses are consistent with other communities located in Northern Ontario with similar population bases. These include abuses of prescribed medications through trafficking and use. Slight increases in property related crimes in 2011 over 2010 (11%), e.g., break-and-enter and theft have been noted. These types of crimes have been positively linked to the previously noted drug abuse. With the recent closing of two lumber mills, economic downturn in the community has resulted in increased police involvement in mental health and social issues that tend to accompany hard economic times (P. Brown personal communication 7 August 2012).

2.2.4.1.2 Ambulance

Ambulance services are provided by the Land Ambulance Services Branch of the Ministry of Health and Long-term care. Within the Rainy River District, including Atikokan, land ambulance services are administered by the Rainy River District Social Services Administration Board (RRDSSAB). There is an ambulance base located within each municipality (RRDSSAB 2010). Currently, 24-hour land ambulance service is provided to Atikokan using two vehicles. A second team is available from Fort Frances, with greater response time. Emergency air service is provided by Ornge, with a helicopter landing pad located at Atikokan General Hospital and at the Project Site (D. McCormick personal communication 21 October 2011). Thunder Bay Emergency medical care is provided by the Superior Northern Emergency Medical Services (EMS), which provides service to the entire district of Thunder Bay. The fleet of 45 emergency vehicles and a staff of approximately 170 form 16 First Response Teams which service a population of 157,000.

2.2.4.1.3 Fire Protection

Municipal fire protection in Atikokan is provided by one fire station, which is operated by a fire chief, and a staff of 25 volunteer fire fighters. This fire department is classified as Town Grade I, and has two triple combination pumper trucks, one light rescue extrication vehicle, one tanker, and one snowmobile with rescue sleigh. In recent years, volunteer firefighter turnover has increased due to volunteer burnout, and an increase in residents traveling outside of the community for employment. While there are no plans to increase or expand the Atikokan Fire Service, preliminary planning for servicing proposed cottage developments has been

considered, including reserving land for a future fire hall when required. Previous mining operations in the area have provided their own volunteer fire fighters (A. Morin personal communication 19 October 2011).

The volunteer fire department at Niobe Lake responds to calls in the unorganized territory and has responded to the OHRG Project Site. It has 1 pumper, a tanker truck and approximately 10 volunteers (P. Brown personal communication 7 Aug 2012).

Support for Atikokan's fire protection service is provided by The Mutual Aid Fort Frances Fire and Rescue Service. This team operates out of one fire station, and has 8 permanent staff members, and 16 volunteer fire fighters, and a fleet of 8 emergency vehicles. They are equipped for both land, and water rescue (Fort Frances Fire and Rescue 2010).

Atikokan has an up to date emergency plan which was revised in 2008. The plan was developed to facilitate effective coordination of the municipality and all relevant emergency and medical services if needed. No capacity or service issues have been raised except for the need to attract and retain volunteer firefighters, which may be aided by the addition of a Project construction or operation workforce to the Town.

2.2.4.2 Health Services

In Ontario, the Ministry of Health and Long-term Care is responsible for providing public health services to all residents. The ministry works with local health authorities, health care providers, agencies and other groups to provide access to care. The ministry is also responsible for social policy, legislation, professional regulation, funding decisions and an accountability framework for health authorities. The province's health units are the organizations primarily responsible for health service delivery. The Northwest Health Unit (NWHU) is designated to deliver health services to residents of Kenora and Rainy River Districts.

Thunder Bay Regional Health Sciences Centre (TBRHSC) provides service to Thunder Bay and Northwestern Ontario. This modern facility has 375 acute care beds, and the emergency room treats 95,000 patients per year (260 per day) (TBRHSC 2010). Mental health and addiction programming works with clients of any age who are either misusing substances or who are affected by those using substances. Many patients who cannot be treated or serviced in Atikokan are transported to Thunder Bay. Since October 2010, routine child birth services have not been offered in Atikokan; women must travel to Thunder Bay (Atikokan Family Health Team personal communication October 20 2011). No surgery, cardiac or dialysis services are provided at the Atikokan General Hospital, and many of these patients seek care in Thunder Bay.

Atikokan and the surrounding area are serviced by the Atikokan General Hospital. This facility provides emergency and acute care and is fully accredited, with a total of 41 beds (22 long-term, 8 complex continuing care and 11 acute care). Currently, services are provided to approximately 6,000 outpatients per year. Acute care occupancy operates at approximately 60% capacity (W. Smith personal communication 24 February 2012). Services include an extended care wing, physiotherapy, community counselling, and diabetes day care (Atikokan General Hospital 2010). Expansion of the hospital is expected to take place between 2012 and 2014, and will increase capacity of the hospital to service a population of 7,000 (Grupi 2012).

Twenty-four-hour on-call community medical service is provided at the Medical Clinic, operated by the Atikokan Family Health Team, including physicians, registered nurses, registered practical nurses, a mental health worker, dietician, pharmacist and support staff. Approximately 800 patients per month are seen by a doctor and 1,000 per month are seen by a nurse. The approximate wait time for an appointment with the clinic is 6 to

7 weeks. Daily walk-ins are also accepted. Accessibility and space issues have been identified. The current building has a service lift but not a proper elevator. The clinic has also reached capacity at its current location, and cannot accommodate additional doctors. Alternative solutions are being assessed (L. Zacharias personal communication 20 October 2011).

Atikokan is designated as underserviced for general/family practitioners by the Ministry of Health and Long-Term Care, and are subsequently receiving grants for additional funding and recruitment of physicians. Atikokan currently has 5.25 doctors and a vacancy for 1.75 doctors (one doctor works part-time) (Ontario Ministry of Health and Long-Term Care 2008). Physician recruitment is facilitated by a committee made up of hospital, municipal, and economic development representatives. These physicians service the emergency room at Atikokan General Hospital, provide service to the nursing home, prenatal care, and operate the clinic.

Additional health care services in Northwestern Ontario are provided by the Community Access Centre, Home Support, and Mobile Medicine service (OMEDT 2010). There are also local physiotherapists, massage therapists, naturopathic treatment options, two local dentists, and anonymous alcoholics and narcotics treatment groups in Atikokan (Immigration Northwestern Ontario 2010).

2.2.4.3 Social Services

The RRDSSAB provides social services for Atikokan, including Ontario Works, Social Housing, and Land Ambulance (RRDSSAB 2010). Funding for the RRDSSAB is provided by each of the 12 municipalities in the District. In Atikokan, other services are provided by the Atikokan Municipal Non-Profit Housing Corporation, and the Atikokan and District Association for Developmental Services including family and children's services and a women's shelter (Immigration Northwestern Ontario 2010). Atikokan has two daycare and preschool facilities which currently have additional capacity due to the declining population, and recent introduction of full day kindergarten program for four- and five-year-olds (D. McCormick personal communication 21 October 2011). Child care is subsidized for low-income families through the RRDSSAB.

Social housing programs, administered by the RRDSSAB, include Atikokan Family Housing, Atikokan Native Non-Profit Housing, and two seniors housing complexes. Currently, there are vacancies in available family housing, however seniors housing is operating at capacity. Recently, Atikokan Native Non-Profit Housing was made available to the general public due to lack of demand from its target group. Previously applicants had to be Aboriginal to apply for this housing.

The Atikokan Native Friendship Centre administers a number of social service and cultural programs for Aboriginal members of the community. These include health outreach, lifelong care program for the elderly and disabled, Aboriginal healing and wellness, prenatal nutrition, and family support programs. The Atikokan Friendship Centre also administers urban Aboriginal support programs for children and youth at risk, including the Wasa-Nabin Program for at-risk youth the Akwe-go Program for at-risk children aged 7 to 12, and the healthy living program.

2.2.4.4 Education

The Ontario Ministry of Education oversees the planning and implementation of education services in the province under guidance of the *Education Act,* which provides direction on planning, funding, capital projects and roles of staff, trustees, parents and students. At the local level, school districts and post-secondary

institutions play a lead role in planning and implementing services. Each school district and post-secondary institution has its own set of policies and procedures for abiding by the tenets laid out in the *Education Act*.

The Ontario Kindergarten to Grade 12 public education system is jointly managed by the provincial government and the elected school boards. The provincial government establishes the amount of grant funding for operating public education annually, and allocates funds to the school districts on the basis of a funding formula. These funds are managed by school district boards according to local spending needs and priorities.

Atikokan has two publically funded elementary schools and one secondary school, which are administered by the Rainy River District School Board (RRDSB). North Star Community School offers kindergarten to grade 6, Atikokan High School Elementary offers grades 7 and 8, and Atikokan High school offers grades 9 through 12. The Northwest Catholic District School Board operates the St. Patrick's School in Atikokan. Atikokan High School offers a Specialist High Skills Major program in Environmental Education. RRDSB has identified interest in developing another Specialist High Skills Major program for the mining sector, however in order for a program to be feasible, partnerships with mining companies would be required to provide equipment, and cooperative education opportunities for students (H. Campbell personal communication 17 October 2011).

Elementary school enrolment in Atikokan declined by 15% from 1998 to 2006 (OnSIS 2008-2009). Enrolment by year from 2006-2012 is shown in Table 2-9. Over this period, total school enrolment in Atikokan decreased by 21% from 619 students to 486 students. Atikokan High School has experienced the greatest decline since 2006 (33%). Overall, schools in Atikokan are operating at approximately 39% capacity. These declines have resulted in some restrictions and barriers to extra-curricular activities due to funding implications resulting from a smaller student population (H.Campbell personal communication 17 October 2011). No capacity issues have been identified for elementary or secondary education in the LSA.

Table 2-9: Primary and Secondary Enrolment and Capacity Utilization in Atikokan (2006-2012)

	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	Capacity
Atikokan High School Elementary –grades 7 and 8	47	51	38	42	46	51	69
North Star Community School – kindergarten to 6	161	153	164	140	138	130	297
Atikokan High School – grades 9 to 12	240	209	170	157	153	160	564
St. Patrick's School	171	171	189	155	137	145	330
TOTAL	**619**	**584**	**561**	**494**	**474**	**486**	**1,260**

Source: Ontario School Information System (OnSIS), 2006-2007 through 2008-2009, and Rainy River School Board, 2009-2010 through 2011-2012

There is no post-secondary educational institution in the Town of Atikokan. However, distance education opportunities are offered by Contact North and Lakehead University located in Thunder Bay (OMEDT 2010). Most of Northwestern Ontario's post-secondary education institutions, including Confederation College, Lakehead University, and the Northern Ontario Medical School are located in Thunder Bay. Confederation

College has several smaller campuses, including one in Fort Frances. Thunder Bay also has several career colleges, including the Academy of Learning Career and Business College, Everest College of Business, Technology and Health Care, and Northwestern Transport Training and Heavy Equipment Training Ltd.

2.2.4.5 Recreation

Recreation in this section refers to the services and facilities offered by Atikokan or recreation, sport, arts and cultural activities focused on urban activities inside municipal boundaries. The land and resource use section provides existing information on outdoor recreation, such as hunting and fishing.

Recreation infrastructure is shown on Figure 2-8. Atikokan is home to the Charleson Recreation Area, which is managed by an association of representatives from various local recreation groups for usage by residents and tourists. Atikokan has a number of community recreational facilities including a community centre, library, and senior's facility. Athletic facilities include an ice arena, two indoor swimming pools, three soccer fields, five baseball diamonds, six public tennis courts and one public golf course. Cultural facilities include a theatre, museum, Native Friendship Centre, and Pictograph Gallery and Arts Centre (OMEDT 2010). Existing recreation infrastructure is showing its age and is in need of repair (N. Halaz personal communication October 2011). Adequate funding is not available to repair the facilities as needed. Human resources needed to operate these facilities are limited, which has resulted in reduced programming.

The Town has awarded a contract for the development of a multi-purpose sports centre called the Atikokan Recreation and Wellness Complex. The complex will include an arena, swimming pool, fitness facility, accessible parking, and landscaping.

2.2.4.6 Water, Wastewater and Waste Management

The locations of the water, and wastewater treatment facilities, as well as the landfill in Atikokan are shown on Figure 2-8. The Atikokan water treatment plant has been approved to operate at a maximum daily flow rate of 70 litres per second, with a total flow of 6,048 cubic metres per day. The current average usage is 2,000 cubic metres per day (A. Morin personal communication 19 October 2011). In 2009, the system operated at an average flow rate of 45.6 litres per second, with a total flow rate of 61.2% of the system capacity (Ontario Clean Water Agency 2010), indicating that there is room for increased demands on this infrastructure.

The wastewater treatment plant has a capacity of 4,080 cubic metres per day, with an average daily flow of 3,375 cubic metres per day, indicating that the system is capable of accommodating increased service demands (A. Morin personal communication 19 October 2011). The sewage treatment plant has capacity for a population of approximately 9,000 resulting in a residual capacity of about 5,000 to accommodate community growth.

The existing water and wastewater treatment infrastructure is some 40 years old. Design flaws, and high volume of inflow to the system during storm events have caused discharges to the river. The current property tax revenue cannot finance the required upgrades. The town has commissioned the development of a business plan to finance the required improvements. While there are no major water treatment or distribution changes planned, a 5 year financial plan is being completed wherein the feasibility of water metering will be considered (A. Morin personal communication 19 October 2011).

The Town's current landfill is expected to reach capacity in 2016 at an annual disposal rate of 4,711 cubic metres. Another site has been identified approximately 20 km northeast of Atikokan on Pipeline Rd., and the Town is undergoing the necessary permitting process to begin operation. The new landfill is expected to have a site life of 50 years. Table 2-10 presents the status, remaining capacity and improvement plans of the Town of Atikokan for water, wastewater and solid waste management (Meridian 2012).

Table 2-10: Status, Remaining Capacity and Plans for Municipal Infrastructure

Infrastructure	Status	Remaining Capacity	Municipal Plans
Water Treatment Plant	Underused	50%	Planning improvements to infrastructure
Wastewater Treatment Plant	Underused	30%	Planning improvements to infrastructure
Landfill	Approaching capacity	Full by 2016	New facility planned

2.2.4.7 Utilities

Electricity is supplied by Atikokan Hydro Inc. The hydroelectric system currently operates at approximately 8,000 KW, and is estimated to have a capacity of 11,000 KW, indicating that there is capacity to deal with increased electricity demand.

Natural Gas is supplied from western Canada by Enbridge and/or Union Gas through a connection to the provincial pipeline system. Accordingly, there should be no constraints on additional gas supply that might be required to support population growth.

Propane is supplied by Johnson's Esso and Voyageur Bait and Tackle. Residential heating may also be provided by wood burning (AEDC 2008).

Digital switching, local internet fibre optics, internet ADSL, satellite TV, and local cell phone providers are available in Atikokan. There are four local internet providers in Atikokan, and three cell phone service providers. There is currently no scalable transmission speed or retail broadband service (OMEDT 2010).

2.2.5 Housing and Accommodation Valued Ecosystem Component

Although accommodation needs for the Project will primarily be met through the construction of an Accommodation Camp near the Project location, it is anticipated that some proportion of the workforce and their families will seek housing and accommodation in the LSA.

The housing and accommodation VEC is characterized by three indicators: housing supply, occupancy rates, and housing costs and listings. Each of these indicators is discussed below.

The characteristics of permanent housing in the RSA and LSA are described in Table 2-11.

2.2.5.1 Housing Supply

In 2006, 88.7% of permanently occupied housing in Atikokan, and 79% in the RSA were in the form of single-detached houses, compared to 56.1% for the Province (StatsCan 2007). There is a marked shortage of rental housing in Atikokan.

Nearly all homes in Atikokan were built prior to 1986 (96.8%), compared to 75.2% for the RSA and 68.6% for the province. In fact, the majority of homes in Atikokan were built during the mining boom in the 1950s. Due to the majority of homes in Atikokan being older than 50 years, homes generally require more maintenance and repairs as compared to homes elsewhere in the RSA and the province.

Table 2-11: Occupied Private Dwelling Characteristics for Atikokan (2006)

		Atikokan	RSA	Province of Ontario
Total private dwellings occupied by residents		1,420	93,445	4,555,025
Housing Type	Single-detached houses (%)	88.7	79	56.1
	Semi-detached houses (%)	3.2	3	5.7
	Row houses (%)	0.0	2	7.9
	Apartments; duplex (%)	1.8	2	3.4
	Apartments in buildings with fewer than five storeys (%)	6.3	9	10.8
	Apartments in buildings with five or more storeys (%)	0.0	2	15.6
	Other dwellings (%)	0.0	3	0.5
Ownership	Owned dwellings (%)	82.7	70.2	71.0
	Rented dwellings (%)	16.9	21.5	28.8
Age	Dwellings constructed before 1986 (%)	96.8	75.2	68.6
	Dwellings constructed between 1986 and 2006 (%)	2.8	24.8	31.4
Repair	Dwellings requiring major repair (%)	12.0	13	6.6
	Average number of rooms per dwellings	6.2	6	6.6
Occupancy	Dwellings with more than one person per room (%)	0.0	2	1.9
Value	Average value of owned dwelling ($)	75,280	147,946	297,479

Source: StatsCan 2007.

A shortage of seniors housing and rental housing in Atikokan has been identified. The development of additional senior's accommodation, and the resulting availability of permanent housing supply, has been suggested as a solution to increasing the availability of housing in the LSA for Project workers and their families (G. McKinnon personal communication 20 October 2011).

Existing housing lots in Atikokan are large compared to other cities; consequently there is room for housing intensification. The Town of Atikokan has surveyed three subdivisions (Northdale Subdivision, Eastdale Subdivision, and Country Creek Estates Subdivision) and laid-out 532 lots available for residential growth. The area south-west of Highway 11B, the south-east shore of Steep Rock Lake and the area east of Wetfoot Creek have also been identified as possible areas for residential development, but these have not been surveyed (AEDC 2005).

There are four hotels and motels (the Atikokan Hotel, the Marlintre Motel, the Steep Rock Inn and the White Otter Inn) in Atikokan with a total of 94 rooms. There are also four bed and breakfasts in the area. The main type of temporary accommodation - focused on supporting the recreation tourism industry - includes over 20 outfitters, resorts, and lodges, and numerous camps. Figure 2-9 shows the distribution of tourism-related establishments in the Rainy River district, which would be able to provide temporary accommodation for Project workers.

2.2.5.2 Occupancy Rates

In 2006, the occupancy rate of private dwellings in Atikokan was 92.4%, compared to 82.4% in the RSA and 91.6% in the province as a whole. It has been identified that there is a shortage of available rental housing units in Atikokan in the form of apartments (Grupi 2012).

2.2.5.3 Housing Costs and Listings

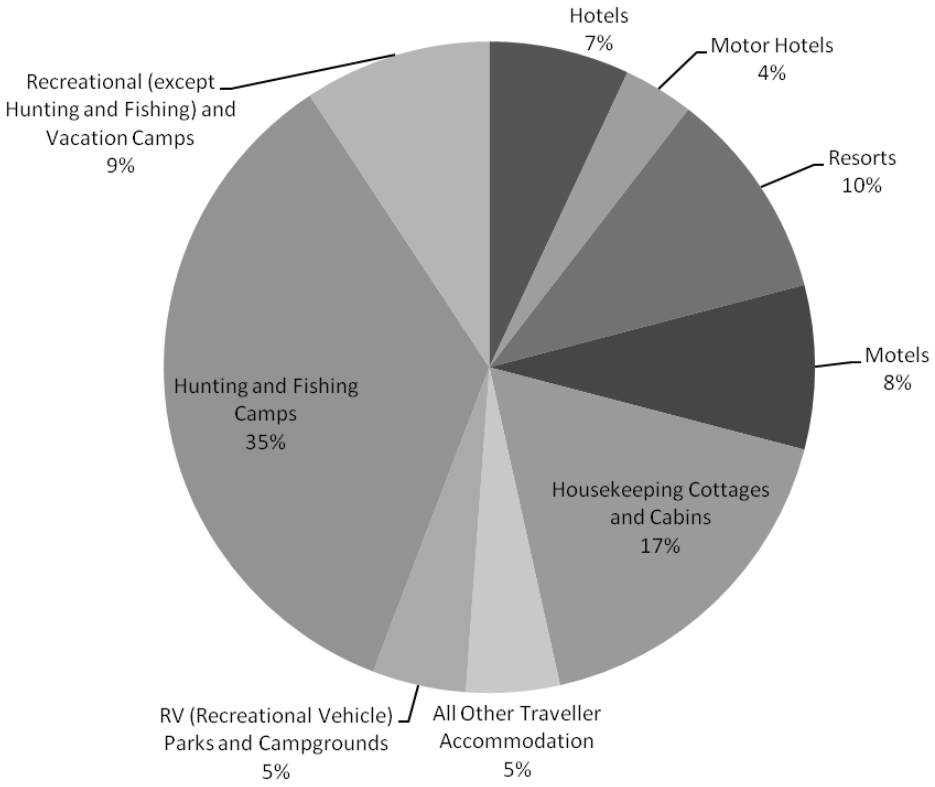
As shown in Table 2-11, the value of houses in Atikokan was much less than elsewhere in the RSA or Province in 2006. On February 28th, 2011, the Municipal Listing Service identified 16 residences for sale in Atikokan ranging from $29,500 to $135,000, compared to 69 residences for sale in Thunder Bay ranging from $149,900 to $579,900.

In 2008, the Municipal Property Assessment Corporation (MPAC) determined that the average value of a single family detached property in Atikokan was $58,014, in Fort Frances $118,646, and Thunder Bay $140,892 (OMEDT 2010). Over the past year (2011) there has been an increase in real estate activity in Atikokan. Housing is being purchased at a greater rate than previous years, with property listings reportedly declining from 85 to 15 from October 2010 to October 2011.

2.2.6 Transportation Valued Ecosystem Component

2.2.6.1 Existing Network

The major highways utilized by the Project as well as other highways in the region are under the jurisdiction of the Ontario Ministry Transportation, subject to the provisions of the *Highway Traffic Act*. The act governs public works related to transportation, as well as the planning, design, holding, construction, use, operation, alteration, maintenance, repair, rehabilitation and closing of provincial highways.



Source: MTC 2009.

Figure 2-9: Tourism Related Establishments in the Rainy River District

The Proposed Growth Plan for Northern Ontario (2009) targets strategic transportation infrastructure expansion and investment related to highways, roads, bridges, short-line railway networks, and air transport and airport facilities in order to better service communities and facilitate economic development opportunities.

Figure 2-10 shows transportation infrastructure in the RSA. Traversing the RSA, Highway 11 is one of only two highways that connect Northern Ontario to Southern Ontario and Quebec in the east and Manitoba in the west. The Canadian National Railway Company (CN) rail line also crosses the area.

Also located in the RSA is the Thunder Bay International Airport, which is one of the busiest airports in Ontario with 96,369 aircraft movements and 625,345 passengers in 2008 (City of Thunder Bay 2010).

The Thunder Bay Port Authority is a major international inland port, providing access to the Great Lakes St. Lawrence Seaway System, and is a key storage and transhipment point for several agricultural, forestry and industrial goods.

Highway access to the United States (about one hour driving time) is provided by Highway 61. The Canadian National Railway services the city, and allows for the transport of goods to other Canadian cities, and the United States (City of Thunder Bay 2010).

The Fort Frances Airport offers passenger service to Winnipeg, Manitoba, and Thunder Bay (Town of Fort Frances 2010). Goods can be transported by train by the Canadian National Railway. Access to the United States is provided via US Highway 53, located just two km outside of the municipality (Immigration Northwestern Ontario 2010).

Atikokan is accessible year round by highway, and Greyhound and Grey Goose Bus lines both operate to the town. Atikokan is 142 km from the TransCanada Highway 17. Highway 622 provides access to the town and Highway 11 is located just 5 km away. The CN Railway transports freight shipments to and from the town. The Atikokan Municipal Airport allows for charter and personal flights to the area, and is mainly utilized by private aircraft and for emergency services (AEDC 2010). The length of the runway is 2500 ft. The nearest international airport is in the city of Thunder Bay (OMEDT 2010). Within the Town, a transportation service is in place for transportation of senior citizens, the physically handicapped, and children.

Transportation infrastructure for the LSA is shown in Figure 2-11. The main access to and from the Project Site for goods, products and employees is via Highway 622, Hardtack Road, Sawbill Road and Reef Road.

2.2.6.2 Traffic Volumes and Levels of Services

Existing traffic conditions were studied to evaluate the current state of the transportation network. The base year for this study was considered to be 2012, representing pre-construction and pre-production conditions. Data were obtained from the Ministry of Transportation (MTO) for the following intersections of interest to this study:

- Highway 11 – Highway 11B (August, 2009).
- Highway 11B – Highway 622 (August, 2009).
- Highway 622 – Highway 17 (August, 2009).



LEGEND

- Project Location
- City/Town
- Airport/Airstrip
- First Nation Community
- Provincial Highway
- Regional Road
- Road
- Existing Railway
- Far North Border
- River/Stream
- Lake
- Regional Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd.
Base Data - MNR NRVIS, obtained 2004
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SCALE 1:2,500,000 KILOMETERS

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

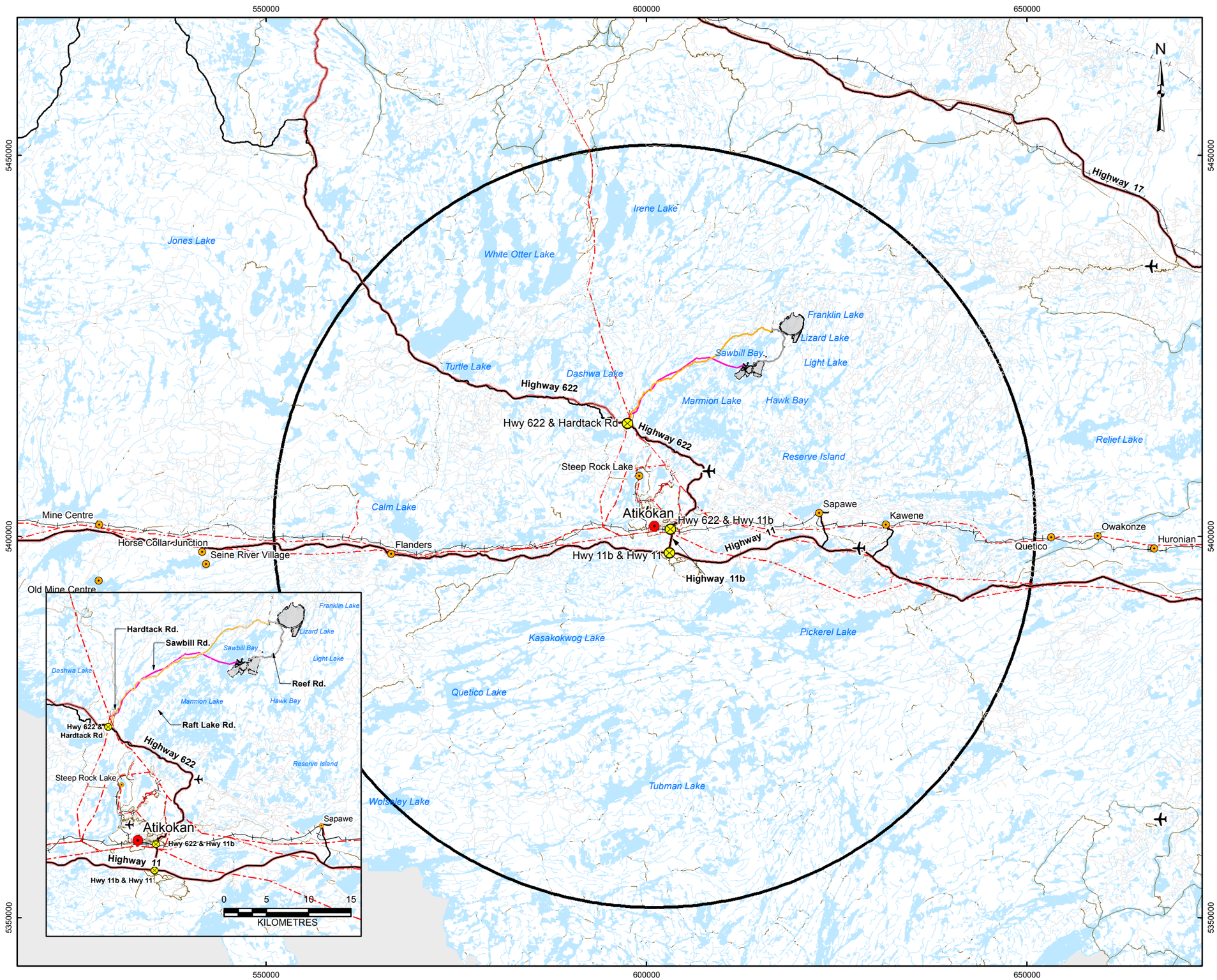
TITLE
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Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	14 Nov. 2008		
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REVIEW	PB	8 Feb. 2013		

FIGURE: 2-10

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LEGEND

- Local Study Area City/Town
- Small Community
- Airport/Airstrip
- Provincial Highway
- Regional Road
- Road
- Trail
- Existing Railway
- River/Stream
- Lake
- Traffic Study Location
- Mine Site Road
- Access Road (Hardtack / Sawbill)
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FIGURE: 2-11

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Although no data are available for the intersection of Hardtack Rd and Highway 622, Hardtack Rd is a gravel back road at present. The existing traffic on this road is negligible, with the overwhelming majority of traffic to be generated by the Project itself. Traffic volumes for the existing conditions are illustrated on Figure 2-12.

Level of service (LOS) is defined as a performance measure that represents quality of service, measured on an A-F scale, with LOS 'A' representing the best conditions. Volume-to-capacity ratio (V/C) is defined as the ratio of flow rate to the capacity of a system element.

The key intersections of the study area were analyzed based on turning movement counts or distributions resulting from the current network. It is evident from the results shown in Table 2-12 that all of the intersections are operating well below capacity with negligible delay.

Table 2-12: Existing Conditions at Study Intersections in the LSA

Location	AM		PM	
	LOS	V/C	LOS	V/C
Hwy 622 & Hardtack Rd	A	0.02	A	0.02
Hwy 11B & Hwy 622	A	0.09	A	0.13
Hwy 11 & Hwy 11B	A	0.07	A	0.07

Mainline analysis of the highway segments was carried out using Highway Capacity Software (HCS). The results, shown in Table 2-13, indicate that all of the highway segments operate at level of service 'B' or better.

Table 2-13: Existing Conditions at Highway Mainlines

Highway	Location	AM		PM	
		LOS	V/C	LOS	V/C
Hardtack Rd	N of Hwy 622	A[(a)]	~0.00	A[(a)]	~0.00
Highway 622	N of Hwy 11B	A	0.06	A	0.08
Highway 11B	W of Hwy 622	B	0.09	B	0.12
Highway 11	E of Hwy 11B	A	0.03	A	0.04

(a) Due to the lack of data on Hardtack Rd, an HCS analysis was not completed. Volumes on Hardtack are extremely low and as such the LOS will be high and the V/C ratio very close to 0.00.

2.2.7 Land and Resource Use

The following sections provide information about non-traditional land uses in the RSA and LSA. Traditional and Aboriginal knowledge related to land and resource use is contained in a separate technical support document.

Land use planning in Northern Ontario is shared by various authorities, including planning boards, the Ministry of Natural Resources (MNR), the Minister of Municipal Affairs and Housing and the Ministry of Northern Development and Mines. Planning boards, specifically the Rainy River District Planning Board, coordinate future growth and land use planning activities relevant to this Project and can adopt official plans and pass zoning by-laws in planning areas that may be without municipal organizations in their jurisdiction. The Minister of Municipal Affairs and Housing defines planning areas and initiates zoning controls in some areas without municipal organization or planning boards. The Ministry of Natural Resources manages Crown land and provincial parks (through Ontario Parks) on behalf of the public. The Ministry of Northern Development and

Mines advocates on behalf of Ontario's northern region, and delivers programs and services related to economic development in this region.

The approach used in the following discussion of land and resource use for the Project is to provide 1) a general overview and background for the RSA to provide context for a specific description of the tourism and recreation, hunting and trapping, fishing, mining and forestry activities and 2) a more detailed discussion of the potential for the Project to affect existing and future land and resource use in the LSA.

As noted in Section 1.7, the LSA is focused on those areas where direct effects are likely on biological species and habitats. This includes the LSAs specified for the aquatic and terrestrial disciplines. For the Project to have an effect on existing or planned land uses and resources it will generally have to affect the aquatic or terrestrial environments.

The Project Site is located in, or in close proximity to, three General Resource Areas: Finlayson, Marmion and Greytrout, as identified by the MNR (2006). The Atikokan District Land Use Guidelines describe these areas and provide land use policy direction for the use of lands and resources within these areas. Exploration and extraction activities are allowed in these areas. The Mine Study Area is located within the Finlayson and Marmion General Resource Areas. The Linear Infrastructure Study Area is located within the Finlayson and Greytrout Areas.

Existing land uses within the Finlayson Area include tourism, recreation, trapping, commercial bait fishing, mineral exploration, aggregate extraction and logging. Recreational use by both residents and visitors for angling and hunting is intensive. Future commercial outpost camps are proposed for Finlayson and Lizard Lake (MNR 2006).

The Marmion General Resource Area consists of Marmion Reservoir, which has a 120 m modified management area around it. Angling, boating, canoeing and camping by residents and visitors occur throughout the open water season. Other activities include trapping, commercial bait fishing, mineral exploration and logging (MNR 2006).

2.2.7.1 Outdoor Tourism and Recreation Valued Ecosystem Component

Figure 2-13 illustrates tourism and recreation infrastructure in the RSA including the location of parks, campsites, trails and cottages. There are numerous national and provincial parks in the RSA.

These parks provide for recreational activities such as camping, hiking, fishing, paddling and boating, although many are do not offer visitor facilities and are accessible only by air. Parks and recreation play a key role in the tourism industry in Northern Ontario. As such, the Government of Ontario's Proposed Growth Plan for Northern Ontario (2009) identifies a number of plans of action related to tourism, including promoting nature-tourism, investments in strategic public infrastructure to improve the competiveness of the tourism industry, and encouraging regions and communities to undertake cultural planning linked to tourism, economic development and land use planning.

Under the *Provincial Parks and Conservation Reserves Act, 2006*, provincial parks and conservation reserves are identified as having objectives related to protecting ecosystems, biodiversity and provincially significant elements of Ontario's natural and cultural heritage; providing opportunities for ecologically sustainable outdoor recreation opportunities and encouraging associated economic benefits; and facilitating scientific research and to providing points of reference to support monitoring of ecological change on the broader landscape.

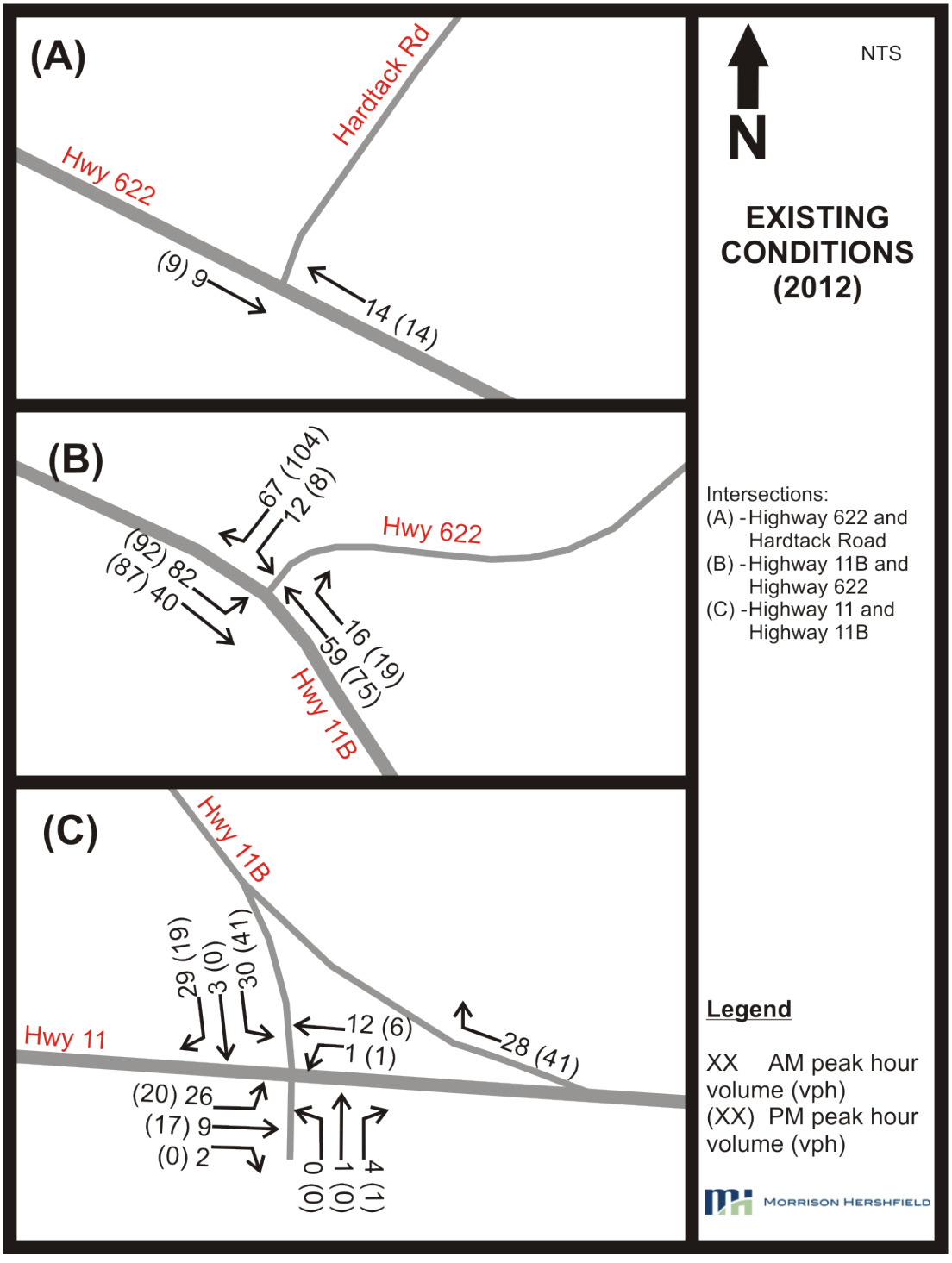
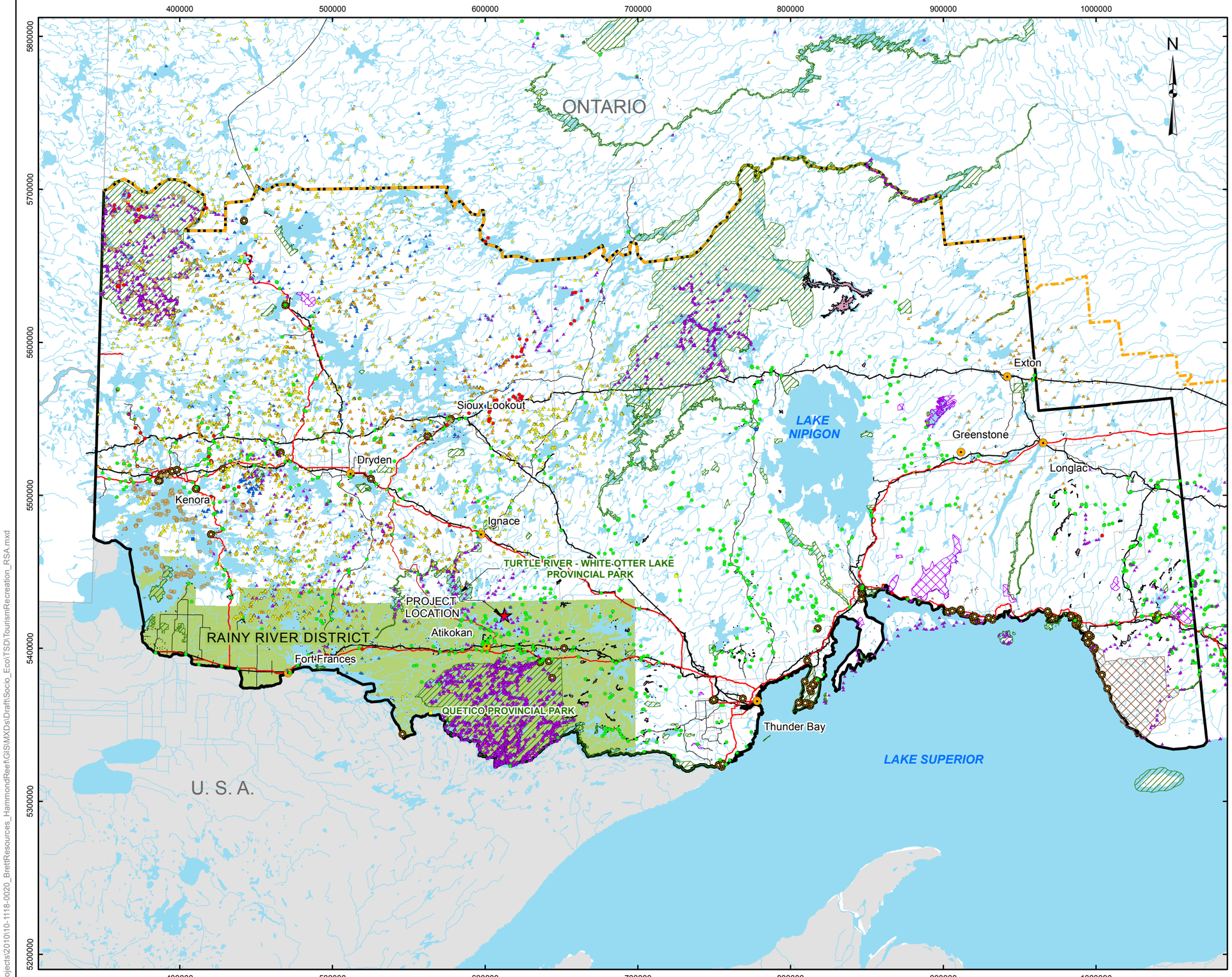


Figure 2-12: Existing Traffic Conditions



LEGEND

- Project Location
- City/Town
- Provincial Highway
- Road
- Existing Railway
- Far North Border
- River/Stream
- Lake
- Rainy River District

Recreation Locations

- Access Point
- Beach
- Boat Cache, Commercial
- Boat Cache, Private
- Boat Cache, Resource Harvest
- Boathouse
- Clubhouse
- Designated Camping Site
- Picnic Site
- Trailhead Location
- Trail
- Potential Tourism Area
- Cottage Recreation Site/Area
- Recreation Camp
- Tourism Established Area
- Provinvial Park
- National Park
- Conservation Area
- Regional 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

25 12.5 0 25 50 75 100 125
SCALE 1:2,500,000 KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
TOURISM AND RECREATION IN THE REGIONAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	14 Nov. 2008		
GIS	CGE	8 Feb. 2013		
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REVIEW	PB	8 Feb. 2013		

FIGURE: 2-13

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Most notably, there are two provincial parks in the general vicinity of the Project, Quetico Provincial Park (~50 km to the south) and the Turtle River – White Otter Lake Provincial Park (~200 km to the northeast).

Quetico Provincial Park occupies 475,782 hectares (ha) and includes an intensive network of canoe routes. Motorized boats are not permitted within the park. In 2010, the park hosted 75,502 visitors, including day-use visitors and campers. Overall park capacity meets demand; during peak season (July-August) the park had a 38% occupancy rate (Riley, R. 2011. Personal Communication).

Turtle River – White Otter Lake Provincial Park occupies 49,294 ha to the north-west of the Project. The park is only accessible by water, and visitor statistics are not kept. The park is mainly utilized recreationally for backcountry canoeing and fishing.

The Ministry of Tourism and Culture provides tourism industry statistics for the Rainy River District, including Atikokan. However, statistics are not available for Atikokan alone. Total visits in 2009 were 455,000, 210,000 of which were overnight visits. Visitors were predominantly from the United States (243,000), Ontario (178,000) and elsewhere in Canada (33,000). By far the most commonly reported purpose for the visit was "any outdoor/sports activity" (206,000), followed by "fishing" (140,000) (MTC 2009).

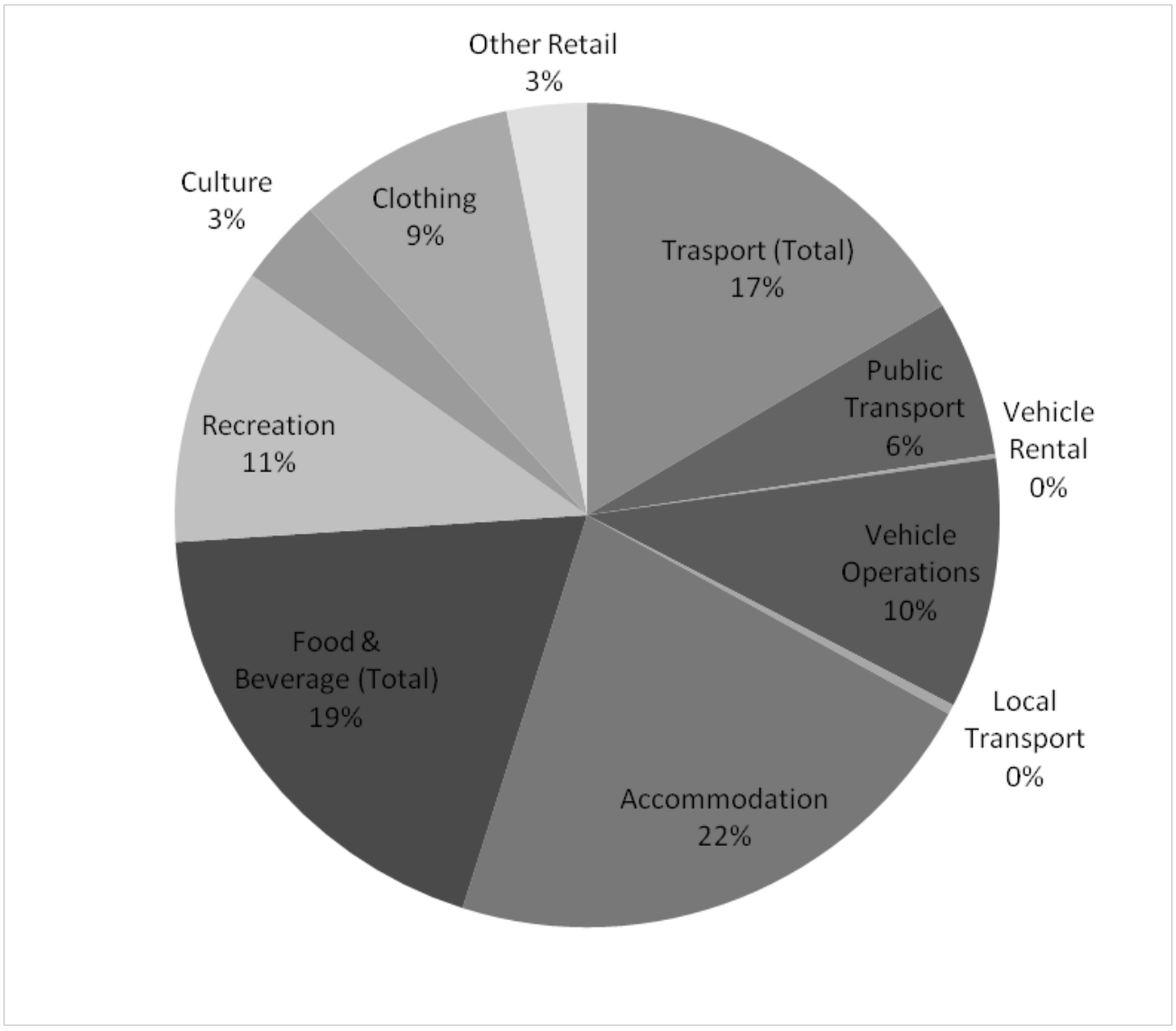
Total visitor spending in the Rainy River District in 2009 was $82,514,000. The highest areas of spending were accommodation (22%) and food and beverage (19%) (Figure 2-14). On average, visitors spent $181 per person (Table 2-14). Visitors from the United States and overseas spent the most on average per overnight visit ($526 and $565 respectively) (MTC 2009). Data in Table 2-14 show how important tourism is to the local economy.

Table 2-14: Average visitor spending in Rainy River District (MTC 2009)

Visitor Spending ($)	Total	Place of Origin			
		Ontario	Other Canada	U.S.	Overseas
Average per person	181	92	93	258	356
Average per person per overnight visit	329	130	92	526	565
Average per person per night	78	51	27	95	50
Average per person per same-day visit	55	65	110	46	104

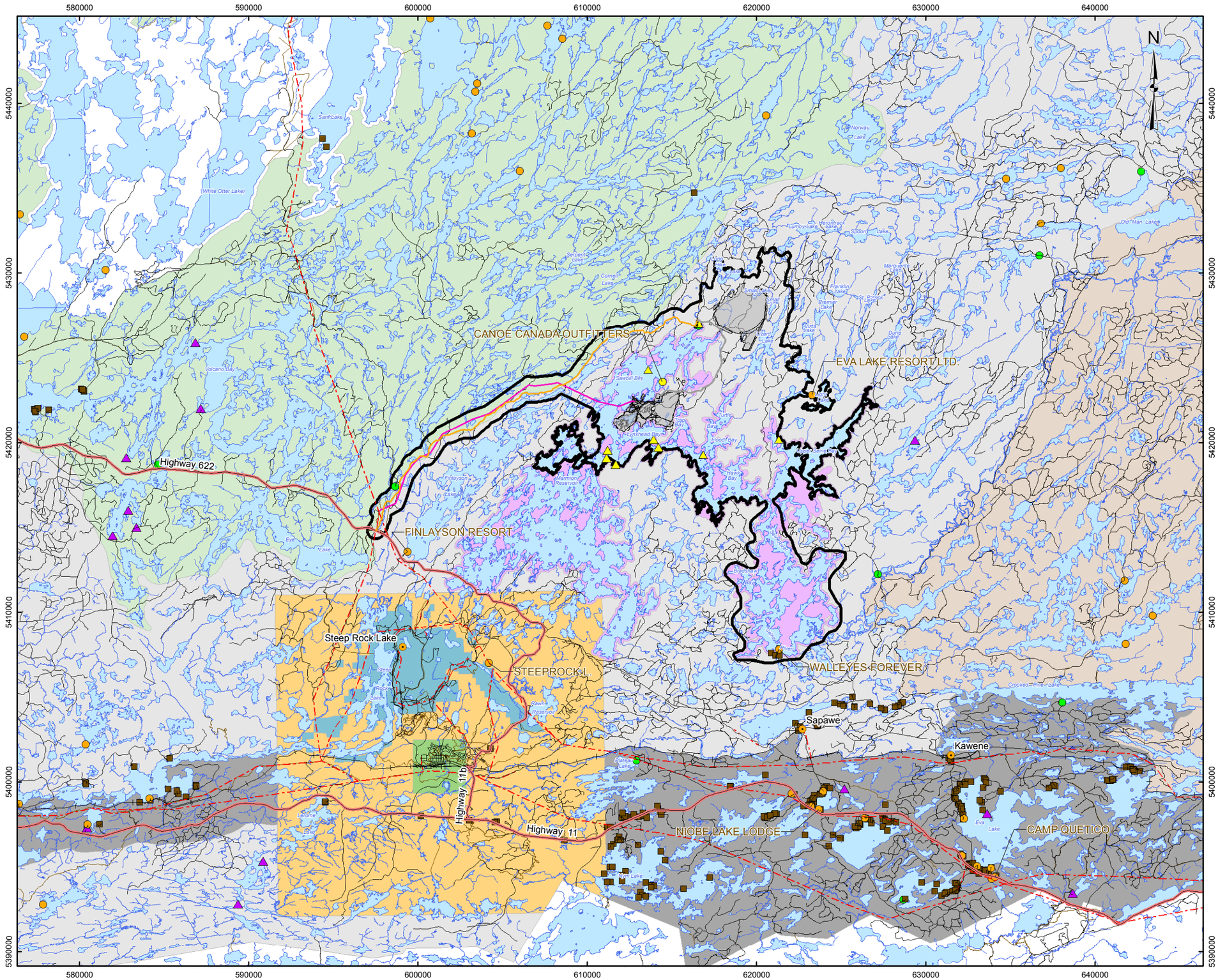
Source: MTC 2009.

Tourism and recreation infrastructure in the LSA is shown on Figure 2-15. This comprises a small and localized part of the broad tourism and recreation resources in the RSA shown on Figure 2-13. Outdoor tourism and recreation is an integral component of the economics and character of Atikokan. The Town's Municipal Cultural Plan (2012), identifies outdoor recreation as the basis for the community's cultural identity.



Source: MTC 2009.

Figure 2-14: Total Visitor Spending in the Rainy River District



LEGEND

- Small Community
- Provincial Highway
- Road
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake
- Former Designated Camping Site
- Former Tourism Establishment
- Recreation Campsites
- Cottage
- Tourism Establishment
- Access Point
- Trail
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Local Study Area

General Resource Area

- Finlayson
- Greytrout
- Highway 11
- Marmion
- Mercutio
- Steep Rock
- Township of Atikokan
- Townsite Atikokan

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
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4 2 0 4 8 12
SCALE 1:225,000 KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
TOURISM AND RECREATION IN THE LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
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REVIEW	PB	8 Feb. 2013		

FIGURE: 2-15

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Within the LSA, there are three operating tourism outfitters as identified by the MNR: Canoe Canada Outfitters on Sawbill Bay, Eva Lake Resort on Light Lake and Walleyes Forever on the Seine River. Finlayson Resort has a location just outside the LSA on Finlayson Lake. Within this LSA, the MNR identifies approximately eight access points used by anglers and boaters, fifteen designated camping sites and four cottages. Interviews conducted with tourism outfitters confirmed the use of these access points on Finlayson Lake, Marmion Reservoir and Sawbill Bay, which are important local recreation and tourism areas.

Outdoor recreational tourism operators in the LSA host remote camping, hunting and fishing vacations. These tourism outfitters provide a variety of services including remote fly-in, and drive in wilderness retreats, guided fishing tours, hunting expeditions, and trapper cabins. Outfitters provide accommodation at resorts, lodges and outposts, and utilize many of the lakes located around the Project Site for fishing tours. These outfitters offer vacations focused on isolated wilderness experience. Project exploration activities have been noted to have resulted in a few complaints from visitors due to noise disturbance (J. Dickson. personal communication 20 October 2011). In addition to the operators who own accommodations in the Project Site, there are also a number of outfitters, including Niobe Lake Resort, and Camp Quetico, which utilize the area for guided tours.

The Project has the potential to affect these outdoor tourism and recreation activities and facilities through physical interaction or removal, or through direct effects of the Project on the aquatic and terrestrial environment.

The Atikokan Chamber of Commerce (ACC) operates the Atikokan Tourist Bureau, which tracks the purpose of visitors to the Atikokan area during peak season (May-September). In 2011, a total of 3,697 tourists visited the Tourist Bureau during this season. This number increased from the 2,378 tourists in 2008. The ACC reports that this increase may be due to an increase in operation hours and staffing over the time period. It cannot be concluded that the increase in recorded visitors represents a real increase in tourism activity. In 2011, the visitor statistics indicate that many visitors to Atikokan were only passing by (approximately 30%). The most popular reasons for visiting Atikokan were recreation (approximately 20%), followed by fishing, and visiting friends or family (approximately 10% each). The ACC is currently assessing the feasibility of opening the Tourist Bureau year round (Wood, J. 2011, personal communication 19 October 2011).

In addition to tourism outfitters offering hunting and fishing vacations, there are also a number of operators that provide canoe outfitting services, including providing supplies and guidance for canoe trips. While the majority of canoe activity occurs within the White Otter and Quetico Parks, some people also utilize surrounding lakes, including those within the Local Study Area, for their canoe adventures. For example, the Boy Scouts of America host several canoe trips annually which travel through the Marmion Reservoir (J. Dickson personal communication 20 October 2011).

2.2.7.2 Hunting Valued Ecosystem Component

Hunting and trapping are managed provincially by the MNR. Recreational bear, moose, elk and deer hunting by residents is managed by Wildlife Management Units (WMUs). There are 95 WMUs for the Province, which are divided into subunits in some areas. The LSA is located predominantly in Wildlife Management Unit 12B, with a small portion of the LSA in WMU 12A. Figure 2-16 shows the WMUs for hunting in the LSA. Within each WMU there are a number of Bear Management Areas. Non-resident hunting permits for bear hunting are managed through the use of Bear Management Areas. These areas are Crown Land licensed to an operator and managed by the MNR for the purpose of providing bear hunting services specifically to non-resident hunters. In 2007, non-residential bear hunting services were offered by approximately 550 tourism operators provincially. Revenue from black bear hunting and associated activities including equipment, travel and accommodation

contributes to provincial tourism revenues in Ontario. In 2002, these revenues were $27 million, including $8.9 million from resident hunters and $18.1 million from non-resident expenditures. Bear hunting for non-residents is licensed to tourism operators by bear management areas distributed by the MNR. There are four Bear Management Areas within the LSA which are operated by tourism operators (e.g., Canoe Canada and Camp Quetico). Between 2007 and 2010, a total of 73 bears were harvested from these four areas (MNR 2011a).

Hunting licenses for moose, elk and deer are distributed by Wildlife Management Units (WMUs) managed by the MNR. Moose populations during the 1990s showed a declining trend in WMU 12B, but recent surveys show that moose numbers have increased since 2000 (MNR 2009). There are archery and gun seasons for moose in WMU 12B that are open to residents and non-residents. The archery season typically opens three weeks before the gun season, which is about five weeks long for non-residents. In 2010, there were an estimated 1,646 active residential moose hunters in this area and 190 moose harvested (Stewart and Dix-Gibson 2011). The number of hunters has fluctuated since 2006, from a low of 1,494 in 2008 to a high of 1,775 in 2006. The total number of moose harvested was as low as 132 in 2009 and as high as 276 in 2006. White-tailed deer are observed during summer and fall in WMU 12B, but they tend to move south for winter. Rabbits, foxes and wolves, as well as game birds such as partridge, ducks, geese, duck, and ruffed and spruce grouse are also hunted in this area.

