APPENDIX K
VEGETATION TECHNICAL SUPPORT DOCUMENT

IAMGOLD

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November 3, 2014

REVISED REPORT

IAMGOLD CORPORATION

CÔTÉ GOLD PROJECT

ENVIRONMENTAL ASSESSMENT REPORT

TECHNICAL SUPPORT DOCUMENT: VEGETATION

Version 2

Submitted to:
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Uploaded via Buzzsaw

Report Number: 13-1197-0003R

Distribution:

1 - e-copy - IAMGOLD Corporation
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Executive Summary

INTRODUCTION

IAMGOLD Corporation (IAMGOLD) is proposing to construct, operate and eventually rehabilitate a new open pit gold mine and transmission line at the Côté Gold Project (the Project) located in Ontario, approximately 20 kilometres (km) southwest of Gogama, 130 km southwest of Timmins and 150 km northwest of Sudbury, in Chester and Neville Townships, District of Sudbury. The Project, as discussed in this Technical Support Document (TSD, consists of the Mine Site, which is defined by its physical footprint, and the portion of the Power Transmission Corridor that is within the regional study area for vegetation.

METHODS

Spatial Boundaries

The study areas selected for the Project define spatial boundaries within which the effects of the Project on vegetation are considered. For the purposes of the Project, study areas and spatial boundaries will be referred to collectively as study areas.

The Terms of References (ToR) and Environmental Impact Statement (EIS) Guidelines require that the study areas defined therein, and described below, encompass the physical works and activities of the Project where effects are expected or likely to occur, and where effects will be studied. The study areas were selected to incorporate the spatial extent of likely effects, as well as considering traditional and local knowledge, and ecological, technical, social, and cultural aspects.

Local Study Area

The local study area (LSA) is common to each selected EAI and extends beyond the footprint of the mine to include the area where immediate direct and indirect effects may occur on surrounding soil, vegetation and wildlife. As such, the LSA encompasses a 2 km buffer around the Project footprint and extends to the south-west to include Chester Lake. The LSA is approximately 120 km^2.

Regional Study Area

The regional study area (RSA) is anticipated to be an appropriate spatial boundary for quantifying baseline conditions and assessing Project-specific effects on surrounding soil, vegetation and wildlife. This area is intended to capture effects that extend beyond the immediate Project footprint. Effects from the Project and other developments in the RSA can also be assessed at this scale for vegetation EAIs. The RSA is expected to be large enough to contain most of the plant populations and communities that may be influenced by the Project and other developments, and provide confident and ecologically relevant effects predictions on vegetation. At this scale, changes to vegetation and associated wildlife habitat from human development can be also used to predict effects to the abundance and distribution of wildlife populations. The RSA is defined as a 30 km buffer from the boundary of the LSA (i.e., extends 32 km from the anticipated footprint of the Mine Site). The RSA is approximately 3,788 km^2.

Temporal Boundaries

Temporal boundaries for the assessment are related to Project phases. The approximate duration of the key Project phases are as follows:

- construction: 2 years;
- operation: 15 years;
- closure: 2 years; and
- post-closure: 50 to 80 years[1] .

Effects to vegetation begin during the construction phase with the removal and alteration of habitat (results in direct and indirect changes), and continue through the operation phase and for a period of time after closure and into the post-closure phase (unless determined to be permanent). Therefore, effects to vegetation are predicted for the construction phase, and are expected to be similar for the operation and closure phases of the Project. This approach generates the maximum potential spatial and temporal extent of effects on vegetation abundance and distribution, which provides confident and ecologically relevant effects predictions.

Effects Assessment Indicators

The vegetation assessment focuses on the components that have the greatest relevance in terms of value and sensitivity, and that are likely to be affected by the Project. To achieve this objective, specific effects assessment indicators (EAIs) are identified for consideration during the environmental effects assessment. Identified EAIs are used to predict the effects of the Project on the terrestrial ecosystem. The following sections provide summaries of the proposed vegetation EAIs for the EA (Table E1), including the rationale for selection of EAIs (Table E2). Changes in measures (Table E1) are used to predict effects to the abundance and distribution of vegetation EAIs.

Table E1: Vegetation Effects Assessment Indicators and Measures

Effects Assessment Indicator	Measures
■ upland plant community types (ecological land-cover [ELC] types)	**<u>Naturally-occurring Plant Communities and Principal Land Cover</u>** ■ change in ecosystem (ELC types) quantity and quality ■ change in abundance and distribution of plant species

[1] Following the removal of infrastructure and waste, as well as the revegetation of disturbed area, the open pit will continue to flood. It is anticipated that this stage could last approximately 50 to 80 years (AMEC 2013).

Effects Assessment Indicator	Measures
	■ change in plant community health and diversity ■ change in the presence of invasive species
■ wetlands	**<u>Naturally-occurring Plant Communities and Valued Secondary Land Cover</u>** ■ change in ecosystem (ELC types) quantity and quality ■ change in abundance and distribution of plant species ■ change in plant community health and diversity ■ change in presence of invasive species ■ change in hydrological regime
■ species at risk, species of special concern and provincially rare species	**<u>Types of Plants and Plant Status</u>** ■ change in abundance and distribution of plant species

Table E2: Rationale for Selection of Vegetation Effects Assessment Indicators

Effects Assessment Indicator	Rationale for Selection
■ upland plant community (ELC) types	■ main component of the naturally-occurring vegetation in the study areas—the basis of biological processes ■ habitat for wildlife ■ basis for many local biological resources
■ wetlands	■ secondary component of the naturally-occurring vegetation in the study areas—the basis of biological processes ■ habitat for wildlife ■ basis for many local biological resources and important contributor to hydrological processes
■ species at risk, species of special concern and provincially rare species	■ plants of limited occurrence in the province (may be threatened or endangered) whose existing populations require consideration for conservation ■ valued component of provincial biodiversity

Prediction of Effects

Project Interactions with Vegetation

The primary Project components and associated activities that could potentially affect vegetation include:

- site clearing and site preparation;
- open-pit mining activities including new open pit mine and associated dewatering;
- overburden and mine rock management;
- process plant effluent and tailings management;
- access road and transmission line;
- water supply and drainage works and facilities;
- aggregate mining and stockpiles (gravel pit[s] and/or quarry[ies]);
- fuel and material management;
- domestic sewage treatment and disposal;
- solid waste management, industrial waste handling/treatment including hazardous materials;
- on-site power supply and power infrastructure (including temporary diesel generation)
- on-site access roads and related infrastructure;
- watercourse realignments;
- water withdrawal; and
- effluent discharge.

Residual Effects

The following interactions were determined to have potential residual effects on vegetation EAIs after a preliminary screening was completed on all possible Project interactions with vegetation:

- Direct vegetation loss, alteration, and fragmentation from the physical footprint of the Mine Site and Access Road.
- Vegetation alteration and fragmentation from the Transmission Line Alignment.
- Changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from dewatering of Coté Lake and portions of Three Duck Lakes, Chester Lake, Clam Lake, and the realignment of Bagsverd Creek, Three Ducks Lakes outflow, Chester Lake outflow, Clam Lake outflow and the Mollie River system may affect the quantity of vegetation.

- Local changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from filling the open pit may affect the quantity of vegetation.

Vegetation Loss and Fragmentation

Decreases in habitat area can directly influence plant populations and communities by reducing the carrying capacity of the environment. Habitat loss includes the direct removal or alteration of habitat due to the Project and other developments. In addition to direct loss of habitat, the Project and other nearby developments results in fragmentation of the landscape. Fragmentation can influence several ecological processes including dispersal between fragments and increased disturbance along habitat edges.

Habitat effects (e.g., changes to habitat amount and fragmentation) to vegetation EAIs from the Project footprint and previous and existing developments in the RSA were analyzed through changes in the area and spatial configuration of habitats on the landscape (i.e., landscape metrics). Landscape metrics were determined for the reference, existing conditions (2012 baseline) and application case (Table E3).

Reference conditions represent the initial period of baseline conditions (conditions with little or no disturbance, and as far back as data are available). Reference conditions were assumed to exist prior to 1940. The existing conditions case includes all previous and existing developments up to 2012 (Table E3). The year 2012 was used for the baseline case because information used in compiling the development database and information on forest harvesting activities was only available until 2012.

Table E3: Developments Applied for Each Assessment Case

Reference Scenario	2012 Existing Conditions Scenario	Application Scenario (IAMGOLD Project plus 2012 Existing Conditions)
■ little to no human development	■ development database	■ development database ■ IAMGOLD mine footprint and transmission line footprint that is located within the RSA

Changes in Downstream Flows

A change in the hydrology has the potential to cause direct mortality to plants, reduce reproductive success, and decrease interspecific competitive advantage for available resources (Poff and Ward 1989), which in turn may transform the type of plant communities being supported by that habitat. An assessment of likely effects from changes in habitat state and condition was based on the calculation of the amount of habitat potentially altered or lost for EAIs in the RSA. Mean baseline and application water levels were calculated for water bodies affected by the Project. These data were considered in combination with predicted changes to the lake areas and watercourse lengths to assess the effect of changes to downstream flows on vegetation EAIs.

Residual Effects Summary

Upland Plant Community Types

Previous and existing developments have removed 9% of upland plant community types, relative to reference conditions in the RSA. The Project is anticipated to remove 13% of the habitat that supports upland plant communities (3% of which is composed of logging depletion cuts and jack pine regeneration/cuts) in the LSA and 0.4% of the upland plant community habitat in the RSA, relative to 2012 baseline conditions.

Dewatering of water bodies and realignment of watercourses in the LSA may affect the upland plant community quantity by changing the quality of the supporting habitat. Changes are anticipated to be measurable at the local scale but are expected to have a negligible effect on the upland plant community abundance and distribution in the RSA. Plant community changes resulting from changes to hydrology will likely remain in effect until flows are allowed to return to natural conditions, following post-closure stage II.

Forestry is expected to have a larger influence on the upland plant community populations in the RSA as human developments not related to forestry (e.g., mineral exploration, recreational lodges, and roads) have disturbed about 2.1% of the RSA since reference conditions. In contrast, recent harvested areas (less than 18 years old) currently cover 7.4% of the RSA. Forest harvesting operations have occurred in the RSA since 1800, with most harvesting activities occurring in the last 25 to 30 years. Most harvesting has occurred in dense coniferous forest (46.1% of harvested area; 7,590 hectare [ha]) and dense mixed forest (46.5% of harvested area; 7,653 ha) habitats. Habitat quantity and quality are probably not limiting for the upland plant communities in the RSA. These communities are common throughout the RSA and the greater surrounding ecoregion.

Following closure, the residual footprint from the Project (i.e., non-reclaimed areas) is predicted to cause a decrease in upland plant community habitat (3% of the LSA, 0.1% of the RSA) that is expected to be partially reversible with a duration of greater than 15 years at the end of closure. Changes in habitat quantity and quality from the Project are anticipated to be measurable at the local scale. However, the changes represent less than 1% of the total available habitat within the RSA and are anticipated to have no measurable effect on the abundance and distribution of upland plant populations and communities in the RSA.

Changes to the quantity and quality of habitats (ELC types) from the Project and other developments in the RSA are likely to have a measurable effect on upland plant populations and communities, but are predicted to not influence the ability of EAIs to be self-sustaining. Forestry likely explains most of the effect to populations, while the Project and other types of human development are expected to have no measurable residual effect on upland plant community abundance and distribution.

Wetlands

Wetlands consist of open bog, treed bog, treed fen, and wetland cover types. Previous and existing developments have removed 10% of wetlands, relative to reference conditions. The Project is anticipated to remove 2% of the habitat that currently supports wetlands in the LSA and 1.5% of the wetland habitat in the RSA.

Dewatering of water bodies and realignment of watercourses in the LSA may affect the quantity of wetlands by changing the quality of the habitat available. While 9,812 m of watercourse is expected to be lost due to the

Project, habitat compensation in the new realignments is expected to introduce 7,912 m of watercourse, resulting in a recovery of approximately 80% of the total watercourse length lost.

Habitat loss calculations suggest that the Project will affect 10% of the wetlands available in the RSA. It is assumed that this wetland loss value is overestimated. In an effort to improve the delineation of wetland polygons within the LSA, a combination of ground-truthed data and interpretation of remote imagery was incorporated into the development layer. The wetland cover for the remainder of the RSA was estimated from available digital mapping only. To test this assumption the ground-truthed polygons were removed and replaced with the original land cover data. This process was completed to remove inconsistencies in the land cover data and provide a more accurate comparison of available habitat proportions in the RSA. Using digitally derived ground cover only, the Project is predicted to affect 0.3% of the wetlands available in the RSA. Since the proportion of wetlands affected by the Project is predicted to be low and the site hydrology will be maintained, no measurable residual effects to wetlands are expected, provided that habitat compensation for the water realignments includes features and functions of the present watercourses. These changes will last until natural flows are returned following post-closure stage II.

Lake areas are expected to have a net increase of 3 ha with changes to the baseline hydrology and applied compensation. Most notably, the shorelines around Chester Lake and the south arm of Bagsverd Lake are expected to increase, inundating the adjacent communities. Consequently, a small area of wetland is expected to become lake habitat (45 ha; 0.3% of baseline wetland habitat). This loss is a conservative estimate, since upland plant communities surrounding the flooded areas will become more suitable for supporting wetlands over time. Consequently, changes are anticipated to be measurable at the local scale but are expected to have no measurable effect on wetland abundance and distribution in the RSA relative to natural fluctuations that occur from wet and dry cycles. These changes are expected to be partially reversible with a duration of greater than 15 years after closure, when natural flows are returned following post-closure stage II.

The open pit is expected to be refilled within 50 to 80 years of the start of the post-closure phase (Section 5: Conceptual Closure and Reclamation Plan). However, the effects to plant populations and communities associated with the open pit are expected to be partially reversible with a duration of greater than 15 years after Project closure. Vegetation has to re-establish on the margins of the open pit, which will likely happen after water levels are constant.

Effects from the Project and previous and existing developments on the abundance and distribution of wetlands are not expected to be measurable and are not predicted to influence the ability of EAIs to be self-sustaining. Wetlands are common throughout the RSA and there should be sufficient undisturbed habitat in the RSA for the continued persistence of this EAI.

Species at Risk, Species of Special Concern and Provincially Rare Species

No plants with special conservation status or rarity in the province have been reported in the RSA (Natural Heritage Information Centre 2013; *Species at Risk Act* 2013; Species at Risk in Ontario 2013) and none were observed during the 2012 and 2013 field programs. As a result, the Project is predicted to have no measurable effects on this EAI.

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GLOSSARY AND ABBREVIATIONS

°C	degrees Celsius
AMEC	AMEC Environment & Infrastructure
cm	centimetres
CNFDB	Canadian National Fire Database
CO_2	carbon dioxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EA	Environmental Assessment
EIS	Environmental Impact Statement
FRI	Forest Resource Inventory
GIS	Geographic Information System
Golder	Golder Associates Ltd.
ha	hectare
hr	hour
km	kilometre
km/h	kilometres per hour
km^2	square kilometres
kV	kilovolt
LC2000	Ontario Land Cover Data Base
LSA	Local Study Area
m	metre
m^3	cubic metres
MDNN	mean distance to nearest similar patch
MNDM	Ministry of Northern Development and Mines
MNR	Ministry of Natural Resources
MRA	Mine Rock Areas
MTO	Ministry of Transportation
NO	mono-nitrogen oxide
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
PM	particulate material
$PM_{2.5}$, PM_{10}	particles less than 2.5 or 10 micrometers in diameter
RSA	Regional Study Area
SAR	Species at Risk
SARA	*Species at Risk Act*
SARO	Species at Risk in Ontario
SO_2	sulphur dioxide
TMF	Tailings Management Facility
ToR	Terms of Reference
TSD	Technical Support Document
TSP	total suspended particulates
yr	year
$\mu g/m^3$	Micrograms (one-millionth of a gram) per cubic metre

1.0 INTRODUCTION AND PROJECT OVERVIEW

IAMGOLD Corporation (IAMGOLD) is proposing to construct, operate and eventually rehabilitate a new open pit gold mine and transmission line at the Côté Gold Project (the Project) located in Ontario, approximately 20 kilometres (km) southwest of Gogama, 130 km southwest of Timmins and 150 km northwest of Sudbury, in Chester and Neville Townships, District of Sudbury (Figure 1-1). The Project consists of the Mine Site, which is defined by its physical footprint, and a portion of the Power Transmission Corridor that is located in the vegetation regional study area.

To support the completion of an Environmental Assessment (EA) for the Project, Golder Associates Ltd. (Golder) was retained by IAMGOLD in early 2012 to complete studies of the existing hydrological, climatological, hydrogeological, water quality and terrestrial biology conditions. These studies are ongoing, concurrent with the assessment of effects associated with the construction, operation and closure of the Project.

This technical support document (TSD) is based partially on results of the baseline vegetation studies completed between April 2012 and July 2013 (Attachment I). The scope of the vegetation component includes the characterization of existing terrestrial biological conditions and potential effects of the Project to plant populations and communities that could occur from construction, operation and closure. This memorandum is intended to provide IAMGOLD and AMEC Environment & Infrastructure (AMEC) with key information to support the impact assessment for other physical discipline study components, as well as allowing AMEC to proceed with their assessment of the significance of the predicted effects and associated EA reporting for the Project.

1.1 Project Overview

1.1.1 Construction Phase

The construction phase represents a transition between pre-development conditions and the start of the Project operations. The construction phase will commence once suitable access for heavy construction equipment has been established. Sequencing of construction activities is based on upgrades to existing access and procurement of construction materials and is expected to last approximately two years. The following activities will occur during the construction phase:

- procurement of material and equipment;
- movement of construction materials to identified laydown areas and site;
- construction of an accommodation complex, with a capacity to host 1, 200 workers;
- expansion of existing environmental protection and monitoring plan(s) for construction activities;
- construction of additional site access roads;
- construction of dams and water realignment channels/ditches for the development of the open pit, as well as the construction of the Tailings Management Facility (TMF);
- construction/placement of "compensatory" fish habitat within channels realignments works authorized to offset the loss of lake habitat;

- dewatering of Côté Lake to allow for the pre-stripping of the open pit;
- stripping of overburden and initiation of open pit mine development;
- development of aggregate source(s) anticipated to be principally for concrete manufacture, foundation work and TMF dam filter zones;
- establishment of site area drainage works, including pipelines from freshwater/recycled water sources;
- development and installation of construction facilities including laydown, camp facilities, augmenting electrical substation capacity and other related construction infrastructure;
- construction of associated buildings and facilities, fuel bay, sewage plant and landfill (if developed);
- preparation of on-site mineral waste handling facilities, including the TMF dams; and
- construction and energizing of a 230 kilovolt (kV) feeder transmission line including on-site electrical substation.

An accommodation complex, with a capacity to host 1,200 workers, will be constructed at the start of construction to be used during the construction and operations phases.

Other construction activities will be sequenced according to manpower and equipment availability and site conditions. Certain activities, such as those involving working in wet or poorly accessible terrain, are best carried out under frozen ground conditions. Sequencing will also consider environmental aspects, such as fish spawning and bird nesting seasons.

1.1.2 Operation Phase

During the Project operations phase, overburden, mine rock and ore will be extracted from the open pit for stockpiling or transported directly to the process plant primary crusher for sizing. Sized ore will be processed in the processing plant to recover the gold and produce ore bars for periodic transportation off-site with the use of roads and security systems. Typically, for a project of this size, the final product is shipped off by truck once a week.

As the operations phase continues, the open pit will become progressively deeper and related overburden and mine rock stockpiles, as well as the TMF, will become larger and higher.

Solid and liquid wastes/effluent will be managed for regulatory compliance. Environment-related activities that will be carried out during the operations phase are anticipated to include:

- ongoing management of chemicals and wastes;
- water management/treatment;
- air quality and noise management;
- environmental monitoring and reporting;
- follow-up environmental studies; and

- progressive site reclamation, where practical.

1.1.3 Closure and Post-Closure Phase

Closure of the Project will be governed by the Ontario *Mining Act* and its associated Regulations and Codes. The *Mining Act* requires that a closure plan be filed for any mining project before the project is undertaken, and that financial assurance be provided prior to substantive development to ensure that funds are in place to carry out the Closure Plan.

The objective of closure is to rehabilitate the Project site to a naturalized and productive condition on completion of mining (AMEC 2013a). The terms naturalized and productive are interpreted to mean a rehabilitated site without infrastructure (unless otherwise negotiated), that while different from the existing environment, is capable of supporting plant, wildlife and fish communities, and other applicable land uses.

It is expected that the active phase of rehabilitation/closure of the Project site will take approximately two years to complete after operations cease, although there will be open pit flooding, environmental monitoring and, potentially, effluent quality management thereafter.

Revegetation will be carried out using non-invasive native plant species. Conventional methods of closure are expected to be used at the Project site, such as:

- flooding of the open pit (passively and/or by active filling);
- construction of a boulder fence around the perimeter of the open pit;
- removal of all infrastructure and equipment from the Project site, including pumps, pipelines, and power-lines;
- removal or stabilization of drainage channels and water management structures;
- construction of permanent overflow spillways and/or channels to safely convey runoff from flood events and drain discharge;
- grading and sloping of stockpiles;
- draining and contouring the TMF;
- progressive rehabilitation of aggregate pits;
- removal of petroleum products, chemicals, and explosives from the Project site;
- remediation and/or removal of contaminated soils;
- scarification of roads;
- capping of on-site landfill; and
- revegetation of the stockpiles, TMF, roads, and on-site landfill.

1.2 Vegetation

The purpose of the vegetation section is to describe the terrestrial environment that may be affected by the Project and to assess the effects to vegetation. The scope of the vegetation section includes an analysis of Project-related changes during construction, operations, closure and post-closure. To provide more confident and ecologically relevant predictions, Project effects on vegetation are assessed in context of the calculated changes in habitat conditions and state from previous and existing developments (e.g., forestry and mining) in the regional study area (RSA).

2.0 METHODS

2.1 Spatial Boundaries

The study areas selected for the Project define spatial boundaries within which the effects of the Project on vegetation are considered. For the purposes of the Project, study areas and spatial boundaries will be referred to collectively as study areas.

The Terms of References (ToR) and Environmental Impact Statement (EIS) Guidelines require that the study areas defined therein, and described below, encompass the physical works and activities of the Project where effects are expected or likely to occur, and where effects will be studied (Figure 2-1). The study areas were selected to incorporate the spatial extent of likely effects, as well as considering traditional and local knowledge, and ecological, technical, social, and cultural aspects.

2.1.1 Local Study Area

The local study area (LSA) is common to each selected effects assessment indicator (EAI, Section 2.3) and extends beyond the physical footprint provided by AMEC (Theben 2013, pers. comm.) to include the area around the physical footprint where immediate direct and indirect effects have the potential to occur on surrounding soil, vegetation and wildlife. The LSA encompasses a 2 km buffer around the physical footprint and extends to the south-west to include Chester Lake. The LSA is approximately 120 km^2.

2.1.2 Regional Study Area

The regional study area (RSA) is anticipated to be an appropriate spatial boundary for quantifying baseline conditions and assessing Project-specific effects on surrounding soil, vegetation and wildlife. This area is intended to capture effects that extend beyond the immediate physical footprint. Effects from the Project and other developments in the RSA can also be assessed at this scale for vegetation EAIs. The RSA is expected to be large enough to contain most of the plant populations and communities that may be influenced by the Project and other developments, and provide confident and ecologically relevant effects predictions on vegetation. At this scale, changes to vegetation and associated wildlife habitat from human development can be also used to predict effects to the abundance and distribution of wildlife populations. The RSA is defined as a 30 km buffer from the boundary of the LSA (i.e., extends 32 km from the anticipated footprint of the Mine Site). The RSA is approximately 3,788 km^2.

2.2 Temporal Boundaries

Temporal boundaries for the assessment are related to Project phases. The approximate duration of the key Project phases are as follows:

- construction: 2 years;
- operation: 15 years;
- closure: 2 years; and
- post-closure: 50-80 years[2].

Effects to vegetation begin during the construction phase with the removal and alteration of habitat (results in direct and indirect changes), and continue through the operation phase and for a period of time after the closure phase and into the post-closure phase (unless determined to be permanent). Therefore, effects to vegetation are predicted for the construction phase, and are expected to be similar for the operation and closure phases of the Project. This approach generates the maximum potential spatial and temporal extent of effects on vegetation abundance and distribution, which provides confident and ecologically relevant effects predictions.

2.3 Selection of Effects Assessment Indicators

The vegetation assessment focuses on the components that have the greatest relevance in terms of value and sensitivity, and that are likely to be affected by the Project. To achieve this objective, specific effects assessment indicators (EAIs) are identified for consideration during the environmental effects assessment. Identified EAIs are used to predict the effects of the Project on the terrestrial ecosystem. The following sections provide summaries of the proposed vegetation EAIs for the EA (Table 2-1). Changes in measures (Table 2-1) are used to predict effects to the abundance and distribution of vegetation EAIs.

Table 2-1: Vegetation Effects Assessment Indicators and Measures

Effects Assessment Indicator	Measures
■ upland plant community types (ecological land-cover [ELC] types)	**Naturally-occurring Plant Communities and Principal Land Cover** ■ change in ecosystem (ELC types) quantity and quality ■ change in abundance and distribution of plant species ■ change in plant community health and diversity ■ change in the presence of invasive species

[2] Following the removal of infrastructure and waste, as well as the revegetation of disturbed area, the open pit will continue to flood. It is anticipated that this stage could last approximately 50 to 80 years (AMEC 2013a).

Effects Assessment Indicator	Measures
■ wetlands	**<u>Naturally-occurring Plant Communities and Valued Secondary Land Cover</u>** ■ change in ecosystem (ELC types) quantity and quality ■ change in abundance and distribution of plant species ■ change in plant community health and diversity ■ change in presence of invasive species ■ change in hydrological regime
■ species at risk, species of special concern and provincially rare species	**<u>Types of Plants and Plant Status</u>** ■ change in abundance and distribution of plant species

Vegetation EAIs represent physical, biological, cultural, social and economic properties of the environment that are considered to be important by society. The inter-relationships between components of the biophysical and socio-economic (human) environments provide the structure of a social-ecological system (Walker et al. 2004; Folke 2006). An EAI is not the only, or necessarily, the most important receptor of those effects, but it is an element that has a recognized and acknowledged value and serves as a surrogate for all of the other elements in this class of environmental features (i.e., vegetation that will or may be affected by the Project).

The identification of EAIs is not intended to obscure potential effects to other vegetation elements, but the EAIs serve as surrogates for these other elements. If a vegetation EAI is not affected by a Project-specific effect, other vegetation elements are unlikely to be affected. Conversely, if a vegetation EAI is affected by a Project-specific effect, other vegetation elements are likely to be affected and the nature and magnitude of that effect can be estimated from the changes in measures of the EAI. A range of representative vegetation EAIs was selected for the Project (Table 2-1). Factors considered when selecting EAIs included the following:

- represent important ecosystem processes;
- represent Species at Risk (SAR) (listed in provincial or federal legislation) and species of conservation concern (e.g., Provincial *Endangered Species Act* [ESA (Government of Ontario 2007]); Natural Heritage Information Center [NHIC 2013]; federal listed (i.e., Committee on the Status of Endangered Wildlife in Canada [COSEWIC 2013]) and *Species at Risk Act* – Schedule 1 (SARA 2013);
- represent communities or species that reflect the interests of regulatory agencies, Aboriginal communities, and other people interested in the Project; and
- can be assessed with one or more practical measures.

Table 2-2 provides the rationale and justification for the selection of EAIs for assessing the effects of the Project on vegetation.

Table 2-2: Rationale for Selection of Vegetation Effects Assessment Indicators

Effects Assessment Indicator	Rationale for Selection
■ upland plant community (ELC) types	■ main component of the naturally-occurring vegetation in the study areas—the basis of biological processes ■ habitat for wildlife ■ basis for many local biological resources
■ wetlands	■ secondary component of the naturally-occurring vegetation in the study areas—the basis of biological processes ■ habitat for wildlife ■ basis for many local biological resources and important contributor to hydrological processes
■ species at risk, species of special concern and provincially rare species	■ plants of limited occurrence in the province (may be threatened or endangered) whose existing populations require consideration for conservation ■ valued component of provincial biodiversity

2.4 Prediction of Potential Effects and Mitigation Measures

Site preparation and construction, operation and closure of the Mine Site, and construction and operation of the transmission line will cause a number of changes to the existing environment that will result in potential effects on vegetation EAIs (Table 2-3). The primary Project components and associated activities that could potentially affect vegetation include:

- site clearing and site preparation;
- open-pit mining activities including new open pit mine and associated dewatering;
- overburden and mine rock management;
- process plant effluent and tailings management;
- access road and transmission line;
- water supply and drainage works and facilities;
- aggregate mining and stockpiles (gravel pit[s] and/or quarry[ies]);
- fuel and material management;
- domestic sewage treatment and disposal;

- solid waste management, industrial waste handling/treatment including hazardous materials;
- on-site power supply and power infrastructure (including temporary diesel generation);
- on-site access roads and related infrastructure;
- watercourse realignments;
- water withdrawal; and
- effluent discharge.

Although Project designs include Best Management Practices (BMPs) and other mitigation policies and practices during all phases of the Project, residual effects to the abundance and distribution of plant populations and communities are expected. While clearing land for the Project facilities will have the greatest impact on vegetation, many other direct and indirect changes to vegetation are linked to alterations in ground and surface water flows, air quality, and soil quality and quantity (Table 2-3).

The objective of this section of the EA is to identify those Project-environment interactions (pathways) that are predicted to result in residual effects to vegetation EAIs. Knowledge of Project designs and mitigation are applied to each of the pathways to determine the expected amount of Project-related changes to the environment and the associated residual effects (i.e., effects after mitigation) on EAIs. Changes to the environment can alter the measures of EAIs (e.g., amount, arrangement, and quality of habitat).

Each potential interaction is evaluated to determine if mitigation can be developed and incorporated to remove the interaction or limit the potential effects to vegetation. Mitigation includes Project design elements, environmental best practices and management policies and procedures. Mitigation is developed through an iterative process which includes the Project team, stakeholders, aboriginal communities and government departments. Knowledge of the terrestrial environment and mitigation is applied to each interaction to determine the expected Project-related change to the environment (i.e., change in a measure) and if there is potential for a residual effect on vegetation.

Interactions are determined to be primary, secondary, or as having no linkage using scientific knowledge, professional judgment of technical specialists, logic, experience with similar developments and mitigation (Table 2-3). Each potential interaction is evaluated and classified as follows:

- **no linkage –** interaction is removed by Project design features and mitigation so that the Project results in no detectable change and no residual effects to vegetation relative to baseline or guideline values;
- **secondary –** interaction could result in a measurable and minor change to the environment, but would have a negligible residual effect on vegetation relative to baseline values; or
- **primary –** interaction is likely to result in a measurable change to the environment that could contribute to a significant residual effect to vegetation relative to baseline values.

Primary interactions are anticipated to result in effects to the abundance and distribution of vegetation and require further analysis to determine the significance of the residual effects. Interactions that are classified as no linkage or secondary will not be analyzed further or classified in the EA because Project design features and mitigation will remove the interaction (no linkage) or residual effects can be determined to be negligible (secondary) through a simple qualitative or quantitative evaluation. Project interactions determined to have no linkage or those that are considered secondary are not predicted to result in significant effects to the abundance and distribution of vegetation.

Project components and activities, and the associated mitigation implemented during the various Project phases, are summarized in Table 2-3. Potential effects to vegetation from each Project interaction and its associated classification are summarized in Table 2-3; detailed descriptions are provided in the subsequent sections.

The Project components and activities listed in Section 2.1 were considered in the pathway for each of the EAIs selected for vegetation. Table 2-3 summarizes the pathway assessment following mitigation for each of the Project components.

Table 2-3: Prediction of Potential Effects and Project Designs and Mitigation for Vegetation

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Pathway Assessment
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Physical footprint (e.g., open pit, TMF, Mine Rock Area, Ore Stockpile, site roads, storage facilities and portion of the Power Transmission Corridor that is located within the RSA) Access Road	Direct vegetation loss, alteration, and fragmentation from the physical footprint of the Project	Limit ground clearing and size of the physical footprint. Existing access roads and infrastructure will be used to the extent practical. Progressive rehabilitation and revegetation will be implemented where practical to reduce the amount of disturbed habitat during the Project lifecycle. Rehabilitation will include active seeding of areas to promote vegetation growth, stabilize the substrate, reduce potential erosion and enhance natural recovery of vegetation communities.	primary
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	230 kV Transmission Line	Vegetation alteration and fragmentation from the transmission line	Limit ground clearing and area of physical footprint. Align corridor adjacent to existing linear features as much as practical.	primary
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing, and hauling)	Introduction of invasive plant species can change vegetation ecosystem composition	Topsoil and overburden stockpiles for use in future rehabilitation activities. Regular cleaning of construction equipment and vehicles. Use of locally-sourced native species to revegetate disturbed and exposed areas, and encourage natural vegetation.	secondary

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Pathway Assessment
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing, and hauling)	Human recreational activity can disturb vegetation	All employees, contractors and sub-contractors will be provided with environmental awareness training. Prohibit recreational off-road use of all-terrain vehicles.	no linkage
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing, and hauling)	Increased risk of soil erosion by wind and water can decrease vegetation quantity and quality	Site grading and ditching. Use of sediment and erosion control measures.	secondary
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing, and hauling)	Dust deposition may cover vegetation and lead to physical and/or physiological damage of vegetation ecosystems and plants	Application of water and/or approved dust suppressants to unpaved roadways. Enforced speed limits to limit dust production. Proper maintenance of machinery and vehicles equipped with appropriate pollution controls. Dust control systems on rock crushing, conveyors and other dust generating equipment will limit dust emissions. All machinery, equipment and vehicles will be equipped with appropriate pollution controls and regularly serviced to maintain proper combustion, and reduce noise and	secondary

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Pathway Assessment
			particulate emissions. Where applicable, high efficiency scrubbers will be used in processing equipment to limit emissions of particulate matter. Crushing and reclaim from stockpiles for crushed materials will be controlled with applicable dust control systems. Emission controls will be provided in areas where airborne particulate may be generated.	
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing, and hauling)	Dust deposition and air emissions may change vegetation quality through changes in the chemical content of soil and air	Application of water and/or approved dust suppressants to unpaved roadways. Enforced speed limits to limit dust production. Proper maintenance of machinery and vehicles equipped with appropriate pollution controls. Dust control systems on rock crushing, conveyors and other dust generating equipment will limit dust emissions. All machinery, equipment and vehicles will be equipped with appropriate pollution controls and regularly serviced to maintain proper combustion, and reduce noise and particulate emissions. Where applicable, high efficiency scrubbers will be used in processing equipment to limit emissions of particulate matter. Crushing and reclaim from stockpiles for crushed materials will be controlled with applicable dust control systems. Emission controls will be provided in areas where airborne particulate may be generated.	secondary

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Pathway Assessment
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing, and hauling)	Accidental release of deleterious substances into the environment may degrade vegetation ecosystems	An Emergency Response Plan will be developed that conforms to the best management practices within the construction industry. All vehicles/equipment will be equipped with a spill kit to contain the volume of deleterious liquid within the vehicle/equipment being operated. Fuel storage and dispensing locations will be located no less than 30 m of a watercourse or a drainage structure that leads to a watercourse.	no linkage
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Mine Rock Management	Leaching of potential acid-generating mine rock may degrade vegetation communities	More than 95% of mine rock is non-PAG. Engineered water management systems will be constructed to collect runoff and seepage from the MRA, low-grade stockpile, TMF, and polishing pond during the operations phase, closure phase and post-closure phase stage I. Contact water that is comprised of inflows and runoff from the pit walls, runoff and seepage from the MRA and low grade stockpiles, and runoff from the plant site will be collected and pumped to the mine water pond during the operations phase and pumped to the open pit during the post-closure phase stage I. During all Project phases, contact water from the MRA, low-grade stockpile, open pit, and TMF will be monitored to determine suitability prior to being discharged to the environment. Contact and process water contained within the collection ponds adjacent to the TMF and polishing ponds will be pumped back into the reclaim pond and polishing pond, respectively, during the operations phase. Effluent will be treated to meet federal and provincial metal mining sector effluent limits prior to being discharged to the	no linkage

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Pathway Assessment
			environment.	
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Site Water Management	Run-off, erosion, and sedimentation may alter vegetation quantity and quality	Clearing activities will be limited to those areas that are required for construction of infrastructure, and will comply with the requirements of all applicable permits/approvals. Culverts will be constructed to maintain natural cross-drainage and to prevent ponding. Erosion and sediment control measures will be implemented immediately both on and around the topsoil and overburden stockpiles to prevent the loss of the topsoil or overburden. Erosion and sediment control measures implemented during the construction will be monitored and replaced as maintenance and operations occur over an extended period of time. Sediment laden water from foundation or other excavation activities will not be discharged directly into the environment. Water pumped from work areas or other runoff will be sent to settling ponds, filtration, or other suitable means before discharge to the environment. Sediment and erosion control measures such as silt fencing, erosion control mats, sedimentation ponds, erosion blankets/geotextile lining, sand bags, terraces, benching, and rip-rap structures will be implemented prior to the initiation of any cutting and clearing activities. Sewage will be treated prior to discharging the effluent to the environment. Vehicle movement will be restricted to designated access roads only, and recreational off-road use of vehicles	secondary

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Pathway Assessment
			prohibited. Sedimentation ponds will be sized in accordance with the Ontario Ministry of the Environment Stormwater Management Planning and Design Manual (2003) where the pit or quarry is larger than 5 ha. Establish and maintain adequate vegetation to control erosion of stockpiles of topsoil or overburden. Discharged water shall be encouraged to follow natural drainage patterns.	
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Project Water Management	Release of seepage and surface water runoff (including erosion) from the MRA and overburden stockpile may degrade vegetation communities	Engineered water management systems will be constructed to collect runoff and seepage from the MRA, low-grade stockpile, TMF, and polishing pond during the operations phase, closure phase and post-closure phase stage I. Contact water that is comprised of inflows and runoff from the pit walls, runoff and seepage from the MRA and low grade stockpiles, and runoff from the plant site will be collected and pumped to the mine water pond during the operations phase and pumped to the open pit during the post-closure phase stage I. During all Project phases, contact water from the MRA, low-grade stockpile, open pit, and TMF will be monitored to determine suitability prior to being discharged to the environment. Contact and process water contained within the collection ponds adjacent to the TMF and polishing ponds will be pumped back into the reclaim pond and polishing pond, respectively, during the operations phase. Effluent will be treated to meet federal and provincial metal mining sector effluent limits prior to being discharged to the	no linkage

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Pathway Assessment
			environment.	
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Project Water Management	Seepage from the TMF may degrade vegetation communities	Engineered water management systems will be constructed to collect runoff and seepage from the MRA, low-grade stockpile, TMF, and polishing pond during the operations phase, closure phase and post-closure phase stage I. Contact water that is comprised of inflows and runoff from the pit walls, runoff and seepage from the MRA and low grade stockpiles, and runoff from the plant site will be collected and pumped to the mine water pond during the operations phase and pumped to the open pit during the post-closure phase stage I. During all Project phases, contact water from the MRA, low-grade stockpile, open pit, and TMF will be monitored to determine suitability prior to being discharged to the environment. Contact and process water contained within the collection ponds adjacent to the TMF and polishing ponds will be pumped back into the reclaim pond and polishing pond, respectively, during the operations phase. Effluent will be treated to meet federal and provincial metal mining sector effluent limits prior to being discharged to the environment.	no linkage
Upland Plant Community Types Wetlands Plant Species of Conservation Concern	Dewatering and Watercourse Realignments	Changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from dewatering of Côté Lake and realigning portions of Three Duck Lakes, Chester Lake, Clam Lake, Bagsverd Creek,	During operations, surface water flow changes were estimated to be greatest where realignment plans exist (Hydrology TSD). Where applicable, the decrease in annual flow in waterways was considered unlikely to alter in-stream characteristics such as sedimentation or connection to downstream features (Hydrology TSD). During post-closure waterways will be reconnected similarly to the existing conditions. Lakes that remain connected to realignment features in this Stage are expected to have higher daily average streamflow than during existing	primary

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Pathway Assessment
		and the Mollie River system may affect the quantity of vegetation	conditions, and streamflow may be decreased in Bagsverd Creek, where the TMF watershed area is directed to Mesomikenda Lake. However, total streamflow change through the Mollie River and Mesomikenda Lake watersheds is anticipated to be less than 5% (Hydrology TSD).	
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Closure[(a)]	Local changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from filling the open pit may affect the quantity of vegetation	Flooding of the open pit will be achieved primarily using passive means such as natural ground water and precipitation. Active filling of the open pit will use runoff from the MRA, and/or seasonal freshwater inputs from nearby watercourses or recycled water from the TMF.	primary
Upland Plant Community Types Wetlands Species at Risk, Species of Special Concern and Provincially Rare Species	Closure[(a)]	Long-term seepage from the MRA and TMF may degrade vegetation communities	Engineered water management systems will be constructed to collect runoff and seepage from the MRA, low-grade stockpile, TMF, and polishing pond during the operations phase, closure phase and post-closure phase stage I Contact water that is comprised of inflows and runoff from the pit walls, runoff and seepage from the MRA and low grade stockpiles, and runoff from the plant site will be collected and pumped to the mine water pond during the operations phase and pumped to the open pit during the post-closure phase stage I. During all Project phases, contact water from the MRA, low-grade stockpile, open pit, and TMF will be monitored to determine suitability prior to being discharged to the environment. Effluent will be treated to meet federal and provincial metal mining sector effluent limits prior to being discharged to the environment.	no linkage

2.4.1 Pathways with No linkage

An interaction may have no linkage to environmental effects if the activity does not occur (e.g., site runoff is not released), or if the interaction is removed by mitigation or Project design features so that the Project results in no detectable change in measures of EAIs. Subsequently, no residual effect to the abundance and distribution of plant populations and communities is expected. The following interactions are anticipated to have no linkage to effects on vegetation and will not be carried through the residual effects assessment.

