

VISUAL ENVIRONMENT BASELINE STUDY
for
PROPOSED WABUSH 3 MINE SITE
LABRADOR CITY, NEWFOUNDLAND AND LABRADOR

Submitted to:

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Table of Contents

1.0	INTRODUCTION.....	1
1.1	Project Overview	1
1.2	Study Purpose and Objectives	2
1.3	Study Area.....	2
2.0	APPROACH AND METHODOLOGY	4
2.1	General Approach	4
2.2	Scope and Methodology.....	4
2.2.1	General Description of Visual Environment.....	5
2.2.2	Viewshed Analysis	5
2.2.3	Visual Sensitivity of Landscape Assessment	6
2.2.4	Key Assessment Viewpoints Selection	6
2.2.5	Photographic Inventory of Key Assessment Viewpoints	7
2.2.6	3D Landscape Model Development	7
3.0	RESULTS.....	7
3.1	General Description of Visual Environment.....	7
3.2	Viewshed Analysis.....	8
3.3	Assessment of Visual Sensitivity	11
3.4	Key Assessment Viewpoints	11
3.5	Photographic Inventory.....	11
3.6	Model Development.....	14
5.0	REFERENCES.....	20

List of Figures

1-1	Project Overview	3
3-1	Location of Natural and Cultural Features	9
3-2	Wabush 3 Viewshed Analysis	10
3-3	Human Use and Activity	12
3-4	Key Assessment Viewpoints	13
3-5	Location of Model Viewpoints	15
3-6	Model Camera 1 – Looking SSW at Pit / Ski Hill.....	16
3-7	Model Camera 2 – Looking WNW Across Top of Existing Ski Hill.....	17
3-8	Model Camera 3 – Looking NW from Wabush 4 (Potential Site of New Ski Hill)	18
3-9	Model Camera 4 – Looking NNE Through Valley	19

List of Tables

Table 3-1: Key Assessment Viewpoints.....	14
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Appendices

Appendix A: IOC Photo Inventory	A1
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1.0 INTRODUCTION

The Iron Ore Company of Canada (IOC) has been operating in Labrador West since the early 1960s. IOC's current mining operations consist of open pit mines, mineral processing (concentrator and pellet plant) and tailings management facilities, as well as transportation infrastructure and other associated components and activities. The operations cover an area of approximately 11,000 hectares.

IOC is proposing to develop the Wabush 3 open pit mine (the Project), at its Labrador West mine site. The Wabush 3 mine will occupy an area of approximately 415 hectares (ha) comprised of the open pit (approximately 253 ha), a waste rock disposal site (approximately 153 ha) and haulage roads (approximately 9 ha). As a prerequisite for the Project's Environmental Assessment, this Visual Environment Baseline Study was prepared to provide information on the existing visual characteristics of the region generally, and of the area immediately surrounding the proposed development site, in particular.

Large-scale mining developments have the potential to cause social, economic and environmental changes to the surrounding region and so are generally subject to federal and provincial environmental assessment legislation. Increasingly, the visual environment is considered an important component for impact assessment. The visual environment can be relevant to the quality of life of human populations, perceptions of their communities and local and regional economies. It can also affect specific sectors of the economy such as tourism that depend on aesthetic factors and the visual appeal of an area.

Surface mining, in particular, has the potential to affect the visual environment. An understanding of the visual character of an area, of specific visually sensitive locations, of potential visual effects that might be associated with proposed developments and how these can be mitigated, is critical to ensuring that effects on local populations and visitors to the region are minimized, and that economic benefits to surrounding communities are maximized.

A number of large resource projects in Newfoundland and Labrador and elsewhere in Canada have incorporated visual impact assessment into their environmental assessments in recent years including the Labrador – Island Transmission Link and the Fermeuse Wind farm development.

1.1 *Project Overview*

The proposed Project involves the development and operation of an open pit mine, Wabush 3, to support the existing iron ore concentrator and pelletizing plant. Wabush 3 will supplement the iron ore produced from the existing operating mines. The Wabush 3 development could start as early as 2015.

The proposed Project, as currently planned, will include:

- an open pit mine, located just southeast of the existing Luce Pit, which contains an estimated 900 Million tonnes of iron ore and has a planned operating life of 40 years;
- a waste rock disposal site, to be located adjacent to and northwest of the open pit;
- a haulage road to the northeast of the open pit, linking the open pit with existing ore conveyor and concentrator facilities; and
- a haulage road to the west of the open pit, linking the open pit with the waste rock disposal site.

Not connected to the Project, but possibly required as a consequence of it, will be:

- a new ski hill and associated facilities to replace Smokey Mountain, if determined to be needed.

1.2 Study Purpose and Objectives

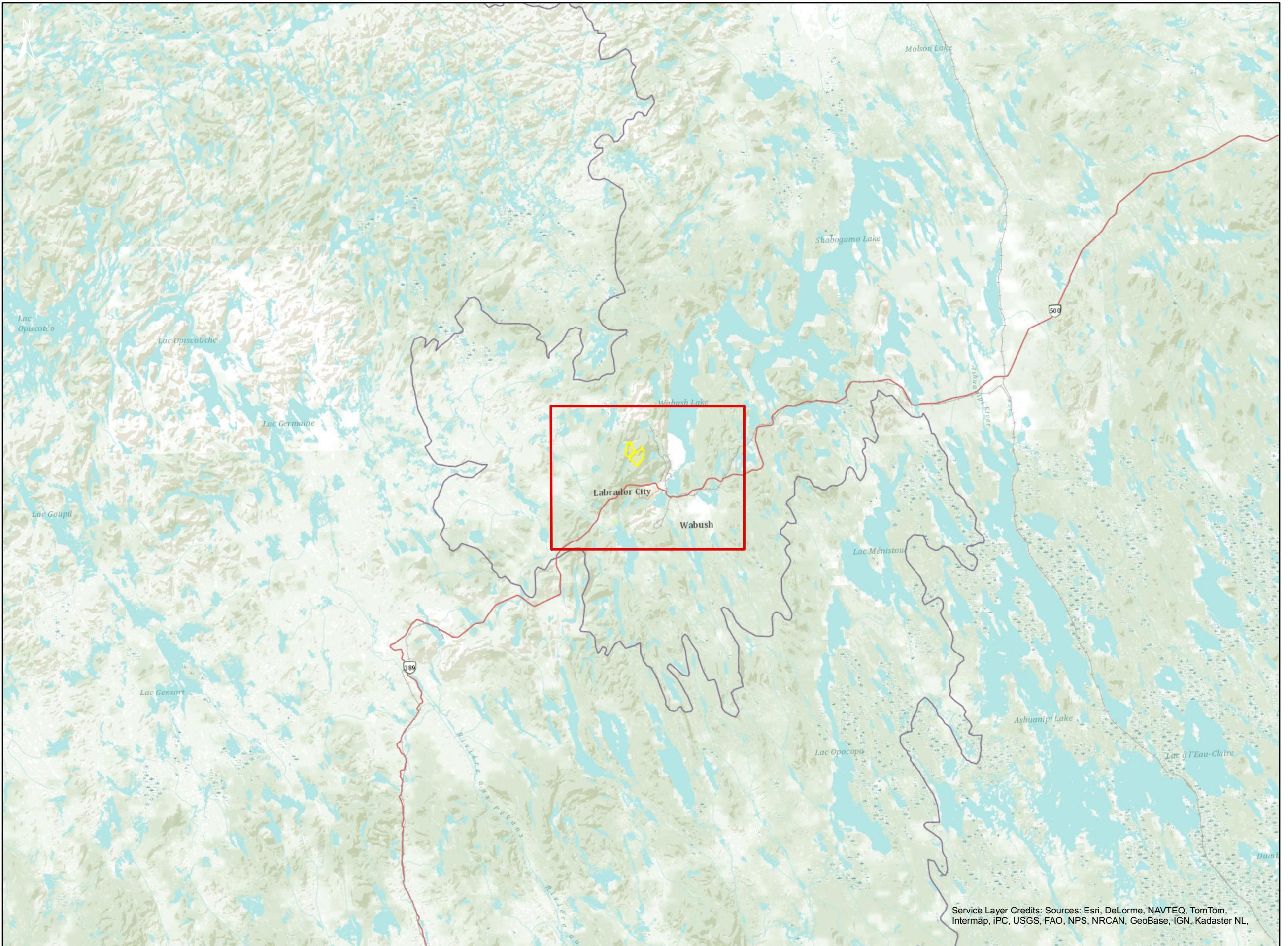
The purpose of this Visual Environment Baseline Study is to provide information on the visual character of the region surrounding Labrador City, Wabush, and the IOC mine operations, including the specific development site. The information will be used as a baseline, against which projected changes will be measured to assess potential visual impact.

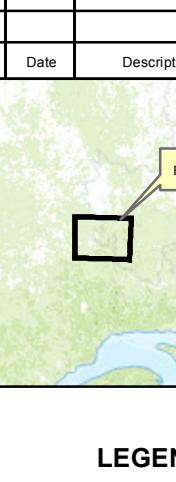
Primary objectives include:

- to compile a photographic inventory of the region, in particular views toward the proposed development site;
- to assess visibility of the proposed development site from areas throughout the region;
- to identify visually sensitive locations throughout the region; and
- to develop 3D landscape models of the region as an aid to visualizing landscape change.

1.3 Study Area

The Study Area for this Visual Environment Baseline Study is illustrated in Figure 1-1. It is located in western Labrador, near the Labrador-Quebec border and is centered on the town of Labrador City. It encompasses the populated areas of the region, as well as most other areas of human use and recreation, from which views might be important. It is approximately 25km x 20km in extent.



NOTES					
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 Study Area					
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PROJECT DESCRIPTION					
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2.0 APPROACH AND METHODOLOGY

Like other large resource projects, mine developments are subject to federal and provincial environmental assessment legislation. Visual impact assessments are becoming more widely used for large projects in Newfoundland and Labrador, in Canada generally, and around the world, and are often specified as being required components of the environmental assessments of such developments. However, no regulatory requirements are in place in Newfoundland and Labrador specifically for the conduct of visual impact assessments, and no generally accepted methodology exists. The methodology described below draws, in part, from a review of previously published visual assessment studies and reports (Nalcor Energy, 2012; Golder Associates, 2012; SLR Consulting Ltd, 2009; Newtown Landscape Architects, 2009; Shetland Islands Council, 2006).

With respect to the region around the IOC mine site and the towns of Wabush and Labrador City, no known previous studies of the existing visual environment have been undertaken. Therefore, no relevant baseline information currently exists.

2.1 General Approach

This baseline study describes the existing visual environment in and near the Project area, primarily through qualitative descriptions and a photographic inventory. To assist with evaluation of potential visual impacts it provides (i) photo-realistic images of the development site (before and after development) built from 3D landscape modelling software and (ii) information on post-development visibility throughout the region using topographical models of the post-development terrain.

2.2 Scope and Methodology

Visual impacts are often assessed in conjunction with landscape impacts. Landscape impacts include the impact of changes to the physical (geology, climate, ecology, etc.) and human (archaeology, settlement, land use, etc.) landscape of a region and its aesthetic character (sensory response), regardless of whether these changes affect views, viewsheds and the visual quality of the region. Visual impacts can be thought of as a subset of aesthetic impacts, which are themselves a subset of landscape impacts (Shetland Islands Council, 2006). This baseline study deals only with visual impacts.

The significance of potential impacts of a project on the visual environment is a function of a number of factors:

- (i) the magnitude of the associated disturbances (degree, extent, duration) at the development site,
- (ii) the sensitivity of the landscape at the site and in the surrounding region,

- (iii) the physical relationship between the development site and the surrounding region (visibility, proximity), and
- (iv) the impact of prior visual intrusions.

The baseline study describes the proposed development and existing conditions in the region. It identifies key viewpoints based on sensitivity, visibility, and proximity and describes through photos and landscape models, views from these locations.

The following general methodology was followed:

2.2.1 General Description of Visual Environment

This is a qualitative description of the region surrounding the proposed development areas. It provides a description of the visual character of the landscape, including physical characteristics such as topography and river valleys, human settlements, industrial developments, and important views and viewpoints. This provides an understanding of the natural landscapes of the region and how they have been influenced to date by human development and other disturbances.

2.2.2 Viewshed Analysis

A viewshed analysis provides information on the visibility of specific target features throughout a study region. Using topographic information for the region, it uses geometric relationships to assess visibility between points.

The post-development visibility of the proposed Wabush 3 pit was assessed using ArcGIS 10.1 software, with the 3D Analyst Extension. The following approach was used:

- i. Using ArcGIS 10.1, a set of 200 random points was generated within the proposed Wabush 3 pit and waste storage area.
- ii. A digital elevation model (DEM) for the region was created using data (1:50,000 scale) downloaded from www.Geobase.ca, a source of freely available topographic and reference datasets for Canada.
- iii. Each grid cell in the DEM contained a value equal to its elevation above sea level. An additional elevation of 1.5 meters was added to this to simulate visibility for a typical person walking or driving at that location.
- iv. Using ArcGIS 10.1's 3D Analyst Extension, the *viewshed* tool was run, with the set of 200 random points as the target, and the Geobase DEM as the topographic surface.

The resulting raster file that was generated contained a grid of 10m x 10m cells covering the entire study region. Each cell contained a value equal to the number of random points that were visible from that cell. That value divided by the total number of points (200) represents the proportion of the proposed pit and waste storage area, based on post-development topography, which is visible from the real world location represented by that cell.

The viewshed analysis served two important functions: (i) it provided information for selection of key assessment viewpoints (see Section 2.2.4); and (ii) it provided a quantifiable, spatial representation of the parts of the proposed development area that are visible throughout the region.

2.2.3 Visual Sensitivity of Landscape Assessment

Visibility, which is based primarily on geometric relationships, is one aspect of visual impact. Visual sensitivity, based primarily on human use and values, is another. The more a location is used in human activity, particularly activities for which aesthetic views are important, the more visually sensitive it is. Areas with high cultural, historical, or ecological value may also be considered visually sensitive, even when human use is relatively low.

Visually sensitive areas were identified throughout the study area. They included:

- Populated areas,
- Places where people gather for recreation and other social and cultural activities,
- Transportation corridors, and
- Places with historical, cultural, or ecological value.