2.2.7.3 Trapping Valued Ecosystem Component

Trapping information in the LSA is shown on Figure 2-17. Trapline areas are identified on the figure. These traplines are classified as Crown Land registered, and the corresponding licenses from these areas are classified as regular registered licenses. The LSA includes part of five trap lines (AT025, AT032, AT039, AT040 and AT041) and contains two trapper cabins. These two trapper cabins are located within 2 km of the proposed Tailings Management Facility. A number of other trapper cabins are located just outside the LSA. Trapline AT044 is located just to northeast of the LSA, and is included in the aggregate data from MNR below. The primary species trapped are muskrat, marten and beaver. The trapping season is typically October to May. Minimum and maximum quota for beaver and fisher are set by the MNR.

The total harvest data for species trapped over a five-year period (2006 to 2010) for the six traplines above are as follows (MNR 2011b):

- Beaver: 991.
- Black Bear: 4.
- Coloured fox: 48.
- Coyote: 14.
- Fisher: 66.
- Lynx: 19.
- Marten: 1,092.
- Mink: 159.
- Muskrat: 1,154.

- Otter: 102.
- Racoon: 3.
- Red squirrel: 36.
- Timber wolf: 16.
- Weasel: 219.

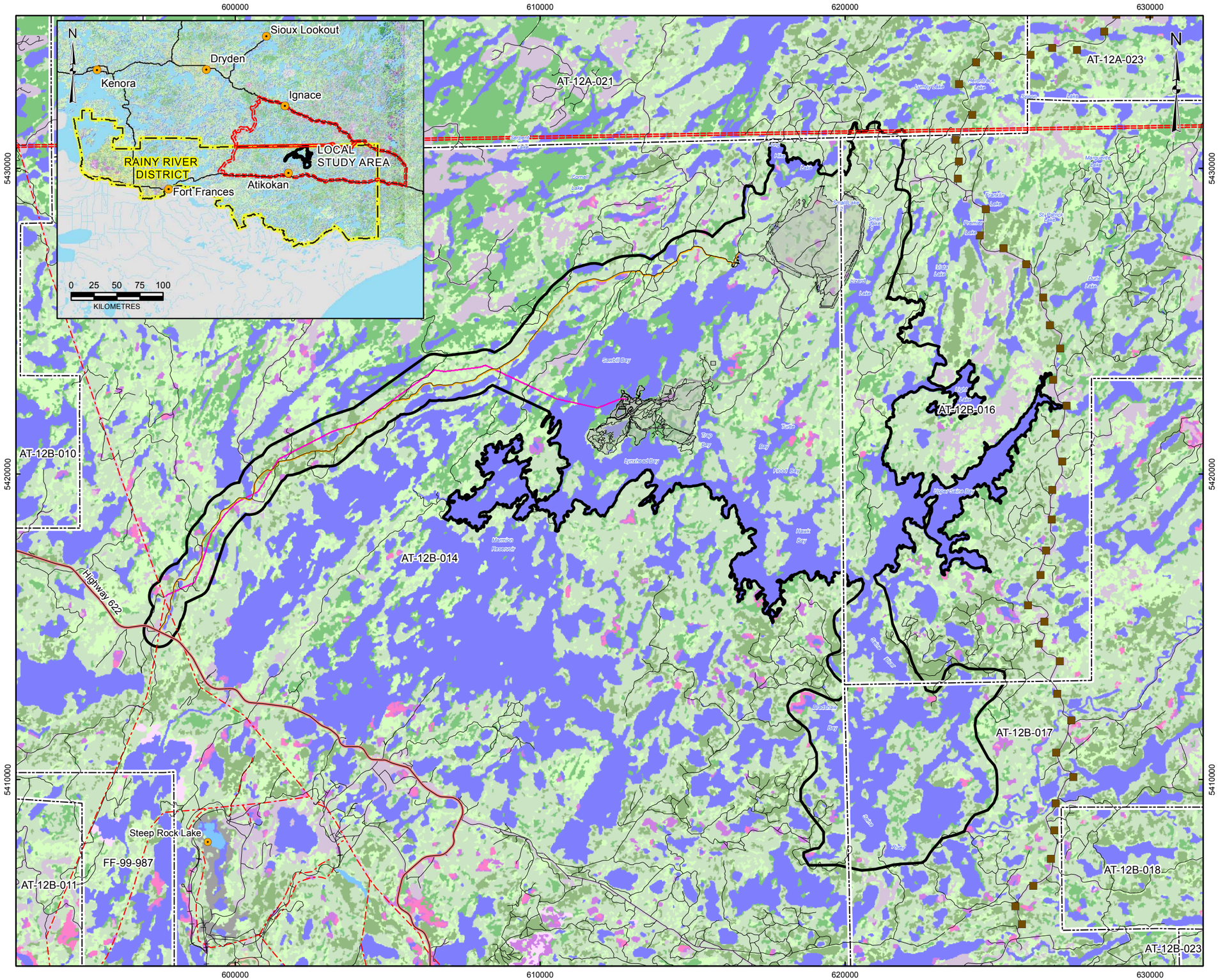
2.2.7.4 Fishing Valued Ecosystem Component

Recreational fishing licenses in the Province are permitted by the MNR based on 20 Fisheries Management Units. The RSA contains 10 Fisheries Management Units. In 2005, a total of 1,426,384 recreational anglers' licenses were issued. This included 919,455 residents, and 506,929 non-residents (Kerr 2010).

Income from all licenses and permits issued under the Fish and Conservation Act must be used to fund fisheries and wildlife programs in the province. In 2010, income from licenses, royalties and fines was estimated to be $65.7 million (MNR 2012).

The LSA (see Figure 2-18) is located within Fisheries Management Unit 5. Commercial bait harvesting is licensed separately by Bait Harvesting Areas, each approximately 100 km^2. As shown on Figure 2-18, there are 10 Bait Harvesting Areas located within the Project Site (FF0174, FF0175, FF0146, FF0147, FF0148, FF0115, FF0116, FF0117, FF0118, FF0086 and FF0087). Two additional areas (FF0174 and FF0085) are included in the aggregate data provided by MNR for the years 2006-2011. Over this period 2,069 gallons of baitfish and 440 pounds of leeches were harvested from these 12 areas. These values under-represent total harvest as 28% of baitfish reports and 39% of leech reports were not submitted (MNR 2012).

Partly within, and immediately south of the LSA, as shown in Figure 2-18, Marmion Reservoir is known for its wilderness fishing experience, particularly for small-mouth bass fishing. Sawbill Bay, in the LSA, is a particularly well known bass fishing destination. Upper and Lower Marmion Lake, Lynxhead Narrows and Hawk Bay are also common fishing destinations. Northern pike and walleye are also commonly caught from Marmion Reservoir. There are a number of access points to the lake from Highway 622. However, due to its size, intricacy and fish population, the lake offers an isolated fishing experience year round. The lake is utilized by several tourism operators to sustain their business activities, and residents for recreation purposes. The lake is also the site of the Atikokan Bass Classic, which is one of the largest and most important annual events for the Town of Atikokan. Fishers utilize both the waters of Upper Marmion Reservoir and Lower Marmion Reservoir during the two day tournament. The Bass Classic is estimated to attract hundreds of tourists each year, and bring in approximately one million dollars in spin-off economic activity (G. McKinnon personal communication 20 October 2011).



LEGEND

- Small Community
- Provincial Highway
- Road
- Existing Railway
- Existing Transmission Line
- Bear Baiting Station
- Wildlife Management Unit
- Bear Management Area
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Local Study Area

Land Cover

1. Water - deep clear
2. Water - shallow / sedimented
3. Settlement / Infrastructure
4. Sand / Gravel / Mine Tailings
5. Bedrock
6. Mudflats
7. Forest Depletion - cuts
8. Forest Depletion - burns
9. Forest - regenerating depletion
10. Forest - sparse
11. Forest - dense deciduous
12. Forest - dense mixed
13. Forest - dense coniferous
15. Marsh - intertidal
16. Marsh - supertidal
17. Marsh - inland
18. Swamp - deciduous
19. Swamp - coniferous
20. Fen - open
21. Fen - treed
22. Bog - open
23. Bog - treed
24. Tundra Heath
25. Agriculture - Pasture / abandoned fields
27. Agriculture - cropland
28. Other - unknown
29. Other - cloud / shadow

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
Base Data - MNR NRVIS, obtained 2004
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50 25 0 50 100 150 200
KILOMETRES

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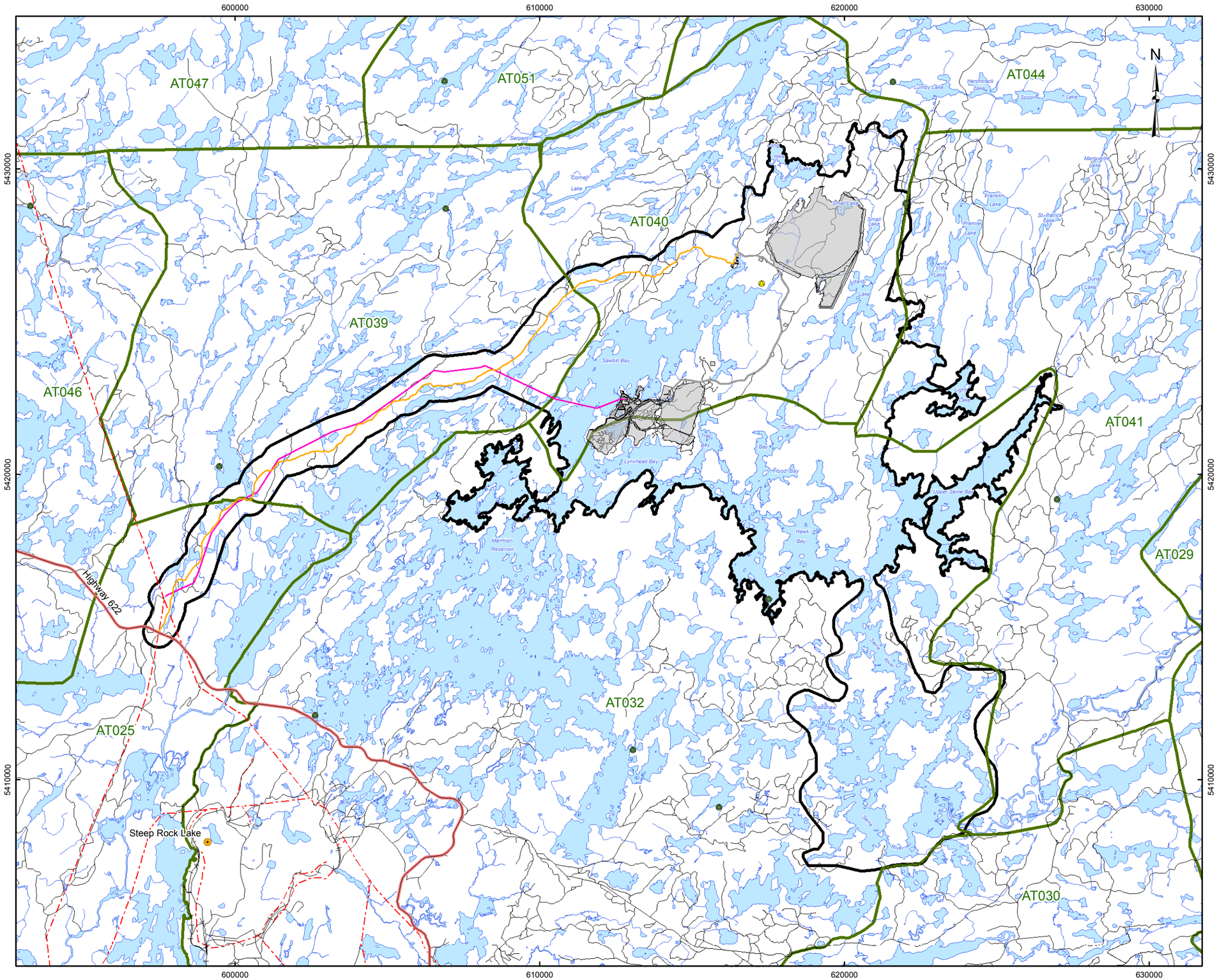
TITLE
HUNTING IN THE LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	14 Nov. 2008		
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FIGURE: 2-16

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LEGEND

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

REFERENCE

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SCALE 1:125,000 KILOMETRES

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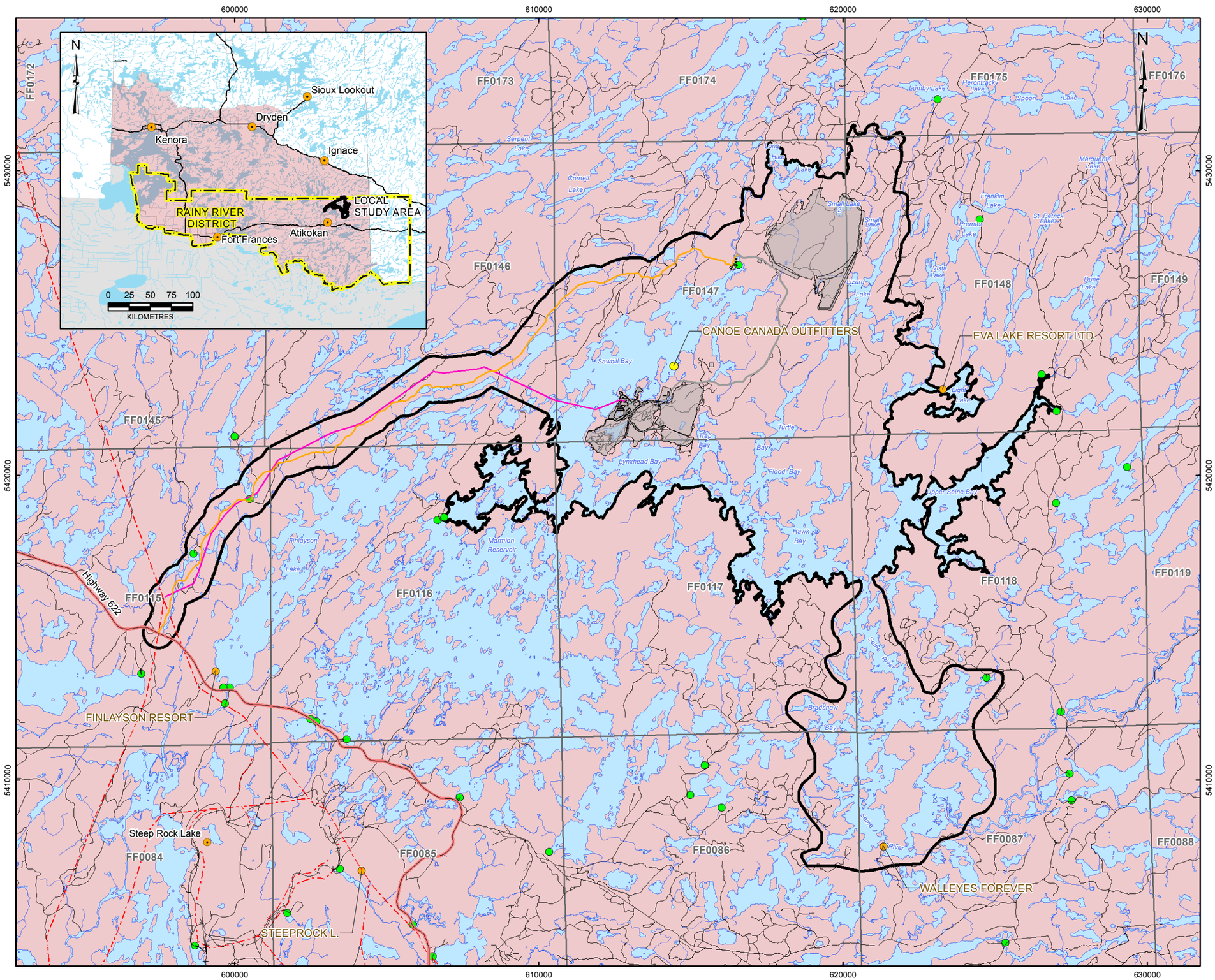
TITLE
TRAPPING IN THE LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

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FIGURE: 2-17

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LEGEND

- Small Community
- Provincial Highway
- Road
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake
- Tourism Establishment
- Former Tourism Establishment
- Access Point
- Bait Harvest Area
- Fisheries Management Unit No.5
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- Local Study Area

REFERENCE

Base Data - Provided by OSISKO Hammond Reef Gold Project Ltd
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2 1 0 2 4 6 8
SCALE 1:125,000 KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
FISHERIES INFORMATION IN THE LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

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DESIGN	CGE	8 Jan. 2013		
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REVIEW	PB	8 Feb. 2013		

FIGURE: 2-18

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2.2.7.5 Mining Valued Ecosystem Component

Mining claims in the RSA are shown in Figure 2-19. The figure shows the areas where mining claims are concentrated across the RSA. The figure shows that there are a large number of claims in the area of the Project Site. As illustrated, there are numerous active claims, dispositions (claims under transfer) and withdraws (Crown land for which prospecting or staking claims have been withdrawn) across the RSA. The region is experiencing increasing mineral exploration activity as long term global commodity prices have increased. Oil and gas are not important extractive resources in the RSA.

The Mine Study Area is located entirely on Crown Land. Mining claims in the LSA are shown in Figure 2-20. Claims held by OHRG as part of the Project are identified. In addition to the Project, there are a number of other active claims in the area.

2.2.7.6 Forestry Valued Ecosystem Component

The Project is located entirely on Crown Land and all forestry activity is managed by the MNR in accordance with the Crown Forest Sustainability Act. The MNR licenses the use of Crown forests through Forest Management Units. The LSA is part of two Forest Management Units, specifically the Crossroute Forest Management Unit and the Sapawe Forest Management Unit, as shown on Figure 2-21. Forestry operations in both of the units may be affected by the Project. It should be noted that both forestry operations affect areas substantially larger than the Project Site. These two Forest Management Units are part of forest operations licensed to two companies, Abitibi-Consolidated and Atikokan Forest Products. Abitibi-Consolidated manages the Crossroute Forest, and Atikokan Forest Products manages the Sapawe Forest. As required by the Crown Forest Sustainability Act, Forest Management Plans have been created for these forests by each company. These plans identify current and potential forest land usage over a 10-year period (2007-2017 for Crossroute Forest and 2010-2020 for the Sapawe Forest).

The total area of the Crossroute Forest is 1,593,225 ha, of which 838,121 ha is managed crown forest. The Crossroute Forest Management Plan divides the 10-year management period into two five-year terms (2007-2012 and 2012-2017). The planned harvest area is 69,659 ha for the first five-year term and 68,901 ha for the second five-year term (Abitibi-Consolidated 2011).

The total area of the Sapawe Forest is 301,500 ha, of which approximately 200,000 ha is managed crown forest. The planned harvest area for the ten-year (2010-2020) forest management plan is 20,224 ha (Atikokan Forest Products 2009).

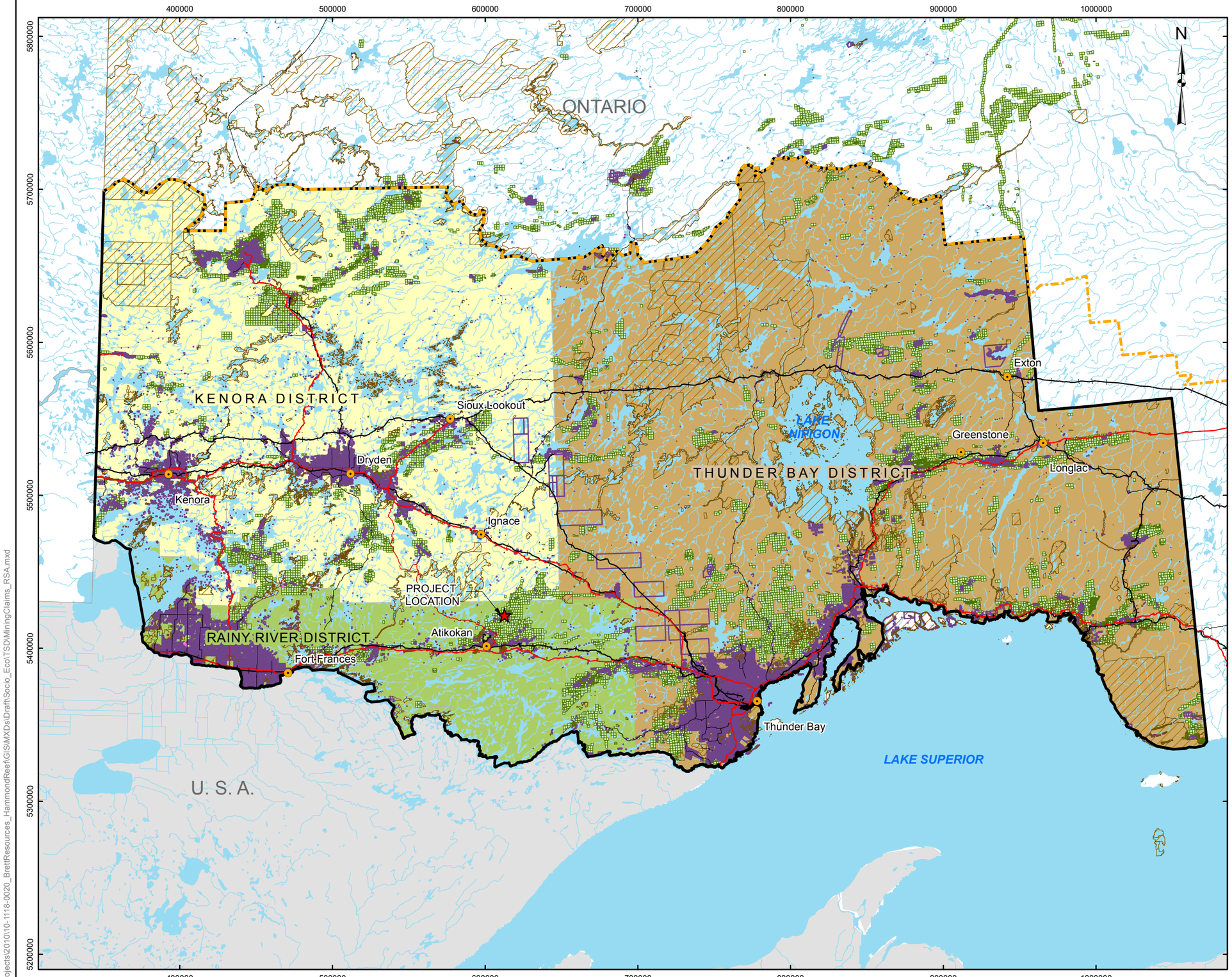
2.2.7.7 Water Use and Access Valued Ecosystem Component

Relevant water use is described for navigable waterways and other hydrological features in the Project Site in the Hydrology TSD. Also described is the identification and analysis of all navigable waterways potentially affected by the Project. Figure 2-22 displays the main surface waterbodies, and the locations of the primary water users, namely waterpower facilities, as well as water crossings and water control dams in the LSA, as described below.

2.2.7.7.1 Watersheds

The Seine River drains the eastern portion of the Lake of the Woods and Rainy River watershed. It originates as the Savanne River near Upsala and flows westerly before emptying into Rainy Lake southeast of the town of Mine Centre. Rainy Lake is drained by the Rainy River at its outlet near the towns of Fort Frances and International Falls, and empties into Lake of the Woods northwest of the town of Baudette. Lake of the Woods

extends across the border between Ontario and Manitoba; and Rainy Lake, Rainy River and Lake of the Woods are transboundary waters between Canada and the United States of America (USA). The tributary drainage area to the Lake of the Woods and Rainy River watershed at its outlet near the town of Kenora is 70,400 km² of which approximately 59% is in Canada and 41% in the USA.



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

Mining Claims

- Pending Claims
- Active Mining Claims
- Active Dispositions
- Active Withdraws
- 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

50 25 0 50 100 150
SCALE 1:2,500,000 KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
MINING CLAIMS IN THE REGIONAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	8 Jan. 2013		
GIS	JO	8 Feb. 2013		
CHECK	PB	8 Feb. 2013		
REVIEW	SP	8 Feb. 2013		

FIGURE: 2-19

G:\Projects\2010\10-1118-0020_BrettResources_HammondReef\GIS\MXDs\Draft\Socio_Eco\TSD\MiningClaims_RSA.mxd

600000
610000
620000
630000
5430000
5420000
5410000
N
Highway 622
Steep Rock Lake
Serpent Lakes
Cornell Lake
Lumsden Lake
Hemstrack Lake
Soonch Lake
Margurette Lake
Franklin Lake
St-Patrick Lake
Dune Lake
Sawbill Bay
Lynxhead Bay
Flood Bay
Upper Seine Bay
Marmion Reservoir
Hawk Bay
Boldshaw Bay
Seine River

LEGEND

- Small Community
- Provincial Highway
- Road
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake

Mining Claims

- Osisko Claims
- Active Mining Claims
- Active Withdrawals
- Active Dispositions
- Manley Pattents
- Osisko Dispositions
- Disposition Ownership Uncertain
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- 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

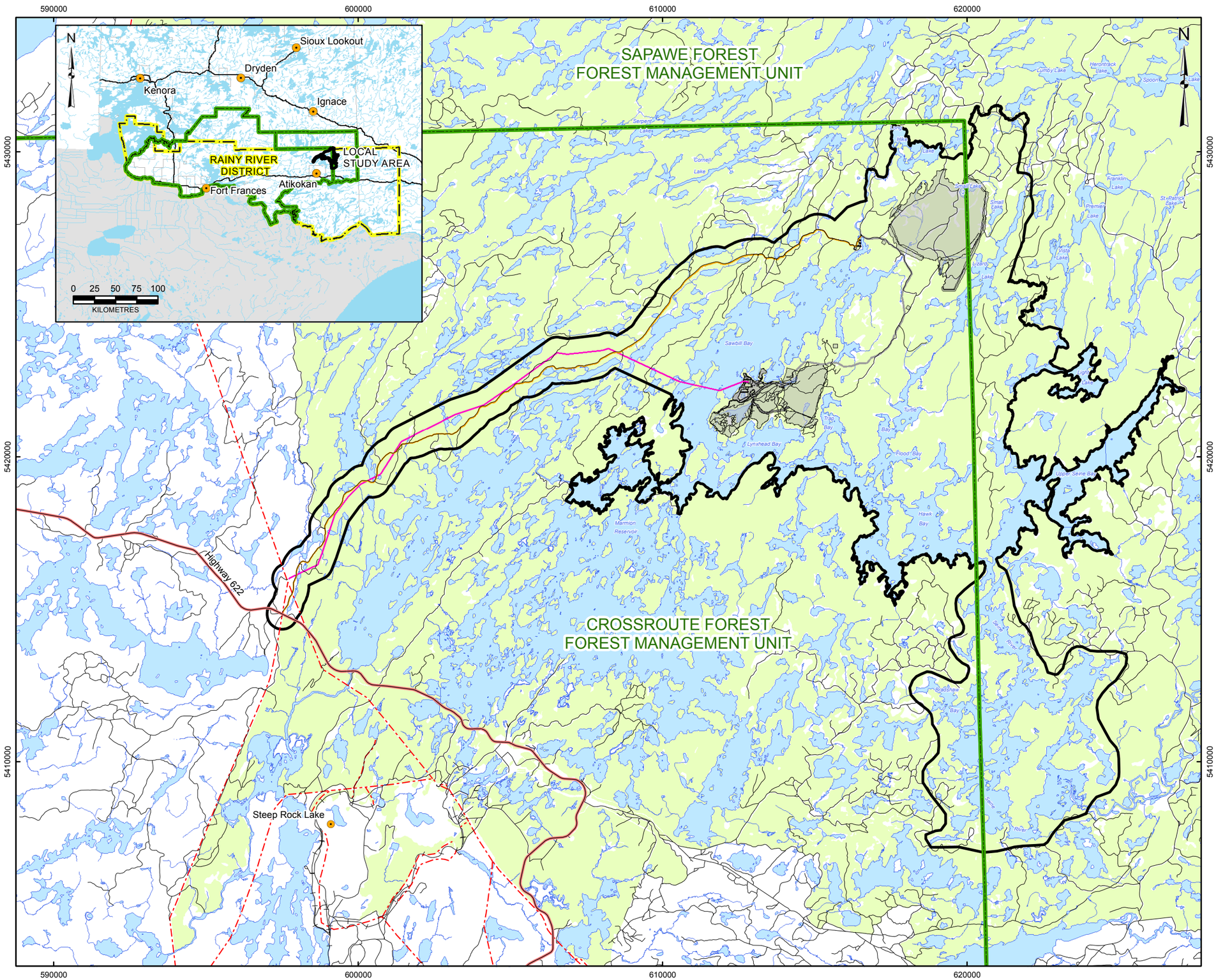
TITLE
MINING CLAIMS IN THE LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	14 Nov. 2008		
GIS	JO	8 Feb. 2013		
CHECK	PB	8 Feb. 2013		
REVIEW	SP	8 Feb. 2013		

FIGURE: 2-20

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LEGEND

- Small Community
- Provincial Highway
- Road
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake
- Forest Management Unit
- Wooded Area
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- 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 1:125,000 KILOMETRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

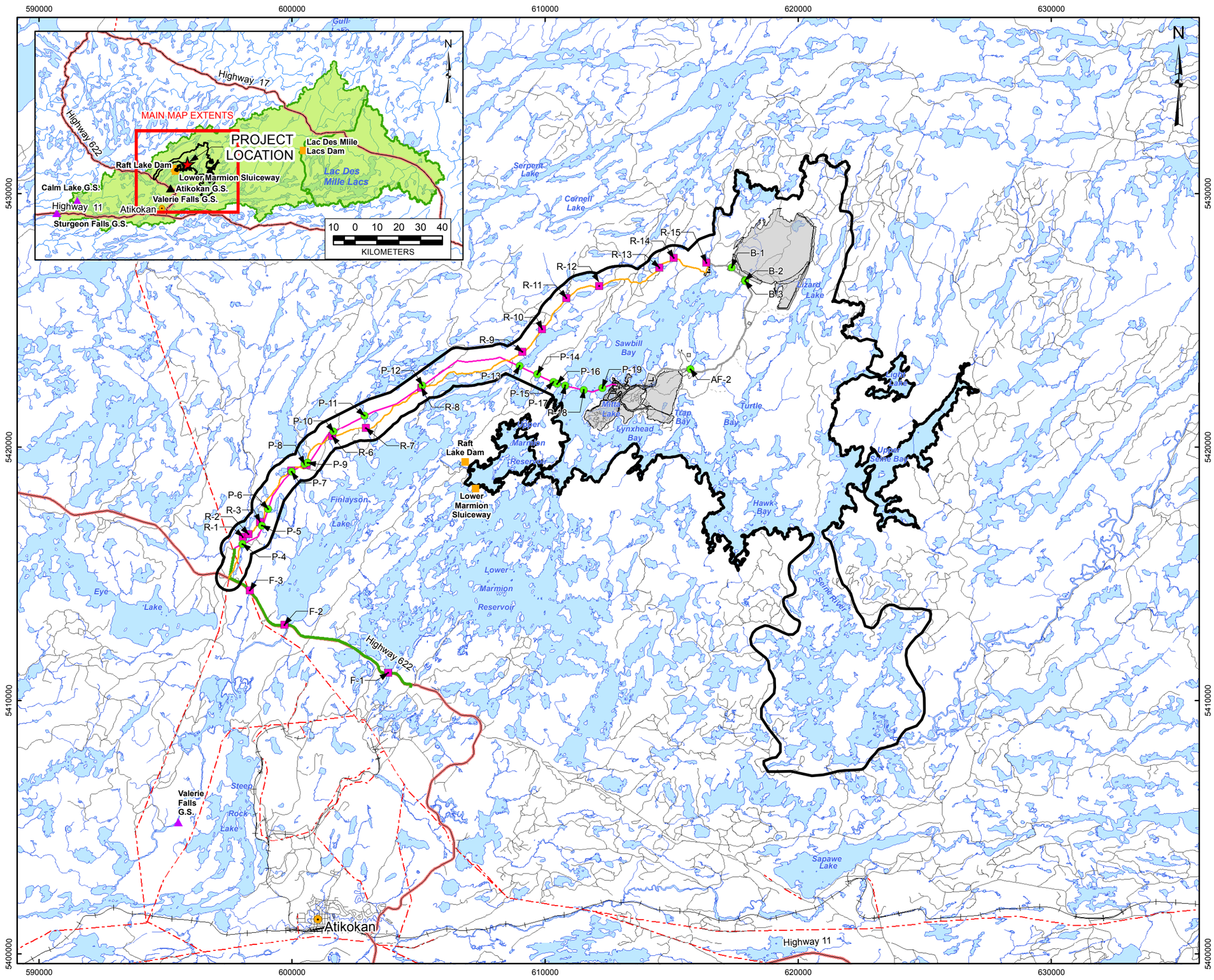
TITLE
FOREST MANAGEMENT UNITS IN THE LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	8 Jan. 2013		
GIS	JO	8 Feb. 2013		
CHECK	PB	8 Feb. 2013		
REVIEW	PB	8 Feb. 2013		

FIGURE: 2-21

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LEGEND

- City/Town
- R1 Existing Water Crossing
- B1 New Water Crossing
- Waterpower Facility
- Water Control Dam Location
- Provincial Highway
- Road
- Trail
- Existing Railway
- Power Transmission Line
- River/Stream
- Lake
- Watershed Boundary
- Fibre Optics Line
- Mine Site Road
- Access Road (Hardtack / Sawbill)
- Project Transmission Line
- Project Facilities
- 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

2,000 0 2,000 4,000 6,000 8,000
SCALE 1:150,000 METRES

PROJECT
HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE
NAVIGABLE WATERS IN THE LOCAL STUDY AREA

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			SCALE AS SHOWN	VERSION 1
DESIGN	CGE	14 Nov. 2008		
GIS	JO	8 Feb. 2013		
CHECK	PB	8 Feb. 2013		
REVIEW	PB	8 Feb. 2013		

FIGURE: 2-22

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The Seine River originates as the Savanne River near Upsala and flows westerly for about 250 km before emptying into Rainy Lake southeast of the town of Mine Centre. Its watershed encompasses approximately 6,250 km². The watershed has an average slope of 0.55 m/km over the length of its main channel. The total drop between Lac des Mille Lacs and Rainy Lake is approximately 120 m.

Four minor north tributaries to the Seine River flow southwards into the Marmion Reservoir between Upper Seine Bay and Sawbill Bay. These are the Caribou River, Light Creek, Lumby Creek and Sawbill Creek.

2.2.7.7.2 Seine River Power Generation Facilities and Water Control Structures

Water use for power in the Seine River Watershed is the primary existing water use relevant to the Project.

Waterpower development on the Seine River commenced in 1909, with the construction of a dam across the Rainy River at Fort Frances. In 1926, the Calm Lake, Sturgeon Falls and Moose Lake generating stations were built, and the Marmion Reservoir was created to serve as the primary storage basin for power regulation at these generating stations. In 1943, the Seine River was diverted around the Steep Rock mining operations and the Moose generating station was decommissioned. The Raft Lake Dam was built to replace the Moose Lake structures as the principal control works for the system. Between 1944 and 1961, Lower Marmion Reservoir was isolated from Upper Marmion Reservoir to minimize the amount of material from dredging operations in the East Arm of Steep Rock from entering the Seine River. The Valerie Falls generating station was built in 1993-1994 and captures 65% of the available drop previously utilized by the Moose Lake generating station.

Figure 2-22 shows the power generation facilities and associated water control structures on the Seine River in operation today. There are three waterpower facilities with associated power dams:

- **Valerie Falls Generating Station**, located on the man-made diversion of the river around the site of the former Steep Rock Mine, and owned and operated by Valerie Falls Limited Partnership (Brookfield Renewable Energy Group).
- **Calm Lake Generating Station**, located on the Seine River at the outlet of Calm Lake, and owned and operated by H2O Power Limited Partnership.
- **Sturgeon Falls Generating Station**, located about 90 km east of Fort Frances, also owned and operated by H2O Power Limited Partnership.

2.2.7.7.3 Ontario Ministry of the Environment Permits to Take Water

Information on Permits to Take Water within a 20 km radius of the Project was provided by the Ontario Ministry of the Environment Northern Region. There is only one active permit for surface water taking, No. 855-777HGF, owned by Ontario Power Generation Inc. for industrial cooling water to be taken at a maximum rate of 607,000 m³/year from Moose Lake (UTM 15 E604417 N5409666) which expires on September 29, 2017.

3.0 EFFECTS ASSESSMENT

This section predicts and describes the changes to the socio-economic environment that are likely to result from the Project. These changes are then assessed to determine if an adverse effect is expected, whether said adverse effect can be mitigated, and for adverse effects that cannot be fully mitigated (residual effects), the significance of the effect is determined. Section 3.1 provides a description of effects assessment methods.

While the focus of the environmental assessment is generally on potential adverse effects, many of the socio-economic effects of the Project are positive and beneficial. A number of opportunities are available to enhance the positive effects and these are identified as appropriate. In addition, when an effect is identified as being positive it is credited as a benefit of the Project and advanced to the "Economic and Social Benefits of the Project" section of EIS/EA Report (Chapter 11).

As part of social management planning discussed in Chapter 8 of the EIS/EA Report, establishment of a "Atikokan/OHRG Committee" is proposed to act as a liaison or conduit for information exchange between OHRG and the community. This Committee could have an important role in monitoring and disseminating the positive effects of the Project on the socio-economic fabric of the community. Areas where the Committee may provide this function are identified in the following sections.

3.1 Effects Assessment Method

The effects assessment comprises the following steps:

- Step 1: Screening of Project activities with the potential to have interactions with the VECs of the socio-economic environment (Section 3.2).
- Step 2: Prediction (i.e., identification and description) of potential effects of the Project (Section 3.3).
- Step 3: Identification of suitable mitigation measures to reduce or eliminate the identified effects.
- Step 4: Assessment of whether adverse effects remain after mitigation (i.e., residual effects).
- Step 5: Determination of the significance of residual effects. If there is uncertainty of whether an effect remains after mitigation, the effect is assessed for determination of significance.

The effects assessment is completed within the framework of temporal and spatial boundaries described in Section 1.7. 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 the restriction of site access directly affecting trapping. Indirect pathways occur when a VEC is affected by an effect on another VEC, for example the Project affecting a terrestrial ecology VEC which is important to trapping. The effects assessment recognizes the widest, reasonable range of potential direct and indirect effects without specific regard for their probability of occurrence.

The effects assessment uses six criteria, as following:

- Direction: the direction of the effect as positive, negative, or non-directional (neutral).
- 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).
- Reversibility: 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 reversibility use three levels: low, medium and high, as shown in Table 3-1.

Magnitude levels are VEC-specific as shown in Table 3-2. Four levels are associated to the magnitude criterion: negligible, low, medium and high.

Table 3-1: Assessment Criteria and Levels for Determining Significance

Assessment Criteria	**Level**		
Geographic Extent (of effect)	**Low**	**Medium**	**High**
	Effect is within the Project Site (i.e. Mine Study Area or Linear Infrastructure Study Area)	Effect extends into the Local Study Area	Effect extends into the 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 Reversibility (of effect)	**Low**	**Medium**	**High**
	Effect is not reversible (i.e., permanent)	Effect is reversible with time	Effect is readily reversible

Table 3-2: Magnitude Levels for Socio-economic Valued Ecosystem Components

Valued Ecosystem Components	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
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	Vacancy rate > 10%	Vacancy rate of 5% - 10%	Vacancy rate < 5%	Demand 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

Table 3-2: Magnitude Levels for Socio-economic Valued Ecosystem Components (Continued)

Valued Ecosystem Components	Magnitude			
	Negligible	**Low**	**Medium**	**High**
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
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 is determined using a decision tree specific to the socio-economic environment. In a decision tree magnitude, geographic extent, frequency, duration, and degree of reversibility are combined to determine the overall significance of the effect. Four levels of significance are differentiated: Negligible, Low, Moderate and High. Only residual effects are assessed for significance.

In general for socio-economics and land use, a residual adverse effect is considered of negligible significance if geographic extent is low or magnitude is negligible. If geographic extent is moderate or high and magnitude is low or medium, significance is moderate. If geographic extent is medium or high, and magnitude is high, the level of significance is high. Generally frequency, duration and degree of reversibility are not used to evaluate the significance of an effect on a socio-economic VEC.

The decision tree for the socio-economic environment is shown in Figure 3-1.

3.2 Screening of Project Activities and Valued Ecosystem Component Interactions

Sections 3.2.1 through 3.2.4 identify which Project activities may have a direct interaction with the VECs of the socio-economic environment by Project phase. Project activities are described in detail in Chapter 5 of the EIS/EA Report.

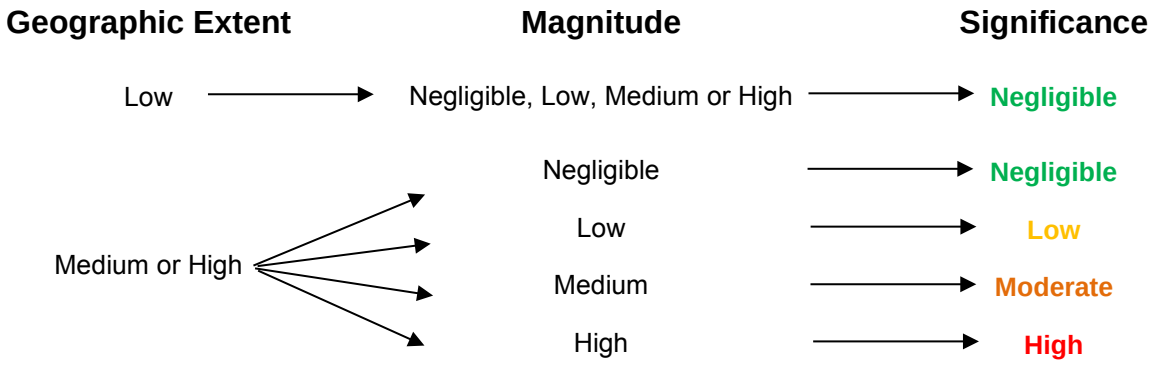


Figure 3-1: Decision Tree for Assigning Significance to Residual Effects on the Socio-economic Environment

3.2.1 Construction Phase

Table 3-3: Construction Phase Activities and Direct Interactions with the Socio-community Valued Ecosystem Components

Project Activities	Population and Demographics	Labour Market	Government Finances	Public Services and Infrastructure	Housing and Accommodation	Transportation
Management, Permitting and Employment	X	X	X	X	X	X
Linear Infrastructure	—	—	—	—	—	X
Support and Ancillary Infrastructure	—	—	—	X	—	X

Notes:
X = Interaction identified.
— = No interaction.

Table 3-4: Construction Phase Activities and Direct Interactions with the Land and Resource Use Valued Ecosystem Components

Project Activities	Outdoor Tourism and Recreation	Hunting	Trapping	Fishing	Water Use and Access	Mining	Forestry
Management, Permitting and Employment	X	X	X	—	—	—	X

Notes:
X = Interaction identified.
— = No interaction.

3.2.2 Operations Phase

Table 3-5: Operations Phase Activities and Direct Interactions with the Socio-community Valued Ecosystem Components

Project Activities	Population and Demographics	Labour Market	Government Finances	Public Services and Infrastructure	Housing and Accommodation	Transportation
Management, Permitting and Employment	X	X	X	X	X	X
Linear Infrastructure	—	—	—	—	—	X
Support and Ancillary Infrastructure	—	—	—	X	—	X

Notes:
X = Interaction identified.
— = No interaction.

Table 3-6: Operations Phase Activities and Direct Interactions with the Land Resource Use Valued Ecosystem Components

Project Activities	Outdoor Tourism and Recreation	Hunting	Trapping	Fishing	Water Use and Access	Mining	Forestry
Management, Permitting and Employment	X	X	X	—	—	—	X

Notes:
X = Interaction identified.
— = No interaction.

3.2.3 Closure Phase

Table 3-7: Closure Phase Activities and Direct Interactions with the Socio-community Valued Ecosystem Components

Project Activities	Population and Demographics	Labour Market	Government Finances	Public Services and Infrastructure	Housing and Accommodation	Transportation
Management, Permitting and Employment	X	X	X	X	X	X
Support and Ancillary Infrastructure	—	—	—	X	—	X

Notes:
X = Interaction identified.
— = No interaction.

Table 3-8: Closure Phase Activities and Direct Interactions with the Land and Resource Use Valued Ecosystem Components

Project Activities	Outdoor Tourism and Recreation	Hunting	Trapping	Fishing	Water Use and Access	Mining	Forestry
Management, Permitting and Employment	X	X	X	—	—	—	X

Notes:
X = Interaction identified.
— = No interaction.

3.2.4 Post-closure Phase

Table 3-9: Post-closure Phase Activities and Direct Interactions with the Socio-community Valued Ecosystem Components

Project Activities	Population and Demographics	Labour Market	Government Finances	Public Services and Infrastructure	Housing and Accommodation	Transportation
Management, Permitting and Employment	X	X	X	X	X	X
Support and Ancillary Infrastructure	—	—	—	X	—	X

Notes:
X = Interaction identified.
— = No interaction.

Table 3-10: Post-closure Phase Activities and Direct Interactions with the Land and Resource Use Valued Ecosystem Components

Project Activities	Outdoor Tourism and Recreation	Hunting	Trapping	Fishing	Water Use and Access	Mining	Forestry
Management, Permitting and Employment	X	X	X	—	—	—	X

Notes:
X = Interaction identified.
— = No interaction.

3.3 Socio-economic Effects Assessment

This section predicts and describes the changes to the socio-economic environment that are likely to result from the Project. These changes are then assessed to determine if an adverse effect is likely, whether any identified adverse effect can be mitigated, and for adverse effects that cannot be fully mitigated (residual effects), the significance of the effect is determined. When an effect is identified as being positive it is credited as a benefit of the Project and advanced to Chapter 11 of the EIS/EA Report (Benefits to Canadians).

The assessment is conducted separately for each of the four phases of the Project, beginning with the construction phase. Since many of the socio-economic effects of the Project are positive and contribute to the overall benefits of the Project, the significance assessment is conducted only on the adverse effects.

3.3.1 Effects Assessment of the Construction Phase

3.3.1.1 Population and Demographics Valued Ecosystem Component

Interactions between construction phase Project activities and the population and demographics VEC are identified in Section 3.2.1. These effects are assessed using four indicators: population change, mobility, age and gender, and dependency ratio.

3.3.1.1.1 Prediction of Potential Effects in the Construction Phase

The likely effects on these interactions are summarized in Table 3-11 and include the following:

- Management, Permitting and Employment is likely to affect population and demographics in the LSA through direct and indirect employment and associated family members. Indirect employment occurs as a result of Project-related expenditures on equipment, materials and services. Changes to the population and demographics in the RSA (and further afield) are likely too small to be measured.

Table 3-11: Effects on Population and Demographics in the Construction Phase

Project Activities	Effect 1	Effect 2	Effect 3	Effect 4
Management, Permitting and Employment	Increase in population of LSA	In-migration of workers and their families into the in LSA	Change in age and gender ratios in LSA	Change in dependency ratios in LSA

Population Change

An increase in population is expected in the LSA over the construction phase. This increase could be due to both direct employment of those employed at the Mine and indirect employment in the LSA as a result of Project-related expenditures. Population effects are compounded by the family dependents associated with each worker.

The average construction phase full-time equivalent workforce is anticipated to be 416 persons, with a peak of approximately 1,200. Figure 3-2 provides the distribution of quarterly workforce levels anticipated over the 30-month construction phase of the Project.

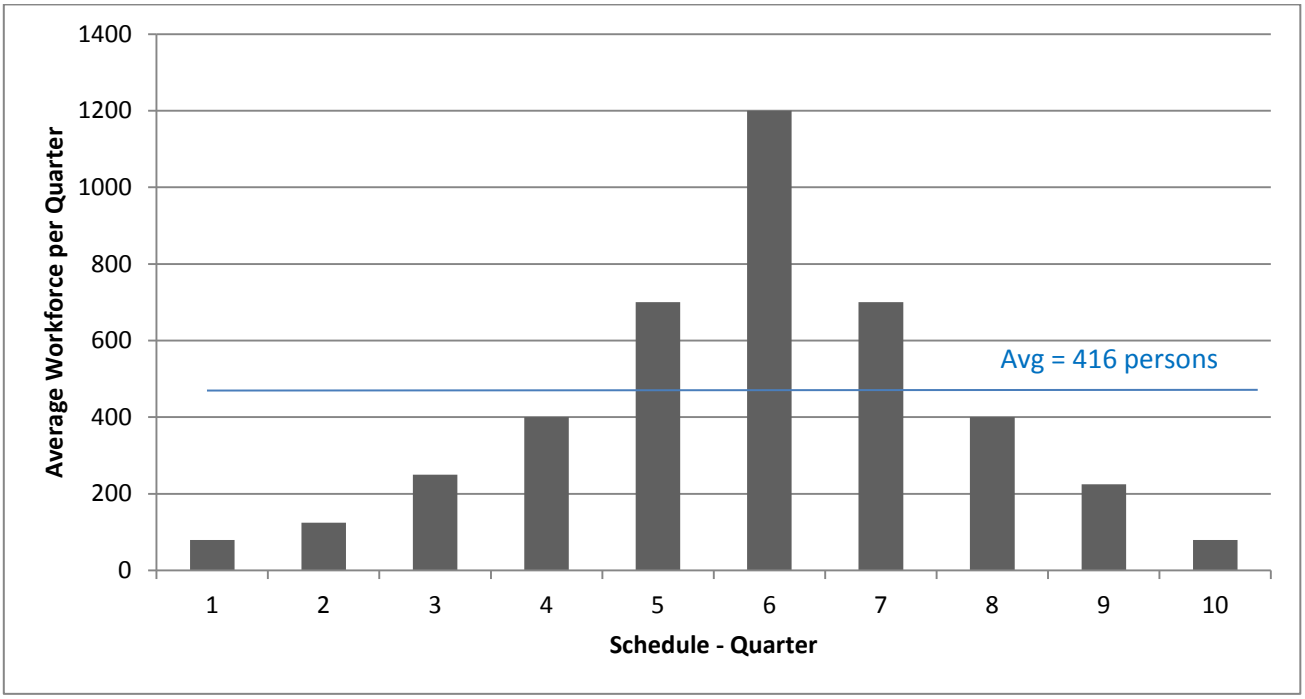


Figure 3-2: Quarterly Average Workforce Estimates for Construction Phase

Table 3-12 provides a breakdown of the occupations required for the construction phase.

Table 3-12: Construction Workforce Breakdown

Occupation	Percentage of Workforce
Welders, metalworkers, installers	25%
Professionals (engineers, architects, etc.)	15%
Mechanics and boilermakers	15%
Electricians	15%
Crane operators, drillers, blasters	15%
Heavy machinery operators, carpenters, pavers	10%
Management	5%

Figure 3-3 provides the anticipated place-of-residence distribution of the construction workforce. Based on the occupations required for the construction phase, and knowledge of the available workforce in the LSA, it is assumed that 10% of the construction workforce would reside in the LSA.

Of the construction workforce, 10% or 42 workers are anticipated to reside in Atikokan. The majority of these workers currently reside in Atikokan. The remainder of the temporary construction workforce is anticipated to reside at the Accommodation Camp. Accordingly, it is not anticipated that the population or demographics of the LSA will change measurably as a result of direct Project employment over the 30-month construction period.

In addition to direct employment, there will be indirect employment as a result of Project-related expenditures. The source of construction expenditures for equipment and materials including consumables, energy and fuel, is estimated based on similar projects and professional judgement.

A change in population and demographics may be expected if a substantial number of business opportunities are realized through new or expanded businesses. As indicated by the economic assessment completed for this Project (Appendix 2.II), it is estimated that the increase in the indirect workforce resulting from the Project as a result of these business opportunities is 40 workers. It is assumed that half of these workers currently reside in Atikokan, and the other half (20) would move to the town from elsewhere. Typically these workers would bring average-sized families (2.7 persons/family) with them (StatsCan 2012). The total increase in population for the construction phase is 54 persons.

The increase in population in the LSA anticipated for the construction phase due to direct and indirect employment is 54 persons. This corresponds to ~2% of the current population of 2,787 for the LSA. This is a positive effect and, though small, serves to mitigate the current recent population decline in the LSA.

Mobility

Population mobility is measured by Statistics Canada as the percentage of persons who report living at a different address one or five years prior to the Census date. Based on this statistic, it is anticipated that approximately 36.4% of the population of the LSA would be expected to move residence in a 5-year period. The in-migration of 54 persons or ~2% of the current population during the construction phase is a positive effect as it may serve to offset and reverse the out-migration from the LSA.

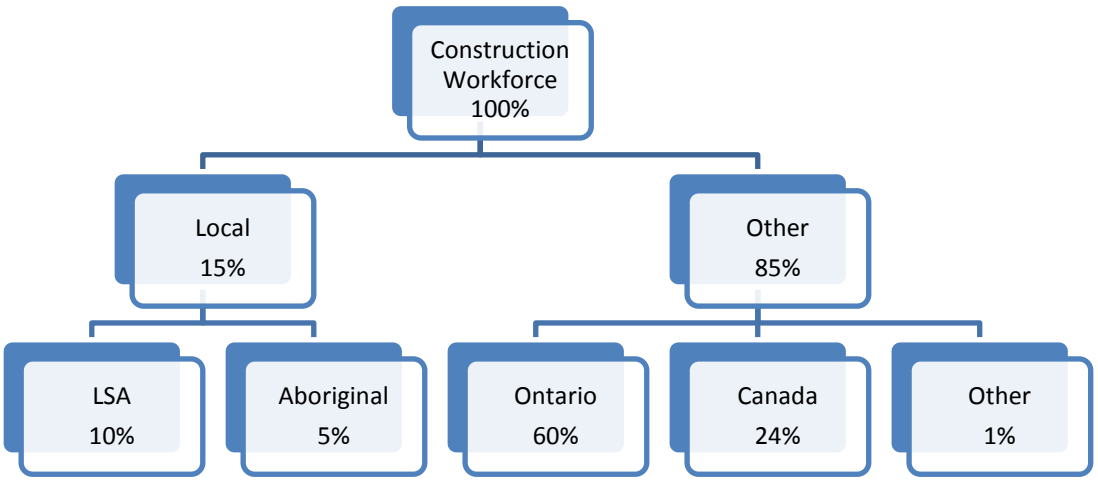


Figure 3-3: Place-of-Residence Distribution of Construction Workforce

Age and Gender

The age and gender profile of the LSA is described in Figure 2-3. Without migration of younger individuals into the LSA, the population can be expected to continue to decrease. The in-migration of twenty families moving into the LSA would add some children and working-age persons to the community. Although small during the construction phase, this effect would be positive.

Dependency Ratios

The slight increase in working-age population in the LSA during the construction phase may reduce the elderly dependency ratio; however, this effect is not anticipated to be evident for the construction phase, as some families may bring elderly family-members with them to the LSA. Because it is assumed that in-migrating families would be typical average Canadian families, the overall child dependency ratio is not expected to change as a result of the construction phase of the Project.

The construction phase of the Project is not likely to have any measurable effect on dependency ratios in the population of the LSA.

3.3.1.1.2 Mitigation

No mitigation measures are required because the effects related to population and demographics are anticipated to be beneficial as workers and their families move into the LSA. While these effects are small during the construction phase, they represent an important reversal of recent population decline in the LSA.

A number of benefit enhancement measures may be implemented to maximize the positive effects associated with workers moving to Atikokan for the construction phase of the Project, including:

- Encouraging job applicants to consider relocating their families to the Town of Atikokan.
- Providing incentives (e.g., transport to and from the Project Site) for workers to live in the Town as opposed to the on-site Accommodation Camp.
- Implementing spousal hiring program to help fill community needs (e.g., doctors and nurses).
- Working with the Town of Atikokan and the Atikokan Economic Development Corporation to identify opportunities for local businesses to develop or expand.

The Atikokan/OHRG Committee identified as part of social management planning could have a role in communicating and supporting these initiatives.

3.3.1.1.3 Summary of Residual Effects

Likely effects on population and demographics during the construction phase of the Project are considered to be positive and beneficial and contribute to the net benefits of the Project.

Table 3-13: Summary of Residual Effects on Population and Demographics in the Construction Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Population Change	Positive effect				
Mobility	Positive effect				
Age and Gender	Positive effect				
Dependency Ratio	No measurable effect				

In the construction phase there will be a small increase in the number of residents (workers and their families) in the LSA due to direct and indirect employment and Project expenditures. This beneficial effect should serve to reverse the population decline in the LSA.

3.3.1.2 Labour Market Valued Ecosystem Component

Interactions between construction phase Project activities and the labour market VEC are identified in Section 3.2.1. These effects are assessed using five indicators: regional and local supplier base, labour force, employment and unemployment, median income, and education and training.

3.3.1.2.1 Prediction of Potential Effects in the Construction Phase

The likely effects from these interactions are summarized in Table 3-14 and include the following:

- Management, Permitting and Employment is likely to affect labour market (employment, income and training) in the LSA and RSA (or province-wide) through the hiring of the construction workforce and through sourcing and obtaining equipment and materials. Changes in the labour market in the RSA and beyond are likely too small to be measured so the following discussion focuses on the LSA.