- human recreational activity can disturb vegetation.

Roads can increase potential for physical damage and destruction of plants by increasing access for recreational activities (e.g., all-terrain vehicles), which in turn increases the erosion potential of soils, reducing the quality of vegetation habitat. A road network currently exists within the RSA, which provides access for vehicles. No new off-site roads are anticipated to be constructed for the Project. Access to Mine Site is expected to occur mostly through the use of existing roads, and any additional road access or modifications to existing roads will be controlled by IAMGOLD (Socio-economic TSD). Therefore, the Project is not anticipated to increase access for recreational activity in the RSA relative to baseline conditions, and this pathway is not assessed further in the EA.

- accidental release of deleterious substances into the environment may degrade vegetation ecosystems.

Measurable changes to the health and mortality of plants from the unplanned (accidental) release of deleterious substances (e.g., chemicals) are not predicted to occur because current mitigation and BMP are known to be effective. Chemical spills on other mine sites are generally localized, and there is a growing history of responsible reaction. The spills are quickly reported and managed to eliminate or minimize environmental degradation (Tahera 2008; BHPB 2010; DDMI 2010; De Beers 2010). Mitigation measures identified in the the analysis of accidents and malfunctions (Section 13) and Project design features will be in place to limit the risk of chemical spills at the Project site (Table 2-3). Consequently, chemical spills are predicted to have no residual adverse effects on the abundance and distribution of plant populations and communities.

- leaching of potential acid-generating mine rock may degrade vegetation communities.
- release of seepage and surface water runoff (including erosion) from the MRAs and overburden stockpile may degrade vegetation communities.
- seepage from the TMF may degrade vegetation communities.
- long-term seepage from the MRA and TMF may degrade vegetation communities.

General site runoff and seepage collection systems, including associated settling ponds, will be developed to capture and treat seepage and runoff from the TMF, the MRA and the low-grade ore stockpiles, plant site area and other potential contaminant sources in accordance with MMER and provincial approval requirements (Table 2-3). Design features may include the construction of bentonite-amended cutoff walls or recovery wells. The cutoff walls may be used to effectively isolate seepage from preferential groundwater flow zones. The recovery wells may be used to locally reverse hydraulic gradients beneath the TMF, such that hydraulic containment of a seepage could be maintained. These design features provide two lines of defense against the release of seepage from the TMF and may be used to contain seepage along both deep and shallow seepage paths.

Release of surface water runoff, seepage from the TMF and MRA, and leaching of potential acid-generating Mine Rock are not anticipated to occur. Project design features will be implemented to limit the potential of seepage, runoff, and leaching effects (Table 2-3). Effluent discharge from the site needs to meet the provincial metal mining sector effluent limits (as per Schedule 1 of Ontario Regulation 560/94 under the *Environmental Protection Act*) and the federal MMER limits (as per Schedule 4 of the MMER under the *Fisheries Act*; Government of Canada 2013). Thus, it is predicted that runoff, seepage, and leaching from the Project will have no residual effects on vegetation EAIs. Effects to vegetation from leaching, seepage, and runoff are not assessed further.

2.4.2 Secondary Pathways

In some cases, both a source and an interaction exist, but because the change caused by the Project is anticipated to be minor relative to baseline values, it is expected to have a negligible residual effect on vegetation abundance and distribution. The following interactions are expected to be minor and will not be carried through the residual effects assessment.

- introduction of invasive plant species can change vegetation ecosystem composition.

The Project has the potential to introduce non-native plant species and disrupt native plant communities. Ground disturbance associated with construction activities can create the type of habitat favoured by invasive plant species (Mack et al. 2000; Truscott et al. 2008). Transportation routes to and from construction areas, as well as additional habitat in the form of disturbed road edges, provide a means of entry for invasive plant species. Vehicles and machinery can serve as dispersal vectors for plant propagules (seeds and/or vegetative parts) that can get lodged in tires, the undercarriage, or mud on the surface of the vehicle.

The complete vegetation inventory provided in Attachment I of this TSD includes information about the endemic status (either native or non-native) of plants identified during baseline conditions. Of the plants identified to species, all are considered native. The remaining 10% consists of vegetation that was identified to the genus level, and therefore the native status of the individual species is unknown.

Effective mitigation strategies are required early in the Project planning to address the introduction, spread, and effects of invasive species on the environment (Haber 1997). Preventing invasive plant species from entering an area is often more efficient and cost effective than dealing with their removal after they are established (Clark 2003; Polster 2005; Carlson and Shephard 2007). To mitigate the transport and introduction of non-native plant species into native plant communities, construction equipment and other equipment or vehicles being brought onto the Project site will be regularly cleaned on-site. An invasive plant management strategy will also be designed and implemented to prevent, detect, control (remove), and monitor areas with invasive plant species. The implementation of mitigation and environmental design features is anticipated to result in minor changes in the occurrence of invasive plants relative to baseline conditions and negligible effects to the abundance and distribution of vegetation EAIs. Introduction of invasive species is not assessed further.

- increased risk of soil erosion by wind and water can decrease vegetation quantity and quality; and
- run-off, erosion, and sedimentation may alter vegetation quantity and quality.

Project activities such as site clearing, contouring and excavation, as well as soil salvage, stockpiling and transport can increase potential for soil erosion. Water runoff from the Mine Site could potentially affect vegetation habitat within and adjacent to the physical footprint. Increased levels of soil erosion can lead to increased sediment loads in wetlands, reducing plant and animal abundance and diversity (Forman and Alexander 1998).

Soil sensitivity to erosion is dependent upon numerous properties including soil texture, cohesiveness, structure, aggregate stability, organic matter content, moisture content and infiltration susceptibility. Site-specific parameters influencing erosion susceptibility include degree of disturbance, slope length and gradient, surface roughness and residue cover and weather, such as high winds or extreme precipitation events (Cruse et al. 2001; Kuhn and Bryan 2004; TAC 2005; Li et al. 2007). Disturbed and stockpiled soil should be protected from wind and water erosion in order to protect ecologically sensitive areas. Establishing a vegetation cover on soil salvage stockpiles can help to protect the stockpiles from wind and water erosion (Stark and Redente 1987; Ghose 2001; Sheoran et al. 2010).

Finer textured clayey soils tend to be less prone to erosion by water than silty soils (TAC 2005), especially when the soil structure has been disturbed by freeze-thaw or human activity (Cruse et al. 2001). The higher permeability of sandy textured soils contributes to a lower potential for over-land flow of water, decreasing the potential for soil erosion. In areas where slope gradient and slope length increases, so does the potential for soil erosion regardless of soil texture.

The interaction between soil type and slope defines the susceptibility of an area to water erosion. Most soil units mapped within the LSA are rated as having a low sensitivity to water erosion on slopes less than 5%. Mitigated surface runoff and sediment releases are not likely to have a residual adverse effect on vegetation EAIs (Attachment II).

In general, coarse (sandy) textured soils and soils low in moisture are more prone to wind erosion than finer (clay) textured soils (Coote and Pettapiece 1989). Sandy textured soils typically do not have a well-developed soil structure. The lack of soil structure is due to limited soil aggregation or adhesion of the soil particles, which does not allow for the formation of larger and more stable soil aggregates that are less likely to be moved by wind. Organic soils are typically less prone to wind erosion, unless they have dried out, or are disturbed (Campbell et al. 2002). Wind erosion of organic soils is a function of the degree of peat decomposition, thus the more highly decomposed (humic) the organic soil is the greater the risk for wind erosion.

Of the soil cores characterized in the LSA, 10% had a sandy effective texture (Johnson et al. 2010) and 38% were dry or moderately-dry. The high forest cover within the LSA acts to reduce wind erosion by sheltering soil and reducing wind intensity at the soil level (Van de Ven et al. 1989; Wolfe and Nickling 1993).

It is expected that best management practices implemented during construction activities would be sufficient to control erosion. For example, seeding exposed soils as soon as practical can reduce erosion potential by up to 90% (TAC 2005). In areas of steep slopes adjacent to waterbodies, the probability of erosion will increase, and additional erosion control may be required. General site runoff and seepage collection systems, including associated settling ponds, will be developed to capture and treat seepage and runoff from the major site facilities, such as from the TMF, the MRA and the low-grade ore stockpiles, plant site area and other potential contaminant sources in accordance with MMER and provincial approval requirements.

Implementation of Project design features and appropriate mitigation is expected to result in minor changes to the environment from site runoff and erosion relative to baseline conditions. Subsequently, this pathway was determined to have negligible effects on the abundance and distribution of plant communities and populations.

- Dust deposition may cover vegetation and lead to physical and/or physiological damage of vegetation ecosystems and plants
- Dust deposition and air emissions may change vegetation quality through changes in the chemical content of soil and air

Construction and operation of the Project will generate air emissions such as carbon monoxide (CO), oxides of sulphur (SO_x) including sulphur dioxide (SO_2), oxides of nitrogen (NO_x) including nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$, PM_{10}), and total suspended particulates (TSP). Air quality modelling was completed to predict the spatial extent of air and dust emissions and deposition from the Project. Assumptions were incorporated into the model to provide conservative estimates of emission concentrations and deposition rates. The deposition of SO_2 and NO_2 can alter soil pH, nutrient content, and cause acidification of the soils, which can lead to changes in soil fauna composition (Rusek and Marshall 2000). Changes in soil fauna may lead to changes in vegetation, as there may be alterations in organic matter decomposition rates and nutrient cycling. Most studies indicate that potential effects from dust are localized to within 50 metres (m) of the source and typically do not extend to the regional area (Everett 1980; Walker and Everett 1987; Meininger and Spatt 1988; Watson et al. 1996; Grantz et al. 2003). The concentration and duration of air and dust emissions and the sensitivity of the ecosystems determine the overall influence that emission deposition will have on vegetation (Bobbink et al. 1998).

Results of the air quality modelling (Table 2-4) indicate that the maximum annual, 1-hour, and 24-hour ground-level concentrations of SO_2 and NO_2 are all below the Ontario Ambient Air Quality Criteria (Ontario Ministry of the Environment 2012) and are limited to the immediate vicinity of the Project (Air Quality TSD). Concentrations of TSP were found to have potential exceedances at the property boundary. The 24-hour Ambient Air Quality Criteria for TSP is expected to be exceeded 7 days per year. Overall, air and dust emissions and subsequent deposition are expected to result in minor changes to surface water, sediment, soil, and vegetation chemistry. Therefore, these interactions were determined to have a negligible residual effect to the abundance and distribution of plant populations and communities in the RSA. Air and dust emissions are not assessed further.

Table 2-4: Comparison of Ontario's Ambient Air Quality Standards and Maximum Predicted Operation Phase Values for Sulphur Dioxide, Nitrogen Dioxide and Total Suspended Particulates

Compound	Ontario Ambient Air Quality Criteria (µg/m³)			Maximum Predicted Value (µg/m³)		
	1-hr Averaging Period	24-hr Averaging Period	1-hr Averaging Period	1-hr Averaging Period	24-hr Averaging Period	1-yr Averaging Period
Sulphur Dioxide	690	275	55	165	36	5
Nitrogen Dioxide	400	200	–	304	101	–
Total Suspended Particulates	–	120	60	–	**197**	21

Notes:
µg/m³ - micro gram per cubic metre
hr – hour
yr - year
Numbers in **bold** denote exceedances.

2.4.3 Primary Pathways

The following interactions were determined to be primary for effects to the abundance and distribution of plant communities and populations, and are carried forward to the residual effects analysis (Section 3.0).

- Direct vegetation loss, alteration, and fragmentation from the physical footprint of the Mine Site and Access Road.
- Vegetation alteration and fragmentation from the Transmission Line Alignment.
- Changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from dewatering of Coté Lake and portions of Three Duck Lakes, Chester Lake, Clam Lake, and the realignment of Bagsverd Creek, Three Ducks Lake outflow, Chester Lake outflow, Clam Lake outflow and the Mollie River system may affect the quantity of vegetation.
- Local changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from filling the open pit may affect the quantity of vegetation.

2.5 Prediction of Effects

2.5.1 Vegetation Alteration and Fragmentation

Decreases in habitat area can directly influence the abundance of plant populations and communities by reducing the carrying capacity of the environment. Habitat loss includes the direct removal or alteration of habitat due to the Project and other developments. In addition to direct loss of habitat, the application of the Project and other developments results in fragmentation (i.e., breaking apart) of the existing landscape. Fragmentation can influence several ecological processes including seed dispersal and successful germination, and temperature and moisture conditions along habitat edges.

It is important to have knowledge of the changes to habitat state and condition from previous and existing developments as it provides context about some of the factors that have and are currently influencing plant populations and communities in the RSA. The understanding of previous and on-going effects from human development in an area allows for more confident and ecologically relevant predictions of the magnitude and significance of Project effects on the abundance and distribution of vegetation EAIs. Habitat effects (i.e., changes to habitat amount and fragmentation) to vegetation EAIs from the physical footprint and previous and existing developments in the RSA were analyzed through changes in the area and spatial configuration of habitats on the landscape (i.e., landscape metrics). Landscape metrics that were calculated for each habitat identified in the ELC included total area, mean patch area, total edge and mean distance to the nearest similar patch. Landscape metrics were calculated using the program FRAGSTATS (Version 3.0; McGarigal et al. 2002) within a Geographic Information System (GIS) platform. The mean distance to nearest similar patch (MDNN) is calculated as the shortest straight-line Euclidean distance between the centroids of the closest cells of equivalent habitat patches (McGarigal et al. 2012).

The FRAGSTATS analysis determined the extent of habitat fragmentation by calculating statistical outputs based on the values of each raster cell (25 m by 25 m). Raster cells for habitats with extensive coverage in the RSA (including disturbed areas) were determined from the Ontario Land Cover Data Base (LC2000) (Spectranalysis et al. 2004). An assessment of likely effects of the habitat change is based on the calculation of the amount of habitat potentially altered or lost for vegetation EAIs in the RSA.

Landscape metrics were determined for the reference, existing conditions (2012 baseline) and application case (Table 2-5). Reference conditions represent the initial period of baseline conditions (conditions with little or no disturbance, and as far back as data are available). Information on the location, year and type of human-related and natural disturbances were obtained from the following sources:

- Land Information Ontario (Ontario Ministry of Natural Resources [MNR]);
- Forest Resource Inventory (FRI) (MNR);
- Canadian National Fire Database (CNFDB);
- 2012 LiDAR imagery (covered 8% of the RSA) (imagery captured by GeoDigital, formerly known as Terrapoint);
- Ontario Ministry of Northern Development and Mines (MNDM): abandoned, inactive mine sites and mine hazards;
- MNDM Assessment File Database (AFRI);
- MNDM mineral deposits; and
- CANMAP v2008.4.

Table 2-5: Developments Applied for Each Assessment Case

Reference Scenario	2012 Existing Conditions Scenario	Application Scenario (IAMGOLD Project plus 2012 Existing Conditions)
■ Little to no human development	■ Development database (Table 2-6)	■ Development database (Table 2-6) ■ IAMGOLD physical footprint and transmission line footprint that is located within the RSA

Table 2-6: Previous and Existing Developments in the Regional Study Area

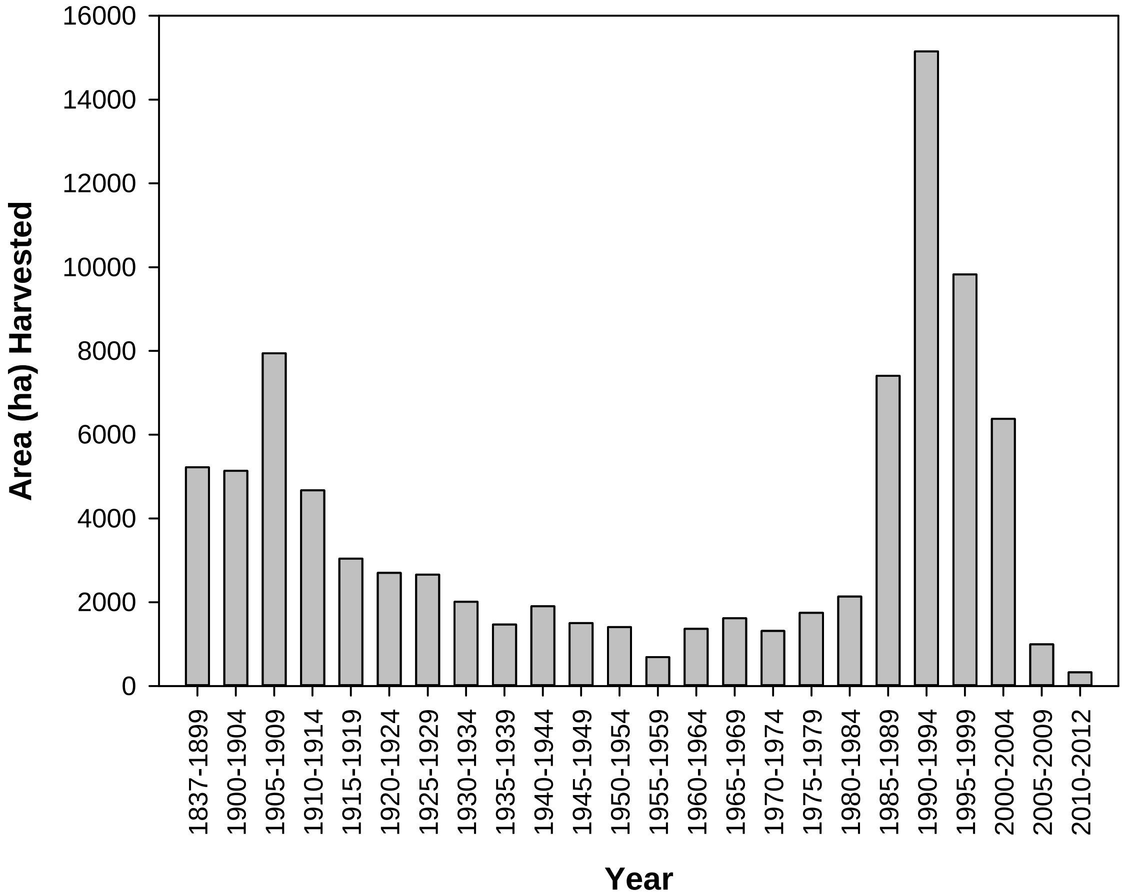
Type of Development	Footprint Area (ha)[(a)]	Number of Developments	Linear Feature Length (km)	Linear Feature Density (km/km^2)
Community	368	15	NA	NA
Mine	1,177	60[(b)(c)]	NA	NA
Mineral exploration	327	126	NA	NA
Mineral exploration (drill holes)	53	268	NA	NA
Recently harvested (logged) areas	28,463	11,598	NA	NA

Type of Development	Footprint Area (ha)[(a)]	Number of Developments	Linear Feature Length (km)	Linear Feature Density (km/km^2)
Camp	<1	1	NA	NA
Outpost camp	4	5	NA	NA
Cell tower	2	11	NA	NA
Airport/helipad	4	5	NA	NA
Buildings	37	566	NA	NA
Pits/quarries	481	102	NA	NA
Power line	614	24	122	<0.01
Highways and all-season roads [(d)]	1,348	370	254	<0.01
Logging and seasonal roads [(d)]	2,984	5,096	1,079	<0.01
Railway	271	30	108	<0.01
Total disturbance	36,133	18,277	1,563	<0.01

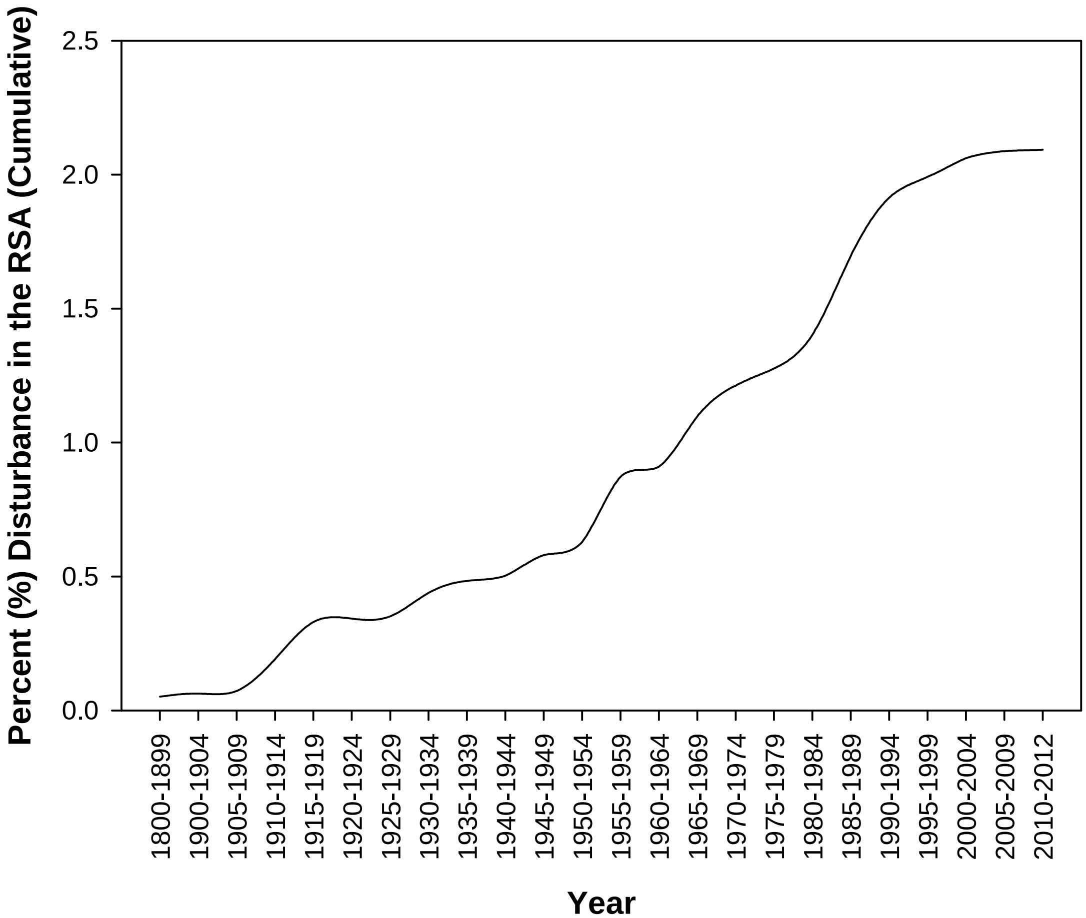
Notes:
Less than (<) indicates that values are approaching zero.
[(a)]Based on actual and hypothetical footprints presented in Table 2-7.
[(b)]All mines are currently inactive
[(c)]Includes prospecting activities; there are 35 mines that were in operation for more than 2 years.
[(d)]The number of developments is exaggerated because the development type was made of multiple segments. For example, one trail on the landscape may be many trail segments in the Land Cover Data Base (Spectranalysis et al. 2004).
NA =Not applicable; < = less than; ha = hectares; km = kilometre; km^2 = square kilometre

Satellite imagery was not available for reference conditions. Logging and forestry operations have been on-going in the RSA since 1800, but during the past 80 years the scale and intensity of forest harvesting remained low until the 1980s (Graphic 2-1). Records of mineral exploration, mining and other linear and non-linear developments begin in the early 1800s and have contributed little to disturbance in the RSA (Graphic 2-2). Based on the spatial extent and rate of human development in the region, it was determined that the creation of a predicted land cover in 1942 would provide a reasonable reference condition representing no to little human disturbance in the RSA (i.e., close to pre-development conditions). The reference land cover was generated by back casting to a set of previous conditions, which can be used to estimate the magnitude and temporal and spatial extent of landscape changes to the RSA from previous and existing developments.

Graphic 2-1: Five Year Interval Area of Timber Harvested in the Regional Study Area, 1837 to 2012



Graphic 2-2: Proportion of the Regional Study Area Disturbed by Human Developments (Excluding Forest Depletion-Cuts), 1800 to 2012



The reference land cover was produced using the following approach.

1) Starting with the original LC2000 data, forest depletion-cuts, forest depletion-burns and other linear and non-linear human developments were identified.

2) The ecosites from the FRI were re-classified as dense coniferous forest, dense mixed forest, dense deciduous forest, sparse forest and treed bog to align with the broader forested habitat types in LC2000. The following method was used:

   - application of the ecosite number descriptions provided in the Field Guide to Forest Ecosystems of Northeastern Ontario (Taylor et al. 2000) to the FRI ecosites;
   - cross-referencing with the stand structure silhouette (a pictoral representation of the composition and structure of a typical ecosite cross section), soil type and typical plant species associations; and
   - using field data to verify the re-classification of FRI ecosites.

3) Forest depletion-cuts or forest depletion-burns and other human developments identified in LC2000 were overlaid on the re-classified FRI data.

4) Applied the re-classified FRI ecosites to the forest depletion-cuts and burns, and other linear and non-linear human disturbance areas.

5) Using the FRI stand origin data, all forest fires and blow downs that occurred from 1924 to 1942 (i.e., less than or equal to 18 years of age under reference conditions) were extracted and applied to the reference land cover and labeled as recent burn (see below for determining number of years that burned and cut areas begin to show regrowth of forest).

The existing conditions case includes all previous, existing and approved developments up to 2012 (Table 2-5). The year 2012 was used for the baseline case because information used in compiling the development database (Table 2-6) and on forest harvesting activities was only available until 2012. Data on previous and existing human-related and natural disturbances in the RSA were used to generate disturbance/development layers within a GIS platform, which were then applied to LC2000 to produce the 2012 baseline land cover.

The LC2000 was developed using satellite imagery from 1999 to 2002 (mostly after 2000), but contains no information on the age of forested and regenerating areas (Spectranalysis et al. 2004). Areas classified as forest depletion-cuts or burns in LC2000 that were harvested or burned more than 15 to 20 years ago have likely begun to regenerate into forested stands under existing conditions (i.e., 2012 to 2013). A comparison of LC2000 and FRI data determined that forest depletion-cuts and forest depletion-burns documented in the FRI as more than 18 years old were classified in LC2000 as treed areas. Thus, the following approach was used to develop a 2012 baseline (existing conditions) land cover for the RSA.

1) Determine the year of origin for forest depletion-cuts and burns identified in the LC2000 by overlaying the FRI data and CNFDB on the LC2000 layer.

2) Assign forest depletion-cuts or burns that were equal to or less than 18 years old (i.e., harvested or burned since 1994) as recent harvest or burns.

3) Assign forest depletion-cuts or burns greater than 18 years old as the re-classified FRI ecosites, which represent the broader level LC2000 classification.

The FRI layer contains harvest information from 1792 through 2010, and fire depletions from 1917 to 2010. The CNFDB contains fire history information for the RSA from 1963 to 2010. Local knowledge was used to identify the existence of a fire that occurred in the RSA during 2012, which was not mapped in the FRI and CNFDB. Golder requested and received the polygon for the Timmins #9 fire from the MNR, which was added to the 2012 baseline land cover.

In addition, LiDAR data was used to identify recent forest harvest and regenerating areas near the Project that did not exist in the FRI data and LC2000. These data covered 8% of the RSA.

After compiling the data layer for forest depletion-cuts and burns under 2012 baseline conditions, the following procedure was used to generate the development layer for other types of non-linear and linear human-related disturbances.

1) Using the acquired data sources, all previous and existing human development types in the RSA were identified (Table 2-6), which included the following:
   - communities;
   - mines;
   - mineral exploration (stripping/trenching and drilling);
   - exploration camps;
   - outpost camps;
   - cell towers;
   - airport/helipads;
   - buildings;
   - pits/quarries;
   - power lines;
   - highways and all-season roads;
   - forestry and seasonal roads; and
   - railways.

2) Generate the development layer with the following attributes:
   - determine the year, number and location of each development type; and
   - calculate the physical footprint area for each development type using actual polygons or shape files, or estimated buffers (Table 2-7).

Two sources of data were available to determine the amount of exploration activity in the RSA through time. Both were provided by the MNDM. The first was the AFRI database that contained all records of mining exploration activity, including descriptions of the activity, the year in which the work was conducted, and GIS polygons of the exploration area. The second was the Ontario Drillhole Database that contained point locations for exploration drillholes; the majority of these represent the specific locations of drilling activity associated with the records in the AFRI database. The most up-to-date AFRI database was provided by MNDM on September 19, 2013. The Ontario Drillhole Database was received from MNDM on February 7, 2013.

Table 2-7: Actual and Hypothetical Footprints for Developments in the Regional Study Area

Type of Development	Feature Type	Footprint Radius or Corridor[a] (m)
Community	Polygon[b]	Actual
Community	Point[c]	25
Mine	Point	250
Mineral exploration – drill holes	Point	25
Mineral exploration – disturbance polygons	Polygon	Actual
Recent harvested (logged) areas	Polygon	Actual
Camp	Point	25
Outpost camp	Point	50
Cell tower	Point	25
Airport/helipad	Polygon[b]	Actual
Airport/helipad	Point[c]	25
Buildings	Point	25
Pits/quarries	Polygon[b]	Actual
Pits/quarries	Point[c]	250
Power line	Line	50
Highways and all-season roads	Line	50
Logging and seasonal roads	Line	25
Railway	Line	25

Notes:
(a) A radius was applied to point features and a corridor was applied to line features.
(b) The polygon feature was used where possible.
(c) Point features were the only data available as the regional study area covers part of the 'unorganized' portion of the province, where polygon data are not available.
m = metres

All records in the Ontario Drillhole Database were considered as disturbances. Based on work type descriptions, exploration records in the AFRI database were considered as potential physical disturbances only if they contained one or more of the following work types (AFRI codes in parentheses):

- Diamond Drilling:
  - Diamond Drilling (PDRILL);
  - Boring other than core drilling (PBORE);
  - Overburden drilling (POVERB); or

- (OTHER).
- Line Cutting:
  - Line cutting (LC);
  - Recutting claim lines once every 5 years (PRECUT); or
  - Manual (PMAN).
- Stripping/Trenching:
  - Overburden stripping (PSTRIP);
  - Bedrock trenching (PTRNCH);
  - Digging pits (PITS); or
  - Open cutting (PCUT).

While line cutting activities were initially included as physical disturbances, their small footprint (approximately 1% of the exploration polygon based on a 1.5 m to 2.0 m width every 200 m), ephemeral nature (cutting was above ground and regrowth of vegetation began the following growing season), and the absence of specific location data within exploration polygons resulted in them being removed from consideration as physical disturbances. The AFRI contained records of line cutting in 97 polygons covering 404 km^2. After screening out duplicate records and records of exploration activities that did not result in physical disturbances to the exploration area, the following data and procedures were used to estimate physical disturbance to habitat from exploration activities:

- 1,293 drillhole locations from the Ontario Drillhole Database are located within the RSA;
  - 1,042 locations matched 158 drilling polygon records in the AFRI data set;
  - mean drillholes per drilling polygon record: 1,042/158 = 6.6;
  - 251 Drill hole locations were not associated with any AFRI record; and
  - all drillholes were applied as disturbances.
- 158 records in the AFRI database with drilling activity noted but without any drillhole locations in the Ontario Drillhole Database. The 158 records were within 158 unique polygons covering 500 km^2:
  - based on mean drillholes per drillhole polygon calculated above, six random points were generated in each of the polygons for each year in which drilling was recorded as having occurred and applied to represent the disturbance from exploration activity;
  - the drillhole polygons themselves were not applied as disturbances;
  - 126 records in the AFRI database with stripping or trenching activity noted. The 126 records related to 126 unique polygons covering 327 km2; and
  - the stripping/trenching polygons were applied such that the exploration disturbance footprint was the entire polygon.

The incremental changes from the Project and other developments on habitat loss were estimated by calculating the relative difference between the baseline and reference case and between the application and baseline case. The following equations were used:

- (2012 baseline value – reference value)/reference value; and
- (application case value – 2012 baseline value)/2012 baseline value.

Each resulting value was then multiplied by 100 to give the percent change in a habitat loss for each comparison, and providing both direction and magnitude of the effect. For example, a high negative value would indicate a substantial loss of that habitat type.

The incremental changes to habitat fragmentation from the Project and other developments were estimated by calculating the difference between reference, baseline and application cases using the following equations:

- 2012 baseline value – reference value; and
- application value – 2012 baseline value.

A change in the hydrology has the potential to cause direct mortality to plants, reduce reproductive success, and decrease interspecific competitive advantage for available resources (Poff and Ward 1989), which in turn may transform the type of plant communities being supported by that habitat. An assessment of likely effects from changes in habitat state and condition was based on the calculation of the amount habitat potentially altered or lost for EAIs in the RSA. Mean baseline and application water levels were calculated for water bodies and watercourses affected by the Project. These data were considered in combination with predicted changes to the lake areas and watercourse lengths to assess the effect of changes to downstream flows on vegetation EIAs.

Magnitude is a measure of the intensity of a residual effect on an EAI, or the degree of change caused by the Project relative to baseline conditions (i.e., effect size). Magnitude is specific to each EAI and is classified into three scales: negligible to low, moderate, and high. Magnitude is a function of the numerical and qualitative changes in measures (e.g., numerical changes in habitat, and hydrology and moisture regimes; Table 2-1). Changes in these measures are used to predict effects to the abundance and distribution of plant populations and communities (vegetation EAIs), and the ability to be self-sustaining. Therefore, the magnitude of residual effects is assessed at the population and community levels (e.g., RSA).

To provide an ecologically relevant classification of effect sizes of changes in measures for a particular EAI, the assessment of magnitude includes the known or inferred ability of the associated plant populations and/or communities to absorb or otherwise accommodate disturbance and have the adaptive capability to be self-sustaining. Similar to animals, self-sustaining populations (and communities) can be considered as healthy, robust populations capable of withstanding environmental change and accommodating random population processes (Reed et al. 2003). The ecological characteristics of a particular plant population and/or community (e.g., life history traits) may provide it with the defences and adaptive capacity to withstand stresses from landscape change, which could include physical damage, changes in lighting levels and temperature, and increased competition. For example, high seed production and seedling survival rates allow for replacement of individuals, and good dispersal ability provides connection among fragmented habitats. Alternately, species that are sensitive to change (or less adaptable) may respond by declining in distribution and abundance gradually or immediately.

A concept closely related to ecological adaptability is ecological resilience. Ecosystems and populations often have inertia and will continue to function after disturbance up to the point where the disturbance becomes severe enough that the ecosystem or population changes. Ecological resilience is the capability of the system to absorb disturbance, and reorganize and retain the same structure, function, and feedback responses (Holling 1973; Gunderson 2000). Population resilience can be considered to share similar features as ecological resilience with adaptability influencing the ability of the population to absorb or recover from change. Highly resilient EAIs have the potential to recover quickly after reclamation (i.e., they are also adaptable), whereas EAIs with narrower resilience limits will recover more slowly or may not recover at all.

Where specific life history information was not available for vegetation EAIs, general ecological principles are discussed in context of the magnitude of the residual effects from changes to the physical environment. Quantitative measures of the change to the physical environment were used to aid in the qualitative magnitude of the effect. Definitions for the three categories of magnitude are:

Negligible to Low: There is no measurable residual effect to the abundance and distribution of plant populations and communities.

Moderate: The residual effect to the abundance and distribution of plant populations or communities is measurable, but the changes are well within the predicted adaptive capability to be self-sustaining.

High: The residual effect to the abundance and distribution of plant populations or communities is expected to be large enough that the changes are approaching the predicted adaptive capability limits to be self-sustaining.

2.6 Existing and Previous Habitat Conditions

Under existing (2012) conditions, the LSA is mainly comprised of dense mixed forest habitat (41.6%; 4,938 ha). Coniferous forest and deciduous forest account for 17.8% (2,105 ha) and 1.7% (201 ha) of the LSA, respectively. The LSA is comprised of 13.4% (1,590 ha) water and 3.8% (455 ha) sparse forest. Wetland habitat covers 5.2% (615 ha) of the LSA. Treed bog (109 ha) and open bog (2 ha) habitats each comprise less than 1.0% of the LSA. Recent harvested forest and regenerating areas make up 7.6% (902 ha) and 7.9% (939 ha) of the LSA, respectively (Attachment I).

The RSA is primarily comprised of mixed forest (41.2%, 156,220 ha) and coniferous forest (25.1%, 94,921 ha) habitats under 2012 baseline conditions. Deciduous forest, sparse forest, treed bog and water constitute between 3.1% and 10.4% of the RSA. Open bog, treed fen and wetland habitats together make up less than 1.0% of the RSA. Existing disturbance, including recent fire, comprises approximately 9.5% of the RSA and is primarily associated with recent harvested forest areas (7.4%). Remaining linear and non-linear human disturbances such as residual mine infrastructure, buildings, campgrounds and primary and local all-season roads and trails make up 2.1% of the RSA.

Previous and existing developments have removed between 1.9% and 2.6% of dense deciduous forest, wetland, and water habitats, relative to reference conditions (Table 2-8). Between 9.5% and 18.7% of dense coniferous forest, dense mixed forest, sparse forest, treed bog, and open bog habitats in the RSA have been removed by previous and existing developments, including forestry operations. No treed fen habitat has been removed by previous and existing developments in the RSA. There has been a 42.8% (1,179 ha) increase in recent burn habitat in the RSA from reference to 2012 baseline conditions.

Table 2-8: Percent Change of Habitat Types in the Regional Study Area from Reference to 2012 Baseline Conditions

Habitat	Reference (ha)	Reference to 2012 Baseline
dense coniferous forest	106,814	-11.1
dense deciduous forest	14,425	-2.6
dense mixed forest	175,870	-11.2
sparse forest	22,375	-9.5
treed fen	504	0
treed bog	13,376	-11.0
open bog	908	-18.7
wetland	1,700	-2.1
water	40,091	-1.9
regenerating	0	NA[a]
recent burn	2,753	42.8
recent logged	0	NA[b]

Notes:
[a] Percent change could not be calculated because there was no modelled regenerating habitat under reference conditions.
[b] Percent change could not be calculated because there was no modelled recent logged habitat under reference conditions.
NA - not applicable

3.0 PREDICTION OF RESIDUAL EFFECTS

3.1 Construction Phase

3.1.1 Vegetation Loss and Fragmentation

The Project (including the portion of the transmission line that is located within the RSA) is predicted to alter 1,713 ha (14.4%) of the land cover in the LSA. It is estimated that 166 ha (9.7% of the physical footprint) will be located in recent harvested forest area. The remainder of the physical footprint will disturb between 21.1% and 29.0% (32 to 224 ha) of treed bog, sparse forest, regenerating and wetland habitats in the LSA. The physical footprint will remove 11.8% (249 ha) and 14.6% (720 ha) of dense coniferous forest and dense mixed forest in the LSA. Approximately 8.7% (18 ha) of dense deciduous forest and 2.4% (38 ha) of open water cover types will be altered. The Project is not expected to disturb open bog or treed fen habitats.

The Project is expected to alter 0.5% (1,785 ha) of the RSA relative to existing conditions. Most of the change will occur within wetland (11.0%) and jack pine regenerating (13.7%) habitats. There is possible overlap of these two habitat types with other habitat classes and so the proportion lost of these land cover classes is likely overestimated. For example, it was difficult to separate regenerating jack pine habitat and forest depletion-cuts (recent logged habitat). Wetland habitat may be treed bog, treed fen, open bog, open fen or marsh (Table 3-2). Less than 1% of the dense deciduous forest, dense coniferous forest, dense mixed forest, sparse forest, treed bog, open water and recent harvest cover types will be altered by the Project (and the proposed power line located within the RSA). Open bog, treed fen and recent burn habitats will not be disturbed by the Project.

Table 3-1: Comparison of Land Cover Distribution between Reference Case, Baseline Case, Application Case and Closure Case

Land Cover Type	Land Cover Distribution							
	Reference Case[a]		Baseline Case[b]		Application Case[c] (ha)		Closure Case[d] (ha)	
	Area (ha)	% RSA	Area (ha)	% RSA	Area (ha)	% RSA	Area (ha)	% RSA
Bog - open	907.8	0.2	737.9	0.2	737.9	0.2	737.9	0.2
Bog - treed	13,375.7	3.5	11,901.6	3.1	11,869.3	3.1	11,869.3	3.1
Depletion - Fire	2,752.7	0.7	3,931.5	1.0	3,931.5	1.0	3,931.5	1.0
Fen - treed	503.6	0.1	503.5	0.1	503.5	0.1	503.5	0.1
Forest - dense coniferous	106,814.2	28.2	94,921.3	25.1	94,608.4	25.0	94,608.4	25.0
Forest - dense deciduous	14,425.1	3.8	14,043.7	3.7	14,015.3	3.7	14,015.3	3.7
Forest - dense mixed	175,869.5	46.4	156,219.9	41.2	155,427.1	41.0	155,427.1	41.0
Forest - sparse	22,375.4	5.9	20,256.4	5.3	20,157.1	5.3	20,157.1	5.3
Forest Depletion - cuts	0.0	0.0	28,189.6	7.4	27,922.3	7.4	27,922.3	7.4
Jack Pine Regeneration/Cut	0.0	0.0	270.3	0.1	233.3	0.1	233.3	0.1
Disturbance[e]	0.0	0.0	6,860.8	1.8	8,646.1	2.3	8,646.1	2.3
Water	40,091.4	10.6	39,315.8	10.4	39,286.6	10.4	39,286.6	10.4
Wetland	1,700.0	0.4	1,664.4	0.4	1,480.6	0.4	1,480.6	0.4
Residual Disturbances[f]	0.0	0.0	0.0	0.0	0.0	0.0	348.7	0.1
Revegetation[g]	0.0	0.0	0.0	0.0	0.0	0.0	1,440.9	0.4
Total	378,815.4	100.0	378,816.8	100.0	378,819.0	100.0	380,608.6	100.5[h]

Notes:
(a) Reference Case refers to pre-disturbance conditions
(b) Baseline Case refers to present conditions
(c) Application Case includes maximum amount of disturbance incurred from the Project
(d) Closure Case refers to conditions after operations have ceased, open pit has been flooded, water realignments have been removed and site has been revegetated
(e) Includes exploration facilities and roads/trails
(f) Includes the flooded open pit, seepage collection/surge ponds, and transmission line alignment
(g) Includes aggregate pits, MRA, TMF, ancillary facilities, landfill, ore stockpiles, pit roads, and access roads
(h) Total percent value may not equal 100% due to rounding.