2.2.4 Key Assessment Viewpoints Selection

Key assessment viewpoints were selected to represent the variety of potential visual impacts throughout the region. They formed the framework for the baseline photo inventory of the region showing existing views to the Wabush 3 site. They also represented potential viewpoints for 3D model development. Selection of key assessment viewpoints was based on:

- i. Visibility (Section 2.2.2),
- ii. Visual sensitivity (Section 2.2.3), and
- iii. Proximity to the development site

Potential visual impact is generally associated with higher visibility, visual sensitivity and greater proximity to the development site. These areas represented the focus of viewpoint selection.

However, other areas of low potential visual impact were also selected for purposes of testing model outputs. Potential viewpoints were identified prior to site visit.

2.2.5 Photographic Inventory of Key Assessment Viewpoints

The photographic inventory was conducted from July 20-23, 2012. The location of potential viewpoints was reviewed and used as a guide for planning travel throughout the region. Photographs were taken with a Ricoh, Caplio 500SE GPS Camera. Remote locations were accessed via helicopter. Others were accessed by truck or by foot. Locations were modified somewhat during site visit depending on specific site conditions and views. Photographs and related notes were uploaded to an ftp site at the end of each day.

2.2.6 3D Landscape Model Development

3D models are the primary means by which potential future changes in the landscape can be visualized and assessed. Visual Nature Studio (VNS), a software that uses real world GIS data, satellite imagery and special “rules of nature” to build topography, virtual ecosystems, and other natural and man-made features, was used for 3D model development. It combines these to produce photo-realistic images and animations of existing and post-development landscapes.

For the proposed Wabush 3 project, the existing topography was defined using a digital elevation model (DEM) obtained from Natural Resources Canada through its GeoBase website (see Section 2.2.2). This was modified based on mine plan information obtained from IOC to show the proposed mine pit and waste storage areas. Land cover was derived from the Ecological Land Classification, satellite imagery and the software’s “rules of nature”. Lake polygons were also used in model development. The model can be modified to reflect the final mine plan and can be used for other documents associated with the Project (e.g., Development Plans and Closure Plans). It will simulate how the landscape will look during and after development, and will assess the changes.

Using this GIS-based approach, augmented by site visits and the photographic inventory, a photo-realistic model, grounded in real world data, was developed.

3.0 RESULTS

3.1 General Description of Visual Environment

The towns of Labrador City and Wabush are located in western Labrador near the Quebec border. The surrounding region is hilly, with prominent ridges to the north and west. These hills

are dominated by coniferous forest, interspersed with some hardwood along eastern slopes, and alpine vegetation along the exposed ridges. Coniferous forest also dominates the area east of the towns, while to the west, beyond the ridges, the land cover is a combination of coniferous scrub, black spruce lichen forest, heathlands, lakes and wetlands.

The towns are also located in proximity to a number of large lakes including Wabush Lake, Little Wabush Lake, Duley Lake, Wahnahnish Lake, Harrie Lake, Canning Lake, and Jean Lake. These are used for various recreation activities, and some, particularly Duley Lake, are important cottage areas. Other lakes in the region that are important for human use and recreation are Dumbell Lake, Beverley Lakes, Leg Lake, Dispute Lake, and Albert Lake.

From a visual perspective, the ridges north and west of the towns are dominant, rising 300 metres above the towns. They remain relatively undeveloped. The lakes surrounding the towns are also important visually. Other less natural, but visually prominent features of the region, are the hills of waste rock from the Wabush Mines operation located south of Labrador City and running to the northeast side of Duley Lake, and the IOC tailings in Wabush Lake. The waste rock piles from the IOC mines are generally hidden by the hills to the north of the towns.

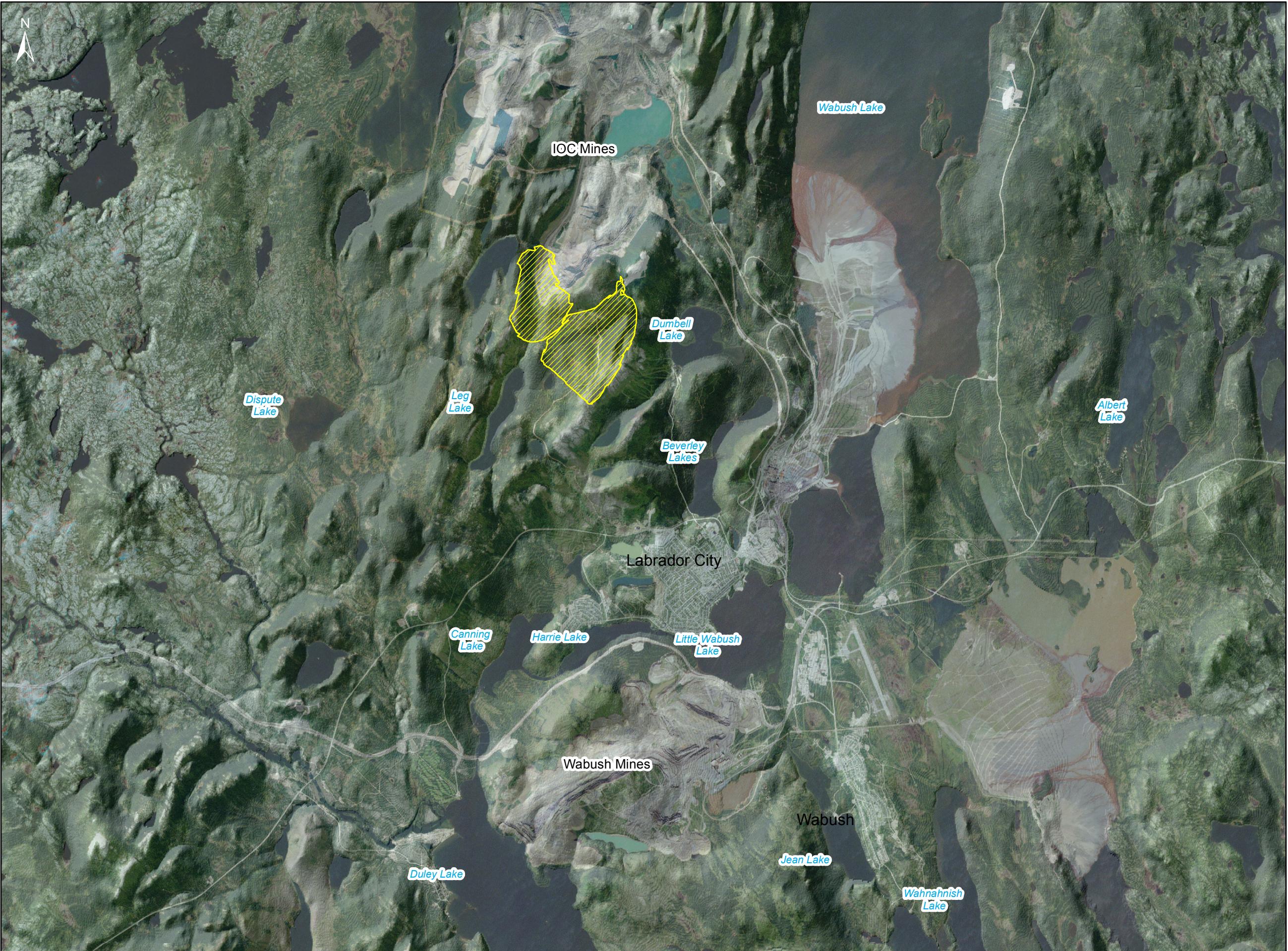
The proposed pit development at Wabush 3 is relatively sheltered from a visual perspective, as it is located in a depression, surrounded by the high ridges northwest of Labrador City. Current plans will have waste rock from Wabush 3 piled to the northwest of the pit.

Figure 3-1 shows the location of these natural and cultural features.

3.2 Viewshed Analysis

Figure 3-2 shows the results of the viewshed analysis. Visibility ranges from 0 (no visibility) to 69% visibility. The darker shaded locations in the north and west parts of the region have limited or no visibility because of the high ridges to the north and west of the proposed development area. Snowmobile trails run through this area; otherwise, there is limited human use. The populated and recreational areas to the south and southeast have moderate visibility (grey). Much of the Town of Labrador City has limited visibility, with the development site hidden behind the ridges to the north. Visibility is somewhat higher in Wabush, though the greater distance reduces the visual impact. Highest visibility in the region (light-grey to white) is found on the ridges surrounding and facing the proposed pit and waste storage area, along the west facing slopes of the areas to the east of Wabush Lake, and near the Quebec-Labrador border to the southwest.

Overall, 53% of the entire study region has visibility of 1% or more (2 of 200 random points) of the Wabush 3 site. Less than 0.5% of the region has visibility of 25% or more of the site.



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No.	Date	Description	Drawn	Chk'd	App'd

LEGEND

Proposed Wabush3 Development



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CLIENT

Rio Tinto
Iron Ore Company of Canada

PROJECT DESCRIPTION

IOC Visual Environment
Baseline Study

DRAWING TITLE

Location of Natural and
Cultural Features

PROJECT NUMBER

TF1243033.2011

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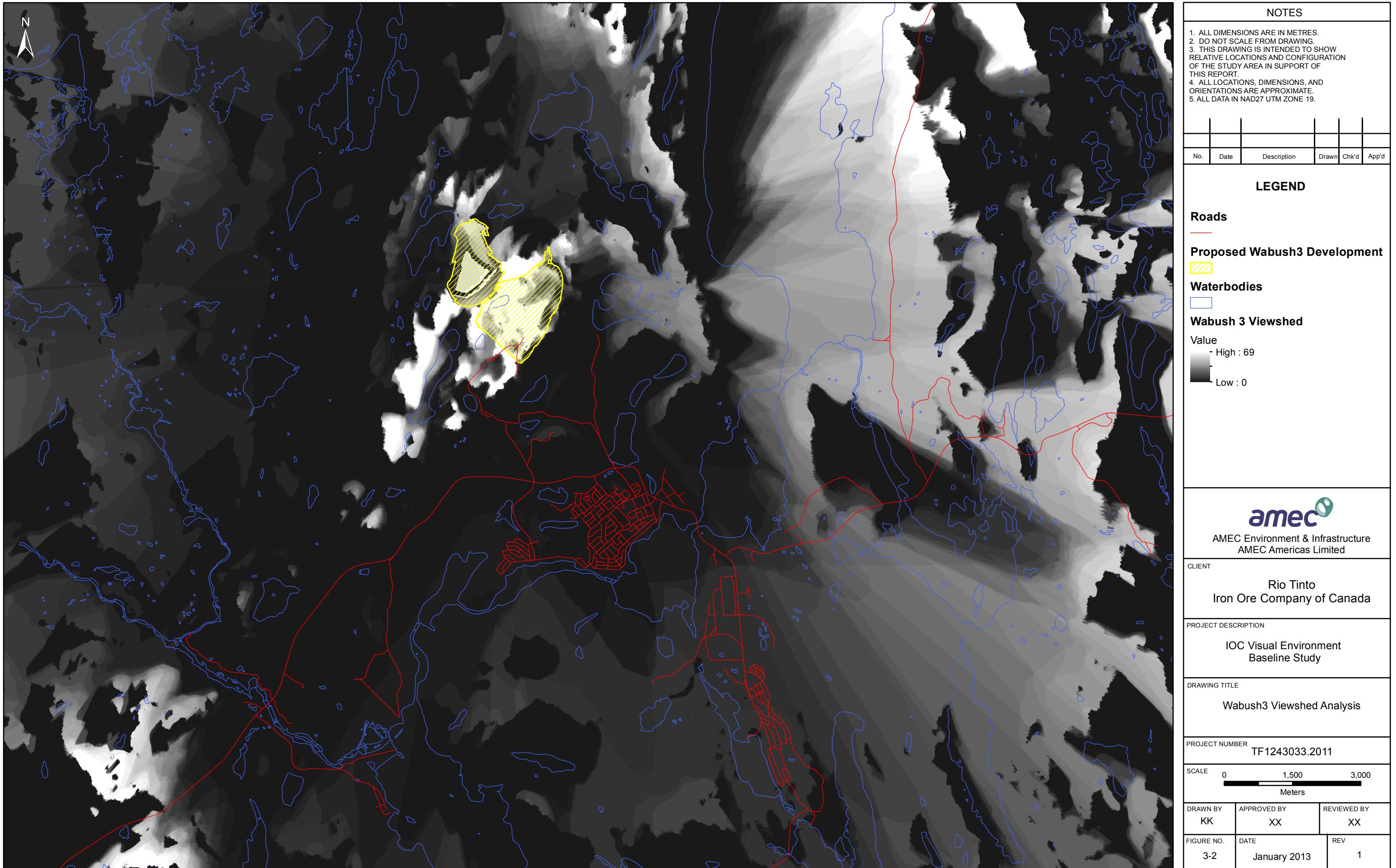
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The results of the viewshed analysis were also valuable as an input into the selection of key assessment viewpoints. It was important to select locations with high visibility (to assess visual impact) and also select locations with limited or no visibility (as a test of the viewshed analysis results).

3.3 Assessment of Visual Sensitivity

The towns of Labrador City and Wabush are the key areas for social, cultural and recreational activity and, therefore, were considered visually sensitive. Specific recreational areas within the towns and other places where people gather are especially sensitive from a visual perspective. Other important centres of human use and recreation activity include the downhill and cross-country ski areas at Smokey Mountain and Dumbell Lake, the recreation and cottage area of Duley Lake, Tamarack Golf Club, the various snowmobile and walking trails throughout the region and the surrounding lakes. Various conservation areas and parks such as Duley Lake and Jean Lake are important from both human use and conservation value perspectives.

Among the areas of highest human activity are the mine sites north of Labrador City (IOC) and west of Wabush (Wabush Mines). These are primarily industrial sites and are thus not considered visually sensitive. Figure 3-3 shows areas of high visual sensitivity.