Table 3-14: Effects on Labour Market in the Construction Phase

Project Activities	Effect 1	Effect 2	Effect 3	Effect 4	Effect 5
Management, Permitting and Employment	Change in regional and local supplier base	Change in labour force in the LSA and RSA	Change in employment and unemploy-ment rates in the LSA and RSA	Change in median and total income in the LSA and RSA	Increased opportunities for training of LSA residents

Regional and Local Supplier Base

Total cost to construct the Project is estimated at $1.4 billion. Total labour costs are estimated at $288 million, or 21% of the total capital expenditure. Of the remaining $1.1 billion, 3% or $33 million is anticipated to be spent in the Local Study Area (primarily Atikokan, with some expenditure in Ignace), 30% ($330 million) in Ontario (including the RSA) and 25% in the rest of Canada. The remaining 40% will be spent in the US or overseas. This information was developed in the economic study included as Appendix 2.II. Figure 3-4 provides the anticipated geographic distribution of construction expenditures.

The supply of goods and services for the Project provides opportunities for the establishment or growth of businesses in the LSA, Ontario and Canada. The following discussion focuses on the likely benefits in the LSA, particularly in the Town of Atikokan.

A mining sector impact analysis was developed for Atikokan (McSweeney and Associates 2011), which identifies the following business opportunities that would be able to service an expanding mining sector in Atikokan:

- Safety supply and equipment.
- Repair shops (road vehicles, quarry and heavy duty equipment, other mechanical equipment).
- Drill parts and repair.

- Electrical repair and supply.
- Blasting supplies.
- Transportation service.
- Part suppliers (mining and heavy equipment, truck and road vehicles).
- Tire sales and repair.
- Assay and testing lab.
- Lumber supply.
- Welding, machining and fabrication.
- Steel supply.
- Mobile repair service.
- Fuel and lubricant supply.
- Diesel and regular gas.
- Heating fuels.

Based on this assessment of the capabilities within Atikokan, it is likely that some of the local businesses identified in Table 2-4, in addition to new businesses, will be able to capitalize on the opportunity offered by the $33 million expenditures over the 30-month the construction phase. This is a positive benefit that should contribute to growing the economic activity of the LSA.

Although the effects on specific businesses or sectors outside of the LSA have not been quantified, the direct Project expenditures of $330 million in Ontario and $275 million in the rest of Canada are major economic benefits of the Project (Appendix 2.II). These expenditures will contribute both to employment and economic activity.

Labour Force

Measurable changes to the labour force during the construction phase likely will be experienced in the LSA.

Total direct employment during construction is 416 full-time equivalents (FTE) over the 30-month construction period. The majority of these workers will be temporary, will come from elsewhere in Ontario, including the RSA, and will reside in the Accommodation Camp. This employment is a major benefit of the Project.

As discussed above, there will be the addition of 42 direct and 40 indirect jobs within the LSA during the construction phase. These 82 jobs are assessed relative to the current labour force of 1,650 persons in the LSA (StatsCan 2007).

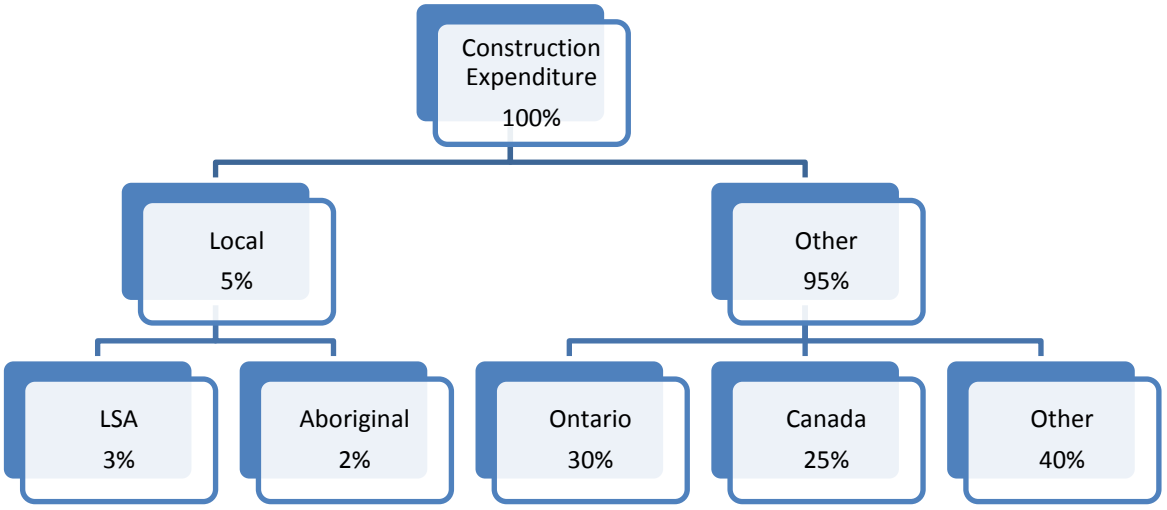


Figure 3-4: Distribution of Construction Expenditures

The addition of 82 FTE jobs in the LSA will be split primarily among construction (approximately 50% of the added workforce or 41 FTEs), manufacturing (20% or 16 FTEs), other services (20% or 16 FTEs) and retail trade (10% or 8 FTEs) based on the proportional shares provided in Table 3-12. This increases the proportion of the workforce in construction from 4% to 6%, or approximately 50% increase in this industry. This is a positive effect of the Project and represents growth in an important sector of the overall economy in the LSA.

Employment and Unemployment

Measurable changes in employment and unemployment rates likely will be confined to the LSA.

Of the 82 FTE created by the construction phase in the LSA it is assumed that 25% of these workers (20 FTE) were previously unemployed in Atikokan. Another 20 persons are assumed to move into the community and be employed. Thus, the overall net increase in employed persons in the LSA is 40. This would increase the number of employed persons from 1,520 (56.8% employment rate) to approximately 1,560 (57.4% employment rate) and reduce the number of unemployed persons from 150 (9.0% unemployment rate) to approximately 130 (7.7% unemployment rate). These changes are positive and represent a reversal in the recent growth in unemployment in the LSA.

Median Incomes

The median income of workers in the LSA is $26,410 (StatsCan 2007). Mine construction projects typically pay high hourly rates, up to $88 per hour. Accordingly, the addition of 42 new jobs during the construction phase will increase the median income in the LSA. The remaining 40 indirect jobs may be expected to pay the current median wage.

The Project will have a positive effect on median incomes by bringing higher-paying jobs to the LSA and reversing the dependence on the public or service sectors.

Education and Training

The Project may be expected to result in increased demand and opportunities in education and training. Because of the short duration of the construction phase, any changes to post-secondary completion rates and other training opportunities are unlikely to be evident. Education and training requirements and opportunities are likely in the operations phase and are discussed as part of that assessment.

3.3.1.2.2 Mitigation

Because any measurable effect of the Project on the labour market VEC are positive, no further assessment is conducted and no mitigation is warranted or identified.

The Atikokan/OHRG Committee identified as part of social management planning could have a role in monitoring and communicating these benefits to the community.

3.3.1.2.3 Summary of Residual Effects

Table 3-15: Summary of Residual Effects on Labour Market in the Construction Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Regional and local suppliers	Positive effect				
Labour force	Positive effect				
Employment and unemployment rates	Positive effect				
Income	Positive effect				
Education and training	No measurable effect				

In summary, likely effects on labour force are considered to be beneficial. The provision of new construction jobs and other jobs associated with the Project is a positive effect. While these jobs are temporary, they lead to additional permanent jobs once the Project begins operating.

3.3.1.3 Government Finances Valued Ecosystem Component

Interactions between construction phase Project activities and government finances are identified in Section 3.2.1. The government finances VEC is assessed using one indicator, namely changes to government revenues.

3.3.1.3.1 Prediction of Potential Effects in the Construction Phase

The likely effects from these interactions are summarized in Table 3-16 and include the following:

- Management, Permitting and Employment is likely to affect government finances through additional tax revenue to the Government of Canada, Government of Ontario and Municipal Government (Town of Atikokan).

Table 3-16: Effects on Government Finances in the Construction Phase

Project Activities	Effect 1
Management, Permitting and Employment	Increase in government revenue

Government Revenues

Government finance will benefit from the construction of the Project at three levels: Federal, Provincial and Municipal. Additional revenues will accrue to the following:

- Government of Canada.
  - Income taxes, both personal and corporate.
  - EI contributions.
  - Sales taxes.
  - CPP contributions.
- Government of Ontario.
  - Income taxes, both personal and corporate.
  - Workplace safety contributions.
  - Employer health tax.
  - Sales taxes.
- Municipal government (Town of Atikokan).
  - Property taxes.
  - Fees.

Because the Project is located in the Unorganized District of Rainy River, there will be no Project-specific property taxes that will accrue to the Town of Atikokan. However, inasmuch as the Project causes residential and other construction in the Town to increase, the assessment levied on such additional construction will increase the financial base of the Town. The extent of additional construction in Town depends to some degree on current vacancy rates and suitability of existing structures to accommodate new demand. However, given an estimated overall permanent population increase of 54 persons or 20 households, it is unlikely that additional houses will be constructed in the Town for the short 30-month construction phase.

Some increase in user fees for services, such as permit applications and waste disposal fees, during the construction phase will provide limited increased revenue to the Town of Atikokan.

Altogether, the three levels of Government derive considerable revenue from a Project such as proposed. In a 2007 study entitled “The economic impacts of a “Representative Mine” in Ontario” by Peter Dungan and Steve Murphy, it was found that about 33% of the total construction cost ultimately ends up in the hands of Government, through the sources outlined above.

The economic study presented in Appendix 2.II presents an estimate of the revenues that will be accrued by the provincial and federal governments from the construction of the Project. In summary, provincial tax revenues during the 30-month construction phase are $36.2 million and federal tax revenues over this period are $115.5 million, for a combined total tax revenue of $151.7 million over the construction phase. This is a positive effect of the Project.

3.3.1.3.2 Mitigation

Because any measurable effects of the Project on the government finances VEC are positive, no further assessment is conducted and no mitigation is identified or warranted.

3.3.1.3.3 Summary of Residual Effects

Table 3-17: Summary of Effects on Government Finances in the Construction Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Government Finances	Positive effect				

The tax revenues from the Project are a positive effect and they represent a major contribution of more than $150 million to federal and provincial revenues over the 30-month construction phase. The contribution to the Town of Atikokan, though likely small, is also positive and sets the stage for future revenues.

3.3.1.4 Public Services and Infrastructure Valued Ecosystem Component

Interactions between construction phase Project activities and public services and infrastructure are identified in Section 3.2.1.

The public services and infrastructure VEC is assessed using indicators that characterize protection and emergency services, health services, social services, education, recreation, water, wastewater and waste management, and utilities. For the construction phase assessment, these services are assessed collectively with specific reference to any individual services where an adverse effects is anticipated. Effects are limited to the LSA.

3.3.1.4.1 Prediction of Potential Effects in the Construction Phase

The likely effects from these interactions are summarized in Table 3-18 and include the following:

- Management, Permitting and Employment is likely to affect public services and infrastructure in the LSA through increased demand for services and infrastructure resulting from employment-related population change.
- Support and Ancillary Infrastructure is likely to affect public services and infrastructure in the LSA due to requirements for non-hazardous waste management.

Table 3-18: Effects on Public Services and Infrastructure in the Construction Phase

Project Activities	Effect 1	Effect 2
Management, Permitting and Employment	Increased demand for services and infrastructure due to Project employment-related population increase in the LSA.	—
Support and Ancillary Infrastructure	—	Increased demand non-hazardous waste disposal capacity in the LSA.

Notes:
— = No effect.

Public Services and Infrastructure

Employment and related increase in population resulting from Management, Permitting and Employment has the potential to increase demand on public services and infrastructure in the LSA. As identified above, the population during the construction phase is expected to increase by 20 workers, or 54 persons. The description of existing conditions in Section 2.2 shows that all of the public services and infrastructure in the LSA are currently below capacity and could readily accommodate the additional demands of the small increase in population due to the construction phase of the Project. Thus, the construction phase of the Project would have no adverse effect on public services and infrastructure and this indicator is not considered further.

Water, Wastewater and Waste Management

The need to dispose non-hazardous waste in a licensed off-site waste management facility during the construction phase could place additional strain on public waste management infrastructure in the LSA. The capacity of the Town's existing waste management facility is currently nearing its approved limit. If the Project is going to avail of local waste management capacity it will be necessary to expand or replace the Town's existing landfill. This represents a likely adverse effect of the Project and mitigation is required to reduce or eliminate it.

3.3.1.4.2 Mitigation

The Town of Atikokan is currently planning to construct a new waste management facility and is undergoing the permitting process for this facility. OHRG is committed to working with the Town of Atikokan to support the licensing, construction and operation of this new landfill site. The new site should be able to accommodate any construction-related waste from the Project.

3.3.1.4.3 Summary of Residual Effects

No residual effects are anticipated on this VEC pending satisfactory approval and construction of the Town's new waste management facility. Accordingly no further assessment of this likely effect is required.

Table 3-19: Summary of Effects on Public Services and Infrastructure in the Construction Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Public Services and Infrastructure	No adverse effect				
Waste Management	No residual effect after mitigation				

The existing public services and infrastructure in the LSA, including the Town's plans for a new waste management facility, are capable of accommodating the small additional demand from the Project and increased population as a result of the construction phase. Accordingly, no adverse effects are anticipated on this VEC.

3.3.1.5 Housing and Accommodation Valued Ecosystem Component

Interactions between construction phase Project activities and housing and accommodation are identified in Section 3.2.1.

The housing and accommodation VEC is assessed using three indicators: housing supply, occupancy rates, and cost and availability. Housing supply and occupancy rates are discussed together. Effects are limited to the LSA.

3.3.1.5.1 Prediction of Potential Effects in the Construction Phase

The likely effects from these interactions are summarized in Table 3-20 and include the following:

- Management, Permitting and Employment is likely to affect housing and accommodation in the LSA through increased demand resulting from employment-related population increase. No measurable effects are anticipated in the RSA.

Table 3-20: Effects on Housing and Accommodation in the Construction Phase

Project Activities	Effect 1	Effect 2
Management, Permitting and Employment	Increased demand for housing and accommodation due to employment-related increase in population in the LSA	Increase in the cost of existing housing in the LSA

Housing Supply and Occupancy Rates

As described above the predicted population increase in the LSA over the construction phase is 20 workers and their families (total increase = 54 persons). The corresponding housing need is for up to 20 temporary homes, although it is expected that some of these workers will not bring families and will not require family housing. Information in Section 2.2 shows that there is an adequate supply of housing in the LSA to meet the demand resulting from the construction phase direct and indirect workers and their dependants. Accordingly, no adverse effect is anticipated on housing supply as a result of the Project.

Despite the population decline in the LSA over the past 20 years, housing availability in the Town of Atikokan remains limited. The 2006 occupancy rate for private dwellings in Atikokan was 92.4%, representing 108 unoccupied dwellings. This is considered sufficient to house the minor increase in population anticipated for the construction phase; however, the occupancy rate is expected to increase to 94% as a result of the population increase. This increase is assessed to be positive since it represents a reduction in the number of vacant or unoccupied homes in the LSA.

Cost and Availability

A modest increase in the demand for housing might be expected to have a modest effect on the cost of available units. However, the magnitude of the additional demand, no more than 20 units, is unlikely to have an effect other than a minor upward effect on the current cost of housing in the LSA. This effect is assessed as being positive since it will likely to serve to stabilize or increase prices modestly.

3.3.1.5.2 Mitigation

Since any effects on housing and accommodation as a result of the construction phase of the Project are not adverse or are positive no mitigation measures are warranted or identified.

The Atikokan/OHRG Committee identified as part of social management planning could have a role in monitoring and communicating changes to housing supply and demand as a result of the Project.

3.3.1.5.3 Summary of Residual Effects

Table 3-21: Summary of Residual Effects on Housing and Accommodation in the Construction Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Housing supply	No measurable effect				
Occupancy rates	Positive effect				
Cost and availability	Positive effect				

Overall, the effect of the Project on housing and accommodation is positive. The construction phase of the Project is anticipated to result in a small increase in the demand and cost of housing in the LSA which should contribute to the stabilization of the local housing market.

3.3.1.6 Transportation Valued Ecosystem Component

Interactions between construction phase Project activities and transportation are identified in Section 3.2.1.

The transportation VEC is assessed using traffic level of service and volume-capacity ratios on the existing road network. Effects are limited to the LSA.

3.3.1.6.1 Prediction of Potential Effects in the Construction Phase

The likely effects from these interactions are summarized in Table 3-22 and include the following:

- Management, Permitting and Employment; Linear Infrastructure; and Support and Ancillary Infrastructure are likely to affect level of service and safety on local roads in the LSA through the movement of Project workers, equipment, supplies and products.

Table 3-22: Effects on Transportation in the Construction Phase

Project Activities	Effect 1
Management, Permitting and Employment; Linear Infrastructure; and Support and Ancillary Infrastructure	Change in levels of service and volume-capacity ratios at relevant intersections and roads in the LSA.

Levels of Service and Volume-Capacity Ratios

As described in Appendix 2.III, future traffic volumes were considered for the following periods in order to determine the full impacts of the Project:

- Background Traffic – 2016, 2021 and 2028: background traffic is generated for each period by projecting existing counts to the analysis year based on historical growth rates.
- Construction Site Traffic – analyzed to consider the traffic impacts associated with the construction period (2014 - 2016).

In order to consider future traffic conditions, existing counts were projected forward for each period. The traffic growth rates were applied based on consideration of historical traffic data – as shown in Table 3-23.

Table 3-23: Historical Traffic Growth Rates for Projecting Background Traffic

Highway	At	Annual Growth Rate
Highway 11	Highway 11B	0%
Highway 11B	Highway 11	0%
Highway 11B	Highway 622	1%
Highway 622	Highway 11B	2%
Highway 622	Hardtack Road	0%

In addition to the existing traffic, there is potential for increased traffic due to other developments or planned road improvements. The Atikokan Generating Station is projected to see an increase in traffic resulting from their Biomass Re-Fuelling Project. However, according to the Atikokan GS Biomass Re-fuelling Project Traffic Impact Study from March, 2011, the Project is only expected to generate 10 trucks trips in the peak hour. As a result, the effect on the future road network is essentially negligible.

A number of assumptions were developed based on similar mining Traffic Impact Study (TIS) reports and application of engineering judgment. Although the average construction workforce is expected to be 416, the maximum expected workforce of 1,200 was used for this study in order to be more conservative in analyzing impacts on the road network. Trip generation assumptions are illustrated in Table 3-24.

Table 3-24: Assumptions for Trip Generation in the Construction Phase

Generator	Notes	Count	Frequency
Employees	1,200 peak		
Shuttle	80% expected to be shuttled from Thunder Bay	39	Monthly
Personal vehicles	20% expected to commute daily	192	Daily
Food	One 40' trailer / 150 people / week	5	Weekly
Camp	Non-food requirements	5	Weekly
Office	Deliveries, supplies, etc.	5	Daily
Warehouse	Materials	5	Weekly
Chemicals			
Ore processing	Assumed based on other TISs	1	Daily
Explosives	Assumed based on other TISs	2	Daily
Dust suppression	Assumed based on other TISs	1	Weekly
Water purification	Assumed based on other TISs	2	Monthly
Fuel			
Back-up generators	Assumed based on other TISs	1	Weekly
Vehicles	Assumed based on other TISs	2	Daily

Table 3-24: Assumptions for Trip Generation in the Construction Phase (Continued)

Generator	Notes	Count	Frequency
Waste			
General/hazardous waste	To landfill	4	Daily
Rock	Potential to be recycled and used in road construction	5	Daily
Construction			
Materials	Assumed based on other TISs	5,000	Annually
Removal	Assumed based on other TISs	1,500	Annually
Totals	Total Annual	84,891	Year
	Total Daily	233	Day

From this table, it was concluded that the Project is expected to generate about 230 trips/day during the peak of the construction period. Based on the peak hour assumptions, this translates to about 44 vehicles per hour (VPH) in the a.m. and p.m. peak hours during construction.

Network distribution was assumed based on the road layout and common destinations in the area, as illustrated in Appendix 2.III. Two scenarios were developed for trip distribution in the inbound (i.e. into Mine) and outbound directions. The primary scenario (Scenario 1) assumes that all traffic is headed to/originates from south of the Mine at Atikokan (80%) and Highway 11 (20%). In the second scenario (Scenario 2), some traffic originates/heads north on Highway 622 to eventually meet up with Highway 17 (20%). Since 80% of the workforce is projected to fly into Thunder Bay and be bussed to the Project Site, and the remaining 20% is projected to drive from Atikokan, employee traffic to/from the Project Site will rely solely on Highway 622. The production volume at the Mine is not expected to generate a significant amount of truck traffic, so the majority of trips come from employee traffic or supply/Accommodation Camp trucks. As a result, the distribution scenarios show high percentages of traffic to and from Atikokan. The resulting effects predicted on levels of services (LOS) and volume-capacity ratios (V/C) at the relevant intersections and roads (mainlines) of these two scenarios are provided in Tables 3-25 and 3-26.

Table 3-25: Intersection Results for Construction Phase

Location	Scenario 1				Scenario 2			
	AM		PM		AM		PM	
	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Hwy 622 and Hardtack Rd	A	0.03	A	0.04	A	0.02	A	0.02
Hwy 11B and Hwy 622	A	0.12	A	0.18	A	0.12	A	0.17
Hwy 11 and Hwy 11B	A	0.07	A	0.07	A	0.07	A	0.07

The results indicate that all intersections will continue to operate at levels of service ‘A’ and volume-to-capacity ratios less than 0.20.

Table 3-26: Mainline Results in Construction Phase

Route	Location	Scenario 1				Scenario 2			
		AM		PM		AM		PM	
		LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Hardtack Rd	N of Hwy 622	A	0.05	A	0.05	A	0.05	A	0.05
Hwy 622	N of Hwy 11B	A	0.09	B	0.10	A	0.09	B	0.10
Hwy 11B	W of Hwy 622	B	0.10	C	0.15	B	0.10	C	0.15
Hwy 11	E of Hwy 11B	A	0.03	A	0.04	A	0.03	A	0.04

The results indicate that all roads will continue to operate at levels of service 'A' – 'C' and volume-to-capacity ratios less than 0.20.

This level of service is satisfactory and will not result in any traffic congestion or safety-related issues. However, it constitutes a measurable change and may be viewed as an adverse effect by current road users.

3.3.1.6.2 Mitigation

No practicable mitigation measures are identified or required since the level of service and volume-capacity ratios are assessed as being satisfactory. The residual adverse effect of the Project on traffic is assessed for significance below.

3.3.1.6.3 Significance of Residual Effects

The construction phase of the Project is anticipated to result in an increase in traffic in the LSA, resulting in a category 'C' level of service on Highway 11B, and a volume-to-capacity ratio up to 0.18 at Highway 11B and 622. Although these levels are well within acceptable service levels, the significance of this adverse effect is assessed below.

The significance of this adverse effect is assessed using the criteria in Section 3.1. The magnitude of the effect is low because the LOS remains at a category 'C' or lower and V/C remains below 0.5. The geographic extent is medium because the effect is limited to the LSA. Duration is low since the effect occurs during the construction phase. The frequency and degree of reversibility are high since the effect occurs daily and is readily reversible. The result of this significance assessment is provided in Table 3-27. Based on the decision tree in Figure 3-1 the overall assessment of significance of this effect is low.

Table 3-27: Significance Assessment of Residual Effects on Transportation in Construction Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Increased Traffic	Low	Medium	Low	High	High

In summary, there is a minor adverse effect on traffic as a result of the construction phase of the Project. The levels of service and volume-capacity ratios on the LSA road network remain satisfactory and demonstrate that the Project should not result in traffic congestion or safety-related issues during the construction phase.

3.3.1.7 Outdoor Tourism and Recreation Valued Ecosystem Component

Outdoor tourism and recreation is one of seven VECs related to land and resource use. Common to all the assessment of effects on all land and resource use, the assessment is limited to the LSA and no consideration is given to effects in the RSA because they are not anticipated to be measurable.

Interactions between construction phase activities and outdoor tourism and recreation are identified in Section 3.2.1.

The outdoor tourism and recreation VEC is assessed using three indicators: tourism activities, number and type of visitors, and tourism revenues. The Project is not anticipated to change the number and types of visitors to the RSA or LSA, nor change the revenue generated in the RSA and LSA from tourism. Accordingly, the assessment is focused on the changes to use and access to existing recreational opportunities in the LSA.

3.3.1.7.1 Prediction of Potential Effects in the Construction Phase

The likely effects from these interactions are summarized in Table 3-28 and include the following:

- Management, permitting and employment are likely to affect outdoor tourism and recreation through the restriction of site access and disturbance and/or through other indirect pathways identified by other disciplines (air quality and noise, aquatic environment, terrestrial ecology, and visual aesthetics).

Table 3-28: Effects on Outdoor Tourism and Recreation in the Construction Phase

Project Activities	Effect 1
Management, Permitting and Employment	The construction phase of the Project will change the use of and access to land and resources used for tourism and recreation

In addition, Project-induced changes to the physical environment identified in the Atmospheric Environment TSD, Aquatic Environment TSD, Terrestrial Ecology TSD and through visual impact may result in indirect effects on outdoor tourism and recreation as follows:

- Adverse effects on *air quality or noise* may affect the use and enjoyment of lands and resources for recreation and tourism.
- Adverse effects on the *aquatic environment* may affect the use and enjoyment of lands and resources for recreation and tourism.
- Adverse effects on the *terrestrial ecology* may affect the use and enjoyment of lands and resources for recreation and tourism.
- Adverse effects on *visual aesthetics* may affect the use and enjoyment of lands and resources for recreation and tourism.

Where measurable changes have been identified as adverse in these other disciplines, the effects are assessed as indirect effects in this assessment. To be considered as an indirect effect for assessment in the socio-economic assessment, an adverse change must have been identified by the original discipline.

Tourism and Recreational Opportunities

Effects on outdoor tourism and recreation within the LSA can result from both direct effects (e.g., physical disturbance, relocation or removal of land) or indirectly through adverse effects on air quality, noise, aquatic or terrestrial environment or aesthetic effects. Potential direct or indirect changes to existing land uses as a result of the Project will affect recreational opportunities, facilities and businesses located close to the Project. This could include camping opportunities, outfitting businesses, or access to certain sites.

Direct Effects

The direct effects of the Project on the outdoor tourism and recreation resources are adverse effects and are further considered for mitigation and significance. In particular, adverse effects are possible where access to recreational sites is restricted or removed because of Project-related activities. However, practicable mitigation measures are possible to avoid or minimize adverse effects on outdoor tourism and recreation resources.

Effects through Air Quality and Noise

Adverse effects on air quality or noise were considered to potentially affect the use and enjoyment of lands and resources for recreation and tourism. According to the Atmospheric Environment TSD, nine designated campsites and one tourism establishment area need to be restricted access in order to comply with air quality standards. Following this recommended mitigation of restricting access, no residual adverse effect remains.

Effects through Aquatic Environment

Adverse effects on the aquatic environment were considered to potentially affect the use and enjoyment of lands and resources for recreation and tourism. No residual adverse effects of moderate or greater significance have been identified in the Aquatic Environment TSD on species or habitats important to tourism and recreation, and therefore no assessment or mitigation related to indirect effects from the aquatic environment on outdoor tourism and recreation is required.

Effects through Terrestrial Environment

Adverse effects on the terrestrial environment were considered to potentially affect the use and enjoyment of lands and resources for recreation and tourism. No residual adverse effects of moderate or greater significance have been identified in the Terrestrial Ecology TSD on species or habitats important to tourism and recreation, and therefore no assessment or mitigation related to indirect effects from the terrestrial environment on outdoor tourism and recreation is required.

Effects due to Aesthetic Environment

Adverse effects on visual aesthetics were considered to potentially affect the use and enjoyment of lands and resources for recreation and tourism. Results from the visual assessment indicate that effects on the perception of the LSA as a remote, pristine wilderness may negatively affect outdoor tourism and recreation in the LSA (from locations from which the Project is visible). Mitigation measures are provided below.

3.3.1.7.2 Mitigation

Mitigation is required for the adverse effects on outdoor tourism and recreation resources that have been directly affected by the restriction of access to resources used for tourism and recreation. In many cases, similar land or recreational opportunities exist within the LSA or RSA. For example, campsites in proximity to the Project will likely no longer be desirable but could be replaced by similar nearby sites. Accordingly, the Project is not likely to adversely affect the overall camping opportunities for wilderness campers in the LSA and RSA.

In other cases, where there is a potential for a business or recreational opportunity to be affected, an agreement is developed between OHRG and the potentially affected party. An example of this agreement is one with Canada Canoe Outfitters relating to restricted access to certain areas. At the request of both parties, details of this agreement are confidential.

There may be some perception of negative effects on outdoor tourism and recreation due to construction of a mine project in the area, and associated effects on visual aesthetics. However, these negative perceptions can be mitigated by reinforcing the positive outdoor tourism and recreational reputation of the LSA. One example of this is the Atikokan Bass Classic which is a major attraction to fishers of all levels of experience. OHRG has provided sponsorship to this event for several years and is committed to continuing this sponsorship.

The Atikokan/OHRG Committee identified as part of social management planning could have a role in identifying appropriate sponsorship opportunities with the potential to offset any negative perceptions because of the Project.

3.3.1.7.3 Significance of Residual Effects

The significance of this adverse effect is assessed using the criteria in Section 3.1. The magnitude of the effect is low because it not anticipated to reduce the number of tourists or revenue generated by tourism in the LSA by more than 5%. The geographic extent is medium because the effect is limited to the LSA. Duration and reversibility are low since it occurs during the construction phase and the effect is not readily reversible. The frequency is high since the effect occurs continuously. The result of this significance assessment is provided in Table 3-29. Based on the decision tree in Figure 3-1 the overall assessment of significance of this effect is low.

Table 3-29: Significance of Residual Effects on Outdoor Tourism and Recreation in the Construction Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Outdoor Tourism and Recreation	Low	Medium	Low	High	Low

3.3.1.8 Hunting Valued Ecosystem Component

Interactions between construction activities and hunting are identified in Section 3.2.1.

Indicators for the hunting VEC include: wildlife management areas, license sales, and harvest volumes. Common to many land and resource use VECs, effects on hunting may result from both direct effects (e.g., physical disturbance, relocation or removal of land) or indirectly through adverse effects on air quality, noise, aquatic or terrestrial environment or aesthetic effects.

No change is predicted in licence sales or harvest volumes as these are based on government-set quotas and which are not expected to change as a result of the Project. The focus of the assessment is on the change to hunting opportunities in the LSA as a result of changes to wildlife management areas.

3.3.1.8.1 Prediction of Potential Effects in the Construction Phase

The likely direct effects from the Project interactions are summarized in Table 3-30 and include the following:

- Management, Permitting and Employment is likely to affect hunting through the removal of land associated with the restriction of site access, and by increasing hunting pressure through access by Project personnel.

Table 3-30: Effects on Hunting in the Construction Phase

Project Activities	Effect 1
Management, Permitting and Employment	The construction phase of the Project will change the hunting opportunities in the LSA, including use of and access to land used for hunting

In addition, Project-induced changes to the physical environment identified in the Terrestrial Ecology TSD, may result in indirect effects on hunting:

- Residual adverse effects on the *terrestrial ecology* may affect species or habitats important to hunting.

Hunting Opportunities

As noted, the effects on hunting within the LSA can result from both direct effects (e.g., physical disturbance, relocation or removal of land) or indirectly through adverse effects on the terrestrial ecology.

Direct Effects

Within the LSA, the Project is expected to remove 2,063 ha of land from Wildlife Management Unit 12B and Bear Management Areas 12B-014 and 12B-016 that would otherwise have been available for hunting. 2,063 ha represents 0.3% of the total area of Wildlife Management Unit 12B, and 2.0% of the total area of Bear Management Areas 12B-014 and 12B-016. This loss of this resource may result in increasing hunting pressure on similar areas in the LSA. Further pressure on hunting may result from recreational hunting by Project workers residing at the Accommodation Camp. These effects represent an adverse effect of the Project and additional assessment and identification of practicable mitigation measures are required to reduce or avoid entirely the effects of reduced hunting opportunities.

Effects through Terrestrial Environment

No residual adverse effects of moderate or greater significance have been identified in the Terrestrial Ecology TSD on species or habitats important to hunting, and therefore no further assessment or mitigation related to effects on hunting is required.

3.3.1.8.2 Mitigation

The assessment identified the reduction in hunting opportunities by 1) loss of management area, 2) increased hunting pressure on remaining areas, and 3) hunting by Project construction personnel.

As noted above, the amount of area being removed is relatively small (0.3 - 2.0%); there is no practical means of replacing this loss. It remains a residual adverse effect of the Project and is assessed for significance.

Steps may be taken to reduce hunting pressure including the Implementation of a firearms policy to restrict hunting for workers while at the Accommodation Camp.

The residual adverse effect is assessed for significance below.

3.3.1.8.3 Significance of Residual Effects

The significance of this adverse effect is assessed using the criteria in Section 3.1. The magnitude of the effect is low because the amount of land removed is less than 5%. The geographic extent is medium because the effect is limited to the LSA and duration is low since it occurs during the construction phase. The frequency and reversibility are both high since the effect occurs continuously and is reversible. The result of this significance assessment is provided in Table 3-31. Based on the decision tree in Figure 3-1 the overall assessment of significance of this effect is low.

Table 3-31: Significance of Residual Effects on Hunting in the Construction Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Land Use for Hunting	Low	Medium	Low	High	High

3.3.1.9 Trapping Valued Ecosystem Component

Interactions between construction activities and trapping are identified in Section 3.2.1. The indicators used to assess the effects on trapping include: tenured trapline areas, and harvest volumes.

3.3.1.9.1 Prediction of Potential Effects in the Construction Phase

The likely effects from these interactions are summarized in Table 3-32 and include the following:

- Management, Permitting and Employment is likely to affect trapping through the removal and fragmentation of land and through restriction of site access.

No change is predicted in harvest volumes as these are based on government-set quotas and which are not expected to change as a result of the Project. The focus of the assessment is on the change to trapping as a result of changes to tenured trapline areas.

Table 3-32: Effects on Trapping in the Construction Phase

Project Activities	Effect 1
Management, Permitting and Employment	The construction phase of the Project will change the use of and access to land used for trapping

In addition, Project-induced changes to the physical environment identified in the Terrestrial Ecology TSD, may result in indirect effects on trapping as follows:

- Adverse effects on the *terrestrial ecology* may affect species or habitats important to trapping.

Tenured Trapline Areas

As noted, the effects on trapping within the LSA can result from both direct effects (e.g., physical disturbance, relocation or removal of land) or indirectly through adverse effects on the terrestrial ecology.

Direct Effects

Within the LSA, the Project is expected to remove 2,063 ha of land from tenured trapline Areas AT025, AT032, AT039 and AT040 that would otherwise have been available for trapping. 2,063 ha represents 2.0% of the total area of these trapline areas. This effect represents an adverse effect of the Project and additional assessment and identification of practicable mitigation measures are required to reduce or avoid entirely the effects of on reduced trapline areas.

Effects through Terrestrial Ecology

No residual adverse effects of moderate or greater significance have been identified in the Terrestrial Ecology TSD on species or habitats important to trapping, and therefore no further assessment or mitigation related to effects on tenured trapline areas is required.

3.3.1.9.2 Mitigation

Mitigation is required for the adverse effects on tenured trapline areas that have been directly affected by the restriction of site access/removal of land as part of the construction of the Project. The general approach to mitigation is compensation and/or restriction of access based on negotiation with the trapline holders. Negotiations will occur after approval of the EA and after a decision to construct has been made. Satisfactory completion of negotiations will mitigate this effect, and no further consideration is warranted.

3.3.1.10 Fishing Valued Ecosystem Component

Interactions between construction activities and fishing are identified in Section 3.2.1. Fishing is assessed using three indicators: recreational fishing participation; fishing areas, licence sales and harvest volumes; and baitfish areas and harvest volumes. Assessment of direct effects is focused on the alteration of fishing areas in the LSA important to recreational and commercial fishing.

3.3.1.10.1 Prediction of Potential Effects in the Construction Phase

The Project will not result in the removal of any commonly-used fishing areas. Further the Project will not restrict access to any of these areas. Direct negotiation with baitfish harvesters may be required to eliminate effects on these fishers.

Accordingly the Project is not likely to result in any measurable changes or direct effects on fishing. However, there may be indirect effects caused by Project-induced changes to the physical environment identified in the Aquatic Environment TSD.

- Adverse effects on the *aquatic environment* may affect species or habitats important to fishing.

These indirect effects may result from the alteration of fish habitat through changes in water quality or water levels as identified in the Aquatic Environment TSD, Section 3.2.1.

Effects through Aquatic Environment

No residual adverse effects of moderate or greater significance have been identified in the Aquatic Environment TSD on species or habitats important to fishing, and therefore no further assessment or mitigation related to effects on fishing is required.

3.3.1.11 Mining Valued Ecosystem Component

The Project is likely to have a net positive effect on future exploration and development in the mining sector in the study areas, and therefore no mitigation measures or further assessment is required.

3.3.1.12 Forestry Valued Ecosystem Component

Interactions between construction activities and forestry are identified in Section 3.2.1. The assessment is based on the evaluation of a single indicator: timber harvest land base in the LSA.

3.3.1.12.1 Prediction of Potential Effects in the Construction Phase

The potential resulting effects from these interactions are summarized in Table 3-33 and include the following:

- Management, Permitting and Employment is likely to affect forestry through the removal of land associated with the restriction of site access.

Table 3-33: Effects on Forestry in the Construction Phase

Project Activities	Effect 1
Management, Permitting and Employment	The construction phase of the Project will change the use of and access to land used for forestry

In addition, Project-induced changes to the physical environment identified in the Terrestrial Ecology TSD, may result in indirect effects on forestry as follows:

- Adverse effects on the *terrestrial ecology* may affect species or habitats important to forestry.

Timber Harvest Land Base

Direct Effects

Within the LSA, the Project is expected to remove 2,063 ha of land from the Sapawe Forest Management Unit and the Crossroute Forest Management Unit that would otherwise have been available for forestry. 2,063 ha represents 0.2% of the total area of these two forest management units. This effect represents an adverse effect of the Project and additional assessment and identification of practicable mitigation measures are required to reduce or avoid entirely the effects on the timber harvest land base.

Effects through Terrestrial Environment

No adverse effects on forestry species or habitat have been identified in the Terrestrial Ecology TSD, beyond the direct effects identified above. Therefore no further assessment or mitigation related to indirect effects on forestry is required.

3.3.1.12.2 Mitigation

Mitigation will involve discussions between OHRG and Atikokan Forest Products and Abitibi Consolidated, as required and after approval of the EA and a decision to construct has been made. Satisfactory completion of these negotiations should mitigate any adverse effects of the Project on timber harvest land base.

It is noted that OHRG may require forestry licences for the removal of trees from the construction of the Project.

3.3.1.13 Water Use and Access Valued Ecosystem Component

Water use and access is assessed using a single indicator: water use for hydro-electric power and for other industrial and commercial uses. Assessment of direct effects is focused on the predicted changes in use, access and availability of water resources for hydro-electric power for other industrial and commercial uses.

3.3.1.13.1 Prediction of Potential Effects in the Construction Phase

The Hydrology TSD has conducted an assessment of the changes on water levels and flows as a result of constructing the Project. The effect being assessed based on the following:

- Changes in the local hydrology that may affect water use for hydro-electric power for other industrial and commercial uses.

Effects through Hydrology Environment

The Hydrology TSD has conducted an assessment of the changes on water levels and flows as a result of constructing the Project, including changes in the local hydrology that may affect water use for hydro-electric power or for other industrial and commercial uses. As identified in the Hydrology TSD, water use during the construction phase is negligible, and therefore no further assessment on water use and access is required.

3.3.2 Effects Assessment of the Operations Phase

The effects assessment of the operations phase is carried out using the same VECs and indicators as the assessment of the effects of the construction phase. In the best interest of the reader, effort has been taken to avoid repetition were possible. It is assumed, however, that the reader has read the preceding Section 3.3.1 in its entirety.

3.3.2.1 Population and Demographics Valued Ecosystem Component

Interactions between operations phase Project activities and population and demographics are identified in Section 3.2.2.

3.3.2.1.1 Prediction of Potential Effects in the Operations Phase

The likely effects from these interactions are summarized in Table 3-34 and include the following:

- Management, Permitting and Employment is likely to affect population and demographics in the LSA through direct, indirect and induced employment and associated family members. Indirect and induced employment occurs as a result of Project-related expenditures on equipment, materials and services.

Table 3-34: Effects on Population and Demographics in the Operations Phase

Project Activities	Effect 1	Effect 2	Effect 3	Effect 4
Management, Permitting and Employment	Increase in population in LSA	In-migration of workers and their families into the LSA	Change in age and gender ratios in LSA	Change in dependency ratios in LSA

Population Change

An increase in population is expected in the LSA over the operations phase due to direct and indirect employment.

An 11-year (2017 – 2028) operations phase is assumed. While there may be differences from year to year, for the purpose of the assessment annual average employment and expenditure levels are assumed through the entire operations phase.

Table 3-35 provides a summary of the average annual staffing levels anticipated over the 11-year life of mine. Approximately 50% of the total workforce (~275) will be on site during operations at all times (single rotation).

Table 3-35: Average Annual Operations Workforce for the OHRG Project

Component	Staff	Hourly	Total
Mine	51	280	331
Ore Processing	23	77	100
General Services and Administration	61	25	86
Accommodation Camp	4	28	32
Total	~140	~410	~550

Table 3-36 provides a breakdown of the occupations required for the operations phase.

Table 3-36: Operations Workforce Breakdown

Component	Percentage of Workforce
Mining	50%
Ore Processing	25%
Maintenance	10%
Technical	5%
Services and Administration	5%
Management	5%

Figure 3-5 provides the anticipated place-of-residence distribution of the operations workforce. Of the operations workforce, 30% or 165 workers are anticipated to consider the LSA their permanent place-of-residence. It is assumed that half of these workers currently reside in Atikokan. The remainder of the workforce is anticipated to move to Atikokan from elsewhere. It is assumed that these workers would bring average-sized families (2.7 persons/family) with them (StatsCan 2012). The total direct increase in population for the operations phase is 223 persons.

An increase in indirect employment may be expected if a substantial number of business opportunities are realized through new or expanded businesses. The economic assessment (Appendix 2.II) predicts 19 permanent jobs. Assuming half of these workers are current residents and half would move to the Town and have average sized families, the increase in population resulting from growth in supply industries is 26 persons.

The total increase in population for the operations phase is directly or indirectly attributable to the Project is 249 persons (223 direct plus 26 indirect).

The increase in population in the LSA anticipated for the operations phase, compared to existing conditions, is ~9% of the current population of 2,787. This is a positive effect that continues the reverse in population decline begun in the construction phase.

Mobility

Based on StatsCan data, it is anticipated that approximately 36.4% of the population of the LSA would be expected to move residence in a 5-year period. The in-migration of 249 persons or ~9% of the current population during the operations phase is a positive effect as it should offset and likely reverse the out-migration from the LSA.

Age and Gender

The age and gender profile of the LSA is described in Figure 2-3. 92 families moving into the LSA would add some children and working-age persons to the community and it is believed that this will cause a measurable change to the age and gender profile of the LSA. As a result the community would more closely represent the provincial profile. This is a positive effect.

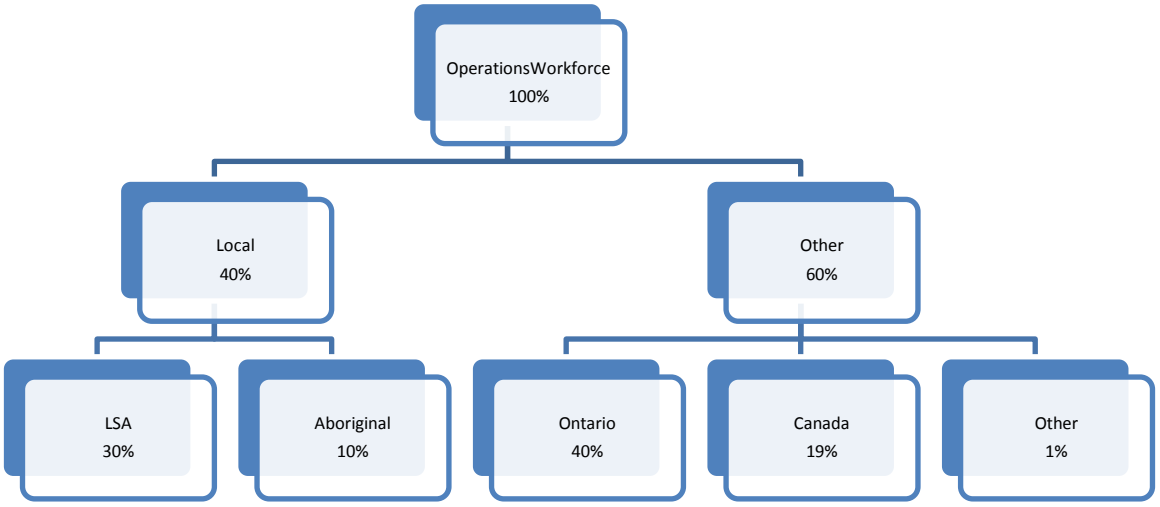


Figure 3-5: Place of Residence Distribution of Operations Workforce

Dependency Ratio

An increase in the working-age population and young families in the LSA during the operations phase may reduce the elderly dependency ratio. The child dependency ratio is not expected to change as a result of the operations phase of the Project, because families would be expected to bring their children if they move to Atikokan. No measurable effect is likely.

3.3.2.1.2 Mitigation

No additional mitigation measures are required because the effects related to population and demographics are either not measurable or positive.

Similar enhancement measures to those suggested for the construction phase (Section 3.3.1.1) are recommended to maximize the number of families that move into Atikokan for the operations phase. Further, the Atikokan/OHRG Committee could continue to have a role in communicating and supporting the initiatives focused on enhancing the Town as a place to live and work.

3.3.2.1.3 Summary of Residual Effects

Likely effects on population change and mobility during the operations phase of the Project are considered to be positive.

Table 3-37: Summary of Residual Effects on Population and Demographics in the Operations Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Population Change	Positive effect				
Mobility	Positive effect				
Age and Gender	Positive effect				
Dependency Ratio	No measurable effect				

In the operations phase there will be an increase of 249 residents (workers and their families) in the LSA due to direct and indirect employment and Project expenditures. This positive effect, which will occur over approximately 11 years, should serve to reverse the population decline in the LSA.

3.3.2.2 Labour Market Valued Ecosystem Component

Interactions between operations phase, Project activities and labour market are identified in Section 3.2.2.

3.3.2.2.1 Prediction of Potential Effects in the Operations Phase

The likely effects from these interactions are summarized in Table 3-38 and include the following:

- Management, Permitting and Employment is likely to affect labour market (employment, income and training) in the LSA and RSA (or province-wide) through the hiring of the operations workforce and through sourcing and obtaining materials and supplies. Changes are anticipated on median income and training and education.

Table 3-38: Effects on Labour Market in the Operations Phase

Project Activities	Effect 1	Effect 2	Effect 3	Effect 4	Effect 5
Management, Permitting and Employment	Change in regional and local supplier base	Change in labour force in the LSA and RSA	Change in employment and unemployment rates in the LSA and RSA	Change in median and total income in the LSA and RSA	Increased opportunities for training of LSA residents

Regional and Local Supplier Base

Total annual operating costs are estimated at $395 million dollars. Total labour costs are estimated at $68 million, or 17% of the total capital expenditure. Of the remaining $327 million, 3% or $9.8 million is anticipated to be spent in the Local Study Area (primarily Atikokan, with some expenditure in Ignace) per year over the operations phase. This is anticipated to create opportunities for the establishment or growth of businesses in Atikokan to supply goods and services for the Project.

The source of operations expenditures for equipment and materials including consumables, energy and fuel, is estimated based on similar projects and professional judgement. Figure 3-6 provides the anticipated geographic distribution of operations expenditures.

This is a positive effect that builds on and amplifies the positive effects on LSA economic activity begun during the construction phase.

Similar to the construction phase, direct expenditures during operations of $119 million in the rest of Ontario including the RSA and $99 million in the rest of Canada will make a positive contribution to the regional, provincial and national economy.

Labour Force

Measurable changes in labour force during the operations phase will be seen primarily in the LSA and somewhat in the RSA. The focus of this assessment is on the effects in the LSA.

As described above, an increase in the LSA workforce of 184 (165 direct plus 19 indirect) is expected in the operations phase. The remaining workforce (385 direct) will reside at the Accommodation Camp and will live in the RSA and elsewhere in Ontario or Canada. Based on Statistics Canada multiplier the Project results in an additional 1,720 indirect and induced jobs spread over the RSA, Ontario and Canada as a whole. This is a positive effect of the Project.

The labour force in the LSA is 1,650 persons [StatsCan 2007]. The addition of 184 full-time equivalent (FTE) jobs in the LSA will be split primarily among Agriculture and Other Resource-Based Industries (approximately 50% of the additional workforce or 92 FTEs), Manufacturing (15% or 28 FTEs), Other Services (15% or 28 FTEs), Construction (approximately 10% of the added workforce or 18 FTEs) and Retail Trade (10% or 18 FTEs) based on the breakdowns provided in Table 3-36. This increases the proportion of the workforce in Agriculture and other resource-based industries from 11% to 14.9% (36% increase), which bounds the effects on all other industries. This is a positive effect of the Project, providing new long-term employment opportunities in the LSA.

Employment and Unemployment

Measurable changes in employment and unemployment rates during the operations phase will be most evident in the LSA.

Of the 184 FTE created by the operations phase in the LSA it is assumed that 25% of these workers (46 FTE) are previously unemployed in Atikokan. Another 92 persons are assumed to move into the community and be employed. This would increase the number of employed persons from 1,520 (56.8% employment rate) to approximately 1,758 (61.5% employment rate) and reduce the number of unemployed persons from 150 (9.0% unemployment rate) to approximately 104 (5.9% unemployment rate). This is a positive effect continuing the reduction in the unemployment rate begun in the construction phase, and bringing the LSA close to the provincial average.

Median Incomes

Similar to the construction phase, the Project will continue to have a positive effect on median incomes by bringing higher-paying jobs to the Town and decreasing the dependence on the public or service sectors.

This is positive effect.

Education and Training

The educational requirements for mine workers are continuing to increase. Most jobs require high-school diploma with many requiring post-secondary trades or academic qualification. Accordingly, the Project may be expected to result in increased demand and opportunities in education and training. Although training opportunities within the LSA are limited, the opportunities in the RSA are extensive. These include Lakehead University and Confederation College. The Project provides an opportunity for these educational organizations to offer skills training to people in the LSA and RSA.

3.3.2.2.2 Mitigation

Because any measurable effects of the Project on the labour force VEC are positive, no further assessment is required.

The positive aspects of the Project could be enhanced through cooperation between OHRG and post-secondary organizations in the RSA by encouraging and focusing training of local residents to better equip them for possible employment with the Project.

3.3.2.2.3 Summary of Residual Effects

Table 3-39: Summary of Residual Effects for Labour Market in the Operations Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Regional and local suppliers	Positive effect				
Labour force	Positive effect				
Employment and unemployment rates	Positive effect				
Income	Positive effect				
Education and training	Opportunity for enhancement				

In summary, effects on labour force are positive. The provision of 550 new direct jobs and 1,739 other jobs associated with the Project is a positive effect. Of these, 184 of the direct jobs and 19 of the indirect jobs are predicted to be in the LSA. These are largely permanent jobs paying above-average salary.

3.3.2.3 Government Finances Valued Ecosystem Component

Interactions between operations phase Project activities and government finances are identified in Section 3.2.2.

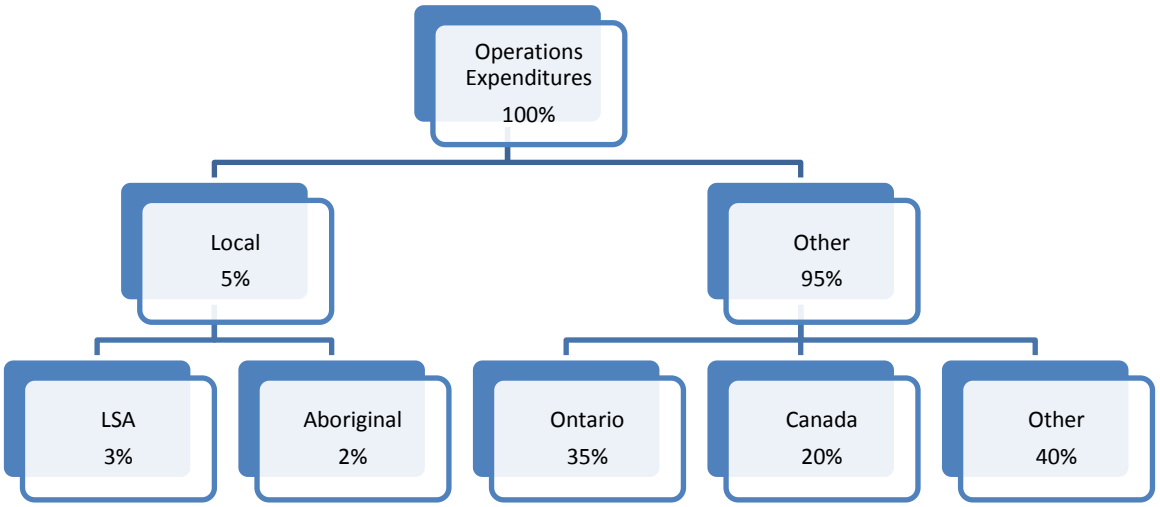


Figure 3-6: Distribution of Operations Expenditures

3.3.2.3.1 Prediction of Potential Effects in the Operations Phase

The potential resulting effects from these interactions are summarized in Table 3-40 and include the following:

- Management, Permitting and Employment is likely to affect government finances through additional tax revenue to the Government of Canada, Government of Ontario and Municipal Government (Town of Atikokan).

Table 3-40: Effects on Government Finances in the Operations Phase

Project Activities	Effect 1
Management, Permitting and Employment	Increase in government revenue

Government Revenues

Government Finance will benefit from the operation of the Project at three levels: Federal, Provincial and Municipal, as identified in Section 3.3.1.

Because the Project is located in the Unorganized District of Rainy River, there will be no Project-specific property taxes that will accrue to the nearest municipality of the Town of Atikokan. However, inasmuch as the Project causes residential and other construction in the Town to increase, the assessment levied on such additional construction will increase the financial base of the Town. The extent of additional construction in the Town depends to some degree on current vacancy rates and suitability of existing structures to accommodate new demand. However, given an estimated overall permanent population increase of 249 persons or 92 households, it is not unreasonable to expect that some additional houses will be constructed in the town

(assume 46 to accommodate half the increase in households, while the other half will find housing in the existing stock).

The current number of occupied dwellings in Atikokan is 1,420. Forty-six new houses represent an increase of 3.24% in the housing stock. New housing will have an assessed value that is considerably higher than the current average assessment per house. Using a tax rate of 1.0%, and an assessed value of new houses of $180,000, the annual property taxes collected from 46 new houses will be $82,800. There will also be an increase in taxation from new businesses and user fees for services; both are difficult to quantify.

Altogether, the three levels of Government derive considerable revenue from a Project such as proposed. In a 2007 study entitled "The economic impacts of a "Representative Mine" in Ontario" by Peter Dungan and Steve Murphy, it was found that about 31% of the total mine output/sales ultimately ends up in the hands of Government, through the sources outlined above.

The economic study presented in Appendix 2.II presents an estimate of the revenues that will be accrued by the provincial and federal governments from the operations of the Project. In summary, annual provincial income tax revenues during the operations phase are $12.7 million and annual federal income tax revenues are $18.1 million, for a combined total income tax revenue over the 11-year operations phase of $339.1 million. This is a positive effect of the Project.

3.3.2.3.2 Mitigation

Because any measurable effects of the Project on the government finances VEC are positive, no further assessment is conducted and no mitigation is identified or warranted.

3.3.2.3.3 Summary of Residual Effects

Table 3-41: Summary of Residual Effects for Government Finances in the Operations Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Government Finances	Positive effect				

The tax revenues from the Project are a positive effect and they represent a major contribution of approximately $340 million to federal and provincial revenues over the 11-year operations phase. The contribution to the Town of Atikokan, though likely small, is also positive and continues the revenue growth begun during the construction phase.

3.3.2.4 Public Services and Infrastructure Valued Ecosystem Component

Interactions between operations phase Project activities and public services and infrastructure are identified in Section 3.2.2. Effects are limited to the LSA.

3.3.2.4.1 Prediction of Potential Effects in the Operations Phase

The likely effects from these interactions are summarized in Table 3-42 and include the following:

- Management, Permitting and Employment is likely to affect public services and infrastructure in the LSA through increased use and requirements for services and infrastructure resulting from employment-related population change.

- Support and Ancillary Infrastructure is likely to affect public services and infrastructure in the LSA due to requirements for non-hazardous waste management.

Table 3-42: Effects on Public Services and Infrastructure in the Operations Phase

Project Activities	Effect 1	Effect 2
Management, Permitting and Employment	Increased demand for services and infrastructure due to project employment-related population increase in the LSA	—
Support and Ancillary Infrastructure	—	Increased demand for non-hazardous waste disposal capacity in the LSA

Notes:
— = No effect.