Table 3-2: Net Changes in Land Cover Distribution from Reference Case to Baseline Case, from Baseline Case to Application Case, and from Reference Case to Application Case in the Regional Study Area

Land Cover Type	Net Change in Land Cover Distribution								
	Reference Case[a] to Baseline Case[b]			Baseline Case to Application Case[c]			Reference Case to Application Case		
	Area (ha)	%Unit	%RSA	Area (ha)	%Unit	%RSA	Area (ha)	%Unit	%RSA
Bog - open	-169.8	-18.7	0.0	0.0	0.0	0.0	-169.8	-18.7	0.0
Bog - treed	-1,474.1	-11.0	-0.4	-32.3	-0.3	0.0	-1,506.4	-11.3	-0.4
Depletion - Fire	1,178.8	42.8	0.3	0.0	0.0	0.0	1,178.8	42.8	0.3
Fen - treed	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0
Forest - dense coniferous	-11,892.9	-11.1	-3.1	-312.8	-0.3	-0.1	-12,205.8	-11.4	-3.2
Forest - dense deciduous	-381.4	-2.6	-0.1	-28.4	-0.2	0.0	-409.8	-2.8	-0.1
Forest - dense mixed	-19,649.6	-11.2	-5.2	-792.8	-0.5	-0.2	-20,442.4	-11.7	-5.4
Forest - sparse	-2,119.0	-9.5	-0.6	-99.3	-0.5	0.0	-2,218.3	-10.0	-0.6
Forest Depletion - cuts	28,189.6	n/a	7.4	-267.4	-0.9	-0.1	27,922.3	n/a[g]	7.3
Jack Pine Regeneration/Cut	270.3	n/a	0.1	-37.1	-13.7	0.0	233.3	n/a[g]	0.1
Disturbance[d]	6,860.8	n/a	1.8	1785.3	26.0	0.5	8,646.1	n/a[g]	2.3
Water	-775.6	-1.9	-0.2	-29.3	-0.1	0.0	-804.9	-2.0	-0.2
Wetland	-35.6	-2.1	0.0	-183.8	-11.0	0.0	-219.4	-13.1	0.0
Residual Disturbances[e]	0.0	n/a	0.0	0.0	n/a	0.0	0.0	n/a	0.0
Revegetation[f]	0.0	n/a	0.0	0.0	n/a	0.0	0.0	n/a	0.0
Total	1.4	0.0	0.0	2.2	0.0	0.0	3.6	0.0	0.0

Notes:
(a) Reference Case refers to pre-disturbance conditions
(b) Baseline Case refers to present conditions
(c) Application Case refers to maximum disturbance from Project
(d) Includes exploration facilities and roads/trails
(e) Includes the flooded open pit, seepage collection/surge ponds, and transmission line alignment
(f) Includes aggregate pits, MRA, TMF, ancillary facilities, landfill, ore stockpiles, pit roads, and access roads
(g) These values cannot be calculated since this land cover type was not modelled in the Reference Case

In addition to measuring habitat loss, patch dynamics is a key factor affecting the long-term survival of vegetation populations and communities. Fragmentation of contiguous habitat into smaller patches limits the colonization ability of older successional plants, which often have large seeds and propagate slowly, primarily via vegetative reproduction. Increased distances between patches, coupled with increased edge habitat generally results in a change from shade tolerant species to rapidly dispersing early successional species and provides increased colonization opportunities for non-native species. Results of the FRAGSTATS analysis indicates that patch number within the RSA will decrease by 0.2% of baseline values, that mean patch size within the RSA will increase by 0.1 ha or <1% of baseline values and that the amount of edge habitat within the RSA will be decreased by 337.1 ha (0.5% of baseline values) at maximum disturbance levels from the Project (Table 3-3 and Table 3-4).

No measureable changes to the abundance and distribution of plant populations and communities are expected as a result of habitat loss and fragmentation. Disturbance to plant populations and communities will be restricted to the Project footprint and these changes are likely to occur continuously throughout the construction phase. These local changes are expected to be partially reversible at the end of construction (2 years).

Table 3-3: Mean Patch Number, Patch Size, Edge Distance, and Distance to Nearest Neighbour for the Reference Case, Baseline Case and Application Case in the Regional Study Area

Land Cover Type	Reference Case[a]				Baseline Case[b]				Application Case[c]			
	Number of Patches	Mean Patch Area (ha)	Total Edge (km)	Distance to NN[d] (km)	Number of Patches	Mean Patch Area (ha)	Total Edge (km)	Distance to NN[d] (km)	Number of Patches	Mean Patch Area (ha)	Total Edge (km)	Distance to NN[d] (km)
Bog - open	344	2.6	265.5	0.6	157	4.7	175.9	1.5	157	4.7	175.9	1.5
Bog - treed	3,053	4.4	3,214.0	0.2	2,022	5.9	2,652.5	0.3	2,009	5.9	2,640.8	0.3
Depletion - Fire	66	41.7	380.5	0.2	2	1,965.8	89.8	0.3	2	1,965.8	89.8	0.3
Fen - treed	95	5.3	134.9	0.6	95	5.3	133.4	0.6	95	5.3	133.4	0.6
Forest - dense coniferous	11,343	9.4	21,982.6	0.1	11,356	8.4	20,361.0	0.1	11,309	8.4	20,284.0	0.1
Forest - dense deciduous	5,202	2.8	5,154.6	0.2	5,179	2.7	5,034.9	0.2	5,176	2.7	5,027.4	0.2
Forest - dense mixed	6,542	26.9	29,060.6	0.1	7,634	20.5	28,188.9	0.1	7,716	20.1	28,066.1	0.1
Forest - sparse	10,557	2.1	9,053.9	0.2	10,672	1.9	8,440.3	0.2	10,602	1.9	8,392.3	0.1
Water	1,695	23.7	4,470.1	0.3	1,431	27.5	4,318.0	0.4	1,437	27.3	4,315.7	0.4
Wetland	729	2.3	575.1	0.4	772	2.2	576.8	0.4	779	1.9	546.8	0.4
Disturbance[e]	0	0.0	0.0	0.0	491	14.0	3,819.5	0.3	493	17.5	3,856.1	0.3
Forest Depletion - cuts	0	0.0	0.0	0.0	4,634	6.1	5,847.4	0.1	4,594	6.1	5,786.4	0.2
Jack Pine Regeneration /Cut	0	0.0	0.0	0.0	174	1.6	94.3	0.1	142	1.6	83.2	0.1

Notes:

(a) Reference Case refers to pre-disturbance conditions

(b) Baseline Case refers to present conditions

(c) Application Case refers to maximum disturbance from Project
(d) NN = Nearest Neighbour. This represents the distance from one patch to another.
(e) Includes exploration facilities, trails, open pit, seepage collection/surge ponds, transmission line alignment, aggregate pits, MRA, TMF, ancillary facilities, landfill, ore stockpiles, pit roads, and access roads

Table 3-4: Change in Patch Number, Patch Size, Edge Distance and Distance to Nearest Neighbour from Reference Case and Baseline Case to Application Case in the Regional Study Area

Land Cover Type	Net Change in Metrics											
	Reference Case[a] to Baseline Case[b]				Baseline Case to Application Case[c]				Reference Case to Application Case			
	Number of Patches	Mean Patch Area (ha)	Total Edge (km)	Mean Distance to NN[d] (km)	Number of Patches	Mean Patch Area (ha)	Total Edge (km)	Mean Distance to NN[d] (km)	Number of Patches	Mean Patch Area (ha)	Total Edge (km)	Mean Distance to NN[d] (km)
Bog - open	154	2.1	-89.6	0.8	0	0.0	0.0	1.5	-187	2.1	-89.6	0.8
Bog - treed	2,018	1.5	-561.5	0.1	-13	0.0	-11.7	0.3	-1,044	1.5	-573.2	0.1
Depletion - Fire	-40	1,924.1	-290.7	0.1	0	0.0	0.0	0.3	-64	1,924.1	-290.7	0.1
Fen - treed	90	0.0	-1.5	0.0	0	0.0	0.0	0.6	0	0.0	-1.5	0.0
Forest - dense coniferous	11,347	-1.0	-1621.6	0.0	-47	0.0	-77.0	0.1	-34	-1.0	-1,698.6	0.0
Forest - dense deciduous	5,176	-0.1	-119.7	0.0	-3	0.0	-7.5	0.2	-26	-0.1	-127.2	0.0
Forest - dense mixed	7,607	-6.4	-871.7	0.0	82	-0.4	-122.8	0.1	1,174	-6.8	-994.5	0.0
Forest - sparse	10,670	-0.2	-613.6	0.0	-70	0.0	-48.0	0.1	45	-0.2	-661.6	0.0
Water	1,407	3.8	-152.1	0.0	6	-0.2	-2.3	0.4	-258	3.6	-154.4	0.0
Wetland	770	-0.1	1.7	0.0	7	-0.3	-30.0	0.4	50	-0.4	-28.3	0.0
Disturbance[e]	491	14.0	3,819.5	0.3	2	3.5	36.6	0.3	493	17.5	3,856.1	0.3
Forest Depletion - cuts	4,634	6.1	5,847.4	0.1	-40	0.0	-61.0	0.2	4,594	6.1	5,786.4	0.2

Land Cover Type	Net Change in Metrics											
	Reference Case[(a)] to Baseline Case[(b)]				Baseline Case to Application Case[(c)]				Reference Case to Application Case			
	Number of Patches	Mean Patch Area (ha)	Total Edge (km)	Mean Distance to NN[(d)] (km)	Number of Patches	Mean Patch Area (ha)	Total Edge (km)	Mean Distance to NN[(d)] (km)	Number of Patches	Mean Patch Area (ha)	Total Edge (km)	Mean Distance to NN[(d)] (km)
Jack Pine Regeneration/ Cut	174	1.6	94.3	0.1	-32	0.0	-11.1	0.1	142	1.6	83.2	0.1

Notes:
(a) Reference Case refers to pre-disturbance conditions
(b) Baseline Case refers to present conditions
(c) Application Case refers to maximum disturbance from Project
(d) NN = Nearest Neighbour. This represents the distance from one patch to another.
(e) Includes exploration facilities, trails, open pit, seepage collection/surge ponds, transmission line alignment, aggregate pits, MRA, TMF, ancillary facilities, landfill, ore stockpiles, pit roads, and access roads

3.1.2 Changes in Downstream Flows

A change in the hydrology has the potential to cause direct mortality to plants, reduce reproductive success, and decrease interspecific competitive advantage for available resources (Poff and Ward 1989), which in turn may transform the type of plant communities being supported by that habitat. An assessment of likely effects from changes in habitat state and condition was based on the calculation of the amount habitat potentially altered or lost for EAIs in the RSA. Mean baseline and application water levels were calculated for water bodies affected by the Project. These data were considered in combination with predicted changes to the lake areas and watercourse lengths to assess the effect of changes to downstream flows on vegetation EIAs.

Predicted changes to average annual water levels [metres above sea level (masl)] from baseline conditions to operation conditions with discharge of the TMF to Bagsverd Creek and discharge to Mesomikenda Lake are provided in Table 3-5 and Table 3-6, respectively. For both scenarios, the most extreme changes in water levels are notably a rise of approximately 2 m in Unnamed Lake #2 and a decrease of approximately 2 m for Little Clam Lake in comparison with baseline water levels. As the Project progresses from operations to closure stage II, water levels in Little Clam Lake are expected to decrease slightly from operation levels and water levels in Bagsverd Creek are expected to remain similar to operation levels (Table 3-7).

Because the flooding of Unnamed Lake #2 will be sustained through the operation phase and post closure stage II (50 to 80 years), wetlands are expected to become established in the flooded area. The current upland plant communities (i.e., jack pine regeneration, forest depletion cuts, dense mixed forest and dense coniferous forest) are expected to be replaced by wetland community types. Decreased water levels in Clam Lake during life of the Project, into post-closure stage II will expose areas of shoreline around the lake. The current upland plant communities (i.e., dense mixed forest) surrounding Little Clam Lake are expected to remain unchanged but are likely to occupy the exposed shoreline area.

Changes to hydrology are not expected to eliminate any of the baseline plant community types. The small proportion of the existing vegetation cover that will be altered because of changes to hydrology from Project activities is predicted to have a negligible effect (i.e., not measureable) on the abundance and distribution of upland and wetland plant populations and communities. With re-establishment of natural flow patterns following post-closure stage II, plant communities will likely re-establish according to moisture and soil conditions not influenced by the Project.

Changes to the abundance and distribution of plant populations and communities resulting from alterations in hydrology are expected to be limited to the Project footprint. Changes are expected to occur continuously throughout the construction phase and are expected to be partially reversible at the end of construction.

Table 3-5: Change in Average Water Levels (masl) with Discharge from the Polishing Pond to Bagsverd Creek from Baseline to Operation Phase

Location	Watershed	Baseline to Operational Stage		
		Wet Climate Conditions 1:25 yr	Average Climate	Dry Climate Conditions 1:25 yr
Mesomikenda Lake	Mesomikenda	0	0	0
Neville Lake	Mesomikenda	0	0	0
Somme River	Mesomikenda	0	0	0
Bagsverd Creek	Mesomikenda	0	0	0
Polishing Pond Effluent Discharge at Basgverd Creek	Mesomikenda	0	0	-0.1
Un-named Lake 2	Mesomikenda	**2.1**	1.6	**2.7**
Bagsverd Lake	Mesomikenda	0.6	0.6	0.6
Schist Lake	Mesomikenda	0	0	0
Little Clam Lake	Mollie River	**-2.1**	-1.6	**-2.7**
West Beaver Pond	Mollie River	0.4	0.4	0.3
Three Ducks Lakes	Mollie River	0.1	0.1	0.4
Weeduck	Mollie River	-0.6	-0.5	-0.4
Mill Pond	Mollie River	0	0	0
Cote Lake	Mollie River	n/a	n/a	n/a
Clam Lake	Mollie River	-0.9	-0.9	-0.8
Chester Lake	Mollie River	1.5	1.5	1.5

Notes:
Values in bold indicate changes in average water levels ⩾ 2 m.
yr - year

Table 3-6: Change in Average Water Levels (masl) with Discharge from the Polishing Pond to Mesomikenda Lake from Baseline to Operation Phase

Locations	Watershed	Baseline to Operational Stage		
		Wet Climate Conditions 1:25 yr	Average Climate	Dry Climate Conditions 1:25 yr
Mesomikenda Lake	Mesomikenda	0	0	0
Neville Lake	Mesomikenda	0	0	0
Somme River	Mesomikenda	0	0	0
Bagsverd Creek	Mesomikenda	-0.1	0	-0.1
Polishing Pond Effluent Discharge at Basgverd Creek	Mesomikenda	0	0	-0.1
Un-named Lake 2	Mesomikenda	**2.1**	1.6	**2.7**
Bagsverd Lake	Mesomikenda	0.6	0.6	0.6
Schist Lake	Mesomikenda	0	0	0
Little Clam Lake	Mollie River	**-2.5**	**-2.5**	**-2.4**
West Beaver Pond	Mollie River	0.4	0.4	0.3
Three Ducks Lakes	Mollie River	0.1	0.1	0.4
Weeduck	Mollie River	-0.6	-0.6	-0.4
Mill Pond	Mollie River	0	0	0
Cote Lake	Mollie River	n/a	n/a	n/a
Clam Lake	Mollie River	-0.9	-0.9	-0.8
Chester Lake	Mollie River	1.5	1.5	1.5

Notes:
Values in bold indicate changes in average water levels ⩾ 2 m.
yr - year

Table 3-7: Change in Average Water Levels (masl) from Baseline to Post Closure Stage II

Locations	Watershed	Baseline to Post Closure Stage II		
		Wet Climate Conditions	Average Climate	Dry Climate Conditions
		1:25 yr		1:25 yr
Mesomikenda Lake	Mesomikenda	0.0	0.0	0.0
Neville Lake	Mesomikenda	0.0	0.0	0.0
Somme River	Mesomikenda	0.0	0.0	0.0
Bagsverd Creek	Mesomikenda	-0.1	0.0	-0.1
Polishing Pond Effluent Discharge at Basgverd Creek	Mesomikenda	n/a	n/a	n/a
Un-named Lake 2	Mesomikenda	**2.1**	1.6	**2.6**
Bagsverd Lake	Mesomikenda	0.6	0.6	0.6
Schist Lake	Mesomikenda	0.0	0.0	0.0
Little Clam Lake	Mollie River	**-2.8**	**-2.9**	**-3.2**
West Beaver Pond	Mollie River	0.0	0.0	0.0
Three Ducks Lakes	Mollie River	0.1	0.2	0.5
Weeduck	Mollie River	-0.8	-0.7	-0.7
Mill Pond	Mollie River	0.0	0.0	0.0
Cote Lake	Mollie River	0.1	0.1	0.0
Clam Lake	Mollie River	-0.9	-0.9	-0.8
Chester Lake	Mollie River	1.5	1.5	1.5

Notes:
Values in bold indicate changes in average water levels ⩾ 2 m
yr - year

3.2 Operations Phase

Effects to all vegetation EAIs from Project operations are expected to be similar to those predicted during construction (Section 3.1.1 through Section 3.1.2). Effects are likely to occur continuously throughout the operations phase for all EAIs and are expected to be partially reversible at the end of operations (15 years).

3.3 Closure Phase

Effects to all vegetation EAIs from Project closure are expected to be similar to those predicted during construction (Section 3.1.1 through Section 3.1.2). Effects are likely to occur continuously throughout the closure phase for all EAIs and are anticipated to be partially reversible at the end of closure (2 years).

3.4 Post-Closure Phase

Effects at the beginning of post-closure are expected to be similar to those predicted during construction (Section 3.1.1 through Section 3.1.2) but should decrease over time. The TMF and MRA will be partially covered with overburden and revegetated during the closure phase (Section 5; Conceptual Closure and Reclamation Plan). However, as overburden will not be placed on the entire MRA and TMF, it is unknown when revegetation of these structures will be complete. Therefore, the local residual effects to plant populations and communities from habitat alteration associated with the MRA and TMF are predicted to be partially reversible with a duration of greater than 15 years after closure of the Project.

The open pit is expected to be refilled within 50 to 80 years of the start of the post-closure phase (Section 5: Conceptual Closure and Reclamation Plan). However, the effects to plant populations and communities associated with the open pit are expected to be partially reversible with a duration of greater than 15 years after Project closure. Vegetation has to re-establish on the margins of the open pit, which will likely happen after water levels are constant.

Local effects from habitat alteration associated with the transmission line on vegetation EAIs are expected to be reversed within a few years after Project closure.

4.0 CONCLUSIONS

4.1 Upland Plant Community Types

Previous and existing developments have removed 9% of upland plant community types, relative to reference conditions in the RSA. The Project is anticipated to remove 13% of the habitat that supports upland plant communities (3% of which is composed of logging depletion cuts and jack pine regeneration/cuts) in the LSA and 0.4% of the upland plant community habitat in the RSA. Dewatering of water bodies and realignment of watercourses in the LSA may affect the upland plant community quantity by changing the quality of the supporting habitat. Changes are anticipated to be measurable at the local scale but are expected to have a negligible effect on the upland plant community abundance and distribution in the RSA. Plant community changes resulting from changes to hydrology will likely remain in effect until flows are allowed to return to natural conditions, following post-closure stage II.

Forestry is expected to have a larger influence on the upland plant community populations in the RSA as human developments not related to forestry (e.g., mineral exploration, recreational lodges, and roads) have disturbed about 2.1% of the RSA since reference conditions. In contrast, recent harvested areas (less than 18 years old) currently cover 7.4% of the RSA. Forest harvesting operations have occurred in the RSA since 1800, with most harvesting activities occurring in the last 25 to 30 years. Most harvesting has occurred in dense coniferous forest (46.1% of harvested area; 7,590 hectare [ha]) and dense mixed forest (46.5% of harvested area; 7,653 ha) habitats. Habitat quantity and quality are probably not limiting for the upland plant communities in the RSA. These communities are common throughout the RSA and the greater surrounding ecoregion.

Following closure, the effects on upland plant community habitats from the residual footprint of the Project (3% of the LSA, 0.1% of the RSA) are predicted to be partially reversible with a duration of greater than 15 years after closure. Changes in habitat quantity and quality from the Project are anticipated to be measurable at the local scale. However, the changes represent less than 1% of the total available habitat within the RSA and are anticipated to have no measurable residual effect on the abundance and distribution of upland plant populations and communities in the RSA.

Changes to the quantity and quality of habitats (ELC types) from the Project and other developments in the RSA are expected to have a measurable effect on upland plant populations and communities, but are predicted to not influence the ability of EAIs to be self-sustaining. Most of the effect to plant populations can be attributed to forestry activities, while the Project and other types of human development are expected to have no measurable residual effect on upland plant community abundance and distribution.

4.2 Wetlands

Wetlands consist of open bog, treed bog, treed fen, and wetland cover types. Previous and existing developments have removed 10% of wetlands, relative to reference conditions. The Project is anticipated to remove 2% of the habitat that currently supports wetlands in the LSA and 1.5% of the wetland habitat in the RSA, relative to 2012 baseline conditions.

Dewatering of water bodies and realignment of watercourses in the LSA may affect the quantity of wetlands by changing the quality of the habitat available. While 9,812 m of watercourse is expected to be lost due to the Project, habitat compensation in the new realignments is expected to introduce 7,912 m of watercourse, resulting in a recovery of approximately 80% of the total watercourse length lost.

Habitat loss calculations (Table 3-2) suggest that the Project will affect 10% of the wetlands available in the RSA. It is assumed that this wetland loss value is overestimated. In an effort to improve the delineation of wetland polygons within the LSA, a combination of ground-truthed data and interpretation of remote imagery was incorporated into the development layer. The wetland cover for the remainder of the RSA was estimated from available digital mapping only. To test this assumption the ground-truthed polygons were removed and replaced with the original land cover data. This process was completed to remove inconsistencies in the land cover data and provide a more accurate comparison of available habitat proportions in the RSA. Using digitally derived ground cover only, the Project appears to affect 0.3% of the wetlands available in the RSA. Since the proportion of wetlands affected by the Project is predicted to be low and the site hydrology will be maintained, no measurable residual effects to wetlands are predicted, provided that habitat compensation for the water realignments includes features and functions of the present watercourses. These changes are expected to be partially reversible with a duration of greater than 15 years after closure, when natural flows are returned following post-closure stage II.

Lake areas are expected to have a net increase of 3 ha with changes to the baseline hydrology and applied compensation. Most notably, the shorelines around Chester Lake and the south arm of Bagsverd Lake are expected to increase, inundating the adjacent communities. Consequently, a small area of wetland is expected to become lake habitat (45 ha; 0.3% of baseline wetland habitat). This loss is a conservative estimate, since upland plant communities surrounding the flooded areas will become more suitable for supporting wetlands over time. Consequently, changes are anticipated to be measurable at the local scale but are expected to have no detectable effect on wetland abundance and distribution in the RSA relative to natural fluctuations that occur from wet and dry cycles.

Effects from the Project and previous and existing developments on the abundance and distribution of wetlands are expected to be measurable but predicted to not influence the ability of EAIs to be self-sustaining. Wetlands are common throughout the RSA and there should be sufficient undisturbed habitat in the RSA for the continued persistence of this EAI.

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ATTACHMENT I

Terrestrial Baseline Studies, Côté Gold Project

November 3, 2014
Report No. 13-1197-0003R

November 3, 2014

REVISED REPORT

2013 TERRESTRIAL BASELINE STUDY CÔTÉ GOLD PROJECT

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Report Number: 13-1197-0003R

Distribution:

1 e-copy - IAMGOLD Corporation

1 copy - Golder Associates Ltd.

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1.0 INTRODUCTION

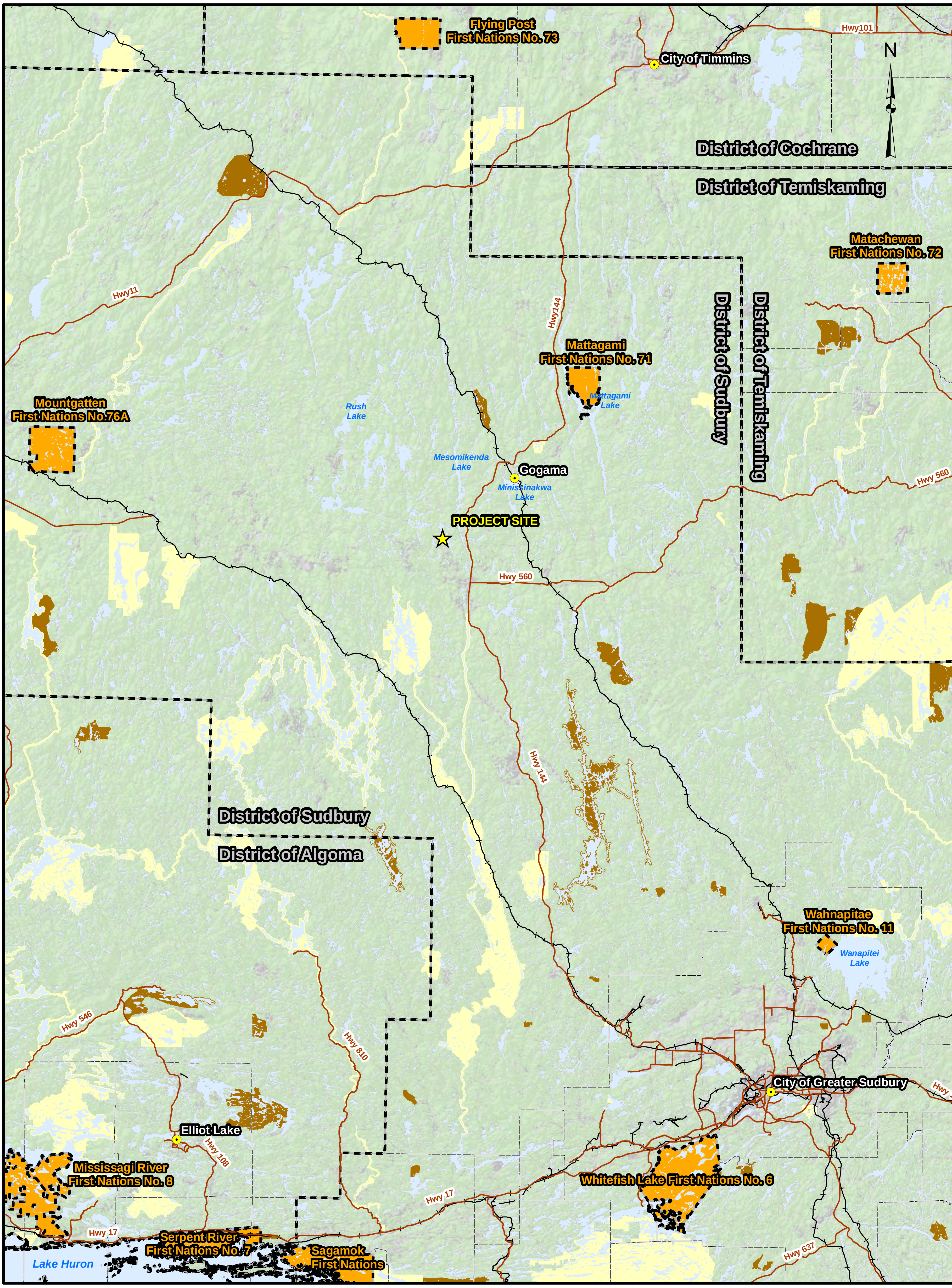
IAMGOLD Corporation (IAMGOLD) is planning to develop the Côté Gold Project (the Project) located approximately 20 kilometres (km) south-west of Gogama, 130 km south-west of Timmins and 200 km north-west of Sudbury (see Figure 1).

This document is one of a series of physical, biological and human environment baseline reports to describe the current environmental conditions at the Project site. These baseline reports are written to support the Environmental Assessment (EA) process.

Several consultants have been involved in the baseline data collection and the preparation of the reports, namely AMEC Environment & Infrastructure (AMEC), Golder Associates Ltd. (Golder), Minnow Environmental Inc. (Minnow) and Woodland Heritage Services Ltd.

The reports include:

- Physical Environment:
  - Air Quality;
  - Noise (and Vibration);
  - Hydrology and Climate;
  - Hydrogeology;
  - Geochemistry and Geology; and
  - Surface and Ground Water Quality.
- Biological Environment:
  - Terrestrial Biology (Soil, Vegetation, Wildlife, Biodiversity and Protected Areas); and
  - Aquatic Biology.
- Human Environment:
  - Land and Resource Use;
  - Aboriginal Traditional Knowledge and Land Use;
  - Cultural Heritage Resources;
  - Archaeology;
  - Visual Aesthetics; and
  - Socio-Economics.



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LEGEND

- Project Site Location
- Regional Communities
- Major Roads
- Railway
- Upper Tier Municipal Boundary
- Lower Tier Municipal Boundary
- Waterbody / Large Watercourse
- Wooded Areas
- Conservation Reserve (Regulated)
- Provincial Park
- First Nation Reserve

REFERENCE

*Figure1 Based on info provided by AMEC(Feb. 26, 2013)
Base Data - MNR NRVIS, CANMAP v2008.4
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources,

Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

35,000 0 35,000
SCALE 1:850,000 METRES

PROJECT
IAMGOLD CÔTÉ GOLD PROJECT

TITLE
Key Plan

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Feb. 2013	FIGURE: 1	
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	Dec. 2013		

1.1 Overview of the Côté Gold Project

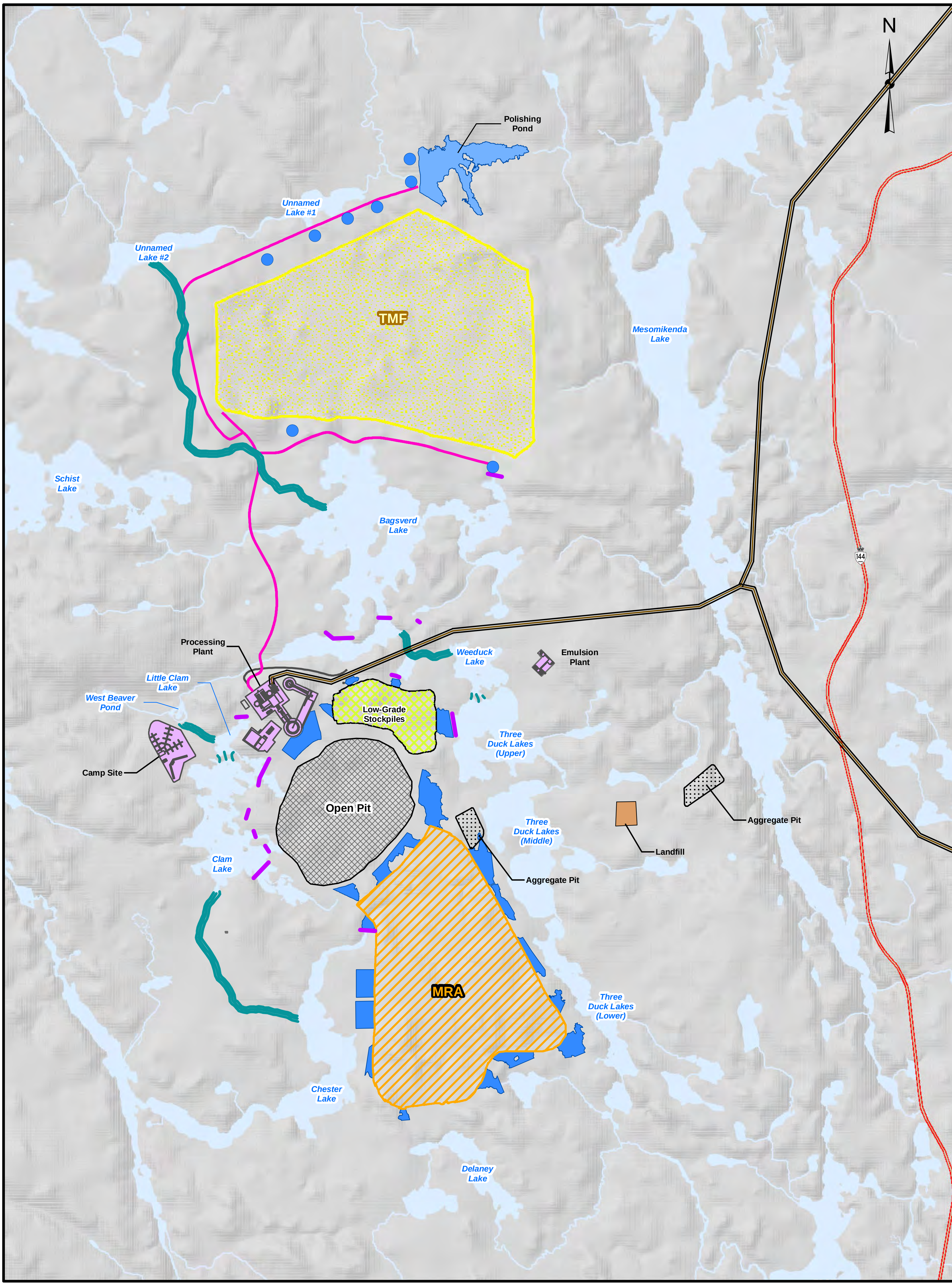
IAMGOLD is planning to construct, operate and eventually reclaim a new open pit gold mine at the Côté Gold Project site.

The proposed site layout places the required mine-related facilities in close proximity to the open pit, to the extent practicable. The proposed site layout is presented in Figure 2 showing the approximate scale of the Côté Gold Project. The site plan will be refined further as a result of ongoing consultation activities, land purchase agreements and engineering studies.

The Project footprint will fully or partially affect several water features. These include Côté Lake, portions of Three Duck Lakes, Clam Lake, Mollie River/Chester Lake system and Bagsverd Creek. As a result, these water features will need to be realigned for safe development and operation of the open pit.

The main proposed Project components are expected to include:

- open pit;
- ore processing plant;
- maintenance garage, fuel and lube facility, warehouse and administration complex;
- construction and operations accommodations complex;
- explosives manufacturing and storage facility (emulsion plant);
- various stockpiles [low-grade ore, overburden and mine rock area (MRA)] in close proximity to the open pit;
- aggregate extraction with crushing and screening plants;
- Tailings Management Facility (TMF);
- on-site access roads and pipelines, power infrastructure and fuel storage facilities;
- potable and process water treatment facilities;
- domestic and industrial solid waste handling facilities (landfill);
- water management facilities and drainage works, including watercourse realignments; and
- transmission line and related infrastructure.



LEGEND

- Realignment Dams
- Transmission Line
- Watercourse Realignment
- Tailings and Reclaim Pipeline
- Highway 144
- Low-Grade Stockpiles
- Aggregate Pit
- Polishing Pond
- Facilities
- Landfill
- Open Pit
- Mine Rock Area (MRA)
- Collection Ponds
- Tailings Management Facility (TMF)
- Waterbodies
- Creek / River

2,000 0 2,000

SCALE 1:45,000 METRES

REFERENCE

Open Pit Shell provided by IAMGOLD, May 2013
Base Data - MNR NRVIS, CANMAP v2008.4
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources,

Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Site Plan

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Feb. 2013	FIGURE: 2	
GIS	AL	Oct. 2013		
CHECK	BW	Oct. 2013		
REVIEW	DJ	Dec. 2013		

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2.0 SCOPE OF WORK

Golder was retained by IAMGOLD to complete a baseline study of the terrestrial plant and wildlife communities within the Project site and surrounding area potentially affected by the Project. The Project site includes the nine claim blocks within the MRA, the TMF, and an Open Pit (Figure 2).

The development of a transmission line alignment (TLA) is also being considered as part of the Project. However, terrestrial baseline plant and wildlife studies for the TLA were undertaken by AMEC as part of their scope of work and is presented in AMECs report titled *IAMGOLD Corporation Côté Gold Project: Terrestrial Ecology Baseline Study for the Proposed Transmission Line*, dated July 2013.

The purpose of this baseline study is to characterize existing conditions, identify potential environmental constraints associated with the Project site and to present information that may support future permit applications and Closure Plans. This report summarizes the baseline terrestrial conditions of the Project site and supplements information provided in a review of existing data submitted to IAMGOLD in March 2013.

Baseline characterisation of the terrestrial environment is an initial phase in advancing an exploration property towards permitting for extraction and operation. The surveys and results presented in this report were completed as per methods outlined in the revised scope of work titled *Terrestrial Biology and Investigations to Support Environmental Assessment for the Côté Gold Project,* dated April 4, 2012. The following tasks were completed to generate a baseline characterisation of the terrestrial environment within the study areas (see Section 3.0) delineated for the Project:

- desktop records review;
- reconnaissance survey;
- plant community (including listed species) surveys;
- breeding bird surveys;
- marsh bird surveys;
- waterbird breeding ground surveys;
- whip-poor-will (*Antrostomus vociferous*) and common nighthawk (*Chordeiles minor*) surveys;
- basking turtle surveys;
- amphibian surveys;
- owl surveys;
- bat surveys; and
- winter track count surveys.

Results of these studies are expected to provide IAMGOLD with an understanding of the terrestrial flora and fauna within the study areas delineated for the Project and can be used as a basis for ongoing monitoring studies, as appropriate.

3.0 STUDY AREAS

The study areas selected for the Project define spatial boundaries within which the environmental effects of the Project are considered. For the purpose of the Project, study areas and spatial boundaries will be referred to collectively as study areas.

The Terms of Reference (ToR) and Environmental Impact Statement (EIS) Guidelines require that the study areas defined therein, and described below, encompass the physical works and activities of the Project where effects are expected or likely to occur, and where effects will be studied. The study areas were selected to incorporate the likely spatial extent of likely effects, as well as considering traditional and local knowledge, and ecological, technical, social, and cultural aspects.

Footprint

The Project site footprint (the footprint) includes the Open Pit, the MRA, the TMF, the Low Grade Ore Stockpile, the Camp, the water diversions, and all supporting and/or ancillary facilities and infrastructure (Figure 2).

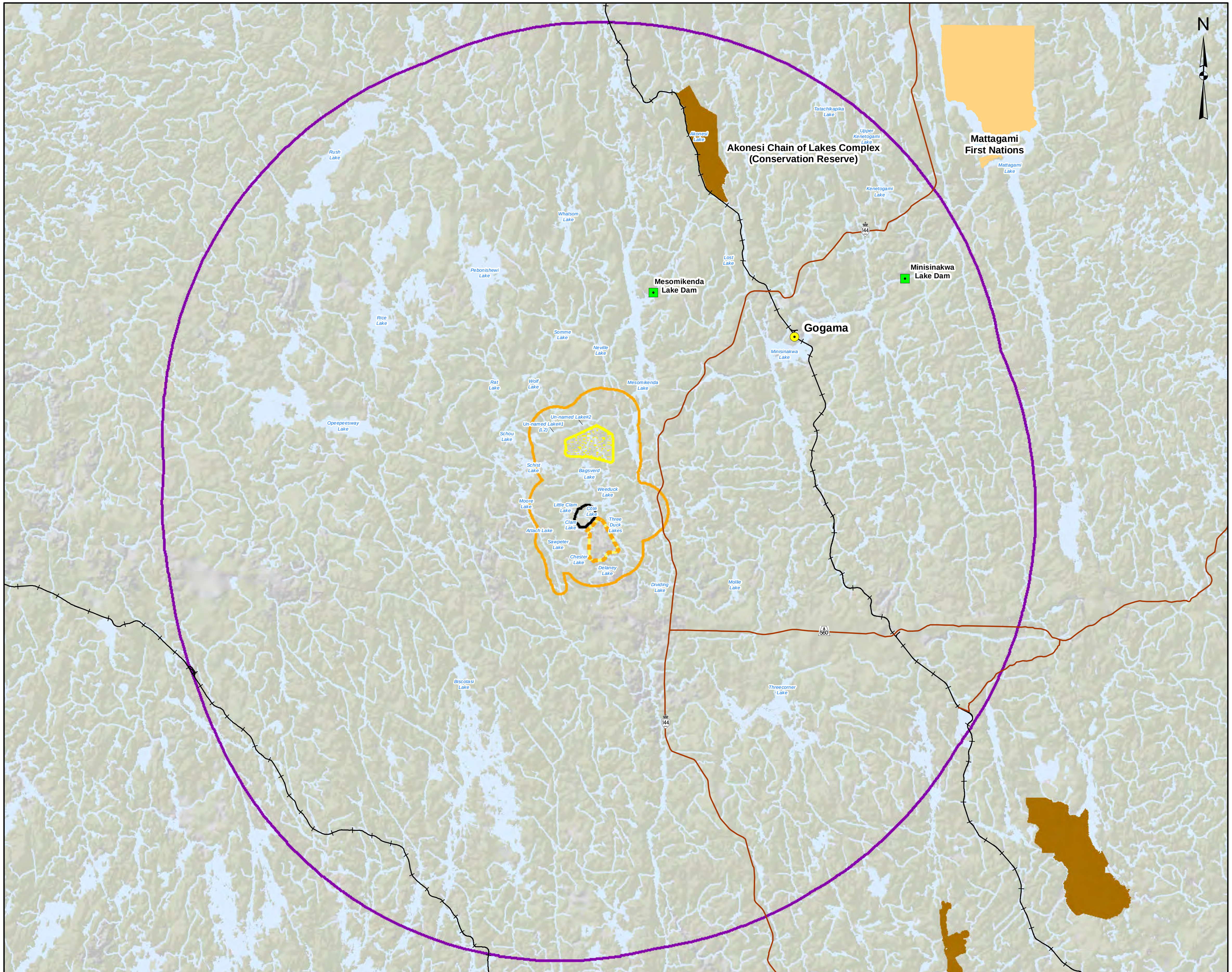
Local Study Area

The Local Study Area (LSA) is common to each selected Ecological Indicator (EI) and extends beyond the footprint provided by AMEC (Theben 2013, pers. comm.). The LSA encompasses a 2 km buffer around the footprint and extends to the south-west to include Chester Lake (Figure 3).