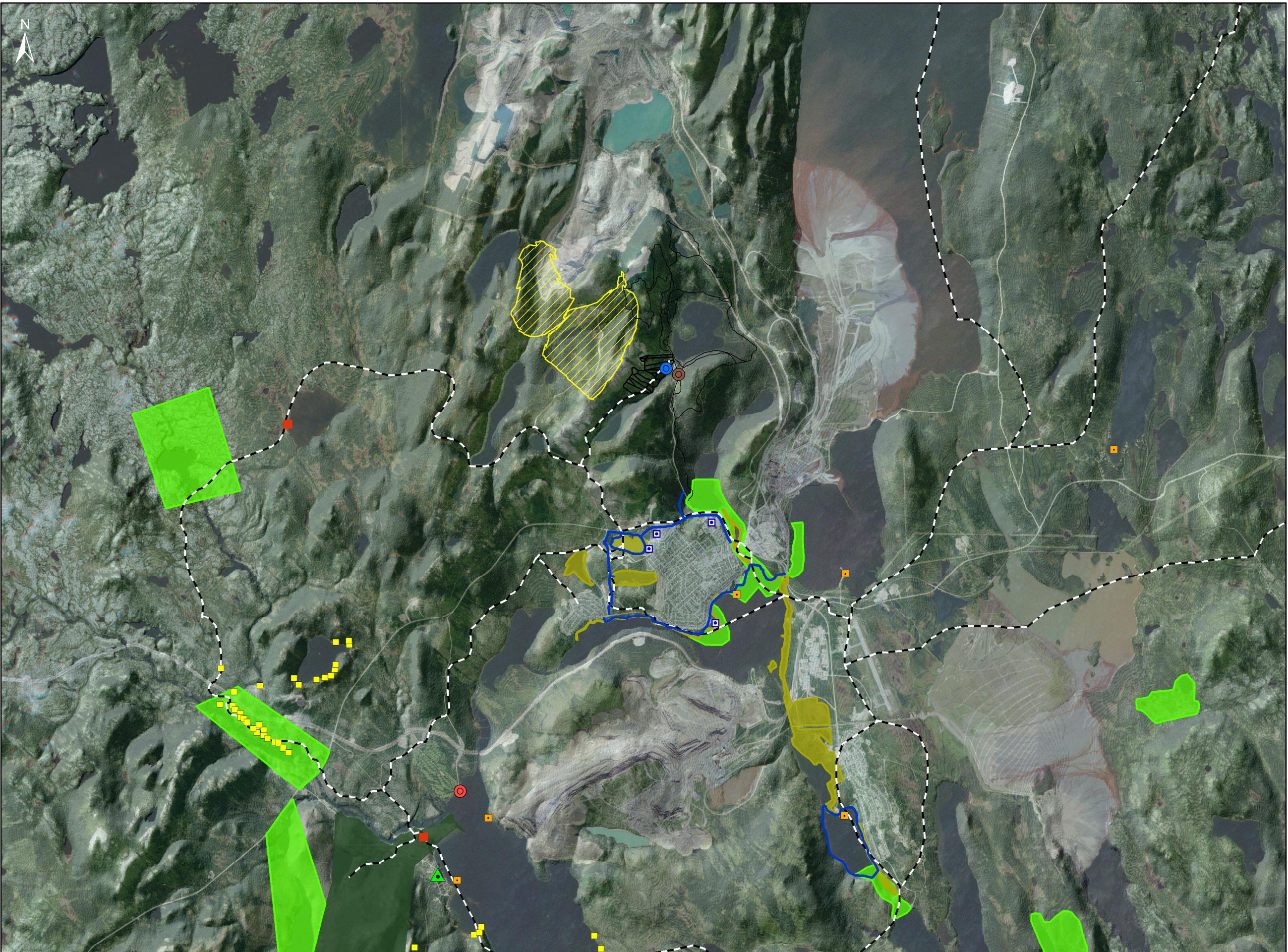
3.4 Key Assessment Viewpoints

More than 100 potential assessment locations were identified throughout the study region prior to site visit. Of these, 25 were selected as key assessment viewpoints. The locations from which all photos were taken and the key assessment viewpoints are shown in Figure 3-4. Table 3-1 lists the key assessment viewpoints, with descriptive information, percent visibility and distance to the Wabush 3 site.

All sites shown in Table 3-1 represent visually sensitive locations. The Table also shows a range of visibility from not visible (0%) to 40% visible. As noted previously, locations with little or no visibility would be expected to show little or no visual impact. They were selected to confirm the viewshed analysis outputs, and to help guide the 3D model development process. Distances from the Wabush 3 site range from 0 – 10 kilometers.

3.5 Photographic Inventory

As noted above, more than 100 photographs were taken to show existing views toward the proposed Wabush 3 development site; 25 of these were selected as key assessment viewpoints. These were used to assess existing views and potential visual impacts. Some of these were used in the model development process – to “calibrate” the model, to allow for assessment of post-development changes and impact.



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No.	Date	Description	Drawn	Chk'd	App'd

LEGEND

- Proposed Wabush3 Development
- Recreation Area
- Campgrounds
- Boat Launch
- Menihek Nordic Ski Club
- Smokey Mountain Ski Resort
- Tamarack Golf Club
- Walking Trail
- Wabush Cottage Areas
- Snowmobile Chalet
- Cottage (Registered)
- Snowmobile Trail
- Menihek Nordic Ski Club Area Trail
- Smokey Mountain Ski Club
- Conservation
- Habitat Management Unit
- Conservation Zone
- Habitat Management Unit
- Duley Park Private
- Duley Lake Provincial Park Reserve



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Rio Tinto
Iron Ore Company of Canada

PROJECT DESCRIPTION

IOC Visual Environment
Baseline Study

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Human Use and Activity

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No.	Date	Description	Drawn	Chk'd	App'd

LEGEND

- Photo Location
- Key Assessment Viewpoint
- ▨ Proposed Wabush 3 Development



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Iron Ore Company of Canada

PROJECT DESCRIPTION

IOC Visual Environment
Baseline Study

DRAWING TITLE

Key Assessment Viewpoints

PROJECT NUMBER

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Appendix A shows each key assessment viewpoint photo, with locational maps.

Table 3-1: Key Assessment Viewpoints

Picture No	Date Taken	Photo Direction	Description	Percent Visible*	Distance to Wabush 3
238	July 20, 2012	80° E	Snowmobile trail at Dispute Lake	0	6
242	July 20, 2012	60° ENE	South end of Leg Lake	6	3
243	July 20, 2012	66° ENE	Looking east over Leg Lake	28	2
246	July 20, 2012	120° ESE	Looking east from north end of Leg Lake	40	1
247	July 20, 2012	260° W	Top of ski hill	13	1
250	July 20, 2012	225° SW	East side of Wabush Lake (snowmobile trail)	13	8
269	July 20, 2012	170° S	Overlooking Wabush 3 from north	2	1
271	July 21, 2012	346° NNW	Looking north from soccer field	0	4
273	July 21, 2012	333° NNW	Matthew Ave, Labrador City	0	5
277	July 21, 2012	298° WNW	Recreation area - Booth Street, Labrador City	0	4
283	July 21, 2012	142° SE	Cross-country ski area - north of ski hill	14	1
289	July 21, 2012	125° SE	Overlooking Wabush 3 from northwest	36	1
293	July 21, 2012	217° SW	Overlooking Wabush 3 from north	26	0
306	July 21, 2012	6° N	Duley Crescent, Labrador City	0	5
310	July 21, 2012	52° NE	Road to golf course	0	6
311	July 21, 2012	34° NE	TLH west of Labrador City	0	4
320	July 21, 2012	228° SW	Ski Lodge	0	2
325	July 22, 2012	7° N	Harrie Lake	0	5
327	July 22, 2012	222° SW	Dumbell Lake	4	2
342	July 22, 2012	310° NW	Bowater Drive, Wabush	2	10
347	July 22, 2012	281° W	TLH - east of Labrador City	6	8
349	July 22, 2012	328° NNW	TLH - east of Labrador City	0	7
351	July 22, 2012	316° NW	Little Wabush Lake	0	6
353	July 23, 2012	55° NE	Crystal Falls hiking trail	0	4
359	July 23, 2012	279° W	Cross country ski trail off Smokey Mountain Rd	0	2

* Percent of Wabush 3 site that is visible from viewpoint, based on post-development topography

3.6 Model Development

Visual Nature Studio modelling software was used to model the proposed Wabush 3 development and the surrounding landscape, and to simulate “before and after” views from four selected viewpoints.

Figure 3-5 shows the location of the 4 model cameras (viewpoints). Figures 3-6 to 3-9 show “before-and-after” views from these cameras, based on the 3D model.

Model Camera 1 looks SSW towards the proposed pit area and existing ski hill (visible directly left of the pit), from a location approximately 400m above ground level. Drum Lake and Leg

Lake are visible just beyond the far end of the pit. Model Camera 2 looks WNW from an elevated position above the existing ski hill. Both the pit and waste storage areas are clearly visible. Model Camera 3 is located at the top of Wabush 4, site of a possible new ski hill development. A portion of the waste storage area is visible just above the ridge to the northwest (centre of image). Model Camera 4 is located just east of Leg Lake, looking NNE through the valley that will be used for the waste rock storage. Both the waste storage area and the pit are visible from this elevated position.

All four cameras were elevated well above ground level (see Figure 3-5). From ground elevation at camera locations 1, 3 and 4, there would be limited, if any, visibility of the pit. The pit would be visible, and quite prominent, from the top of the existing ski hill (Model Camera 2).



Figure 3-5: Location of Model Viewpoints.

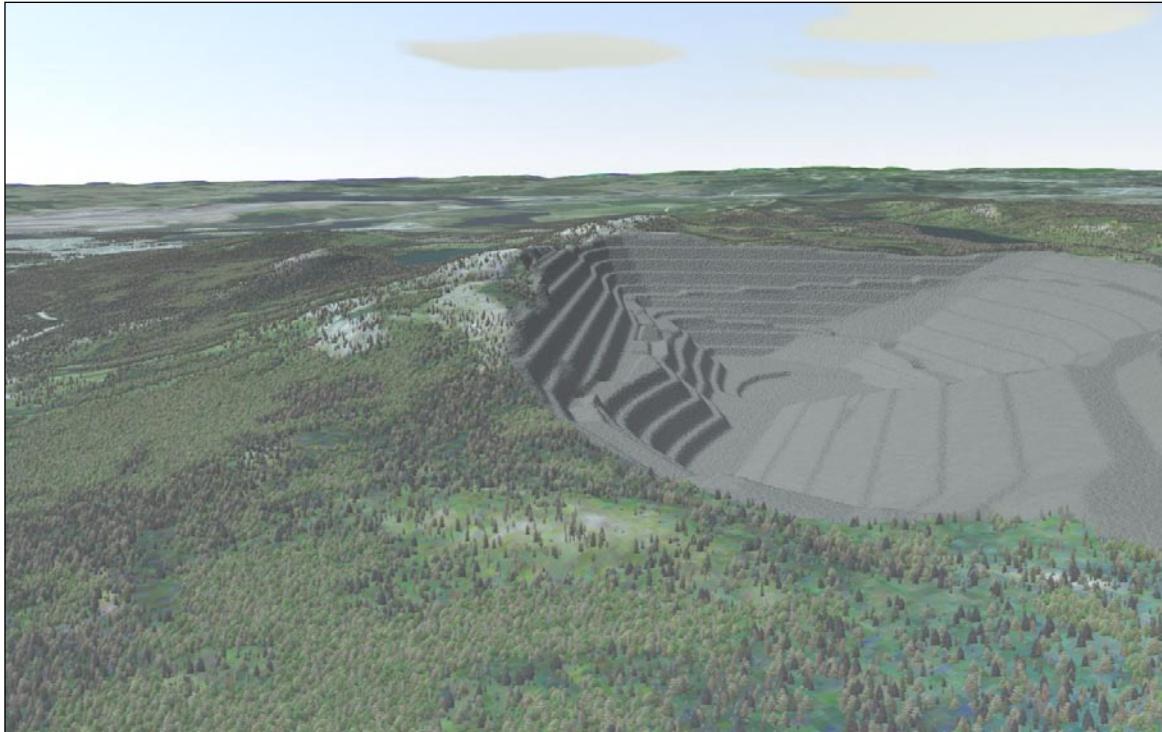
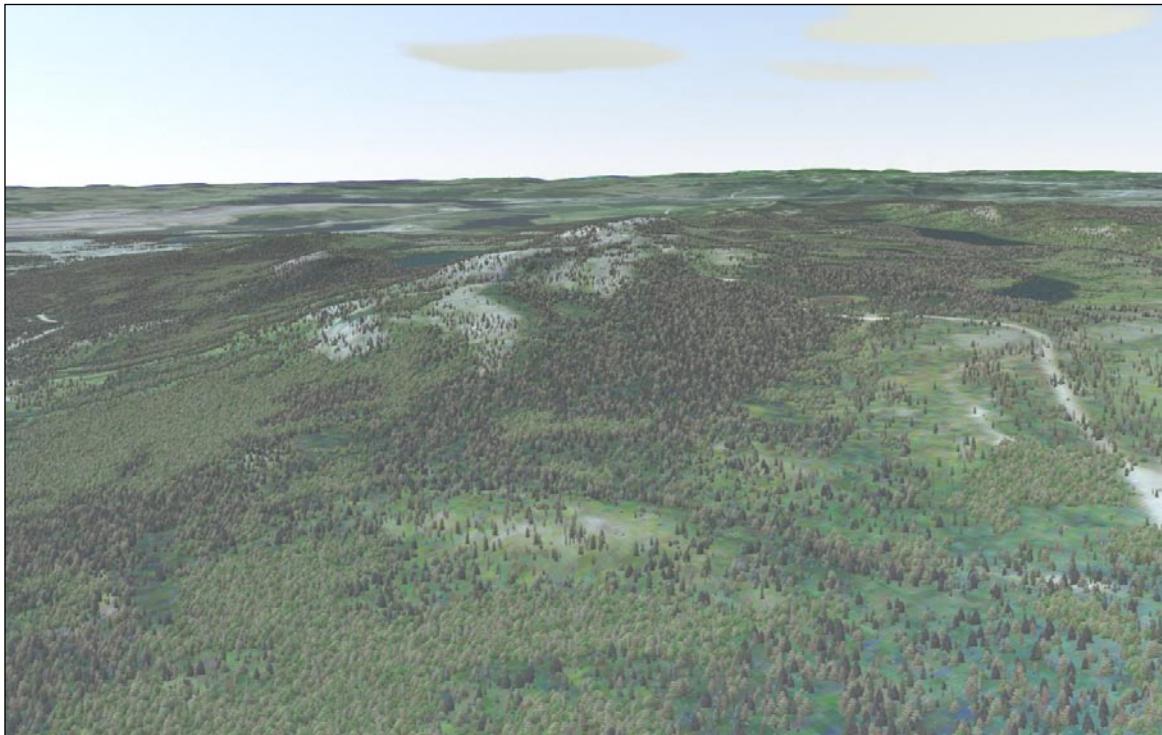


Figure 3-6: Model Camera 1 – Looking SSW at Pit / Ski Hill.