Public Services and Infrastructure

Employment and related increase in population resulting from management, permitting and employment has the potential to increase demand on public services and infrastructure in the LSA. The population during the operations phase is expected to increase by 92 workers, or 249 persons. The description of existing conditions in Section 2.2.4 shows that all of the public services and infrastructure in the LSA are currently below capacity and could readily accommodate the additional demands of the small increase in population due to the operations phase of the Project. Thus, the operations phase of the Project would have no adverse effect on public services and infrastructure and this indicator is not considered further.

Water, Wastewater and Waste Management

As described above, if the Project is going to use local waste management, it will be necessary to expand or replace the Town's existing landfill. Because this effect is assessed in Section 3.3.1, no further assessment is required.

3.3.2.4.2 Mitigation

Mitigation is described in Section 3.3.1. No further mitigation or assessment is identified or warranted.

3.3.2.4.3 Summary of Residual Effects

No residual effects are anticipated on this VEC pending satisfactory approval and construction of the Town's new waste management facility. Accordingly no further assessment of this likely effect is required.

Table 3-43: Summary of Effects on Public Services and Infrastructure in the Operations Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Public Services and Infrastructure	No adverse effect				
Waste Management	No residual effect after mitigation				

The existing public services and infrastructure in the LSA, including the Town's plans for a new waste management facility, are capable of accommodating the small additional demand from the Project and increased population as a result of the operations phase. Accordingly, no adverse effects are anticipated on this VEC.

3.3.2.5 Housing and Accommodation Valued Ecosystem Component

Interactions between operations phase Project activities and housing and accommodation are identified in Section 3.2.2.

3.3.2.5.1 Prediction of Potential Effects in the Operations Phase

The likely effects from these interactions are summarized in Table 3-44 and include the following:

- Management, Permitting and Employment is likely to affect housing and accommodation in the LSA through increased demand resulting from employment-related population increase. No measurable effects are anticipated in the RSA.

Table 3-44: Effects on Housing and Accommodation in the Operations Phase

Project Activities	Effect 1	Effect 2
Management, Permitting and Employment	Increased demand for housing and accommodation due to employment-related increase in population in the LSA	Increase in the cost of existing housing in the LSA

Housing Supply and Occupancy Rates

The predicted population increase in the LSA over the operations phase is 92 workers and their families (total increase = 249 persons). The corresponding housing need is for up to 92 permanent homes, although it is expected that some of these workers will not bring families and will not require permanent housing.

Despite the population decline in the LSA over the past 20 years, housing availability in the Town of Atikokan remains limited. The 2006 occupancy rate for private dwellings in Atikokan was 92.4%, representing 108 unoccupied dwellings. Some of the available housing stock is expected to be below acceptable standard. This is not considered sufficient to house the increase in population anticipated for the operations phase. It is assumed that 46 new houses will be required to accommodate the operations workforce. However, there is capacity within the Town of Atikokan for residential housing development of this scale and new housing construction would be a positive effect.

Cost and Availability

A modest increase in the demand for housing might be expected to have a modest effect on the cost of available units. However, the magnitude of the additional demand, approximately 46 units, is unlikely to have an effect other than a minor upward impact on the current cost of housing in the LSA. This effect is assessed as being positive since it will likely serve to stabilize or increase prices modestly.

3.3.2.5.2 Mitigation

Since any effects on housing and accommodation as a result of the operations phase of the Project are not adverse or are positive no mitigation measures are identified or warranted.

3.3.2.5.3 Summary of Residual Effects

Table 3-45: Summary of Residual Effects on Housing and Accommodation in the Operations Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Housing Availability	No measurable effect				
Occupancy Rates	Positive effect				
Cost and Availability	Positive effect				

Overall, the effect of the Project on housing and accommodation is positive. The operations phase of the Project is anticipated to result in a small increase in the demand and cost of housing in the LSA which should contribute to the stabilization of the local housing market.

3.3.2.6 Transportation Valued Ecosystem Component

Interactions between operations phase Project activities and Transportation are identified in Section 3.2.2. Effects are limited to the LSA.

3.3.2.6.1 Prediction of Potential Effects in the Operations Phase

The likely effects from these interactions are summarized in Table 3-46 and include the following:

- Management, Permitting and Employment; Linear Infrastructure; and Support and Ancillary Infrastructure are likely to affect level of services and safety on local roads through the movement of Project workers, equipment, supplies and products.

Table 3-46: Effects on Transportation in the Operations Phase

Project Activities	Effect 1
Management, Permitting and Employment; Linear Infrastructure; and Support and Ancillary Services	Change in levels of service and volume-capacity ratios at relevant intersections and roads in the LSA.

Level of Service and Volume-Capacity Ratios

As described in Appendix 2.III, future traffic volumes were considered for the following periods in order to determine the full impacts of the Project:

- Background Traffic – 2016, 2021 and 2028: background traffic is generated for each period by projecting existing counts to the analysis year based on historical growth rates.
- Operations Traffic – analyzed to consider the traffic impacts associated with the operations period (2021 and 2028).

In order to consider future traffic conditions, existing counts were projected forward for each period. The traffic growth rates were applied based on consideration of historical traffic data.

A number of assumptions were developed based on similar mining Traffic Impact Study (TIS) reports and application of engineering judgment. Trip generation assumptions for the operations phase are illustrated in Table 3-47.

Table 3-47: Assumptions for Trip Generation in the Operations Phase

Generator	Notes	Count	Frequency
Employees	550 average		
Shuttle	80% expected to be shuttled from Thunder Bay	18	Weekly
Personal vehicles	20% expected to commute daily	88	Daily
Gold Transport	1,140 oz per day	2	Weekly
Food	One 40' trailer / 150 people / week	4	Weekly
General Supplies			
Camp	Non-food requirements	3	Weekly
Office	Deliveries, supplies, etc.	5	Daily
Warehouse	Materials	5	Weekly
Chemicals			
Ore processing	Assumed based on other TISs	1	Daily
Explosives	Assumed based on other TISs	2	Daily
Dust suppression	Assumed based on other TISs	1	Weekly
Water purification	Assumed based on other TISs	2	Monthly
Fuel			
Back-up generators	Assumed based on other TISs	1	Weekly
Vehicles	Assumed based on other TISs	2	Daily
Waste			
General/hazardous waste	To landfill	2	Daily
Rock	Potential to be recycled and used in road construction	2	Daily
Infrastructure			
Maintenance	Assumed based on other TISs	1	Monthly
Repairs	Assumed based on other TISs	2	Monthly
Inspection	Assumed based on other TISs	3	Annually
Totals	Total Annual	39,061	Year
	Total Daily	108	Day

From this table, it was concluded that the project is expected to generate about 110 trips/day during the operations period. Based on the peak hour assumptions, this translates to about 20 VPH in the a.m. and p.m. peak hours during operations.

Network distribution was assumed based on the road layout and common destinations in the area, as illustrated in Appendix 2.III. Two scenarios were developed for trip distribution in the inbound (i.e., into M) and outbound directions. The primary scenario (Scenario 1) assumes that all traffic is headed to/originates from south of the M at Atikokan (80%) and Highway 11 (20%). In the second scenario (Scenario 2), some traffic originates/heads

north on Highway 622 to eventually meet up with Highway 17 (20%). Since 80% of the workforce is projected to fly into Thunder Bay and be bussed to the Project site, and the remaining 20% is projected to drive from Atikokan, employee traffic to/from the Project site will rely solely on Highway 622. The production volume at the Mine is not expected to generate a significant amount of truck traffic, so the majority of trips come from employee traffic or supply/Accommodation Camp trucks. As a result, the distribution scenarios show high percentages of traffic to and from Atikokan. The resulting effects predicted on levels of services (LOS) and volume-capacity ratios (V/C) at the relevant intersections and roads (mainlines) of these two scenarios are provided in Tables 3-48 and 3-49.

Effects were estimated for the years 2021 and 2028. Because effects are more pronounced for the year 2028 due to increased projected background traffic levels, this year is used for purposes of the effects assessment.

Table 3-48: Intersection Results in Operations Phase (2028)

Location	Scenario 1				Scenario 2			
	AM		PM		AM		PM	
	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Hwy 622 and Hardtack Rd	A	0.02	A	0.02	A	0.02	A	0.02
Hwy 11B and Hwy 622	A	0.15	B	0.20	A	0.14	B	0.20
Hwy 11 and Hwy 11B	A	0.07	A	0.07	A	0.07	A	0.07

The results indicate that all intersections will continue to operate at levels of service ‘A’ or ‘B’ and volume-to-capacity ratios less than or equal to 0.20.

Table 3-49: Mainline Results in Operations Phase (2028)

Route	Location	Scenario 1				Scenario 2			
		AM		PM		AM		PM	
		LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Hardtack Rd	N of Hwy 622	A	0.02	A	0.02	A	0.02	A	0.02
Hwy 622	N of Hwy 11B	B	0.09	B	0.11	B	0.09	B	0.10
Hwy 11B	W of Hwy 622	B	0.12	C	0.16	B	0.12	C	0.15
Hwy 11	E of Hwy 11B	A	0.03	A	0.04	A	0.03	A	0.04

The results indicate that all intersections will continue to operate at levels of service ‘A’ – ‘C’ and volume-to-capacity ratios less than 0.20. This level of service is satisfactory and will not result in any traffic congestion or safety-related issues. However, it constitutes a measurable change and may be viewed as an adverse effect by current road users.

3.3.2.6.2 Mitigation

No practicable mitigation measures are identified or required since the level of service is assessed as being satisfactory. The residual adverse effect of the Project on traffic is assessed for significance below.

3.3.2.6.3 Significance of Residual Effects

The operations phase of the Project is anticipated to result in a slight increase in traffic in the LSA, resulting in a level of service as high as 'C' on Highway 11B, and a volume-to-capacity ratio as high as 0.20 at Highway 11B and 622. Although these levels are well within acceptable service levels, the significance of this adverse effect is assessed in Table 3-51.

The significance of this adverse effect is assessed using the criteria in Tables 3-1 and 3-2. The magnitude of the effect is low because the LOS remains at a category 'C' or lower and V/C remains below 0.5. The geographic extent is medium because the effect is limited to the LSA. Reversibility is high since the effect is readily reversible. Duration is medium because the effect occurs during the operations phase. The frequency is high since the effect occurs daily. The result of this significance assessment is provided in Table 3-50. Based on the decision tree in Figure 3-1 the overall assessment of significance of this effect is low.

Table 3-50: Significance Assessment of Residual Effects on Transportation in the Operations Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Increased Traffic	Low	Medium	Medium	High	High

In summary, there is a minor adverse effect on traffic level of service as a result of the operations phase of the Project. The levels of service on the LSA road network remain satisfactory and the analysis demonstrates that the Project should not result in traffic congestion or safety-related issues during the operations phase.

3.3.2.7 Outdoor Tourism and Recreation Valued Ecosystem Component

Outdoor tourism and recreation is one of seven VECs related to land and resource use. Common to all the assessment of effects on all land and resource use, the assessment is limited to the LSA and no consideration is given to effects in the RSA because they are not anticipated to be measurable. Generally, direct effects of the Project on land and resource use occur during the construction phase when access to, or use of, land is restricted by Project activities.

Interactions between operations phase activities and outdoor tourism and recreation are identified in Section 3.2.2. The Project is not anticipated to change the number and types of visitors to the RSA or LSA, nor change the revenue generated in the RSA and LSA from tourism. Accordingly, the assessment is focussed on the changes to use and access to tourism and recreational opportunities in the LSA.

3.3.2.7.1 Prediction of Potential Effects in the Operations Phase

The likely effects from these interactions are summarized in Table 3-51 and include the following:

- Management, Permitting and Employment is likely to affect outdoor tourism and recreation through the restriction of site access and disturbance and/or through other indirect pathways identified by other disciplines (air quality and noise, aquatic environment, terrestrial ecology, and visual aesthetics).

Table 3-51: Effects on Outdoor Tourism and Recreation in the Operations Phase

Project Activities	Effect 1
Management, Permitting and Employment	The operations phase of the Project will change the use of and access to land and resources used for tourism and recreation

In addition, Project-induced changes to the physical environment identified in the Atmospheric Environment TSD, Aquatic Environment TSD, Terrestrial Ecology TSD and through visual impact may result in indirect effects on outdoor tourism and recreation as follows:

- Adverse effects on *air quality or noise* may affect the use and enjoyment of lands and resources for recreation and tourism.
- Adverse effects on the *aquatic environment* may affect the use and enjoyment of lands and resources for recreation and tourism.
- Adverse effects on the *terrestrial ecology* may affect the use and enjoyment of lands and resources for recreation and tourism.
- Adverse effects on *visual aesthetics* may affect the use and enjoyment of lands and resources for recreation and tourism.

Where measurable changes have been identified as adverse in these other disciplines, the effects are assessed as indirect effects in this assessment. To be considered as an indirect effect for assessment in the socio-economic assessment, an adverse effect must have been identified by the original discipline.

Recreational Opportunities

Those resources identified to have been directly affected by the restriction of site access/removal of land (2,063 ha) for the purposes of recreation and tourism have been assessed in Section 3.3.1.7, and are not assessed further.

Effects through Air Quality and Noise

Adverse effects on air quality or noise were considered to potentially affect the use and enjoyment of lands and resources for recreation and tourism. The adverse effect can be mitigated through continuing the restriction of access to the specific sites identified in the construction phase.

Effects through Aquatic Environment

No adverse effects of moderate or greater significance have been identified in the Aquatic Environment TSD on species or habitats important to tourism and recreation, and therefore no assessment or mitigation related to indirect effects from the aquatic environment on outdoor tourism and recreation is required.

Effects through Terrestrial Environment

No residual adverse effects of moderate or greater significance have been identified in the Terrestrial Ecology TSD on species or habitats important to tourism and recreation, and therefore no assessment or mitigation related to indirect effects from the terrestrial environment on outdoor tourism and recreation is required.

Effects due to Aesthetic Environment

Adverse effects on visual aesthetics may affect the use and enjoyment of lands and resources for recreation and tourism. Negative perception-related effects on the LSA as a pristine wilderness destination are likely to be experienced through adverse effects on visual aesthetics. Mitigation measures are previously described for the construction phase, and no further assessment is warranted.

3.3.2.7.2 Mitigation

Mitigation required for the adverse effects on outdoor tourism and recreation resources that have been directly affected by the restriction of site access/removal of land are identified as part of the construction phase effects assessment and are not discussed further.

3.3.2.7.3 Significance of Residual Effects

The significance of this adverse effect is assessed using the criteria in Section 3.1. The magnitude of the effect is low because it not anticipated to reduce the number of tourists or revenue generated by tourism in the LSA by more than 5%. The geographic extent is medium because the effect is limited to the LSA. Duration is medium since it occurs during the operations phase. The frequency is high since the effect occurs continuously and reversibility is low because the effect is not readily reversible. The result of this significance assessment is provided in Table 3-52. Based on the decision tree in Figure 3-1 the overall assessment of significance of this effect is low.

Table 3-52: Significance of Residual Effects on Outdoor Tourism and Recreation in the Construction Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Outdoor Tourism and Recreation	Low	Medium	Low	High	Low

3.3.2.8 Hunting Valued Ecosystem Component

Interactions between operations activities and hunting are identified in Section 3.2.2. Common to many land and resource use VECs, effects on hunting may result from both direct effects (e.g., physical disturbance, relocation or removal of land) or indirectly through adverse effects on air quality, noise, aquatic or terrestrial environment or aesthetic effects.

No change is predicted in licence sales or harvest volumes as these are based on government-set quotas and which are not expected to change as a result of the Project. The focus of the assessment is on the change to hunting opportunities as a result of changes to wildlife management areas and increased hunting pressure.

3.3.2.8.1 Prediction of Potential Effects in the Operations Phase

The likely direct effects from these interactions are summarized in Table 3-53 and include the following:

- Management, Permitting and Employment is likely to affect hunting through the removal of land associated with the restriction of site access.

Table 3-53: Effects on Hunting in the Operations Phase

Project Activities	Effect 1
Management, Permitting and Employment	The operations phase of the Project will create little change in hunting opportunities in the LSA, although there will be a small reduction in land available for hunting and increased hunting pressure

In addition, Project-induced changes to the physical environment identified in the Terrestrial Ecology TSD, may result in indirect effects on hunting:

- Residual adverse effects on the *terrestrial ecology* may affect species or habitats important to hunting.

Hunting Opportunities

Direct Effects

Direct effects on hunting within the LSA from the removal of land and restriction of site access are considered and assessed in Section 3.3.1.8. Therefore no further discussion is warranted.

Effects through Terrestrial Environment

No residual adverse effects of moderate or greater significance have been identified in the Terrestrial Ecology TSD on species or habitats important to hunting, and therefore no further assessment or mitigation related to effects on hunting is required.

3.3.2.8.2 Mitigation

Mitigation to reduce impacts on hunting for residents and tourists was identified in Section 3.3.1.8, and not discussed further.

3.3.2.8.3 Significance of Residual Effects

The significance of this adverse effect is assessed using the criteria in Tables 3-1 and 3-2. The magnitude of the effect is low because the amount of land removed is less than 5%. The geographic extent is medium since the effect is limited to the LSA. Duration is medium because the effect occurs during the operations phase. The frequency and reversibility are both high since the effect occurs continuously and is readily reversible. The result of this significance assessment is provided in Table 3-54. Based on the decision tree in Figure 3-1 the overall assessment of significance of this effect is low.

Table 3-54: Significance of Residual Effects on Hunting in the Operations Phase

Effect	Magnitude	Geographic extent	Duration	Frequency	Reversibility
Land Use for Hunting	Low	Medium	Medium	High	High

3.3.2.9 Trapping Valued Ecosystem Component

Interactions between operations activities and trapping are identified in Section 3.2.2.

3.3.2.9.1 Prediction of Potential Effects in the Operations Phase

The likely effects from these interactions are summarized in Table 3-55 and include the following:

- Management, Permitting and Employment is likely to affect trapping through the removal of land associated with the restriction of site access.

No change is predicted in harvest volumes as these are based on government-set quotas and which are not expected to change as a result of the Project. The focus of the assessment is on the change to trapping as a result of changes to tenured trapline areas.

Table 3-55: Effects on Trapping in the Operations Phase

Project Activities	Effect 1
Management, Permitting and Employment	The operations phase of the Project will change the use of and access to land used for trapping

In addition, Project-induced changes to the physical environment identified in the Terrestrial Ecology TSD, may result in effects on trapping as follows:

- Adverse effects on the *terrestrial ecology* may affect species or habitats important to trapping.

Tenured Trapline Areas

Direct Effects

Direct effects on hunting within the LSA from the removal of land or restriction of site access are considered and assessed in Section 3.3.1.9. No further assessment is warranted.

Effects through Terrestrial Environment

No residual adverse effects of moderate or greater significance have been identified in the Terrestrial Ecology TSD on species or habitats important to trapping, and therefore no further assessment or mitigation related to effects on tenured trapline areas is required.

3.3.2.9.2 Mitigation

Mitigation required for the adverse effects on trapping due to the restriction of site access/removal of land are identified as part of the construction phase effects assessment and are not discussed further.

3.3.2.10 Fishing Valued Ecosystem Component

Assessment of direct effects on fishing is focused on the alteration of fishing areas important to recreational and commercial fishing. As described in Section 3.3.1.10, no direct effects on fishing are anticipated.

3.3.2.10.1 Prediction of Potential Effects in the Operations Phase

Project-induced changes to the physical environment identified in the Aquatic Environment TSD may result in effects on fishing as follows:

- Adverse effects on the *aquatic environment* may affect species or habitats important to fishing.

Effects through Aquatic Environment

No residual adverse effects resulting from the alteration of fish habitat through changes in water quality or water were identified in the Aquatic Environment TSD that would have an adverse effect on fishing in the LSA. No further assessment on fishing is required.

3.3.2.11 Mining Valued Ecosystem Component

As described in Section 3.3.1.11, no further assessment of effects on mining is warranted.

3.3.2.12 Forestry Valued Ecosystem Component

Interactions between operations activities and forestry are identified in Section 3.2.2.

3.3.2.12.1 Prediction of Potential Effects in the Operations Phase

The likely effects from these interactions are summarized in Table 3-56 and include the following:

- Management, Permitting and Employment is likely to affect forestry through the removal of land associated with the restriction of site access.

Table 3-56: Effects on Forestry in the Operations Phase

Project Activities	Effect 1
Management, Permitting and Employment	The operations phase of the Project will change the use of and access to land used for forestry

In addition, Project-induced changes to the physical environment identified in the Terrestrial Ecology TSD, may result in effects on forestry as follows:

- Adverse effects on the *terrestrial ecology* may affect species or habitats important to forestry.

Timber Harvest Land Base

Direct Effects

The direct effect of land removal or restriction of site access on forestry is described in Section 3.3.1.12, and no further assessment is warranted.

Effects through Terrestrial Environment

No residual adverse effects on forestry species or habitat have been identified in the Terrestrial Ecology TSD, beyond the direct effects identified above. Therefore no further assessment or mitigation related to indirect effects on forestry is required.

3.3.2.12.2 Mitigation

Mitigation required for the adverse effects on forestry due to the restriction of site access/removal of land are identified as part of the construction phase effects assessment and is not discussed further.

3.3.2.13 Water Use and Access Valued Ecosystem Component

Water use and access is assessed using a single indicator: water use for hydro-electric power and for other industrial and commercial uses.

3.3.2.13.1 Prediction of Potential Effects in the Operations Phase

Assessment of direct effects is focused on the predicted changes in use, access and availability of water resources for hydro-electric power for other industrial and commercial uses. The Hydrology TSD has conducted an assessment of the changes on water levels and flows as a result of operating the Project. The effect being assessed is:

- Changes in the local hydrology that may affect water use for hydro-electric power for other industrial and commercial uses.

Effects through Hydrology

Predicted changes in flows as a result of the Project, for example at Raft Lake Dam, are not measurable compared to annual variability, and are therefore unlikely to affect downstream water users for hydroelectricity or other commercial or industrial uses. Any minor changes in water levels and flows could be accommodated by minor changes in reservoir management procedures. Discussions will be carried out with water users and regulators, as appropriate. No further assessment is required.

3.3.3 Effects Assessment of the Closure and Post-Closure Phases

The effects assessment of the closure and post-closure phases is carried out using the same VECs and indicators as the assessment of the effects of the construction and operations phases. In the best interest of the reader, the discussion of the closure and post-closure phase is presented together, and effort has been taken to avoid repetition were practicable. It is assumed, however, that the reader has read the preceding Sections 3.3 and 3.4 in their entirety.

3.3.3.1 Population and Demographics Valued Ecosystem Component

Interactions between closure and post-closure phase Project activities and population and demographics are identified in Sections 3.2.3 and 3.2.4.

3.3.3.1.1 Prediction of Potential Effects in Closure and Post-Closure Phase

Although Management, Permitting and Employment is likely to affect Population and Demographics through changes to workforce requirements, any changes from existing conditions expected during the closure and post-closure phases are bounded by the construction and operations phases, which have greater workforce requirements. Further no adverse effects compared to existing conditions are anticipated for the closure and post-closure phases.

3.3.3.1.2 Summary of Residual Effects

No residual effects on populations and demographics compared to existing conditions are anticipated as a result of the closure or post-closure phases of the Project.

3.3.3.2 Labour Market Valued Ecosystem Component

Interactions between closure and post-closure phase Project activities and labour market are identified in Sections 3.2.3 and 3.2.4.

3.3.3.2.1 Prediction of Potential Effects in the Closure and Post-Closure Phase

Although Management, Permitting and Employment is likely to affect the labour market through changes to workforce requirements, any changes from existing conditions are bounded by the construction and operations Phases, which have greater workforce requirements.

3.3.3.2.2 Summary of Residual Effects

No residual effects on labour market are anticipated as a result of the closure or post-closure phases of the Project.

3.3.3.3 Government Finance Valued Ecosystem Component

3.3.3.3.1 Prediction of Potential Effects in the Closure and Post-Closure Phase

Effects on government finances during the closure and post-closure phases are beneficial, and will be bounded by effects during the construction and operations phases. No further assessment or mitigation is required.

3.3.3.4 Housing and Accommodation Valued Ecosystem Component

The effects of the closure and post-closure phases on housing and accommodation are expected to be bounded by effects during the construction and operations Phases. No further assessment or mitigation is required.

3.3.3.5 Transportation Valued Ecosystem Component

3.3.3.5.1 Prediction of Potential Effects in the Closure and Post-Closure Phase

Effects on traffic and transportation during the closure and post-closure phases are expected to be bounded by effects during the construction and operations phases. No further assessment or mitigation is required.

3.3.3.6 Outdoor Tourism and Recreation Valued Ecosystem Component

3.3.3.6.1 Prediction of Potential Effects in the Closure and Post-Closure Phase

Effects on outdoor tourism and recreation during the closure and post-closure phases are bounded by effects predicted during the construction and operations phases, and therefore no further assessment or mitigation measures are required.

3.3.3.7 Hunting Valued Ecosystem Component

3.3.3.7.1 Prediction of Potential Effects in the Closure and Post-Closure Phase

Effects on hunting during the closure and post-closure phases are bounded by effects predicted during the construction and operations phases, and therefore no further assessment or mitigation measures are required.

3.3.3.8 Trapping Valued Ecosystem Component

3.3.3.8.1 Prediction of Potential Effects in the Closure and Post-Closure Phase

Effects on trapping during the closure and post-closure phases are bounded by effects predicted during the construction and operations phases, and therefore no further assessment or mitigation measures are required.

3.3.3.9 Fishing Valued Ecosystem Component

3.3.3.9.1 Prediction of Potential Effects in the Closure and Post-Closure Phase

Effects on fishing during the closure and post-closure phases are bounded by effects predicted during the construction and operations phases, and therefore no further assessment or mitigation measures are required.

3.3.3.10 Forestry Valued Ecosystem Component

3.3.3.10.1 Prediction of Potential Effects in the Closure and Post-Closure Phase

Effects on forestry during the closure and post-closure phases are bounded by effects predicted during the construction and operations phases, and therefore no further assessment or mitigation measures are required.

3.3.3.11 Water Use and Access Valued Ecosystem Component

3.3.3.11.1 Prediction of Potential Effects in the Closure and Post-Closure Phase

Effects on water use and access during the closure and post-closure phases are bounded by effects predicted during the construction and operations phases, and therefore no further assessment or mitigation measures are required.

4.0 SUMMARY OF FINDINGS

4.1 Introduction

The socio-economic effects assessment of the Project has involved:

- The identification of 13 Valued Ecosystem Components (VECs) that represent the socio-economic conditions that may be affected by the construction, operation, closure and post-closure phases of the Project.
- The identification of Regional (RSA) and Local (LSA) Study Areas, the focus of the assessment being on the LSAs.
- The description of one LSA to assess effects on population and demographics, economics, and services and infrastructure, which is represented by the Town of Atikokan and a 50 km radius around the Town.
- The description of a second LSA to assess effects on land and resource use corresponding to the LSAs for the aquatic environment and terrestrial ecology assessments, which represent the primary indirect pathways for effects on land and resource use.
- The design of a 5-step effects assessment methodology:
  - Screening of Project activities.
  - Prediction of effects.
  - Identification of mitigation measures.
  - Identification of residual effects.
  - Determination of significance of residual adverse effects.
- The selection of 6 effects assessment criteria:
  - Direction.
  - Magnitude.
  - Geographic extent.
  - Duration.
  - Frequency.
  - Reversibility.

4.2 Economic Analysis

An independent economic analysis (Appendix 2.II) was carried out of the Project to determine the benefits from the investments made for the Project.

The economic analysis has indicated that the Project will result in considerable benefits to the Local Study Area (LSA), the Province of Ontario and Canada.

As inputs to the economic analysis the following key parameters were used, as provided by OHRG:

- A 30-month construction period.
- An average of 416 construction jobs per month during the construction phase.
- An 11-year operations period.
- An average of 550 operations jobs per year.
- Estimated construction cost of the Project of $1.4 billion (labour, materials and supplies).
- Estimated lifetime operations cost of the Project of $4.9 billion (labour, materials and supplies).

Based on these factors the economic analysis was performed, using generally accepted economic multipliers for the construction and gold/silver mining industries, and estimates as to local, provincial and national shares of the economic activity. Direct benefits refer to actual Project-related jobs and expenditures, while indirect benefits refer to the spin-off effects of the direct expenditures by way of multipliers. All calculations are made in nominal dollars adjusted for annual inflation.

The results show that over the entire construction and operations period of 14 years, the Project will generate 34,734 person-years of direct and indirect employment.

The contribution to the Canadian economy over the life of mine is $3.2 billion GNP. Out of this, $490 million will be provincial and federal income taxes that will be collected.

The benefits to the LSA will be 3,129 person years of direct and indirect employment and $457 million in employment income.

In summary, the economic benefits of the Project are highly positive.

4.3 Assessment Results

The socio-economic impact assessment of the Project has yielded detailed results that are presented in the preceding chapters. The overall effect of the Project is summarized in Table 4-1.

Table 4-1: Summary of Overall Socio-economic Effects Assessment Results

Valued Ecosystem Component	Overall Residual Effect	Description
Population and Demographics	Positive	The population increase associated with the Project will first stem the decline and then augment the population of the Town. This will have an overall beneficial effect on the community.

Table 4-1: Summary of Overall Socio-economic Effects Assessment Results (Continued)

Valued Ecosystem Component	Overall Residual Effect	Description
Labour Market	Positive	The increase in employment and training and corresponding decrease in unemployment will bring additional income into the LSA, which will contribute to the overall economic wellbeing of the community.
Government Finance	Positive	Beyond additional revenue to the federal and provincial governments, new construction in the LSA will generate additional property assessment for the Town of Atikokan resulting in revenues that can be applied to the provision of services.
Public Services and Infrastructure	Neutral	There is sufficient capacity for existing infrastructure and service delivery to absorb the increases in demand associated with the Project.
Housing and Accommodation	Positive	The vacancy rate in the Town of Atikokan will be reduced by the influx of workers and their families, and new housing will be constructed. This will help stabilize the local housing market.
Transportation	Low-level adverse effect	The local transportation network currently operates well below capacity levels; hence the increase created by the Project can readily be absorbed.
Outdoor Tourism and Recreation	Low-level adverse effect	Upon the application of mitigation measures required for air quality and/or noise compliance, residual adverse effects on tourism and recreation are unlikely. The overall attractiveness of Atikokan and environs is not likely to be affected by the Project; however a low-level effect through loss of visual aesthetics is anticipated.
Hunting	Low-level adverse effect	No effect is anticipated on the number of hunting licences issued or on general hunting activity in the area. A relatively small amount of land will no longer be available for hunting, which will have a low-level effect on hunting in the LSA.
Trapping	Neutral	Upon the application of mitigation for the loss of some portions of tenured trapline areas, no residual adverse effect on trapping is anticipated.
Fishing	Neutral	Overall fishing activity in the study areas is not likely to be affected.
Mining	Positive	Beyond the positive effects of the Project described in this TSD, the Project would likely have net beneficial effects on local or regional exploration and development in this sector.

Table 4-1: Summary of Overall Socio-economic Effects Assessment Results (Continued)

Valued Ecosystem Component	Overall Residual Effect	Description
Forestry	Neutral	Upon the application of mitigation, no residual adverse effect on forestry is likely.
Water Use and Access	Neutral	No adverse effect on other commercial or industrial water users is anticipated.

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6.0 GLOSSARY OF TERMS

Table 6-1: Glossary of Terms

Term	Definition
Dependency Ratio	The ratio of the combined child population aged 0 to 19 and population aged 65 and over to the population 20 to 64 years old.
Employment Rate	Proportion of persons employed expressed as a percentage of the total population 15 years of age and over.
Level of Service	A quantitative measure of quality of service for a roadway or intersection based on average travel speed and time spent following another vehicle, measured on an A-F scale, with LOS A representing the best operating conditions.
Linear Infrastructure	Refers to access roads, transmissions lines and fibre optic lines.
Labour Force	Proportion of persons who are either employed or unemployed and available for employment.
Mainline	Major roadway such as a highway or primary road.
Mobility Rate	The proportion of a population to have move addresses over a specified period of time.
N/A	Not applicable.
Participation Rate	Proportion of a population participating in the labour force expressed as a percentage of the total population.
Unemployment Rate	Proportion of the labour force unemployed expressed as a percentage of the labour force.
Vacancy Rate	Percentage of houses or other dwellings identified to be unoccupied.
Volume-Capacity Ratio	The ratio of flow rate to the capacity of a system element such as a roadway or intersection.

7.0 LIST OF ABBREVIATIONS, ACRONYMS AND INITIALISMS

Table 7-1: List of Abbreviations, Acronyms and Initialisms

Acronym	Definition
ACC	Atikokan Chamber of Commerce
AEDC	Atikokan Economic Development Commission
CEA Agency	Canadian Environmental Assessment Agency
CEDC	Community Economic Development Commission
CNR	Canadian National Railway
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMS	Emergency Medical Services
GDP	Gross Domestic Product
GIS	Geographic Information Systems
HCS	Highway Capacity Software
HRSDC	Human Resources and Skills Development Canada
LISA	Linear Infrastructure Study Area
LOS	Level of Service
LSA	Local Study Area
MPAC	Municipal Property Assessment Corporation
MNR	Ontario Ministry of Natural Resources
MOE	Ontario Ministry of the Environment
MTC	Ontario Ministry of Culture, Tourism and Sport
MTO	Ontario Ministry of Transportation
MSA	Mine Study Area
NWHU	Northwest Health Unit
NWTAB	Northwest Training and Adjustment Board
OHRG	Osisko Hammond Reef Gold Ltd.
OMA	Ontario Mining Association
OMEDT	Ontario Ministry of Economic Development and Trade
OMNDMF	Ontario Ministry of Northern Development, Mines and Forestry
OMEDT	Ontario Ministry of Economic Development and Trade
OPG	Ontario Power Generation
OPP	Ontario Provincial Police
RRDSB	Rainy River District School Board
RRDSSAB	Rainy River District Social Services Administration Board
RSA	Regional Study Area
StatsCan	Statistics Canada
TIS	Traffic Impact Study

Table 7-1: List of Abbreviations, Acronyms and Initialisms (Continued)

Acronym	Definition
ToR	Terms of Reference
TBRHSC	Thunder Bay Regional Health Sciences Centre
TSD	Technical Support Document
V/C	Volume-to-Capacity Ratio
VEC	Valued Ecosystem Component
WMU	Wildlife Management Unit

8.0 LIST OF UNITS

Table 8-1: List of Units

Unit	Abbreviation
$	Canadian Dollars
°C	Degrees Celsius
Ft	Foot
Ha	Hectare
Km	Kilometre
km^2	Square Kilometre
kW	Kilowatt
M	Metre
Mm	Millimetre
VPH	Vehicles per Hour

APPENDIX 2.I

Key Informants Interviews

Data gaps and key informants were identified following a socio-economic desktop analysis. Informants were provided with the option of either completing and submitting a questionnaire or participating in a telephone or in-person interview. Interviews with key informants were semi-structured and detailed notes were taken from all interviews. Results of all interviews will be incorporated into the baseline and effects assessment reporting for the Environmental Assessment (EA).

Please note that because the interviews were semi-structured, using questions designed to direct or focus the interviews, the results of these interviews are not considered to be representative of the views and opinions of the informants generally. These interviews were not designed to understand the overall key issues in the community.

Through the signing of informed consent forms, informants were given the opportunity to indicate if they do not want their names associated with their comments in any public reports. In some cases, informants chose to remain confidential, and these results are not included in the summary in Table 1 below.

Completed questionnaires were received from the following:

- Heather Campbell, Director of Education, Rainy River District School Board
- Cathe Hoszowski, Administrator, Atikokan Family Health Team
- Andre Morin, Chief Administrative Office, Town of Atikokan

Telephone interviews were completed with the following:

- Robin Riley, Manager, Quetico Provincial Park

In-person interviews were conducted with the following:

- Andre Morin, Chief Administrative Officer, Town of Atikokan
- Jolene Wood, Office Manager, Atikokan Chamber of Commerce
- Deborah Coulson, Niobe Lake Resort/ Avenue A Realty
- Garry McKinnon, Atikokan Economic Development Corp
- Jeremy Dickson, Canoe Canada Outfitters
- Lorraine Zacharias and Mike Lewis, Atikokan Family Health Team Board
- Dan McCormick, Chief Administrative Officer and Sandra Weir, Housing Manager; Rainy River District Social Services Admin Board
- Geoff Gillon, Regional Economic Development Officer and Tannis Drysdale, Business Development Consultant; Rainy River Future Development Corporation
- Anthony Mason, Manager and Mark Caron, President; Fort Frances Chamber of Commerce

Additional informal interviews were conducted at the consultation workshops held on Tuesday, October 18 and Thursday, October 20, at the open house held on Wednesday, October 19, and at a meeting with town doctors on Thursday, October 20. Results from these meetings were recorded by the Project's consultation team. Informal meetings were also held with Child and Family Services, Atikokan and the Atikokan Native Friendship Centre.

Table 1 provides a summary of the completed questionnaires received from, and interviews conducted with, key informants for the socio-economic baseline studies.

Table 1: Summary of Results from Socio-Economic Interviews

Informant	Summary of Comments
Heather Campbell	■ The Rainy River District School Board has approximately 3,000 students, JK to Grade 12, and 400 employees, spanning Atikokan to Rainy River to Nestor Falls. The 14 schools include three secondary schools, with the largest high school being Fort Frances High School. Within the secondary schools, alternative education programs are available to students and to adults wishing to complete their high school diploma program. With respect to employees, the Rainy River District School Board works with six to seven bargaining units as well as non-union employees. Also within two of our secondary schools, we have Specialist High Skills Major programs: Environmental Education at Atikokan High School and Manufacturing at Fort Frances High School. These programs allow students to focus on a specific sector, gain valuable experiential programming within that sector as well as certifications to support their post-secondary education and job placements. ■ One issue is the fact that, like most northern Ontario district school boards, we are faced with declining enrolment. This proves to be challenging with respect to programming within the high schools, which leads to staffing issues (attracting candidates with subject specialties but then are faced with teaching outside their subject areas due to the limited number of staff.). In some areas of the Board, however, we have seen slight spikes in enrolment and have two schools that are at capacity. Yet, across the system, most schools have additional space within their buildings to house any increases in enrolment. ■ The recent change in procurement in the broader public sector has placed some restrictions or barriers for extra-curricular, due to the rise in rates for field trips. We've always offered many different types of extra-curricular programming for our students across the Board and will continue to find ways to sustain these opportunities for students. ■ Presently, we are embarking on a pupil accommodation review process for three of our elementary schools in the west, starting with Donald Young School in Emo, then Sturgeon Creek School in Barwick, and finally, with Crossroads School in Devlin. Donald Young School has been declared prohibitive to repair, so before proceeding on this process and to attract provincial funding to rebuild, this process needs to be undertaken. ■ Recently, we have opened a newly amalgamated school in Fort Frances, Robert Moore School (opened in September 2010). And, we are currently finishing a new school in Mine Centre, Ontario – Mine Centre School – which should be open to students and staff by the end of October.

Table 1: Summary of Results from Socio-Economic Interviews (Continued)

Informant	Summary of Comments
	■ For services, we have been fortunate to receive funding for priority schools, an enhancement project to bring community partners into North Star Community School in Atikokan to maximize the use of space after school hours. With respect to programming, we have received specialized grants for the enhancement of speech/language programming, for special education services, as well as literacy and numeracy supports. Overall, our supports for students with special needs are very solid and are continuously being enhanced to maximize success for our students. ■ At present, we have not noted an effect. However, we are very interested in pursuing another Specialist High Skills Major program within the high schools in order to give students a pathway into this employment sector. To accomplish this, we need partnerships with mining companies that can provide equipment, linkages to industry certification and post-secondary training, and certainly, cooperative education placements to allow the students a full pathway into the mining industry.
Cathe Hoszowski	■ Our health services include primary care for all the residents of Atikokan, provided by a team of health professionals, including physicans, nurses, mental health worker, dietitian, pharmacist, and support and clerical staff. We operate out of a Town-owned municipal building, on two floors. The Atikokan Family Health Team rents from the Town on a monthly lease. We have 10-11 staff at any point in time. ■ The AFHT continues to expand on its program offerings and services and currently offers approximately 20 programs, all of which operate under physician supervision, particularly the nursing programs. As we expand our programs, we are increasingly challenged to work within a confined space and to find appropriate and suitable work areas in which to provide patient-centered care. Our future plans include identifying a satisfactory space solution that can help us serve our patients more efficiently. In particular, if Atikokan were to grow in population, our future plans need to include a strategy to house the health professionals so that we can continue to provide expanded programs and services. ■ As mentioned above, if Atikokan's population grows we will have issues with delivering primary care services in our existing location; for example, as the population increases, more staff will be hired. Our challenge will be to recruit and retain health professionals so that we can continue to provide services.
Robin Riley	■ Commercial tourism and recreation services in proximity to the park are inadequate; ■ The capacity of the park and its programs meets demand; ■ There are no major plans for changes or expansions to programs or facilities, except some expanded winter and hiking services; ■ Past mining projects have not had much effect on the park or its program, and major effects from the Hammond Reef Project are not anticipated; ■ Interested in potential air quality effects, and effects due to increased truck traffic on Highway 11; ■ Would like to be kept informed of other opportunities to get involved.

Table 1: Summary of Results from Socio-Economic Interviews (Continued)

Informant	Summary of Comments
Andre Morin	■ Described water and wastewater infrastructure. ■ Water and wastewater operating costs are increasing due to changing regulations and overwhelmed resources. ■ Debt on old (40+ years) infrastructure is unaffordable through the property tax system. An infrastructure study is currently underway. ■ Design flaws in the sanitary system cause discharge to the river during high inflow/infiltration during storm events. Town is currently discussing the financing of a plan to upgrade the wastewater system with the MOE. ■ There are no other major water treatment and distribution changes planned, however a 5-year financial plan is considering water metering. ■ During dry weather the water and wastewater system has capacity for about 6,000 residents. ■ No previous concerns with mining projects noted, however capacity issues with the wastewater system may be a concern if more residential, commercial and industrial users are added to the system. ■ Industrial cutting of mining core has created operational issues within the wastewater system, but the Town is working with Osisko to resolve these issues. ■ The municipal landfill is expected to reach capacity around 2015-2016. A Certificate of Approval has not been completed for a new site, but planning is underway. ■ Currently exploration waste is being accepted at the landfill, and there may be an opportunity to take construction and operation waste. ■ The bridge to the Western Industrial Park is a concern if traffic increases. Also the ploughing of snow on Highway 622 may be a concern. ■ Atikokan Fire Rescue service was described and the need for ice water rescue was identified. ■ The turnover of volunteer firefighters is also a concern. ■ No plans to expand the Atikokan Fire Service were identified. Preliminary plans to better service cottage lots have been discussed. Land adjacent to Town Hall has been set aside for a future fall hall. ■ In the past, mine workers have worked as volunteer firefighters. ■ Improvements to the Fire Service in the future could include paid staff; trained first responders at mine sites; and collaborative training, employment, prevention and education programs between mine sites and Town. ■ The Town had its own police service until 2005. The Town still maintains 24-hour police service. ■ Rainy River District Social Services Board administers emergency and social services in Atikokan. ■ Town owns medical building and supports equipment costs. There are concerns with the current building not being able support future capacity. ■ The Town is experiencing stagnant population growth, and has started a 5-year

Table 1: Summary of Results from Socio-Economic Interviews (Continued)

Informant	Summary of Comments
	planning process. The AEDC Labour Market Study identified a lack of local skilled workers. Trade jobs tend to predominantly attract men, and men are lost from community when they seek labour elsewhere. It is difficult for the Town to attract technical staff. ■ A new fitness centre is desired and the arena needs repair. Studies have been completed for a new Recreation and Wellness Centre, but the Town is seeking funding. ■ It was suggested we obtain copies of the Cultural Plan and Accommodation Study currently under publication. ■ It was noted that there is a shortage of housing capacity for seniors in the Town, as well as a general lack of rental/short-term housing. ■ Plans for a possible future subdivision are underway.
Garry McKinnon	■ Population of the Town has been slowly declining. Osisko can help by attracting families, not just tradesmen. ■ Tradespeople leaving Town to work has affected social fabric and the Town's economy. The Project may entice former residents to return. ■ The population is aging – need opportunities to attract and retain youth. ■ The Town should also market to semi-professionals. ■ If seniors had a place to move, this would free up housing for workers/families. ■ Town is a traditional mining town, but open to responsible development. ■ Approximately 400 of the Town's workforce of 1,400 – 1,600 are directly employed in the mining sector. ■ Primary industry is part of the past and key to the future of Atikokan. Forestry industry may return with opportunities for new forestry products (e.g., pellets). ■ Town could advertise lifestyle (e.g., access to healthcare, recreation, education, entertainment) to attract families. ■ Recruitment process (e.g., website, printed materials) should target families. ■ Osisko has not been communicating with AEDC to date, but should to maximize benefits to community. ■ Malarctic goods and service providers could open branches in Atikokan to create a mine service centre. ■ Osisko should work with AEDC on recruitment of families. ■ Project will increase diversity in community and there needs to be awareness for new employees. ■ The Bass Classic was identified as a source of civic pride and responsible for approximately $1,000,000 in revenue. ■ Tourism accounts for approximately 15% of the local economy.

Table 1: Summary of Results from Socio-Economic Interviews (Continued)

Informant	Summary of Comments
Jeremy Dickson	■ Described Canoe Canada (6 full-time staff and about 40 seasonal guides, base workers and pilots per year, approximately 1,200 paddlers outfitted, about 1,800 partially outfitted, fly-in/fly-out to 14 remote lakes, 930 outpost guests per year, 140 hunters per year, 300 resort guests per year, wilderness experience with fishing and paddling, significant repeat customers on Sawbill Bay, equipment rental, retail). ■ Canoe Canada revenue about $2,000,000 per year. ■ Boy Scouts (about 1,400 per year) and youth groups (who cannot afford park fees) also use White Otter and Marmion Lake. ■ Approximately 150 people employed locally in tourism sector. ▪ Noise would affect pristine wilderness experience. ■ Community not concerned about effects on Atikokan in general, but a small number of outfitters will be directly affected. ■ Marmion Lake not used as much as Quetico or White Otter, but Marmion and Sawbill Bay are known bass destinations. ■ Use of Sawbill Bay dropped about 30% in 2011 due to activities near there. ■ Tourists pay more for rental accommodation than construction workers. ■ Identified labour force pressures on tourism industry because of better paying jobs in mining sector. ■ Future plans include drive-in cabins, considering options around Marmion Lake and to the west. Would need capacity to move trips from Sawbill Bay. New camps would cost about $350,000.
Lorraine Zacharias and Mike Lewis	■ Described Atikokan Family Health Team ■ State of facility (size, accessibility) is an issue as it is currently operating at capacity. This will become more critical should population demand increase. ■ Osisko could help build a new clinic as mitigation. ■ Lack of ambulance service an issue. ■ Mining has increased the use of the walk-in clinic and Atikokan General Hospital in the past. ■ Heart disease, diabetes, substance abuse (e.g., prescription drugs) main community health concerns. ■ No surgery, obstetrics or dialysis offered in Atikokan. Need better shuttle service to Thunder Bay/ Fort Frances. ■ Lack of housing for seniors.

Table 1: Summary of Results from Socio-Economic Interviews (Continued)

Informant	Summary of Comments
Daniel McCormick and Sandra Weir	■ Described the services and infrastructure under the RRDSSAB. ■ Identified capacity in family and seniors housing. ■ No capacity issues in childcare. More kids would help viability of services. ■ Land ambulance services operating with no excess capacity, additional capacity may be required during Project construction. Communication required from Osisko on staffing numbers, timelines and proposed activities. ■ Doctor shortage in Rainy River District. ■ Activity in housing market seems to be increasing. ■ Recommend Osisko communicate about services to potential employees.
Anthony Mason and Mark Caron	■ The economy of Fort Frances was based on forestry, but this is in slow decline. ■ The Chamber of Commerce can help communicate and educate local business. ■ The public and business community need more education and information about Project. ■ There is a shortage of skilled tradespeople – more training is required. ■ Fort Frances is a regional service and retail centre, with easy access to the United States. This may increase with increased employment. Tourism also generally benefits from employment opportunities. ■ Mining courses are offered at the local college.

APPENDIX 2.II
Economic Assessment Study

Economic Benefits to Ontario and Canada

Of the Proposed

Osisko Hammond Reef Gold Mine

FINAL DRAFT REPORT

Prepared for: Golder Associates Ltd.

Prepared by: Chisholm Consulting

14 December 2012

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1. Introduction

1.1 Background

Osisko Hammond Reef Gold Ltd. (OHRG) is proposing to develop and operate the Hammond Reef Gold Project ("the Project") and its associated infrastructure located near Atikokan in Northwest Ontario. This Project is required to undergo both provincial and federal environmental assessment processes, and in so doing evaluate its local, provincial and national impacts. The purpose of this report is to identify the economic benefits that the Project would generate. Chisholm Consulting has been tasked with estimating the potential direct, indirect and induced economic benefits that would occur throughout both the construction and operations phases.

In the absence of pre-feasibility data for this project, Golder has provided the consultant with estimated data about total capital cost, the shares of labour and materials & equipment, labour requirements and wages & salaries, using the Malartic Project as a benchmark. The required outputs for this assignment are:

- Direct, indirect and induced employment and income effects during construction and operations phases — both provincal and national;
- Direct and indirect employment and income effects during construction and operations phases — local;
- Provincial and national government revenue effects for both phases; and,
- Provincial and national GDP contribution of the mine.

We have not been required to assess any residual or cumulative effects, or mitigation measures, as part of this assignment.

1.2 Project Description and Context

The proposed gold mine site is located approximately 170 km west of Thunder Bay and 30 km northeast of the town of Atikokan, the closest municipality. Since the early 1900s, Atikokan's economy has been largely driven by the mining, forestry and electrical generation industries. Mine and sawmill closures since the late 1970s led to an economic slowdown and population exodus from Atikokan and other communities within the Regional Study Area (RSA),[1] and high unemployment rates continue to persist in this part of Ontario (Golder Associates, July 2012). In 2011, the population of Atikokan was 2,787.

[1] The Regional Study Area is defined as all or parts of the District of Kenora, Rainy River and Thunder Bay south of the Far North boundary.

It is our understanding that, as of November 2012, the proposed Osisko Hammond Reef gold mine is one of four projects in various stages of development that could affect the local economy. The others are the Akikokan Renewable Fuels, the conversion of the Atikokan Generation Station from coal to wood pellets, and the Bending Lake Iron ore mine (McSweeney and Associates, February 2011).

Based on capital costs of Osisko's Malartic mine, it is estimated that the total capital cost of the proposed Hammond Reef Gold Project would be $1.4 billion ($2012 Canadian) (Golder Associates, September, 2012). The Project would include the development of an open pit mine, processing facility, and tailings management facility, as well as infrastructure at the site, the upgrading of an access road, and the construction of a new electrical transmission line. The construction workforce would be drawn from within the RSA, as well as from elsewhere in Ontario and Canada, depending on skill requirements.

Once operational, throughput at the mine would be 50,000 tonnes of ore per day. Supplies to support the operation of the site (e.g., fuel, explosives, consumables) would be transported along an access road on an as-needed basis. Supporting infrastructure would include maintenance facilities, warehouses, water supply plant, an explosives plant, sewage treatment plant, and electrical substation. Total output of refined gold would be 369,000 ounces per year (OHRG, October 2012). With a permanent camp near the mine site, the operation would employ both locals living nearby, as well as workers from elsewhere in Ontario and Canada.

2 Economic Benefits

2.1 Approach and Assumptions

For this analysis, the breakdown of construction costs and labour inputs was derived based on the feasibility study of Osisko's Malarctic Gold Project in Quebec undertaken in 2008, as well as Golder's industry knowledge based on other mining projects. All calculations have been done in nominal dollars, adjusted by a 2% annual inflation rate.

Construction

Of the total $1.4 billion capital costs of the Hammond Reef Gold Project, it is estimated that approximately 79% ($1.1 billion) would be spent on materials and equipment (M&E) and 21% ($302 million) would be spent on labour during the 3 year construction period (Golder Associates, September 2012).[2] Of the $1.112 billion spent on M&E, it is assumed that 60% would be spent within Canada, with the following breakdown:

- local 5%
- elsewhere in Ontario 30%
- elsewhere in Canada 25%

The remaining 40% of purchases of materials and equipment would come from other countries, primarily the US.

Construction activity would last 30 months, beginning in the second quarter of year 1 (2014), and continuing until the third quarter of year 3 (2016), with peak activity and employment occurring in year 2. Approximately 85% of the construction labour force would come from outside the Local Study Area (LSA), while 15% would be local.[3] OHRG's hiring policy would determine what percent of these local workers would be Aboriginal, but for the purposes this analysis it is assumed that Aboriginal workers would garner one third of local jobs during construction.

Operations

Full mining operations are assumed to start at the beginning of year 4, and to continue until the end of year 14 (2027).[4] In year one of operations annual expenditures would be approximately $327 million, and labour costs would be $75 million. This is in 2012 dollars, and costs in subsequent years have been adjusted for 2% annual inflation. Throughout the production period, it estimated that 60% of operating expenditures would be made in Canada, with the following breakdown:

- local 5%
- elsewhere in Ontario 35%
- elsewhere in Canada 20%

The remaining 40% of purchases of operating materials and equipment would come from other countries, primarily the US.

Approximately 40% of the operations workforce would be drawn from within the LSA, that is Atikokan and local Aboriginal communities, while the rest (60%) would come from elsewhere in Ontario and Canada, and reside in an on-site camp.

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[2] See **Appendix A** for breakdown of principal construction categories and associated costs.

[3] Local Study Area (LSA) is defined as Town of Atikokan and an area centred on Atikokan within a radius of 50 km.

[4] In the absence of information about mine closure, this component of the project has been omitted from our analysis.

While mine output and employment would vary throughout the production years, it is assumed here that the same average number of workers would be employed at the mine each year, the average annual output would be 369,000 ounces of gold, and that the annual value is $1,600 per ounce (Golder Associates, 2012).

See **Appendix B** for assumptions about workforce wages and salaries.

2.2 Employment and Income Effects

2.2.1 Direct

Construction

During the 30 month construction period, Osisko's expenditures on direct labour and in the industries that supply the necessary goods and services to support construction activities would generate employment in a range of occupations. In total, 1,040 Person Years (PYs) of construction jobs and $302.5 million in wages & salaries to the construction trades would be generated in Canada. The Ontario share of this would be 780 PYs and $181.5 million respectively, over the construction period.

In addition to direct construction labour, direct expenditures on M&E would create jobs in the industries that supply the Project during construction (e.g, mining machinery, transportation equipment, materials handling). It is estimated that Osisko would make 60% of its M&E purchases in Canada, a total of $658.5 million over the 30 month period. Using Statistics Canada's provincial direct employment multiplier of 6.08 jobs per million dollars of expenditure in the "other engineering" industry and the corresponding wages & salaries multiplier of .32 FTE jobs per dollar of expenditure, this translates into a total of approximately 4,004 direct PYs, and $209 million in wages and salaries in the supplying industries within Canada.[5] Of this, 2,335 PYs of employment and $121.9 million in wages and salaries would accrue within Ontario.

Altogether, it is estimated that 5,044 PYs of employment and $511.5 million in earnings would be directly created during the 30 month construction phase of the Project. This is summarized in Table 1 below.

Operations

The operations phase of the Hammond Reef Gold Project would generate 550 direct full time equivalent (FTE) jobs and $83.7 million in earnings annually to mining company workers in Ontario over an 11 year period.

Jobs would also be generated for workers in the industries that supply the gold mine operations with materials and equipment. Direct multipliers of 2.96 jobs per million of expenditure and .274 in wages & salaries per dollar of expenditure in the gold and silver mining industry applied to the Canadian share of annual expenditures (averaging $217.1 million) results in a national average of 642 PYs annually in the supplying industries, and

[5] See Appendix B Methodology for explanation of multipliers.

$59.5 million in annual wages and salaries.[6] The Ontario share of this would be 428 PYs of employment annually, and $39.7 million.

Altogether, during its operations phase the Hammond Reef Gold Project would create an average of almost 1,192 direct PYs and $143.2 million in wages & salaries in Canada in each year of operation. In Ontario, total direct annual jobs would be 868 PYs, with $106.6 million in earnings.

This adds up to 13,112 jobs over the 11 year period, and $1.57 billion in earnings. Ontario would accrue 9,548 of these jobs, and $1.17 billion in earnings (See Table 1.)

[6] Ibid.

Table 1 Direct Employment and Income Effects

	National Direct	Provincial Direct
Construction (Years 1-3)		
Employment (PYs)[a] -- over 30 months		
Construction labour	1,040	780
In supply industries	4,004	2,335
Total	5,044	3,115
Wages & salaries (million $C) – over 30 months		
Construction labour	$302.5	$181.5
In supply industries	$209.0	$121.9
Total	$511.5	$303.4
Operation (Years 4 – 15)		
Employment (PY s) -- annual average		
In operations	550	440
In supply industries	642	428
Total	1,192	868
Wages & salaries (million $C) – annual average	$83.7	$66.9
In operations	$59.5	$39.7
In supply industries	$143.2	$106.6
Total		
Total employment over 11 years (PYs)	13,112	9,548
Total wages & salaries over 11 years (billion $C)	$1.57	$1.17

Note: some slight rounding errors

[a] PY is Person Year

2.2.2 Indirect Effects

Direct employment at the mine during both the construction and operations phases would generate annual spin-off (indirect) employment and earnings among many suppliers of goods and services throughout the provincial economy – manufacturing, technical and IT services, finance and real estate, transportation and other businesses in the service sector to name a few -- throughout its lifetime. There would also be induced effects, defined as the changes in economic activity that result from household spending of income earned directly or indirectly as a result of the original direct spending.