Regional Study Area

The Regional Study Area (RSA) was selected to capture the predicted maximum spatial extent of the combined direct and indirect effects of the Project on soil, vegetation, and wildlife species. To be conservative, the RSA is defined as an approximately 30 km buffer (i.e., extends 28 km beyond the LSA) around the footprint (Figure 3). The RSA is anticipated to be an appropriate spatial boundary for quantifying baseline conditions and assessing Project-specific and cumulative effects on vegetation and larger ranging species [i.e., moose (*Alces alces*), black bear (*Ursus americanus*), and eastern wolf (*Canis lupus*)].

The RSA defined by Golder overlaps with the TLA LSA included in AMECs scope of work (Figure 4). For the purpose of this baseline study, areas surveyed by Golder that fall within the TLA LSA will be included in Golder's characterization of RSA terrestrial biology, provided in this report. All areas within the RSA defined by Golder that were surveyed by AMEC as part of their terrestrial baseline studies of the TLA will included in the AMEC report titled *IAMGOLD Corporation Côté Gold Project: Terrestrial Ecology Baseline Study for the Proposed Transmission Line Alignment*, dated July 2013.



LEGEND

- Dams
- Major Roads
- Railway
- First Nation Reserve
- Mine Rock Area (MRA)
- Tailings Management Facility (TMF)
- Open Pit
- Conservation Reserve (Regulated)
- Terrestrial Local Study Area
- Terrestrial Regional Study Area
- Rivers
- Waterbody / Large Watercourse

REFERENCE

Base Data - MNR NRVIS, CANMAP v2008.4
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2013
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

6,700 0 6,700

SCALE 1:300,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Study Areas

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012	FIGURE: 3	
GIS	AL	Oct. 2013		
CHECK	JB	Oct. 2013		
REVIEW	DJ	Dec. 2013		

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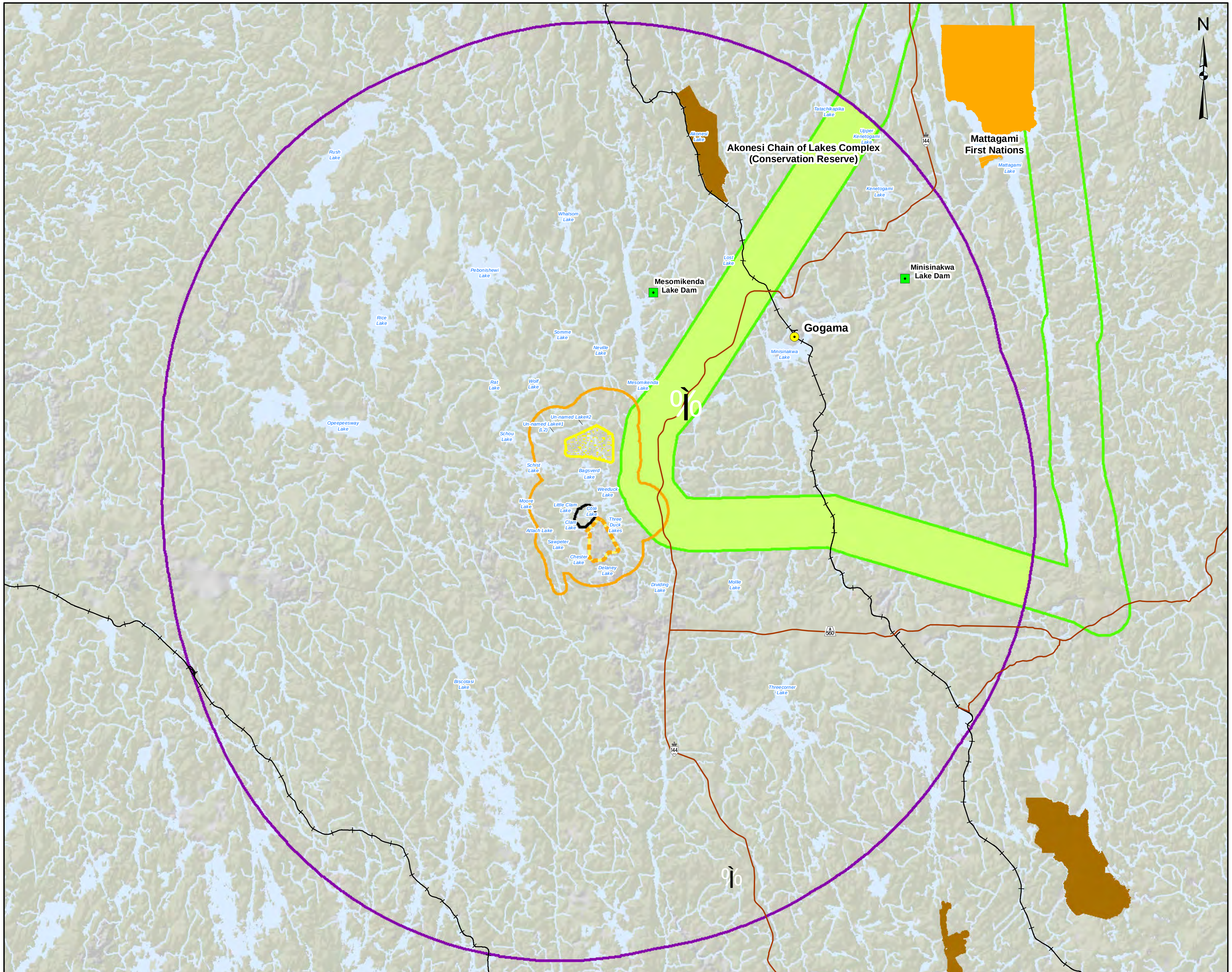

LEGEND

- Dams
- Major Roads
- Railway
- First Nation Reserve
- Mine Rock Area (MRA)
- Tailings Management Facility (TMF)
- Open Pit
- Conservation Reserve (Regulated)
- Terrestrial Local Study Area
- Terrestrial Regional Study Area
- AMEC Regional Study Area
- Area where Golder & AMEC Baseline Regional Study Areas Overlap
- Rivers
- Waterbody / Large Watercourse

REFERENCE

Base Data - MNR NRVIS, CANMAP v2008.4
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2013
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

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SCALE 1:300,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Overlap between the Site Regional Study Area and AMEC's TLA Local Study Area

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012		
GIS	JMC/RRD	July 2013		
CHECK	JB	July 2013		
REVIEW	DJ	Dec 2013		

FIGURE: 4

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4.0 METHODS

4.1 Desktop Records Review

A desktop records review was completed to search for and analyze publically available records pertaining to the RSA to determine if it contains or is near a significant natural feature. Information requests were submitted to the Timmins District Ontario Ministry of Natural Resources (MNR), to identify potential natural environmental constraints associated with the Project site. Databases, including those maintained by the MNR and the Natural Heritage Information Centre (NHIC) were consulted to obtain natural environment resource information on wildlife habitat, listed species occurrences, wetland mapping [Provincially Significant Wetlands (PSW)] and locations of Areas of Natural and Scientific Interest (ANSI). Other relevant databases, including the *Species at Risk Act* (SARA), the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the Species at Risk in Ontario (SARO), were searched via the internet to identify the presence of potential constraints. Existing literature specific to the nearby Chester Mine (located 2.5 km west of Côté Lake) and literature related to species at risk identified as having potential to occur on or near the RSA was also reviewed.

4.1.1 Species at Risk

The potential presence of nationally and provincially listed species at risk was determined by searching the NHIC (2013), SARO (2013), COSEWIC (2013), and SARA (2013) databases and existing species' range information, and through discussions with the planning biologist for the Timmins District MNR (Copeland 2012, pers. comm.). Based on a comparison of this information to the current Project site conditions, an assessment of the potential for occurrences of species at risk was made.

A ranking of low indicates no suitable habitat availability at the survey location and no specimens were observed in similar habitats. Moderate probability indicates potential for the species to occur, as suitable habitat types were present at the survey location, but the species was not observed in similar habitat. High potential indicates a known species record on/adjacent to the survey location (including during field surveys or background data review) and good quality habitat is present.

4.2 Aerial Reconnaissance

An aerial reconnaissance survey was conducted on April 21, 2012, to determine the accuracy of land cover data, select detailed survey locations for plant community and breeding bird surveys and to locate raptor nests potentially used by bald eagle (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*) in the LSA. A Eurocopter Astar helicopter was used to survey the perimeter of waterbodies large enough to support raptors. The survey was conducted during favorable weather conditions (e.g., good visibility, complete snow cover and good flying weather). Weather conditions, including temperature, cloud cover and visibility were recorded on the day of the survey.

Survey routes were flown at a height of 60 m to 100 m above-ground at a speed of approximately 60 km per hour (km/hr). Surveys were conducted by two Golder observers; one in the front seat acted as a navigator and observer and one in the back seat, behind the navigator, acted as an observer/recorder. Locations of stick nests observed and visual sightings of raptors were marked with a Global Positioning System (GPS) unit and recorded on data sheets and digital image maps. For each raptor observation, observers recorded the number of individuals, maturity level (if possible), location, and ecosite phase/wetland type that the bird was using or flying over. For stick nest observations, observers noted whether the nest was occupied or unoccupied (if possible).

Incidental wildlife sightings, including other wildlife species, raptors, and wildlife tracks observed during the aerial survey, were recorded.

4.3 Plant Community Surveys

An Ecological Land Classification (ELC) system was used to define ecosites within digitally derived Land Cover 2000 polygons (land cover) (Spectranalysis Inc. 2004). An ELC provides a consistent framework for operational planning of forests, wetlands, wildlife habitat, natural heritage, and planning applications (Banton et al. 2009). Using an ELC approach, the baseline ecosites were mapped for the LSA.

Generally, ecosite mapping is undertaken as a part of an EA, as it provides a means of relating vegetation conditions with other environmental components such as soils and terrain. Ecosites can also be used in the process of evaluating the effects of proposed mining developments and associated infrastructure (International Union for Conservation of Nature and International Council on Mining and Minerals 2003)

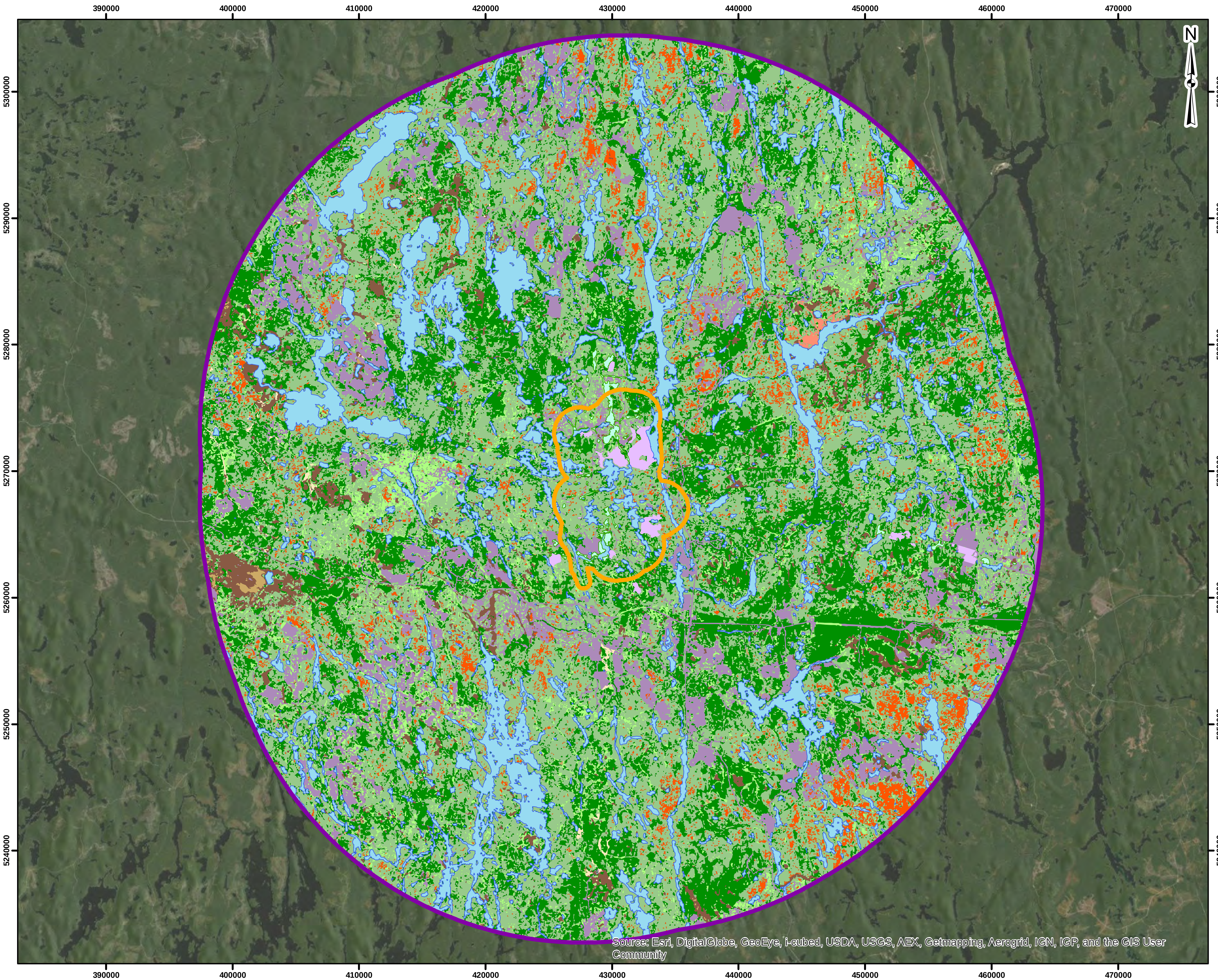
Plant community mapping was initially completed as a desktop exercise using information acquired during the desktop review. Figure 5 shows the distribution of available land cover throughout the RSA. Existing information was used to identify habitats with potential to support plant species at risk. Preliminary desktop mapping of upland and wetland plant communities were ground-truthed and detailed plant species inventories were completed from September 1 to 10, 2012 and from July 6 to 8, 2013. Golder biologists surveyed a representative subset of each land cover type identified during the desktop review (Figure 6). In total, 50 plots were sampled in the LSA and 27 were sampled in the RSA.

Plant community survey plots were established in a representative location within an ecosite (Figure 6). Approximate boundaries of the ecosite were determined from land cover data and an aerial reconnaissance of the polygon prior to arriving at each survey location. Following boundary confirmation, each ecosite was surveyed in the field to determine the general vegetation cover and terrain.

The plant communities were classified to the ecosite level of detail using the Ecosites of Ontario (Banton et al. 2009) ELC system, which includes both terrestrial and wetland plant community types. At each location, plant species were inventoried, and the percent cover of each vegetation stratum was estimated. The stratum refers to a layer of vegetation, for example, the tree stratum or the shrub stratum. Ecosites were characterized by noting species composition, abundance and cover within the various strata present.

Soil was described using guidance provided by the Field Guide to the Substrates of Ontario (Johnson et al. 2010). Substrate observations from inspection pits dug with Dutch augers were used to determine effective texture of the substrate and moisture regime at locations representing the prevailing substrate conditions. If more than one texture, moisture regime or vegetation condition was encountered, the most common or modal condition was chosen to describe the polygon (Johnson et al. 2010).

Uncommon vascular and non-vascular plant species were documented during the plant community surveys and, where required, collected for taxonomical identification. The two tallest trees at each survey plot were cored, and the diameter at breast height (DBH) and the height of those trees were recorded. If there were no trees over 5 m in a survey plot, no cores were taken. General site conditions (e.g., slope, aspect, percent surface substrate, and surface expression) were also recorded at each survey location.



LEGEND

- Terrestrial Local Study Area
- Terrestrial Regional Study Area
- Water - deep clear
- Wetland
- Settlement / Infrastructure
- Forest Depletion - cuts
- Jack Pine Regeneration/Cut
- Forest - sparse
- Forest - dense deciduous
- Forest - dense mixed
- Forest - dense coniferous
- Fen - treed
- Bog - open
- Bog - treed

REFERENCE

ArcGIS Online Basemaps published and hosted by ESRI®.
Sources: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

7,500 0 7,500

SCALE 1:300,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Land Cover Distribution in the Regional Study Area

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012	FIGURE: 5	
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	Dec. 2013		

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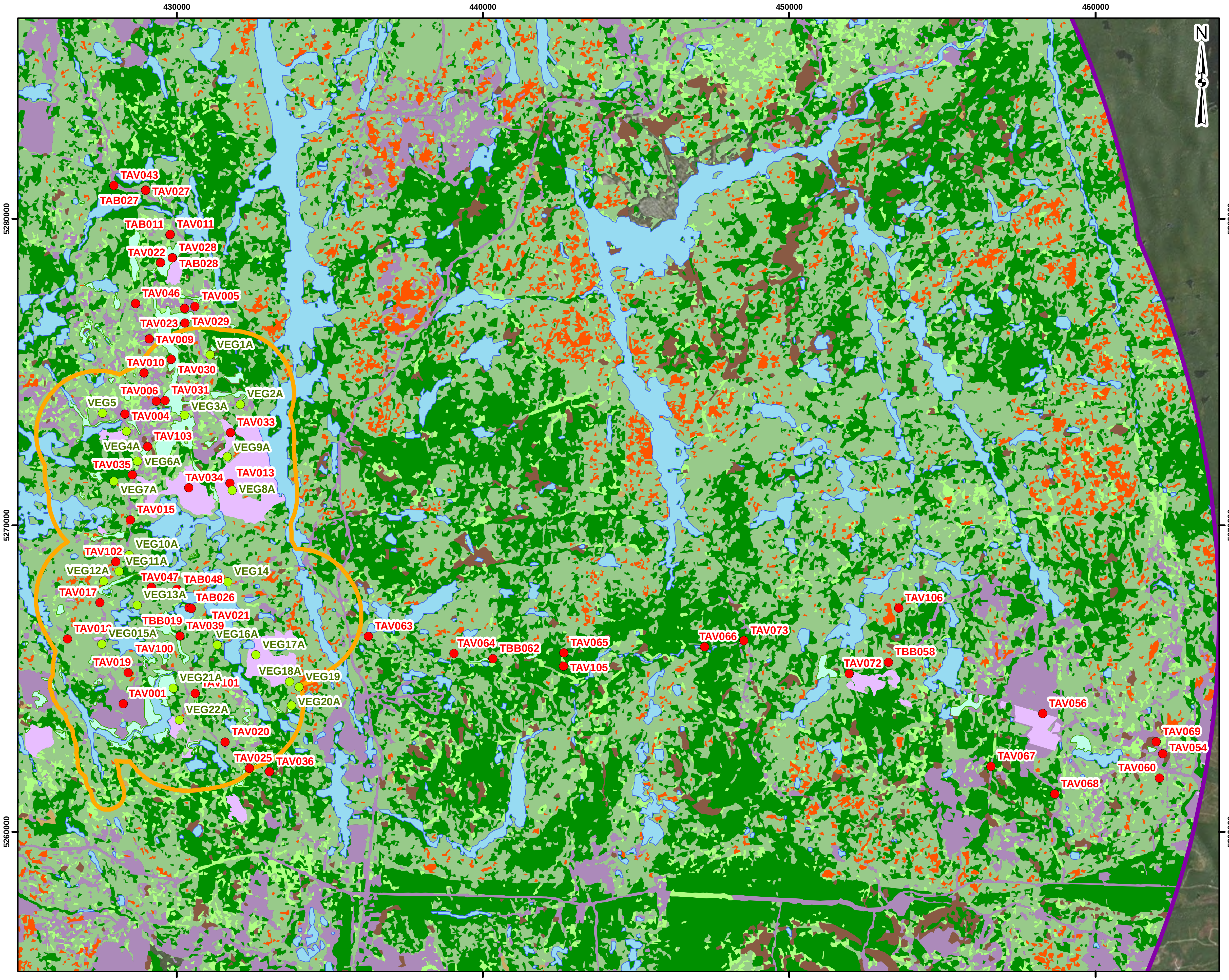
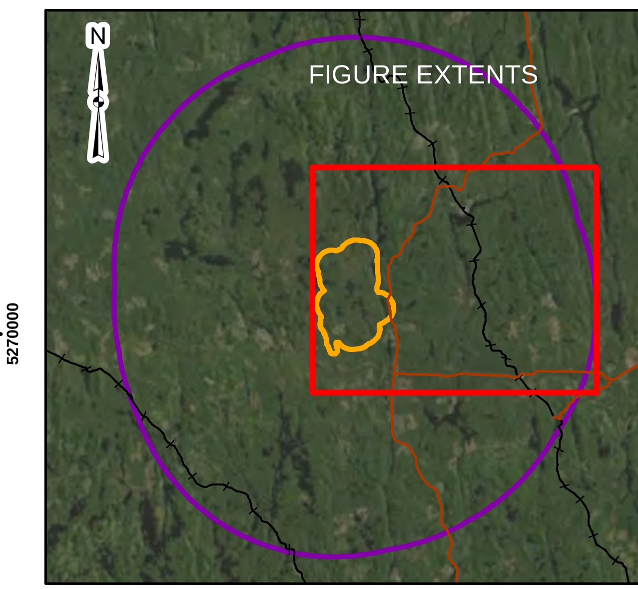


LEGEND

- Plant Community Survey Locations 2012
- Plant Community Survey Locations 2013
- Terrestrial Local Study Area
- Terrestrial Regional Study Area
- Water - deep clear
- Wetland
- Forest Depletion - cuts
- Jack Pine Regeneration/Cut
- Forest - sparse
- Forest - dense deciduous
- Forest - dense mixed
- Forest - dense coniferous
- Bog - open
- Bog - treed



REFERENCE

ArcGIS Online Basemaps published and hosted by ESRI®.
Sources: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

SCALE 1:125,000 METRES
2,800 0 2,800

PROJECT
IAMGOLD CÔTÉ GOLD PROJECT

TITLE
Plant Community Survey Locations within the Local and Regional Study Areas

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012		
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	JB	Dec. 2013		

FIGURE: 6

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4.3.1 Data Analysis

The plant community data collected during the field surveys were used to determine an ecosite for each land cover type identified in the LSA and RSA. Tree cores were used to determine the average age structure of plots surveyed within the LSA and RSA.

4.4 Breeding Bird Point Count Surveys

Upland breeding birds are commonly studied in baseline programs to determine the importance of habitats used by migratory upland birds for breeding and foraging activities. Most migratory bird species are protected under the *Migratory Birds Convention Act* (MBCA 1994). Upland breeding bird surveys were completed to describe species occurrence, relative abundance, and habitat use of songbirds and other bird species that nest in terrestrial/riparian habitat. The objectives of the breeding bird surveys were:

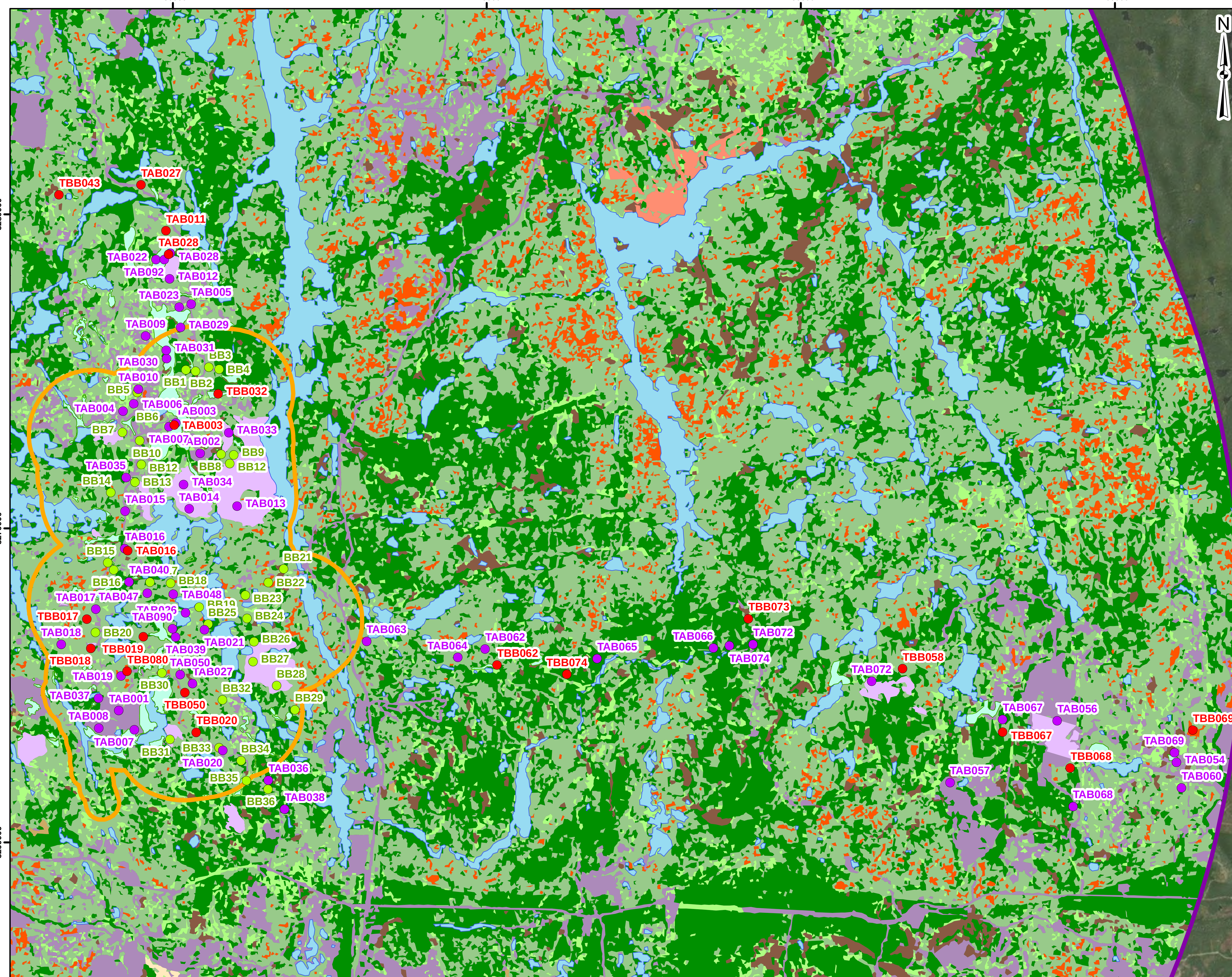
- to document upland bird species' relative abundance and richness within the RSA; and
- to assess the use of upland bird nesting habitats within the RSA.

The breeding season for upland breeding birds in Ontario is divided into early and late survey periods. The early breeding surveys were completed between June 1 and 7, 2012, and the late surveys were completed between July 7 and 11, 2012. An additional early round of breeding bird surveys was completed between June 4 and 8, 2013 to provide greater spatial coverage.

Breeding bird surveys began approximately 30 minutes before sunrise and ended no later than 10 a.m. (Ralph et al. 1993). Breeding bird survey locations were pre-selected to be representative of the proportion of land cover types identified in the RSA (Ralph 1993) (Figure 7). The plot centre for each of the survey locations were spaced a minimum of 250 m apart in forested habitats and 400 m apart in open habitats (e.g., grasslands, open wetlands) to avoid double counting of individuals.

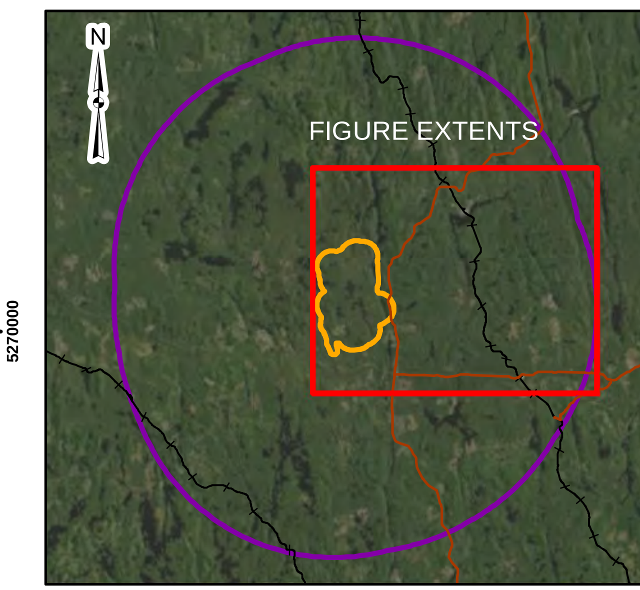
Each survey location consisted of a 50 m radius circular-plot; with an additional 50 m radius buffer (i.e., a total of 100 m radius was surveyed). Survey locations were selected in contiguous land cover types (Figure 7). A GPS unit was used to navigate to each pre-selected survey location and if the survey location was adjusted by field crews, a new GPS location was recorded. Prior to the start of the breeding bird survey at each plot, the observer waited two minutes to allow the birds to habituate to the observers' presence. A 10 minute survey period followed, and all species heard or seen in the survey area were recorded, with their respective distance from the plot centre.

An acoustic monitor (CZM Compression Zone® E3A-CM bioacoustics monitor with Marantz PMD 661 Digital Recorder) was used to record birds at each point location during the late 2012 breeding bird survey period. The acoustic monitor was assembled at each survey location and the recording was initiated. The plot number was spoken and recorded, followed by a two minute silent listening period. At the end of the 10 minute survey period, the recording was stopped. The recordings were downloaded to a computer at the end of each day. At the end of the field program, recordings were analyzed in the office by an experienced Golder ornithologist.



LEGEND

- Early Breeding Bird Survey Locations 2012
- Late Breeding Bird Survey Locations 2012
- Breeding Bird Survey Locations 2013
- Terrestrial Local Study Area
- Terrestrial Regional Study Area
- Water - deep clear
- Wetland
- Forest Depletion - cuts
- Jack Pine Regeneration/Cut
- Forest - sparse
- Forest - dense deciduous
- Forest - dense mixed
- Forest - dense coniferous
- Bog - open
- Bog - treed



REFERENCE

ArcGIS Online Basemaps published and hosted by ESRI®.
Sources: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

1,800 0 3,600

SCALE 1:125,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Breeding Bird Survey Locations
in the Local and Regional Study Areas

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012		
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	Dec. 2013		

FIGURE: 7

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Baseline\Figure7_BreedingBirdSurveyLocations_LSA.mxd

The following data were collected for each breeding bird survey location and for each incidental observation:

- Universal Transverse Mercator (UTM) co-ordinate of point count station;
- date and time of observation;
- species;
- number of individuals;
- habitat; and
- behavioural activity (e.g., flushed, territorial calls or displays, nest or nest with eggs and flyovers).

Poor weather such as high winds, rain, and fog can influence both the bird's behaviour and the observer's ability to visually and/or aurally identify individuals. Point count surveys were not completed during periods of high winds [i.e., Beaufort scale greater than five (trees in leaf sway)] or inclement weather that would reduce the likelihood of identifying species. In total, 98 point count surveys were completed in six land cover types (Table 1).

Table 1: Distribution of Upland Breeding Bird Point Count Surveys in the Regional Study Area by Land Cover Type, 2012 and 2013

Land Cover Type[(a)]	Number of Point Counts
Dense Coniferous Forest	25
Deciduous Forest	6
Dense Mixed Forest	36
Jack Pine Regeneration/Cut	14
Sparse Forest	7
Wetland	10
Total	98

Note:
[(a)] Source: Spectranalysis Inc. 2004

4.4.1 Data Analysis

Only observations within 50 m from the observers were used in the statistical analyses. Observations of upland breeding birds between 51 m to 100 m, flyovers, and observations of waterbirds and raptors were recorded as incidental observations and were used for generating a comprehensive species list, but were not used in the analyses.

Human error in distance estimation of auditory bird observations may cause bias in bird density estimates. To limit the potential for this bias, an effective detection radius (EDR) (Buckland et al. 2001) was calculated using the following formula (Bayne 2008, pers. comm.):

$$EDR = \sqrt{\frac{2}{\left[\left(\frac{2}{k^2}\right) * ln\left(\frac{n}{n_2}\right)\right]}}$$

where:

k = distance at which birds are declared as being in or out (i.e., 50 m);

n = total number of birds detected;

n_2 = total number of birds detected outside of the value of k.

The EDR was used as a detectability correction factor for density estimates. The EDR reduces bias in density estimates that may arise by missing birds within the sampling radius, recording birds inside the sampling radius as outside the sampling radius, or recording birds outside the sampling radius as inside the sampling radius (Buckland et al. 2001).

Data from the early surveys in 2012 and 2013 were combined to create a larger dataset for the analysis, thereby allowing for a more robust analysis. Data collected by acoustic monitors during the late 2012 survey period were not included in the statistical analysis as density estimates cannot reliably be estimated from these data. Instead, these data were used to help generate a comprehensive species list for the RSA.

Two levels of analysis were completed on the dataset. A species-level analysis examined the relative abundance (i.e., density) of individual species within each land cover type, and a community-level analysis examined the density and richness of all species in the bird community. Species richness was used as a measure of community composition for each land cover type based on Costello et al. (2004), which concluded that species richness provides the most suitable univariate measure of community composition. Species richness for each habitat type was determined using individuals recorded within the sampling radius (i.e., 50 m). Relative abundance was calculated as the number of individuals per area surveyed (i.e., within 50 m of the observer) and included only those bird species that were recorded within 50 m of the observer. One-way analysis of variance (ANOVA) and Tukey-Kramer mean comparisons were calculated in JMP 7.0 (SAS Institute Inc. 2007) and were used to determine if relative abundance of birds differed across habitat types.

4.5 Marsh Bird Surveys

Bird Studies Canada (BSC) marsh bird survey protocol (BSC 2012) was used as guidance for completing these surveys. Marsh bird surveys were completed to describe species occurrence and habitat use of bird species that nest in marsh habitat. The objectives of the marsh bird surveys were:

- to document the occurrence of marsh bird species within the LSA; and
- to assess the importance of marsh bird nesting habitats within the LSA.

Marsh bird surveys use an active survey approach and are complimentary to the breeding bird point count survey methods. The marsh bird surveys were completed between June 1 and 7, 2012, and the late surveys were completed between July 7 and 11, 2012 as per the BSC (2012) protocol, in conjunction with the breeding bird point count surveys. An additional early round of marsh bird surveys was completed between June 4 and 8, 2013 to provide greater spatial coverage.

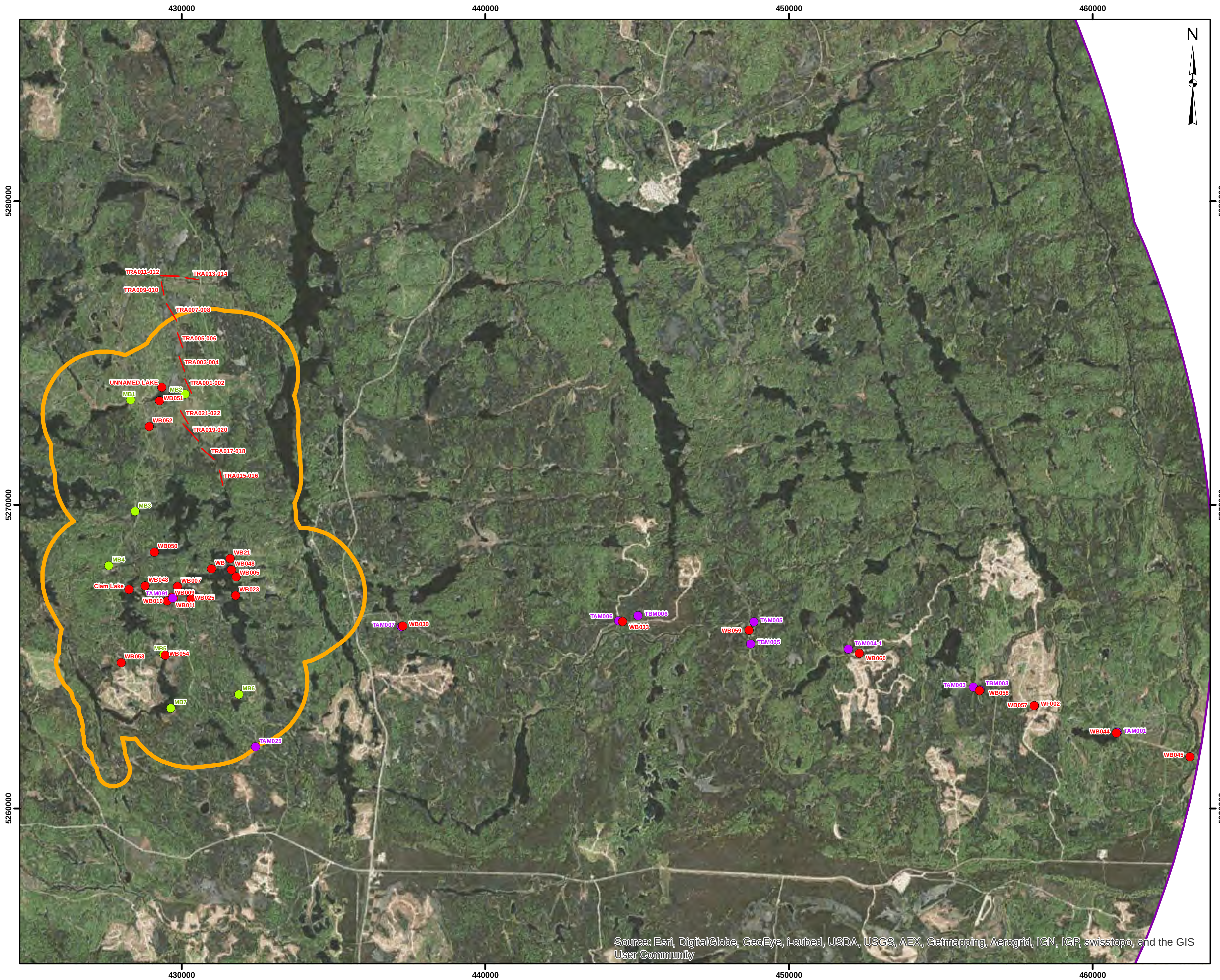
In total, nine marsh bird surveys were completed in the LSA between 2012 and 2013. Marsh bird surveys began approximately 30 minutes before sunrise and ended no later than 10 a.m. (Ralph 1993). Marsh bird surveys are weather dependant and were only completed during suitable weather conditions (i.e., low wind and no rain).

Marsh bird survey points were placed (Figure 8) at least 250 m apart in marsh habitat identified by the field crews as having the habitat characteristics (e.g., minimum marsh size, plant community diversity) required to provide suitable habitat for the focal species (i.e., Virginia rail [*Rallus limicola]*, sora [*Porzana Carolina*], least bittern [*Ixobrychus exilis]*, common moorhen [*Gallinula chloropus*], American coot [*Fulica americana]* and pied-billed grebe [*Podilymbus podiceps*]).

A 15-minute survey was completed at each point using a fixed-distance, 100 m radius semi-circular sampling area in which all birds seen or heard were recorded. Birds observed outside the 100 m radius were recorded as incidentals, however, focal mash bird species were recorded regardless of distance observed. Each survey began with a five minute silent listening period, followed by a five minute call broadcast period (using the Marsh Bird Monitoring Broadcast sound files) to elicit calls of the normally secretive focal marsh bird species, and ended with another five minute silent listening period.

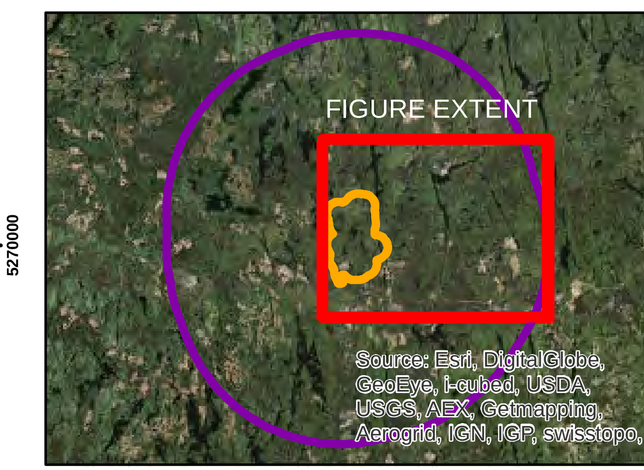
The following information was recorded during each 15-minute survey period:

- all focal species seen or heard within an unlimited-distance semi-circular area;
- all other bird species heard and/or seen within the 100 m station boundaries;
- focal species observed foraging within the 100 m station boundaries; and
- all non-focal species observed flying through or outside the 100 m station boundaries (tallied separately).