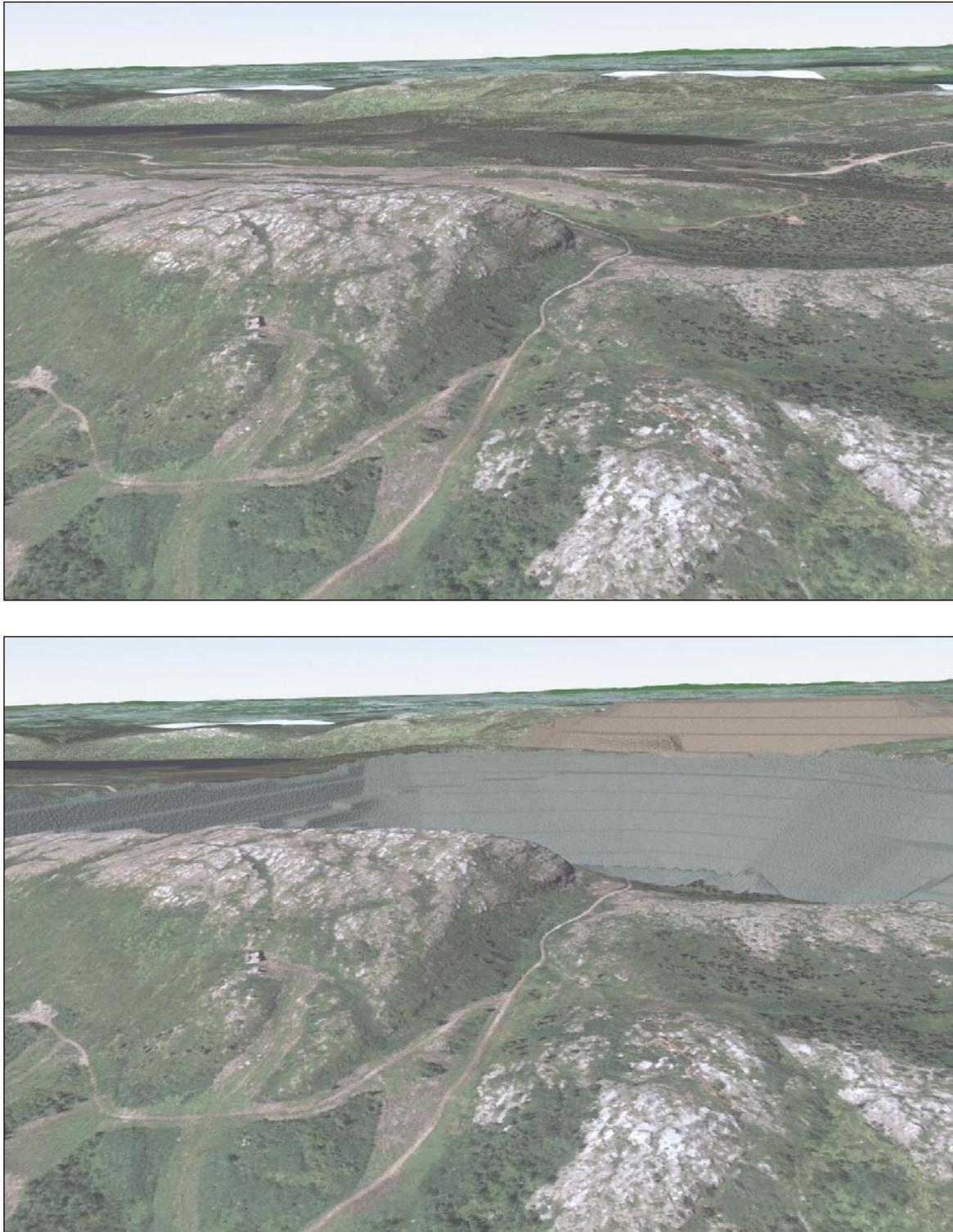


Figure 3-7: Model Camera 2 – Looking WNW Across Top of Existing Ski Hill.

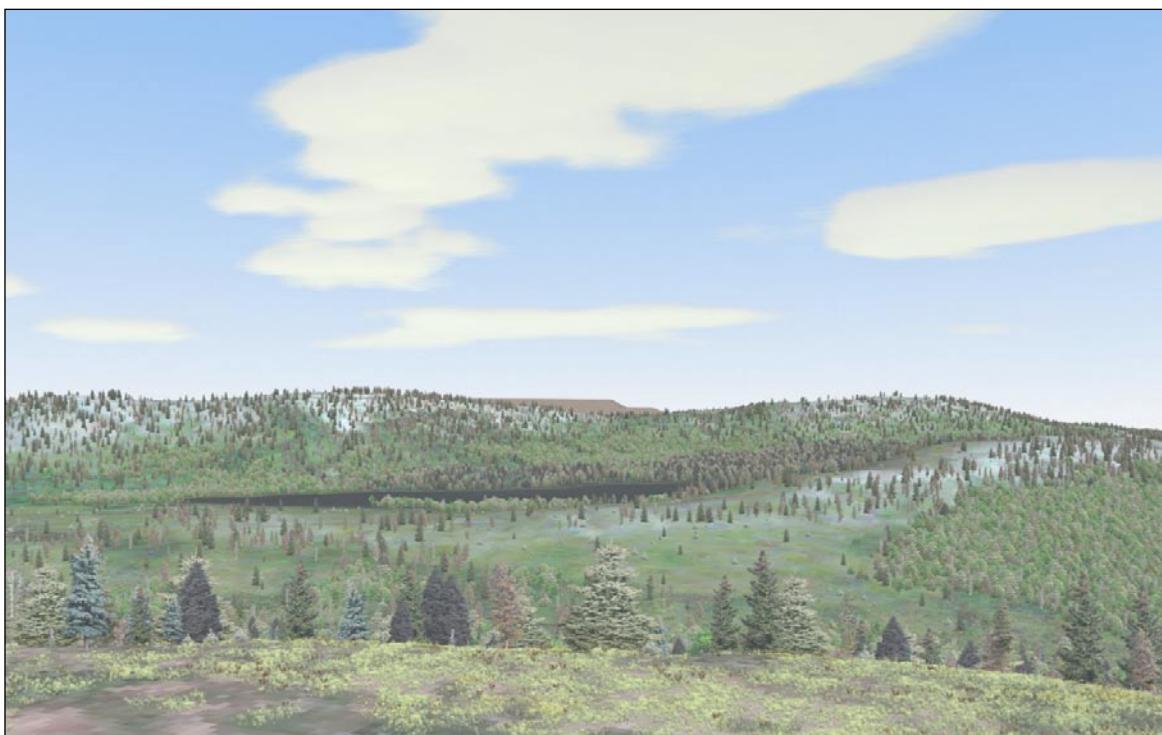
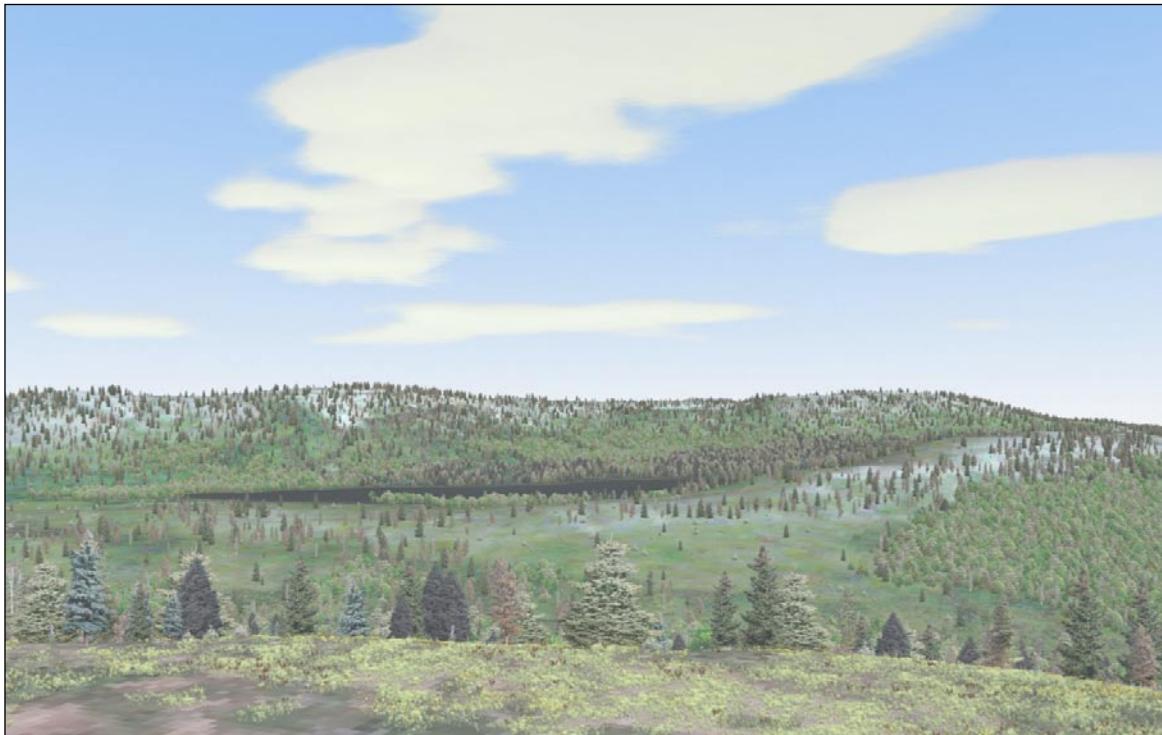


Figure 3-8: Model Camera 3 – Looking NW from Wabush 4 (Potential Site of New Ski Hill).

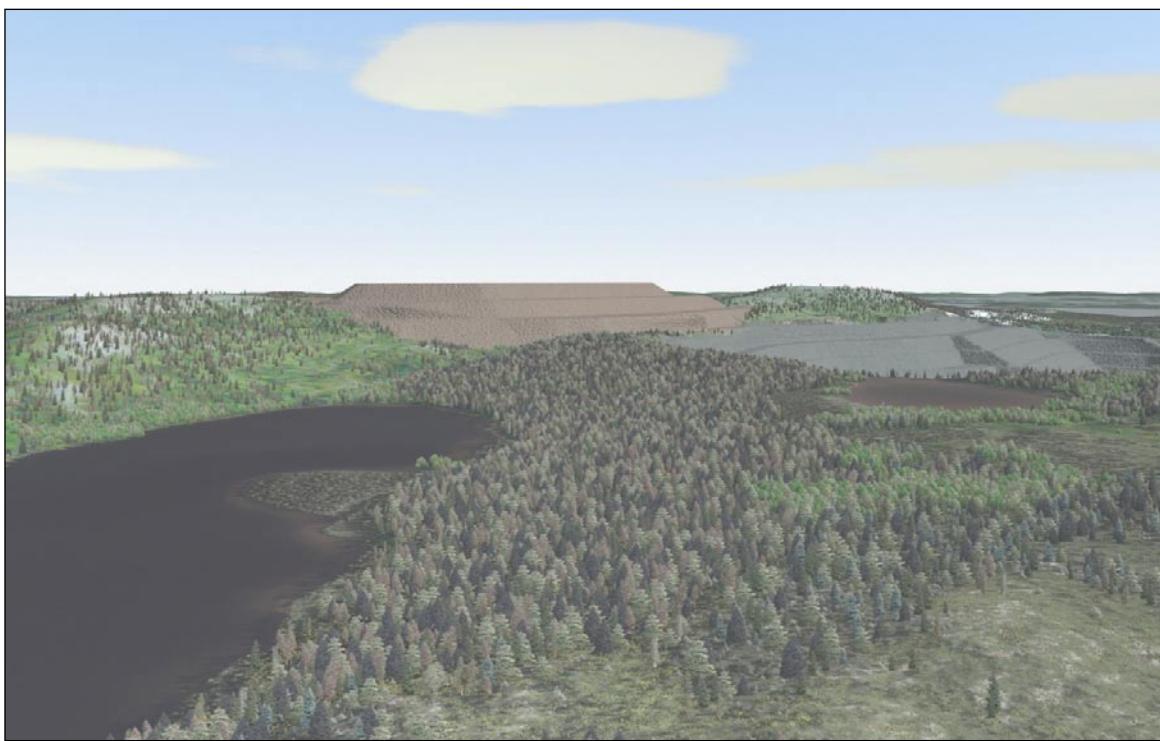
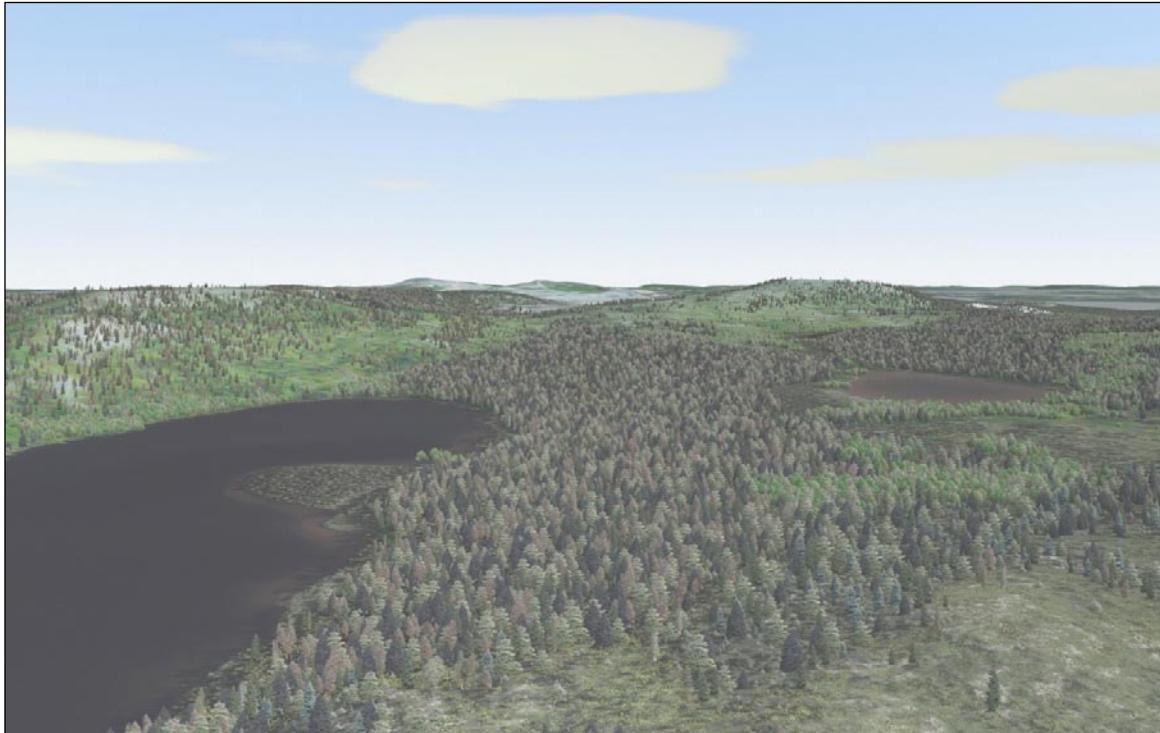


Figure 3-9: Model Camera 4 – Looking NNE Through Valley.