Statistics Canada's Input/Output 2008 provincial and national multipliers have been used to calculate the indirect benefits of the Project. For this analysis, annual indirect employment and income effects related to the Project were calculated at the provincial level. Statistics Canada does not provide the multipliers required to estimate provincial induced effects, however they are available at the national level, and national induced effects were calculated accordingly.[7]

An example of the usage of these multipliers is as follows. Statistics Canada's direct and indirect FTE job multiplier for "other engineering construction" in Ontario is 9.13, that is, for every one million dollars of expenditure, 9.13 direct and indirect jobs are created in Ontario. During the construction period, $384.1 million (35% of all expenditures in Canada, $658.5 million) would be spent in Ontario over a 30 month period. Multiplying $384.1 million by 9.13 results in an estimated total of 3,507 direct and indirect jobs in Ontario's supply industries. Adding this to the total number of construction jobs (780) results in a total of 4,287 PYs during the construction phase. This same approach is used to calculate both the indirect and induced jobs and income benefits in Ontario and Canada.

Taking indirect and induced effects into account gives a better sense of the magnitude of the full effects of construction and operations expenditures. Table 2 shows that the construction phase of the OHRG Project would generate 4,287 PYs of direct and indirect construction and supply industry employment, and $365.7 million in wages and salaries, over a 30 month period. Including national effects results in total direct, indirect and induced benefits of 9,557 PYs of employment, and $719.7 million in earnings.

Year-to-year operations would generate an average of 1,182 PYs of employment and $123 million in direct and indirect operations and supply industry earnings. This is further compounded at the national level, where total annual direct, indirect and induced jobs would be 2,289 PYs, with a corresponding $189.8 million in annual income.

Altogether OHRG Project is expected to generate 34,734 PYs of direct, indirect and induced employment, and $2.81 billion in wages and salaries in Canada over the 14 year construction and operations phases.

[7] See Appendix B Methodology for discussion of multipliers.

Table 2 Direct, Indirect and Induced Employment and Income Effects

	Provincial Direct	National Direct	Provincial Direct & Indirect	National direct, indirect & induced
CONSTRUCTION (Years 1-3)				
Employment (PYs) -- over 30 months	3,115	5,044	4,287	9,557
Wages & salaries (million $C) – 30 mo.	$303.4	$511.5	$365.7	$719.7
OPERATIONS (Years 4-14)				
Annual ave. employment (PYs)	868	1,199	1,182	2,289
Annual ave. wages & salaries (million $C)	$106.6	$143.2	$123.0	$189.8
Total employment over 11 years (PYs)	9,548	13,112	13,000	25,177
Total wages & salaries over 11 years (billion $C)	$1.17	$1.57	$1.4	$2.1
TOTAL CONSTRUCTION & OPERATIONS (Years 1-14)				
Total employment years 1-14 (PYs)	12,663	18,156	17,287	34,734
Wages & salaries (billion $C)	$1.47	$2.08	$1.72	$2.81

2.2.3 Local Benefits

The community of Atikokan and others within the LSA and RSA would be major economic beneficiaries of the proposed Project. Local employment and earnings benefits are described as follows.

Construction

Approximately 15% of construction jobs would be taken by residents of the LSA (The Town of Atikokan and the region within a 50 km radius), with local Aboriginal workers accounting for approximately one third of this (Golder Associates, September 2012). The remaining 85% would go to workers from elsewhere within the RSA (outside the LSA) and Ontario (60%), Canada (24%) and other countries (1%). These workers would reside in an on-site camp.

Based on an estimated 15% local jobs, a total of 156 PYs of construction employment and $45.4 million in wages and salaries would accrue to workers within the LSA during the 30 month construction period. Of this, it is estimated that approximately 104 PYs of employment and $30.3 million in earnings would be concentrated in Atikokan, while local First Nations workers would realize 52 PYs of employment, and a corresponding $15.1 million in wages and salaries.

Based on the assumption that 5% of expenditures on materials and equipment during the construction phase would be with contractors and businesses within the LSA, it estimated that 200 jobs would be directly created in these industries during the construction period, and $10.5 million in wages & salaries. Respective shares would be, respectively, 120 PYs and $6.3 million to supply industry workers in Atikokan, and 80 PYs and $4.2 million in earnings to local First Nation communities.

Operations

Mine operations over the subsequent 11 years would continue to bolster the local economy. Based on the assumption that 40% of the operations workforce would reside within the LSA, it is estimated that the mine operation could create 252 PYs of work annually for local workers, and $36.5 million in wages and salaries.[8] Of these, 220 would be in operations, and the rest (32) in local industries that service and supply the mine operations.

With regards to operations employment, workers who reside within the LSA would account for approximately 165 Person Years of mine operations employment annually, while the remaining 55 PYs would accrue to local First Nations workers. In the supply industries that serve the mine, the respective shares of jobs would be 19 PYs annually to residents of the LSA and 13 PYs annually to local First Nation workers.

Workers from elsewhere in Ontario -- mostly within the RSA -- would account for another 40% of operations jobs while workers from elsewhere in Canada would comprise 19%. These workers would reside on an on-site camp, and are not included in our calculation of local workers. Over the full 11 year operations period, total local jobs within the LSA (and excluding workers from elsewhere in Ontario and Canada) would add up to approximately 2,773 local direct jobs, and $400.9 million in income. See Table 3 for details.

A review of the most recent labour market data for the LSA and RSA (Golder Associates, *Osisko Hammond Reef Gold Project, Interim Baseline Report Socio-Economics and Land Use*, July 2012) shows a finite capacity for Atikokan and the LSA to supply enough workers with the required skills for construction or operations. In 2006, the LSA labour force in the manufacturing, construction and agriculture & resource-based industries was approximately 362. Mill closures since that time have probably reduced the available

[8] Of the 40% of operations workers who reside with the LSA, it is estimated that Aboriginal workers would comprise about one-quarter or 10%, depending on the implementation of Osisko hiring policies in this regard and the availability of qualified or trainable workforce.

labour pool in the LSA, but no more up to date information exists. The number of construction and operations jobs that are taken locally will depend on specific skills requirements, the availibility of workers in these occupations, and Company hiring and training policies.

Table 3 Direct Effects within LSA and Local Aboriginal Communities

	Total Local Direct	Direct in LSA	Direct Local Aboriginal
CONSTRUCTION (Years 1 to 3)			
Employment (PYs) -- over 30 months			
Construction labour	156	104	52
In supply industries	200	120	80
Total	356	224	132
Wages & salaries (million $C) – over 30 months			
Construction labour	$45.4	$30.3	$15.1
In supply industries	$10.5	$6.3	$4.2
Total	$55.9	$36.6	$19.3
OPERATIONS (Years 4 to 14)			
Employment (PY s) -- annual average			
In operations	220	165	55
In supply industries	32	19	13
Total	252	184	68
Wages & salaries (million $C) – annual average			
In operations	$33.5	$25.1	$8.4
In supply industries	$3.0	$1.8	$1.2
Total	$36.5	$26.9	$9.6
Total employment over 11 years (PYs)	2,773	2,027	746
Total wages & salaries over 11 years (million $C)	$400.9	$295.8	$105.1
TOTAL CONSTRUCTION & EMPLOYMENT (Years 1 to 14)			
Employment (PYs)	3,129	2,251	878
Wages & Salaries	$456.7	$519.8	$124.4

The creation of local jobs in the supply industries during both construction and operations phases will depend on what businesses are needed to support the Project, and whether these services can be provided locally. During the 30-month construction period, it has been estimated that 5% of all expenditures would be with local businesses, translating to a total of 200 PYs of employment in these establishments (or 80 PYs annually). In this short period, it is reasonable to expect these labour market needs could be met by the Atikokan labour force and local First Nations communities, but that some part of this would also likely come from companies further afield within the RSA, such as Thunder Bay. How many jobs go to residents of the LSA will depend to a large degree on how many businesses are attracted there by the Project.

The need to supplement local labour resources with those from elsewhere within the RSA is especially evident in view of the findings of a recent mining sector impact analysis undertaken for the Town of Atikokan and the Atikokan Economic Development Corporation (McSweeney & Associates, February 2011). It indicates that 26 to 28 businesses could be required to support two proposed mining projects if they proceed (including the Hammond Reef Gold Project).[9]

3 Government Revenues

Both provincial and federal personal income taxes resulting from wages and salaries earned as a result of the Project were estimated based on average direct, indirect and induced incomes using Ontario and federal government 2012 personal tax rates in Table 4 below.[10]

Table 4: Ontario & Federal 2012 Personal Tax Rates

Ontario Tax Brackets	Up to $39,020	Up to $78,043	$78,043 to $500,000	
Ontario Tax Rate	5.05%	9.15%	11.16%	
Federal Tax Brackets	Up to $42,707	Up to 85,414	Up to $132,406	$132,406+
Federal Tax Rate	15%	22%	26%	29%

Source: Canada Revenue Agency November 2012

Ontario personal taxes that would result from wages, salaries and taxable benefits earned in Project-related direct and indirect jobs are estimated based on an assumption that annual income for construction workers would fall into the highest provincial and federal tax brackets and income for workers in mine operations would fall into the third provincial and federal tax brackets. And, on average, incomes for indirect and induced workers

[9] The other, Bending Lake Iron Ore mine and smelter, is still undergoing the Environmental Review Process as of November 2012.

[10] It has been assumed that the 2012provincial and federal personal income tax rates will be the same for the duration of construction and operations.

would fall into the first and second provincial and federal tax brackets. Using assumptions about what shares of total annual wages & salaries would fall into each of the income brackets identified in Table 4, the corresponding provincial and federal tax rates were applied to calculate total annual government revenues.

Based on the foregoing, the Project is expected to return $36.2 million in personal income tax revenues to the province of Ontario over the 30 month construction period. These are provincial taxes that would be paid by those working directly on the Project as well as those within Ontario who realize the indirect economic benefits.

Federal personal taxes would also flow from the wages, salaries and taxable benefits of direct and indirect workers in Ontario as well as other provinces that would benefit from supplier contracts.[11] Federal government income tax revenues during the construction phase are estimated to be another $115.5 million. Given the high wages and salaries of the construction workers (approximately $211,000 in year 2012 before salary burden), a high proportion of aggregate earnings during the construction period would be taxed at the highest provincial and federal government tax rates.

Over the 11 year operations period, annual provincial personal taxes paid would be approximately $12.7 million, while federal taxes would amount to another $18.1 million, for an annual total of $30.8 million. Over the entire operations period, federal and provincial tax revenues would total $339.1 million. Adding government revenues over the total construction and operations phases, total provincial income tax would be $175.7 million, and federal would be $315.1 million.

Both provincial and federal tax revenues will benefit Ontario by being recycled back into the provincial and national economies.

Table 5: Provincial and Federal Revenues from Personal Income Taxes ($ millions)

	Provincial[a]	Federal[b]	Total
Construction (total years 1 to 3)	$36.2	$115.5	$151.7
Operations			
Annual	$12.7	$18.1	$30.8
Total years 4 to 15	$139.5	$199.6	$339.1
Total Construction & Operations (Years 1 to 14)	$175.7	$315.1	$490.8

[a] provincial taxes on direct and indirect income

[b] federal taxes on direct, indirect and induced income

Potential government revenues from the Hammond Reef Gold Project are not restricted to just personal taxes paid, although this would account for a major share. Corporate tax revenue would also be paid to both provincial and federal governments, but in the absence

[11] Federal tax is calculated for Ontario direct and indirect income, and for national direct, indirect and induced income.

of a feasibility study with financial data, there is not enough information to calculate this. The Project would also pay into EI and WSIB for its direct workers, and pay a range of indirect taxes such as fuel and retail, but there is also insufficient information to quantify these benefits to government. Our estimate of government revenues are conservative in view of this, as well as the fact that no estimate of tax on provincial induced income has been made.

Because the proposed mine site would be situated outside any municipal boundaries, no municipal taxes would be paid to Atikokan or any other communities within the LSA. However, any new housing constructed in the Town of Atikokan would produce property taxes for the municipality.

4 GDP Benefits

The foregoing analysis shows that a new gold mine in Ontario would generate significant employment and business expenditures during operations. These direct expenditures would, in turn, generate new rounds of spending throughout the provincial and national economies. GDP is the sum of the "value added" created in each stage of production throughout the various affected industries.

GDP has been calculated here as the value of gross mine output minus purchases of intermediate inputs. Intermediate inputs is defined as the purchase of all goods and services for operations only (fuel, electricity, repairs, services, etc).

Canadian direct GDP generated by the Project is estimated to be $291.4 million annually, totalling $3.205 billion over 11 years.

As discussed in Appendix B, our estimate is conservative because it does not include indirect or induced effects.

Table 6: GDP Contribution of OHRG Mine Operations ($ millions)

	Canada
Annual	$291.4
Total (years 4 to 15)	$3,205.2

5 Sensitivity Analysis

The foregoing results are derived from an economic model that makes an array of assumptions about capital cost, direct employment, wages and salaries, and expenditures based on the best information available. Nevertheless, all model results will vary with a change in key assumptions. In this section, we have modified two basic assumptions to evaluate how this could change the overall economic results and to provide a wider range of possible results.

For the purposes of this sensitivity analysis, we have made the following changes in assumptions:

- 20% increase and decrease in total machinery & equipment expenditures during construction;
- 10% increase and decrease in Canadian share of annual operating expenditures.

In both cases, changes in expenditures will affect employment and income in the supply industries, with corresponding effects on indirect and induced jobs and earnings. We have also calculated related local effects.

In the base case scenario above, it is assumed that the total capital expenditure on materials and equipment would be $1.112 billion. If this were to increase by 20% to $1.334 billion, the total number of jobs in the Canadian supply industries would increase from 4,004 PYs to 4,815 PYs (+811 PYs) during the construction period, with a corresponding rise in income of $42.3 million. Including total direct, indirect and induced effects throughout Canada, there would be an increase of 1,726 PYs of employment and $84.5 million in earnings associated with a capital expenditure of $1.334 billion.

Conversely, if machinery and equipment expenditures were 20% lower than the base case scenario ($889.6 million), the number of direct jobs in the supply industries would decline from 4,004 PYs to 3,192 PYs (-812 PYs), with reduced earnings of $42.4 million. This would correspond with a total reduction in national direct, indirect and induced PYs of 1,726, and $84.6 million in wages and salaries.

With a 20% increase in the purchase of machinery and equipment during the construction period, total provincial government tax revenues would increase from $36.2 million to $39.7 million; federal taxes would rise from $115.5 million to $128.6 million. A 20% decrease in value of machinery and equipment purchases would reduce overall provincial government revenues to $32.8 million and federal government revenues to $102.3 million.

Results are summarized in Table 7.

Table 7 Sensitivity Analysis of Changes in Machinery and Equipment Expenditures during Construction

	Provincial Direct	National Direct	Provincial Direct & Indirect	National Direct, Indirect & Induced	LSA	Local Aboriginal
Base case scenario: M&E of $1.1 billion						
Jobs in supply industries (PYs)	2,335	4,004	3,507	8,517	120	80
W&S in supply industries ($million)	$121.9	$209	$184.2	$417.2	$6.3	$4.2
With 20% increase in purchases of M&E						
Jobs in supply industries (PYs)	2,809	4,815	4,217	10,243	144	96
W&S in supply industries ($million)	$146.6	$251.3	$221.6	$501.7	$7.5	$5.0
With 20% decrease in purchases of M&E						
Jobs in supply industries (PYs)	1,862	3,192	2,796	6,791	96	64
W&S in supply industries ($million)	$97.2	$166.6	$146.9	$332.6	$5.0	$3.3

Another key assumption in the base case scenario is that 60% of operating expenditures would take place in Canada. If Canada's share of these expenditures rose to 70%, more employment and income would be created in the Ontario and Canadian economies.[12]

In the base case scenario above, it is assumed that average annual operating expenditures would be $361 million, and that 60% of this ($217.1 million) would be spent in Canada. If Canada's share of operating expenditures is increased by 10% to $253.2 million, the total number of jobs in the Canadian supply industries would rise from 642 PYs to 749 PYs, a gain of 107 PYs, and $9.9 million in wages and salaries. Including total direct, indirect and induced effects throughout Canada, total employment in Canada would rise by 290 PYs from 1,739 PYs to 2,029 PYs; income would rise correspondingly by $17.7 million to $123.8 million.

Reducing Canada's share of operating expenditures from 60% to 50% would have the opposite result, with approximately the same amount of jobs and income lost. Total direct, indirect and induced jobs in Canada would decline from 1,739 to 1,449 PYs, and income from $106.1 million to $88.4 million.

With a 70% Canadian share of operating expenditures, total annual provincial government tax revenues would increase from $12.7 million to $14.1 million; annual federal taxes would rise from $18.1 million to $21.2 million. If it is assumed that Canada would only have a 50% share of

[12] It is assumed that the full increase and decrease in annual operating expenditures would take place in Ontario.

annual expenditures, this would reduce overall provincial government revenues to $11.3 million and federal government revenues to $15.1 million.

Table 8 Sensitivity Analysis of Changes in Canadian Share of Operating Expenditures

	Provincial Direct	National Direct	Provincial Direct & Indirect	National Direct, Indirect & Induced	LSA	Local Aboriginal
Base case scenario: 60% of operating expenditures in Canada						
Annual jobs in supply industries (PYs)	428	642	742	1,739	19	13
Annual W&S in supply industries ($million)	$39.7	$59.5	$56.1	$106.1	$1.8	$1.2
With 70% of operating expenditures in Canada						
Annual jobs in supply industries (PYs)	535	749	972	2,029	22	15
Annual W&S in supply industries ($million)	$49.6	$69.4	$70.1	$123.8	$2.1	$1.4
With 50% of operating expenditures in Canada						
Annual jobs in supply industries (PYs)	321	535	556	1,449	16	11
Annual W&S in supply industries ($million)	$29.8	$49.6	$42.1	$88.4	$1.5	$1.0

6 Conclusions

The proposed Osisko Hammond Reef Gold Project represents a major investment of capital into Ontario's economy. The benefits would accrue to workers and businesses throughout the province, especially within the RSA, as well as elsewhere in Canada. The community of Atikokan and local Aboriginal communities would benefit directly from employment during construction and operations, and with companies servicing the mine.

In summary, the proposed Hammond Reef Gold Project is expected to support approximately 34,734 PYs of direct, indirect and induced jobs in Canada over its construction and operations phases, a period of 14 years. Just over half of these jobs would accrue in Ontario. Given that the highest-paying direct construction and operations jobs would be concentrated within the RSA, Ontario's share of wages and salaries would be 65%.

Over the 14 year analysis period, the Project is expected to generate $490.8 million in federal and provincial income tax revenues.

During the 11-year operations period the Project would contribute approximately $3.2 billion to national GDP.

Total benefits to Atikokan and local First Nation communities would be 3,129 jobs over the construction and operations periods, and $456.7 million in wages and salaries to construction workers, mine operators and workers in the supply industries.

Table 9: Summary of Benefits of Construction and Operations of Hammond Reef Mine

	Direct	Total Direct, Indirect & induced
CONSTRUCTION (Years 1-3)		
National		
Wages & salaries ($ millions)	$511.5	$719.7
Employment (Person Years)	5,044	9,557
Provincial		
Wages & salaries ($ millions)	$303.4	$365.7[13]
Employment (Person years)	3,115	4,287[14]
Local in LSA		
Wages & salaries ($ millions)	$36.5	Na
Employment (Person years)	224	Na
Local Aboriginal communities		
Wages & salaries ($ millions)	$19.3	Na
Employment (Person years)	132	Na
OPERATIONS (Years 4-14)		
National		
Wages & salaries ($ billions)	$1.575	$2.088
Employment (Person Years)	13,112	25,177
Provincial		
Wages & salaries ($ billions)	$1.17	$1.353[15]
Employment (Person years)	9,548	13,000[16]
Local in LSA		
Wages & salaries ($ millions)	$295.8	Na
Employment (Person years)	184	Na
Local Aboriginal communities		
Wages & salaries ($ millions)	$105.1	Na
Employment (Person years)	746	Na

[13] Provincial direct & indirect only
[14] Ibid.
[15] Ibid.
[16] Ibid.

TOTAL CONSTRUCTION & OPERATIONS		
National		
Wages & salaries ($ billions)	$2.086	$2.81
Employment (Person Years)	18,156	34,734
Provincial		
Wages & salaries ($ billions)	$1.476	$1.719
Employment (Person years)	12,663	17,287
Local LSA		
Wages & salaries ($ millions)	$332.3	Na
Employment (Person years)	408	Na
Local Aboriginal communities		
Wages & salaries ($ millions)	$124.4	Na
Employment (Person years)	878	Na

This significant infusion of earnings into the local communities as well as the regional study area would offset the earnings losses in forest products and mining during the past decade. While the economic benefits of the Project are significant, there would also be important social and economic benefits that cannot necessarily be quantified. A major mining project could attract and retain new skilled labour in the RSA, bringing with it new knowledge, expertise and training opportunities. This in turn would draw new families and help to reverse the regional population decline, creating new opportunities for businesses. A policy of training and hiring aboriginal workers would provide much-needed employment and economic opportunities to local First Nation communities.

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Appendix A: Estimated Cost Breakdowns

Table A1: Estimated Construction Costs of Hammond Reef mine

Component	2012 $ millions
General admin.	29
Mining	269
Electricity and communications	39
Infrastructure	59
Processing	682
Tailings and Water Management	29
Indirects	143
Contingency	129
Camp	25
Total	**1,400**

Source: Golder Associates, September 2012. Based on comparisons with Malartic mine capital costs

Table A2: Estimated Operating Costs of Hammond Reef mine

	2012 $ millions		
	Labour	**Expenditures**	**Total**
Mine	41	109	150
Processing	13	187	200
General services & administration	10	16	26
Transportation and refining	-	4	4
Camp	4	11	15
Total	**68**[17]	**327**	**395**

Annual operating expenditures of $327 million are broken down as follows:

- M&E 63%
- Energy 17%
- Fuel 10%
- Maintenance 5%
- Admin & overhead 5%

Note that expenditures of $327 million are used in first year of analysis, and that it is adjusted for an annual inflation rate of 2%. Over the 11 year operation period, average annual expenditures are $361.7 million.

[17] Note that there is a small inconsistency between this total labour cost, and what is produced using the hourly wages & hours provided by Golder ($75.6 million 2012$).

Appendix B: Methodology

Wages and salaries

In estimating the average wages and salaries for construction and operation, the following assumptions were made about workforce breakdown:

Table B1: Construction workforce breakdown

Occupation	Percentage of workforce
Welders, metalworkers, installers	25%
Professionals (engineers, architects, etc.)	15%
Mechanics and boilermakers	15%
Electricians	15%
Crane operators, drillers, blasters	15%
Heavy machinery operators, carpenters, pavers	10%
Management	5%

Table B2: Operations workforce breakdown

Occupation	Percentage of workforce
Mining	50%
Processing	25%
Maintenance	10%
Technical	5%
Services and administration	5%
Management	5%

Golder Associates provided direct employment and income data for construction and operations. This was used to develop annual construction and operations time series over a total period of 14 years. All wages and salaries were adjusted annually with a 2% inflation rate.

The average **construction** wage and salary rate in 2012 is assumed to be $88 per hour, with an average work year of 2,400 hours and a 30% labour burden (employer's social contributions, such as pension, EI, CPP, etc.).

The average **operations** wage and salary rate in 2012 is assumed to be $48 per hour, with an average work year of 2,000 hours, and a 30% labour burden. All wages and salary rates are pre-tax, include the 30% labour burden, and were scaled by an annual inflation rate of 2% for every year of the construction period.

Multipliers and Their Application in this Model

The following Statistics Canada Input/Output 2008 provincial and national multipliers were used in this analysis:

- Construction: Industry 32, "Other Engineering Construction" – used to calculate direct, indirect and national induced jobs and wages and salaries in the supplying industries, based on share of expenditures in Canada and Ontario;
- Operations: Industry 13, "Gold and Silver Ore Mining" – used to calculate direct, indirect and national induced jobs and wages and salaries in the supplying industries based on share of annual M&E expenditures in Canada and Ontario.

The multiplier values are as follows.

Table B3: Stats Canada I/O Employment and Income Multipliers used in OHRG Economic Impact Assessment

		Other Engineering Construction		Gold & Silver Ore Mining	
		W&S[s]	FTE jobs[b]	W&S[s]	FTE jobs[b]
Provincial (from provincial I/O multipliers)	Direct	.32	6.08	.274	2.96
	Direct & Indirect	.48	9.13	.39	5.13
All Provinces (from provincial I/O multipliers)	Direct & indirect	.50	9.59	.41	5.62
National (from national I/O multipliers)	Simple Direct & indirect	NA	8.87	NA	5.06
	Direct, indirect & induced	NA	11.96	NA	7.35

NOTES:
NA: not applicable
[a] I/O multiplier per $1 of exogenous industry output shock
[b] job effects per $million of output

For the construction period, the direct construction jobs and earnings were provided by Golder. In order to estimate employment and earnings among contractors and suppliers of machinery and equipment, it was assumed that Canadian share of capital expenditures was $658.5 million, and that Ontario's share was $384.1 million. The Canadian share ($658.5 million) was multiplied by the following factors to get FTE jobs:

Direct provincial FTE jobs = 6.08 X $384.1 million = 2,335 PYs

Direct and indirect provincial FTE jobs = 9.13 X $384.1 million = 3,507 PYs

Direct national FTE jobs = 6.08 X $658.5 million = 4,004 PYs

Direct and indirect national jobs[18] = 9.59 X $658.5 million = 6,317 PYs

Because provincial I/O multipliers do not include a factor to calculate national induced effects, we employed the national I/O multiplier to estimate this as follows:

6,317 FTE jobs X 1.348 = 8,515 FTE jobs

where

- 6,317 is "all provinces" direct and indirect employment (derived with provincial multiplier above)
- 1.348 is the ratio of national direct, indirect & induced employment (11.96) to "all provinces" direct & indirect employment (8.87)
- 8,515 FTE jobs is the resulting estimate of total national direct, indirect and induced employment

The same approach was taken to calculating wages and salaries in the supply industries during construction. This approach was also used in calculating direct, indirect and induced employment and income effects for the supply industries during the operations phase, using the multipliers for mining silver and gold ore in Table B3.

As a check of the results, when the ratios of total national direct, indirect and induced employment to direct employment is calculated, they produce job multipliers of 1.89 for construction, and 1.92 for operations. These can be regarded as conservative because no calculation of provincial induced effects is included.

Local Effects

Local effects were calculated based on local share of direct employment and jobs in the supplying industries, specifically:

Construction phase: locals take 15% of construction jobs and 5% of jobs in supply industries

Operations phase: locals take 40% of operating jobs and 5% of jobs in supply industries

[18] Using Provincial I/O multiplier for "all provinces"

Government Revenues

In order to apply the appropriate provincial or federal government personal income tax rates it was necessary to make some assumptions about average income categories. Provincial and federal government revenues were calculated separately. As stated in the report, annual income for construction workers would fall into the highest provincial and federal tax brackets (about $200,000 annually without tax burden), and it is assumed that income for workers in mine operations (who average $90,000 annually) would fall into the third provincial and federal tax brackets. The average annual income for "direct and indirect" workers is approximately $75,000 but encompasses a range of occupations with various salaries, and for the purpose of this analysis, it was assumed that these workers' incomes fall into the first and second provincial and federal tax brackets.[19] By the same token, average induced earnings are about $40,000 annually, putting these incomes into the first provincial and federal brackets. [20]

Using assumptions about what shares of total annual wages & salaries would fall into each of the income brackets identified in Table 4, the corresponding provincial and federal tax rates were applied to calculate total annual government revenues. An example of how federal taxes were calculated for construction workers with annual wage of $200,000 in year 1 of the construction phase is as follows.

Federal tax revenue in year 1 of construction =

(42/200) X 15% X $22.7 million + (42/200) X 22% X $22.7 million + (47/200) X 26% X $22.7 million + (69/200) X 29% X $22.7 million = $5.42 million

where

- $22.7 million is total construction workers' wages and salaries in year 1
- $200,000 is average income (net of labour burden)
- 42/200, 47/200 and 69/200 are the shares of income that correspond with respective tax rates

The effective federal government tax rate on this stream of earnings in year 1 of construction is therefore 23.9% ($5.42 million/$22.7 million).

This approach is used to calculate provincial and federal government revenues for construction and mine operations workers, as well as workers in the supply industries. Our estimate of government revenues can be regarded as conservative because it does not calculate tax on provincial induced income, and it is based on salaries without labour burden.

[19] Source of income: Statistics Canada Provincial I/O multipliers.
[20] Ibid.

GDP Effects

For this analysis GDP has been calculated as the value of gross mine output minus purchases of intermediate inputs. Intermediate inputs is defined as the purchase of all goods and services for operations only (fuel, electricity, repairs, services, etc).

Total GDP generated by the Project is estimated to be $291.4 million annually, totalling $3.205 billion over 11 years. This is direct GDP only, and does not include indirect or induced effects.

Our estimate can be regarded as conservative, especially in light of an industry report for the Ontario Mining Association, published at the end of 2012 after completion of this analysis (Dungan, Peter and Murphy, Steve, December 2012). This report states that, based on new Statistics Canada I/O industry GDP multipliers, that for one dollar of output, total direct, indirect and induced effects in Canada would be 1.118 dollars. Using the total estimated value of output of the OHRG mine over 11 years ($7.2 billion), this would create total direct, indirect and induced GDP of $8 billion during the Project's operating lifetime.

APPENDIX 2.III
Traffic Impact Study

MORRISON HERSHFIELD

FINAL REPORT

Hammond Reef Gold Mine Project

Traffic Impact Study

Atikokan, Ontario

Presented to:

Peter Brown
Golder Associates Limited
2390 Argentia Road
Mississauga, Ontario, L5N 5Z7

Project No. 2124026.00 November 9, 2012

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APPENDIX A: Traffic Data

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1. INTRODUCTION

1.1 Overview

Morrison Hershfield Limited was retained by Golder Associates to examine the traffic-related impacts of the Hammond Reef Gold Mine Project, a mining site which is slated to open for production purposes in 2017, pending all approvals. The site is expected to include a camp-site and tailings management facility in addition to two open-pit mines, and will remain in production until 2028, when it will be decommissioned and closed.

As a result of the production occurring at the mine, an increase in traffic will occur as employees, supplies and products travel to and from the facility. This study will investigate the impact of the site generated traffic, during construction and operations, on the existing and future traffic conditions of the neighbouring road network.

This report will detail the following elements of the traffic impact study:

- **Project Description & Study Area** – A brief summary of the project limits;
- **Summary of Base Data** – Including anticipated truck traffic to and from the project area, anticipated number of employees working at the project site, other relevant studies, and available traffic counts at the key intersections and access roads;
- **Traffic Data Collection** – Summary of data requirements for the project, and collection of appropriate additional data;
- **Trip Generation/Distribution** – Identification of trip generation, peaking characteristics and potential direction of approach, including traffic forecasts and distribution across the network;
- **Analysis of Existing Conditions** – Traffic analysis of surrounding routes at present, prior to the addition of project-based traffic;
- **Analysis of Future Conditions –** Traffic analysis at a number of horizons (end of construction, 5 year horizon from launch, 10 year horizon from launch); and
- **Mitigation Measures** – For locations (if any) where operational and geometric improvements will be required.

1.2 Study Area

The Hammond Reef Mining Project is located in Northwestern Ontario, northeast of the Town of Atikokan in the District of Rainy River. The project site is accessible from Highway 622 via Hardtack/Sawbill Road. Highway 622 runs in the north-south direction and connects Highway 11 in the south with Highway 17 in the north. The surrounding land uses support a variety of recreational activites such as canoeing, boating, camping and hiking. The OPG Atikokan Generation Station, one of the major employers in Atikokan, is located on Marimon Lake, approximately 8 kilometers north of the town along Highway 622. Another major employer, the Atikokan General Hospital, is located within town limits.

The study area is presented below in Figure 1 and includes Highway 11, as well as the primary access route to the site.

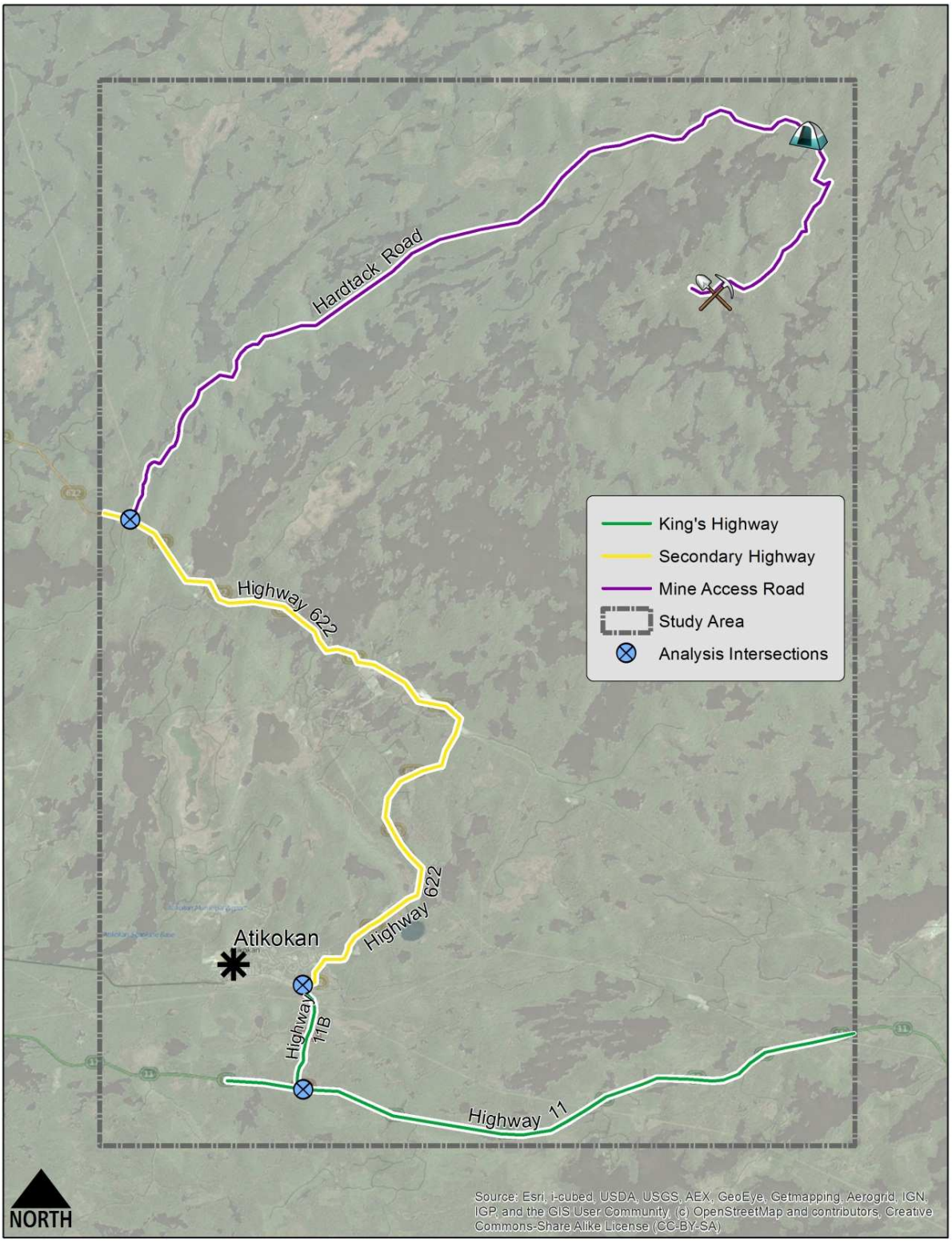


Figure 1 – Hammond Reef Study Area

1.3 Road Network & Site Description

Within the study area (illustrated in Figure 1), the primary routes to the mine site are a combination of provincial highways and local, gravel roads. A summary of the major roads in the study area is provided below in Table 1.

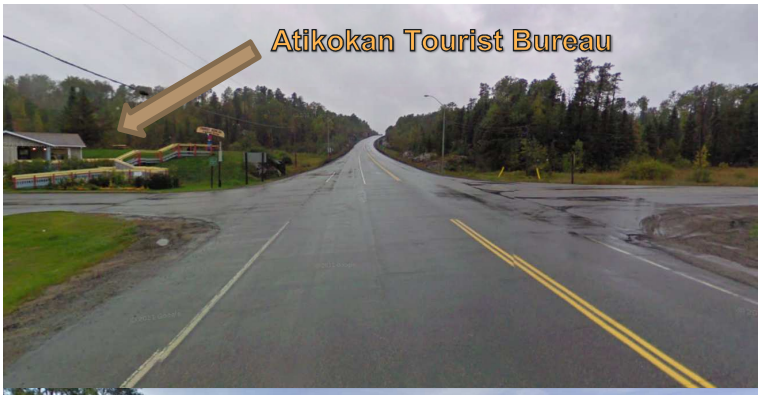
Table 1 – Primary Routes in the Study Area

Highway 11 ▪ Two-lane ▪ Rural; Arterial; Undivided with posted speed of 90 km/hr (RAU 90) ▪ Provincial jurisdiction ▪ King's Highway ▪ Gravel shoulders	
Highway 11B ▪ Two-lane ▪ Rural; Arterial; Undivided with posted speed of 80 km/hr (RAU 80) ▪ Speed limit near Atikokan = 60 km/hr ▪ Provincial jurisdiction ▪ King's Highway ▪ Gravel shoulders	
Highway 622 ▪ Two-lane ▪ Rural; Arterial; Undivided with posted speed of 80 km/hr (RAU 80) ▪ Posted speed near Atikokan = 60 km/hr ▪ Posted speed at Hardtack Road = 80 km/hr ▪ Provincial jurisdiction ▪ Secondary Highway ▪ Gravel shoulders	
Hardtack/Sawbill Road ▪ Two-lane ▪ Rural; Local; Undivided , with posted speed of 50 km/hr (RLU 50) ▪ Currently under construction	

The analysis of existing, projected background, and site traffic will be carried out by determining the influence of the site traffic at each of the intersections of the study area.

A summary of the major intersections in the study area is provided below.

Table 2 – Key Intersections in the Study Area

Hwy 11 and Hwy 11B ▪ Intersection between the TransCanada Highway (Highway 11) and Town of Atikokan access spur (Highway 11B) ▪ Two-way stop controlled T-intersection with a westbound right turn channelization and eastbound left turn auxiliary lane (Stop control in NB and SB directions) ▪ Fourth leg of the intersection is a driveway entrance to the Atikokan Tourist Bureau	 
Hwy 11B & Highway 622 ▪ Two-way stop controlled T-intersection (Stop control in SB direction) ▪ Right-turn and left-turn auxiliary lanes along Highway 11B ▪ At–grade rail crossing is located just south of the intersection	
Hwy 622 and Hard Tack Rd ▪ Adjacent to Valerie Fall Rd/Highway 622 intersection ▪ Offset intersection (modelled as a standard intersection) ▪ T-intersection with minor leg stop-controlled	

2. ANALYSIS METHODOLOGY

The general approach utilized in evaluating the impacts of the project is described below in Figure 2.

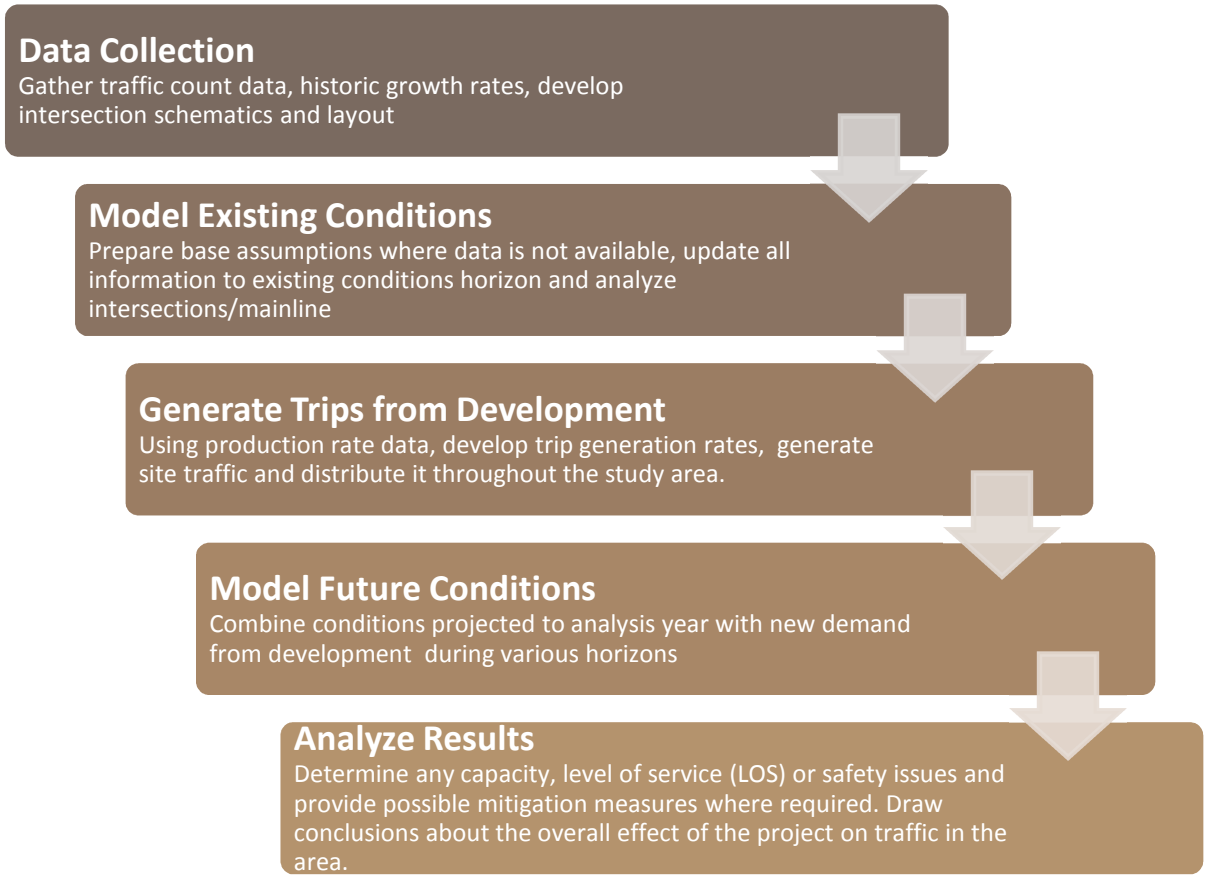


Figure 2 – Analysis Methodology

2.1 Modeling Approach

Traffic counts were projected to the baseline year of 2012 and then analyzed for existing conditions using Synchro (intersections)[1] and Highway Capacity Software (mainlines)[1].

For the intersections analyzed with Synchro, poor performance is defined as any intersection with a volume-to-capacity (V/C) ratio greater than 0.9, or a delay greater than 50 seconds for an individual movement of the intersection. The level of service categories for unsignalized intersections are provided in Table 3 below.

[1] Synchro and HCS are state-of-the-art software programs that are extensively used in the transportation engineering industry to analyze traffic operations at intersections and along roadway segments.

Table 3 – Level of Service Categories

LOS[2]	V/C[3]	Delay
A	0-0.6	≤10 sec
B	0.61-0.70	10-15 sec
C	0.71-0.80	15-25 sec
D	0.81-0.90	25-35 sec
E	0.91-1.00	35-50 sec
F	>1.00	≥50 sec

For the mainline segments, level of service in Highway Capacity Software (HCS) is calculated based on average travel speed and percent time spent following. The level of service categories for Class I Highways are provided in Table 4 below.

Table 4 – HCS Level of Service Categories

LOS	Average Travel Speed (km/hr)	Percent Time Spent Following (%)
A	≤35	≤35
B	>35-50	>35-50
C	>50-65	>50-65
D	>65-80	>65-80
E	>80	>80
F	Applies whenever the flow rate exceeds the segment capacity	

The following are some general assumptions that were used in the analysis for this report – more detailed assumptions appear throughout the report in the appropriate sections:

- Where traffic counts were unavailable, assumptions were made as to the distribution of traffic on the network. In developing future conditions, the baseline conditions were projected forward using similar growth rates. The traffic stemming from the project was added to future conditions for the three horizons (construction, five years into operation and end of operations [12 years]).

- Peak hour site-generated traffic volumes were assumed to occur during the morning (AM) and afternoon (PM) peak hours of the intersections in the study area;

- The site-generated volumes were assumed to occur over an 8 hour period and the peak hour volumes were 50% higher than the other hours. This approach was taken to analyze realistic yet slightly conservative scenarios;

[2] Level of service is defined by the 2010 Highway Capacity Manual as "A quantitative stratification of a performance measure of measures that represent quality of service, measured on an A-F scale, with LOS A representing the best operation conditions"
[3] V/C is defined as "the ratio of flow rate to the capacity for a system element."

- Mainline traffic volumes were derived from the intersection counts. 50% no passing zones and 5% recreational vehicles were assumed on the highways;

- Analysis assumes that there is a sufficient minimum pavement quality that is maintained in order to reduce the effect on operating and posted speeds. Currently, many of the roads are gravel or dirt, so it is assumed that an investigation will be carried out and any required upgrades to surface conditions of the road will be made;

- The growth rate was analyzed using ten years' worth of Annual Average Daily Traffic (AADT)[4] data from the Ministry of Transportation of Ontario (MTO). The annual growth rate was applied to the most recent traffic data in order to update it to the various time frames. Where the growth rate showed a decline in traffic over the ten year period (i.e. -3% for Highway 11 at 11B, Highway 11B at 11, Highway 622 at Hardtack), a conservative modeling approach was taken and a 0% increase was assumed. In all other cases, the actual calculated rate was applied;

- Two trip distribution scenarios were analyzed to try to capture the most conservative cases and as such analyze the "worst case" for the surrounding roadway infrastructure;

[4] Annual Average Daily Traffic (AADT) is the total volume of traffic passing a point or segment of a highway facility in both directions for 1 year divided by the number of days in the year in vehicles per hour (vph)

3. EXISTING CONDITIONS

Existing conditions were studied to evaluate the current state of the transportation network – which helps to provide a benchmark for comparing the future conditions resulting from the development. The base year for this study was considered to be 2012, representing pre-construction and pre-production conditions.

3.1 Data Collection

Data was obtained from the MTO for the following intersections of interest to this study:

- Highway 11 – Highway 11B (August, 2009)
- Highway 11B – Highway 622 (August, 2009)
- Highway 622 – Highway 17 (August, 2009)

Although no data is available for the intersection of Hard Tack Rd and Highway 622, Hard Tack Rd is a gravel back road at present. It is therefore assumed that the existing traffic on this road is negligible and the overwhelming majority of traffic will be generated by the site itself. Traffic volumes for the existing conditions are illustrated in Figure 3.

3.2 Analysis Results

3.2.1 Intersections

The key intersections of the study area were analyzed based on turning movement counts or distributions resulting from the current network. It is evident from the results shown in Table 5 that all of the intersections are operating well below capacity with negligible delay.

Table 5 – Existing Conditions at Study Intersections

Location	AM		PM	
	LOS	V/C	LOS	V/C
Hwy 622 & Hardtack Rd	A	0.02	A	0.02
Hwy 11B & Hwy 622	A	0.09	A	0.13
Hwy 11 & Hwy 11B	A	0.07	A	0.07

3.2.2 Highway Segments

Mainline analysis of the highway segments was carried out using HCS. The results, shown in Table 6, indicate that all of the highway segments operate at level of service 'B' or better.

Table 6 – Existing Conditions on Highway Mainlines

Highway	Location	AM		PM	
		LOS	V/C	LOS	V/C
Hardtack Rd	N of Hwy 622	A*	~0.00	A*	~0.00
Highway 622	N of Hwy 11B	A	0.06	A	0.08
Highway 11B	W of Hwy 622	B	0.09	B	0.12
Highway 11	E of Hwy 11B	A	0.03	A	0.04

**Note: Due to the lack of data on Hardtack Rd, an HCS analysis was not completed. It was assumed that volumes on Hardtack are extremely low and as such the LOS will be high and the V/C ratio very close to 0.00.*

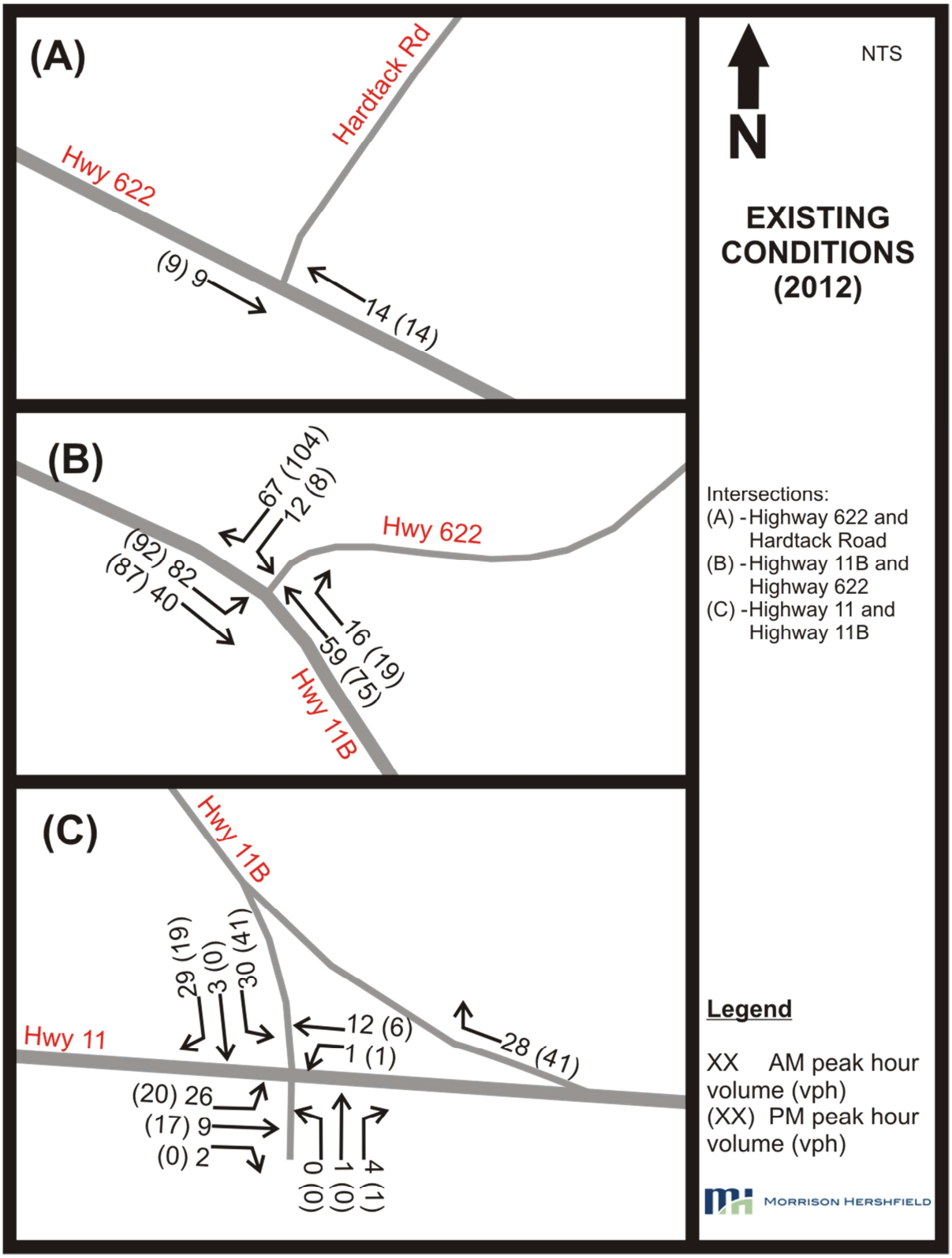


Figure 3 – Existing Traffic Conditions

4. FUTURE CONDITIONS

The future traffic volumes were considered under several conditions in order to determine the full impacts of the mine development.

- *Background Traffic* – 2016, 2021 and 2028
    - Background traffic is generated for each horizon by projecting existing counts to the analysis year based on historical growth rates (refer to section 4.1)
- *Construction Site Traffic* – 2016; Scenario 1 and 2
    - Since trip generation varies between construction and operation, the first horizon is analyzed to consider the traffic impacts associated with the construction period (early 2014 to late 2016). Scenarios 1 and 2 correspond to different trip distribution settings (refer to Section 4.3).
- *Operations Site Traffic* – 2021 and 2028; Scenario 1 and 2
    - A five year and twelve year horizon are analyzed during mine operation. The twelve year horizon (2028) corresponds to the end of mine operations. Scenarios 1 and 2 correspond to different trip distribution settings (refer to Section 4.3).

The background traffic at each horizon was added to either the construction or operation site traffic (as appropriate for the horizon) and the results were analyzed to determine any network deficiencies or resulting drops in level of service.

4.1 Existing (Background) Traffic Growth Projections

In order to consider future traffic conditions, existing counts were projected forward for each time horizon. The traffic growth rates were applied based on consideration of historical traffic data – as shown in Table 7. These projected future volumes were then added to site traffic for the future horizons (refer to Sections 4.4-4.6)

Table 7 – Historical Traffic Growth Rates for Projecting Background Traffic

Highway	At	Growth Rate
Highway 11	Highway 11B	0%
Highway 11B	Highway 11	0%
Highway 11B	Highway 622	1%
Highway 622	Highway 11B	2%
Highway 622	Hardtack Road	0%

In addition to the existing traffic, there is potential for increased traffic due to other developments or planned road improvements. The Atikokan Generating Station is projected to see an increase in traffic resulting from their Biomass Re-Fuelling Project. However, according to the *Atikokan GS Biomass Re-fuelling Project Traffic Impact Study* from March,

2011, the project is only expected to generate 10 trucks trips in the peak hour. As a result, the effect on the future road network is essentially negligible.

4.2 Trip Generation

Since the trip generation will be production-based for this project, traditional trip generation methodologies (i.e. applying ITE's Trip Generation Manual based on the number of employees or square footage of development) are not valid. Instead, a number of assumptions were developed based on similar mining Traffic Impact Study (TIS) reports and application of engineering judgment. The appropriateness of these assumptions was confirmed with Osisko and Golder before proceeding with the study. Note that although the average construction workforce is expected to be 390, the maximum expected workforce of 1200 was used for this study in order to be more conservative in analyzing impacts on the road network.The trip generation is illustrated in Table 8.

Table 8 – Trip Generation

Generator	Notes	Construction		Operations	
		Count	Frequency	Count	Frequency
Employees	Operations – 550; Construction - 1200				
Shuttle	80% expected to be shuttled (stay on site during shift)	39	Monthly	18	Weekly
Personal Vehicles	20% expected to drive in every day (commute daily)	192	Daily	88	Daily
Gold Transport	1140 oz per day	0	Weekly	2	Weekly
Food	One 40' trailer / 150 people / wk	5	Weekly	4	Weekly
General Supplies					
Camp	Non-food requirements for living	5	Weekly	3	Weekly
Office	Deliveries, supplies, etc.	5	Daily	5	Daily
Warehouse	Materials	5	Weekly	5	Weekly
Chemicals					
Ore processing	Assumed Based on other TIS's	1	Daily	1	Daily
Explosives	Assumed Based on other TIS's	2	Daily	2	Daily
Dust Suppression	Assumed	1	Weekly	1	Weekly
Water Purification	Assumed	2	Monthly	2	Monthly
Fuel					
Back-up generators	Assumed Based on other TIS's	1	Weekly	1	Weekly
Vehicles	Assumed	2	Daily	2	Daily
Waste					
General Hazardous Waste	To landfill	4	Daily	2	Daily
Rock	Potentials to be recycled and used in road construction	5	Daily	2	Daily

Generator	Notes	Construction		Operations	
		Count	Frequency	Count	Frequency
Infrastructure					
Maintenance	Assumed	0	Monthly	1	Monthly
Repairs	Assumed	0	Monthly	2	Monthly
Inspection	Assumed	0	Annually	3	Annually
Construction	Includes provision for temporary structures				
Materials	Assumed Based on other TIS's	5000	Annually	0	Annually
Removal	Assumed Based on other TIS's	1500	Annually	0	Annually
Totals	Total Annual:	84,891	/ year	39,061	/ year
	Total Daily:	233	/ day	108	/ day

From this table, it was concluded that the project is expected to generate about 230 trips / day during the construction period (2014-2016) and about 110 trips / day during operations (2017-2028).

Based on the peak hour assumptions described in Section 2.1, this translates to about 44 vph in the AM and PM peak hours during construction. During operations, this results in about 20 vph in the AM and PM peak hours.

4.3 Trip Distribution

Network distribution was assumed based on the road layout and common destinations in the area. Two scenarios were developed for trip distribution in the inbound (i.e. into mine site) and outbound directions. The primary scenario assumes that all traffic is headed to/originates from the south of the mine site at Atikokan (80%) and Highway 11 (20%). In the second scenario, some traffic originates/heads north on Highway 622 to eventually meet up with Highway 17 (20%). Since 80% of the workforce is projected to be bussed to the site, and the remaining 20% is projected to drive from Atikokan, employee traffic to/from the site will rely solely on Highway 622. The production volume at the mine is not expected to generate a significant amount of truck traffic, so the majority of trips come from employee traffic or supply/camp trucks. As a result, the distribution scenarios show high percentages of traffic to and from Atikokan.

An illustration of the trip distribution assumptions is shown in Figure 4. The resulting traffic volumes on the road network are illustrated for the construction period (Scenario 1 & Scenario 2) in Figure 5 and Figure 6. Traffic volumes during operations are shown in Figure 7 and Figure 8.