LEGEND

- Waterbird Survey Location Transects
- Marsh Bird Survey Locations 2012
- Waterbird Survey Locations 2012
- Marsh Bird Survey Locations 2013
- Terrestrial Local Study Area
- Terrestrial Regional Study Area



REFERENCE

ArcGIS Online Basemaps published and hosted by ESRI®.
Sources: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

3,100 0 3,100

SCALE 1:125,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Marsh Bird and Waterbird Survey Locations in the Local and Regional Study Areas

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 1
DESIGN	RRD	Dec. 2012	FIGURE: 8	
GIS	JMC/RRD	Nov. 2014		
CHECK	JB	Nov. 2014		
REVIEW	DJ	Nov. 2014		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Baseline\Figure8_MarshBirdWaterbirdSurveyLocations_LSA.mxd

4.5.1 Data Analysis

Locations of survey plots and incidental observations were recorded using GPS units. Data from GPS units were downloaded to a computer each evening by the field crew lead and datasheets were checked by the crew leads for errors and omissions at the end of each survey day, as part of Golder's Quality Assurance/Quality Control (QA/QC) program.

Due to the small sample size, no statistical analysis was performed on the marsh bird data set. Details on observations of focal marsh bird species are presented in the results section. Incidental observations of upland breeding birds made during the marsh bird surveys are presented in Appendix A.

4.6 Waterbird Breeding Ground Surveys

Surveys were designed to collect data on waterbirds breeding within the LSA. Waterbird breeding surveys were completed once the majority of late-nesting species arrived and dispersed onto breeding territories (typically between mid and late May). Ground surveys were completed between May 9 and 13, 2012. Waterbird breeding surveys were completed between dawn and 1:30 p.m.to take advantage of the best light conditions and the most bird activity. A second round of surveys was completed at three shoreline locations throughout the day (dawn until dusk) on June 6 and 7, 2012.

Waterbird sampling involved observers scanning wetlands from the shore to prevent flushing birds. Observers used topography (e.g., hillside vantage points) for scanning wetlands, and positioned themselves with the sun at their backs to prevent sun glare on the water from affecting their ability to observe birds. Observers recorded each waterbird species seen in the appropriate category: lone pair, lone male, lone female, grouped males, grouped females, unknown sex, and broods. During the second round of surveys, brood development was classified into three categories:

1) Downy young – no feathers visible.
2) Partly feathered – as viewed from the side.
3) Fully feathered – in profile.

The categories were further divided into subclasses based on feather colour and development.

Waterbird breeding ground surveys were completed in the LSA using seven, 500 m transects and 18 point count locations (Figure 8). Waterbird breeding ground surveys were completed in the RSA using four, 500 m transects and nine point count locations (Figure 8). The transects were established in the LSA along Bagsverd Creek with a 100 m separation to reduce the potential for double counting. Transects were surveyed from a canoe using a variable observation distance that extended to the wetted width of Bagsverd Creek. The point count locations were surveyed from shore, and from a canoe if conditions allowed, using an observation distance of 100 m.

4.6.1 Data Analysis

Estimations of area [in hectares (ha)] of each transect sampled were determined using ArcGIS® software. This provided a discrete area for each transect survey completed. Shoreline surveys recorded waterbird sightings in a half-circle with a 100 m radius. Densities for each species observed in each waterbody type were calculated to determine relative abundance of waterbirds in the LSA.

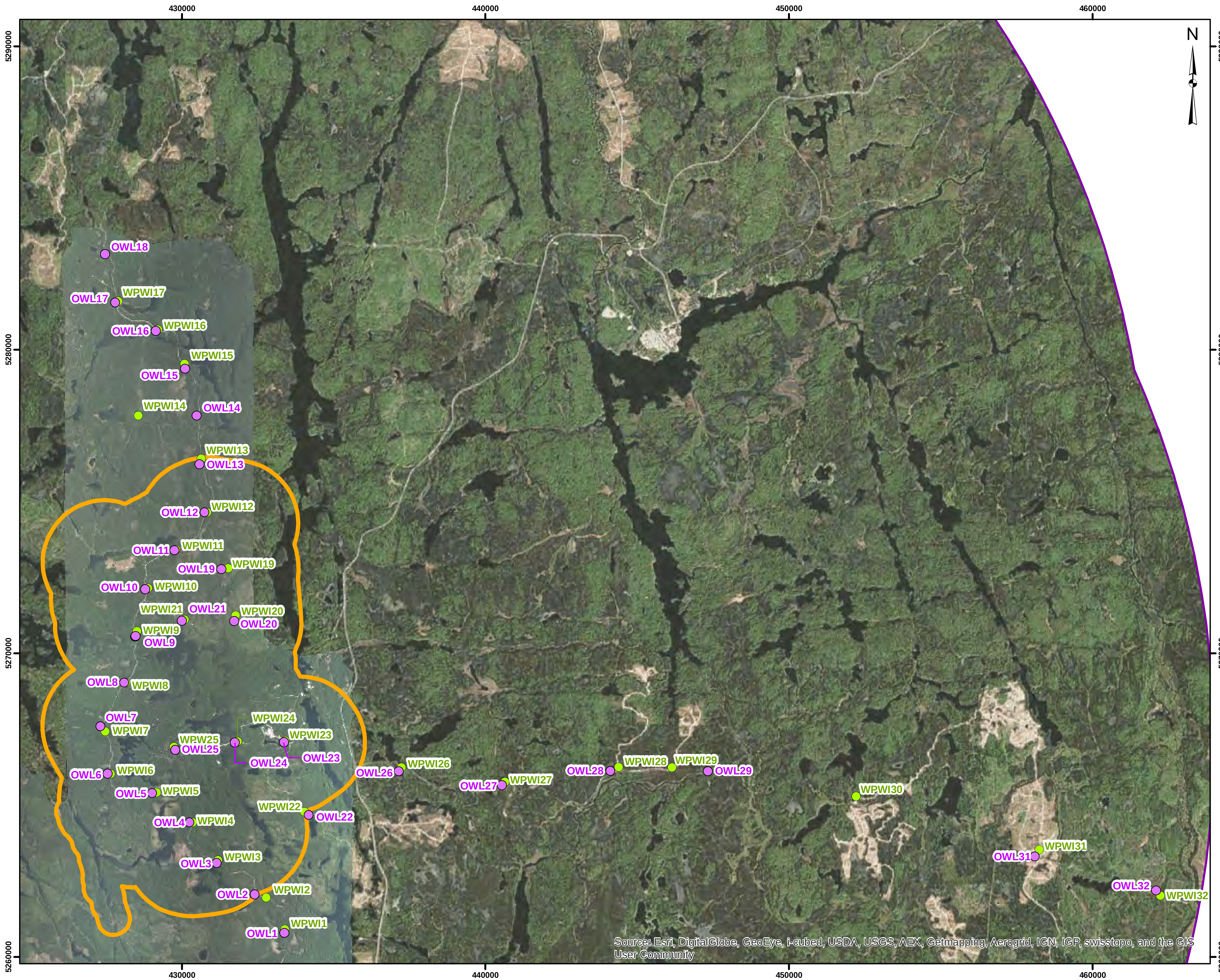
4.7 Whip-poor-will and Common Nighthawk Surveys

Whip-poor-will is documented as occurring in Chester Township (Copeland 2012, pers. comm.) and is designated by Ontario's *Endangered Species Act* (ESA) [Government of Ontario (Ontario) 2007] as Threatened. Because of their Threatened status, whip-poor-will and the habitat they use are protected by the ESA. Identification of habitat used by whip-poor-will is typically a requirement of the MNR. Common nighthawk is also a bird species that occurs in Chester Township (Copeland 2012, pers. comm.) and is designated by the ESA as Special Concern.

Whip-poor-will and common nighthawk are both nocturnal species and utilise open habitat. As a result, surveys for both species can be conducted simultaneously, using the same approach. This survey was completed in accordance with the *Draft Whip-poor-will Survey Protocol* obtained through the MNR Sudbury District Species at Risk Biologist (Cobb 2012, pers. comm.).

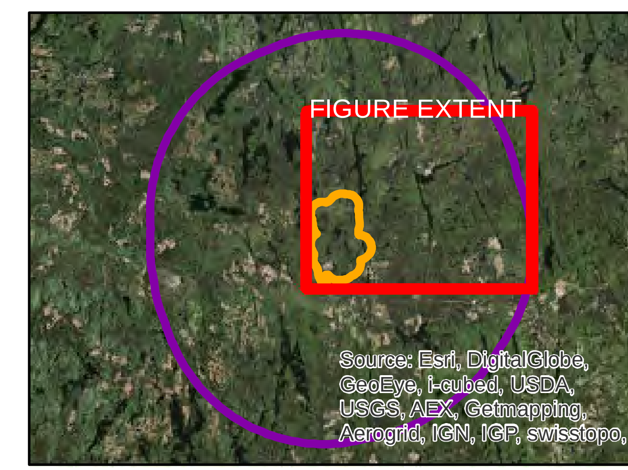
Based on the protocol, whip-poor-will surveys are ideally conducted in Ontario between late May and early July. Whip-poor-will generally arrive in Ontario in early May, and lay eggs between late May and early July. Intensity and duration of calling vary seasonally and vocalizations have been shown to decline in July. Two rounds of whip-poor-will surveys were completed at 22 locations during the first round of surveys and 31 locations during the second round along existing roads and trails to determine the occurrence and relative abundance of whip-poor-will in suitable habitat types (Figure 9). The first round of whip-poor-will surveys was completed from June 5 to 8, 2012, at 13 locations in the LSA and nine locations in the RSA. The second round was completed from July 6 to 7, 2012, at 17 locations in the LSA and 14 locations in the RSA. Weather conditions are a key consideration when planning whip-poor-will surveys. Surveys were conducted when the face of the moon was at least 50% illuminated and when the moon was above the horizon. Whip-poor-will detectability has been shown to double on nights when the moon is at least half illuminated, above the horizon, and not obscured by clouds (Wilson and Watts 2006).

Each survey was conducted by two Golder biologists. The biologists adjusted their separation depending on background noise and were separated by 150 m to 500 m, simultaneously listening for whip-poor-will from pre-established points. The biologists recorded the time of each detection, as well as a compass bearing and estimated distance to the bird. Intersections of azimuths of birds detected at the same time were used to provide approximate locations of individual birds.



LEGEND

- Owl Survey Locations
- *Whip-poor-will and Common Nighthawk Survey Locations 2012*
- Terrestrial Local Study Area
- Terrestrial Regional Study Area



REFERENCE

ArcGIS Online Basemaps published and hosted by ESRI®.
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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

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SCALE 1:125,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Whip-poor-will and Owl Survey Locations in the Local and Regional Study Areas

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 1
DESIGN	RRD	Dec. 2012	FIGURE: 9	
GIS	JMC/RRD	Nov. 2014		
CHECK	JB	Nov. 2014		
REVIEW	DJ	Nov. 2014		

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4.7.1 Data Analysis

Simultaneous observations of whip-poor-will recorded during the field surveys were used to triangulate an approximate location of each calling whip-poor-will. Approximate territories of each calling whip-poor-will were delineated using the guidance provided by the Sudbury District MNR Species at Risk Biologist (Cobb 2012, pers. comm.). Territory delineations were completed for whip-poor-will locations estimated through simultaneous observations, by placing the locations of calling whip-poor-will at the centre of a polygon with a radius of 170 m. The location of whip-poor-will detected by one observer was estimated using the bearing, and distance was recorded by the second observer. Territory delineation was not completed for whip-poor-will heard by only one observer. Because of the limited sample size, the common nighthawk observations were used to provide a description of habitat use. The presence or absence of common nighthawk was the primary objective of the data analysis.

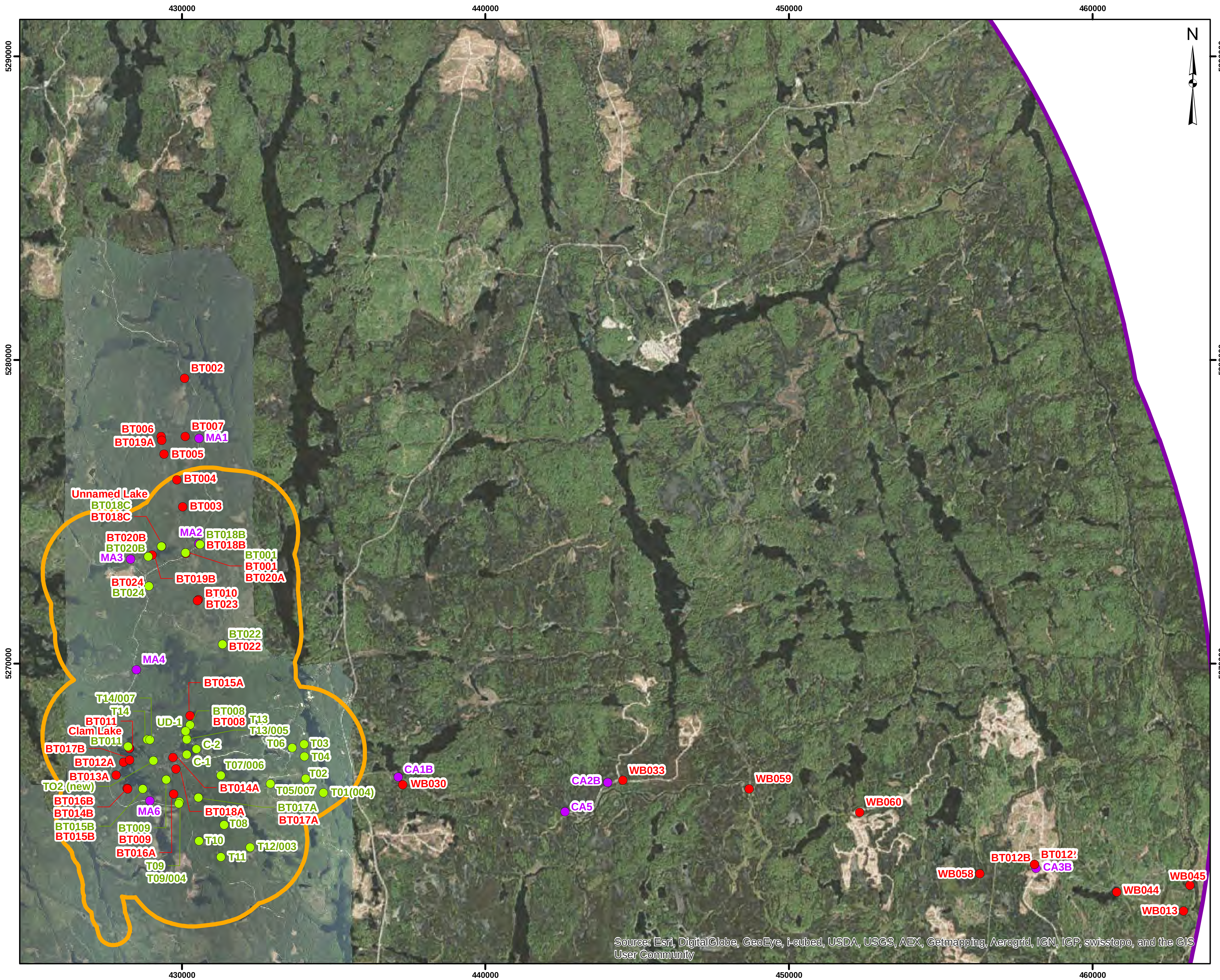
4.8 Basking Turtle Surveys

In the summer, Blanding's turtle (*Emydoidea blandingii*) and snapping turtle (*Chelydra serpentine*) are found in several types of freshwater environments, including lakes, permanent or temporary pools, slow-flowing streams, marshes and swamps. In general, these species prefer shallow water that is rich in nutrients, organic soil and dense vegetation. Based on reported species' ranges (SARA 2013), there is potential for Blanding's turtle, designated as Threatened by SARA (Schedule 1) and Ontario's ESA (Ontario 2007), and snapping turtle, designated as Special Concern by SARA and Ontario's ESA (Ontario 2007) to occur in the LSA.

Basking turtle surveys are the most effective method of confirming the presence of Blanding's turtle. Turtles seen basking in the early spring (April to May) are likely still present in their overwintering habitat. Snapping turtles also bask on logs, rocks or hummocks and along the edges of shorelines and can be detected while searching for Blanding's turtle.

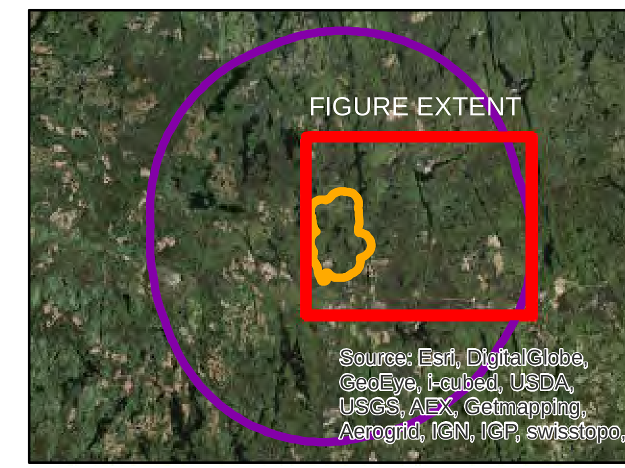
Basking turtle survey methodology followed the guidelines provided by the MNR Sudbury District Species at Risk Biologist (Cobb 2012, pers. comm.). Mr. Copeland confirmed that the Blanding's turtle survey methodology provided by the Sudbury District was also being used in the Timmins District (Copeland 2012, pers. comm.). According to the guidelines (Cobb 2012, pers. comm.), basking turtle surveys should occur between April 15 and May 30. Later in the season (late May to early June), turtles are less reliably found on basking structures as the day progresses. Two separate rounds of basking turtle surveys were completed by Golder. The first round was completed from May 8 to 13, 2012, and the second round was completed from June 6 to 9, 2012. Five rounds of basking turtle surveys were conducted between May 16 and June 12, 2013. Photographs and descriptions of habitat suitability were collected during plant community surveys from September 1 to 10, 2012.

A total of 147 basking turtle surveys were completed at 44 locations in the LSA and 14 locations in the RSA in 2012 and 2013 (Figure 10). A canoe was used to survey the length of Bagsverd Creek and the entire shoreline of Clam Lake and the Unnamed Lake #1 (Figure 10). Habitats that were observed with characteristics similar to those preferred by Blanding's turtle in Bagsverd Creek, Clam Lake and Unnamed Lake were selected for intensive basking turtle surveys. Other habitats within the LSA potentially affected by the Project were also selected for intensive basking turtle surveys. Incidental observations recorded during other surveys completed by Golder and Minnow (Weech 2012, pers. comm.) provides additional basking turtle survey observations.



LEGEND

- Amphibian Survey Locations 2012
- Basking Turtle Survey Locations 2012
- Basking Turtle Survey Locations 2013
- Terrestrial Local Study Area
- Terrestrial Regional Study Area



REFERENCE

ArcGIS Online Basemaps published and hosted by ESRI®.
Sources: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

2,700 0 2,700

SCALE 1:125,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Basking Turtle and Amphibian Survey Locations in the Local and Regional Study Areas

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 1
DESIGN	RRD	Dec. 2012		
GIS	JMC/RRD	Nov. 2014		
CHECK	JB	Nov. 2014		
REVIEW	DJ	Nov. 2014		

FIGURE: 10

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\TerrestrialBaseline\Figure10_BaskingTurtleAmphibianSurveyLocations_LSA.mxd

At each location, basking turtles were surveyed for, and available habitat was characterised, to assess the potential for Blanding's turtle to occur. The potential for the species to occur was determined through a probability of occurrence. A ranking of low indicates no suitable habitat availability at the survey location and no specimens were observed in similar habitats. Moderate probability indicates potential for the species to occur, as suitable habitat is present at the survey location, but the species was not observed in similar habitat. High potential indicates a known species record on/adjacent to the survey location (including during field surveys or background data review) and good quality habitat is present.

Basking turtle surveys were completed between 10 a.m. and 5 p.m., depending on air temperature. Where possible, basking turtle survey observations and waterbird breeding survey observations were simultaneously recorded during the overlapping survey period of 10 a.m. to 1:30 p.m. Appropriate weather conditions for basking turtle surveys are sunny or partially sunny conditions at times when potential basking sites are receiving full sunlight (Cobb 2012, pers. comm.). Surveys were not conducted when it was heavily overcast, raining or when winds were above 50 km/hr.

Blanding's turtle are easily startled and will quickly dive into the water if disturbed, so biologists slowly and quietly traversed the survey locations. Golder biologists used 10 power binoculars to scan the perimeter of sunlit shorelines and potential basking sites. A 45 power spotting scope was also used at some locations to determine species identification where the biologist's view was partially obstructed or where the turtle was out of range for 10 power binoculars.

Golder biologists waded or used a canoe in cases where tall shrubs or other vegetation made it difficult to survey potential basking sites (especially hummocks) from the shore. Photographs of representative habitat were taken facing all four cardinal directions. Photo log sheets were used to record photo numbers, location and descriptions.

4.8.1 Data Analysis

Because of the limited sample size, the information collected on basking turtle species was used to provide a description of habitat use. The presence or absence of Blanding's turtle and snapping turtle was the primary objective of the data analysis.

4.9 Amphibian Surveys

Amphibians are an important component of biodiversity throughout North America. The status of herpetofauna in North American is generally poorly known, and there are many data gaps regarding their distribution, habits, and behaviours. In addition, amphibians are primary components in the structure of most healthy ecosystems. Due to their porous skin and aquatic lifestyles, amphibians are good indicators for the health of an ecosystem.

One round of three minute amphibian surveys was completed at three survey locations in the LSA and four survey location in the RSA (Figure 10) using the Marsh Monitoring Program (BSC 2012) as the survey guidance protocol. Surveys were also conducted at an additional five locations in the RSA. Each amphibian survey location was separated by at least 500 m to reduce the possibility that calls or choruses are double-counted between stations. Amphibian calling intensity is strongly associated with season, time of day and weather conditions. As a result, each round of amphibian surveys was initiated one half-hour after sunset and ended near midnight during evenings with little wind and minimum night air temperatures of 5°C.

The surveys were completed from June 5 to 8, 2012. The amphibian surveys were conducted using an unlimited distance semi-circular sampling area. Biologists recorded whether calls were heard originating inside a 100 m semi-circular radius or if they were heard originating outside of this radius. At each wetland, air and water temperature, and water pH were measured, and wind speed and direction were estimated. Individual amphibian species were identified based on their distinctive calls and a rough estimate of breeding chorus size was made by rating the chorus on a call index scale; Relative Abundance: 0 = none; 1 = 1 individual; 2 = few; 3 = several, calls distinguishable but overlapping; 4 = large numbers, full continuous chorus.

4.9.1 Data Analysis

Because of the limited sample size, the collected amphibian species information was used to provide a description of habitat use. The presence or absence of amphibian species was the primary objective of the data analysis.

4.10 Owl Surveys

Owl surveys were conducted at pre-selected survey locations along existing roads and trails within the RSA using the Guidelines for Nocturnal Owl Monitoring in North America (Takats et al. 2001) and the Ontario Nocturnal Owl Survey (BSC 2012). The surveys were designed to determine the occurrence and relative abundance of owl species in representative habitats. Because of variation in peak calling dates for owls [e.g., great horned owls (*Bubo virginianus*) generally start calling earlier than barred owls (*Strix varia*)] the pre-selected survey locations were sampled twice to identify species occurrences. The first round of surveys was completed from April 12 to 14, 2012 and the second round of surveys was completed from April 27 to 28, 2012.

Prior to the first evening survey, the pre-selected survey locations were established along the existing roads and trails in the RSA. Thirty-one call locations were sampled with 18 locations in the LSA and 13 locations in the RSA. Owl survey locations completed in the LSA and RSA are shown in Figure 9. The pre-selected locations were stratified by habitat type and separated by at least 1.5 km to avoid overlap of owl territories and to reduce the probability of counting individuals twice.

Because owls are territorial during the early breeding season, imitating or broadcasting tape recordings of owl vocalizations can invoke vocal responses from many species of owls. Call playbacks, an effective method for measuring presence/not detected and relative abundance of most owls were used. Surveying was limited to 30 minutes after sunset to approximately midnight. Call rates typically peak shortly after sunset and shortly before sunrise; however, owls often call throughout the night. Surveying was not conducted when the wind had a velocity greater than 20 km/hr (Beaufort 3 or more) or when it was raining or snowing as these factors influence the owls' behaviour and the ability of the biologists to hear the calls.

4.10.1 Data Analysis

Because of the limited sample size, the collected owl species information was used to provide a description of presence-absence and habitat use.

4.11 Bat Surveys

During the summer, bats occupy a variety of day and night roosts (Caceres and Barclay 2000). Sexes roost separately, and reproductive females form small maternity colonies in tree cavities. Adult males and non-reproductive females roost singly or in small (<10) groups in or on buildings, caves or trees (Nagorsen and Brigham 1993; Nagorsen and Nash 1984; Turner 1974). Distance traveled by northern long-eared myotis (*Myotis septentrionalis*) between summer habitat and hibernacula may be up to 56 km (Nagorsen and Brigham 1993). Migration distances for little brown myotis (*Myotis lucifugus*) recorded by Fenton (1970) ranged from ten to 220 km. The young are born in June and by late July the nursery colonies are abandoned for other roosts (Fenton 1969; Banfield 1974; Gerson 1984).

Little brown myotis, northern long-eared myotis, small-footed myotis (*Myotis leibii*), and tri-coloured bats (*Perimyotis subflavus*) share similar ecologies. Time spent in the hibernacula is preceded by swarming or flights through the hibernacula, which occurs in August and September in Ontario (Gerson 1984; Caceres and Barclay 2000). Bats spend the winter in their hibernacula, usually caves or abandoned mines (Caire et al. 1979; Griffin 1940; Hitchcock 1965; Whitaker and Rissler 1992a,b), but occasionally in buildings (Barbour and Davis 1969). Hibernation may begin in September to early November and last until March, April or May (Caire et al. 1979; Griffin 1940; Hitchcock 1949; Mills 1971).

Little brown myotis and northern long-eared myotis were designated as *Endangered* on the SARO List in January 2013. Newly listed species designated as Endangered receive species and habitat protection under the ESA. These species are considered colonial, forming maternity colony groups in the summer and hibernating colony groups in the winter. Studying these species and determining accurate measures of colony size or movement between roost sites is particularly challenging (O'Shea 2003). Results from the 2012 Baseline Study (Golder 2013) identified habitats within 320 m of the Project footprint (bat study area; Figure 11 and Figure 12) with potential to support these species.

A three-step approach was developed to assess the bat study area, based on consultation with the MNR (Copeland 2013, pers. comm.):

- Desktop Habitat Assessment;
- Acoustic Survey of Candidate Bat Maternity Roost Habitat; and
- Investigation of Candidate Hibernacula.

This approach assesses habitat and habitat use by little brown myotis and northern long-eared myotis during the maternity roosting season and candidate features that could be used for hibernation. These data will also facilitate the assessment of potential Project effects and the development of appropriate avoidance and mitigation measures.

Desktop Habitat Assessment

Information from Forest Resource Inventory (FRI) data, digital remote imagery, and results from 2012 plant community surveys were used to delineate communities within the bat study area with potential to support maternity roost trees. Mixedwood or deciduous forests with deciduous trees greater than 25 cm DBH were considered candidate sites for maternity roosts (MNR 2011).

Little brown myotis and northern long-eared myotis typically use caves and abandoned mines as hibernacula to overwinter, although any opening with a high humidity (over 90%), stable winter interior air temperatures above 0°C, and sufficient space for roosting may be used (MNR 2000). Potential hibernacula areas were screened using remote satellite imagery to identify areas of exposed rock and soil visible through the vegetation. Available information was reviewed to identify the presence of abandoned mines and caves including a request for known locations of these features from the MNR (Copeland 2013, pers. comm).

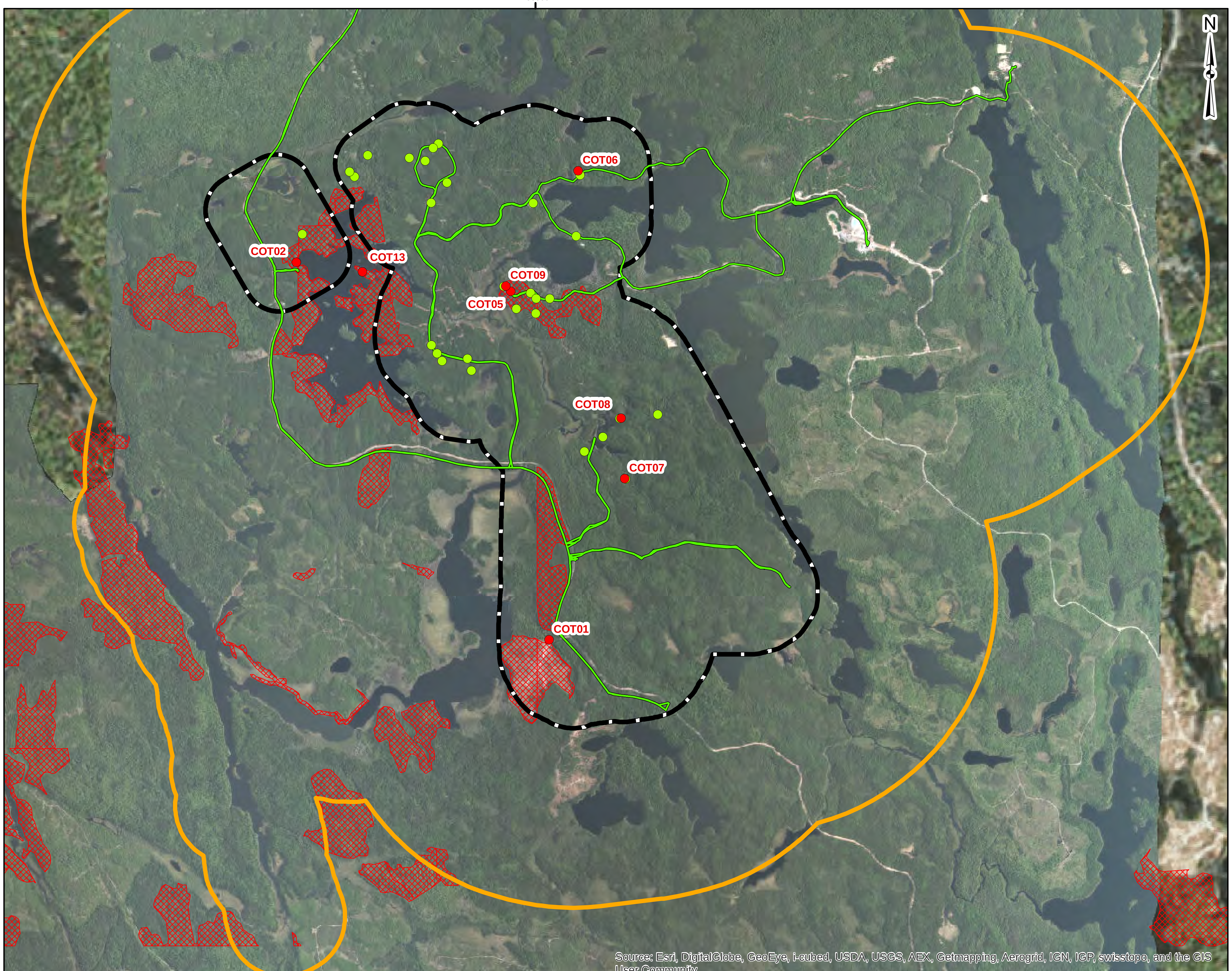
Acoustic Survey of Candidate Bat Maternity Roost Habitat

All Vespertilionid bats of North America use echolocation for navigation and hunting of insect prey (Kunz and Racey 1998). For this reason, acoustic recording of echolocating bats is an effective method to determine the presence and relative abundance of bats at a particular location (Kunz and Parsons 2009). Six monitoring stations throughout the bat study area were established by deploying a Binary Acoustics Technology AR125 detector and a solar power panel at each station (Figure 11 and Figure 12) to collect information on bat species utilizing the bat study area. Monitoring station locations were chosen in habitats that best represented maternity roost characteristics within the bat study area. Monitoring station locations were also chosen to provide spatial coverage of the bat study area. The detectors were deployed on June 12, 2013 and left to collect data for several nights in June and early July (Britzke and Herzog 2013; see Table 2).

Table 2: Number of Nights Echolocation Data were Collected by Station During the 2013 Acoustic Survey of Candidate Bat Maternity Roost Habitat

Station	Nights
COT01	16
COT02	14
COT03	18
COT04	13
COT05	22
COT06	16

In addition to the stationary acoustic detectors, a transect survey was conducted using a mobile Binary Acoustics Technology AR125 detector. Transect surveys are not ideal for determining bat species abundance or richness, but are used to cover large areas and make relative comparisons of bat species presence. The transect survey was conducted on June 12 and 13, 2013 by driving along the access road with a mobile Binary Acoustics Technology AR125 detector affixed to the vehicle. The vehicle traversed a total of 70 km each night while maintaining a speed of approximately 30 km/hr where possible to reduce the chance of recording the same individual multiple times (Britzke and Herzog 2013).



LEGEND

- Bat Detector Locations 2013
- Potential Hibernacula Locations 2013
- Bat Survey Driving Route
- Terrestrial Local Study Area
- Bat Study Area
- Potential Deciduous Trees with 25cm or Greater DBH

REFERENCE

ArcGIS Online Basemaps published and hosted by ESRI®.
Sources: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

910 0 910
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PROJECT
IAMGOLD CÔTÉ GOLD PROJECT

TITLE
Bat Survey Locations in the Southern Half of the Bat Study Area

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 1
DESIGN	RRD	Dec. 2012		
GIS	RRD	Nov. 2014		
CHECK	JB	Nov. 2014		
REVIEW	DJ	Nov. 2014		

FIGURE: 12

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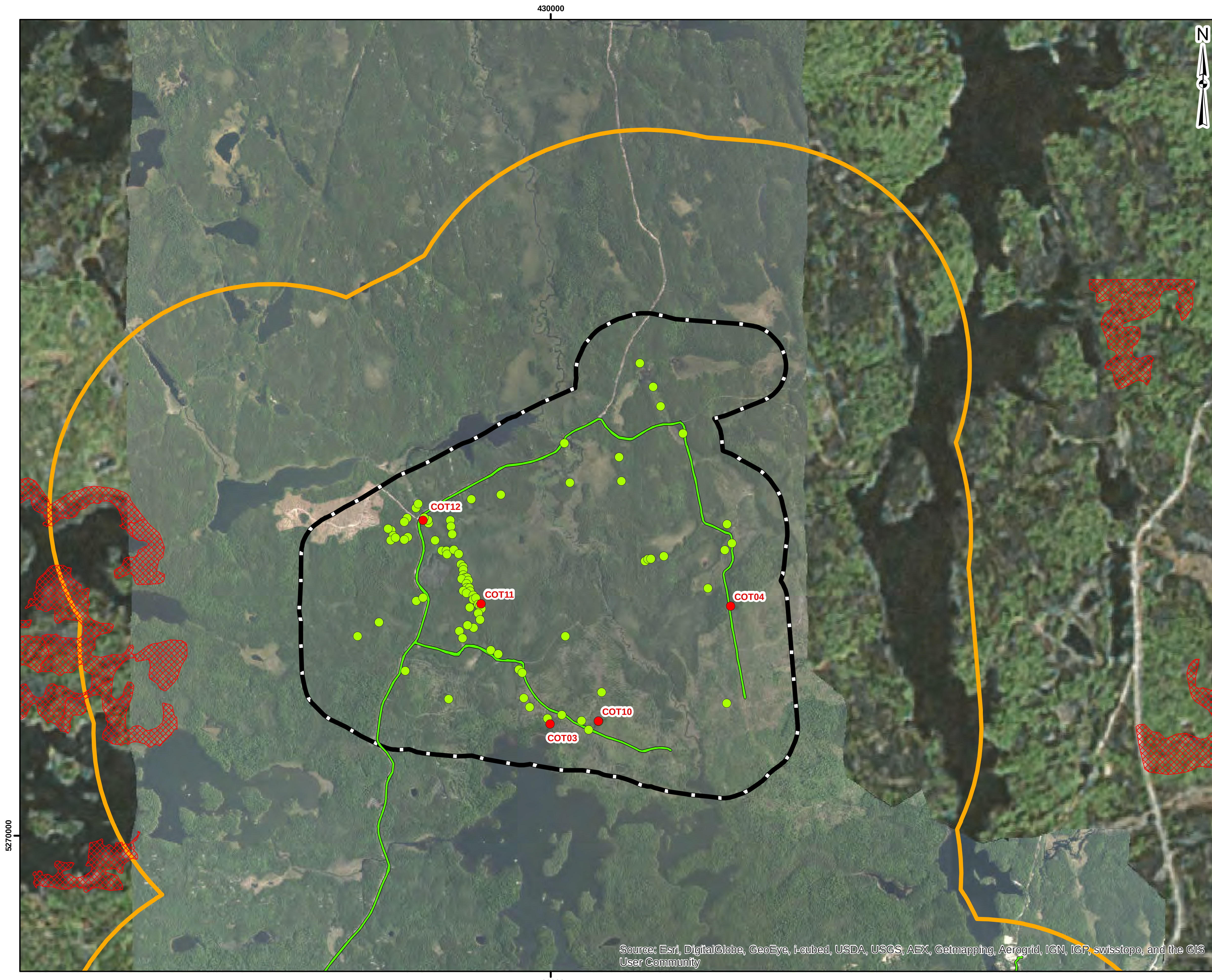
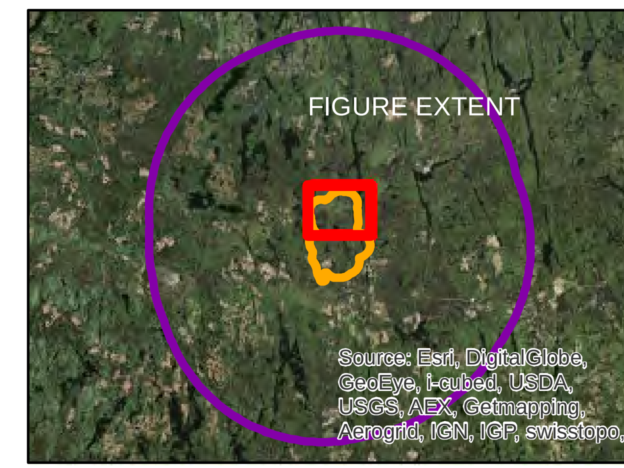


LEGEND

- Bat Detector Locations 2013
- Potential Hibernacula Locations 2013
- Bat Survey Driving Route
- Terrestrial Local Study Area
- Bat Study Area
- Terrestrial Regional Study Area
- Potential Deciduous Trees with 25cm or Greater DBH



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Sources: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

940 0 940

SCALE 1:35,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Bat Survey Locations in the Northern Half of the Bat Study Area

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 1
DESIGN	RRD	Dec. 2012	FIGURE: 11	
GIS	RRD	Nov. 2014		
CHECK	JB	Nov. 2014		
REVIEW	DJ	Nov. 2014		

Candidate Hibernacula Assessment

Areas identified as potential hibernacula within the bat study area through the desktop assessment were visited in the field to determine their suitability. Candidate hibernacula were visited on June 12 and 13, 2013 and on July 4, 2013. For each candidate hibernacula, observations regarding the presence of cracks or crevices, crack or crevice depth, the surrounding plant community, and topography were noted and photos were taken. Locations where there was potential for the ground openings to extend beyond the frost line and provide adequate interior microclimate were considered candidate swarming and hibernacula locations for further investigation.

Suitable bat hibernacula were not identified at any of the 119 sites surveyed within the bat study area. Areas identified as candidate hibernacula locations were primarily composed of smooth, lichen-covered bedrock outcrops, cobble derived from old river beds, or bedrock boulders exposed from logging activities (Appendix P). Although no candidate hibernacula were found, the six locations with the deepest rock cracks and openings between boulders were chosen for a candidate hibernacula assessment (COT07, COT08, COT09, COT10, COT11 and COT12) (Figure 11 and Figure 12). One additional location (COT13) was added during installation of the stationary bat detectors (Binary Acoustics Technology AR125 detector and a power source) where a capped abandoned mine was discovered (Figure 12). Although the mine was capped, there were openings around the cap through which a bat could pass. A description of the feature and the habitat at each of these seven stations is provided in Table 3.