5.0 REFERENCES

Golder Associates (2012), *New Liberty Gold Mine (NLGM) Project ESIA – Visual Impact Specialist Study Assessment Report*, Report 12898, submitted to Aureus Mining Inc., Monrovia, Liberia.

Nalcor Energy (2012), *Labrador-Island Transmission Link: Environmental Impact Statement*, Government of Newfoundland and Labrador, St. John's, NL.

Newtown Landscape Architects (2012), *Proposed Mafube Open Cast Nooitgedacht & Wildfontein Expansion Project, Mpumalanga Province: Specialist Study Report: Visual Impact Assessment*, NLA Project No. 1454, submitted to Golder Associates Africa (Pty) Ltd., New Zealand.

Shetland Islands Council (2006), *Basic Principles of Landscape and Visual Impact Assessment for Sponsors of Development*, Shetland Islands, United Kingdom.

SLR Consulting Limited (2009), *Severn Road Resource Recovery Centre: Chapter 11: Landscape and Visual Impact Assessment*, SLR Reference: 402.0036.00374, submitted to Viridor Waste Management, Bristol, England.

APPENDIX A

IOC PHOTO INVENTORY

Figure A1: Key Assessment Viewpoints (Photo Locations)

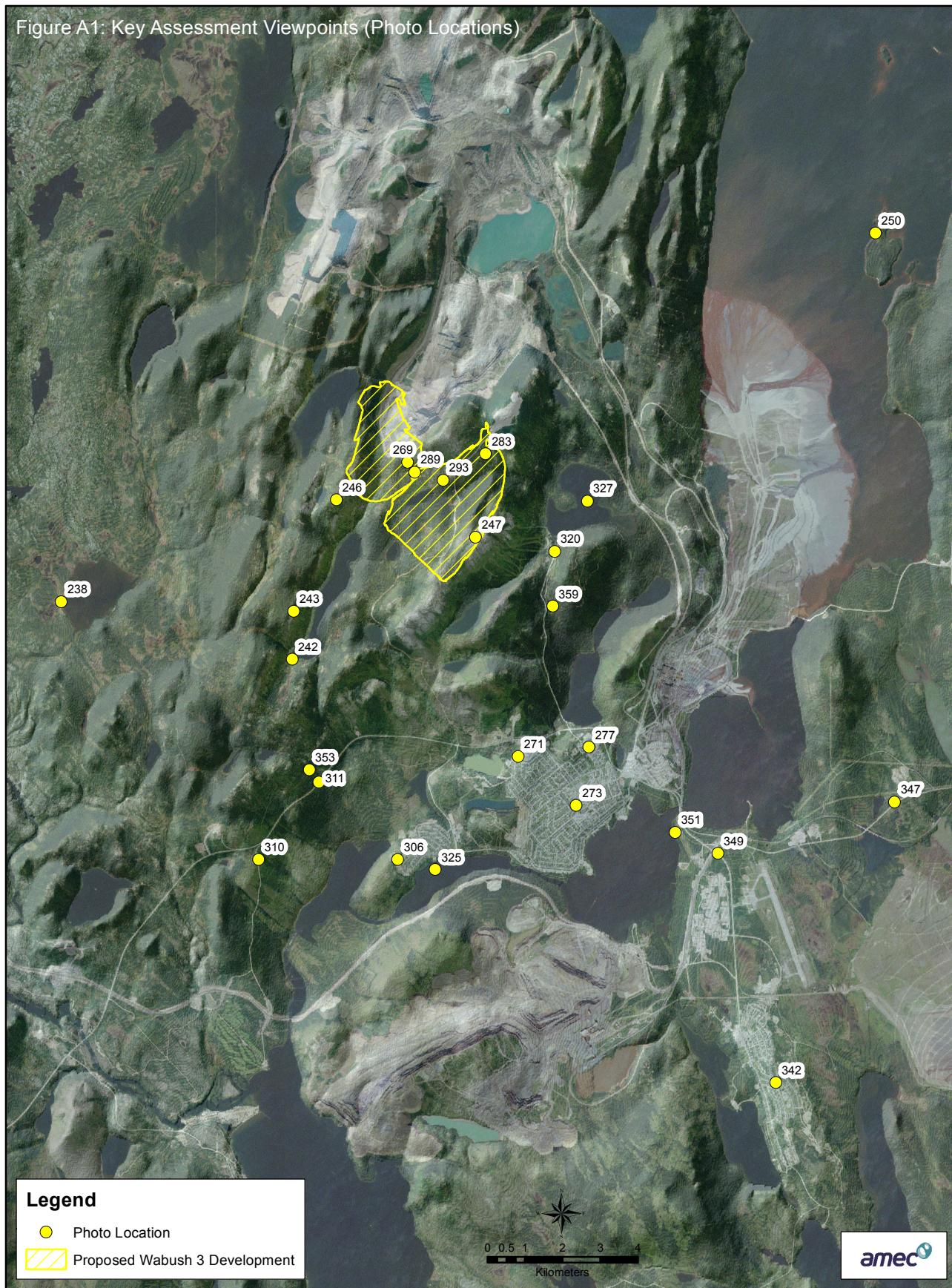


Photo 238
Title: Snowmobile trail at Dispute Lake



Photo 242

Title: South end of Leg Lake

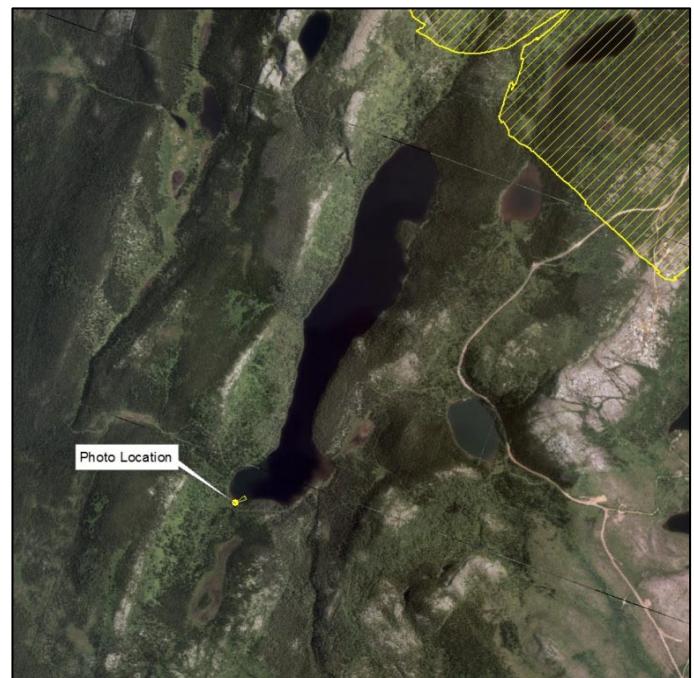
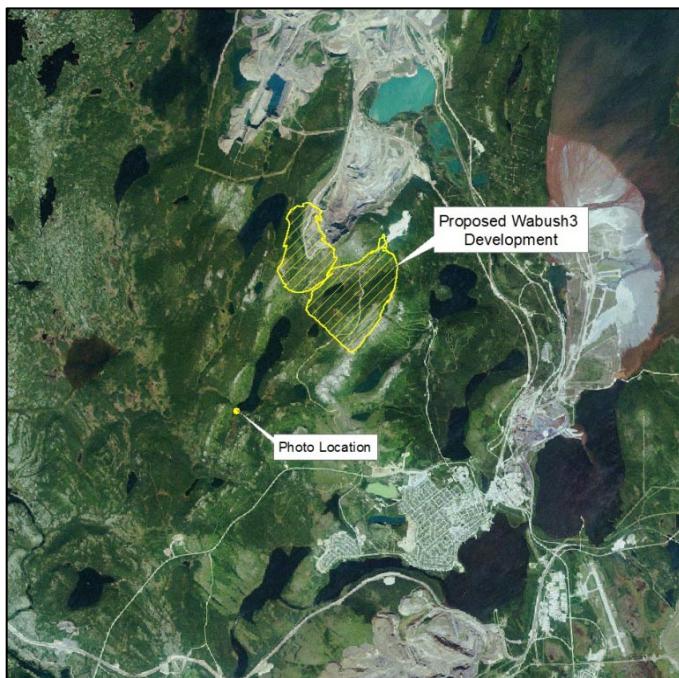
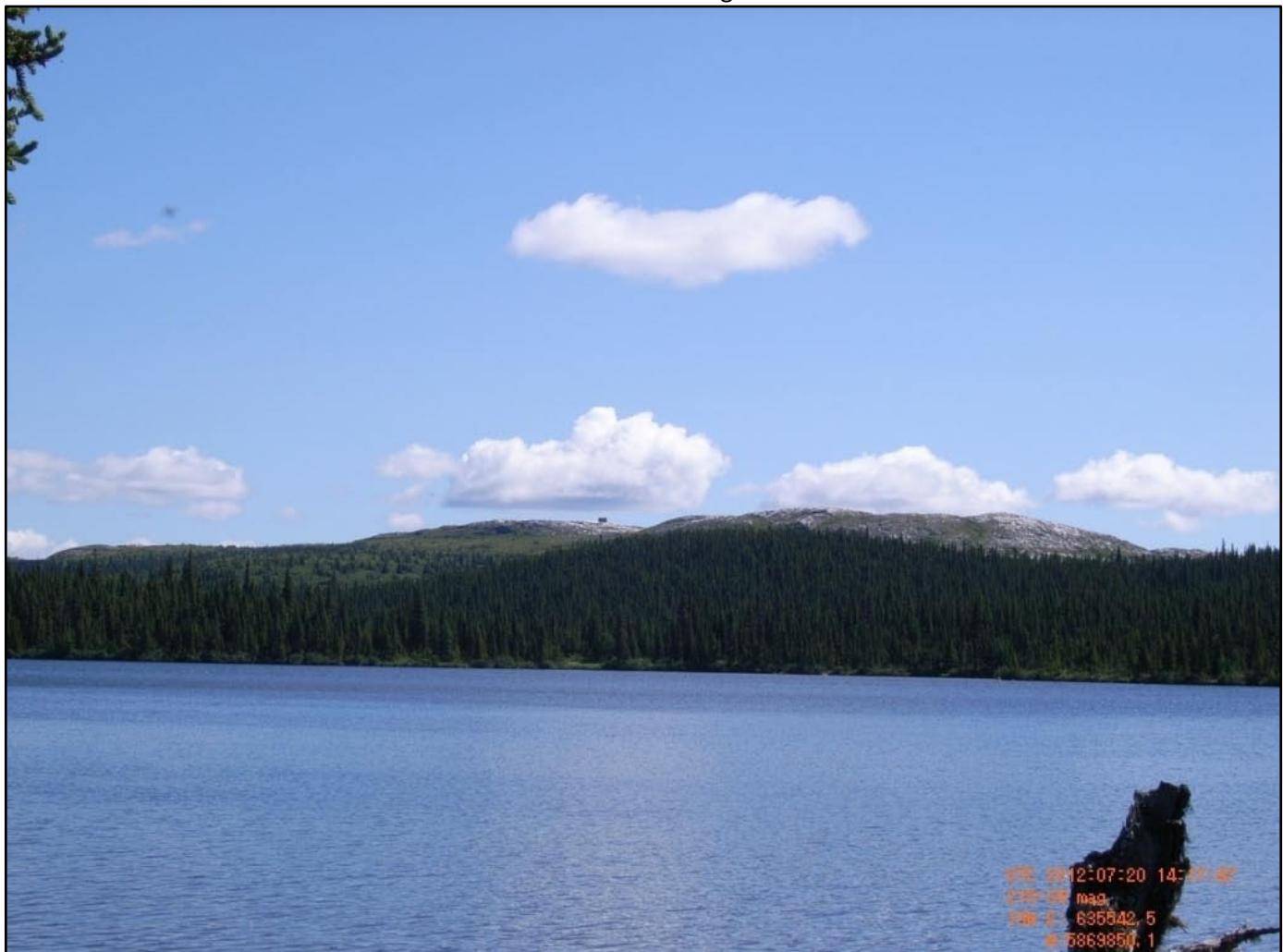