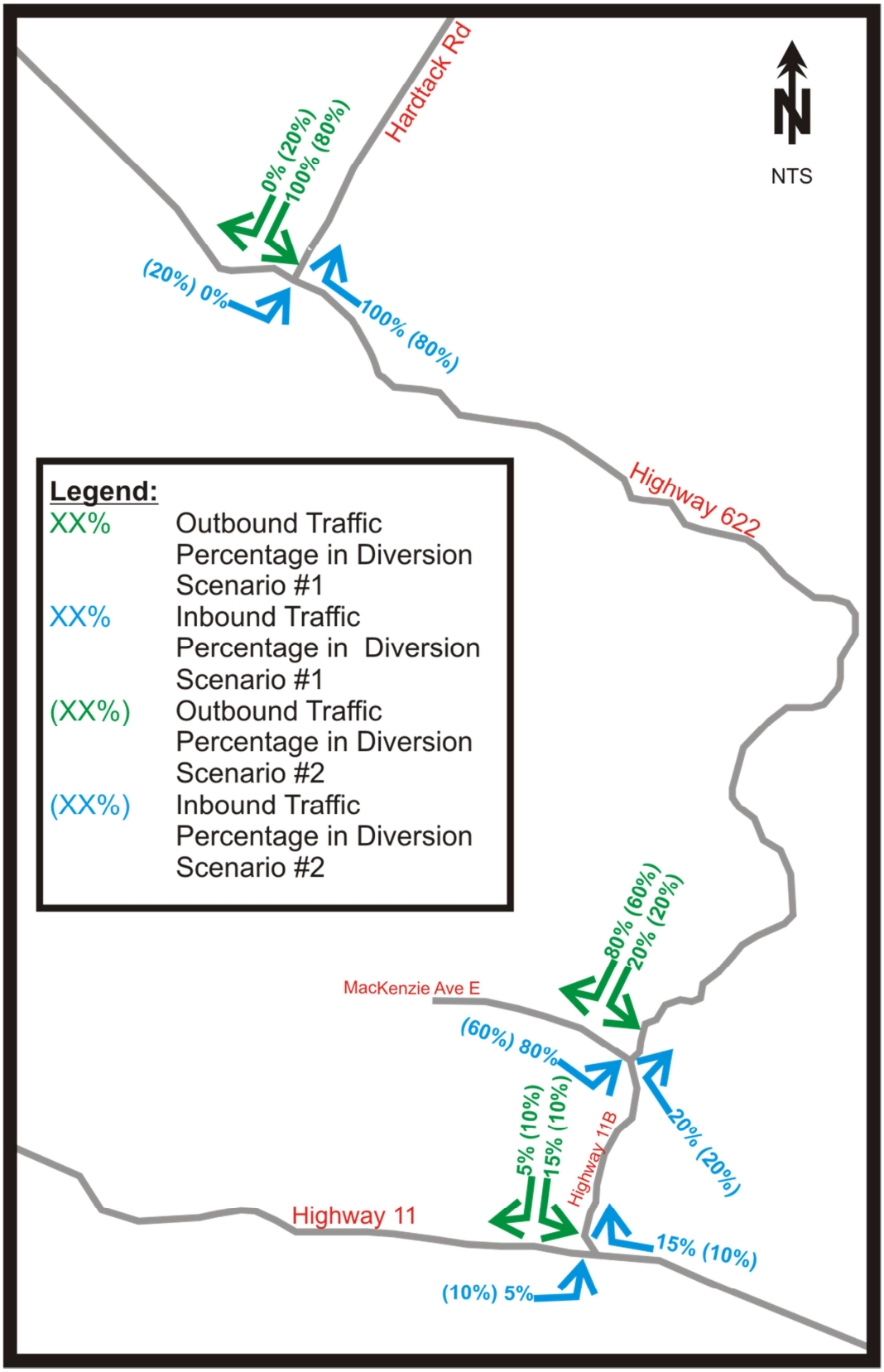


Figure 4 – Trip Distribution Assumptions

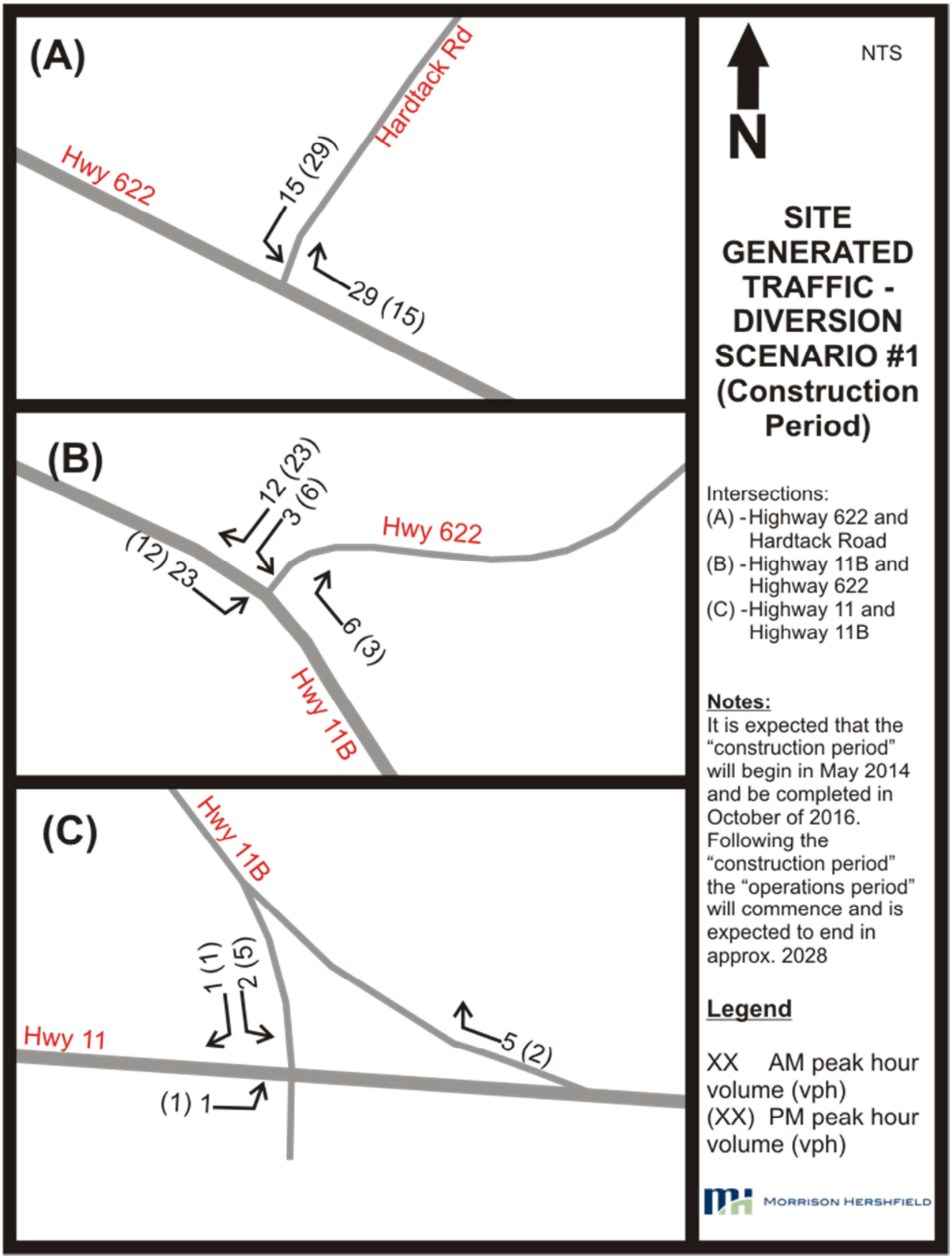


Figure 5 – Site Generated Traffic during Construction (Scenario 1)

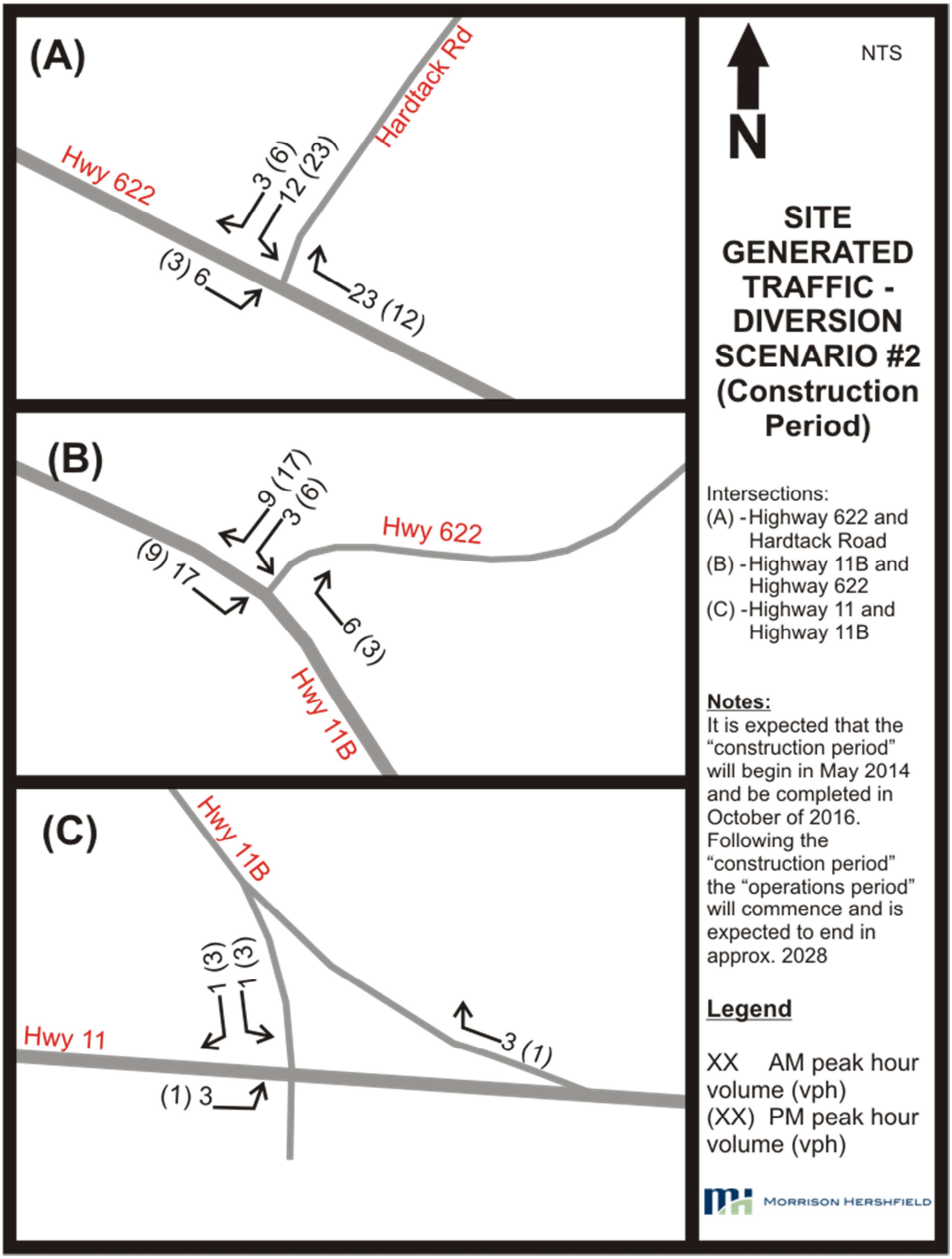


Figure 6 – Site Generated Traffic during Construction (Scenario 2)

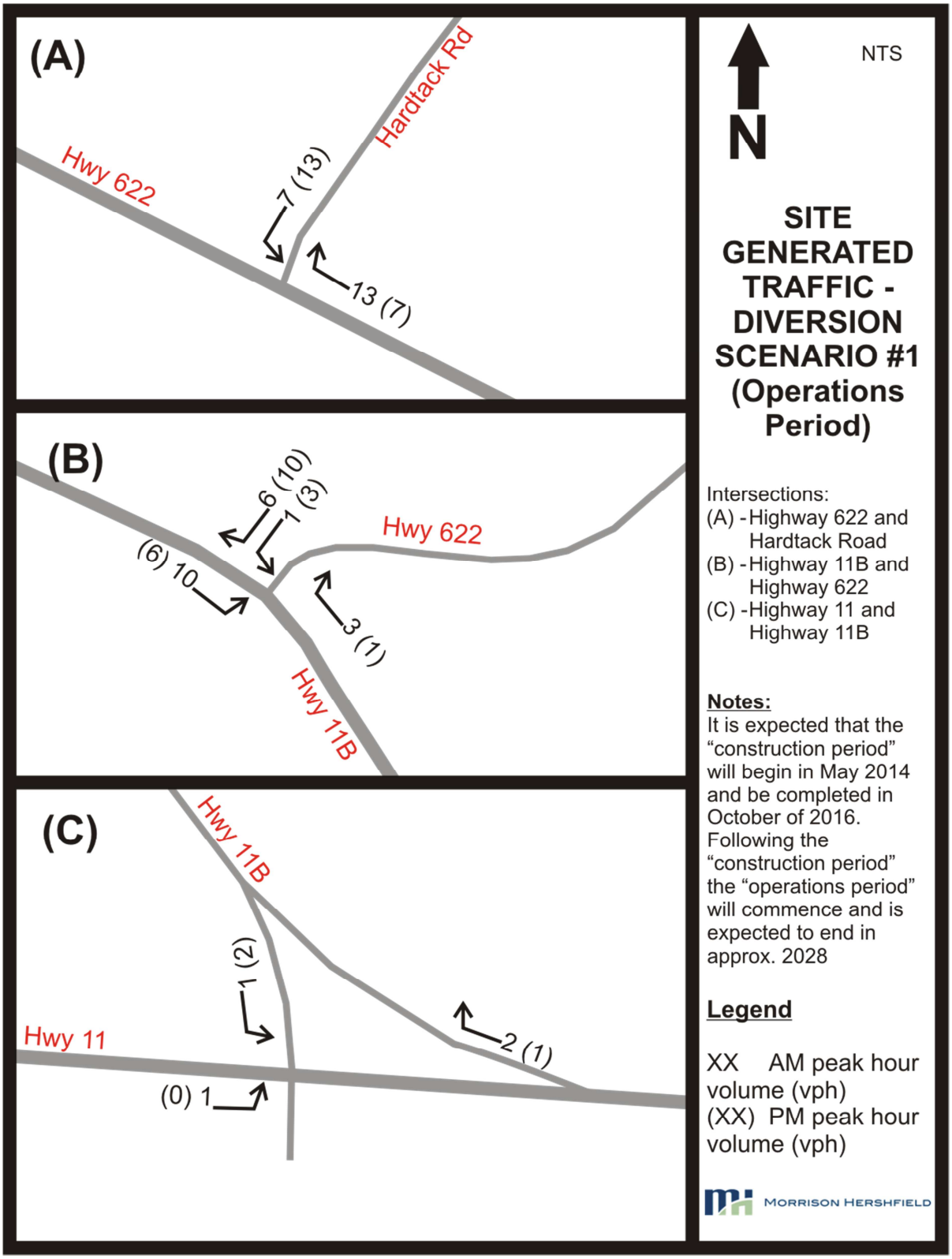


Figure 7 – Site Generated Traffic during Operations (Scenario 1)

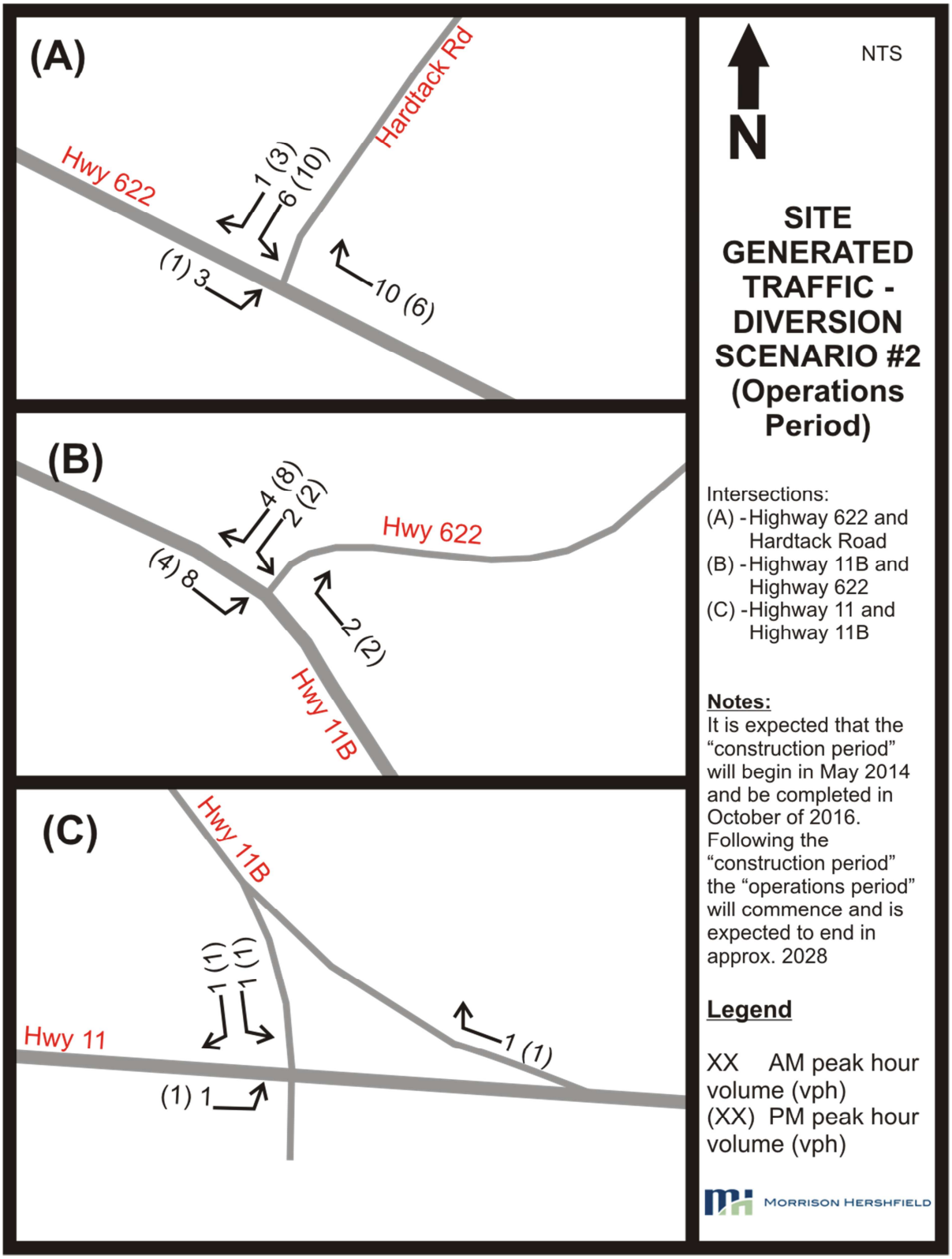


Figure 8 – Site Generated Traffic during Operations (Scenario 2)

4.4 2016 – End of Construction (Site + Background Traffic)

Final traffic volumes for the 2016 horizon were developed for both distribution scenarios based on projected existing counts (background) and the construction trip generation (site). These volumes are illustrated in Figure 9 and Figure 10.

These volumes were analyzed in Synchro to determine the impacts at the study intersections. The results (shown in Table 9) indicate that all intersections continue to operate at level of service A.

Table 9 – Intersection Results for 2016 Horizon

Location	Diversion Scenario 1				Diversion Scenario 2			
	AM		PM		AM		PM	
	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Hwy 622 & Hardtack Rd	A	0.03	A	0.04	A	0.02	A	0.02
Hwy 11B & Hwy 622	A	0.12	A	0.18	A	0.12	A	0.17
Hwy 11 & Hwy 11B	A	0.07	A	0.07	A	0.07	A	0.07

The mainline results, evaluated using HCS, are shown below in Table 10. Results indicate that all highway segments operate at acceptable levels of service.

Table 10 – Mainline Results for 2016 Horizon

Route	Location	Diversion Scenario 1				Diversion Scenario 2			
		AM		PM		AM		PM	
		LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Hard Tack	N of Hwy 622	A	0.05	A	0.05	A	0.05	A	0.05
Hwy 622	N of Hwy 11B	A	0.09	B	0.10	A	0.09	B	0.10
Hwy 11B	W of Hwy 622	B	0.10	C	0.15	B	0.10	C	0.15
Hwy 11	E of Hwy 11B	A	0.03	A	0.04	A	0.03	A	0.04

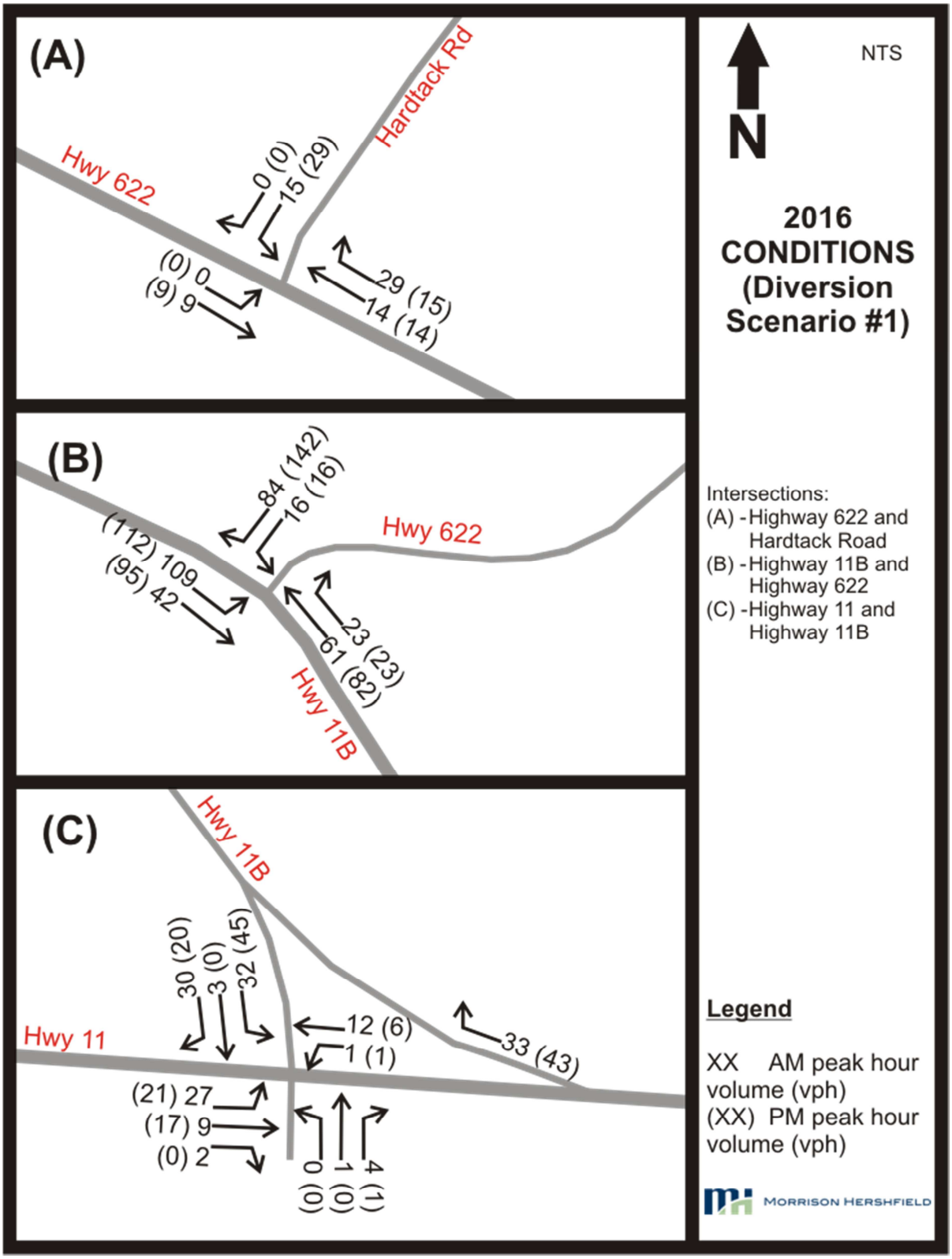


Figure 9 – 2016 Traffic Volumes (Scenario 1)

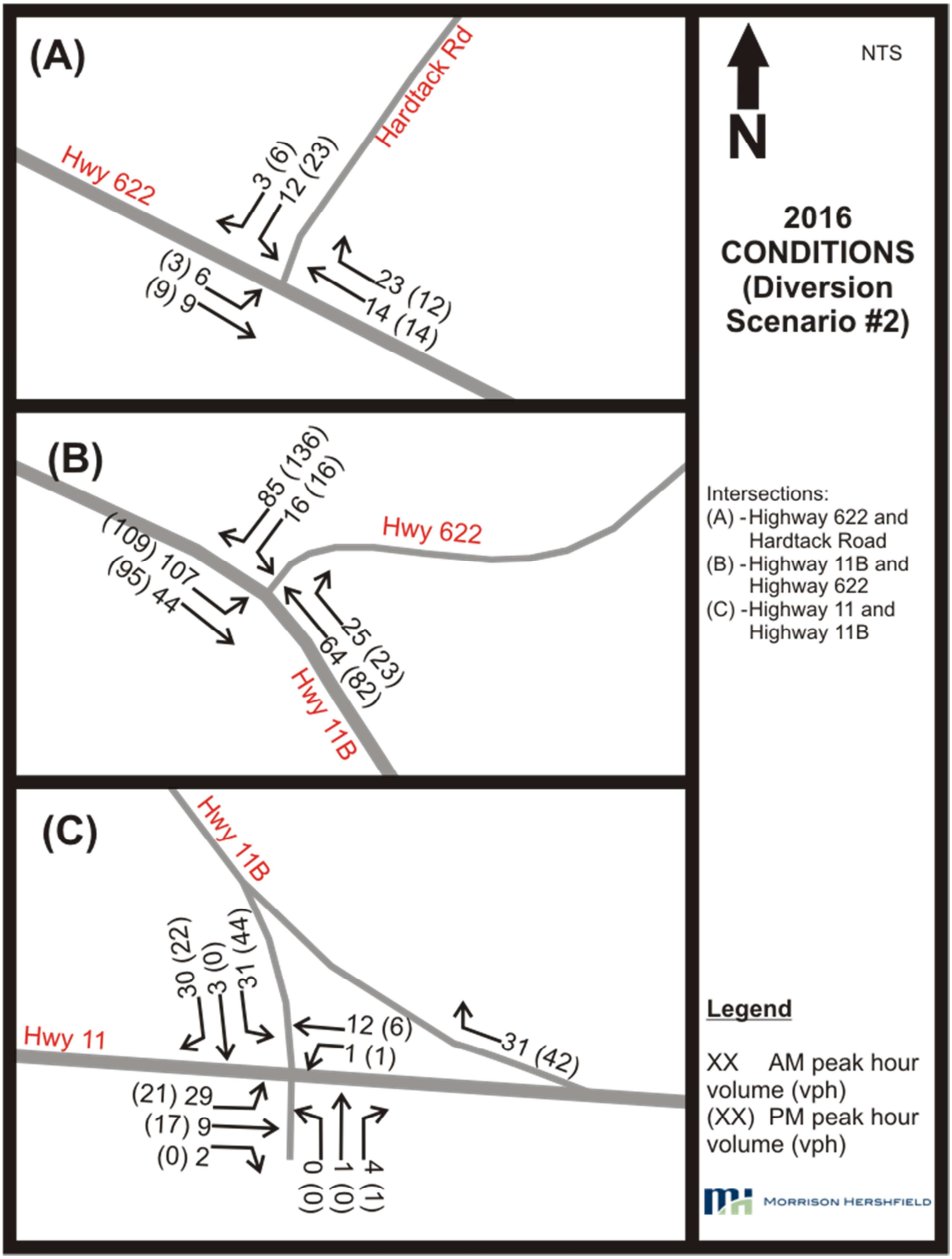


Figure 10 – 2016 Traffic Volumes (Scenario 2)

4.5 2021 – Five Year Horizon – Operations (Site + Background Traffic)

The five year horizon considers operation conditions along with projected background traffic. The traffic volumes pertaining to this analysis horizon are shown in Figure 11 and Figure 12.

Table 11 illustrates the results of the intersection analysis – which confirms that all intersections continue to operate well below capacity in 2021.

Table 11 – Intersection Results for 2021 Horizon

Location	Diversion Scenario 1				Diversion Scenario 2			
	AM		PM		AM		PM	
	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Hwy 622 & Hardtack Rd	A	0.02	A	0.02	A	0.01	A	0.02
Hwy 11B & Hwy 622	A	0.12	A	0.18	A	0.13	A	0.18
Hwy 11 & Hwy 11B	A	0.07	A	0.07	A	0.07	A	0.07

Similarly, mainline results show acceptable levels of service, as illustrated in Table 12.

Table 12 – Mainline Results for 2021 Horizon

Route	Location	Diversion Scenario 1				Diversion Scenario 2			
		AM		PM		AM		PM	
		LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Hard Tack	N of Hwy 622	A	0.02	A	0.02	A	0.02	A	0.02
Hwy 622	N of Hwy 11B	A	0.09	B	0.10	A	0.08	B	0.10
Hwy 11B	W of Hwy 622	B	0.11	C	0.15	B	0.11	C	0.14
Hwy 11	E of Hwy 11B	A	0.03	A	0.04	A	0.03	A	0.04

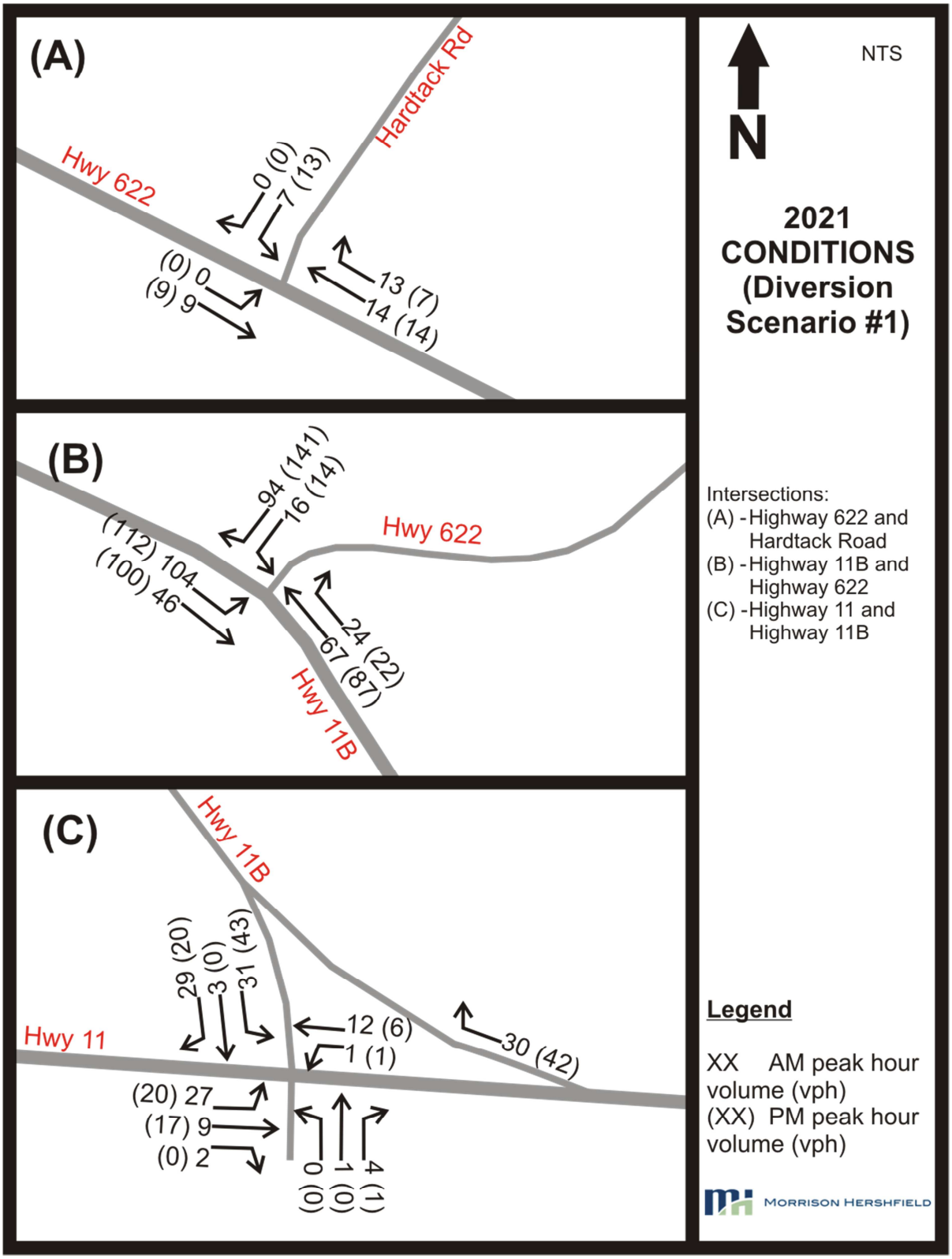


Figure 11 – 2021 Traffic Volumes (Scenario 1)

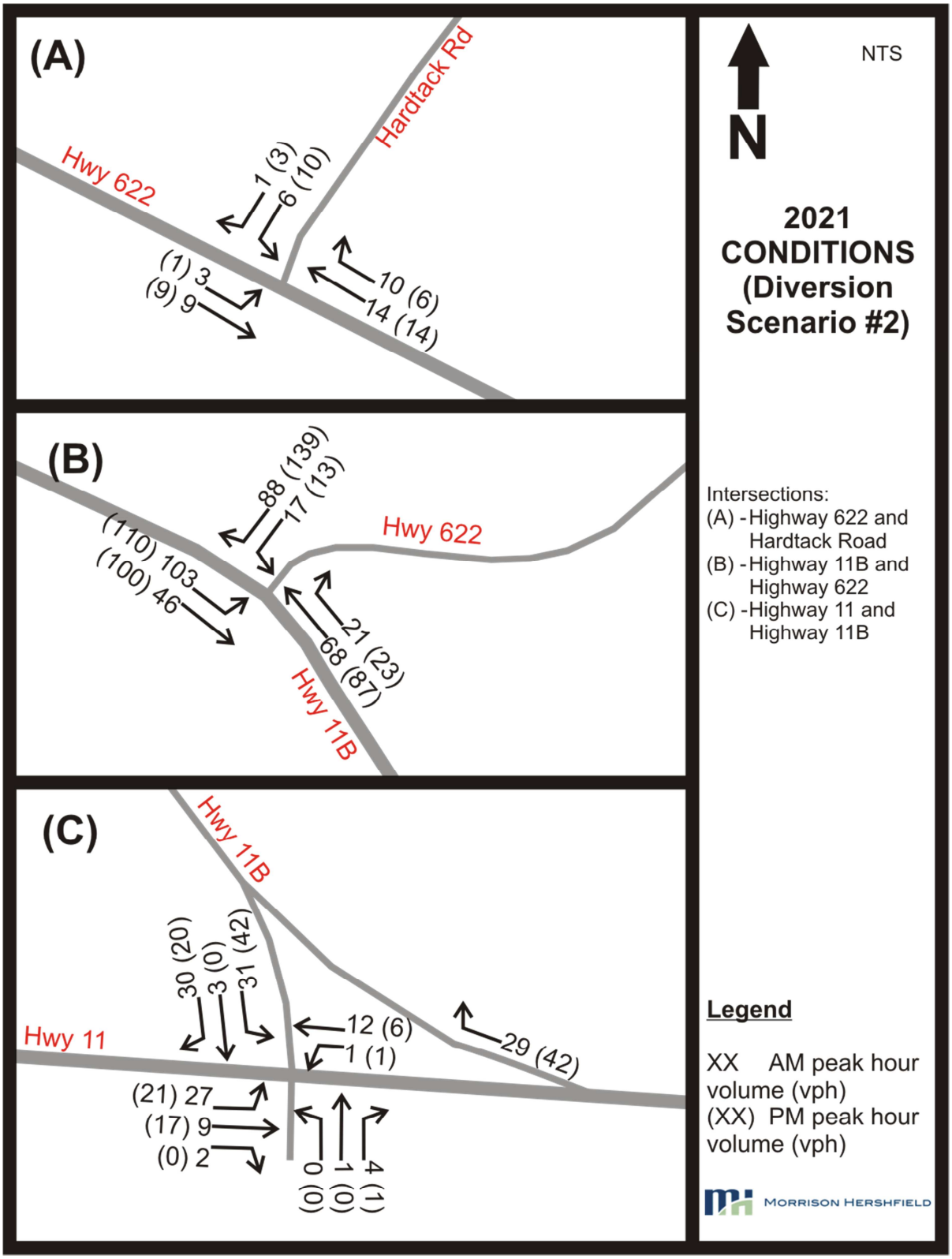


Figure 12 – 2021 Traffic Volumes (Scenario 2)

4.6 2028 – Twelve Year Horizon – Operations (Site + Background Traffic)

For the 2028 horizon, background traffic was compounded over a twelve year period and operations traffic was added to this. The traffic volumes associated with this analysis year are shown in Figure 13 and Figure 14, for Scenario 1 and 2, respectively.

Table 13 provides results for the intersection analysis, which continues to show that all intersections operate at an acceptable level of service.

Table 13 – Intersection Results for 2028 Horizon

Location	Diversion Scenario 1				Diversion Scenario 2			
	AM		PM		AM		PM	
	LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Hwy 622 & Hardtack Rd	A	0.02	A	0.02	A	0.02	A	0.02
Hwy 11B & Hwy 622	A	0.15	B	0.20	A	0.14	B	0.20
Hwy 11 & Hwy 11B	A	0.07	A	0.07	A	0.07	A	0.07

Table 14 shows the results of the mainline analysis. The results are similar to the previous horizons – all of the highways operate at acceptable levels of service.

Table 14 – Mainline Results for 2028 Horizon

Route	Location	Diversion Scenario 1				Diversion Scenario 2			
		AM		PM		AM		PM	
		LOS	V/C	LOS	V/C	LOS	V/C	LOS	V/C
Hard Tack	N of Hwy 622	A	0.02	A	0.02	A	0.02	A	0.02
Hwy 622	N of Hwy 11B	B	0.09	B	0.11	B	0.09	B	0.10
Hwy 11B	W of Hwy 622	B	0.12	C	0.16	B	0.12	C	0.15
Hwy 11	E of Hwy 11B	A	0.03	A	0.04	A	0.03	A	0.04

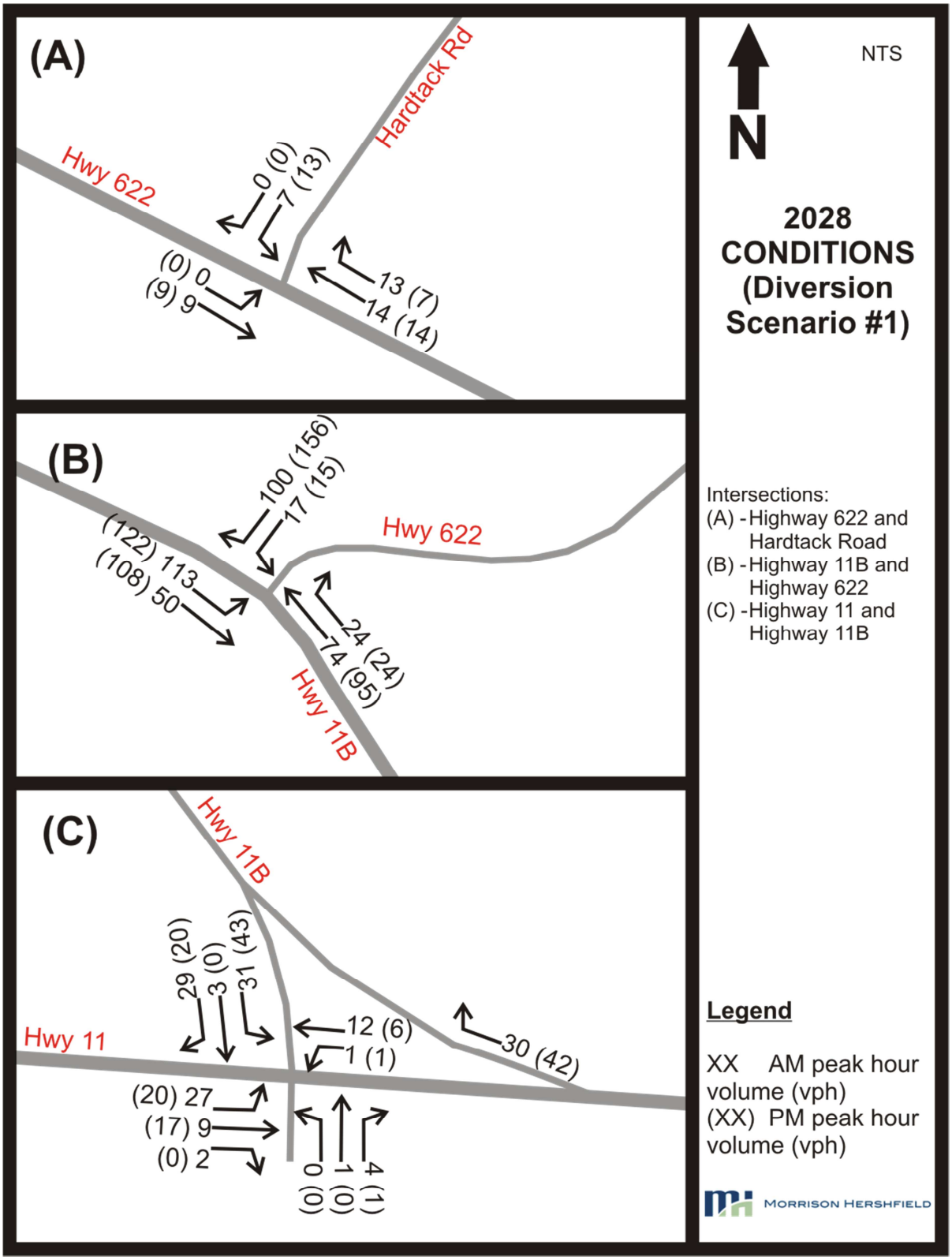


Figure 13 – 2028 Traffic Volumes (Scenario 1)

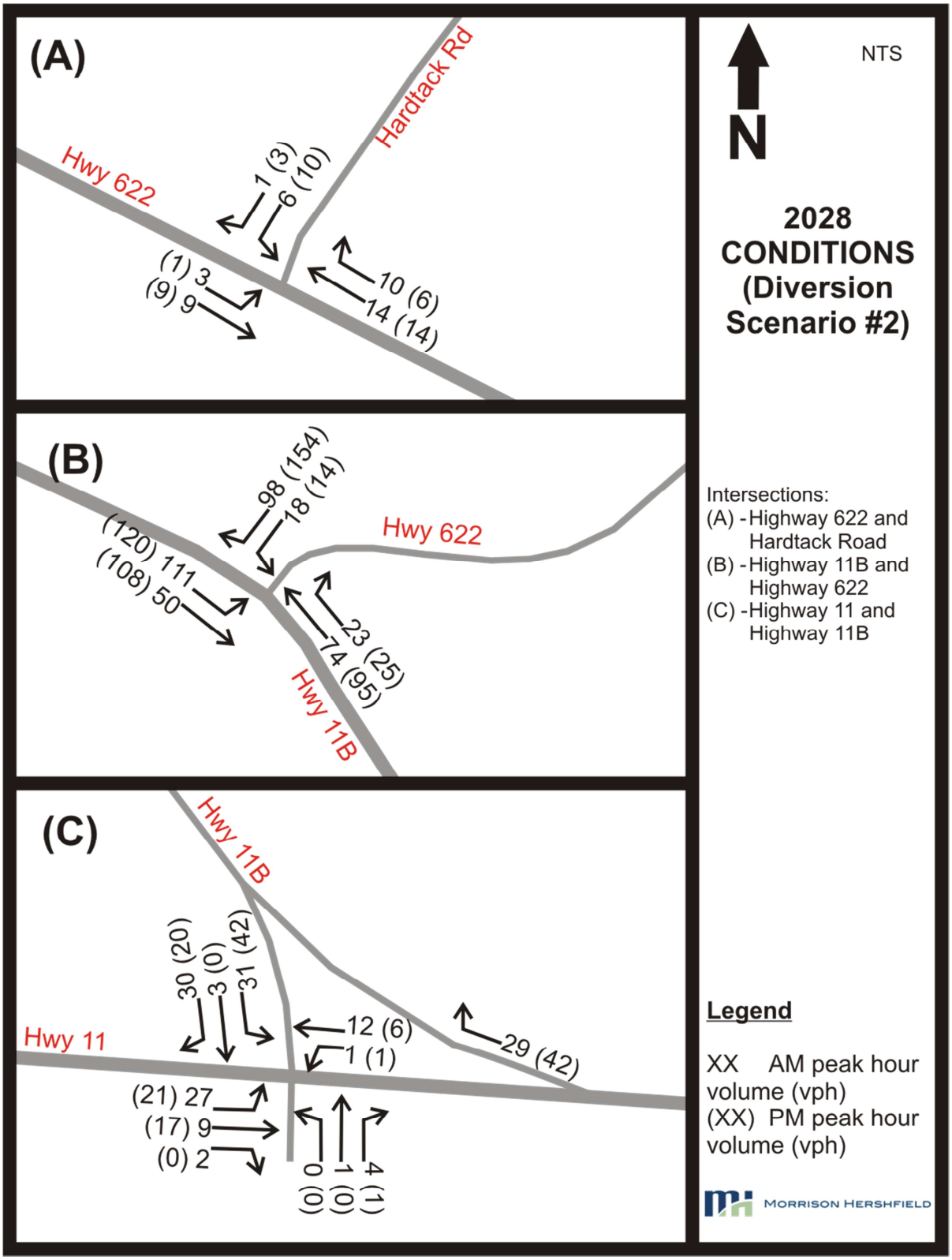


Figure 14 – 2028 Traffic Volumes (Scenario 2)

5. CONCLUSIONS

Based on the analysis presented in this report, it is not expected that the Hammond Reef Gold Mine Project will produce any significant impact on the transportation network, as a result of the following factors:

- The low existing traffic volumes;
- Low historical traffic growth rates; and
- Relatively low trip generation of the site.

A summary of v/c results for each time horizon and scenario is shown below in Table 15 for the worst case scenario. A similar comparison for mainline conditions is shown in Table 16.

Table 15 – Summary of Intersection Analysis Results

	Baseline Conditions – 2012	End of Construction – 2016	5-Year Horizon – 2021	12-Year Horizon – 2028
Hardtack Rd & Hwy 622	0.02	0.04	0.02	0.02
Hwy 11B & Hwy 622	0.13	0.18	0.18	0.20
Hwy 11 & Hwy 11B	0.07	0.07	0.07	0.07

Table 16 – Summary of Mainline Analysis Results

	Baseline Conditions – 2012	End of Construction – 2016	5-Year Horizon – 2021	12-Year Horizon – 2028
Hard Tack – N of Hwy 622	~0.00	0.03	0.02	0.02
Hwy 622 – N of Hwy 11B	0.08	0.10	0.10	0.11
Hwy 11B – W of Hwy 622	0.12	0.15	0.15	0.16
Hwy 11 – E of Hwy 11B	0.04	0.04	0.04	0.04

As a result of the minimal impacts to the road network, no infrastructure changes are recommended for the study area. In addition, since all intersections continue to operate at level of service ‘A’, no intersections modifications (i.e. signals) are required.

APPENDIX A: Traffic Data

15 MIN REPORT

Intersection ID: 19010 0.0 **Hwy 11B & Hwy 622** **Municipality: Northwest** **Date: Thurs Aug 13, 2009**

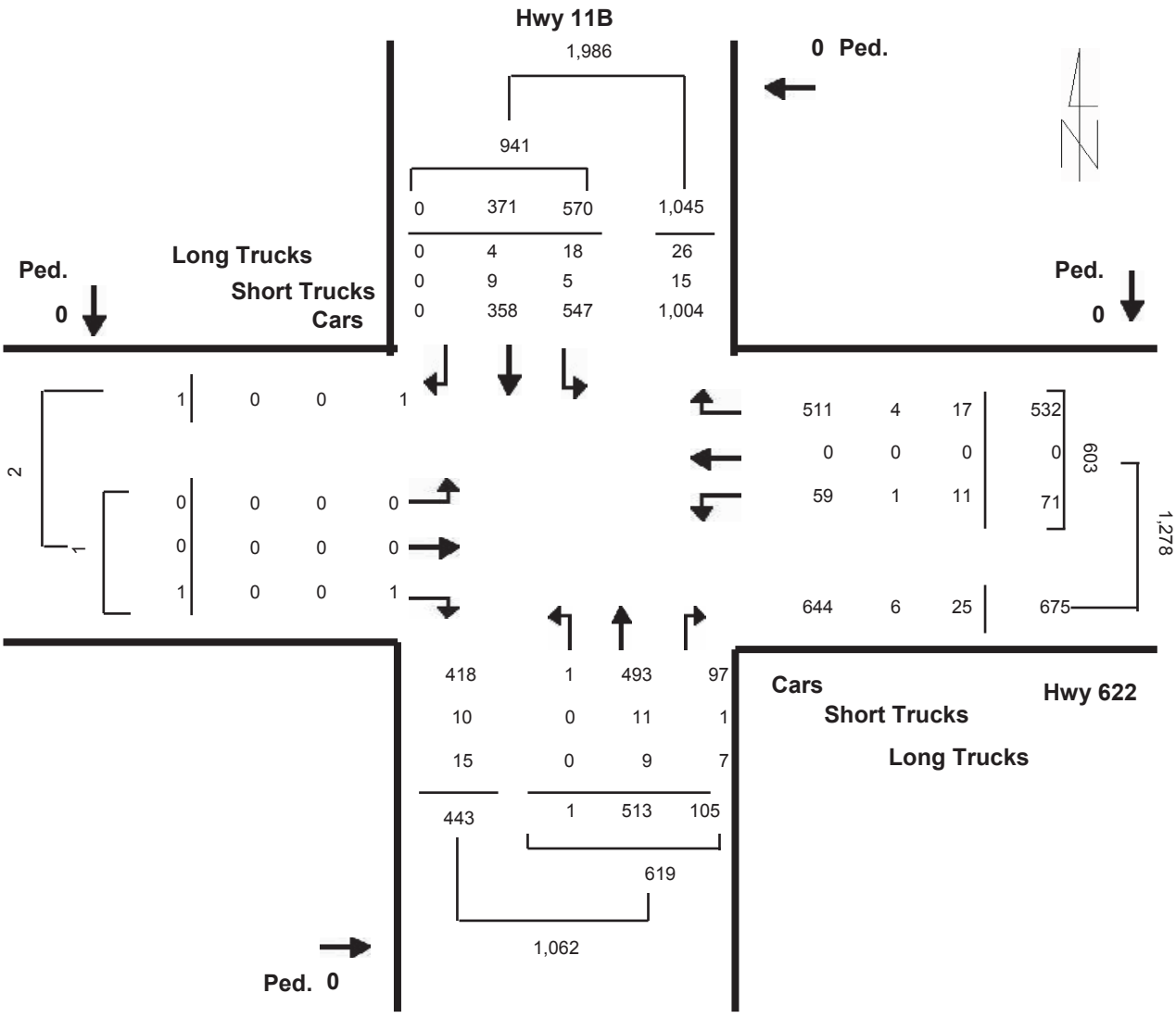
	Hwy 11B - North Leg										Hwy 622										Hwy 11B - South Leg										Gravel Trail										
Time	Cars			S Trucks			L Trucks			Ped	Cars			S Trucks			L Trucks			Ped	Cars			S Trucks			L Trucks			Ped	Cars			S Trucks			L Trucks			Ped	Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
Period1																																									
8:15	11	9	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	1	0	0	9	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	35
8:30	12	5	0	0	0	0	0	0	0	0	2	0	7	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
8:45	17	12	0	1	0	0	2	0	0	0	0	0	13	0	0	0	2	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55
9:00	12	13	0	0	0	0	0	0	0	0	1	0	12	0	0	0	1	0	0	0	0	10	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	51
9:15	16	12	0	0	0	0	1	0	0	0	1	0	11	0	0	1	0	0	0	0	0	15	5	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65
9:30	9	7	0	0	1	0	1	0	0	0	3	0	9	0	0	0	0	0	2	0	0	5	2	0	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	43
9:45	12	8	0	0	1	0	1	0	0	0	1	0	10	0	0	0	0	0	2	0	0	13	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	50
10:00	20	7	0	0	0	0	2	1	0	0	0	0	11	0	0	0	2	0	0	0	0	14	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60
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10:30	18	5	0	1	1	0	3	0	0	0	2	0	16	1	0	0	0	0	0	0	0	13	4	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	67
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11:00	16	13	0	0	0	0	2	0	0	0	1	0	11	0	0	0	0	0	3	0	0	14	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	63
11:15	2	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
11:30	20	14	0	0	0	0	2	0	0	0	5	0	20	0	0	0	0	0	0	0	0	8	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76
11:45	15	14	0	0	0	0	0	0	0	0	2	0	30	0	0	0	1	0	0	0	0	13	4	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	82
12:00	27	7	0	0	0	0	0	0	0	0	4	0	21	0	0	0	1	0	2	0	0	12	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	77
Period2																																									
13:15	15	7	0	0	2	0	0	0	0	0	2	0	10	0	0	0	0	0	0	0	0	20	6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	63
13:30	22	12	0	0	1	0	0	0	0	0	4	0	26	0	0	1	0	0	0	0	0	14	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	86
13:45	20	7	0	0	1	0	1	0	0	0	3	0	14	0	0	0	0	0	0	0	0	25	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75
14:00	20	8	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	7	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50
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14:30	15	10	0	0	0	0	2	0	0	0	0	0	26	0	0	0	0	0	0	0	0	17	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	73
14:45	21	8	0	0	0	0	0	2	0	0	1	0	18	0	0	0	0	0	1	0	0	14	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68
15:00	28	18	0	0	0	0	0	1	0	0	3	0	22	0	0	0	0	0	0	0	0	25	5	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	104
15:15	21	24	0	0	0	0	0	0	0	0	2	0	37	0	0	0	0	0	0	0	0	9	5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	99
15:30	19	21	0	1	0	0	0	0	0	0	1	0	29	0	0	0	0	0	0	0	0	21	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97
15:45	20	20	0	0	0	0	0	0	0	0	2	0	10	0	0	0	0	0	0	0	0	17	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	71
16:00	16	10	0	0	0	0	0	0	0	0	2	0	19	0	0	1	0	0	0	0	0	29	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81
16:15	15	14	0	0	0	0	0	0	0	0	3	0	12	0	0	0	0	0	0	0	0	40	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	92
16:30	18	19	0	0	1	0	0	0	0	0	5	0	17	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81
16:45	14	15	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	30	5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79
17:00	17	11	0	0	0	0	0	0	0	0	1	0	15	0	0	0	0	0	0	0	1	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69