Table 3: Candidate Bat Hibernacula Survey Locations

Station	Detector	UTM	Survey Dates	Habitat	Feature Description
COT07	MISB16	430806 E 5265188 N	August 21 - 29	Rock outcrop in dense coniferous forest	Three small, narrow cracks in rock with unknown depth
COT08	OTTB03	430777 E 5265731 N	August 21 - 31	Rock outcrop in dense mixed forest	Three small, narrow cracks in rock with unknown depth
COT09	OTTB07	429698 E 5266938 N	August 20 - September 4	Rocky edge of marsh	Openings between blasted boulders where rocks have been stripped for mining investigation
COT10	MISB10	430436 E 5271051 N	August 21 - 30	Dense mixed regrowth	Several small cracks of unknown depth on north slope of a hill
COT11	MISB13	429368 E 5272116 N	August 21 - 31	Rock outcrop in dense coniferous forest	Several small cracks of unknown depth in lichen covered rock
COT12	MISB05	428833 E 5772903 N	August 21 - September 3	Edge of dense coniferous forest	Boulder pile with some openings between rocks and small cracks
COT13	MISB20	428449 E 5267043 N	August 21 - 31	Capped Clam Lake mine on a peninsula	Capped vertical mine shaft with water in it and small openings around mine cap

The assessment was comprised of installing a stationary bat detector within 10 m of the feature and conducting one evening visual survey at each location. The stationary bat detector was a Binary Acoustics Technology AR125, identical to those used for maternity roost assessments and the data was analyzed using the Sonobat© 3.2.0

automated classifier software package. Bat detectors were installed on August 20 and 21, 2013 and collected on September 4, 2013 so that they collected between 9 and 16 nights of data.

Visual surveys were conducted by a Golder biologist, assisted by an IAMGOLD staff member at each of the six candidate hibernacula. Surveys began 30 minutes before sunset and lasted for a minimum of 3 hrs. Surveying was not conducted when the wind had a velocity greater than 20 km/hr (Beaufort 3 or more) or when it was raining or snowing as these factors influence the bats' behaviour. Photos were taken of the candidate hibernacula and a hand-held Wildlife Acoustics Echo Meter EM3 Bat Detector was used to identify the species of bats observed and alert the observers to bats passing by, outside of visual range. Surveyors observed the area for visual sightings of bats and monitored the hand-held device, noting all bat activity. All bat observations were noted along with the time of the observation. Echo meter recordings were later analyzed using Kaleidoscope© and Sonobat© software and manual species identification was conducted by an experienced bat acoustic specialist.

4.11.1 Data Analysis

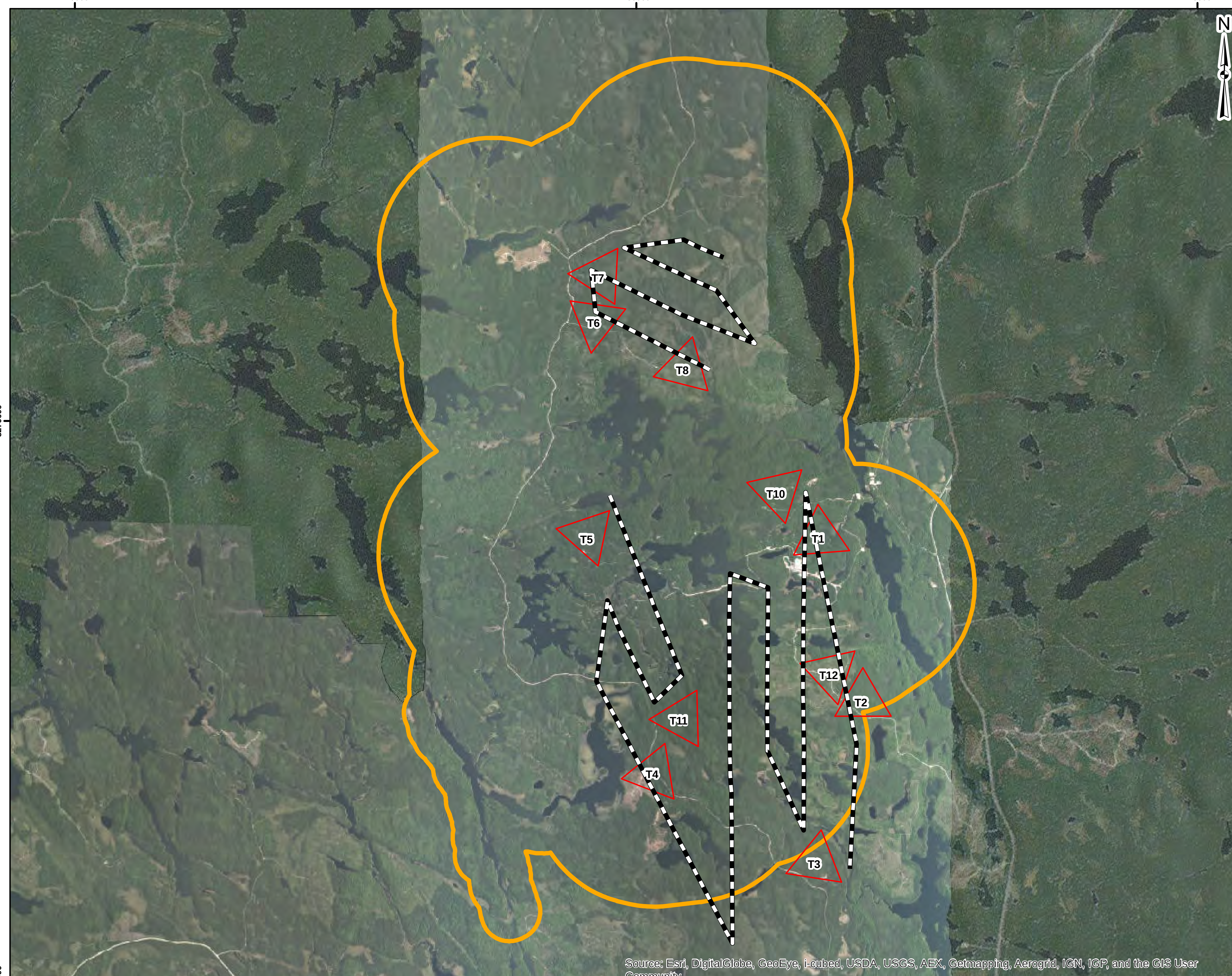
Automated analysis of full-spectrum acoustic data was completed using a multi-step process of extracting, filtering and classifying the digital recordings. The Sonobat© 3.2.0 automated classifier software package was used for final species classification, with manual QA/QC conducted on a subset of files by an experienced bat biologist. Mean and standard deviation of bat passes per night were calculated for each station and each species of bat. The total number of recordings and maximum number of recordings in one night of focal species (i.e., little brown myotis and northern long-eared myotis) were also tallied.

4.12 Winter Track Count Surveys

Winter track counts were completed to determine the relative activity, habitat use and distribution of wildlife that may be active during the winter months within the LSA and RSA. Transects were pre-selected using land cover polygons (Spectranalysis Inc. 2004) in such a way that the transects intersect with the major habitats present within the LSA and RSA. Transects were adjusted in hazardous terrain to meet safety standards.

Seventeen transects (totalling 17.4 km) were surveyed between March 3 and 5, 2013 and eighteen transects (totalling 18.0 km) were surveyed between March 14 and 17, 2013 (Figure 13). Ideally, each winter track count survey was timed to occur at least 24 hours after a snowfall of greater than 2 cm to allow animals to make tracks after a snowfall event. Surveys were postponed during high winds or a heavy snowfall event but occasionally were completed less than 24 hours after a light snowfall event when snowfall did not influence the visibility of tracks.

Locations of observations and transect track logs were recorded using GPS. Tracks observed within 1 m on either side of the transect (i.e., total 2 m width) were recorded. Other wildlife signs were also recorded on incidental wildlife datasheets including ungulate bedding areas, winter bird species, and other sign (browse, snow roosts, etc.). The start, change in direction, change in habitat type, and end points of each transect were recorded with a GPS device. If a track was observed, a waypoint was collected, the habitat type was recorded, and the type and number of all snow tracks observed were noted. The same waypoint was used to record all tracks that were seen within 10 m along the transect. If the track was observed further than 10 m from the last waypoint, a new waypoint and habitat type were recorded. Snow tracks were categorized as tracks, trails, or networks. Snow thickness was recorded for each habitat surveyed, as well as the number of days since the last snowfall. GPS device data were downloaded to a computer and datasheets were checked by the crew leads for errors and omissions at the end of each survey day.



LEGEND

- Aerial Winter Track Survey Flight Path
- Winter Track Count Transects Locations
- Terrestrial Local Study Area

REFERENCE

ArcGIS Online Basemaps published and hosted by ESRI®.
Sources: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP
Projection: Transverse Mercator   Datum: NAD 83   Coordinate System: UTM Zone 17

1,500   0   1,500
SCALE 1:70,000   METRES

IAMGOLD

PROJECT
IAMGOLD CORPORATION
CÔTÉ GOLD PROJECT

TITLE
Winter Track Count Survey Transects Locations and Flight Path of AMEC Winter Track Aerial Survey

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012	FIGURE: 13	
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	July. 2013		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Figure13_WinterTrackTransectsAerialTrackFlightPath_LSA.mxd

4.12.1 Data Analysis

Fisher (*Martes pennanti*) and marten (*Martes americana*) tracks were combined for the winter track count analysis as there is overlap between female fisher and male marten track size. Weasel (*Mustela* sp.), small mammal species, and grouse tracks were recorded and analyzed by family due to difficulties in distinguishing between species within these species groups.

The number of tracks was standardized by the number of days since last snowfall/wind event (i.e. track accumulation period [TAP]) as snowfall and wind (greater than 20 km/h) influences the visibility of snow tracks. The adjusted track density (TKD) was the number of tracks per km sampled in a habitat segment per TAP to the nearest quarter day. The number of days since last snowfall was determined from field observations. Mean TKD (with associated standard error) are presented for each species and habitat type. These calculations were completed to determine the relative activity level of carnivores, furbearers, and ungulates within the RSA.

In addition to the winter track count data collected by Golder, AMEC performed two rounds of winter aerial surveys for mammals in an area which included the Golder RSA (Figure 13). The winter aerial survey for mammals was undertaken on February 27, 28 and March 1, 2013.

The Shiningtree TLA follows 118.4 km of an existing 115 kilovolt (kV) TLA from the City of Timmins to the Shiningtree and then travels west for 40.2 km to the Project. The Cross-Country TLA follows 45.9 km of the same existing 115 kV TLA from the City of Timmins and then travels southwest for 71.5 km to the Project. The aerial survey involved flying five north-south transects along the proposed TLA common to both proposed TLAs that were 45.9 km long and spaced at 500 m intervals, five north-south transects exclusively along the Cross-Country TLA that were 71.5 km long and spaced at 500 m intervals, and five north-south transects exclusively along the Shiningtree TLA that were 72.5 km long and also spaced at 500 m intervals for a total flight distance of 950 km. Transect lines provided 100% coverage of habitat within a 1 km buffer on either side of the proposed and alternative transmission lines.

The aerial surveys were undertaken with a Bell 206L Long Ranger helicopter. The airspeed traveled during surveys was approximately 70 km/hr to 90 km/hr at an elevation of approximately 100 to 150 feet (ft) (30 m to 45 m). Waypoints for the start and end of the survey lines were prepared and provided to the pilot for navigation. Weather conditions were fair to excellent with unlimited to 10 km visibility, calm to moderate winds, and no precipitation to light snow. Tracks were readily detected on a base of snow 30 cm to 90 cm in depth (1 foot to 3 ft). Observers sat on either side of the aircraft and sightings of tracks and wildlife were called out on the intercom system and recorded on a standard form.

Data collected from these surveys are used to provide additional information regarding species presence in the RSA for this report. A detailed analysis of the aerial track data collected by AMEC is provided in AMEC's report titled *IAMGOLD Corporation Côté Gold Project: Terrestrial Ecology Baseline Study for the Proposed Transmission Line*, dated October 2013.

5.0 RESULTS AND DISCUSSION

5.1 Regional Conditions

The Project is located within the Lake Abitibi (3E-5) Ecoregion (Crins 2002) which extends from Wawa, Ontario, in the west to just past the Ottawa River in the east (Environment Canada 2010). Throughout this region the typical forest habitat is described as a mixed forest characterized by stands of white spruce (*Picea glauca*), balsam fir (*Abies* *balsamea*), and eastern white pine (*Pinus strobus*), along with some red pine (*Pinus resinosa*), yellow birch (*Betula allegheniensis*) and trembling aspen (*Populus tremuloides*) (Environment Canada 2010).

Warmer areas along the Lake Superior shore contain sugar and red maple (*Acer saccharum*, *A. rubra*), and yellow birch, whereas drier sites may have stands of white, red and jack pine (*Pinus banksiana*) (Environment Canada 2010). Black spruce (*Picea mariana*), tamarack (*Larix laricina*), and eastern white cedar (*Thuja occidentalis*) dominate in poorly drained areas. Wetlands are characteristically bowl bogs that are treed and surrounded by peat margin swamps (Environment Canada 2010).

5.1.1 Climate

Mean annual precipitation for the region is approximately 800 to 900 mm with wetter conditions south of the Project area and drier conditions to the north and west of the Project area (Fisheries and Environment Canada 1978).

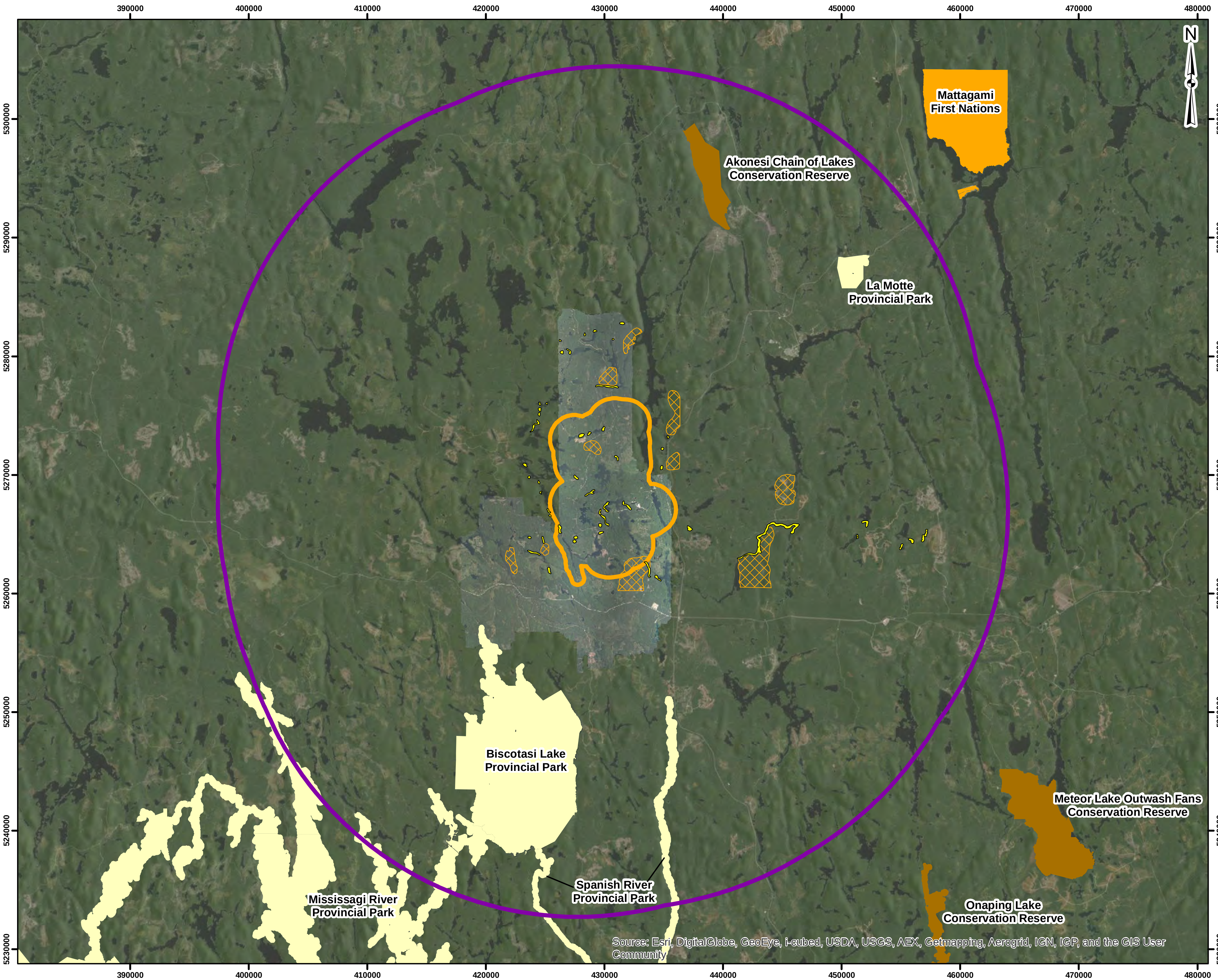
Based on the 1971 to 2000 climate normals for regional climate monitoring stations (Environment Canada 2012), total annual precipitation normals are 797 mm in Chapleau, 831 mm in Timmins and 899 mm in Sudbury. Of this total precipitation, the proportion that falls as snow is reported as 38% at Timmins, 35% at Chapleau and 31% at Sudbury (Appendix B). Average annual temperature ranges from 3.7ºC at Sudbury to 1.3ºC at Timmins.

5.1.2 Significant Natural Features

The Forestry Management Plan (FMP) for the Spanish Forest was used to identify significant wildlife land uses within the RSA (MNR 2008). Moose wintering habitat and moose aquatic feeding areas were identified within the LSA and RSA (Figure 14).

The location of one known abandoned mine near Chester Township was provided by MNR (Copeland 2013, pers. comm.). As abandoned mines have potential to be used as a bat hibernacula, this mine was visited to determine its status. The field visit revealed that the abandoned mine has been capped and no longer has potential as a bat hibernacula. No other wildlife features identified in the FMP were found to occur in the RSA.

Three Provincial Parks are located within the RSA: Biscotasi Lake Provincial Park, Mississagi River Provincial Park, and La Motte Provincial Park (Figure 14). Biscotasi Lake Provincial Park is located approximately 14 km to the southwest of the footprint, with Mississagi River Provincial Park located immediately south of it. Spanish River Provicial Park is 7 km east of Biscotasi Lake Provincial Park and is about 13 km south of the footprint. La Motte Provincial Park is 8 km northeast of Gogama, and 20 km northeast of northern extent of Mesomikenda Lake, as shown in Figure 14.



LEGEND

- Moose Aquatic Feeding Habitats
- Moose Wintering Habitats
- Terrestrial Local Study Area
- Terrestrial Regional Study Area
- Conservation Reserve (Regulated)
- Provincial Park
- First Nation Reserve

REFERENCE

ArcGIS Online Basemaps published and hosted by ESRI®.
Sources: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

8,000 0 8,000

SCALE 1:320,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Significant Natural Features in the Regional Study Area

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012		
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	Dec. 2013		

FIGURE: 14

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\TerrestrialBaseline\Figure14_MooseAquaticFeedingWinteringHabitats_LSA.mxd

5.1.3 Land Cover

5.1.3.1 Regional Study Area

The RSA comprises 3,788 km^2 and is classified into 12 land cover types (Table 4). Land cover types were generated using satellite imagery and the resolution of the land cover data does not allow for distinguishing between specific ecosites.

Undisturbed upland communities composed the majority (77%) of the RSA, 42% of which is dense mixed forest. Wetland communities represent only 4% of the land cover in the RSA, with treed bog encompassing 84% of the total wetland cover types.

Table 4: Total Area and Proportion of Land Cover Types in the Regional Study Area

Land Cover Type [(a)]	Total Area (km^2)	Percent Cover of the Regional Study Area
Upland Communities		
Forest – dense coniferous	971.04	25.63
Forest – dense deciduous	142.71	3.77
Forest – dense mixed	1599.15	42.21
Forest - sparse	207.16	5.47
Subtotal	2920.06	77.08
Wetland Communities		
Wetland	9.82	0.26
Bog – open	7.57	0.20
Bog – treed	121.47	3.21
Fen - treed	5.05	0.13
Subtotal	143.91	3.8
Other		
Water – deep clear	399.39	10.54
Settlement/Infrastructure	3.10	0.08
Forest Depletion – cuts	308.78	8.15
Jack Pine Regeneration/Cuts	12.91	0.34
Subtotal	724.18	19.11
Total	3788.15	99.99

Note:
km_2 = kilometre squared
[(a)] Source: Spectranalysis Inc. 2004

5.1.3.2 Local Study Area

The LSA comprises 119 km^2 and is classified into 10 land cover types (Table 5; Figure 6). Sixty-five percent of the habitat is comprised of undisturbed upland communities, with 42% of the total cover consisting of dense mixed forest. Wetland communities, comprised predominantly of treed bogs, makes up approximately 6% of the total cover. The remainder of the LSA is composed of disturbed communities and water.

Table 5: Total Area and Proportion of Land Cover Types in the Local Study Area

Land Cover Type	Total Area (km^2)	Percent Cover of the Local Study Area
Upland Communities		
Forest – dense coniferous	21.05	17.75
Forest – dense deciduous	2.01	1.70
Forest – dense mixed	49.38	41.64
Forest - sparse	4.55	3.84
Subtotal	76.99	64.93
Wetland Communities		
Wetland	6.15	5.19
Bog – open	0.02	0.02
Bog – treed	1.09	0.92
Subtotal	*7.26*	*6.13*
Other		
Water – deep clear	15.90	13.41
Forest Depletion – cuts	9.02	7.61
Jack Pine Regeneration/Cuts	9.39	7.92
Subtotal	34.31	30.64
Total	118.56	100

Notes:
km_2 = kilometre squared
[a] Source: Spectranalysis Inc. 2004

5.1.4 Wildlife Community

Wildlife characteristic of the region includes white-tailed deer (*Odocoileus virginianus*), moose, black bear, lynx (*Lynx canadensis*), snowshoe hare *(Lepus americanus)*, wolf (*Canis lupus*) and coyote (*Canis latrans*) (Environment Canada 2010).

A list of wildlife species with potential to inhabit the RSA was compiled as part of an ecological risk assessment performed for the Chester Township (SARA Group 2009). This inventory includes commonly observed species inhabiting Chester Township. This list, along with data obtained from publicly available databases [NHIC (2013), the Atlas of the Breeding Birds of Ontario (BSC 2013), the Ontario Odonata Atlas (2005), the Atlas of the Mammals of Ontario (Dobbyn 1964), the Ontario Herpetofaunal Atlas (Oldham and Weller 2000)], and MNR was used to generate a list of wildlife species with potential to occur in Chester Township, is provided in Appendix C.

5.2 Species at Risk

A background review of publically available information indicates that there is potential for 23 sensitive species to occur in the region containing the Project. Of these, 18 species are considered at risk provincially (10 are designated *Special Concern*, five are *Threatened*, and two are considered *Endangered* (Ontario 2007). One species [rusty blackbird (*Euphagus carolinus*)] is designated *Special Concern* under federal legislation (SARA 2013). One species [tri-coloured bat (*Pipistellus subflavus*)], while not at risk currently, has been designated by COSEWIC as *Endangered* and one additional species [barn swallow (*Hirundo rustica*)] has been designated by COSEWIC as *Threatened* (COSEWIC 2013). A list of these species, their designations and the potential for them to occur in or near the RSA is provided in Appendix D.

The potential for these sensitive species to occur within the RSA is based on the known site conditions, known habitat preference, habitat availability, and species range information available through accessible databases. A ranking of low indicates that no suitable habitat is available in the RSA and that no occurrence of the species has been observed in habitats similar to those observed in the RSA. Moderate probability indicates potential for the species to occur, as suitable habitat is likely present in the RSA, but no occurrence of the species has been observed in similar habitat. High potential indicates a known species record on/adjacent to the RSA (including during field surveys or background data review) and good quality habitat is present.

Based on the information available, bald eagle and olive-sided flycatcher (*Contopus cooperi*), Canada warbler (*Cardellina canadensis*), rusty blackbird, common nighthawk and whip-poor-will have a high potential to occur within the RSA. Jefferson-blue spotted newt salamander complex (*Ambystoma jeffersonianum-laterale*x complex) was assessed as having a moderately-high potential to occur within the RSA.

A review of detailed tree data collected during the plant community surveys identified five ecosites with the potential to provide maternity bat roosts. Ecosites identified as B014Tt (Very Shallow, Dry to Fresh: Conifer), B049Tt (Dry to Fresh, Coarse: Jack Pine – Spruce Dominated), B050Tt (Dry to Fresh, Coarse: Pine – Black Spruce Conifer), B099Tt (Fresh, Silty to Fine Loamy: Pine – Black Spruce Conifer), and B224Tt (Mineral Rich Conifer Swamp) have trees with a DBH greater than 25 cm and had deciduous trees in the upper canopy (MNR 2011). These ecosites have potential to support bat maternity roosts for little brown bat and northern long-eared myotis), recently listed as *Endangered* under the ESA (MNR 2012).

No provincially or federally listed plant species are known to occur in the RSA (NHIC 2013; SARA 2013; SARO 2013) and none were observed during the 2012 and 2013 field programs.

5.3 Plant Community Surveys

Observations recorded during the plant community surveys indicate that habitat in the LSA is typical to that described by Environment Canada for Ecoregion 3E-5. The topography is predominantly hummocky and undulating, broadly sloping uplands and lowlands. Mixed forest habitat within the LSA is dominated by jack pine, white spruce, balsam fir, trembling aspen, and white birch (*Betula papyrifera*). Poorly drained areas are dominated by black spruce.

In total, 50 plots were sampled in the LSA and 27 were sampled in the RSA. Locations of detailed vegetation inventory plots are shown in Figure 6.

A total of 121 plant species were identified during plant community surveys within the LSA. This includes 11 tree species, 39 species of small trees, shrubs and woody vines, 10 species of ferns and allies, 15 species of graminoids, 27 species of forbs, nine species of mosses, and 10 species of lichens. All plant species recorded during the plant community surveys are listed in Appendix E. Descriptions of the ecosites that were surveyed within the LSA are provided in Appendix F with representative photographs provided in Appendix G.

Table 6 provides a list of ecosites that were identified through ground-truthing within each of the land cover types in the LSA. Survey effort reflected the proportion of the availability of the land cover types, resulting in low numbers of vegetation plots in some of the land cover types.

Table 6: Number of Vegetation Survey Plots per Land Cover Type in the Local Study Area

Land Cover Type[a]	Ecosites of Ontario Classification[b]		Total Number of Vegetation Plots Surveyed
	Ecosite Code	Ecosite Name	
Forest – dense coniferous	B012Tl	Very Shallow, Dry to Fresh: Pine – Spruce Conifer	1
	B137Tt	Sparse Treed Bog	1
	B139N	Poor Fen	1
Forest – dense deciduous	B088Tt	Fresh, Clayey: Aspen – Birch Hardwood	1
	B104Tt	Fresh, Silty to Fine Loamy: Aspen – Birch Hardwood	1
	B120Tt	Moist, Fine: Elm – Ash Hardwood	1
Forest – dense mixed	B012Tt/Tl	Very Shallow, Dry to Fresh: Pine – Spruce Conifer	4
	B014Tt	Very Shallow, Dry to Fresh: Conifer	1
	B016Tt/Tl	Very Shallow, Dry to Fresh: Aspen – Birch Hardwood	2
	B018Tt	Very Shallow, Dry to Fresh: Maple Hardwood	1
	B049Tl	Dry to Fresh, Coarse: Jack Pine – Black Spruce Dominated	1
	B053Tl	Dry to Fresh, Coarse: Conifer	1
	B098Tt	Fresh, Silty to Fine Loamy: Jack Pine – Black Spruce Dominated	1
	B099Tt/Tl	Fresh, Silty to Fine Loamy: Pine – Black Spruce Conifer	2
	B104Tt	Fresh, Silty to Fine Loamy: Aspen – Birch Hardwood	3
	B108Tl	Fresh, Silty to Fine Loamy: Mixedwood	1
	B126Tt	Treed Bog	1
	B130Tl	Intolerant Hardwood Swamp	1
	B224Tt	Mineral Rich Conifer Swamp	1
Forest - sparse	B016Tl	Very Shallow, Dry to Fresh: Aspen – Birch Hardwood	2
	B049Tl	Dry to Fresh, Coars: Jack Pine – Black Spruce Dominated	1
	B098Tl	Fresh, Silty to Fine Loamy: Jack Pine – Black Spruce Dominated	1
Forest Depletion - cuts	B012Tt	Very Shallow, Dry to Fresh: Pine – Spruce Conifer	2
	B014Tt	Very Shallow, Dry to Fresh: Conifer	1
	B009S	Very Shallow, Dry to Fresh: Sparse Shrub	1
	B034Tl	Dry, Sandy: Jack Pine – Black Spruce Dominate	1
	B098Tl	Fresh, Silty to Fine Loamy: Jack Pine – Black Spruce Dominated	2
	B099Tl	Fresh, Silty to Fine Loamy: Pine – Black Spruce Conifer	1
Jack Pine Regeneration/Cut	B010S	Very Shallow, Dry to Fresh: Shrub	2
	B047S	Dry to Fresh, Coarse: Shrub	2
	B096S	Fresh, Silty to Fine Loamy: Shrub	2
	B099Tl	Fresh, Silty to Fine Loamy: Pine – Black Spruce Conifer	1
	B138S	Open Bog	1
Wetland	B126Tl	Treed Bog	1

Land Cover Type[a]	Ecosites of Ontario Classification[b]		Total Number of Vegetation Plots Surveyed
	Ecosite Code	Ecosite Name	
	B136TI	Sparse Treed Fen	1
	B138S	Open Bog	1
	B142N	Mineral Meadow Marsh	1

Notes:
[a] Source: Spectranalysis Inc. 2004
[b] Source: Banton et al. 2009

Land Cover Types of Restricted Distribution in the Local Study Area

Land cover types of restricted distribution are defined as those that represent 1% or less of the land base within the LSA (Table 5; Figure 6). Open bog was the only land cover type identified as representing less than or equal to 1% of the LSA and may offer unique habitat for listed plant species.

5.3.1 Listed Plants

5.3.1.1 Listed Plant Occurrences

No provincially rare plant species listed under the Provincial ESA (Ontario 2007) or federally listed species (COSEWIC 2013; SARA 2013) are known to inhabit the RSA (Ontario 2007; NHIC 2013; SARA 2013). No provincially rare plant species were detected within the LSA during the field programs and no occurrences were recorded for these species within the LSA by MNR (NHIC 2013). No provincially tracked plant species were observed during the 2012 and 2013 field surveys.

5.3.2 Ecosite Type Richness and Uniqueness

Plant community composition indices calculated by ecosite include:

- total number of vascular species unique (i.e., observed only once) to a single ecosite; and
- species richness.

5.3.2.1 Total Plant Species Richness

The total plant species richness (i.e., number of plant species) among ecosites in the LSA was calculated as one measure of plant community composition (Table 7). The highest plant species richness values were detected within the B012Tt/TI, B016Tt/TI, B098Tt/TI, B099Tt/TI, B104Tt ecosites, with 49, 40, 42, 46, and 40 plant species, respectively (Table 6). The lowest species richness was observed within ecosites B009S (14 species), B 139N (13 species) and B142N (7 species) (Table 6). Minimum and maximum values of species richness are provided to indicate the variability in the number of species observed in a given polygon for that ecosite type.

Table 7: Vegetative Species Diversity of the Ecosites in the Local Study Area

Ecosite	Number of Sites	Species Richness	Minimum and Maximum Species Richness	Percent of All Plant Species	Number of Rare or Provincially Tracked Species Occurrences	Number of Plant Species Unique to the Ecosite
B009S	1	14	–	11.6	0	0
B010S	2	27	17 / 20	22.3	0	0
B012Tt/Tl	7	49	18 / 26	40.5	0	1
B014Tt	2	26	18 / 21	21.5	0	1
B016Tt/Tl	4	40	20 / 29	33.1	0	3
B018Tt	1	20	–	16.5	0	0
B034Tl	1	20	–	16.5	0	0
B047S	2	24	10 / 17	19.8	0	2
B049Tl	2	35	14 / 29	28.9	0	1
B053Tl	1	24	–	19.8	0	1
B088Tt	1	16	–	13.2	0	0
B096S	2	31	13 / 24	25.6	0	3
B098Tt/Tl	4	42	12 / 30	34.7	0	1
B099Tt/Tl	4	46	20 / 26	38.0	0	0
B104Tt	4	40	15 / 26	33.1	0	3
B108Tl	1	18	–	14.9	0	0
B120Tl	1	19	–	15.7	0	4
B126Tt/Tl	2	29	19 / 19	24.0	0	2
B130Tl	1	25	–	20.7	0	1
B136Tl	1	17	–	14.0	0	2
B137Tt	1	20	–	16.5	0	2
B138S	2	32	18 / 21	26.4	0	0
B139N	1	13	–	10.7	0	6
B142N	1	7	–	5.8	0	3
B224Tt	1	21	–	17.4	0	0
Total	50	121		N/A	0	36

Notes:
[(a)] Source: Banton et al. 2009
N/A = Not applicable as many of the plants occur in several ecosites. The percent of all vascular species is not intended to be a cumulative total.
"—" = A minimum and maximum could not be calculated because the ecosite sample size is one.

5.3.2.2 Total Number of Unique Plant Species

Calculating the total number of unique plant species within ecosites is a way of expressing habitat uniqueness (Table 6). Ecosites B120Tl and B139N have the highest number of unique species, with 6 and 4, respectively. Several ecosites do not contain unique species, including B009S, B010S, B018Tt, B034Tl, B088Tt, B108Tl, B138S, and B224Tt.

5.3.2.3 Tree Core Data

During each plant community survey, tree cores were taken from the two tallest trees (>5 m) in the stand (Appendix H). Typically, balsam poplar and white birch are difficult to age due to heart rot or poor tree ring development, so cores were not taken from these species, unless they were the only tree species present in the plot. Height and age data for the trees are summarized by ecosite in Table 8.

Table 8: Mean (± 1SE) Diameter at Breast Height, Height, and Age of Trees within each Treed Ecosite Present in the Local and Regional Study Areas, 2012 and 2013

Ecosite	Study Area	Diameter at Breast Height (cm)	Height (m)	Age (years)
B009S (n=2)	RSA	8.05 ± 0.35	5.65 ± 0.17	31.5 ± 4.5
B012Tl (n=6)	LSA, RSA	19.05 ± 1.37	15.17 ± 1.76	46.17 ± 6.76
B012Tt (n=8)	LSA	14.66 ± 1.50	9.56 ± 1.07	20.13 ± 2.52
B014Tt (n=4)	LSA	19.9 ± 4.38	17.13 ± 2.73	45.00 ± 5.89
B016Tl (n=4)	LSA	13.1 ± 2.93	5.87 ± 0.86	17.25 ± 3.84
B016Tt (n=2)	LSA	21.75 ± 0.25	18.00 ± 0.00	26.50 ± 3.50
B018Tt (n=2)	LSA	15.00 ± 0.60	12.80 ± 0.06	19.00 ± 3.00
B034Tl (n=2)	LSA	13.30 ± 1.70	6.75 ± 0.61	17.5 ± 0.50
B034Tt (n=4)	RSA	18.93 ± 2.84	13.29 ± 1.58	34.75 ± 9.41
B049Tl (n=8)	LSA, RSA	14.5 ± 0.92	9.57 ± 0.79	22.25 ± 1.46
B049Tt (n=2)	RSA	32.5 ± 7.10	17.25 ± 2.15	83.5 ± 1.50
B050Tt (n=4)	RSA	23.33 ± 3.86	15.52 ± 3.25	54.00 ± 16.39
B053Tl (n = 2)	LSA	7.45 ± 1.85	7.88 ± 0.28	20.00 ± 4.00
B098Tl (n = 8)	LSA, RSA	15.16 ± 0.82	9.25 ± 0.66	23.50 ± 3.13
B098Tt (n = 4)	LSA, RSA	19.75 ± 0.88	13.06 ± 0.71	90.00 ± 13.17
B099Tl (n = 5)	LSA	15.54 ± 0.70	9.91 ± 1.23	21.20 ± 1.32
B099Tt (n = 8)	LSA, RSA	19.68 ± 1.20	14.56 ± 1.50	40.75 ± 5.38
B104Tt (n = 12)	LSA, RSA	17.92 ± 1.46	11.84 ± 0.73	40.75 ± 5.51
B108Tl (n = 2)	LSA	17.25 ± 0.15	9.68 ± 0.40	23.50 ± 0.50
B110Tt (n=2)	RSA	18.85 ± 1.45	17.75 ± 0.33	64.00 ± 3.00
B114Tl (n = 2)	LSA	17.65 ± 1.35	7.79 ± 0.22	19.00 ± 0.00
B120Tl (n = 2)	LSA	15.35 ± 5.45	10.00 ± 0.00	54.5 ± 18.50
B126Tl (n = 2)	LSA	17.15 ± 2.35	14.35 ± 0.35	132.00 ± 2.00

Ecosite	Study Area	Diameter at Breast Height (cm)	Height (m)	Age (years)
B126Tt (n = 2)	LSA	14.00 ± 3.00	14.10 ± 2.90	40.00 ± 13.00
B136Tl (n = 2)	LSA	9.05 ± 1.05	5.90 ± 0.35	68.00 ± 4.00
B137Tl (n = 6)	LSA, RSA	7.92 ± 0.69	5.23 ± 0.53	74.33 ± 11.79
B137Tt (n = 4)	LSA, RSA	20.38 ± 1.30	13.83 ± 1.06	87.75 ± 34.92
B138S (n = 2)	RSA	9.15 ± 1.15	3.94 ± 0.24	42.00 ± 8.00
B164Tt (n = 2)	RSA	30.00 ± 2.30	27.63 ± 0.11	72.50 ± 3.50
B224Tt (n = 2)	LSA	24.00 ± 3.20	15.55 ± 2.69	54.00 ± 10.00

Note:
n - sample size

In total, cores from 59 jack pine, 33 black spruce, 12 balsam fir, four tamarack, four trembling aspen, three white spruce, one eastern white cedar, and one black ash (*Fraxinus nigra*) were collected during plant community surveys. Cores were not taken from 20 sites because there were no trees or no conifer trees within the plot.

5.4 Raptors

Raptor observations recorded during the aerial reconnaissance and field surveys were compiled and are presented in Table 9.

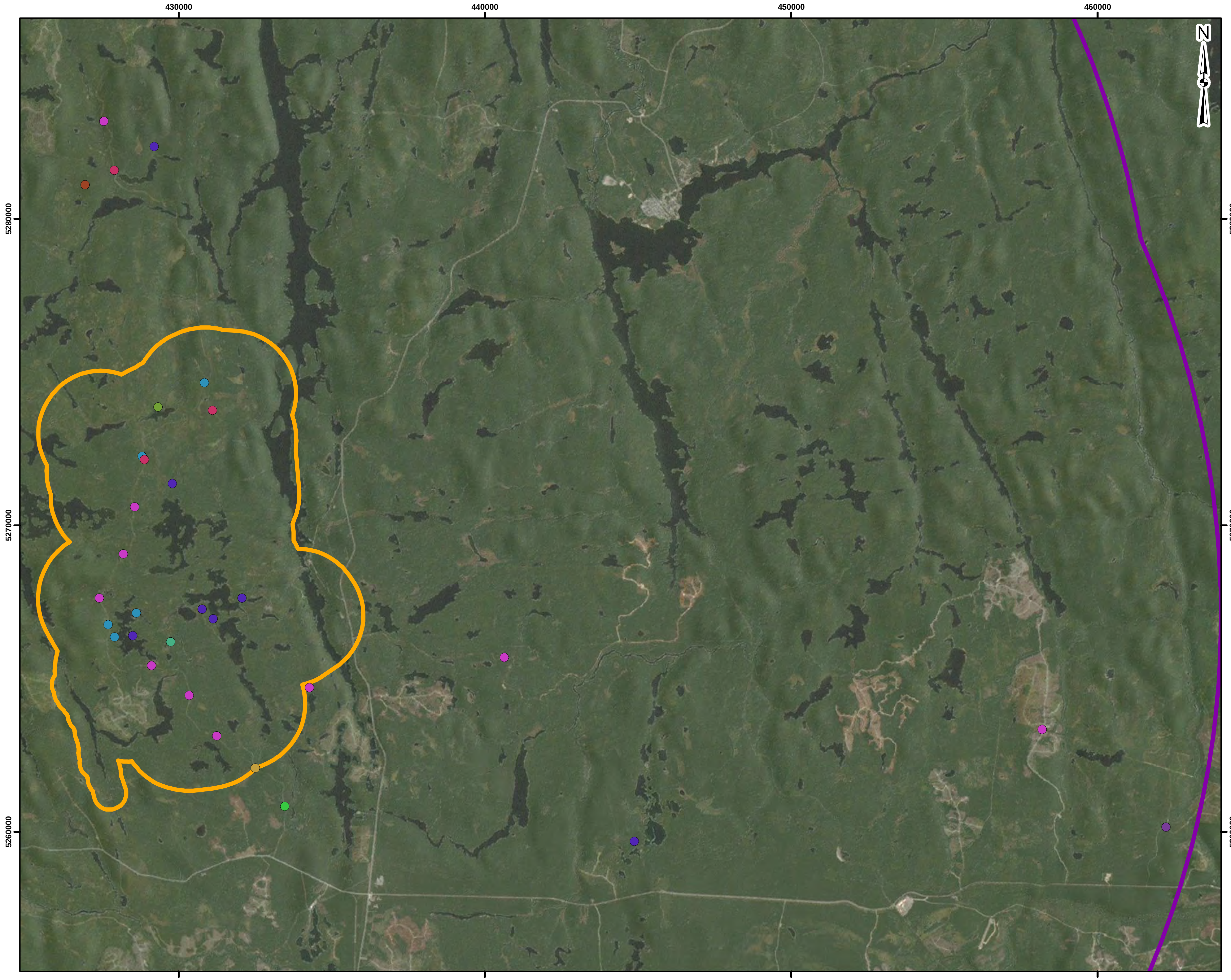
Table 9: Raptor Observations in the Local Regional Study Areas, 2012 and 2013

Common Name	Scientific Name	SRank[a]	Local Study Area	Regional Study Area
bald eagle	*Haliaeetus leucocephalus*	Not listed	X	X
broad-winged hawk	*Buteo platypterus*	Not listed	X	
merlin	*Falco columbarius*	S5B	X	
northern harrier	*Circus cyaneus*	S4B		X
osprey	*Pandion haliaetus*	S5B	X	
red-tailed hawk	*Buteo jamaicensis*	S5		X

Notes:
[a] Based on MNR provincial ranking definitions:
S5 - Secure in Ontario
S4B - Apparently secure and breeding in Ontario
S5B - Secure and breeding in Ontario

One occupied bald eagle nest was observed in the RSA during the aerial reconnaissance flight and a second occupied bald eagle nest was observed adjacent to Côté Lake in the LSA (Figure 15). No other stick nests were observed in the RSA. All other raptors were observed visually during field surveys in 2012 and 2013 (Appendix A).