Photo 243
Title: Looking east over Leg Lake

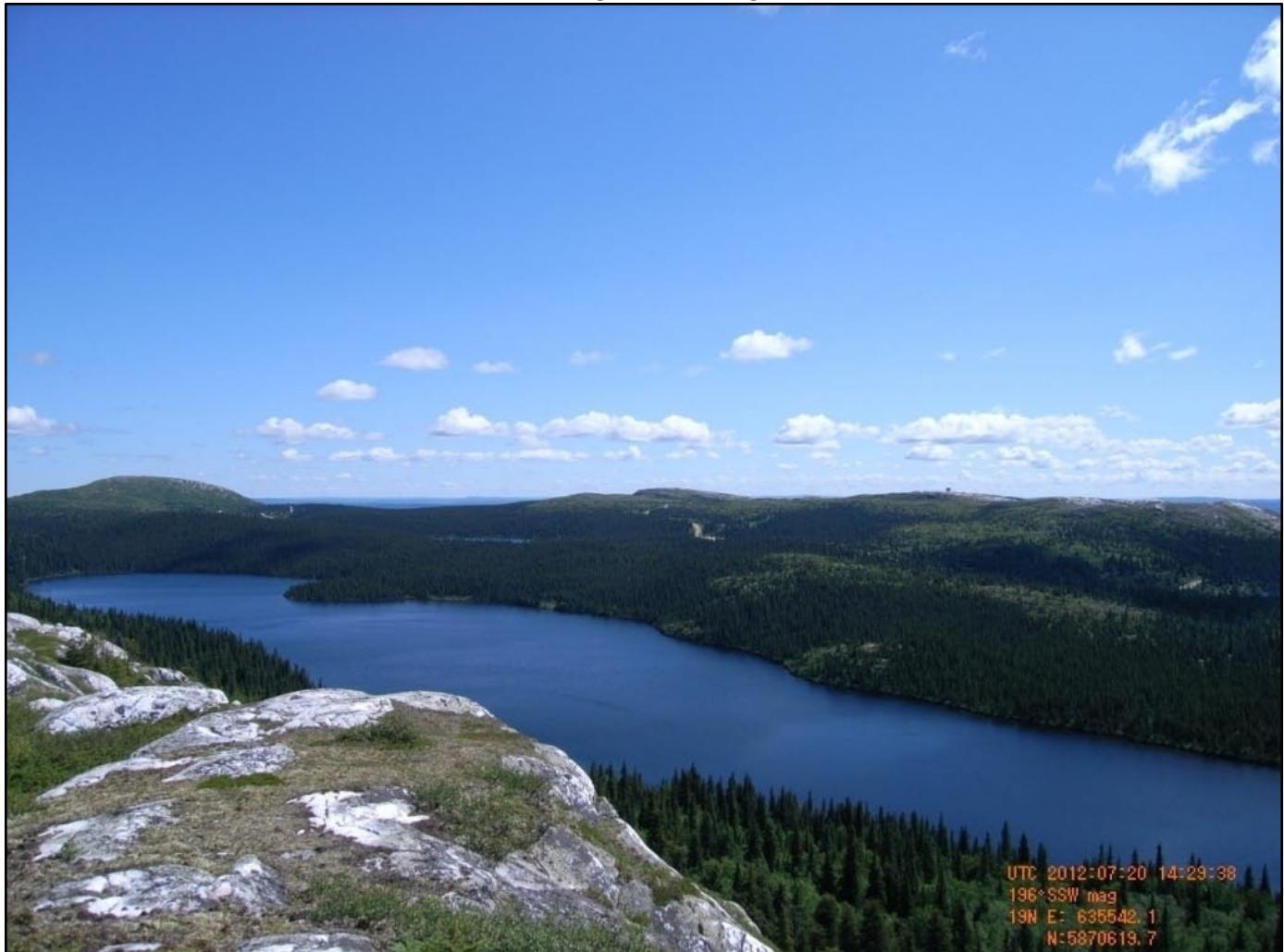


Photo 246
Title: Looking east from north end of Leg Lake

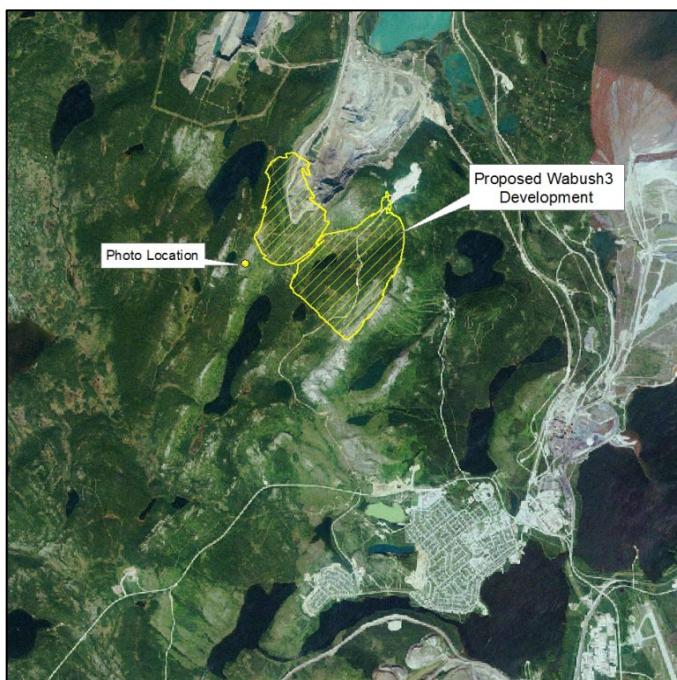


Photo 247
Title: Top of ski hill

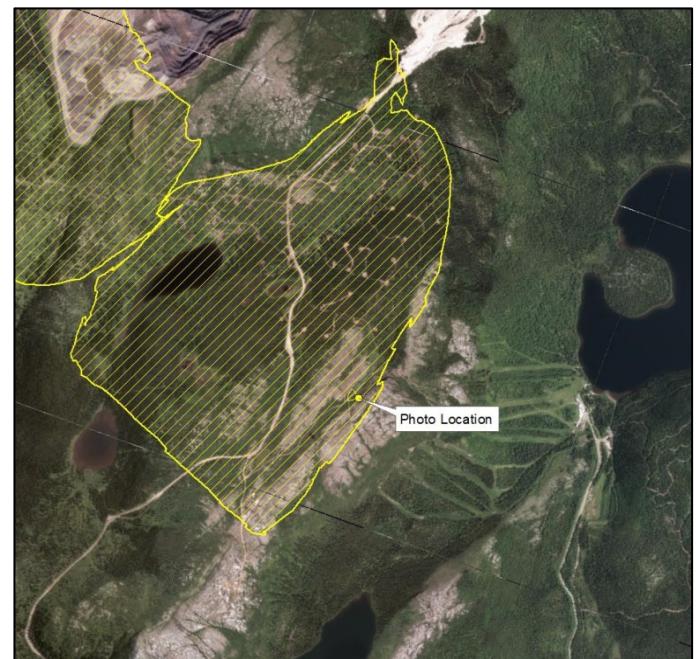


Photo 250
Title: East side of Wabush Lake (snowmobile trail)



Photo 269
Title: Overlooking Wabush 3 from north

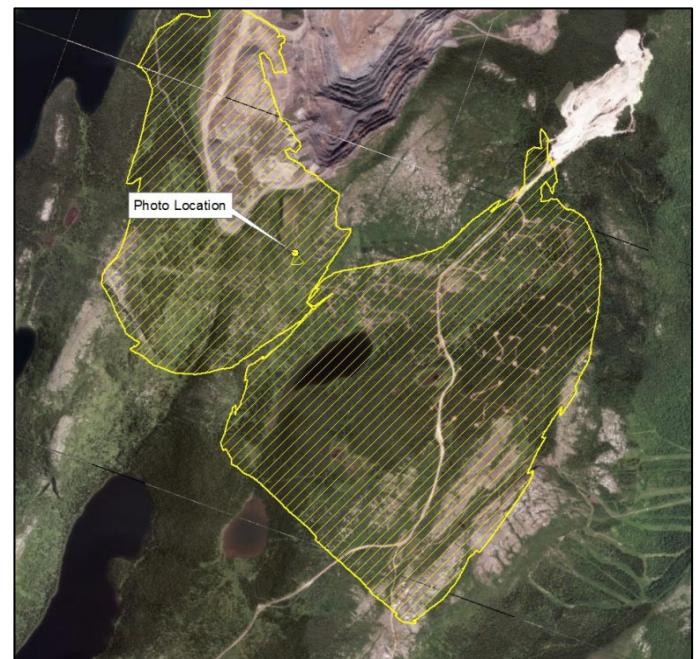


Photo 271
Title: Looking north from soccer field

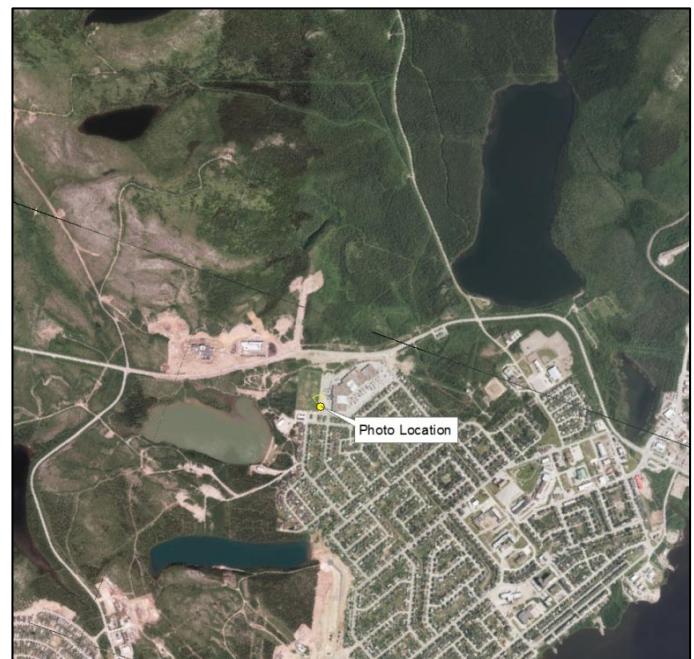
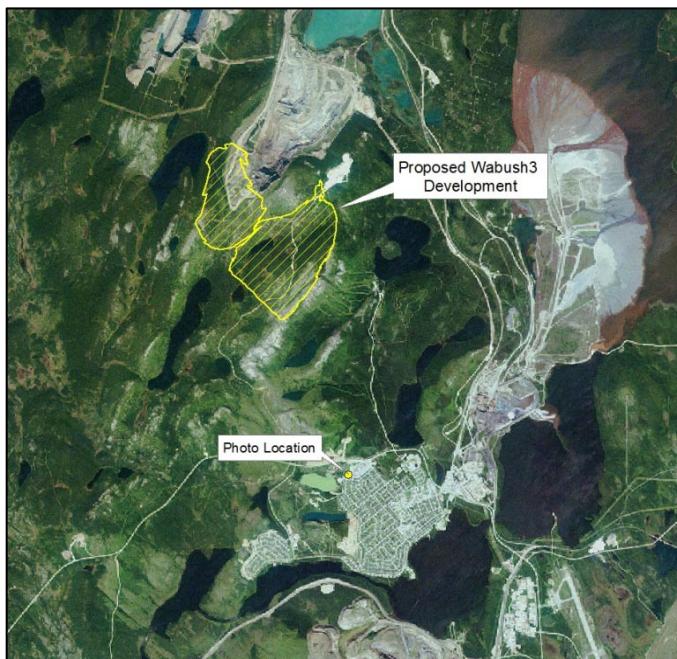