8 HOUR COUNT TOTAL

Hwy 11B & Hwy 622

Northwest

Intersection ID: 19010 0.0 **Date: Thurs Aug 14, 2009**



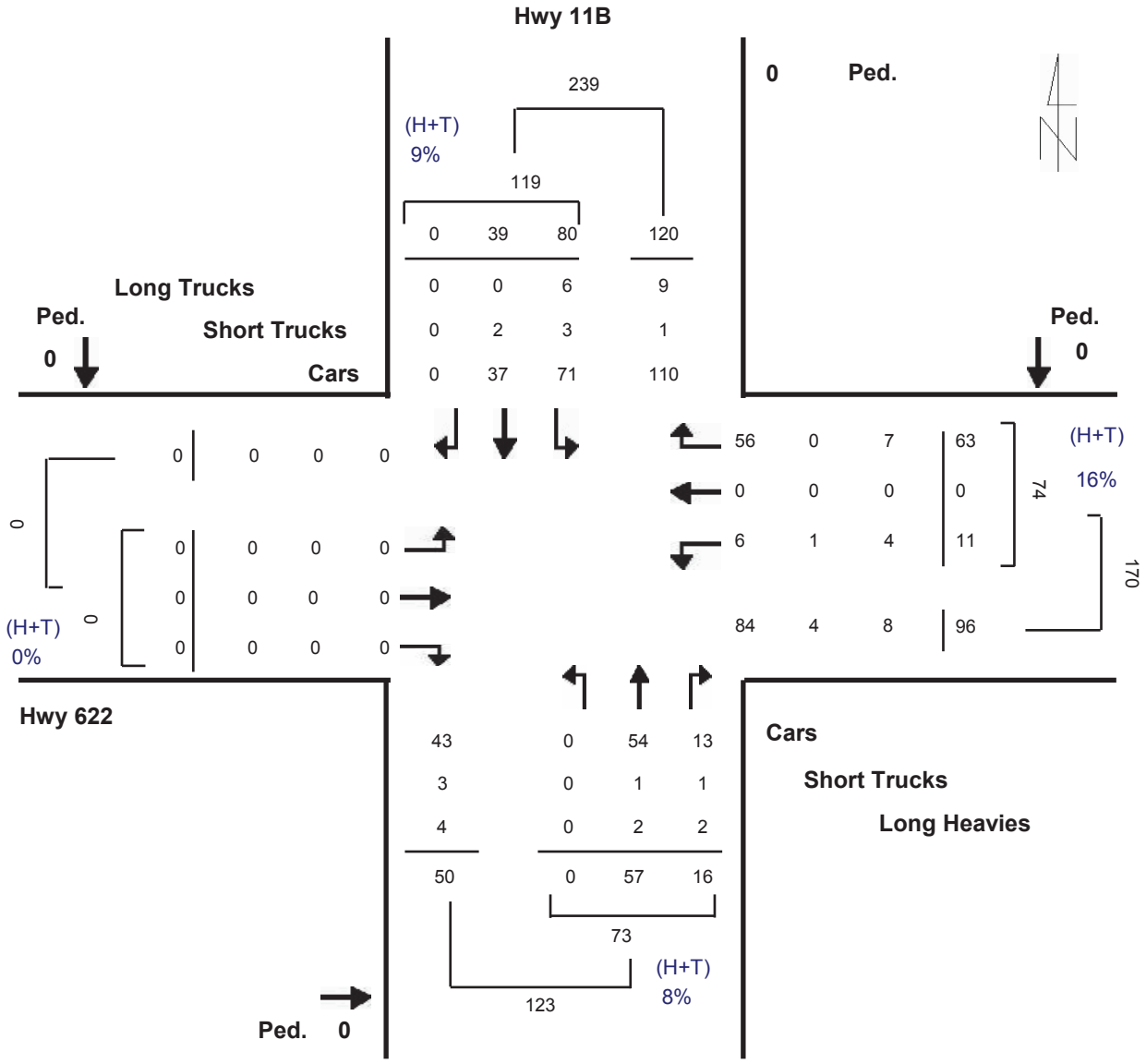
Mid Day Peak Hour Diagram

Traffic Engineering Software

Hwy 11B & Hwy 622

Northwest

Intersection ID: 19010 0.0 **PK HR End: 11:00** **Date:Thurs Aug 13, 2009**



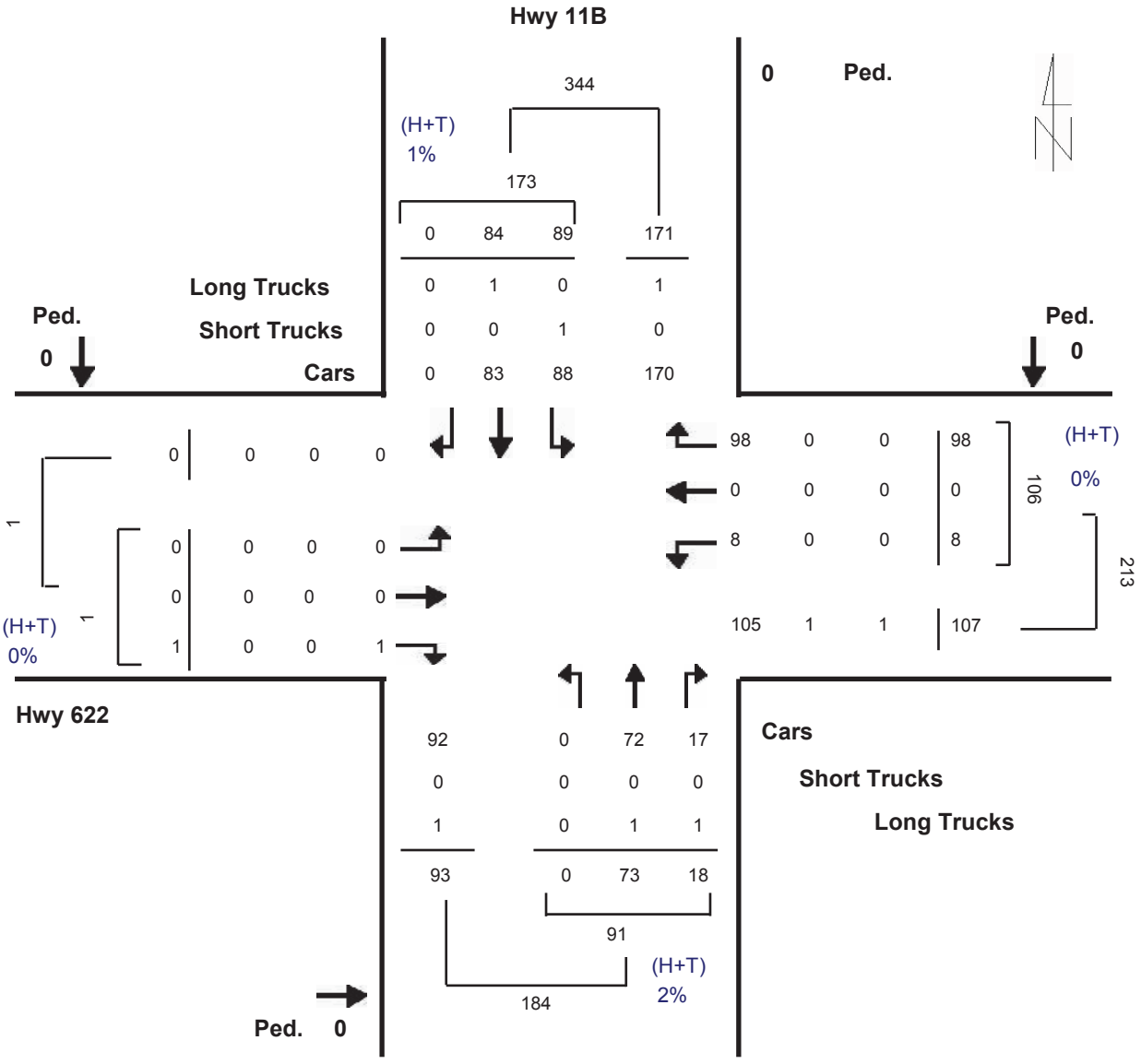
PM Peak Hour Diagram

Traffic Engineering Software

Hwy 11B & Hwy 622

Northwest

Intersection ID: 19010 0.0 **PK HR End: 15:45** **Date: Thurs Aug 13, 2009**



15 MIN REPORT

Intersection ID: 18240 0.0 **Hwy 11 & Hwy 11B** **Municipality: Northwest** **Date: Wed August 12, 2009**

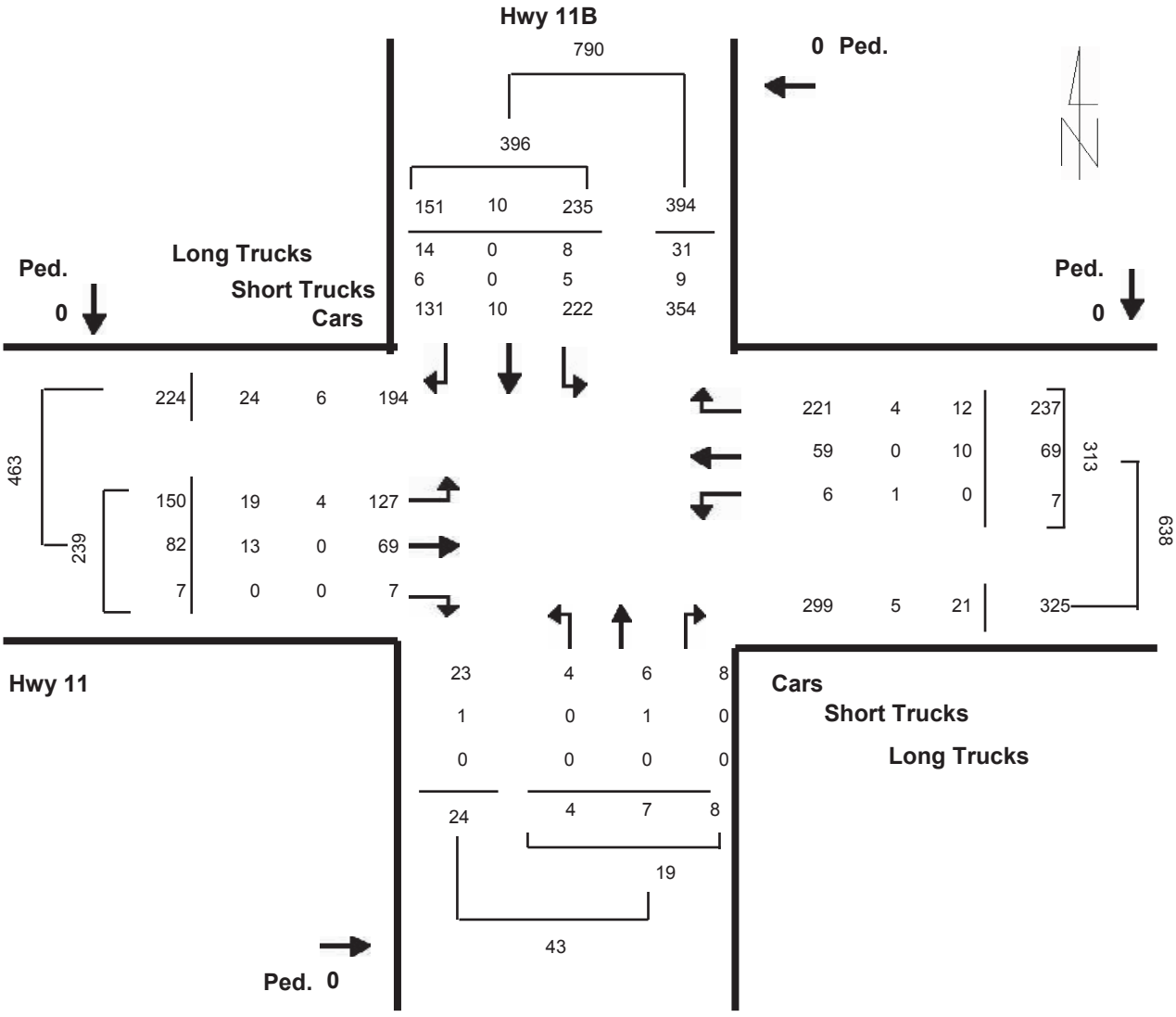
	Hwy 11B										EAST LEG - Hwy 11										Tourist Info Center										WEST LEG – Hwy 11										
Time	Cars			S Trucks			L Trucks			Ped	Cars			S Trucks			L Trucks			Ped	Cars			S Trucks			L Trucks			Ped	Cars			S Trucks			L Trucks			Ped	Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
Period1																																										
8:15	6	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	11
8:30	3	0	2	0	0	0	1	0	0	0	0	1	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	16
8:45	2	0	4	0	0	0	0	0	0	0	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	16
9:00	5	0	6	0	0	0	0	0	0	0	0	2	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	0	0	0	0	0	0	0	33
9:15	2	0	6	0	0	0	1	0	0	0	0	1	8	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	3	2	1	0	0	0	1	0	0	0	30
9:30	6	0	4	0	0	1	0	0	0	0	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	19
9:45	7	0	2	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	0	0	0	0	0	1	0	0	22
10:00	3	0	4	0	0	0	2	0	0	0	0	1	5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	4	0	0	23
10:15	4	0	7	0	0	0	0	0	1	0	1	4	6	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	3	0	2	0	0	0	0	0	0	0	31
10:30	7	2	6	0	0	1	0	0	0	0	0	5	8	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	7	5	0	1	0	0	1	1	0	0	47
10:45	6	1	5	1	0	1	0	0	1	0	0	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2	0	0	0	0	0	0	0	0	30
11:00	11	0	7	0	0	0	1	0	0	0	0	1	4	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	8	0	0	1	0	0	0	1	0	0	37
11:15	5	0	2	0	0	0	0	0	0	0	0	1	7	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0	1	0	0	21
11:30	9	2	2	0	0	0	0	0	0	0	0	2	6	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	8	1	1	0	0	0	3	1	0	0	36
11:45	6	1	2	0	0	0	0	0	0	0	0	4	10	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	3	1	2	0	0	0	0	0	0	35
12:00	9	1	3	0	0	0	0	0	1	0	0	2	9	0	0	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0	4	2	0	0	0	0	0	1	0	0	36
Period2																																										
13:15	9	0	3	0	0	1	1	0	0	0	0	2	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
13:30	13	0	2	2	0	0	0	0	0	0	1	2	12	0	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	6	5	0	0	0	0	0	0	0	0	47
13:45	5	0	3	0	0	0	1	0	2	0	0	4	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0	0	0	0	0	0	0	31
14:00	8	0	3	1	0	0	1	0	1	0	0	0	9	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2	0	0	0	0	1	0	0	0	33
14:15	10	0	8	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6	0	0	0	0	0	0	0	0	35
14:30	17	0	6	0	0	0	0	0	0	0	0	2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	3	0	0	0	40
14:45	11	0	6	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	1	0	0	0	28
15:00	2	2	1	0	0	1	0	0	1	0	0	4	3	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0	0	5	1	0	0	0	0	1	2	0	0	27
15:15	3	0	6	0	0	0	0	0	3	0	2	1	9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	0	0	1	0	0	31
15:30	9	0	6	0	0	0	0	0	1	0	1	1	4	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	25
15:45	2	0	3	0	0	0	0	0	0	0	0	1	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	22
16:00	4	0	2	0	0	0	0	0	0	0	0	3	6	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	11	6	1	0	0	0	3	0	0	0	37
16:15	8	0	4	0	0	0	0	0	0	0	0	2	5	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	6	2	0	0	0	0	0	0	0	0	29
16:30	11	1	4	1	0	1	0	0	1	0	0	3	15	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	41
16:45	10	0	5	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	9	5	0	0	0	0	0	0	0	0	37
17:00	9	0	6	0	0	0	0	0	2	0	0	6	9	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2	1	0	0	0	2	0	0	0	39

8 HOUR COUNT TOTAL

Hwy 11 & & Hwy 11B

Northwest

Intersection ID: 18240 0.0 **Date: Wed Aug 12, 2009**

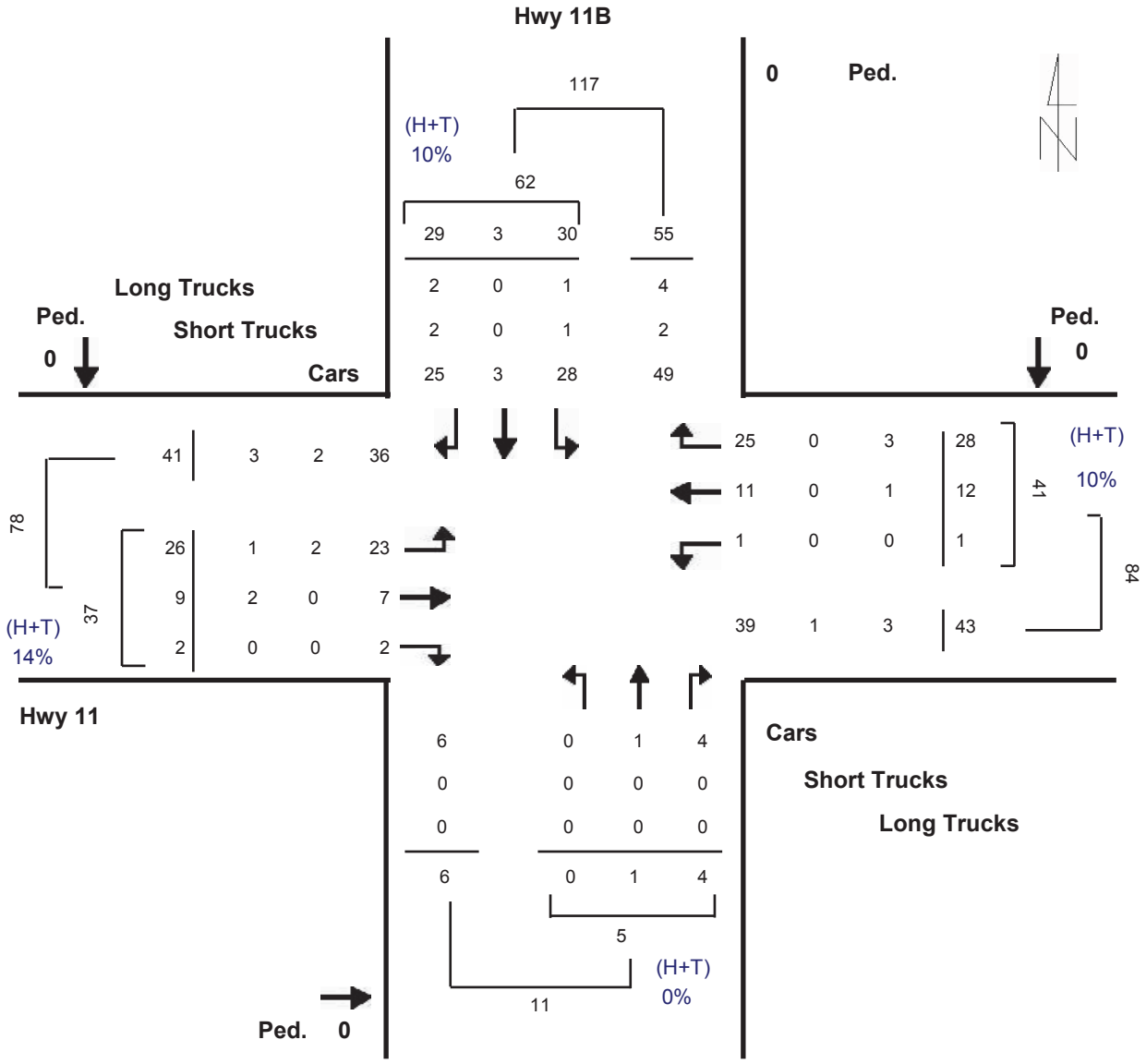


Mid Day Peak Hour Diagram

Hwy 11 & Hwy 11B

Northwest

Intersection ID: 18240 0.0 **PK HR End: 11:00** **Date: Wed Aug 12, 2009**



APPENDIX B: Modelling Results

MAINLINE ANALYSIS

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2012 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	16	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	177	veh/h	
Directional split	55 / 45	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.899	
Two-way flow rate,(note-1) vp	207	pc/h
Highest directional split proportion (note-2)	114	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	3.1	km/h
Average travel speed, ATS	88.2	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.984	
Two-way flow rate,(note-1) vp	189	pc/h
Highest directional split proportion (note-2)	104	
Base percent time-spent-following, BPTSF	15.3	%
Adj.for directional distribution and no-passing zones, fd/np	19.3	
Percent time-spent-following, PTSF	34.6	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.06	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2012
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	3	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	223		veh/h
Directional split	50	/ 50	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.979	
Two-way flow rate,(note-1) vp	240	pc/h
Highest directional split proportion (note-2)	120	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	3.4	km/h
Average travel speed, ATS	87.4	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.997	
Two-way flow rate,(note-1) vp	235	pc/h
Highest directional split proportion (note-2)	118	
Base percent time-spent-following, BPTSF	18.7	%
Adj.for directional distribution and no-passing zones, fd/np	19.1	
Percent time-spent-following, PTSF	37.7	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.08	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2012
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	248		veh/h
Directional split	50	/ 50	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	277	pc/h
Highest directional split proportion (note-2)	139	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	3.8	km/h
Average travel speed, ATS	86.6	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	263	pc/h
Highest directional split proportion (note-2)	132	
Base percent time-spent-following, BPTSF	20.6	%
Adj.for directional distribution and no-passing zones, fd/np	19.4	
Percent time-spent-following, PTSF	40.0	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.09	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2012
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	1	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V 358 veh/h
Directional split 50 / 50 %

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.993	
Two-way flow rate,(note-1) vp	379	pc/h
Highest directional split proportion (note-2)	190	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.8	km/h
Average travel speed, ATS	84.3	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.999	
Two-way flow rate,(note-1) vp	377	pc/h
Highest directional split proportion (note-2)	189	
Base percent time-spent-following, BPTSF	28.2	%
Adj.for directional distribution and no-passing zones, fd/np	20.6	
Percent time-spent-following, PTSF	48.8	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.12	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11
From/To	E of Hwy 11B
Jurisdiction	MTO
Analysis Year	2012
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	10	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	84		veh/h
Directional split	50	/ 50	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.935	
Two-way flow rate,(note-1) vp	95	pc/h
Highest directional split proportion (note-2)	48	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	1.4	km/h
Average travel speed, ATS	91.2	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.990	
Two-way flow rate,(note-1) vp	89	pc/h
Highest directional split proportion (note-2)	45	
Base percent time-spent-following, BPTSF	7.5	%
Adj.for directional distribution and no-passing zones, fd/np	17.5	
Percent time-spent-following, PTSF	25.0	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.03	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11
From/To	E of Hwy 11B
Jurisdiction	MTO
Analysis Year	2012
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	107		veh/h
Directional split	50	/ 50	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	120	pc/h
Highest directional split proportion (note-2)	60	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	1.8	km/h
Average travel speed, ATS	90.5	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	114	pc/h
Highest directional split proportion (note-2)	57	
Base percent time-spent-following, BPTSF	9.5	%
Adj.for directional distribution and no-passing zones, fd/np	17.8	
Percent time-spent-following, PTSF	27.3	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.04	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM-PM
Highway	Hardtack Road
From/To	N of Hwy 622
Jurisdiction	MTO
Analysis Year	2016 (DS1&2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	0.3	m	Peak-hour factor, PHF	0.95	
Lane width	3.0	m	% Trucks and buses	80	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Rolling		% No-passing zones	80	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	44	veh/h	
Directional split	65 / 35	%	

Average Travel Speed

Grade adjustment factor, fG	0.71	
PCE for trucks, ET	2.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.454	
Two-way flow rate,(note-1) vp	144	pc/h
Highest directional split proportion (note-2)	94	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	70.0	km/h
Adj. for lane and shoulder width, fLS	8.5	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	58.2	km/h
Adjustment for no-passing zones, fnp	3.0	km/h
Average travel speed, ATS	53.3	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.77	
PCE for trucks, ET	1.8	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.610	
Two-way flow rate,(note-1) vp	99	pc/h
Highest directional split proportion (note-2)	64	
Base percent time-spent-following, BPTSF	8.3	%
Adj.for directional distribution and no-passing zones, fd/np	25.2	
Percent time-spent-following, PTSF	33.5	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.05	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2016 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	16	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	232	veh/h	
Directional split	56 / 44	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.899	
Two-way flow rate,(note-1) vp	272	pc/h
Highest directional split proportion (note-2)	152	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	3.8	km/h
Average travel speed, ATS	86.7	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.984	
Two-way flow rate,(note-1) vp	248	pc/h
Highest directional split proportion (note-2)	139	
Base percent time-spent-following, BPTSF	19.6	%
Adj.for directional distribution and no-passing zones, fd/np	19.4	
Percent time-spent-following, PTSF	39.0	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.09	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2016 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	16	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	233		veh/h
Directional split	56	/ 44	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.899	
Two-way flow rate,(note-1) vp	273	pc/h
Highest directional split proportion (note-2)	153	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	3.8	km/h
Average travel speed, ATS	86.7	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.984	
Two-way flow rate,(note-1) vp	249	pc/h
Highest directional split proportion (note-2)	139	
Base percent time-spent-following, BPTSF	19.7	%
Adj.for directional distribution and no-passing zones, fd/np	19.4	
Percent time-spent-following, PTSF	39.1	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.09	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2016 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	3	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	293		veh/h
Directional split	53	/ 47	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.979	
Two-way flow rate,(note-1) vp	315	pc/h
Highest directional split proportion (note-2)	167	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.2	km/h
Average travel speed, ATS	85.8	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.997	
Two-way flow rate,(note-1) vp	309	pc/h
Highest directional split proportion (note-2)	164	
Base percent time-spent-following, BPTSF	23.8	%
Adj.for directional distribution and no-passing zones, fd/np	19.6	
Percent time-spent-following, PTSF	43.4	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.10	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2016 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	3	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	284	veh/h	
Directional split	53 / 47	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.979	
Two-way flow rate,(note-1) vp	305	pc/h
Highest directional split proportion (note-2)	162	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.1	km/h
Average travel speed, ATS	86.0	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.997	
Two-way flow rate,(note-1) vp	300	pc/h
Highest directional split proportion (note-2)	159	
Base percent time-spent-following, BPTSF	23.2	%
Adj.for directional distribution and no-passing zones, fd/np	19.6	
Percent time-spent-following, PTSF	42.8	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.10	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2016 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	296		veh/h
Directional split	51	/ 49	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	331	pc/h
Highest directional split proportion (note-2)	169	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.3	km/h
Average travel speed, ATS	85.4	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	314	pc/h
Highest directional split proportion (note-2)	160	
Base percent time-spent-following, BPTSF	24.1	%
Adj.for directional distribution and no-passing zones, fd/np	19.8	
Percent time-spent-following, PTSF	44.0	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.10	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2016 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	300		veh/h	
Directional split	50	/ 50	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	336	pc/h
Highest directional split proportion (note-2)	168	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.4	km/h
Average travel speed, ATS	85.3	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	319	pc/h
Highest directional split proportion (note-2)	160	
Base percent time-spent-following, BPTSF	24.5	%
Adj.for directional distribution and no-passing zones, fd/np	20.0	
Percent time-spent-following, PTSF	44.4	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.10	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2016 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	10	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	431	veh/h	
Directional split	52 / 48	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.935	
Two-way flow rate,(note-1) vp	485	pc/h
Highest directional split proportion (note-2)	252	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.7	km/h
Average travel speed, ATS	83.1	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.990	
Two-way flow rate,(note-1) vp	458	pc/h
Highest directional split proportion (note-2)	238	
Base percent time-spent-following, BPTSF	33.1	%
Adj.for directional distribution and no-passing zones, fd/np	19.5	
Percent time-spent-following, PTSF	52.6	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2016 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	10	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	422		veh/h
Directional split	52	/ 48	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.935	
Two-way flow rate,(note-1) vp	475	pc/h
Highest directional split proportion (note-2)	247	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.8	km/h
Average travel speed, ATS	83.2	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.990	
Two-way flow rate,(note-1) vp	449	pc/h
Highest directional split proportion (note-2)	233	
Base percent time-spent-following, BPTSF	32.6	%
Adj.for directional distribution and no-passing zones, fd/np	19.6	
Percent time-spent-following, PTSF	52.2	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11
From/To	E of Hwy 11B
Jurisdiction	MTO
Analysis Year	2016 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	10	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	91		veh/h
Directional split	51	/ 49	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.935	
Two-way flow rate,(note-1) vp	102	pc/h
Highest directional split proportion (note-2)	52	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	1.6	km/h
Average travel speed, ATS	91.0	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.990	
Two-way flow rate,(note-1) vp	97	pc/h
Highest directional split proportion (note-2)	49	
Base percent time-spent-following, BPTSF	8.2	%
Adj.for directional distribution and no-passing zones, fd/np	17.9	
Percent time-spent-following, PTSF	26.1	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.03	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11
From/To	E of Hwy 11B
Jurisdiction	MTO
Analysis Year	2016 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	10	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	88		veh/h
Directional split	50	/ 50	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.935	
Two-way flow rate,(note-1) vp	99	pc/h
Highest directional split proportion (note-2)	50	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	1.5	km/h
Average travel speed, ATS	91.1	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.990	
Two-way flow rate,(note-1) vp	94	pc/h
Highest directional split proportion (note-2)	47	
Base percent time-spent-following, BPTSF	7.9	%
Adj.for directional distribution and no-passing zones, fd/np	17.6	
Percent time-spent-following, PTSF	25.5	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.03	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11
From/To	E of Hwy 11B
Jurisdiction	MTO
Analysis Year	2016 (DS1&DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	112	veh/h	
Directional split	56 / 44	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	125	pc/h
Highest directional split proportion (note-2)	70	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	1.9	km/h
Average travel speed, ATS	90.4	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	119	pc/h
Highest directional split proportion (note-2)	67	
Base percent time-spent-following, BPTSF	9.9	%
Adj.for directional distribution and no-passing zones, fd/np	19.4	
Percent time-spent-following, PTSF	29.3	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.04	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM-PM
Highway	Hardtack Road
From/To	N of Hwy 622
Jurisdiction	MTO
Analysis Year	2021 & 2026 (DS1&2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	0.3	m	Peak-hour factor, PHF	0.95	
Lane width	3.0	m	% Trucks and buses	80	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Rolling		% No-passing zones	80	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	20		veh/h
Directional split	65	/ 35	%

Average Travel Speed

Grade adjustment factor, fG	0.71	
PCE for trucks, ET	2.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.454	
Two-way flow rate,(note-1) vp	65	pc/h
Highest directional split proportion (note-2)	42	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	70.0	km/h
Adj. for lane and shoulder width, fLS	8.5	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	58.2	km/h
Adjustment for no-passing zones, fnp	1.4	km/h
Average travel speed, ATS	56.0	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	0.77	
PCE for trucks, ET	1.8	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.610	
Two-way flow rate,(note-1) vp	45	pc/h
Highest directional split proportion (note-2)	29	
Base percent time-spent-following, BPTSF	3.9	%
Adj.for directional distribution and no-passing zones, fd/np	25.8	
Percent time-spent-following, PTSF	29.7	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.02	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2021 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	16	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	238		veh/h
Directional split	54	/ 46	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.899	
Two-way flow rate,(note-1) vp	279	pc/h
Highest directional split proportion (note-2)	151	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	3.8	km/h
Average travel speed, ATS	86.6	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.984	
Two-way flow rate,(note-1) vp	255	pc/h
Highest directional split proportion (note-2)	138	
Base percent time-spent-following, BPTSF	20.1	%
Adj.for directional distribution and no-passing zones, fd/np	19.4	
Percent time-spent-following, PTSF	39.4	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.09	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2021 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	16	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	229	veh/h	
Directional split	54 / 46	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.899	
Two-way flow rate,(note-1) vp	268	pc/h
Highest directional split proportion (note-2)	145	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	3.7	km/h
Average travel speed, ATS	86.8	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.984	
Two-way flow rate,(note-1) vp	245	pc/h
Highest directional split proportion (note-2)	132	
Base percent time-spent-following, BPTSF	19.4	%
Adj.for directional distribution and no-passing zones, fd/np	19.3	
Percent time-spent-following, PTSF	38.7	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.08	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2021 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	3	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	289	veh/h	
Directional split	54 / 46	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.979	
Two-way flow rate,(note-1) vp	311	pc/h
Highest directional split proportion (note-2)	168	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.1	km/h
Average travel speed, ATS	85.8	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.997	
Two-way flow rate,(note-1) vp	305	pc/h
Highest directional split proportion (note-2)	165	
Base percent time-spent-following, BPTSF	23.5	%
Adj.for directional distribution and no-passing zones, fd/np	19.5	
Percent time-spent-following, PTSF	43.1	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.10	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2021 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	3	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	285	veh/h	
Directional split	53 / 47	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.979	
Two-way flow rate,(note-1) vp	306	pc/h
Highest directional split proportion (note-2)	162	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.1	km/h
Average travel speed, ATS	86.0	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.997	
Two-way flow rate,(note-1) vp	301	pc/h
Highest directional split proportion (note-2)	160	
Base percent time-spent-following, BPTSF	23.2	%
Adj.for directional distribution and no-passing zones, fd/np	19.6	
Percent time-spent-following, PTSF	42.8	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.10	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2021 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	311	veh/h	
Directional split	52 / 48	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	348	pc/h
Highest directional split proportion (note-2)	181	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.5	km/h
Average travel speed, ATS	85.0	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	330	pc/h
Highest directional split proportion (note-2)	172	
Base percent time-spent-following, BPTSF	25.2	%
Adj.for directional distribution and no-passing zones, fd/np	19.9	
Percent time-spent-following, PTSF	45.0	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.11	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2021 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	305	veh/h	
Directional split	51 / 49	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	341	pc/h
Highest directional split proportion (note-2)	174	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.4	km/h
Average travel speed, ATS	85.2	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	324	pc/h
Highest directional split proportion (note-2)	165	
Base percent time-spent-following, BPTSF	24.8	%
Adj.for directional distribution and no-passing zones, fd/np	19.9	
Percent time-spent-following, PTSF	44.7	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.11	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2021 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	1	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	440	veh/h	
Directional split	52 / 48	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.993	
Two-way flow rate,(note-1) vp	466	pc/h
Highest directional split proportion (note-2)	242	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.8	km/h
Average travel speed, ATS	83.3	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.999	
Two-way flow rate,(note-1) vp	464	pc/h
Highest directional split proportion (note-2)	241	
Base percent time-spent-following, BPTSF	33.5	%
Adj.for directional distribution and no-passing zones, fd/np	19.4	
Percent time-spent-following, PTSF	52.9	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
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Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2021 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	1	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	436		veh/h
Directional split	51	/ 49	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.993	
Two-way flow rate,(note-1) vp	462	pc/h
Highest directional split proportion (note-2)	236	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.8	km/h
Average travel speed, ATS	83.3	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.999	
Two-way flow rate,(note-1) vp	459	pc/h
Highest directional split proportion (note-2)	234	
Base percent time-spent-following, BPTSF	33.2	%
Adj.for directional distribution and no-passing zones, fd/np	19.6	
Percent time-spent-following, PTSF	52.8	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.14	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11
From/To	E of Hwy 11B
Jurisdiction	MTO
Analysis Year	2021 & 2026 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	10	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	87		veh/h
Directional split	50	/ 50	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.935	
Two-way flow rate,(note-1) vp	98	pc/h
Highest directional split proportion (note-2)	49	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	1.5	km/h
Average travel speed, ATS	91.1	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.990	
Two-way flow rate,(note-1) vp	92	pc/h
Highest directional split proportion (note-2)	46	
Base percent time-spent-following, BPTSF	7.8	%
Adj.for directional distribution and no-passing zones, fd/np	17.5	
Percent time-spent-following, PTSF	25.3	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.03	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
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Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11
From/To	E of Hwy 11B
Jurisdiction	MTO
Analysis Year	2021 & 2026 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	10	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	86	veh/h	
Directional split	58 / 42	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.935	
Two-way flow rate,(note-1) vp	97	pc/h
Highest directional split proportion (note-2)	56	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	1.5	km/h
Average travel speed, ATS	91.2	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.990	
Two-way flow rate,(note-1) vp	91	pc/h
Highest directional split proportion (note-2)	53	
Base percent time-spent-following, BPTSF	7.7	%
Adj.for directional distribution and no-passing zones, fd/np	20.0	
Percent time-spent-following, PTSF	27.7	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.03	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

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Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11
From/To	E of Hwy 11B
Jurisdiction	MTO
Analysis Year	2021 & 2026 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	111	veh/h	
Directional split	56 / 44	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	124	pc/h
Highest directional split proportion (note-2)	69	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	1.9	km/h
Average travel speed, ATS	90.4	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	118	pc/h
Highest directional split proportion (note-2)	66	
Base percent time-spent-following, BPTSF	9.9	%
Adj.for directional distribution and no-passing zones, fd/np	19.4	
Percent time-spent-following, PTSF	29.2	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.04	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11
From/To	E of Hwy 11B
Jurisdiction	MTO
Analysis Year	2021 & 2026 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	109		veh/h
Directional split	55	/ 45	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	122	pc/h
Highest directional split proportion (note-2)	67	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	1.9	km/h
Average travel speed, ATS	90.5	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	116	pc/h
Highest directional split proportion (note-2)	64	
Base percent time-spent-following, BPTSF	9.7	%
Adj.for directional distribution and no-passing zones, fd/np	19.1	
Percent time-spent-following, PTSF	28.8	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.04	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2028 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	16	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	254		veh/h
Directional split	54	/ 46	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.899	
Two-way flow rate,(note-1) vp	297	pc/h
Highest directional split proportion (note-2)	160	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.0	km/h
Average travel speed, ATS	86.2	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.984	
Two-way flow rate,(note-1) vp	272	pc/h
Highest directional split proportion (note-2)	147	
Base percent time-spent-following, BPTSF	21.3	%
Adj.for directional distribution and no-passing zones, fd/np	19.4	
Percent time-spent-following, PTSF	40.7	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.09	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2028 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	16	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	250		veh/h
Directional split	54	/ 46	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.899	
Two-way flow rate,(note-1) vp	293	pc/h
Highest directional split proportion (note-2)	158	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.0	km/h
Average travel speed, ATS	86.2	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.984	
Two-way flow rate,(note-1) vp	267	pc/h
Highest directional split proportion (note-2)	144	
Base percent time-spent-following, BPTSF	20.9	%
Adj.for directional distribution and no-passing zones, fd/np	19.4	
Percent time-spent-following, PTSF	40.3	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.09	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2028 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	3	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	317	veh/h	
Directional split	54 / 46	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.979	
Two-way flow rate,(note-1) vp	341	pc/h
Highest directional split proportion (note-2)	184	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.4	km/h
Average travel speed, ATS	85.2	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.997	
Two-way flow rate,(note-1) vp	335	pc/h
Highest directional split proportion (note-2)	181	
Base percent time-spent-following, BPTSF	25.5	%
Adj.for directional distribution and no-passing zones, fd/np	19.7	
Percent time-spent-following, PTSF	45.2	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.11	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 622
From/To	N of Hwy 11B
Jurisdiction	MTO
Analysis Year	2028 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 2				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	3	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	313	veh/h	
Directional split	54 / 46	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.979	
Two-way flow rate,(note-1) vp	336	pc/h
Highest directional split proportion (note-2)	181	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.4	km/h
Average travel speed, ATS	85.3	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.997	
Two-way flow rate,(note-1) vp	330	pc/h
Highest directional split proportion (note-2)	178	
Base percent time-spent-following, BPTSF	25.2	%
Adj.for directional distribution and no-passing zones, fd/np	19.6	
Percent time-spent-following, PTSF	44.8	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.10	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2028 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	337	veh/h	
Directional split	52 / 48	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	377	pc/h
Highest directional split proportion (note-2)	196	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.8	km/h
Average travel speed, ATS	84.4	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	358	pc/h
Highest directional split proportion (note-2)	186	
Base percent time-spent-following, BPTSF	27.0	%
Adj.for directional distribution and no-passing zones, fd/np	20.1	
Percent time-spent-following, PTSF	47.1	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.12	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	AM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2028 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	9	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	333		veh/h
Directional split	50	/ 50	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.941	
Two-way flow rate,(note-1) vp	373	pc/h
Highest directional split proportion (note-2)	187	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.7	km/h
Average travel speed, ATS	84.5	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.991	
Two-way flow rate,(note-1) vp	354	pc/h
Highest directional split proportion (note-2)	177	
Base percent time-spent-following, BPTSF	26.7	%
Adj.for directional distribution and no-passing zones, fd/np	20.4	
Percent time-spent-following, PTSF	47.1	%

Level of Service and Other Performance Measures

Level of service, LOS	B	
Volume to capacity ratio, v/c	0.12	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2028 (DS1)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	1	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	481	veh/h	
Directional split	52 / 48	%	

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.993	
Two-way flow rate,(note-1) vp	510	pc/h
Highest directional split proportion (note-2)	265	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.6	km/h
Average travel speed, ATS	82.8	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.999	
Two-way flow rate,(note-1) vp	507	pc/h
Highest directional split proportion (note-2)	264	
Base percent time-spent-following, BPTSF	36.0	%
Adj.for directional distribution and no-passing zones, fd/np	18.7	
Percent time-spent-following, PTSF	54.7	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.16	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	Morrison Hershfield
Date Performed	10/16/2012
Analysis Time Period	PM
Highway	Highway 11B
From/To	W of Hwy 622
Jurisdiction	MTO
Analysis Year	2028 (DS2)
Description	Hammond Reef TIS

Input Data

Highway class	Class 1				
Shoulder width	1.5	m	Peak-hour factor, PHF	0.95	
Lane width	3.5	m	% Trucks and buses	1	%
Segment length	0.0	km	% Recreational vehicles	5	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		km	Access points/km	5	/km
Up/down		%			

Two-way hourly volume, V	456		veh/h
Directional split	50	/ 50	%

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.7	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.993	
Two-way flow rate,(note-1) vp	483	pc/h
Highest directional split proportion (note-2)	242	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	100.0	km/h
Adj. for lane and shoulder width, fLS	2.8	km/h
Adj. for access points, fA	3.3	km/h
Free-flow speed, FFS	93.9	km/h
Adjustment for no-passing zones, fnp	4.7	km/h
Average travel speed, ATS	83.1	km/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.999	
Two-way flow rate,(note-1) vp	480	pc/h
Highest directional split proportion (note-2)	240	
Base percent time-spent-following, BPTSF	34.4	%
Adj.for directional distribution and no-passing zones, fd/np	19.5	
Percent time-spent-following, PTSF	53.9	%

Level of Service and Other Performance Measures

Level of service, LOS	C	
Volume to capacity ratio, v/c	0.15	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.

INTERSECTION ANALYSIS

Phone: Fax:
E-Mail:

Two-Way Two-Lane Highway Segment Analysis

Analyst	MH
Agency/Co.	MH
Date Performed	10/5/2012
Analysis Time Period	Peak Hour
Highway	622
From/To	@ Hardtack Road
Jurisdiction	MTO
Analysis Year	2012
Description	Hammond Reef Gold Mine

Input Data

Highway class	Class 2				
Shoulder width	1.8	m	Peak-hour factor, PHF	0.85	
Lane width	3.6	m	% Trucks and buses	25	%
Segment length	0.0	km	% Recreational vehicles	15	%
Terrain type	Rolling		% No-passing zones	50	%
Grade: Length		km	Access points/km	3	/km
Up/down		%			

Two-way hourly volume, V	23	veh/h	
Directional split	60 / 40	%	

Average Travel Speed

Grade adjustment factor, fG	0.71	
PCE for trucks, ET	2.5	
PCE for RVs, ER	1.1	
Heavy-vehicle adjustment factor,	0.719	
Two-way flow rate,(note-1) vp	53	pc/h
Highest directional split proportion (note-2)	32	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	km/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	90.0	km/h
Adj. for lane and shoulder width, fLS	0.0	km/h
Adj. for access points, fA	2.0	km/h
Free-flow speed, FFS	88.0	km/h
Adjustment for no-passing zones, fnp	0.8	km/h
Average travel speed, ATS	86.5	km/h

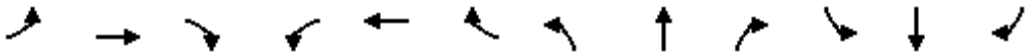
Percent Time-Spent-Following

Grade adjustment factor, fG	0.77	
PCE for trucks, ET	1.8	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	0.833	
Two-way flow rate,(note-1) vp	42	pc/h
Highest directional split proportion (note-2)	25	
Base percent time-spent-following, BPTSF	3.6	%
Adj.for directional distribution and no-passing zones, fd/np	21.0	
Percent time-spent-following, PTSF	24.6	%

Level of Service and Other Performance Measures

Level of service, LOS	A	
Volume to capacity ratio, v/c	0.02	
Peak 15-min vehicle-kilometers of travel, VkmT15	0	veh-km
Peak-hour vehicle-kilometers of travel, VkmT60	0	veh-km
Peak 15-min total travel time, TT15	0.0	veh-h

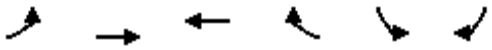
Notes:
1. If vp >= 3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp >= 1700 pc/h, terminate analysis-the LOS is F.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	26	9	2	1	12	0	0	1	4	30	3	29
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	27	9	2	1	13	0	0	1	4	32	3	31
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	13			12			111	79	9	84	81	13
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			12			111	79	9	84	81	13
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	98			100			100	100	100	96	100	97
cM capacity (veh/h)	1543			1621			832	800	1078	874	798	1034

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	27	9	2	14	5	65
Volume Left	27	0	0	1	0	32
Volume Right	0	0	2	0	4	31
cSH	1543	1700	1700	1621	1008	938
Volume to Capacity	0.02	0.01	0.00	0.00	0.01	0.07
Queue Length 95th (m)	0.4	0.0	0.0	0.0	0.1	1.7
Control Delay (s)	7.4	0.0	0.0	0.6	8.6	9.1
Lane LOS	A			A	A	A
Approach Delay (s)	5.2			0.6	8.6	9.1
Approach LOS					A	A

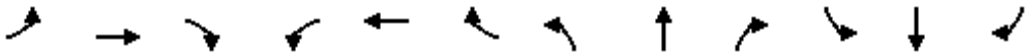
Intersection Summary				
Average Delay	6.9			
Intersection Capacity Utilization	25.0%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	80	39	57	16	11	63
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	87	42	62	17	12	70
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	79				278	62
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	79				278	62
tC, single (s)	4.2				6.8	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.9	3.4
p0 queue free %	94				98	93
cM capacity (veh/h)	1464				592	978

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	87	42	62	17	83
Volume Left	87	0	0	0	12
Volume Right	0	0	0	17	70
cSH	1464	1700	1700	1700	892
Volume to Capacity	0.06	0.02	0.04	0.01	0.09
Queue Length 95th (m)	1.4	0.0	0.0	0.0	2.3
Control Delay (s)	7.6	0.0	0.0	0.0	9.4
Lane LOS	A				A
Approach Delay (s)	5.1		0.0		9.4
Approach LOS					A

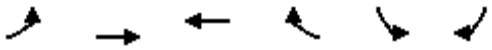
Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	22.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	17	0	1	6	0	0	0	1	41	0	19
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	18	0	1	6	0	0	0	1	43	0	20
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	6			18			88	68	18	69	68	6
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	6			18			88	68	18	69	68	6
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.5	6.4
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	99			100			100	100	100	95	100	98
cM capacity (veh/h)	1595			1612			875	815	1067	888	815	1037

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	21	18	0	7	1	63
Volume Left	21	0	0	1	0	43
Volume Right	0	0	0	0	1	20
cSH	1595	1700	1700	1612	1067	930
Volume to Capacity	0.01	0.01	0.00	0.00	0.00	0.07
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	1.7
Control Delay (s)	7.3	0.0	0.0	1.0	8.4	9.2
Lane LOS	A			A	A	A
Approach Delay (s)	3.9			1.0	8.4	9.2
Approach LOS					A	A

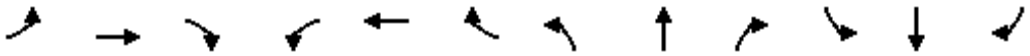
Intersection Summary				
Average Delay	6.8			
Intersection Capacity Utilization	22.1%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	89	84	73	18	8	98
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	96	91	79	20	9	109
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	99				363	79
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	99				363	79
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				99	89
cM capacity (veh/h)	1501				599	987

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	96	91	79	20	118
Volume Left	96	0	0	0	9
Volume Right	0	0	0	20	109
cSH	1501	1700	1700	1700	941
Volume to Capacity	0.06	0.05	0.05	0.01	0.13
Queue Length 95th (m)	1.6	0.0	0.0	0.0	3.3
Control Delay (s)	7.6	0.0	0.0	0.0	9.4
Lane LOS	A				A
Approach Delay (s)	3.9		0.0		9.4
Approach LOS					A

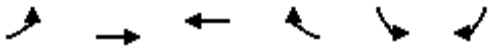
Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	9	2	1	12	0	0	1	4	32	3	30
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	28	9	2	1	13	0	0	1	4	34	3	32
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	13			12			114	81	9	86	83	13
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			12			114	81	9	86	83	13
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	98			100			100	100	100	96	100	97
cM capacity (veh/h)	1543			1621			826	798	1078	871	795	1034

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	28	9	2	14	5	68
Volume Left	28	0	0	1	0	34
Volume Right	0	0	2	0	4	32
cSH	1543	1700	1700	1621	1007	935
Volume to Capacity	0.02	0.01	0.00	0.00	0.01	0.07
Queue Length 95th (m)	0.4	0.0	0.0	0.0	0.1	1.8
Control Delay (s)	7.4	0.0	0.0	0.6	8.6	9.2
Lane LOS	A			A	A	A
Approach Delay (s)	5.2			0.6	8.6	9.2
Approach LOS					A	A

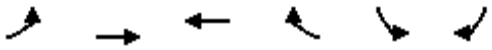
Intersection Summary				
Average Delay	7.0			
Intersection Capacity Utilization	25.3%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	109	42	61	23	16	84
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	115	44	64	24	17	88
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	88				338	64
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	88				338	64
tC, single (s)	4.2				6.8	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.9	3.4
p0 queue free %	92				97	91
cM capacity (veh/h)	1452				533	975

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	115	44	64	24	105
Volume Left	115	0	0	0	17
Volume Right	0	0	0	24	88
cSH	1452	1700	1700	1700	861
Volume to Capacity	0.08	0.03	0.04	0.01	0.12
Queue Length 95th (m)	2.0	0.0	0.0	0.0	3.2
Control Delay (s)	7.7	0.0	0.0	0.0	9.8
Lane LOS	A				A
Approach Delay (s)	5.6		0.0		9.8
Approach LOS					A

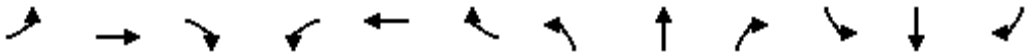
Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	25.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	9	14	29	15	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	9	15	31	16	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	45				39	30
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	45				39	30
tC, single (s)	4.2				7.2	6.3
tC, 2 stage (s)						
tF (s)	2.3				4.2	3.4
p0 queue free %	100				98	100
cM capacity (veh/h)	1513				807	1022

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	9	45	16
Volume Left	0	0	16
Volume Right	0	31	0
cSH	1513	1700	807
Volume to Capacity	0.00	0.03	0.02
Queue Length 95th (m)	0.0	0.0	0.5
Control Delay (s)	0.0	0.0	9.6
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.6
Approach LOS			A

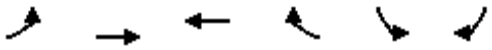
Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	29	9	2	1	12	0	0	1	4	31	3	30
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	31	9	2	1	13	0	0	1	4	33	3	32
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	13			12			118	85	9	90	87	13
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			12			118	85	9	90	87	13
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	98			100			100	100	100	96	100	97
cM capacity (veh/h)	1543			1621			820	792	1078	865	790	1034

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	31	9	2	14	5	67
Volume Left	31	0	0	1	0	33
Volume Right	0	0	2	0	4	32
cSH	1543	1700	1700	1621	1005	932
Volume to Capacity	0.02	0.01	0.00	0.00	0.01	0.07
Queue Length 95th (m)	0.5	0.0	0.0	0.0	0.1	1.8
Control Delay (s)	7.4	0.0	0.0	0.6	8.6	9.2
Lane LOS	A			A	A	A
Approach Delay (s)	5.4			0.6	8.6	9.2
Approach LOS					A	A

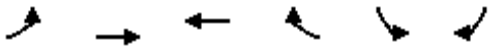
Intersection Summary			
Average Delay	7.0		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	107	44	64	25	16	85
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	113	46	67	26	17	89
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	94				339	67
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	94				339	67
tC, single (s)	4.2				6.8	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.9	3.4
p0 queue free %	92				97	91
cM capacity (veh/h)	1446				533	971

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	113	46	67	26	106
Volume Left	113	0	0	0	17
Volume Right	0	0	0	26	89
cSH	1446	1700	1700	1700	859
Volume to Capacity	0.08	0.03	0.04	0.02	0.12
Queue Length 95th (m)	1.9	0.0	0.0	0.0	3.2
Control Delay (s)	7.7	0.0	0.0	0.0	9.8
Lane LOS	A				A
Approach Delay (s)	5.5		0.0		9.8
Approach LOS					A

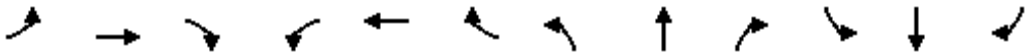
Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	25.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	6	9	14	23	12	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	6	9	15	24	13	3
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	39				49	27
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	39				49	27
tC, single (s)	4.8				7.3	7.2
tC, 2 stage (s)						
tF (s)	2.9				4.3	4.2
p0 queue free %	99				98	100
cM capacity (veh/h)	1207				775	825

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	16	39	16
Volume Left	6	0	13
Volume Right	0	24	3
cSH	1207	1700	784
Volume to Capacity	0.01	0.02	0.02
Queue Length 95th (m)	0.1	0.0	0.5
Control Delay (s)	3.2	0.0	9.7
Lane LOS	A		A
Approach Delay (s)	3.2	0.0	9.7
Approach LOS			A

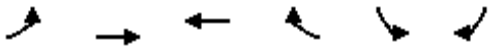
Intersection Summary			
Average Delay		2.9	
Intersection Capacity Utilization		15.8%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	21	17	0	1	6	0	0	0	1	45	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	22	18	0	1	6	0	0	0	1	47	0	21
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	6			18			92	71	18	72	71	6
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	6			18			92	71	18	72	71	6
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.5	6.4
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	99			100			100	100	100	95	100	98
cM capacity (veh/h)	1595			1612			869	812	1067	885	812	1037

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	22	18	0	7	1	68
Volume Left	22	0	0	1	0	47
Volume Right	0	0	0	0	1	21
cSH	1595	1700	1700	1612	1067	927
Volume to Capacity	0.01	0.01	0.00	0.00	0.00	0.07
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	1.8
Control Delay (s)	7.3	0.0	0.0	1.0	8.4	9.2
Lane LOS	A			A	A	A
Approach Delay (s)	4.0			1.0	8.4	9.2
Approach LOS					A	A

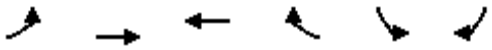
Intersection Summary				
Average Delay	6.9			
Intersection Capacity Utilization	22.6%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	112	95	82	23	16	142
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	118	100	86	24	17	149
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	111				422	86
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	111				422	86
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				97	85
cM capacity (veh/h)	1486				545	978

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	118	100	86	24	166
Volume Left	118	0	0	0	17
Volume Right	0	0	0	24	149
cSH	1486	1700	1700	1700	905
Volume to Capacity	0.08	0.06	0.05	0.01	0.18
Queue Length 95th (m)	2.0	0.0	0.0	0.0	5.1
Control Delay (s)	7.6	0.0	0.0	0.0	9.9
Lane LOS	A				A
Approach Delay (s)	4.1		0.0		9.9
Approach LOS					A

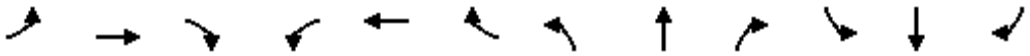
Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	29.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	9	14	15	29	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	9	15	16	31	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	31				32	23
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	31				32	23
tC, single (s)	4.1				7.2	7.0
tC, 2 stage (s)						
tF (s)	2.2				4.2	4.0
p0 queue free %	100				96	100
cM capacity (veh/h)	1595				815	868

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	9	31	31
Volume Left	0	0	31
Volume Right	0	16	0
cSH	1595	1700	815
Volume to Capacity	0.00	0.02	0.04
Queue Length 95th (m)	0.0	0.0	0.9
Control Delay (s)	0.0	0.0	9.6
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.6
Approach LOS			A

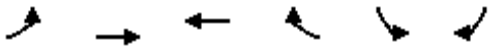
Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	21	17	0	1	6	0	0	0	1	44	0	22
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	22	18	0	1	6	0	0	0	1	46	0	23
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	6			18			94	71	18	72	71	6
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	6			18			94	71	18	72	71	6
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.5	6.4
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	99			100			100	100	100	95	100	98
cM capacity (veh/h)	1595			1612			865	812	1067	885	812	1037

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	22	18	0	7	1	69
Volume Left	22	0	0	1	0	46
Volume Right	0	0	0	0	1	23
cSH	1595	1700	1700	1612	1067	930
Volume to Capacity	0.01	0.01	0.00	0.00	0.00	0.07
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	1.8
Control Delay (s)	7.3	0.0	0.0	1.0	8.4	9.2
Lane LOS	A			A	A	A
Approach Delay (s)	4.0			1.0	8.4	9.2
Approach LOS					A	A

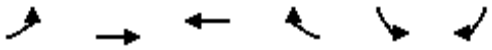
Intersection Summary				
Average Delay	6.9			
Intersection Capacity Utilization	22.7%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	109	95	82	23	16	136
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	115	100	86	24	17	143
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	111				416	86
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	111				416	86
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				97	85
cM capacity (veh/h)	1486				551	978

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	115	100	86	24	160
Volume Left	115	0	0	0	17
Volume Right	0	0	0	24	143
cSH	1486	1700	1700	1700	904
Volume to Capacity	0.08	0.06	0.05	0.01	0.18
Queue Length 95th (m)	1.9	0.0	0.0	0.0	4.9
Control Delay (s)	7.6	0.0	0.0	0.0	9.8
Lane LOS	A				A
Approach Delay (s)	4.1		0.0		9.8
Approach LOS					A

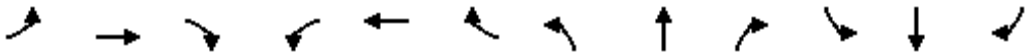
Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	28.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	3	9	14	12	23	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	3	9	15	13	24	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	27				37	21
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	27				37	21
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	100				97	99
cM capacity (veh/h)	1536				954	1034

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	13	27	31
Volume Left	3	0	24
Volume Right	0	13	6
cSH	1536	1700	969
Volume to Capacity	0.00	0.02	0.03
Queue Length 95th (m)	0.0	0.0	0.7
Control Delay (s)	1.8	0.0	8.8
Lane LOS	A		A
Approach Delay (s)	1.8	0.0	8.8
Approach LOS			A

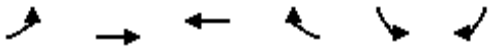
Intersection Summary			
Average Delay		4.2	
Intersection Capacity Utilization		13.3%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	9	2	1	12	0	0	1	4	31	3	29
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	28	9	2	1	13	0	0	1	4	33	3	31
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	13			12			113	81	9	86	83	13
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			12			113	81	9	86	83	13
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	98			100			100	100	100	96	100	97
cM capacity (veh/h)	1543			1621			828	798	1078	871	795	1034

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	28	9	2	14	5	66
Volume Left	28	0	0	1	0	33
Volume Right	0	0	2	0	4	31
cSH	1543	1700	1700	1621	1007	935
Volume to Capacity	0.02	0.01	0.00	0.00	0.01	0.07
Queue Length 95th (m)	0.4	0.0	0.0	0.0	0.1	1.7
Control Delay (s)	7.4	0.0	0.0	0.6	8.6	9.1
Lane LOS	A			A	A	A
Approach Delay (s)	5.2			0.6	8.6	9.1
Approach LOS					A	A