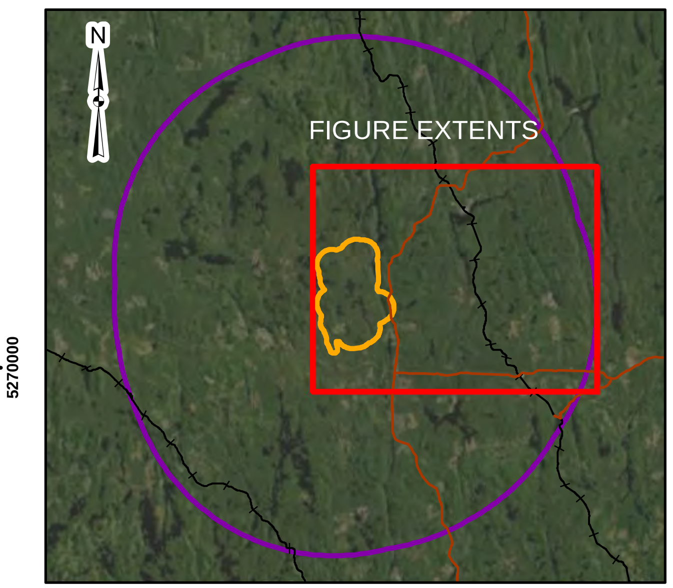
Bald eagle is listed as *Special Concern* under the ESA (Ontario 2007). All other raptor species observed are considered secure provincially (NHIC 2013).



LEGEND

Occupied Stick Nest Locations

- American Kestrel
- Bald Eagle
- Broad Winged Hawk
- Great Horned Owl
- Long-eared Owl
- Merlin
- Northern Hawk Owl
- Northern Harrier
- Northern Saw-whet-owl
- Osprey
- Red-tailed Hawk
- Terrestrial Local Study Area
- Terrestrial Regional Study Area



REFERENCE

ArcGIS Online Basemaps published and hosted by ESRI®.
Sources: ESRI, i-cubed, USDA FSA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGP
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

2,800 0 2,800
SCALE 1:125,000 METRES

PROJECT
IAMGOLD CÔTÉ GOLD PROJECT

TITLE
Occupied Stick Nests Observed in the Local Study Area

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012		
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	JB	Dec. 2013		

Golder Associates
Sudbury, Ontario

FIGURE: 15

Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Figure16_Occupied Stick Nests Observed in the Local Study Area.mxd

5.5 Breeding Bird Point Count Surveys

Population Status and Distribution

The spring migration of birds in Ontario begins in early April and peaks around mid-May. The breeding season for song birds (passerines) and near passerines (e.g., woodpeckers) typically starts during the first week of June and continues for approximately 4 to 5 weeks. Fall migration begins in mid-August for some species such as sandpipers, and continues through to late-October for late migrants such as horned larks (*Eremophila alpestris*).

Sauer et al. (2012) describes population change information for North American bird species, as estimated from the North American Breeding Bird Survey. Estimates of population trends are available for various regions, states, and provinces. Population trends in the Boreal Hardwood Transition Region, encompassing the Great Lakes Region, central Ontario and southern Quebec (North American Bird Conservation Initiative Canada 2012), from 1966 to 2011 are available for 51 of the 52 upland breeding bird species that were recorded within 50 m of observers during the breeding bird surveys conducted in the RSA (Table 10).

Table 10: Population Trends for Upland Breeding Bird Species Recorded within 50 metres of Observers during Upland Breeding Bird Surveys in the Regional Study Area, 2013

Common Name	Scientific Name	Population Trend[(a)]
ruffed grouse	*Bonasa umbellus*	Declining
ruby-throated hummingbird	*Archilochus colubris*	Increasing
pileated woodpecker	*Dryocopus pileatus*	Increasing
hairy woodpecker	*Picoides villosus*	Increasing
yellow-bellied sapsucker	*Sphyrapicus varius*	Increasing
northern flicker	*Colaptes auratus*	Declining
alder flycatcher	*Empidonax alnorum*	Not significant
least flycatcher	*Empidonax minimus*	Declining
yellow-bellied flycatcher	*Empidonax flaviventris*	Not significant
red-eyed vireo	*Vireo olivaceus*	Increasing
blue-headed vireo	*Vireo solitarius*	Increasing
gray jay	*Perisoreus canadensis*	Not significant
black-capped chickadee	*Poecile atricapillus*	Increasing
boreal chickadee	*Parus hudsonica*	Declining
brown creeper	*Certhia americana*	Increasing
red-breasted nuthatch	*Sitta canadensis*	Increasing
winter wren	*Troglodytes troglodytes*	Increasing
marsh wren	*Cistothorus palustris*	Declining
ruby-crowned kinglet	*Regulus calendula*	Declining
golden-crowned kinglet	*Regulus satrapa*	Increasing
American robin	*Turdus migratorius*	Declining
Swainson's thrush	*Catharus ustulatus*	Declining
veery	*Catharus fuscescens*	Declining
cedar waxwing	*Bombycilla cedrorum*	Declining
blackburnian warbler	*Setophaga fusca*	Increasing
black-and-white warbler	*Mniotilta varia*	Declining

Common Name	Scientific Name	Population Trend[(a)]
bay-breasted warbler	*Setophaga castanea*	Declining
black-throated blue warbler	*Setophaga caerulescens*	Increasing
Canada warbler	*Cardellina canadensis*	Declining
chestnut-sided warbler	*Setophaga pensylvanica*	Not significant
magnolia warbler	*Dendroica magnolia*	Increasing
yellow-rumped warbler	*Dendroica coronata*	Not significant
northern parula	*Setophaga americana*	Increasing
yellow warbler	*Dendroica petechia*	Declining
common yellowthroat	*Geothlypis trichas*	Declining
American redstart	*Setophaga ruticilla*	Declining
mourning warbler	*Oporornis philadelphia*	Declining
Nashville warbler	*Oreothlypis ruficapilla*	Not significant
pine warbler	*Setophaga pinus*	Increasing
northern waterthrush	*Parkesia noveboracensis*	Declining
ovenbird	*Seiurus aurocapillus*	Not significant
black-throated green warbler	*Setophaga virens*	Increasing
chipping sparrow	*Spizella passerina*	Declining
Lincoln's sparrow	*Melospiza lincolnii*	Declining
song sparrow	*Melospiza melodia*	Declining
swamp sparrow	*Melospiza georgiana*	Increasing
white-throated sparrow	*Zonotrichia leucophrys*	Declining
eastern towhee	*Pipilo erythrophthalmus*	Declining
evening grosbeak	*Coccothraustes vespertinus*	Declining
pine siskin	*Carduelis pinus*	Declining
white-winged crossbill	*Loxia leucoptera*	Not significant

Note:
[(a)] = population trends as reported in Sauer et al. (2012), species with a not significant rank are those whose populations changes have a P>0.05.

The Ontario Landbird Conservation Plan for Region 12 (Boreal Hardwood Transition Region) was used to identify bird species of conservation priority within the RSA [Ontario Partners in Flight (PIF) 2008]. Priority species are identified through a combination of factors including distribution of breeding and non-breeding populations, population trends, changing environmental conditions or threats to habitat, and population size. These include species on the PIF continental watch list (PIF 2008) with important populations in this region, species with small global ranges, populations that are considered vulnerable to future change and common widespread species that have experienced population declines and face ongoing threats to their breeding or wintering grounds.

Under the Ontario Landbird Conservation Plan (PIF 2008) species are classified by geographic scale as continentally and/or regionally important. Further classification within the geographic scale designates species as conservation concern, in which the bird conservation region has some conservation responsibility, and / or responsibility for a stewardship species, where the bird conservation area has a stewardship responsibility. A total of 18 upland breeding bird species observed in the RSA were assigned conservation priority in Region 12

(PIF 2008). Canada warbler and bay-breasted warbler are classified as a species of both continental and regional concern in the bird conservation region. Northern flicker is classified as only of regional concern in the conservation region. Nashville warbler (*Oreothlypis ruficapilla*), white-throated sparrow (*Zonotrichia leucophrys*), and swamp sparrow (*Melospiza georgiana*) are classified as continental species of stewardship responsibility. Blackburnian warbler (*Setophaga fusca*), black-throated green warbler (*Setophaga virens*),chestnut-sided warbler (*Setophaga pensylvanica*), mourning warbler (*Oporornis Philadelphia*), and yellow-bellied sapsucker (*Sphyrapicus varius*) are continental and regional species of stewardship responsibility. Black-throated blue warbler (*Setophaga caerulescens*), common yellowthroat (*Geothlypis trichas*), least flycatcher (*Empidonax minimus*), ruffed grouse (*Bonasa umbellus*), sedge wren (*Cistothorus platensis*), and veery (*Catharus fuscescens*) are regional species of stewardship responsibility.

Occurrence and Distribution of Upland Breeding Birds within the RSA

Effective Detection Radius (EDR)

The EDR was calculated to be 68 m, which was used to calculate the effective sampling area of 1.53 ha. This was used to estimate density for species and relative abundance for breeding bird community analysis.

Species Level Results

A total of 79 species of birds and two unidentified species group were recorded during the 2012 and 2013 upland breeding bird early survey periods (Appendix I), and includes incidental bird observations (i.e., birds recorded as outside of 50 m from the plot centre, waterbirds, and raptors). Of these, 52 upland breeding bird species and one unidentified species group were recorded within 50 m of observers during the two survey periods (Table 10).

A total of 39 species of upland breeding bird species were identified from data collected during the acoustic monitor surveys (Appendix I). This accounts for all birds heard on the acoustic monitors. Due to the difficulty in determining the distance of singing birds from the observer when listening to the sound recordings created by the acoustic monitors, all birds heard were grouped together. Eastern phoebe (*Sayornis phoebe*) was the only species heard during this round of surveys that was not heard during the early survey rounds in 2012 and 2013.

Northern flicker (*Colaptes auratus*), evening grosbeak (*Coccothraustes vespertinus*), and chipping sparrow (*Spizella passerine*) were only observed in dense coniferous land cover, while yellow-bellied sapsucker was only observed in jack pine regeneration/cut land cover. Eastern towhee (*Pipilo erythrophthalmus*), pileated woodpecker (*Dryocopus pileatus*), hairy woodpecker (*Picoides villosus*), Lincoln's sparrow (*Melospiza lincolnii*), song sparrow (*Melospiza melodia*), gray jay (*Perisoreus canadensis*), ruffed grouse, and ruby-throated hummingbird (*Archilochus* colubris) were only observed in dense forest mixed land cover. American three-toed woodpecker (*Picoides dorsalis*), marsh wren (*Cistothorus palustris*), swamp sparrow, and white-winged crossbill (*Loxia leucoptera*) were only observed in wetland land cover.

Nashville warbler was the most abundant species observed in dense coniferous forest, dense mixed forest, jack pine regeneration/cuts, sparse forest, and wetland land cover types (Table 11). Red-eyed vireo was the most abundant species observed in deciduous forest land cover. Yellow-rumped warbler (*Dendroica coronate*), Nashville warbler, common yellowthroat, red-eyed vireo, and ruby-crowned kinglet (*Regulus calendula*) were the only species to be observed in all six land cover types.

Table 11: Mean (± 1SE) Density (individuals per hectare) of Upland Breeding Bird Species among Land Cover Types in the Regional Study Area, 2013

Common Name	Scientific Name	Dense Coniferous Forest (n = 25)	Jack Pine Regeneration / Cut (n = 14)	Deciduous Forest (n = 6)	Dense Mixed Forest (n = 36)	Sparse Forest (n = 7)	Wetland (n = 10)
ruffed grouse	*Bonasa umbellus*	0	0	0	0.02 [a]	0	0
ruby-throated hummingbird	*Archilochus colubris*	0	0	0	0.02 [a]	0	0
pileated woodpecker	*Dryocopus pileatus*	0	0	0	0.02 [a]	0	0
hairy woodpecker	*Picoides villosus*	0	0	0	0.02 [a]	0	0
yellow-bellied sapsucker	*Sphyrapicus varius*	0	0.05 [a]	0	0	0	0
northern flicker	*Colaptes auratus*	0.03 [a]	0	0	0	0	0
American three-toed woodpecker	*Picoides dorsalis*	0	0	0	0	0	0.07 [a]
unidentified woodpecker	N/A	0	0	0	0.02 [a]	0	0
alder flycatcher	*Empidonax alnorum*	0.08 ± 0.05	0.39 ± 0.21	0.23 ± 0.15	0.02 [a]	0	0
least flycatcher	*Empidonax minimus*	0.03 [a]	0.05 [a]	0	0.08 ± 0.04	0	0
yellow-bellied flycatcher	*Empidonax flaviventris*	0.17 ± 0.07	0.20 ± 0.09	0	0.10 ± 0.05	0.20 ± 0.13	0.28 ± 0.11
red-eyed vireo	*Vireo olivaceus*	0.17 ± 0.06	0.20 ± 0.11	0.34 ± 0.15	0.23 ± 0.07	0.10 [a]	0.07 [a]
blue-headed vireo	*Vireo solitarius*	0.03 [a]	0	0	0.04 ± 0.03	0	0
gray jay	*Perisoreus canadensis*	0	0	0	0.02 [a]	0	0
black-capped chickadee	*Poecile atricapillus*	0.03 [a]	0	0	0.02 [a]	0	0
boreal chickadee	*Parus hudsonica*	0.03 [a]	0	0	0.02 [a]	0	0
brown creeper	*Certhia americana*	0.19 ± 0.07	0.05 [a]	0	0.04 ± 0.03	0.10 [a]	0
red-breasted nuthatch	*Sitta canadensis*	0.14 ± 0.06	0	0.11 [a]	0.02 [a]	0	0
winter wren	*Troglodytes troglodytes*	0.08 ± 0.05	0	0	0.04 ± 0.03	0	0

Common Name	Scientific Name	Dense Coniferous Forest (n = 25)	Jack Pine Regeneration / Cut (n = 14)	Deciduous Forest (n = 6)	Dense Mixed Forest (n = 36)	Sparse Forest (n = 7)	Wetland (n = 10)
marsh wren	*Cistothorus palustris*	0	0	0	0	0	0.07 [a]
ruby-crowned kinglet	*Regulus calendula*	0.30 ± 0.09	0.05 [a]	0.11 [a]	0.06 ± 0.03	0.20 ± 0.13	0.14 ± 0.09
golden-crowned kinglet	*Regulus satrapa*	0.25 ± 0.09	0.05 [a]	0.23 ± 0.15	0.25 ± 0.06	0.10 [a]	0
American robin	*Turdus migratorius*	0	0.05 [a]	0	0	0.10 [a]	0
Swainson's thrush	*Catharus ustulatus*	0.03 [a]	0.10 ± 0.07	0	0.08 ± 0.04	0	0
veery	*Catharus fuscescens*	0	0	0.11 [a]	0.04 ± 0.03	0	0
cedar waxwing	*Bombycilla cedrorum*	0.08 ± 0.05	0.20 ± 0.15	0	0	0.29 ± 0.29	0.07 [a]
blackburnian warbler	*Setophaga fusca*	0.06 ± 0.04	0.05 [a]	0.11 [a]	0.06 ± 0.03	0.10 [a]	0
black-and-white warbler	*Mniotilta varia*	0.06 ± 0.04	0.10 ± 0.07	0.11 [a]	0.15 ± 0.05	0.10 [a]	0
bay-breasted warbler	*Setophaga castanea*	0.03 [a]	0	0	0.04 ± 0.03	0	0
black-throated blue warbler	*Setophaga caerulescens*	0	0	0.23 ± 0.15	0.06 ± 0.03	0	0
Canada warbler	*Cardellina canadensis*	0	0.10 ± 0.07	0	0.06 ± 0.03	0	0
chestnut-sided warbler	*Setophaga pensylvanica*	0.30 ± 0.11	0.34 ± 0.14	0.46 ± 0.46	0.15 ± 0.05	0.20 ± 0.13	0
magnolia warbler	*Dendroica magnolia*	0.11 ± 0.05	0.05 [a]	0.34 ± 0.15	0.19 ± 0.06	0	0
yellow-rumped warbler	*Dendroica coronata*	0.25 ± 0.08	0.29 ± 0.09	0.23 ± 0.15	0.25 ± 0.06	0.20 ± 0.13	0.14 ± 0.09
northern parula	*Setophaga americana*	0.08 ± 0.05	0	0	0.10 ± 0.04	0.20 ± 0.13	0
yellow warbler	*Dendroica petechia*	0	0.05 [a]	0	0.04 ± 0.03	0	0
common yellowthroat	*Geothlypis trichas*	0.06 ± 0.04	0.20 ± 0.11	0.11 [a]	0.08 ± 0.05	0.10 [a]	0.34 ± 0.11
American redstart	*Setophaga ruticilla*	0.03 [a]	0.05 [a]	0.11 [a]	0.06 ± 0.03	0	0

Common Name	Scientific Name	Dense Coniferous Forest (n = 25)	Jack Pine Regeneration / Cut (n = 14)	Deciduous Forest (n = 6)	Dense Mixed Forest (n = 36)	Sparse Forest (n = 7)	Wetland (n = 10)
mourning warbler	*Oporornis philadelphia*	0.03 [a]	0.25 ± 0.12	0.11 [a]	0.06 ± 0.04	0	0
Nashville warbler	*Oreothlypis ruficapilla*	0.74 ± 0.11	0.88 ± 0.17	0.34 ± 0.15	0.46 ± 0.08	0.69 ± 0.26	0.76 ± 0.19
pine warbler	*Setophaga pinus*	0.03 [a]	0	0	0.06 ± 0.03	0	0
northern waterthrush	*Parkesia noveboracensis*	0	0	0	0.04 [a]	0.29 [a]	0
ovenbird	*Seiurus aurocapillus*	0.03 [a]	0.05 [a]	0.11 [a]	0.23 ± 0.07	0	0
black-throated green warbler	*Setophaga virens*	0	0	0.11 [a]	0.02 [a]	0	0
chipping sparrow	*Spizella passerina*	0.03 [a]	0	0	0	0	0
Lincoln's sparrow	*Melospiza lincolnii*	0	0	0	0.02 [a]	0	0
song sparrow	*Melospiza melodia*	0	0	0	0.02 [a]	0	0
swamp sparrow	*Melospiza georgiana*	0	0	0	0	0	0.07 [a]
white-throated sparrow	*Zonotrichia leucophrys*	0.11 ± 0.07	0.10 ± 0.07	0.11 [a]	0.08 ± 0.05	0.10 [a]	0
eastern towhee	*Pipilo erythrophthalmus*	0	0	0	0.02 [a]	0	0
unidentified blackbird	N/A	0	0.05 [a]	0	0	0	0
evening grosbeak	*Coccothraustes vespertinus*	0.03[a]	0	0	0	0	0
pine siskin	*Carduelis pinus*	0	0.05 [a]	0	0.02 [a]	0	0.07 [a]
white-winged crossbill	*Loxia leucoptera*	0	0	0	0	0	0.07 [a]

Notes:
(a) Only the mean is reported, as the species was only recorded at one plot within the land cover type.
n = sample number

Community Level Results

Relative abundance of bird species (birds per ha) was calculated for each land cover type. Jack pine regeneration/cut land cover had the highest relative abundance, while deciduous forest land cover had the highest species richness of the land cover types sampled in the RSA (Table 12). Wetland land cover had the lowest relative abundance and species richness of land cover types sampled in the RSA. No significant difference in relative abundance was found between the sampled land cover types ($F_{5, 92} = 2.2$, $P = 0.06$).

Table 12: Relative Abundance and Observed Species Richness of Upland Breeding Birds among Habitats, 2013

Land Cover Type	Number of Plots	Relative Abundance[(a)]		Species Richness[(b)]	
		Mean ± 1SE	Min – Max	Mean ± 1SE	Min – Max
Dense Coniferous Forest	25	3.58 ± 0.19	0.69 - 4.82	4.36 ± 0.27	1 - 6
Jack Pine Regeneration/Cut	14	3.98 ± 0.43	1.38 - 6.19	4.57 ± 0.48	2 - 8
Deciduous Forest	6	3.67 ± 0.88	1.38 - 6.19	4.83 ± 1.08	2 - 9
Dense Mixed Forest	36	3.36 ± 0.25	0.69 - 6.19	4.42 ± 0.31	1 - 8
Sparse Forest	7	3.05 ± 0.83	0.69 - 6.19	3.43 ± 0.90	1 - 7
Wetland	10	2.13 ± 0.26	0.69 - 3.44	2.70 ± 0.30	1 - 4

Notes:
(a) Abundance = the number of birds per ha
(b) Richness = the number of bird species identified
SE = standard error; Min = minimum; Max = maximum

The species accumulation curve for the RSA that used all upland breeding bird observations within the sampling radius (i.e., 50 m) did not reach an asymptote (Figure 16). The curve predicted that 54 species (46 to 62 [95% Confidence Interval (CI)]) would be present in the RSA, based on 468 observed birds. Using all observations of upland breeding birds recorded during the breeding bird surveys (i.e., fly-overs and birds detected within 100 m) the generated species accumulation curve also did not reach an asymptote (Figure 16). The curve predicted that 69 species [61 to 77 (95% CI)] would be detected, and that further sampling is required to estimate the total number of species that may occupy the RSA. The occurrence of species in any given area likely varies from year to year, particularly for uncommon species that may be at the edge of their geographic range and/or are currently at low population size. However, the results from the species accumulation curve indicate that sampling was adequate to assess the effects of the Project on upland breeding birds.

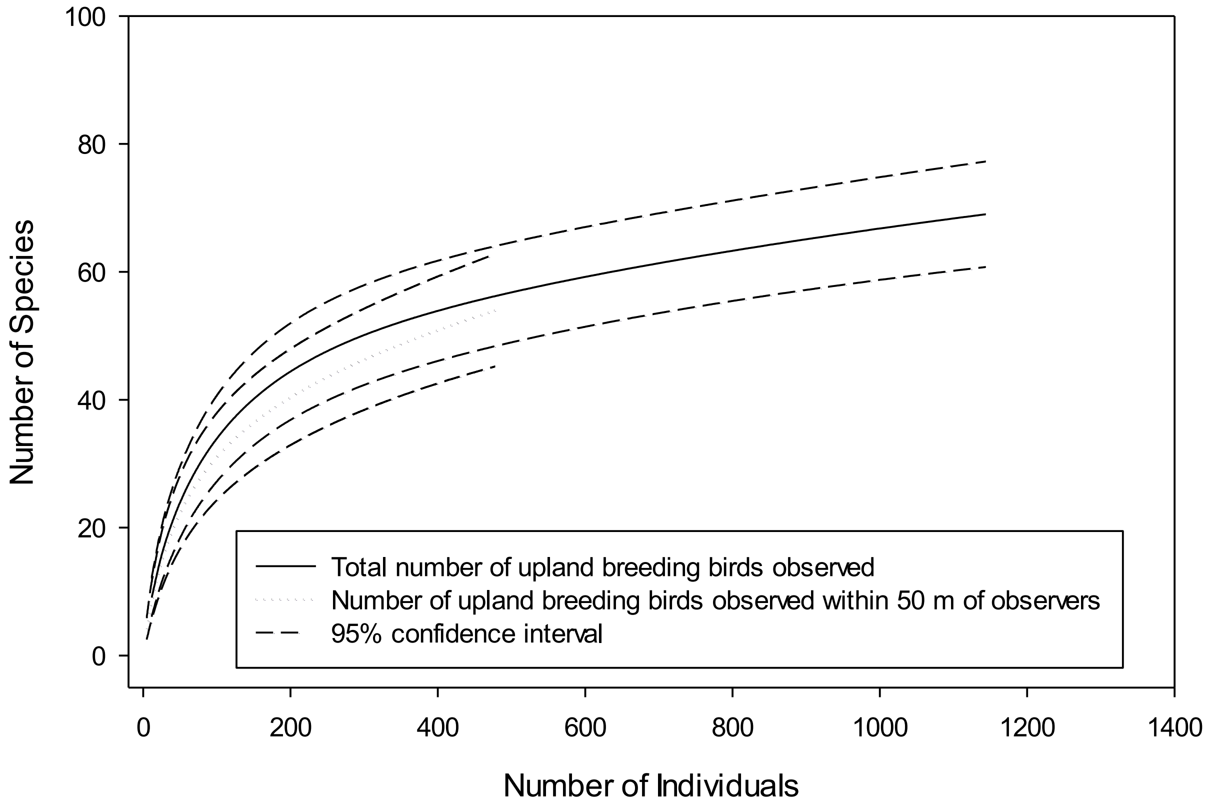


Figure 16: Species Richness Curve (95% Confidence Intervals) for Upland Breeding Birds within the Regional Study Area, 2012 and 2013

Habitat Selection and Foraging

Most upland breeding birds prefer specific habitats to nest in and are associated with this habitat for the duration of nesting. Upland breeding birds nest in a variety of habitats, including woodland, grassland, shrubland, and disturbed habitats. Woodland habitat breeding species (e.g., red-eyed vireo and black-throated green warbler) were the most abundant species observed during the upland breeding bird surveys within the RSA and accounted for 75% of the upland breeding bird species observed. Shrubland breeding birds (e.g., white-throated sparrow) accounted for 17% of the species observed, while wetland (e.g., marsh wren) and urban [e.g., American robin and blue jay (*Cyanocitta cristata*)] breeding birds each accounted for 4% of the species recorded in the RSA.

Most upland breeding birds observed within the RSA are insectivorous (i.e., they eat insects), although they will also occasionally eat seeds, fruit, and other arthropods (Birds of North America Online 2013). Some exceptions to this are American crow, which is omnivorous (i.e., eat a variety of foods), and cedar waxwing, which is primarily fructivorous (i.e., eats fruit).

Two Threatened (SARA 2013) upland breeding bird species were observed in the RSA during upland breeding bird surveys: olive-sided flycatcher and Canada warbler. Olive-sided flycatcher was recorded at one point count location in the RSA (approximately 13 km east of the LSA) and prefer to nest on the edge of natural openings (e.g., rivers, muskegs, bogs, swamps) in open to semi-open mature forest stands in the boreal forest (COSEWIC 2007). A large proportion of their breeding range is in Canada (54%) and they have suffered a 29% decline in population size in North America and Canada from 1996 to 2006 (COSEWIC 2007).

Canada warblers were observed at five point count locations in the LSA and two point count locations in the RSA. Canada warbler is a forest nesting bird that uses many different breeding habitats (e.g., deciduous, coniferous, mixed, riparian shrub, and old growth forest), which often have a well-developed shrub understory (COSEWIC 2008). They breed in all provinces except Nunavut, Newfoundland, and Labrador, and approximately 80% of their breeding range is in Canada (COSEWIC 2008).

5.6 Marsh birds

Population Status and Distribution

No focal marsh bird species were observed during the 13 marsh survey periods in 2012 and the seven marsh surveys in 2013.

Population trend data for the Boreal Hardwood Transition region was available for four of the focal marsh bird species (Sauer et al. 2012). Sora, Virginia rail, pied-billed grebe and American coot all had non-significant ($P>0.05$) population trends in this region. However, no population trend data was available for least bittern and common moorhen.

Habitat Selection and Foraging

Marsh birds prefer to nest and forage in the dense vegetation of wetlands and thus are typically not well studied (Conway 1995; Melvin and Gibbs 1996; Muller and Storer 1999; Lowther et al. 2009). Many marsh bird species are cryptically coloured to match wetland vegetation. They spend most of their time foraging on the ground, often reacting to threats by hiding in the vegetation and relying on camouflage for protection. Marsh birds are opportunistic foragers consuming invertebrates, amphibians, fish, and wetland vegetation.

5.7 Waterbirds

Population Status and Distribution

Waterbird populations in northern Saskatchewan, northern Manitoba, and western Ontario have significantly decreased over the last 57 years (-21%; $P<0.001$), but the 2012 populations increased by 13% compared to the 2011 season (Zimpfer et al. 2012). In 2012, mallard (*Anas platyrhynchos*), green-winged teal (*Anas crecca*), and blue-winged teal (*Anas discors*) all had non-significant ($P>0.05$) increases in population from the 2011 season. All three species had decreasing population trends from the long-term average but only blue-winged teal and green-winged teal had *significant* decreases.

Population trends are also available for areas (Zimpfer et al. 2012) that overlap with the LSA. Green-winged teal, mallard, and merganser species (*Mergus* sp.) had non-significant population increases from the 2011 season, while ring-necked duck (*Aythya collaris*) and goldeneye species (*Bucephala islandica* or *B. clangula*) had non-significant decreasing trends. Only green-winged teal had a non-significant increasing population trend compared to the long-term average, while mallard, ring-necked duck, goldeneye species, and merganser species all have non-significant decreasing population trends (Zimpfer et al. 2012).

A total of 10 waterbird species were observed during the waterbird breeding surveys (Table 13). Two species [bufflehead (*Bucephala albeola*) and common merganser (*Mergus merganser*)] were only observed in lake habitat, while American black duck (*Anas rubripes*), blue-winged teal, and wood duck (*Aix sponsa*) were only observed in river habitat. Common goldeneye (*Bucephala clangula*) was the most abundant species observed in lake habitat, while American black duck was the most abundant species observed in river habitat.

Table 13: Mean (± 1SE) Density (individuals per hectare) of Waterbird Species during Breeding Surveys among Waterbody Types[(a)] in the Local Study Area, 2012

Common Name	Scientific Name	Lake (n = 16)	River (n = 22)
ring-necked duck	*Aythya collaris*	0.08([b])	0.38 ± 0.19
bufflehead	*Bucephala albeola*	0.28 ± 0.20	0
common goldeneye	*Bucephala clangula*	0.32 ± 0.17	0.54 ± 0.20
American black duck	*Anas rubripes*	0	0.81 ± 0.37
green winged-teal	*Anas crecca*	0.16 ± 0.09	0.22 ± 0.16
blue-winged teal	*Anas discors*	0	0.2(b)
mallard	*Anas platyrhynchos*	0.16 ± 0.12	0.24 ± 0.14
wood duck	*Aix sponsa*	0	0.03([b])
common merganser	*Mergus merganser*	0.08([b])	0
hooded merganser	*Lophodytes cucullatus*	0.04([b])	0.60 ± 0.41

Notes:
[(a)] Waterbody type was grouped by either lake or river habitat being surveyed.
[(b)] Only the mean is reported, as the species was only recorded at one location within the waterbody type.

Five waterbird species [ring-necked duck, hooded merganser (*Lophodytes cucullatus*), American black duck, common merganser and common loon (*Gavia immer*)] were observed in lake habitat during the second round of waterbird surveys in 2012. Ring-necked ducks were the most observed species and the only species observed with a brood (one brood of nine young). American black duck was the second most observed species.

Four waterbird species [common loon, Canada goose (*Branta canadensis*), mallard, and ring-necked duck] were incidentally observed in the LSA during marsh bird surveys conducted in 2012.

Habitat Selection and Foraging

Dabbling ducks [e.g., mallards, American wigeon (*Anas americana*)] nest in upland areas, while diving ducks (e.g., scaup species, ring-necked duck) nest over water in emergent vegetation or on structures such as beaver lodges. Merganser, goldeneye, and bufflehead nest in tree cavities. The variety of aquatic habitats in the boreal forest provides food items such as aquatic vegetation, invertebrates, and fish that can support many species of waterbirds. Waterfowl young are dependent on invertebrates during their first four weeks of life because invertebrates satisfy protein requirements for feather development (Hornung 2005).

5.8 Whip-poor-will and Common Nighthawk

Surveys were conducted between 9:30 p.m. and 3:20 a.m, from June 5 to June 8, and from July 6 to July 7, 2012. Cloud cover ranged from clear to cloudy and air temperatures ranged from 8.1°C to 16.9°C in June and 13.3°C to 17.8°C in July. During the surveys, whip-poor-wills were heard calling at one location (WPWL-29B) within the RSA. Common nighthawks were not detected in the LSA but were heard calling at three locations within the RSA (WPWL-15A, WPWL-a30 and WPWL-a31) (Figure 9). Table 14 provides a summary of weather conditions and survey times for these surveys.

Table 14: Whip-poor-will and Common Nighthawk Survey Weather Conditions

Date (2012)	Start Time (p.m.)	End Time (a.m.)	Maximum Temperature (°C)	Minimum Temperature (°C)	Maximum Wind Speed	Minimum Wind Speed	Cloud Cover
June 5	10:51	12:09	13.0	10.1	calm	light	Cloudy
June 6	9:59	2:50	13.6	8.1	calm	-	Mostly cloudy
June 7	9:39	3:20	16.9	14.0	calm	light	Mostly cloudy
June 8	9:30	12:28	14.5	11.1	calm	-	Mostly cloudy/cloudy
July 6	9:53	3:12	17.8	13.7	calm	light	Cloudy
July 7	9:55	1:38	14.7	13.3	calm	-	Clear

Note:
[(a)] Minimum and Maximum temperatures cited from Environment Canada 2012.

Whip-poor-wills are typically found in areas with a mix of open and forested habitat, such as savannahs, open woodlands or openings in more mature, deciduous, coniferous and mixed forests (MNR 2009c). It forages in open areas and uses forested areas for roosting (resting and sleeping) and nesting. Whip-poor-will territories were delineated at locations where simultaneous whip-poor-will calls were noted in the RSA. Based on remote imagery interpretation, the whip-poor-will territories appear to be in a cut area surrounded by dense coniferous forest habitat, suggesting that habitat use by whip-poor-wills in the RSA is consistent with the habitat requirements documented in the literature (MNR 2009c).

Common nighthawk are typically found in open areas with little to no ground vegetation, such as logged or burned-over areas, forest clearings, rock barrens, peat bogs, lakeshores, mine tailings (MNR 2009d). The common nighthawk were observed in jack pine regeneration / cut areas and open bog land cover types which are consistent with the habitat requirements documented by the MNR (2009d).

5.9 Basking Turtle Surveys

Blanding's turtle can be found in several types of freshwater environments, including lakes, permanent or temporary pools, slow flowing streams, marshes and swamps (SARA 2013). Blanding's turtles of all ages occur primarily in shallow water, with adults and juveniles showing slightly different habitat preferences. Adult Blanding's turtles are generally found in open or partially vegetated sites, and juveniles prefer areas that contain thick aquatic vegetation, including sphagnum (*Sphagnum* sp.), species of the water lily family (*Nymphaeaceae*) and algae (COSEWIC 2005).

No Blanding's turtles were observed during basking turtle surveys within the LSA, however, painted turtles (*Chrysemys picta marginata*) were observed along Bagsverd Creek (BT001), at unnamed lake (BT020B) and at Clam Lake (BT013A) (Figure 10). Based on the known habitat requirements of Blanding's turtle, habitat in Bagsverd Creek (Appendix J; Table J-1; Appendix K), Unnamed Lake (Appendix J; Table J-2; Appendix K), and Clam Lake (Appendix J; Table J-3) was judged to have a low potential to support Blanding's turtle. This was based on the presence of dense shrub vegetation along the banks of Bagsverd Creek that limited the number of potential basking locations, and lake shoreline habitat that was typically defined by steep bedrock, deep water, limited aquatic vegetation, and limited basking locations. Occasional inclusions of habitat in these water features were judged to have moderate potential and were selected for intensive basking surveys (Appendix K). Habitat selected for the intensive basking surveys typically provided more locations for basking [e.g., logs, vegetation hummocks, and beaver (*Castor canadensis*) dams], areas of dense aquatic vegetation and/or an organic substrate in areas of low water flow. Substrate and weather conditions at the time of each intensive basking turtle survey are provided in Appendix L.

An additional eight wetland features within the LSA were selected for intensive basking turtle surveys in 2012 and eight more wetland features were selected for the same purpose in 2013 (Figure 10; Appendix J; Table J-6). These wetlands were identified as potentially being affected by the Project and were judged to have habitat characteristics similar to those preferred by Blanding's turtle. No basking turtles were observed during these surveys and of these 16 wetlands, 11 (BT014A, BT015A, BT016A, BT018A, T01, T03, T06, T09, T11, T13, and T14) were judged to have low potential due to the absence of cover provided by aquatic vegetation and limited potential basking habitat.

Results of the 2012 and 2013 basking turtle surveys are detailed in Appendix J; Tables J-1 through J-6 and basking turtle survey location photographs area presented in Appendix K.

Nine wetland features and five locations along Bagsverd Creek within the RSA (Appendix M; Tables M-1 and Table M-2) were also selected for intensive basking turtle surveys No basking turtles were found at survey locations within the RSA (Appendix M; Table M-1 and Table M-2).

Golder biologists recorded incidental wildlife observations while completing other terrestrial biological surveys and searched possible turtle nesting locations that were encountered. Egg shells of an unknown turtle species were observed in the RSA adjacent to survey location WB-045. Minnow biologists (Weech 2012, pers. comm.) also recorded observations of basking turtles, and turtles captured in sampling equipment while conducting aquatic surveys, between July 4 and July 16, 2012 (Appendix N). Those surveys utilised hoop nets of various sizes (large - 0.9 m diameter 3.8 cm stretched mesh, medium - 0.75 m diameter hoops 2.5 cm stretched mesh, small - 0.61 diameter hoops 1.3 cm stretched mesh). Incidental observations of turtles recorded by Minnow augmented the basking turtle survey observations with five painted turtles being captured in hoop nets set in Unnamed Lake. Minnow did not record observations of turtle species at any other aquatic survey locations.

5.10 Amphibian Surveys

Amphibian species identified during the surveys are classified as secure provincially and federally. Based on available range maps [Royal Ontario Museum (ROM) 2012] there are no amphibians in Chester Township that are considered at risk. As a result, any amphibians occurring within the RSA are expected to be common and widespread species across northern Ontario.

In total, three species of amphibians were heard calling during the amphibian surveys in the LSA and four species were heard calling within the RSA. Detailed results of the surveys are provided in Appendix O. Incidental observations by Golder biologists identified wood frog (*Rana sylvatica*), redback salamander (*Plethodon cinereus*) and an unidentified salamander species in the LSA, and a mink frog (*Rana septentrionalis*) in the RSA. The species heard or observed during the 2012 and 2013 surveys and their preferred habitat are listed in Table 15.

Table 15: Amphibian Species Heard and Observed in the Local and Regional Study Areas, 2012 and 2013

Common Name	Scientific Name	Study Area where Observed	Preferred Habitat
American toad	*Bufo americanus*	LSA	American toads are typically found in coniferous and deciduous forests, but are also known to inhabit clearings and open fields (ROM 2012).
bullfrog	*Rana catesbeiana*	LSA	Bullfrogs are found in lowland permanent water bodies including wetlands, ponds, lakes, sloughs, creeks and rivers. Although bullfrogs are primarily a "shore frog" they occasionally move to terrestrial sites at night (Hallock and McAllister 2009).
gray treefrog	*Hyla versicolor*	LSA, RSA	Gray treefrogs live in moist, deciduous woodlands and swamps near water. They are also found in pine barrens (ROM 2012).
spring peeper	*Pseudacris crucifer*	LSA, RSA	Spring peepers are reported to overwinter in leaf litter and tend to breed in shallow ponds or vernal pools, often congregating in early spring, before ponds are ice-free (MacCulloch 2002).
wood frog	*Rana sylvatica*	LSA, RSA	Wood frogs spend the summer on the forest floor, in both deciduous and coniferous forests. Possibly the most widely distributed amphibian species in Ontario, the wood frog can be found wherever suitable habitat exists (ROM 2012).
redback salamander	*Plethodon cinereus*	LSA	Redback salamanders inhabit moist areas on the forest floor (ROM 2012).
unidentified salamander	-	-	-

5.11 Owl Surveys

Two species of owls were noted in the LSA and five species of owls were noted in the RSA during the 2012 owl surveys. In addition, a great horned owl was observed incidentally in the LSA during the 2013 bat hibernacula field surveys. Owl species that were heard or observed during the 2012 and 2013 field surveys are listed in Table 16.

Table 16: Owl Species Identified within the Local Study Area and Regional Study Area, 2012 and 2013

Common Name	Scientific Name	SRank[a]	Local Study Area	Regional Study Area
great horned owl	*Bubo virginianus*	S4	X	X
long-eared owl	*Asio otus*	S4	–	X
northern hawk owl	*Surnia ulula*	S4	–	X
northern saw-whet owl	*Aegolius acadicus*	S4	X	X
unidentified owl	–	–	–	X

Note:
[a] Based on Provincial ranking definitions: S4 – Apparently secure in Ontario

Northern saw-whet owls were heard calling at multiple locations during both rounds of owl surveys in the LSA and one great-horned owl was heard calling near survey location Owl-10 in the LSA. These survey locations were located in dense mixed, dense deciduous and depletion (cut) forest types. Within the RSA, one long-eared owl (*Asio otus*) was heard calling near survey location Owl-1, one great horned owl was heard calling near survey locations Owl-17, Owl-18, and Owl-19, and one northern hawk owl (*Surnia ulula*) was heard calling near survey location Owl-8. All owl species observed in the LSA are ranked as apparently secure (S4) in Ontario (NHIC 2013).