Photo 273
Title: Matthew Ave, Labrador City



Photo 277
Title: Recreation area - Booth Street, Labrador City



Photo 283
Title: Cross-country ski area - north of ski hill

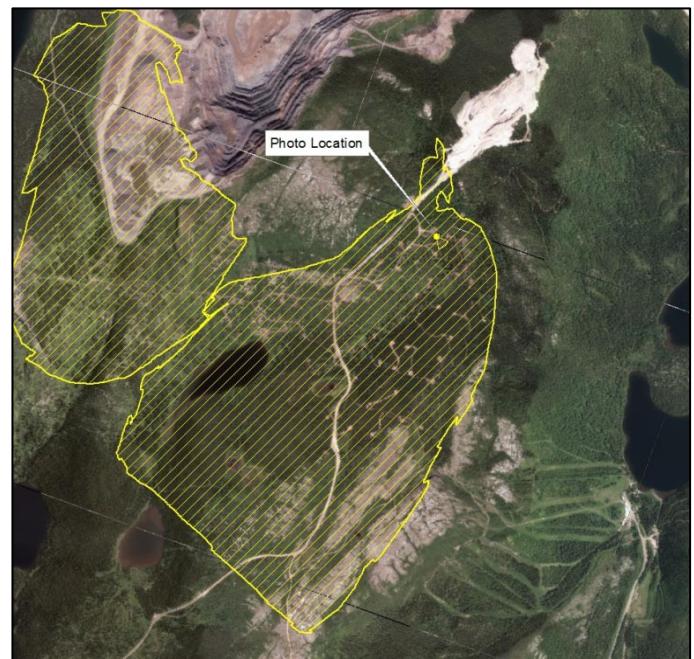


Photo 289
Title: Overlooking Wabush 3 from northwest

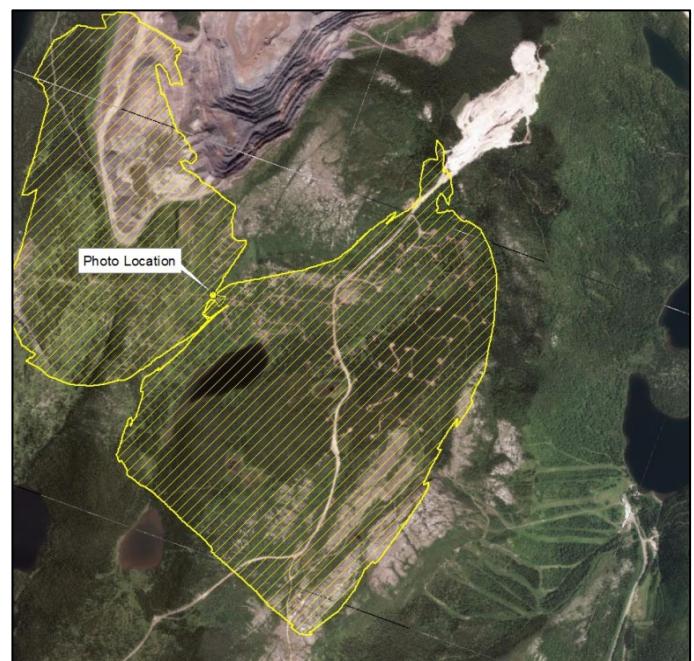


Photo 293
Title: Overlooking Wabush 3 from north

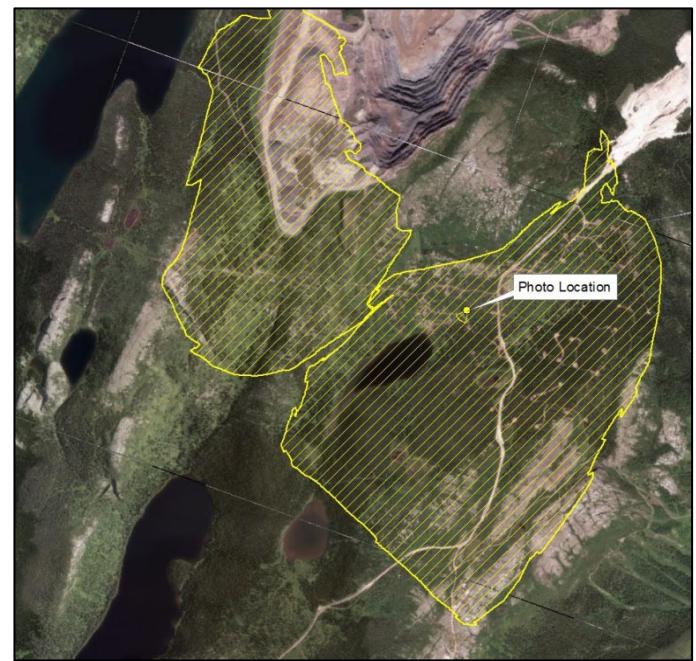


Photo 306
Title: Duley Crescent, Labrador City

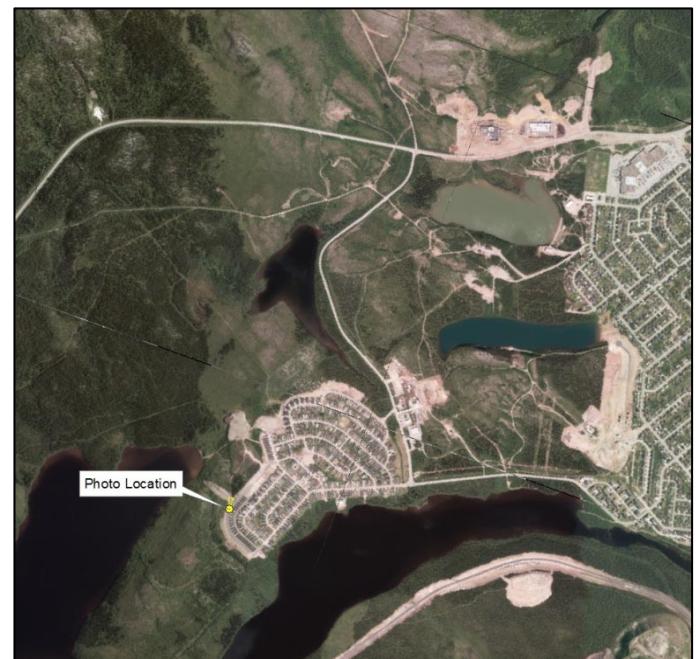
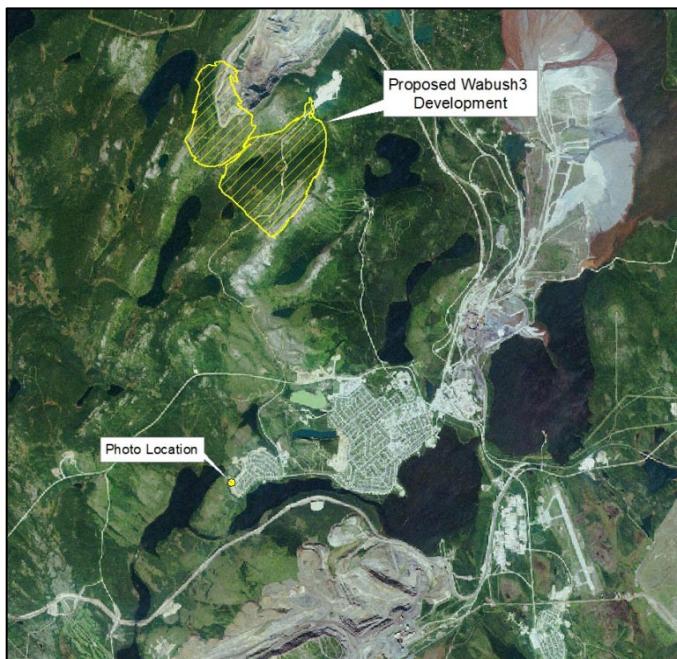


Photo 310
Title: Road to golf course

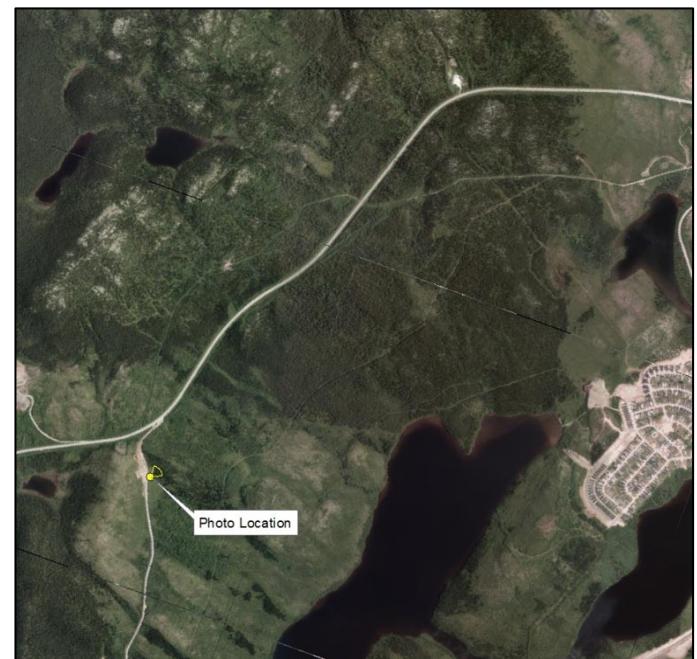


Photo 311
Title: TLH west of Labrador City

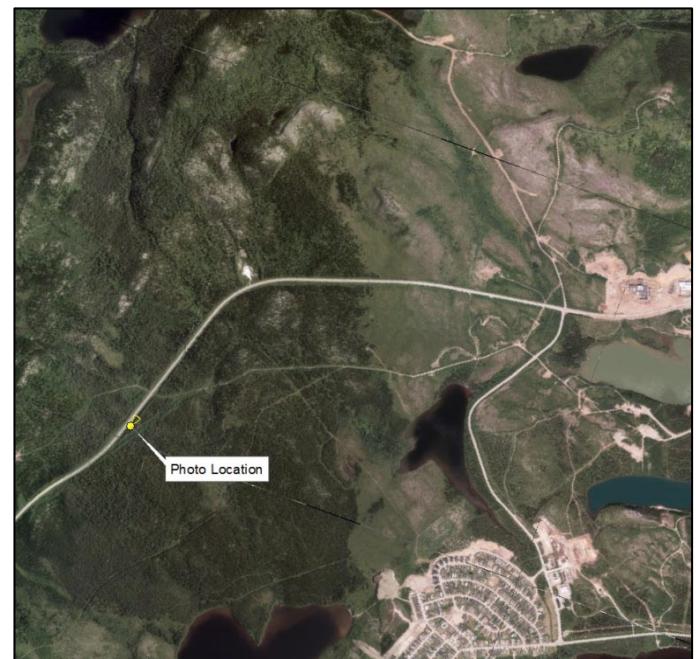
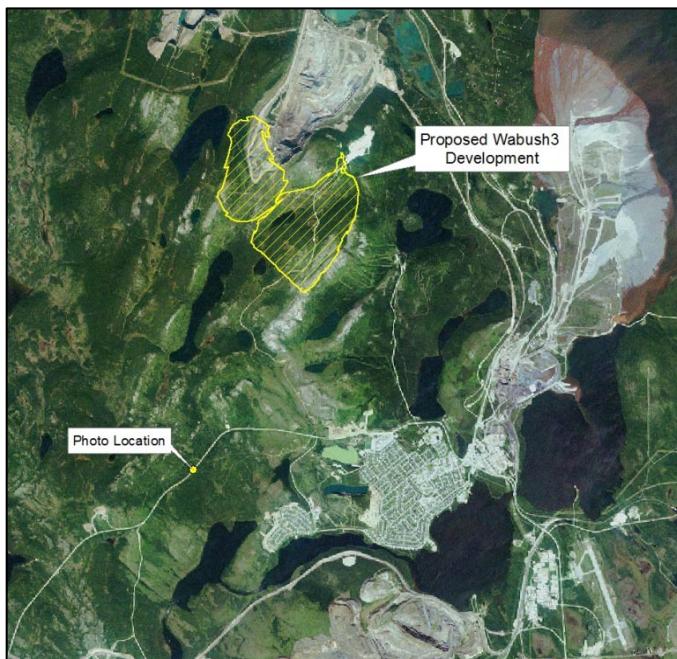