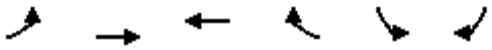
Intersection Summary				
Average Delay	6.9			
Intersection Capacity Utilization	25.1%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	104	46	67	24	16	94
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	109	48	71	25	17	99
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	96				338	71
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	96				338	71
tC, single (s)	4.2				6.8	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.9	3.4
p0 queue free %	92				97	90
cM capacity (veh/h)	1443				535	967

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	109	48	71	25	116
Volume Left	109	0	0	0	17
Volume Right	0	0	0	25	99
cSH	1443	1700	1700	1700	866
Volume to Capacity	0.08	0.03	0.04	0.01	0.13
Queue Length 95th (m)	1.9	0.0	0.0	0.0	3.5
Control Delay (s)	7.7	0.0	0.0	0.0	9.8
Lane LOS	A				A
Approach Delay (s)	5.3		0.0		9.8
Approach LOS					A

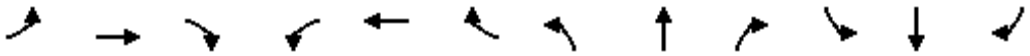
Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	25.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	9	14	13	7	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	9	15	14	7	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	28				31	22
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	28				31	22
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	100				99	100
cM capacity (veh/h)	1535				963	1033

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	9	28	7
Volume Left	0	0	7
Volume Right	0	14	0
cSH	1535	1700	963
Volume to Capacity	0.00	0.02	0.01
Queue Length 95th (m)	0.0	0.0	0.2
Control Delay (s)	0.0	0.0	8.8
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.8
Approach LOS			A

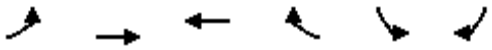
Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	9	2	1	12	0	0	1	4	31	3	30
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	28	9	2	1	13	0	0	1	4	33	3	32
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	13			12			114	81	9	86	83	13
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			12			114	81	9	86	83	13
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	98			100			100	100	100	96	100	97
cM capacity (veh/h)	1543			1621			826	798	1078	871	795	1034

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	28	9	2	14	5	67
Volume Left	28	0	0	1	0	33
Volume Right	0	0	2	0	4	32
cSH	1543	1700	1700	1621	1007	936
Volume to Capacity	0.02	0.01	0.00	0.00	0.01	0.07
Queue Length 95th (m)	0.4	0.0	0.0	0.0	0.1	1.8
Control Delay (s)	7.4	0.0	0.0	0.6	8.6	9.1
Lane LOS	A			A	A	A
Approach Delay (s)	5.2			0.6	8.6	9.1
Approach LOS					A	A

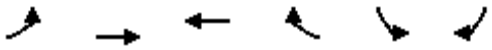
Intersection Summary			
Average Delay	7.0		
Intersection Capacity Utilization	25.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	103	46	68	21	17	88
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	108	48	72	22	18	93
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	94				337	72
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	94				337	72
tC, single (s)	4.2				6.8	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.9	3.4
p0 queue free %	93				97	90
cM capacity (veh/h)	1446				536	966

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	108	48	72	22	111
Volume Left	108	0	0	0	18
Volume Right	0	0	0	22	93
cSH	1446	1700	1700	1700	855
Volume to Capacity	0.07	0.03	0.04	0.01	0.13
Queue Length 95th (m)	1.8	0.0	0.0	0.0	3.4
Control Delay (s)	7.7	0.0	0.0	0.0	9.8
Lane LOS	A				A
Approach Delay (s)	5.3		0.0		9.8
Approach LOS					A

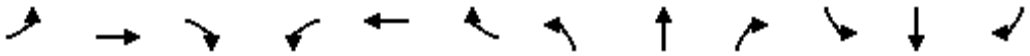
Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	25.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	3	9	14	10	6	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	3	9	15	11	6	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	25				36	20
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	25				36	20
tC, single (s)	4.8				7.2	7.2
tC, 2 stage (s)						
tF (s)	2.8				4.2	4.2
p0 queue free %	100				99	100
cM capacity (veh/h)	1242				809	833

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	13	25	7
Volume Left	3	0	6
Volume Right	0	11	1
cSH	1242	1700	812
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (m)	0.1	0.0	0.2
Control Delay (s)	2.0	0.0	9.5
Lane LOS	A		A
Approach Delay (s)	2.0	0.0	9.5
Approach LOS			A

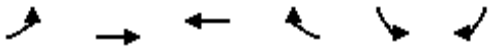
Intersection Summary			
Average Delay		2.1	
Intersection Capacity Utilization		13.3%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	17	0	1	6	0	0	0	1	43	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	18	0	1	6	0	0	0	1	45	0	21
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	6			18			89	68	18	69	68	6
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	6			18			89	68	18	69	68	6
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.5	6.4
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	99			100			100	100	100	95	100	98
cM capacity (veh/h)	1595			1612			873	815	1067	888	815	1037

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	21	18	0	7	1	66
Volume Left	21	0	0	1	0	45
Volume Right	0	0	0	0	1	21
cSH	1595	1700	1700	1612	1067	931
Volume to Capacity	0.01	0.01	0.00	0.00	0.00	0.07
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	1.7
Control Delay (s)	7.3	0.0	0.0	1.0	8.4	9.2
Lane LOS	A			A	A	A
Approach Delay (s)	3.9			1.0	8.4	9.2
Approach LOS					A	A

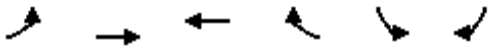
Intersection Summary				
Average Delay	6.8			
Intersection Capacity Utilization	22.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	112	100	87	22	14	141
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	118	105	92	23	15	148
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	115				433	92
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	115				433	92
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				97	85
cM capacity (veh/h)	1481				537	971

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	118	105	92	23	163
Volume Left	118	0	0	0	15
Volume Right	0	0	0	23	148
cSH	1481	1700	1700	1700	905
Volume to Capacity	0.08	0.06	0.05	0.01	0.18
Queue Length 95th (m)	2.0	0.0	0.0	0.0	5.0
Control Delay (s)	7.6	0.0	0.0	0.0	9.8
Lane LOS	A				A
Approach Delay (s)	4.0		0.0		9.8
Approach LOS					A

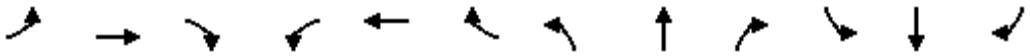
Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	29.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	9	14	7	13	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	9	15	7	14	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	22				28	18
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	22				28	18
tC, single (s)	4.1				7.2	7.0
tC, 2 stage (s)						
tF (s)	2.2				4.2	4.0
p0 queue free %	100				98	100
cM capacity (veh/h)	1606				820	873

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	9	22	14
Volume Left	0	0	14
Volume Right	0	7	0
cSH	1606	1700	820
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.0	9.5
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.5
Approach LOS			A

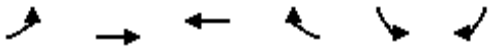
Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	21	17	0	1	6	0	0	0	1	42	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	22	18	0	1	6	0	0	0	1	44	0	21
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	6			18			92	71	18	72	71	6
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	6			18			92	71	18	72	71	6
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.5	6.4
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	99			100			100	100	100	95	100	98
cM capacity (veh/h)	1595			1612			869	812	1067	885	812	1037

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	22	18	0	7	1	65
Volume Left	22	0	0	1	0	44
Volume Right	0	0	0	0	1	21
cSH	1595	1700	1700	1612	1067	929
Volume to Capacity	0.01	0.01	0.00	0.00	0.00	0.07
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	1.7
Control Delay (s)	7.3	0.0	0.0	1.0	8.4	9.2
Lane LOS	A			A	A	A
Approach Delay (s)	4.0			1.0	8.4	9.2
Approach LOS					A	A

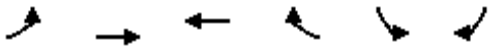
Intersection Summary				
Average Delay	6.8			
Intersection Capacity Utilization	22.4%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	110	100	87	23	13	139
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	116	105	92	24	14	146
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	116				428	92
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	116				428	92
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				97	85
cM capacity (veh/h)	1479				541	971

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	116	105	92	24	160
Volume Left	116	0	0	0	14
Volume Right	0	0	0	24	146
cSH	1479	1700	1700	1700	910
Volume to Capacity	0.08	0.06	0.05	0.01	0.18
Queue Length 95th (m)	1.9	0.0	0.0	0.0	4.8
Control Delay (s)	7.6	0.0	0.0	0.0	9.8
Lane LOS	A				A
Approach Delay (s)	4.0		0.0		9.8
Approach LOS					A

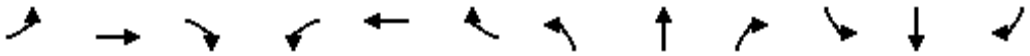
Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	28.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	1	9	14	6	10	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	1	9	15	6	11	3
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	21				29	18
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	21				29	18
tC, single (s)	5.1				7.3	6.9
tC, 2 stage (s)						
tF (s)	3.1				4.3	3.9
p0 queue free %	100				99	100
cM capacity (veh/h)	1137				800	894

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	11	21	14
Volume Left	1	0	11
Volume Right	0	6	3
cSH	1137	1700	820
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.8	0.0	9.5
Lane LOS	A		A
Approach Delay (s)	0.8	0.0	9.5
Approach LOS			A

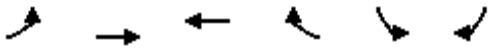
Intersection Summary			
Average Delay		3.1	
Intersection Capacity Utilization		13.3%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	9	2	1	12	0	0	1	4	31	3	29
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	28	9	2	1	13	0	0	1	4	33	3	31
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	13			12			113	81	9	86	83	13
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			12			113	81	9	86	83	13
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	98			100			100	100	100	96	100	97
cM capacity (veh/h)	1543			1621			828	798	1078	871	795	1034

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	28	9	2	14	5	66
Volume Left	28	0	0	1	0	33
Volume Right	0	0	2	0	4	31
cSH	1543	1700	1700	1621	1007	935
Volume to Capacity	0.02	0.01	0.00	0.00	0.01	0.07
Queue Length 95th (m)	0.4	0.0	0.0	0.0	0.1	1.7
Control Delay (s)	7.4	0.0	0.0	0.6	8.6	9.1
Lane LOS	A			A	A	A
Approach Delay (s)	5.2			0.6	8.6	9.1
Approach LOS					A	A

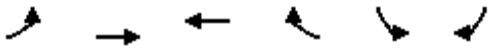
Intersection Summary				
Average Delay	6.9			
Intersection Capacity Utilization	25.1%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	113	50	74	24	17	100
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	119	53	78	25	18	105
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	103				368	78
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	103				368	78
tC, single (s)	4.2				6.8	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.9	3.4
p0 queue free %	92				96	89
cM capacity (veh/h)	1434				509	958

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	119	53	78	25	123
Volume Left	119	0	0	0	18
Volume Right	0	0	0	25	105
cSH	1434	1700	1700	1700	849
Volume to Capacity	0.08	0.03	0.05	0.01	0.15
Queue Length 95th (m)	2.1	0.0	0.0	0.0	3.8
Control Delay (s)	7.7	0.0	0.0	0.0	10.0
Lane LOS	A				A
Approach Delay (s)	5.4		0.0		10.0
Approach LOS					A

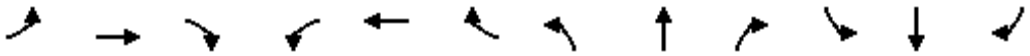
Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	26.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	9	14	13	7	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	9	15	14	7	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	28				31	22
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	28				31	22
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	100				99	100
cM capacity (veh/h)	1535				963	1033

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	9	28	7
Volume Left	0	0	7
Volume Right	0	14	0
cSH	1535	1700	963
Volume to Capacity	0.00	0.02	0.01
Queue Length 95th (m)	0.0	0.0	0.2
Control Delay (s)	0.0	0.0	8.8
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.8
Approach LOS			A

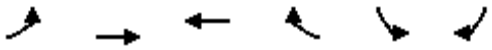
Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	9	2	1	12	0	0	1	4	31	3	30
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	28	9	2	1	13	0	0	1	4	33	3	32
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	13			12			114	81	9	86	83	13
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	13			12			114	81	9	86	83	13
tC, single (s)	4.2			4.1			7.1	6.5	6.2	7.2	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	98			100			100	100	100	96	100	97
cM capacity (veh/h)	1543			1621			826	798	1078	871	795	1034

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	28	9	2	14	5	67
Volume Left	28	0	0	1	0	33
Volume Right	0	0	2	0	4	32
cSH	1543	1700	1700	1621	1007	936
Volume to Capacity	0.02	0.01	0.00	0.00	0.01	0.07
Queue Length 95th (m)	0.4	0.0	0.0	0.0	0.1	1.8
Control Delay (s)	7.4	0.0	0.0	0.6	8.6	9.1
Lane LOS	A			A	A	A
Approach Delay (s)	5.2			0.6	8.6	9.1
Approach LOS					A	A

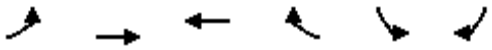
Intersection Summary				
Average Delay	7.0			
Intersection Capacity Utilization	25.2%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	111	50	74	23	18	98
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	117	53	78	24	19	103
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	102				364	78
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	102				364	78
tC, single (s)	4.2				6.8	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.9	3.4
p0 queue free %	92				96	89
cM capacity (veh/h)	1435				513	958

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	117	53	78	24	122
Volume Left	117	0	0	0	19
Volume Right	0	0	0	24	103
cSH	1435	1700	1700	1700	844
Volume to Capacity	0.08	0.03	0.05	0.01	0.14
Queue Length 95th (m)	2.0	0.0	0.0	0.0	3.8
Control Delay (s)	7.7	0.0	0.0	0.0	10.0
Lane LOS	A				A
Approach Delay (s)	5.3		0.0		10.0
Approach LOS					A

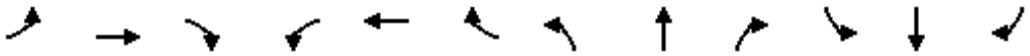
Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	26.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	3	9	14	10	6	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	3	9	15	11	6	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	25				36	20
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	25				36	20
tC, single (s)	4.8				7.2	7.2
tC, 2 stage (s)						
tF (s)	2.8				4.2	4.2
p0 queue free %	100				99	100
cM capacity (veh/h)	1242				809	833

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	13	25	7
Volume Left	3	0	6
Volume Right	0	11	1
cSH	1242	1700	812
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (m)	0.1	0.0	0.2
Control Delay (s)	2.0	0.0	9.5
Lane LOS	A		A
Approach Delay (s)	2.0	0.0	9.5
Approach LOS			A

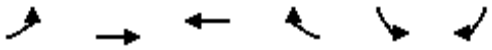
Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	17	0	1	6	0	0	0	1	43	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	18	0	1	6	0	0	0	1	45	0	21
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	6			18			89	68	18	69	68	6
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	6			18			89	68	18	69	68	6
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.5	6.4
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	99			100			100	100	100	95	100	98
cM capacity (veh/h)	1595			1612			873	815	1067	888	815	1037

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	21	18	0	7	1	66
Volume Left	21	0	0	1	0	45
Volume Right	0	0	0	0	1	21
cSH	1595	1700	1700	1612	1067	931
Volume to Capacity	0.01	0.01	0.00	0.00	0.00	0.07
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	1.7
Control Delay (s)	7.3	0.0	0.0	1.0	8.4	9.2
Lane LOS	A			A	A	A
Approach Delay (s)	3.9			1.0	8.4	9.2
Approach LOS					A	A

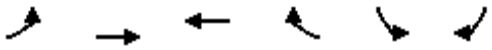
Intersection Summary				
Average Delay	6.8			
Intersection Capacity Utilization	22.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	122	108	95	24	15	156
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	128	114	100	25	16	164
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	125				471	100
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	125				471	100
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	91				97	83
cM capacity (veh/h)	1468				507	961

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	128	114	100	25	180
Volume Left	128	0	0	0	16
Volume Right	0	0	0	25	164
cSH	1468	1700	1700	1700	891
Volume to Capacity	0.09	0.07	0.06	0.01	0.20
Queue Length 95th (m)	2.2	0.0	0.0	0.0	5.7
Control Delay (s)	7.7	0.0	0.0	0.0	10.1
Lane LOS	A				B
Approach Delay (s)	4.1		0.0		10.1
Approach LOS					B

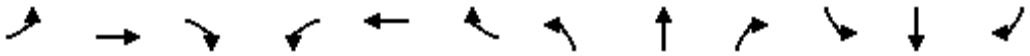
Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	30.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	0	9	14	7	13	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	9	15	7	14	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	22				28	18
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	22				28	18
tC, single (s)	4.1				7.2	7.0
tC, 2 stage (s)						
tF (s)	2.2				4.2	4.0
p0 queue free %	100				98	100
cM capacity (veh/h)	1606				820	873

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	9	22	14
Volume Left	0	0	14
Volume Right	0	7	0
cSH	1606	1700	820
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.0	9.5
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.5
Approach LOS			A

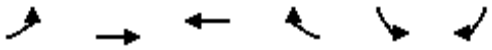
Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	21	17	0	1	6	0	0	0	1	42	0	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	22	18	0	1	6	0	0	0	1	44	0	21
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	6			18			92	71	18	72	71	6
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	6			18			92	71	18	72	71	6
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.2	6.5	6.4
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.6	4.0	3.4
p0 queue free %	99			100			100	100	100	95	100	98
cM capacity (veh/h)	1595			1612			869	812	1067	885	812	1037

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	NB 1	SB 1
Volume Total	22	18	0	7	1	65
Volume Left	22	0	0	1	0	44
Volume Right	0	0	0	0	1	21
cSH	1595	1700	1700	1612	1067	929
Volume to Capacity	0.01	0.01	0.00	0.00	0.00	0.07
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	1.7
Control Delay (s)	7.3	0.0	0.0	1.0	8.4	9.2
Lane LOS	A			A	A	A
Approach Delay (s)	4.0			1.0	8.4	9.2
Approach LOS					A	A

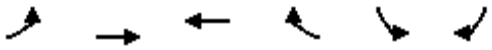
Intersection Summary				
Average Delay	6.8			
Intersection Capacity Utilization	22.4%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	120	108	95	25	14	154
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	126	114	100	26	15	162
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	126				466	100
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	126				466	100
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	91				97	83
cM capacity (veh/h)	1466				510	961

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	126	114	100	26	177
Volume Left	126	0	0	0	15
Volume Right	0	0	0	26	162
cSH	1466	1700	1700	1700	895
Volume to Capacity	0.09	0.07	0.06	0.02	0.20
Queue Length 95th (m)	2.1	0.0	0.0	0.0	5.6
Control Delay (s)	7.7	0.0	0.0	0.0	10.0
Lane LOS	A				B
Approach Delay (s)	4.0		0.0		10.0
Approach LOS					B

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	30.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	1	9	14	6	10	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	1	9	15	6	11	3
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	21				29	18
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	21				29	18
tC, single (s)	5.1				7.3	6.9
tC, 2 stage (s)						
tF (s)	3.1				4.3	3.9
p0 queue free %	100				99	100
cM capacity (veh/h)	1137				800	894

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	11	21	14
Volume Left	1	0	11
Volume Right	0	6	3
cSH	1137	1700	820
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.8	0.0	9.5
Lane LOS	A		A
Approach Delay (s)	0.8	0.0	9.5
Approach LOS			A

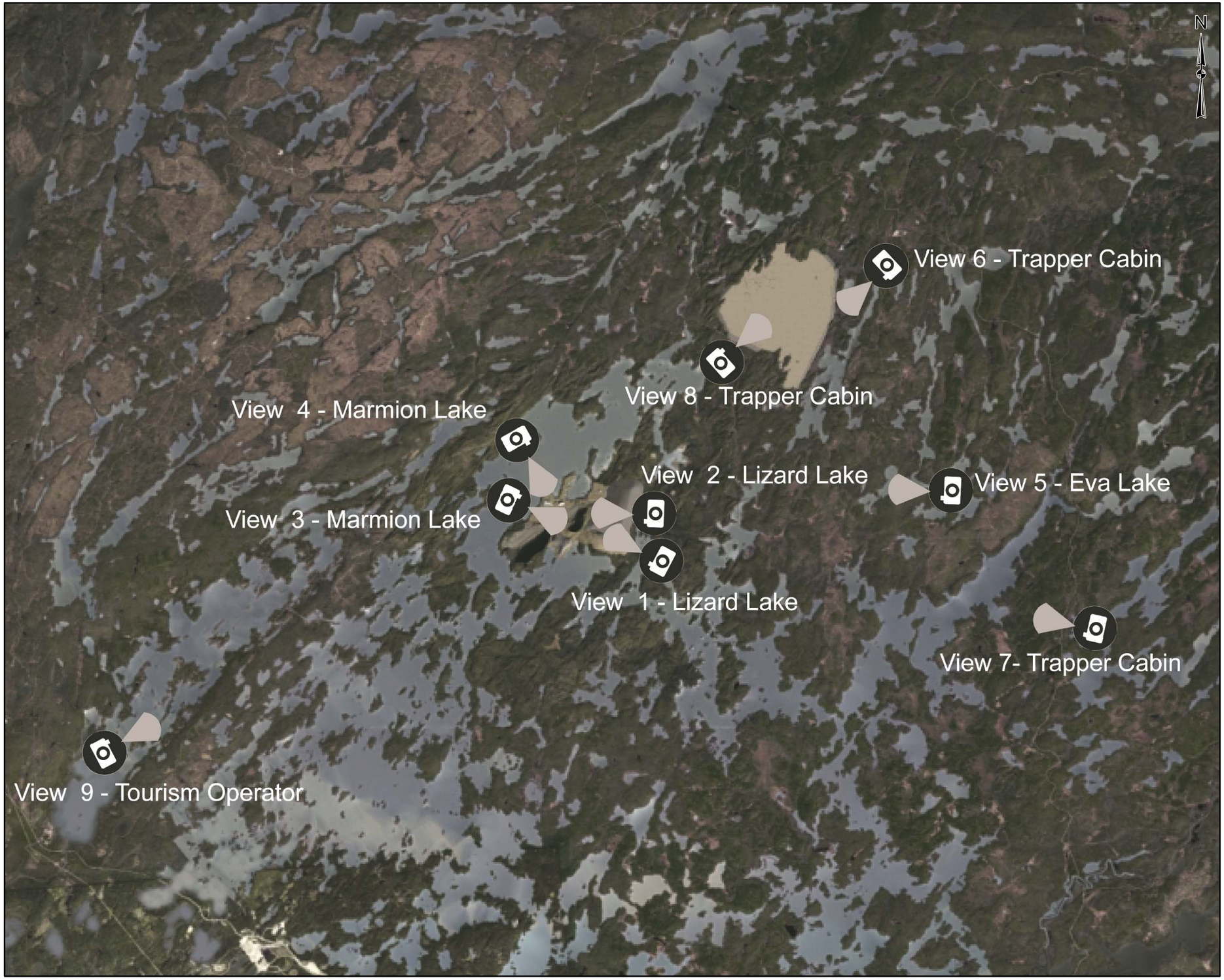
Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX 3.I
Visual Impact Assessment

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LEGEND

Photo Locations

Mine Facilities

REFERENCE

Visual Simulation - 3D Renderings Point of Views provided by Genivar on February 20, 2013.
File name: Hammond_Reef_Localisation_Synthese_R2.jpg

PROJECT

HAMMOND REEF GOLD PROJECT
ATIKOKAN, ONTARIO, CANADA

TITLE

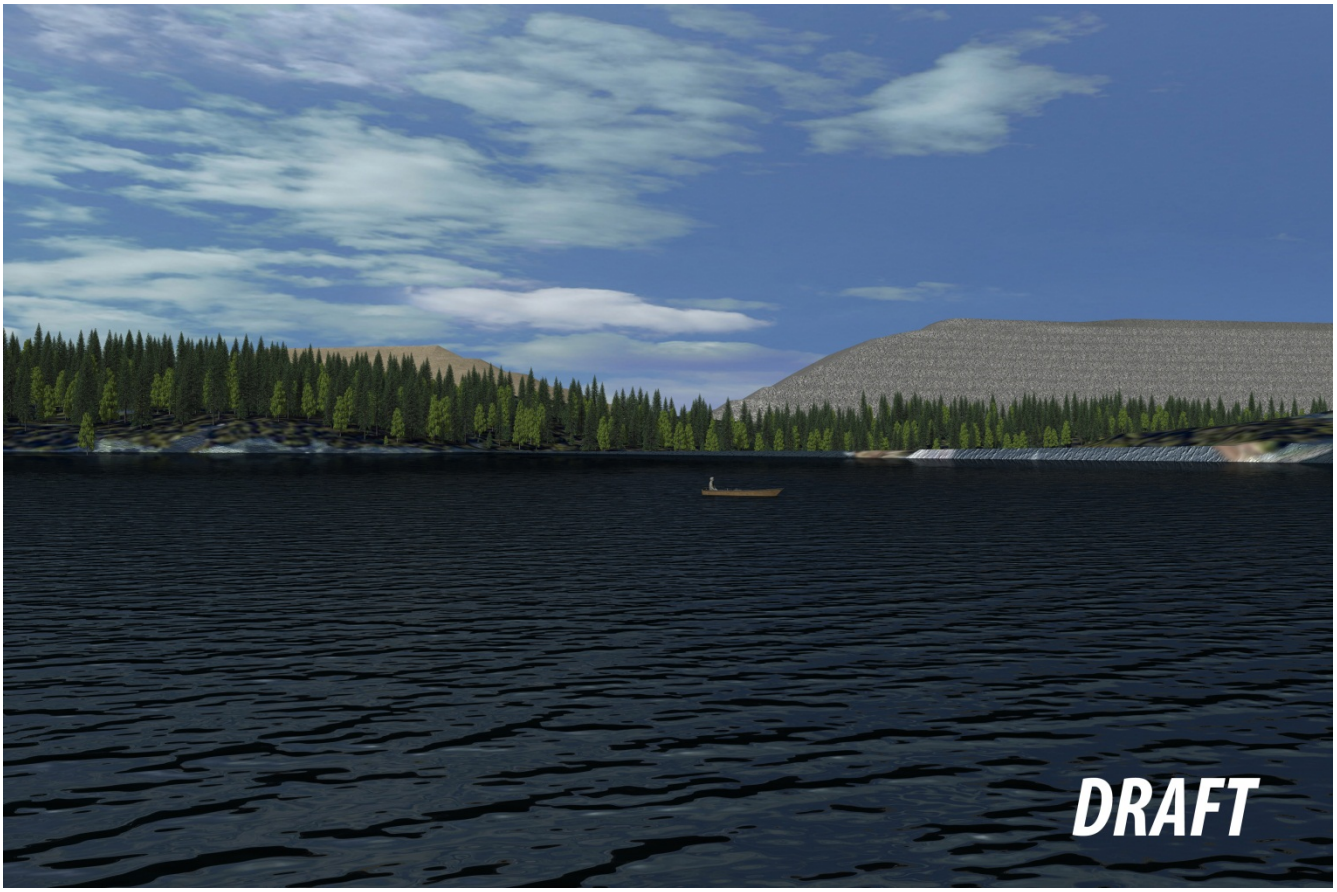
VISUAL SIMULATION -
3D RENDERINGS POINT OF VIEWS

Golder Associates
Mississauga, Ontario

PROJECT NO. 10-1118-0020			NOT TO SCALE	VERSION 1
DESIGN	CGE	14 Nov. 2008		
GIS	JO	4 Feb. 2013		
CHECK	PB	4 Feb. 2013		
REVIEW	PB	4 Feb. 2013		

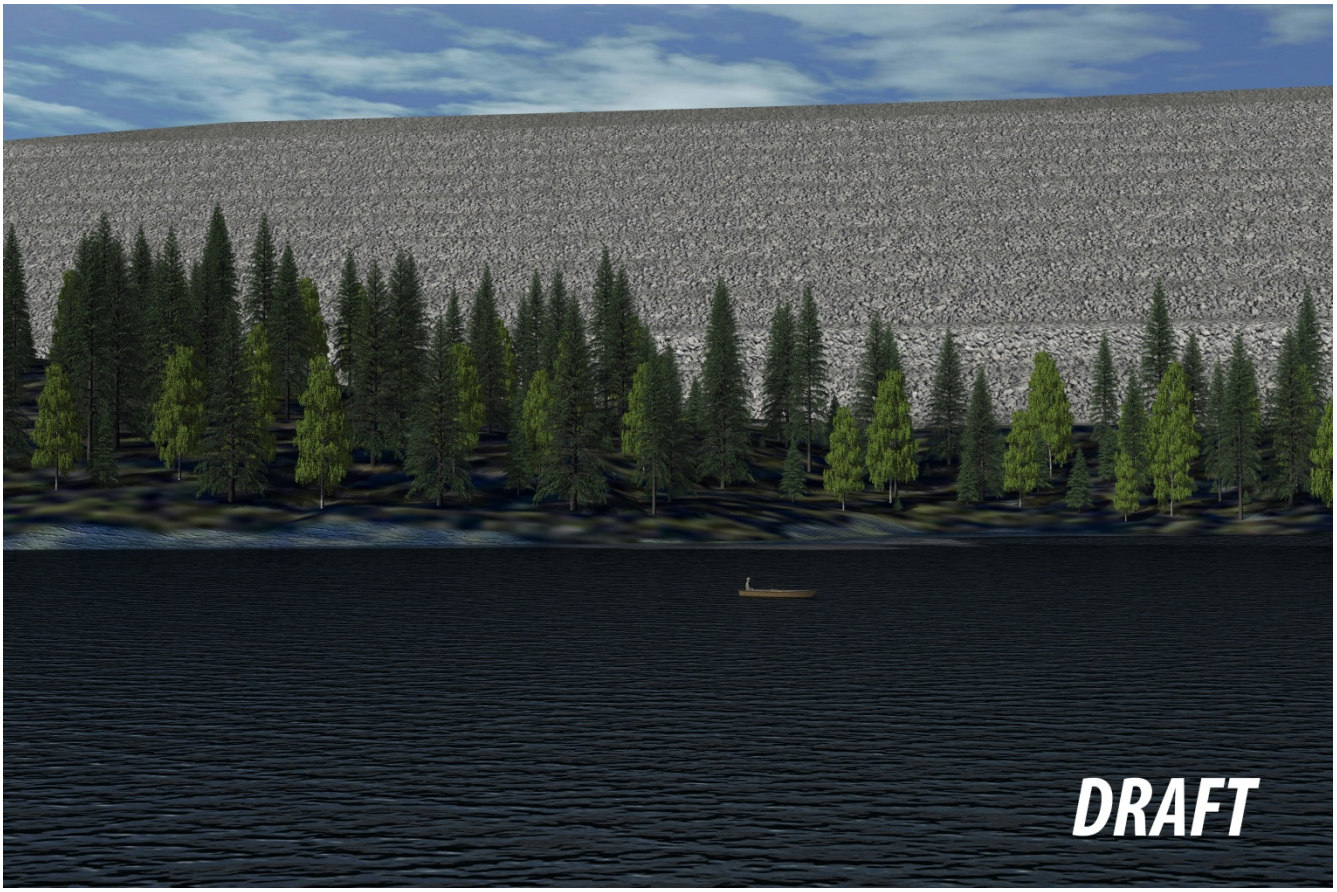
FIGURE: 1

G:\Projects\2010\10-1118-0020_BrettResources_HammondReef\GIS\MXDs\Draft\VisualImpactRenders_Point_of_View.mxd



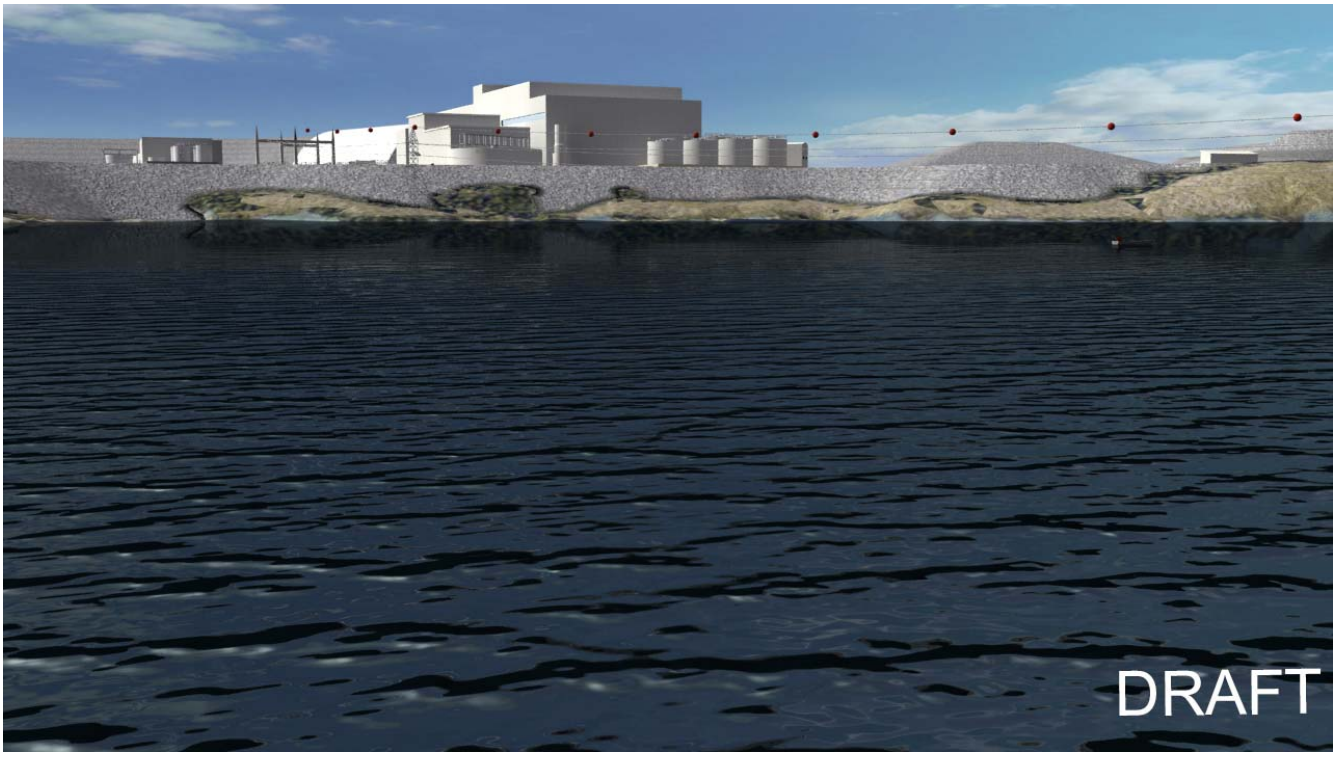
Source: Genivar 2013

Figure 2: View 1 Visual Simulation - View of Overburden and Waste Rock Stock Piles form Lizard Lake



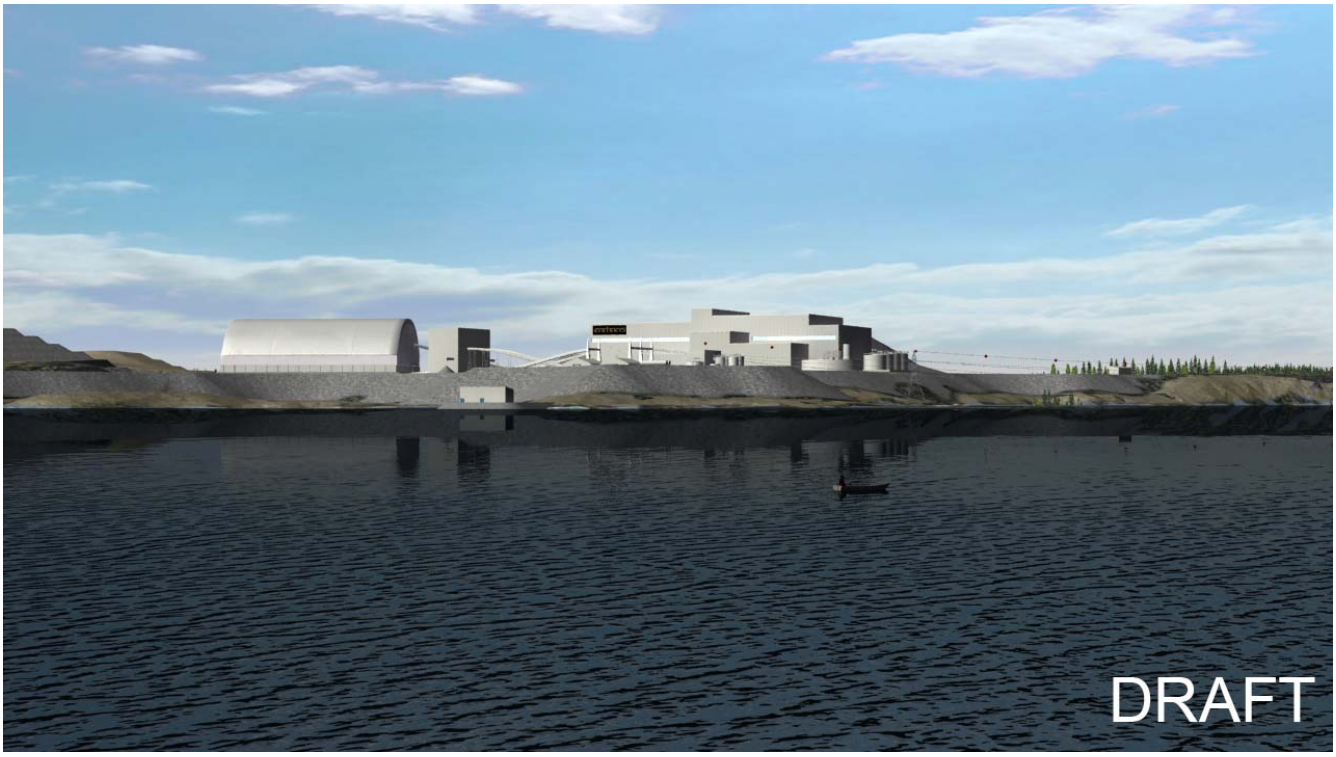
Source: Genivar 2013

Figure 3: View 2 Visual Simulation - View of Waste Rock Stock Pile from Lizard Lake



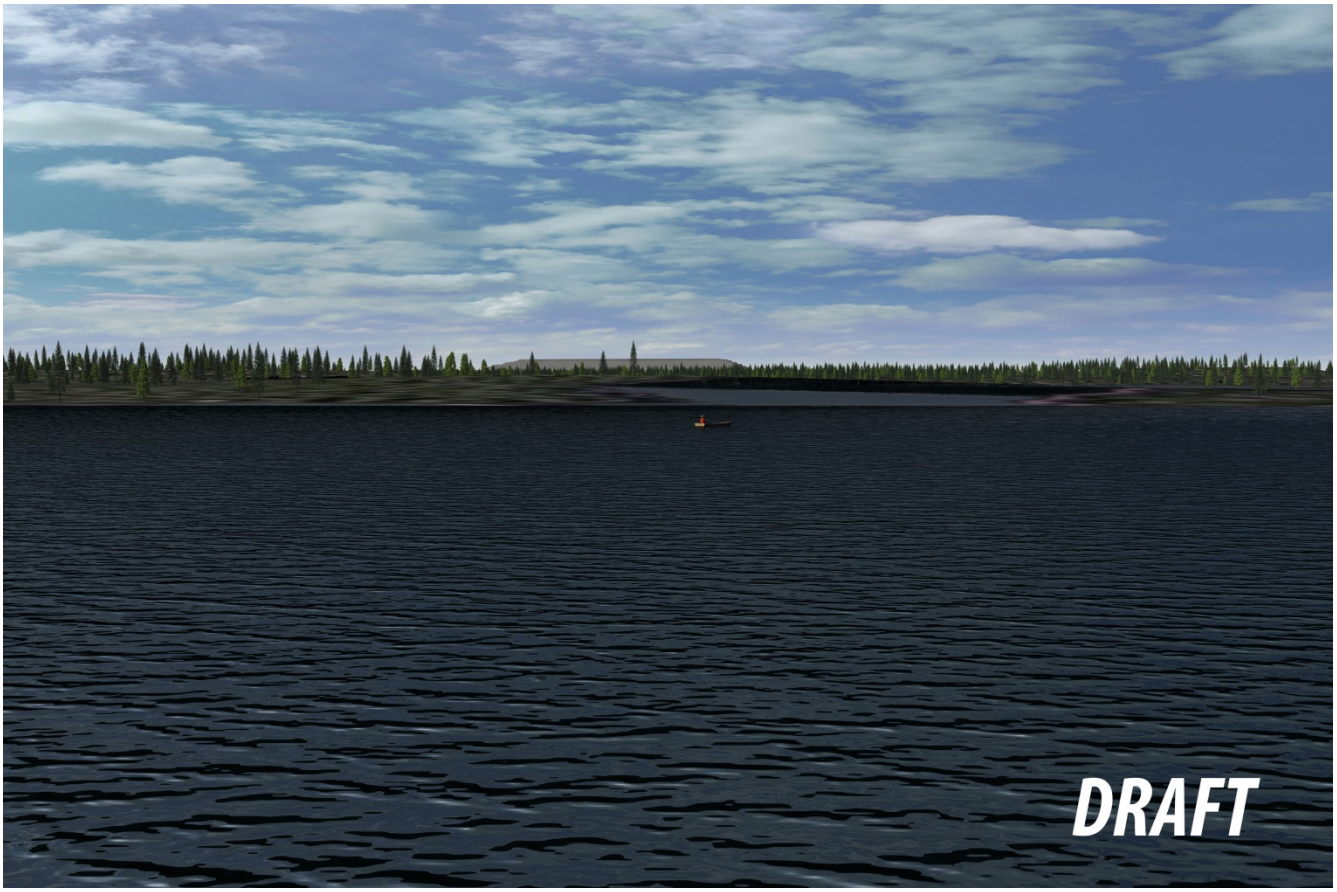
Source: Genivar 2013

Figure 4: View 3 Visual Simulation - View of Process Plant from Sawbill Bay



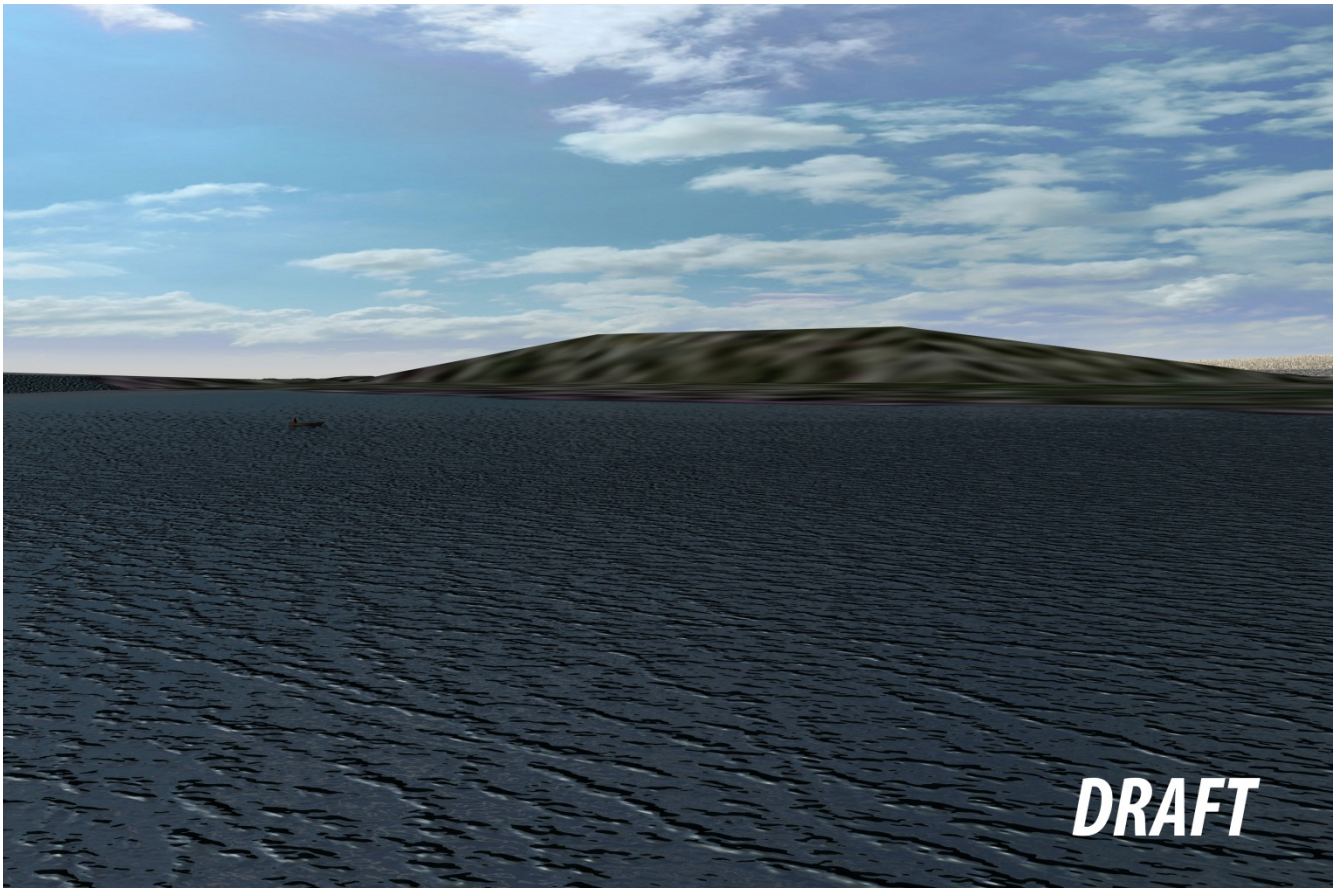
Source: Genivar 2013

Figure 5: View 4 Visual Simulation - View of Process Plant from Sawbill Bay



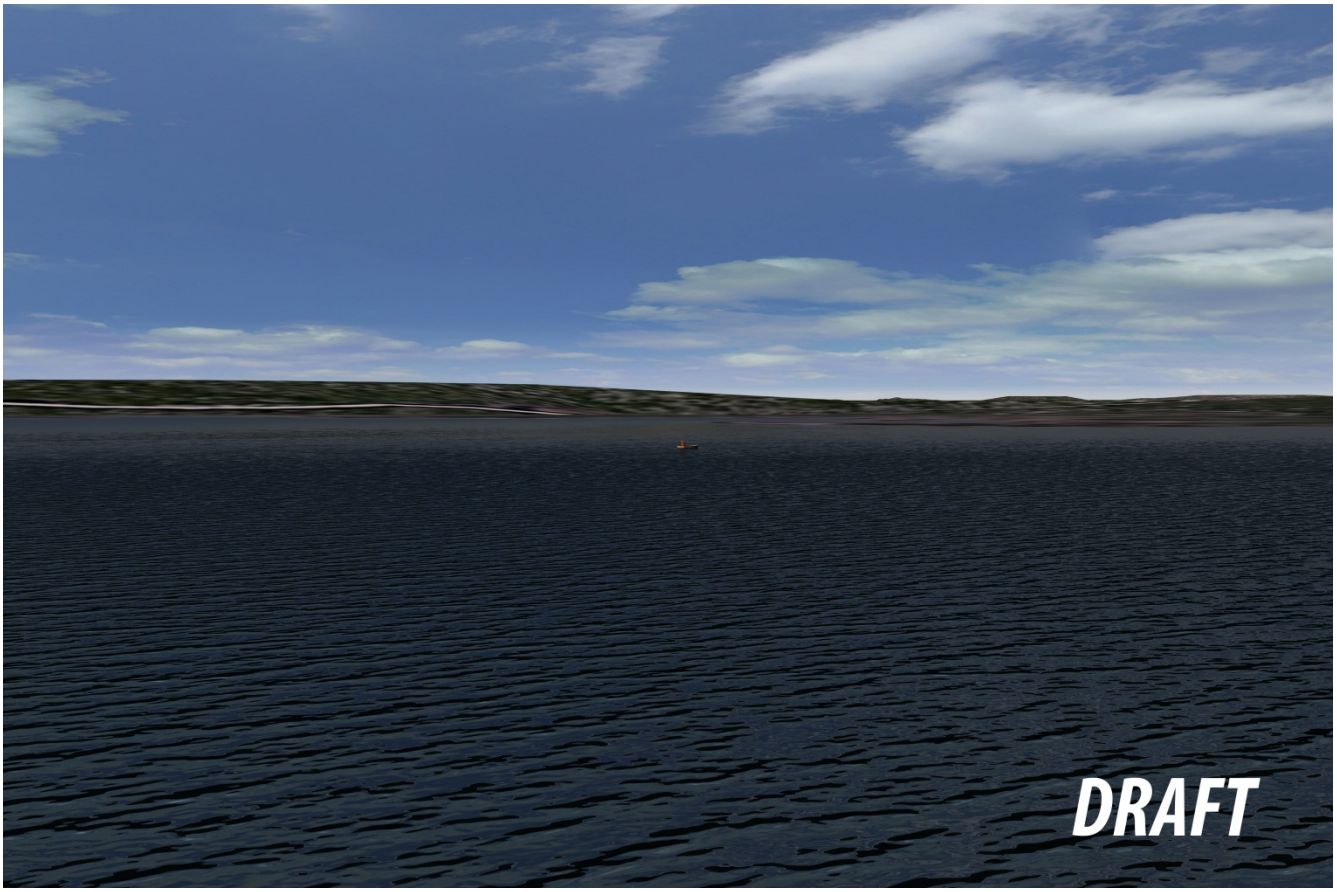
Source: Genivar 2013

Figure 6: View 5 Visual Simulation - View of Waste Rock Stock Pile from Tourism Operator



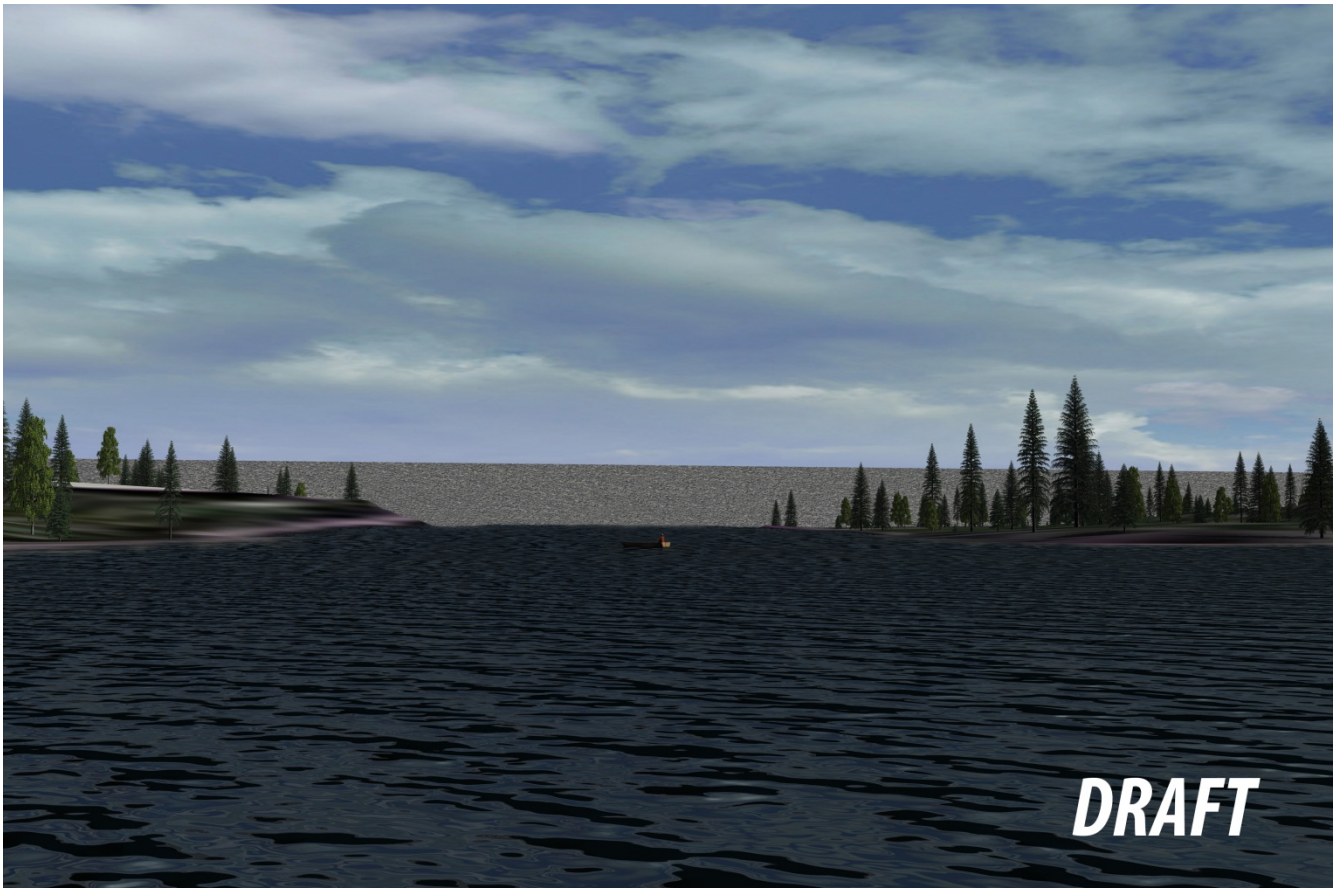
Source: Genivar 2013

Figure 7: View 6 Visual Simulation - View of Tailings Management Facility from Trapper Cabin



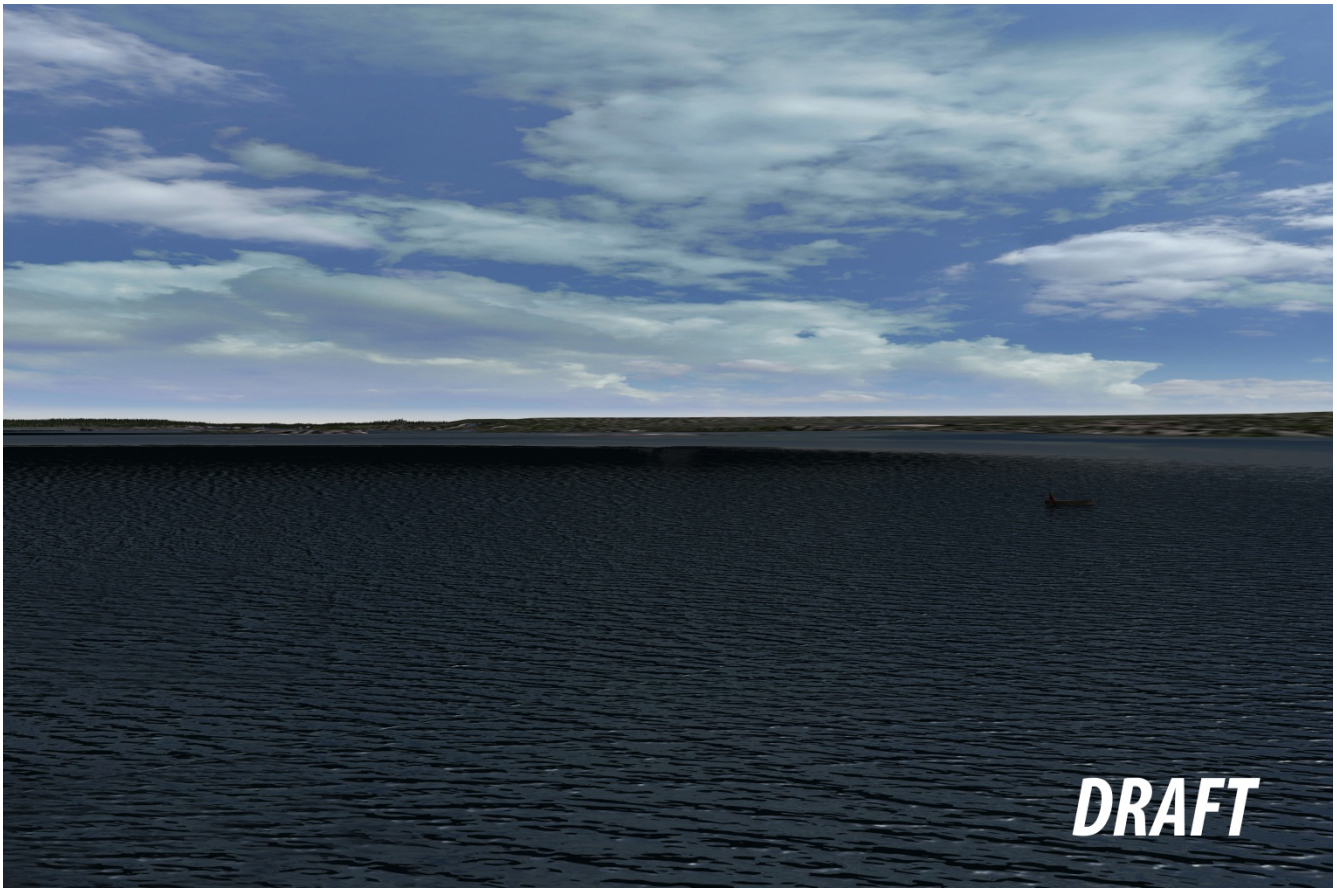
Source: Genivar 2013

Figure 8: View 7 Visual Simulation - View from Trapper Cabin



Source: Genivar 2013

Figure 9: View 8 Visual Simulation - View of Tailings Management Facility from Trapper Cabin



Source: Genivar 2013

Figure 10: View 9 Visual Simulation - View from Tourism Operator