Photo 320
Title: Ski Lodge



Photo 325
Title: Harrie Lake

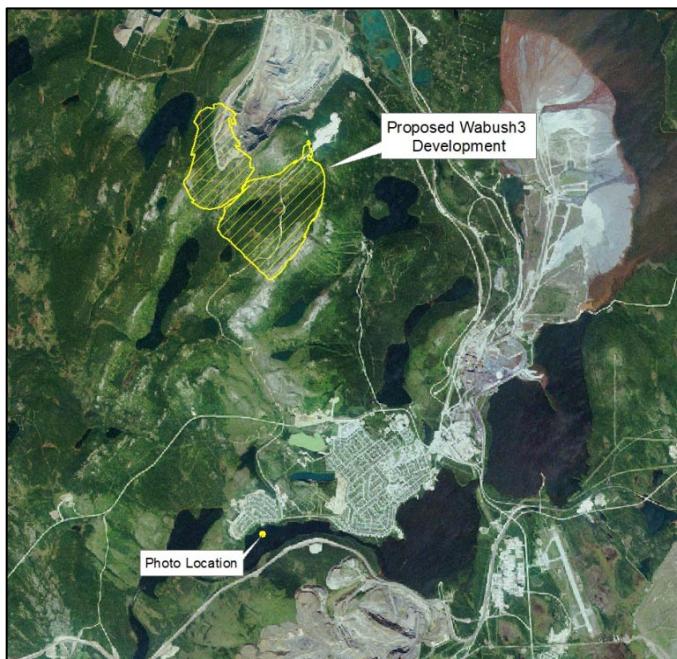


Photo 327
Title: Dumbell Lake



Photo 342
Title: Bowater Drive, Wabush

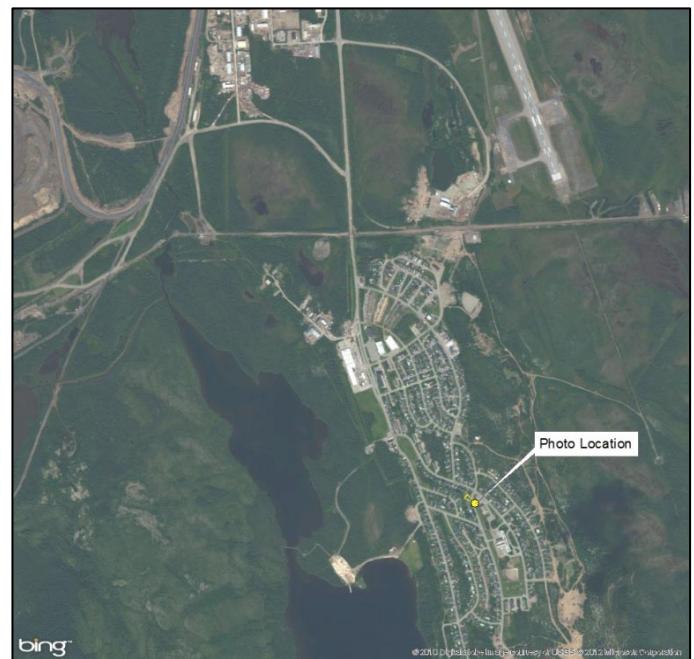


Photo 347
Title: TLH east of Labrador City

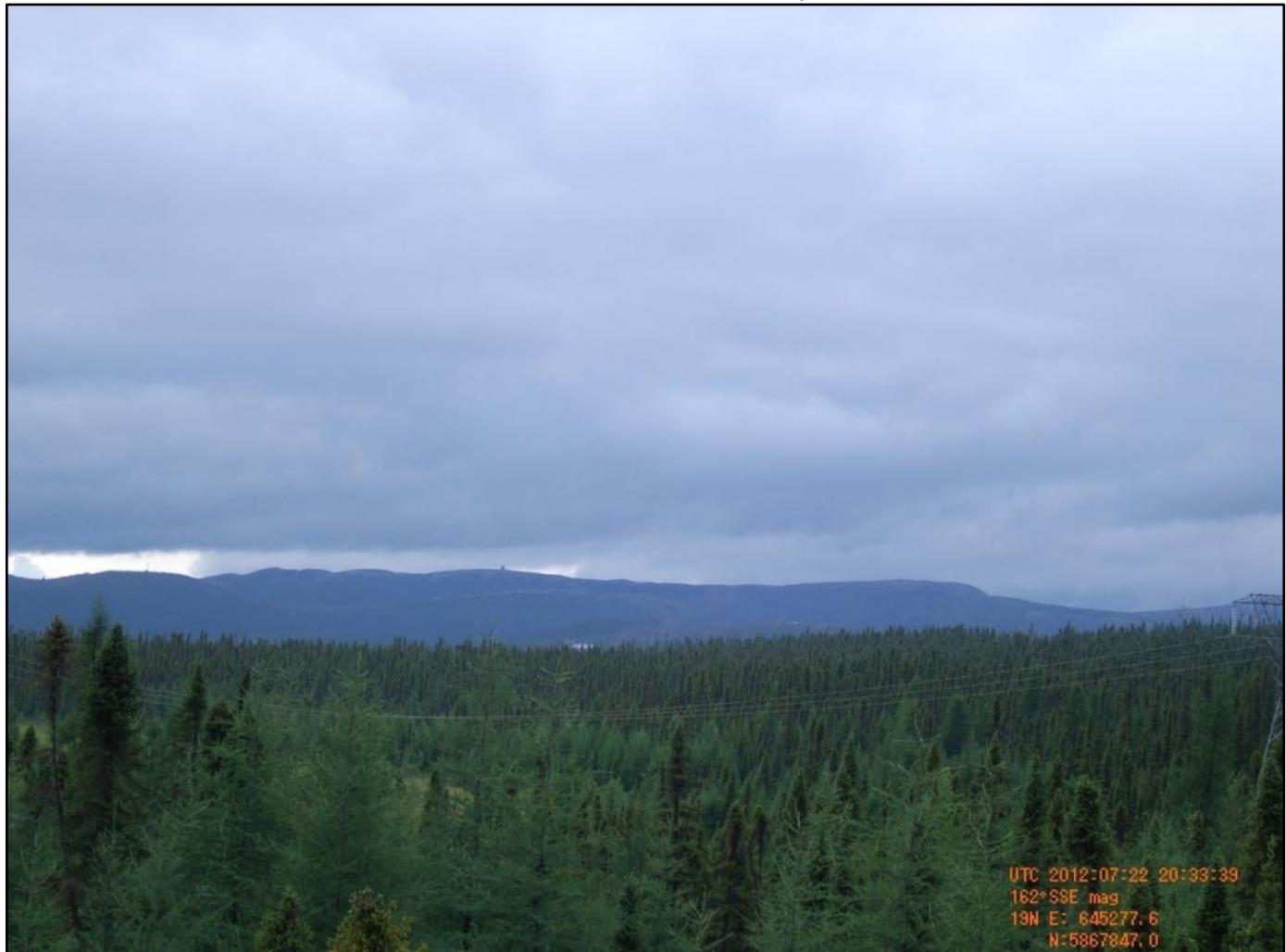


Photo 349
Title: TLH - east of Labrador City

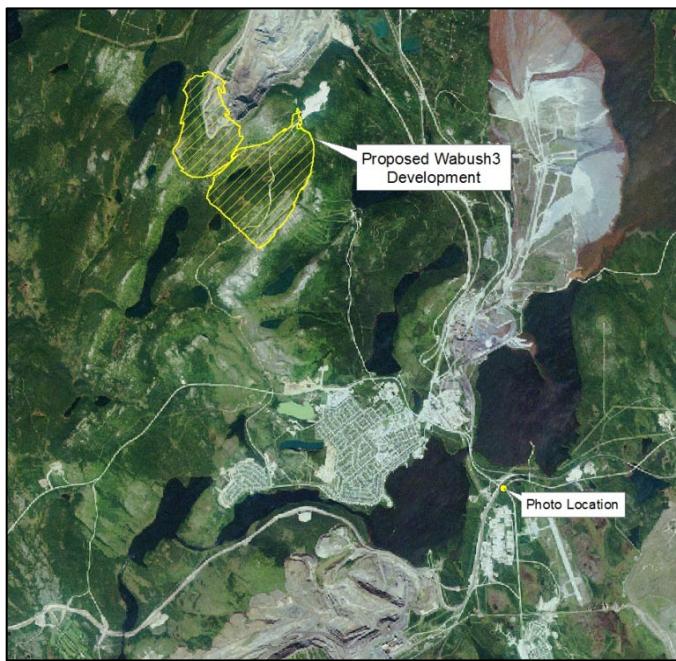


Photo 351
Title: Little Wabush Lake

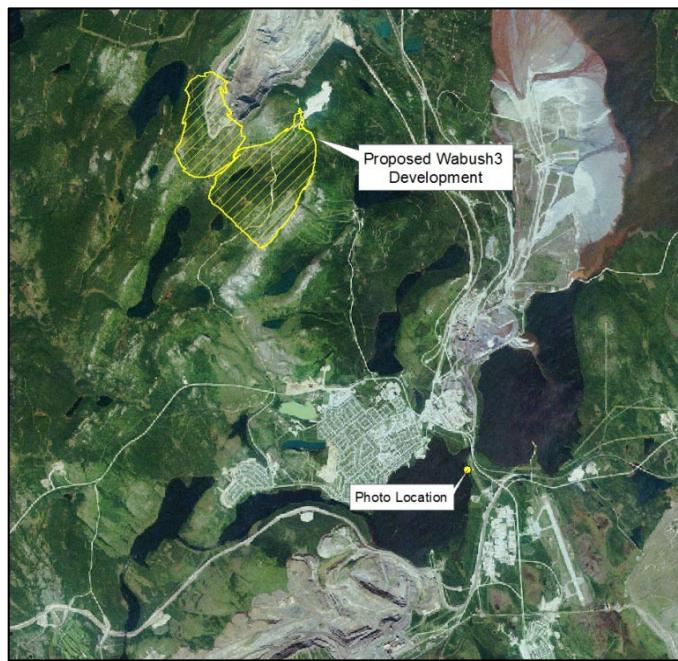
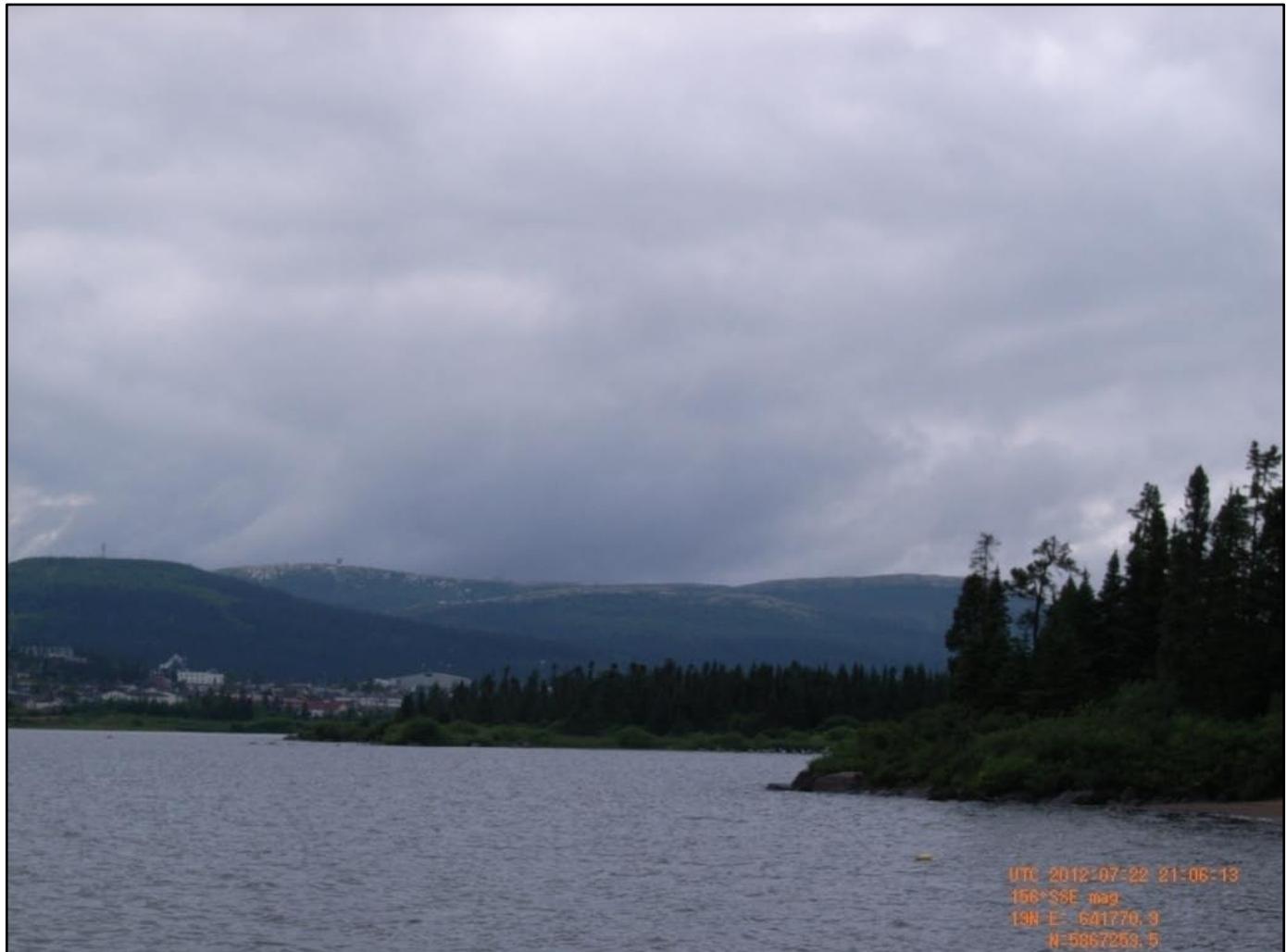


Photo 353
Title: Crystal Falls hiking trail

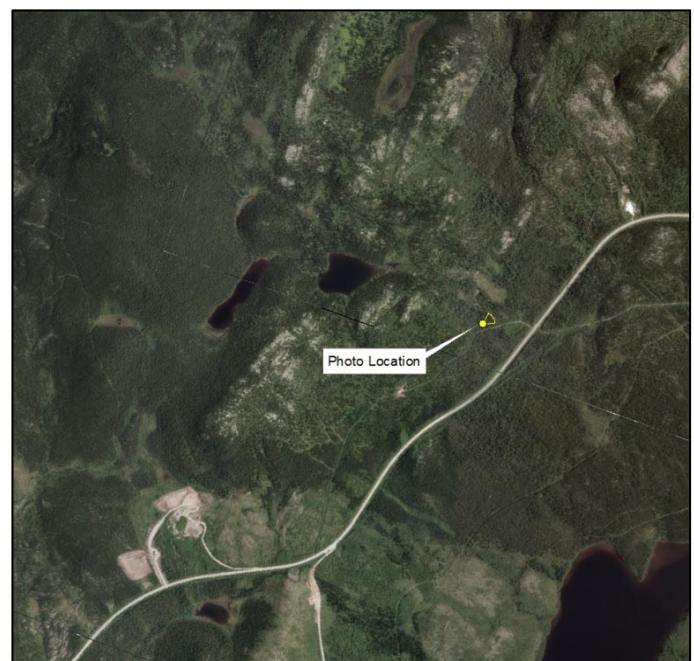
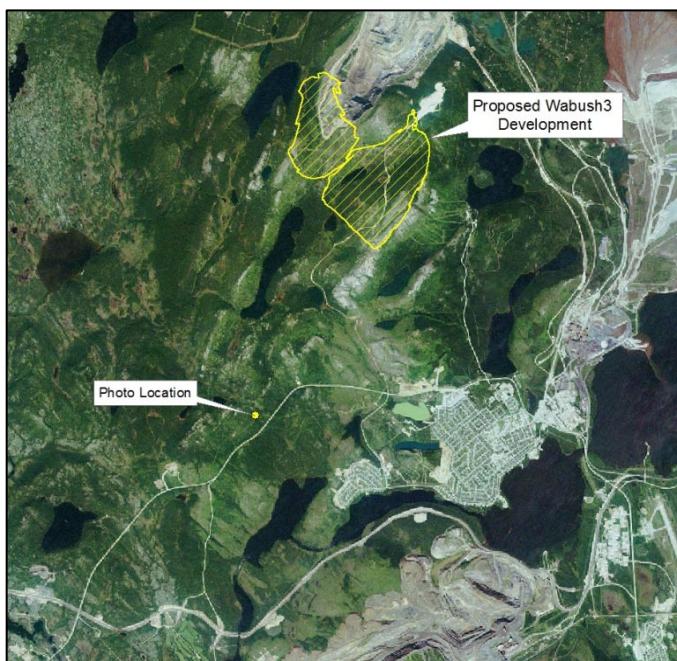
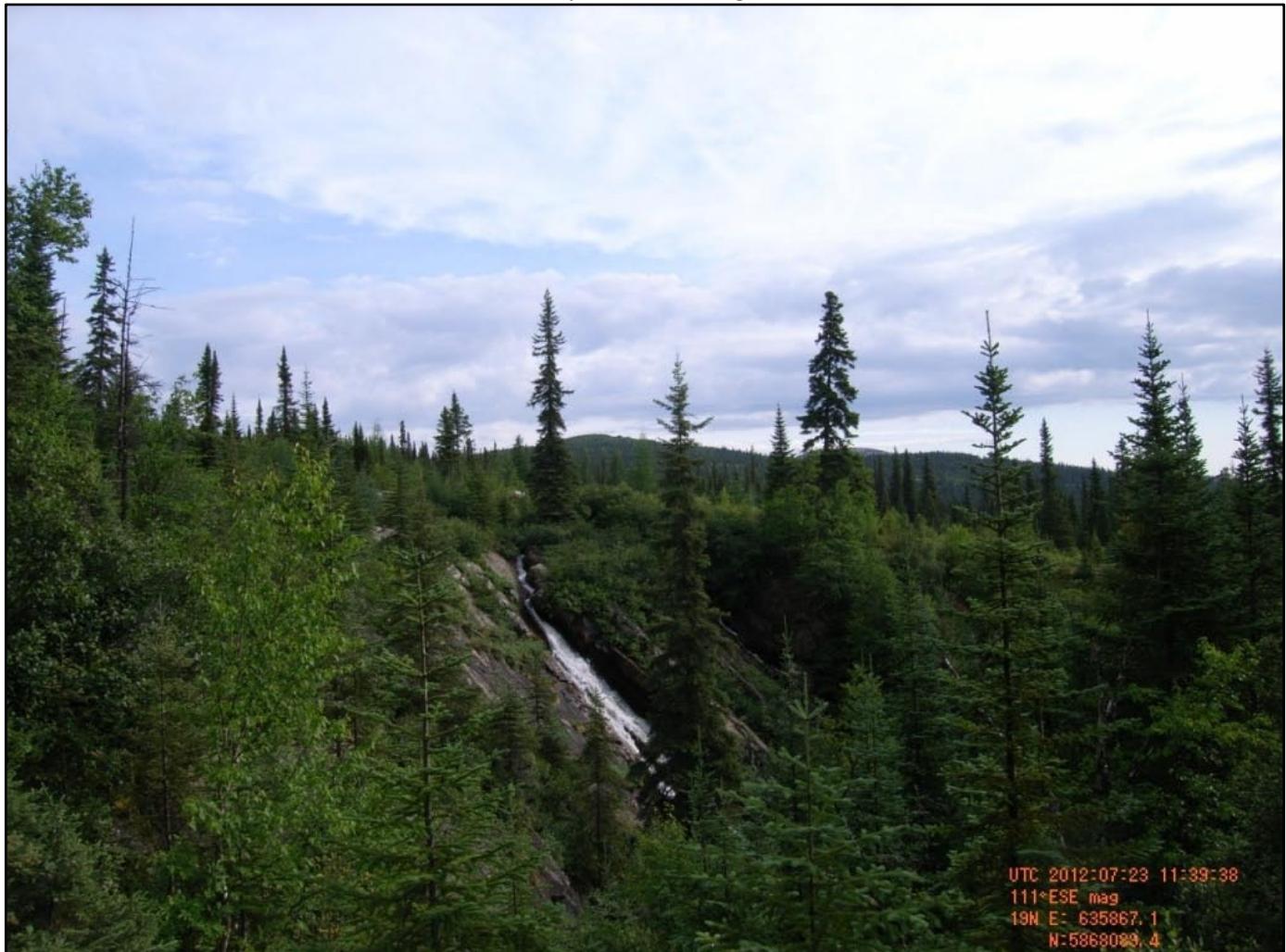


Photo 359
Title: Cross country ski trail off Smokey Mountain Rd