Habitat required by owl species heard during owl surveys, is widely distributed throughout the RSA. Great horned owls can be found in forested habitats, but prefer the fragmented habitats of open, second-growth forests, or swamps. Long-eared owls nest in dense coniferous forest, mixed forest, and woodlots usually in close proximity to foraging habitat in open woodlands or marshes. The northern hawk owl prefers forest openings such as burns or extensive clear cuts, especially with a graminoid ground cover, which provides habitat for its desired prey. Northern saw-whet owls breed in a wide variety of forest types, but most frequently in coniferous forests (Cadman et al. 2007).

5.12 Bats

Desktop Habitat Assessment

A desktop habitat assessment was conducted to identify areas within the bat study area with potential to support maternity roosts and bat hibernacula. Six areas were identified as having characteristics suitable for supporting bat maternity roosts (Figure 11). In addition, 119 locations were identified within the bat study area with potential characteristics for suitable bat hibernacula (Figure 12).

Acoustic Survey of Candidate Bat Maternity Roost Habitat

Five species of bat and one unidentified species of bat were recorded during acoustic surveys completed in the bat study area (Table 17). The relative bat activity for all species was highest at COT02 followed by COT05 (Figure 12; Table 17). While little brown myotis was not recorded during the driving transects, this species was recorded at five of the six stationary stations (Table 17). Little brown myotis was recorded on the night of June 13, 2013 during the surveys at COT02 (Table 18). Northern long-eared myotis was not recorded within the bat study area.

Table 17: Mean (Standard Deviation) Acoustic Bat Survey Results in the Bat Study Area

Station	Nights	Total Passes	Hi Frequency Total[(a)]	Lo Frequency Total[(b)]	Big Brown or Silver-Haired Bat	Unknown Myotis	Hoary Bat	Silver-Haired Bat	Big Brown Bat	Red Bat	Little Brown Myotis	Northern Long-Eared Myotis
COT01	16	2.06(3.94)	0.31(0.6)	1.75(3.49)	0(0)	0(0)	0(0)	0.56(1.31)	0.06(0.25)	0.06(0.25)	0(0)	0(0)
COT02	14	162.5(120.88)	71.14(106.57)	91.36(59.5)	3.14(3.53)	2.21(5.81)	2(2.22)	34.71(31.31)	0.57(0.76)	2.5(5.02)	19.64(33.59)	0(0)
COT03	18	13.5(14)	2.69(2.44)	10.81(12.75)	0.13(0.5)	0.19(0.4)	2.13(7.74)	2.94(2.24)	0.13(0.34)	0(0)	1.13(1.26)	0(0)
COT04	13	5.23(5.66)	0.31(0.63)	4.92(5.3)	0(0)	0(0)	1.08(1.71)	1.62(2.36)	0.08(0.28)	0(0)	0.08(0.28)	0(0)
COT05	22	28.27(26.06)	3.27(1.93)	25(25.87)	0.45(0.91)	0.09(0.43)	1.77(4.5)	11.27(10.29)	0.64(1.76)	0.09(0.29)	2.14(1.64)	0(0)
COT06	16	3.81(2.14)	1.56(1.31)	2.25(1.69)	0(0)	0.06(0.25)	0.13(0.34)	0.38(0.62)	0(0)	0.13(0.34)	0.19(0.54)	0(0)

Notes:
(a) Hi Frequency bats include little brown myotis, northern long-eared myotis, and red bat.
(b) Lo Frequency bats include hoary bat, big brown bat, and silver-haired bat.

Table 18: Number of Nights with Little Brown Myotis Recordings

Station	Number of Survey Nights	Total Number Little Brown Myotis Recordings	Maximum Number of Little Brown Myotis Observations (Passes per Survey Night)
COT01	16	0	0
COT02	14	275	117
COT03	18	19	3
COT04	13	1	1
COT05	22	47	7
COT06	16	3	2

Candidate Hibernacula Investigation

During the six visual surveys, no bats were observed entering or exiting the features identified as potential hibernacula locations or interacting with each other. One little brown myotis was recorded on the handheld EM3 during the survey at COT13 (Table 19 and Figure 12) on August 21, 2013 but it was not observed visually. One little brown myotis was also recorded on September 4, 2013 at COT12. One or two other non-cave bats (i.e., bats that do not hibernate in caves) were observed, or heard through the EM3 on each of the nights of visual survey.

The stationary detectors recorded between one and eight total bat passes per night (Table 20). Northern long-eared myotis was not recorded at any station. Little brown myotis was recorded at stations COT07, COT09, COT10 and COT13 (Figure 11 and Figure 12). On August 21, 2013 at station COT13, three little brown bat recordings were made, which may have been from the same individual. On all other nights when little brown bat was recorded, there was only one recording of this species. Swarming activity is indicated by an increase in activity of cave hibernating bats during late August and early September. Neither the visual surveys, nor the stationary acoustic surveys provide evidence that there is an increase in cave bat activity at these times and locations within the bat study area.

Table 19: Total Survey Nights and Maximum Passes of the Little Brown Myotis during a Single Evening at Each Monitoring Station

Station	Nights	Total Little Brown Myotis	Max Little Brown Myotis
COT07	9	1	1
COT08	11	0	0
COT09	16	2	1
COT10	10	2	1
COT11	11	0	0
COT12	11	0	0
COT13	11	7	3

Table 20: Mean (Standard Deviation) Bat Passes at Stationary Bat Detectors Placed at Candidate Hibernacula

Station	Number of Nights	Mean Number of Passes	HiF[a] Total	LoF[b] Total	Big Brown or Silver-haired	Unknown Myotis	Hoary	Silver-haired	Big Brown	Red	Little Brown	Northern Long-eared Myotis
COT07	9	3(2.6)	1.33(1.22)	1.67(1.73)	0(0)	0(0)	0.22(0.44)	0.11(0.33)	0(0)	0(0)	0.11(0.33)	0(0)
COT08	11	6.45(13.73)	0.55(1.04)	5.91(13.12)	0.09(0.3)	0.09(0.3)	0.09(0.3)	1.36(2.73)	0(0)	0(0)	0(0)	0(0)
COT09	16	8(4.02)	2(1.63)	6(3.16)	0.06(0.25)	0(0)	0.31(0.6)	2.81(1.76)	0(0)	0.13(0.34)	0.13(0.34)	0(0)
COT10	10	4.2(3.43)	1.9(1.97)	2.3(2.21)	0(0)	0(0)	0(0)	0.2(0.42)	0(0)	0(0)	0.2(0.42)	0(0)
COT11	11	5.09(6.56)	0.55(0.93)	4.55(6.39)	0.09(0.3)	0(0)	0(0)	1.09(2.17)	0(0)	0(0)	0(0)	0(0)
COT12	11	1.82(1.78)	1(1.26)	0.82(0.75)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
COT13	11	7.36(4.01)	2.55(2.73)	4.82(4.09)	0(0)	0(0)	0.64(0.67)	2.36(3.04)	0(0)	0.09(0.3)	0.64(1.03)	0(0)

Notes:
HiF = high frequency (>36 Hz) calls
LoF = low frequency (<36 Hz) calls

5.13 Winter Track Count Surveys

The following sections discuss population status, occurrence, and distribution of wildlife that were observed in the RSA during winter track count. Winter track observation photographs area provided in Appendix Q.

5.13.1 Grouse

Population Status and Distribution

Grouse species typically found in the RSA include sharp-tailed grouse (*Tympanuchus phasianellus*), ruffed grouse (*Bonasa umbellus*) and spruce grouse (*Falcipennis canadensis*). There are no known at risk grouse species with potential to inhabit the RSA. Ruffed grouse are a popular gamebird and are distributed widely across North America. They most commonly use forests in an early to mid-successional stage with small diameter trees (Rusch et al. 2000). Ruffed grouse populations can vary dramatically from year to year with a population peak occurring approximately every 10 years (Rusch et al. 2000). The spruce grouse range extends across North America and are commonly found in the coniferous boreal forest of northern Ontario (Boag and Schroeder 1992). Northern populations of sharp-tailed grouse fluctuate and some populations may be migratory but they are generally found in low numbers in Ontario (Connelly et al. 1998).

Occurrence and Distribution of Grouse within the Regional Study Area

Grouse species tracks were combined for the winter track density as it is difficult to differentiate species by tracks. The highest average track densities were detected in dense deciduous forest and forest depletion-cuts (Table 21).

Table 21: Grouse Snow Track Density among Land Cover Types within the Regional Study Area

Land Cover Type	Number of Tracks (mean ± SE)	Observed Use (TKD)	Distance Sampled (km)
Bog – treed	0	0	0.75
Forest – dense coniferous	0.56 ± 0.45	24.60	7.03
Forest – dense deciduous	0.81 [(a)]	6.49	0.93
Forest – dense mixed	0.32 ± 0.13	25.01	17.20
Forest – sparse	0	0	0.88
Forest Depletion – cuts	0.74[(a)]	10.31	1.72
Jack Pine Regeneration/ Cut	0.06[(a)]	0.67	5.34
Wetland	0	0	1.59

Notes:
SE = Standard error;
TKD = total number of tracks standardized divided by land cover type segment length and number of days since last snow; km = kilometres;
[(a)] Only the mean is reported, as tracks were only recorded in one land cover type segment.

Habitat Selection and Foraging

Spruce grouse are coniferous forest specialists that inhabit the boreal region of Canada and the northern United States (Boag and Schroeder 1992). During the winter, pine and spruce needles comprise a majority of their diet; however, in the summer they consume buds, fruit, leaves, flowers, fungi, and invertebrates.

Ruffed grouse are an early successional forest species found across Canada and the northern United States where they are most closely associated with deciduous and mixed coniferous-deciduous forests, primarily aspen stands (Rusch et al. 2000). Although they are sometimes found in boreal forests, their survival rates are much lower in this habitat. Their diet includes buds, leaves, fruit, acorns, berries, grasses, and invertebrates.

Sharp-tailed grouse prefer the semi-open habitats found in grasslands, steppes, and shrublands, but are sometimes found in bog and fen habitats (Connelly et al. 1998). They primarily nest in habitats with dense herbaceous and shrub cover but will also nest in agricultural fields such as alfalfa and wheat stubble. Their diet consists of buds, flowers, seeds (often from cereal grains), fruit, flowers, and invertebrates.

5.13.2 Lynx

Population Status and Distribution

In Ontario, lynx are common north of the French and Mattawa Rivers and are found throughout the boreal forest (Dobbyn 1994). Lynx in Ontario are listed as Secure (SARO 2013) and Not at Risk under SARA (2013).

Occurrence and Distribution of Lynx within the Regional Study Area

The highest average track density for lynx in the RSA was detected in dense mixed forest, followed by jack pine regeneration / cut and dense coniferous forest (Table 22). Total track density was highest in dense mixed forest.

Table 22: Lynx Snow Track Density among Land Cover Types within the Regional Study Area

Land Cover Type	Number of Tracks (mean ± SE)	Observed Use (TKD)	Distance Sampled (km)
Bog – treed	0	0	0.75
Forest – dense coniferous	0.16 ± 0.11	6.94	7.03
Forest – dense deciduous	0	0	0.93
Forest – dense mixed	0.35 ± 0.15	28.02	17.20
Forest – sparse	0	0	0.88
Forest Depletion – cuts	0	0	1.72
Jack Pine Regeneration / Cut	0.21[a]	2.53	5.34
Wetland	0	0	1.59

Notes:
SE = Standard error;
TKD = total number of tracks standardized divided by land cover type segment length and number of days since last snow; km = kilometres;
[a] Only the mean is reported, as tracks were only recorded in one land cover type segment.

Lynx are only found in forests where there are sufficient numbers of snowshoe hares (*Lepus americanus*) and their home range size varies with the abundance of prey and the season (Dobbyn 1994). Larger home ranges are required when prey density is low, and lynx have larger ranges in the summer compared to winter (Keith 2001). Home range size may vary between 15.5 to 221 km² and depends on the sex, age, population density, prey density, and survey method used (Ulev 2007).

Mating occurs between February and March, and the young are born between April and May. The young disperse between 9 and 12 months of age (Keith 2001; Poole 1997; Reid 2006). Unlike other mammal species, in which primarily males disperse, both male and female dispersal is common in lynx (Brand and Keith 1979; Poole 1997; Campbell and Strobeck 2006). Adults may abandon their home range territories during periods of low snowshoe hare densities and disperse to other areas. Long distance dispersals of 830 km (O'Donoghue et al. 1997) and 1,000 km (Slough and Mowat 1996; Moen et al. 2010) have been reported for lynx during cyclic lows of the snowshoe hare cycle.

Habitat Selection and Foraging

In general, lynx favour old-growth boreal forest with an undercover of thickets and windfalls (Keith 2001). However, they will occupy other types of habitat if there is minimal forest cover and adequate prey abundance. Lynx in the Northwest Territories selected deciduous and coniferous forest, shrubland, and meadow habitats over wetlands and open black spruce forests (Poole et al. 1996). Mowat and Slough (2003) found that lynx in the Yukon used regenerating forest and riparian habitats more than mature white spruce forest during the summer. Riparian habitat had greater use during the winter than other habitat types (Mowat and Slough 2003).

Lynx avoid recent burns because there is little vegetation cover for their main prey species, snowshoe hare. However, 15 to 30 year old burns are prime habitat for lynx and snowshoe hare (reviewed in Nelson et al. 2008). Fires may also create appropriate denning habitat for lynx by creating deadfall and willow thickets (Koehler 1990).

Lynx primarily feed on snowshoe hare and in times of high hare densities will feed on little else [Environment and Natural Resources ENR) 2012]. However, in times of low snowshoe hare densities, lynx diets may be supplemented with grouse, ptarmigan, voles, mice, squirrels, foxes, and carrion (Nellis et al. 1972; Brand et al. 1976; Brand and Keith 1979; ENR 2012). Lynx populations throughout North America are closely tied to, and lag one to two years behind the cyclic fluctuations of snowshoe hare populations (Brand et al. 1976; Poole 1994; ENR 2012). There can be large emigrations of lynx from the boreal forest to southern latitudes in times of low hare populations (Keith 2001).

5.13.3 American Marten and Fisher

Population Status and Distribution

Historically, marten have been trapped for fur in North America, and populations have declined since European contact (Buskirk and Ruggiero 1994). Marten is listed as Secure in Ontario (SARO 2013), and is Not at Risk federally (SARA 2013).

Marten breed between July and August, and the young are born in March or April of the following year (Strickland 1982). Marten occupy larger home ranges than would be expected for a mammal of their size (Buskirk and Ruggiero 1994), with adult males occupying ranges of 0.8 to 45 km^2, and adult females occupying ranges of 0.42 to 27 km^2 (Burnett 1981; Mech and Rogers 1977; Latour et al. 1994; Smith and Schaefer 2002). Marten home ranges vary as a function of geographic area, habitat type, and prey density (Soutiere 1979; Thompson and Colgan 1987). Marten movements have not been rigorously studied, and reports on the dispersal period range from August to October (Buskirk and Ruggiero 1994).

Fisher, once considered widespread in Canada and the central United States, have experienced range and population size decreases due to trapping and habitat loss (Powell and Zielinkski 1994; Proulx et al. 2004). However, because of wildlife management practices and controlled reintroductions, fisher now inhabit much of their historic range.

The breeding season for fisher lasts from late January though early April (Powell and Zielinkski 1994). Females are sexually mature at one year of age and produce their first litter at two years of age (Powell and Zielinkski 1994). Litter size varies between 2.0 to 3.9 kits (Powell and Zielinkski 1994; Frost and Krohn 1994). Kits do not open their eyes until about 7 or 8 weeks and are capable of killing prey by the age of 4 months (Powell and Zielinkski 1994). Males have larger home ranges than females, and a male's territory may overlap with those of multiple females (Powell and Zielinkski 1994; Koen et al. 2007). Home range sizes vary from approximately 17 to 85 km^2 for males and 4 to 32 km^2 for females (Powell and Zielinkski 1994). By one year of age juvenile fisher have established their own territories, often dispersing between 10 and 42 km with no significant difference between the sexes (Arthur et al. 1993).

Occurrence and Distribution of American Marten and Fisher within the Regional Study Area

Marten and fisher tracks were combined for the winter track count analysis as there is overlap between female fisher and male marten track size. Marten and fisher tracks were only observed in dense coniferous and dense mixed forest habitat types. Total track densities were highest in dense mixed forest (Table 23).

Table 23: Marten and Fisher Snow Track Density among Land Cover Types within the Regional Study Area

Land Cover Type	Number of Tracks (mean ± SE)	Observed Use (TKD)	Distance Sampled (km)
Bog – treed	0	0	0.75
Forest – dense coniferous	0.10 ± 0.08	4.47	7.03
Forest – dense deciduous	0	0	0.93
Forest – dense mixed	1.05 ± 0.69	82.75	17.20
Forest – sparse	0	0	0.88
Forest Depletion – cuts	0	0	1.72
Jack Pine Regeneration/ Cut	0	0	5.34
Wetland	0	0	1.59

Notes:
SE = Standard error;
TKD = total number of tracks standardized divided by land cover type segment length and number of days since last snow; km = kilometres.

Habitat Selection and Foraging

Marten have been classified as requiring late succession forests and are intolerant of habitat types with sparse canopy cover (Buskirk and Ruggiero 1994; Chapin et al. 1997; Smith and Schaefer 2002). Some studies suggest that marten are closely associated with late-succession mesic conifer forests that have complex physical structure near the ground (Buskirk and Ruggiero 1994). However, other studies suggest that requirements of canopy cover and structure near the ground can be met in a variety of habitat types (Chapin et al. 1997).

Wildfire may provide a mosaic of habitat for marten to use throughout various life stages (Nelson et al. 2008). Marten do use burned areas, but burned habitat is avoided relative to its availability on the landscape (Latour et al. 1994). Non-breeding individuals were found in higher densities in 6 to 9 year old burn versus mature sites; however, breeding individuals were only found in low densities in these recently burned areas (Paragi et al. 1996; Fisher and Wilkinson 2005). Non-breeding individuals may be responding to the high density of microtine prey species that can be found in burned areas (Nelson et al. 2008). Burns may not provide adequate denning habitat for marten.

Although there is little information available on denning sites that are preferred by marten, especially in western and northern North American, studies have reported marten to be highly sensitive of sites used for denning. Marten have separate denning sites for parturition (giving birth) and raise their young with both den types reported to be found only in old-growth forest (Ruggiero et al. 1998).

Marten diet varies seasonally. In summer, marten eat bird eggs and nestlings, insects, fish, and young mammals. Their winter diet is more restricted and is comprised of small to medium sized mammals. Snowshoe hare is an important prey species for marten and can consist of 3% to 64% of marten diet by biomass (Poole and Graf 1996). Marten diet, body fat, ovulation rates, and juvenile's recruitment vary with snowshoe hare density. As the treed bog land cover type occurs throughout the RSA, marten are expected to be broadly distributed throughout the habitats with a tree cover. Marten are not expected to only occupy open habitats within the RSA.

Fisher primarily inhabit mid to late successional coniferous and mixed coniferous-deciduous forests (Powell and Zielinkski 1994). A fully formed canopy layer, thick understory, and abundance of coarse woody debris provide cover for fishers to hunt and protect them from predators. Young stands of forest are also used to supplement foraging (Powell and Zielinkski 1994). Habitat selection is likely less influenced by tree species composition than by prey abundance and diversity.

Denning sites are selected for the protection they provide and are often associated with late-successional forests (Powell and Zielinkski 1994). Females primarily choose denning sites in tree hollows or snags high above the ground, or fallen logs. One to three dens are used during kit rearing; the natal den where parturition occurs and one or more maternal dens used to raise the kits. Once kits reach the age of eight to ten weeks they are moved to the maternal den.

Fishers are generalist predators and scavengers that require large ranges to secure food resources. They are one of the only predators of porcupines (*Erethizon dorsatum*), but also prey heavily upon snowshoe hares (Powell and Zielinkski 1994). Searching for bird eggs in trees is also a common foraging technique as well as eating carrion.

5.13.4 Snowshoe Hare

Population Status and Distribution

Snowshoe hare are considered secure federally (SARA 2013) and provincially (SARO 2013). Snowshoe hare populations undergo cyclical fluctuations that are about ten years long (Krebs et al. 2001). At the population peak, hares can be extremely abundant, reaching densities of 12 hares/ha to 15 hares/ha (Pattie and Fisher 1999). Population cycles occur roughly at about the same time throughout the species' range, although the timing of peaks may vary by one to three years among regions. A snowshoe hare's home range is approximately 6 ha to 10 ha.

Occurrence and Distribution of Snowshoe Hare within the Regional Study Area

Snowshoe hare tracks were the most numerous tracks recorded during the winter track surveys in the RSA. Tracks were recorded in all habitat types, except wetland. Average snowshoe hare track densities were highest in dense mixed forest and forest depletion/cut habitats (Table 24). Snowshoe hare track density (i.e., observed use) was highest in dense mixed forest habitat.

Table 24: Snowshoe Hare Snow Track Density among Land Cover Types within the Regional Study Area

Habitat Type	Number of Tracks (mean ± SE)	Observed Use (TKD)	Distance Sampled (km)
Bog – treed	16.62 ± 6.45	99.70	0.75
Forest – dense coniferous	55.76 ± 16.66	2,453.60	7.03
Forest – dense deciduous	27.17 ± 6.90	217.34	0.93
Forest – dense mixed	52.11 ± 8.70	4,116.62	17.20
Forest – sparse	29.97 ± 18.51	329.63	0.88
Forest Depletion – cuts	55.47 ± 17.24	776.64	1.72
Jack Pine Regeneration / Cut	9.68 ± 3.60	116.14	5.34
Wetland	0	0	1.59

Notes:
SE = Standard error;
TKD = total number of tracks standardized divided by land cover type segment length and number of days since last snow; km = kilometres.

Habitat Selection and Foraging

Snowshoe hares prefer habitats with a dense understory, which helps protect them from predators and provides them with food (Reid 2006; Maletzke et al. 2008). Hares establish an intricate network of trails within their territory between resting and feeding areas, which are used by other species, such as squirrels, porcupines, and skunks (Reid 2006). Snowshoe hares primarily consume herbaceous plants, grass, and berries during the summer (Forsyth 1985; Reid 2006), but also eat leaves from shrubs. Their winter diet consists of small twigs, buds and bark from many coniferous and deciduous species.

5.13.5 Weasel

Population Status and Distribution

Two weasel species have the potential to occur in the RSA: short-tailed weasel (*Mustela erminea*) and least weasel (*Mustela nivalis*). Both weasel species are considered secure federally (SARA 2013) and provincially (SARO 2013).

Least weasels are the smallest members of Order *Carnivora* in North America (Sheffield and King 1994). Their range in North America extends from the central United States into northern Canada (Simms 1979; Tikhonov et al. 2008). Their range has been expanding on the western and southern extremes due to their ability to use various habitats (Sheffield and King 1994). Least weasels are considered rare in North America with large variations in their abundance correlated with habitat type and prey density. Least weasels usually have two litters per year of approximately six young per litter, with the first litter usually occurring in the spring (Sheffield and King 1994; Amstislavsky and Ternovskaya 2000). The young are born pink and hairless, but by 49 days of age they are able to hunt and kill prey. Females become sexually mature at around three months of age and can produce a litter in the same year (Amstislavsky and Ternovskaya 2000). Males have larger home ranges (0.6 to 26.2 ha) than females (0.2 to 7.0 ha), although range size is highly variable.

Short-tailed weasels, also referred to as ermine or stoat, are a medium-sized mustellid species in Order *Carnivora*. In North America they range from northern Canada to the central United States (Simms 1979; King 1983). Their distribution overlaps with that of the least weasel, but dietary preference lead to niche partitioning between these species (Simms 1979; King 1983). Short-tailed weasel have one litter per year with between 4 and 13 young (King 1983; Amstislavsky and Ternovskaya 2000). The young are born naked and hairless, but are able to hunt at approximately three months of age. Females are sexually mature at 20 days of age, but have their first litter the following spring (King and Moody 1982; Amstislavsky and Ternovskaya 2000). Males generally have home ranges between 10 and 40 ha that may overlap many of the smaller home ranges of females (King 1983).

Occurrence and Distribution of Weasel within the Regional Study Area

Weasel tracks were combined in the winter track density analyses as it is difficult to differentiate tracks to species. Average weasel track densities were highest in jack pine regeneration / cut habitat (Table 25). Weasel track density (i.e., observed use) was highest in dense mixed forest habitat.

Table 25: Weasel Snow Track Density among Land Cover Types within the Regional Study Area

Land Cover Type	Number of Tracks (mean ± SE)	Observed Use (TKD)	Distance Sampled (km)
Bog – treed	0.66[(a)]	3.96	0.75
Forest – dense coniferous	0.08[(a)]	3.40	7.03
Forest – dense deciduous	0.35 ± 0.24	2.78	0.93
Forest – dense mixed	0.75 ± 0.37	59.18	17.20
Forest – sparse	0	0	0.88
Forest Depletion – cuts	1.21 ± 1.12	16.88	1.72
Jack Pine Regeneration/ Cut	3.94 ± 2.69	47.27	5.34
Wetland	0	0	1.59

Notes:
SE = Standard error;
TKD = total number of tracks standardized divided by land cover type segment length and number of days since last snow; km = kilometres;
[(a)] Only the mean is reported as tracks were only recorded in one land cover type segment.

Habitat Selection and Foraging

Weasels are found in a variety of habitats, including open forests, farmlands, meadows, prairies, steppe, and semi-deserts (Newell 1999). The diet of least weasels is usually comprised of small mammals, mainly rodents. When rodents are scarce, weasels will eat bird eggs and nestlings, and lizards. Both least and short-tailed weasels are specialist predators. Because of the overlap in distribution and habitat these species have evolved specialized prey preferences to partition resources (Simms 1979). Short-tailed weasels prefer to prey on rabbits and smaller mammals, but least weasels prey almost exclusively on microtine rodents (e.g., voles, lemmings) and mice (Simms 1979; King 1983; Sheffield and King 1994). However, both species will supplement their diets with bird eggs, insects, amphibians and reptiles, other small mammals, and berries.

5.13.6 American Red Squirrel

Population Status and Distribution

The boreal and mixed forests and mountainous areas of the United States and Canada are home to the American red squirrel (Steele 1998). Red squirrel densities vary from 0.3 to 2.0 squirrels/ha depending on abundance of food. Territory size is variable (0.24 to 0.98 ha) and depends on habitat and resource abundance (Steele 1998). Young are often born in the spring with an average litter number of 3.2 to 5.4 young (Kemp and Keith 1970; Steele 1998). Squirrels in the western extent of their range usually have only one litter per year while those from the east often have two litters. The young are born pink and hairless, but within seven weeks they venture outside the nest and are independent by approximately ten weeks (Steele 1998). Red squirrels are not a provincial (SARO 2013) or federal (COSEWIC 2012; SARA 2012) listed species.

Red squirrel pelts represent between one and three million squirrels in Canada each year (Kemp and Keith 1970).

Red squirrel tracks were found in all habitat types except for sparse forest and forest depletion/cut (Table 26). Total track density (i.e., observed use) was highest in dense mixed forest habitat. The highest average density was seen in dense coniferous forest habitat.

Table 26: American Red Squirrel Snow Track Density among Land Cover Types within the Regional Study Area

Land Cover Type	Number of Tracks (mean ± SE)	Observed Use (TKD)	Distance Sampled (km)
Bog – treed	1.02 ± 0.69	6.15	0.75
Forest – dense coniferous	9.75 ± 7.67	428.91	7.03
Forest – dense deciduous	0.13[(a)]	1.01	0.93
Forest – dense mixed	6.48 ± 5.10	511.66	17.20
Forest – sparse	0	0	0.88
Forest Depletion – cuts	0	0	1.72
Jack Pine Regeneration/ Cut	1.13 ± 0.68	13.55	5.34
Wetland	1.79 ± 1.52	12.55	1.59

Notes:
SE = Standard error;
TKD = total number of tracks standardized divided by land cover type segment length and number of days since last snow; km = kilometres;
[(a)] Only the mean is reported as tracks were only recorded in one land cover type segment.

Habitat Selection and Foraging

Red squirrels require mature trees for foraging, breeding, and dietary requirements. Mature forest with dense canopy layers provide shelter, nests for breeding, and escape routes from predators (Steele 1998). Coniferous seeds are the primary food source of red squirrels, which they hoard in caches that are used during the winter. Red squirrels supplement their diets with fungi, flowers, tree sap, tree bark, berries, seeds, and other plant material. Their diet is also supplemented with animal matter, including bird eggs, hatchling and adult birds and insects (Steele 1998).

5.13.7 Small Mammal Species

Small mammal species that may be present in the RSA include deer mouse (*Peromyscus maniculatus*), woodland jumping mouse (*Napaeozapus insignis*), meadow jumping mouse (*Zapus hudsonius*), meadow vole (*Microtus pennsylvanicus*), rock vole (*Microtus chrotorrhinus), southern red-backed vole (Clethrionomys gapperi*) and southern bog lemming (*Synaptomys cooperi*) (Burt and Grossenheider 1976). There are no known sensitive small mammal species that have ranges that overlap with the RSA. Since small mammal tracks are difficult to differentiate among species, all small mammal tracks were combined for winter track analysis.

Occurrence and Distribution of Small Mammals within the Regional Study Area

Small mammal tracks were only recorded in dense coniferous forest, dense mixed forest, jack pine regeneration/cut, and wetland. Small mammal track density (i.e., observed use) was highest in dense coniferous forest habitat (Table 27).

Table 27: Small Mammal Snow Track Density among Land Cover Types within the Regional Study Area

Land Cover Type	Number of Tracks (mean ± SE)	Observed Use (TKD)	Distance Sampled (km)
Bog – treed	0	0	0.75
Forest – dense coniferous	0.28[(a)]	12.50	7.03
Forest – dense deciduous	0	0	0.93
Forest – dense mixed	0.11 ± 0.09	9.06	17.20
Forest – sparse	0	0	0.88
Forest Depletion – cuts	0	0	1.72
Jack Pine Regeneration/ Cut	0.22(a)	2.63	5.34
Wetland	0.09[(a)]	0.64	1.59

Notes:
SE = Standard error;
TKD = total number of tracks standardized divided by land cover type segment length and number of days since last snow; km = kilometres;
[(a)] Only the mean is reported as tracks were only recorded in one land cover type segment.

Habitat Selection and Foraging

Overall, small mammals are habitat generalists and are found where suitable cover and preferred dietary items are available, including bogs and fens, grasslands, woodlands, and shrublands (Whitaker and Wrigley 1972; Whitaker 1972; Reich 1981; Kirkland and Jannett 1982; Merrit 1981; Linzey 1983). Food preferences typically consist of seeds, berries, fruit, and insects. Many small mammals are difficult to observe because of their size, they tend to be nocturnal, and may live underground or in areas with thick, moist vegetation. Small mammals play an important role in the food chain as they are staple prey for larger animals including weasels, foxes, wolves, wolverines, marten, as well as hawks and owls.

6.0 SUMMARY AND CONCLUSIONS

This report provides preliminary baseline data to describe the vegetation, habitat and wildlife within the LSA and RSA. Based on the results of the records review and field surveys, the following points relative to the RSA can be highlighted:

- there is potential for 18 provincially listed wildlife species, one federally listed wildlife species, and two provincially tracked wildlife species to occur in the region containing the RSA. Seven of these species were documented in the RSA. Four species listed as Special Concern (bald eagle, Canada warbler, common nighthawk, and olive-sided flycatcher), one species listed as Threatened (whip-poor-will), and one species listed as Endangered (little brown myotis) under the ESA were observed during the field surveys. In addition, one species listed as Special Concern (rusty black bird) under SARA was observed during the field surveys;
- a total of 121 plant species were identified within the LSA;
- seventy-nine species, and two unidentified species, of birds were recorded during upland breeding bird surveys. Focal marsh bird species were not observed during marsh bird surveys;
- ten waterbird species were observed during the first round of waterbird surveys and five waterbird species were observed in lake habitat during the second round of waterbird surveys;
- whip-poor-wills were heard calling at one survey location within the RSA. They are considered to have a high potential to occur within the RSA;
- painted turtles were observed at one location along Bagsverd Creek, Unnamed Lake, and Clam Lake during basking turtle surveys within the LSA. No Blanding's turtles were observed during the basking turtle surveys or recorded as incidental observations during other types of surveys;
- three species of amphibians were heard calling during amphibian surveys in LSA and four species were heard calling during amphibian surveys within the RSA. Amphibian species identified during the surveys are considered secure provincially and federally;
- two owl species were heard calling in the LSA and four owl species and one unidentified owl were heard calling within the RSA. All identified species are considered apparently secure provincially;
- five species of bat and one unknown species of bat were recorded at the stationary monitoring locations. Little brown myotis was recorded at five of the six stationary stations within the bat study area. Northern long-eared myotis was not recorded within the bat study area;
- silver-haired bat was the most commonly recorded species during June and early July;
- only silver-haired bat and hoary bat were observed during the mobile acoustic monitoring driving transects;

- relative bat activity for all species was highest during June and early July at COT02, and secondly at COT05. Suitable hibernacula habitat was not identified at any of the 119 sites surveyed within the bat study area;
- silver-haired bat was also the most commonly recorded species during August and early September;
- relative bat activity of little brown myotis was low during August and early September with a maximum of 3 passes of this species on August 21. None were observed visually during the visual survey on that night, but two little brown myotis recordings were identified on the handheld detector;
- swarming activity was not observed in the bat study area during any of the visual surveys, or evident from the acoustic data; and
- the highest total track densities occurred in dense mixed forest for lynx, American marten and fisher, snowshoe hare, weasel, and red squirrel. The highest total track density for small mammal species occurred in dense coniferous forest. Grouse showed equal preference between the dense deciduous forest and forest depletion – cuts, with approximately equal total grouse track density occurring in each land cover type. American marten and fisher were only observed in dense coniferous and dense mixed forests.

7.0 LIMITATIONS

This report was prepared for the exclusive use of IAMGOLD. The report, which specifically includes all tables, figures and appendices, is based on data and information collected by Golder Associates Ltd. and is based solely on the conditions in the LSA at the time of the work, supplemented by historical information and data obtained by Golder Associates Ltd. as described in this report. No assurance is made regarding the accuracy and completeness of these data.

Parts of this report rely on third party information, which was assumed to be factual and accurate. Golder Associates Ltd. therefore accepts no responsibility for the accuracy of the information by third parties.

Golder Associates Ltd. has exercised reasonable skill, care and diligence to assess the information acquired during the preparation of this assessment, but makes no guarantees or warranties as to the accuracy or completeness of this information. This report is based upon and limited by circumstances and conditions acknowledged herein, and upon information available at the time of the surveys.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

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9.0 CLOSURE

We trust that the information presented in this report meets your requirements at this time. Should you have any questions or wish to discuss the contents of this report further, please do not hesitate to contact the undersigned.

Report Signature Page

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APPENDIX A

Incidental Wildlife Observations within the Regional Study Area

Incidental Observations Recorded during 2012 and 2013 Field Surveys in the Regional Study Area

Common Name	Scientific Name	Srank*	Forest-dense Coniferous	Forest-dense Deciduous	Forest-dense Mixed	Forest-sparse	Forest Depletion-cuts	Wetland	Water-deep Clear
American bittern	*Botaurus lentiginosus*	S4B			X				
American black duck	*Anas rubripes*	S4	X			X			X
American kestrel	*Falco sparverius*	S4				X			
American robin	*Turdus migratorius*	S5B	X				X		X
American toad	*Bufo americanus*	S5	X	X	X	X	X	X	X
American woodcock	*Scolopax minor*	S4B	X				X		
bald eagle	*Haliaeetus leucocephalus*	not listed			X	X	X		X
beaver	*Castor canadensis*	S5			X				
belted kingfisher	*Ceryle alcyon*	S4B	X				X		
black bear	*Ursus americanus*	S5	X		X		X	X	
black-backed woodpecker	*Picoides arcticus*	S4			X				
black-capped chickadee	*Poecile atricapilus*	S5	X				X		
blackburnian warbler	*Dendroica fusca*	S5B							X
broad-winged hawk	*Buteo platypterus*	not listed			X		X		X
bullfrog	*Rana catesbeiana*	S4					X		
Canada goose	*Branta canadensis*	S5	X		X			X	
Canada lynx	*Lynx canadensis*	not listed	X						
Canada warbler	Wilsonia canadensis	S4B			X				
cedar waxwing	*Bombycilla cedrorum*	S5B	X						
common goldeneye	*Bucephala clangula*	S5	X		X				X
common grackle	*Quiscalus quiscula*	S5B	X			X			X
common loon	*Gavia immer*	S5B,S5N	X	X	X		X	X	X
common merganser	*Mergus merganser*	S5B, S5N	X						X
common nighthawk	*Chordeiles minor*	S4B			X		X	X	
common raven	*Corvus corax*	S5			X				X
downy woodpecker	*Picoides pubescens*	S5	X		X				
eastern garter snake	*Thamnophis sirtalis sirtalis*	S5					X	X	
gray wolf	*Canis lupus*	S4	X						
great horned owl	*Bubo virginianus*	S4					X		
green frog	*Rana clamitans*	S5	X	X	X	X	X	X	
gray treefrog	*Hyla versicolor*	S5	X				X		
grouse species	-	-			X				
hermit thrush	*Catharus guttatus*	S5B	X						
hooded merganser	*Lophodytes cucullatus*	S5B,S5N			X				
mallard	*Anas platyrhynchos*	S5			X	X	X		
merlin	*Falco columbarius*	S5B			X				
mink frog	*Rana septentrionalis*	S5					X		
moose	*Alces alces*	S5	X	X	X	X	X		
Nashville warbler	*Vermivora ruficapilla*	S5B						X	
northern flicker	*Colaptes auratus*	S4B	X		X				
northern harrier	*Circus cyaneus*	S4B			X				
northern red-backed salamander	*Plethodon cinereus*	S5					X		
northern parula	*Parula americana*	S4B							X

Incidental Observations Recorded during 2012 and 2013 Field Surveys in the Regional Study Area

Common Name	**Scientific Name**	**Srank***	**Forest-dense Coniferous**	**Forest-dense Deciduous**	**Forest-dense Mixed**	**Forest-sparse**	**Forest Depletion-cuts**	**Wetland**	**Water-deep Clear**
northern saw-whet owl	*Aegolius acadicus*	S4					X		
osprey	*Pandion haliaetus*	S5B			X				
pileated woodpecker	*Dryocopus pileatus*	S5			X				
red fox	*Vulpes vulpes*	S5	X						
red squirrel	*Tamiasciurus hudsonicus*	S5	X	X	X	X	X	X	
red-breasted nuthatch	*Sitta canadensis*	S5	X						
red-eyed vireo	*Vireo olivaceus*	S5B							X
red-tailed hawk	*Buteo jamaicensis*	S5			X				
red-winged blackbird	*Agelaius phoeniceus*	S5			X				X
ring-necked duck	*Aythya collaris*	S5			X		X		X
ruby-crowned kinglet	*Regulus calendula*	S4B			X	X	X		X
ruffed grouse	*Bonasa umbellus*	S5			X		X		
ruby-throated hummingbird	*Archilochus colubris*	S5B					X		
rusty blackbird	*Euphagus carolinus*	S4B				X	X	X	X
sandhill crane	*Grus canadensis*	S5B			X				
snowshoe hare	*Lepus americanus*	S5	X	X	X	X	X		
spotted sandpiper	*Actitis macularia*	S5							X
spring peeper	*Pseudacris crucifer*	S5	X	X	X	X	X	X	X
Swainson's thrush	*Catharus ustulatus*	S4B							X
tree swallow	*Tachycineta bicolor*	S4B	X		X				
veery	*Catharus fuscescens*	S4B	X						
western painted turtle	*Chrysemys picta bellii*	S4					X	X	
white-throated sparrow	*Zonotrichia albicollis*	S5B	X		X		X	X	X
winter wren	*Troglodytes troglodytes*	S5B				X	X		X
wood frog	*Rana sylvatica*	S5	X	X	X	X	X	X	
yellow-rumped warbler	*Dendroica coronata*	S5B			X	X	X		

Notes:
sensitive species are underlined
*SRanks are based on Provincial ranking definitions:
S1 – Critically imperiled in Ontario
S2 – Imperiled in Ontario
S3 – Vulnerable in Ontario
S4 – Apparently secure in Ontario
S5 – Secure in Ontario
SZN – Non-breeding migrants
S#B – Breeding individuals

APPENDIX B

Climate Data for Sudbury, Chapleau, and Timmins

SUDBURY A *
ONTARIO

Latitude: 46°37'32.000" N **Longitude**: 80°47'52.000" W **Elevation**: 348.40 m

Climate ID: 6068150 **WMO ID**: 71730 **TC ID**: YSB

*** This station meets WMO standards for temperature and precipitation.**

January-June January-December+Year July-December

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-13.6	-11.4	-5.3	3.1	11.3	16.2	19	17.7	12.3	5.8	-1.5	-9.5	3.7	A
Standard Deviation	3	2.9	2.4	2.1	2.2	1.6	1.3	1.3	1.4	1.8	1.8	3.4	0.9	A
Daily Maximum (°C)	-8.4	-6.1	-0.1	8.5	17.2	22	24.8	23.1	17.3	10	2	-5.1	8.8	A
Daily Minimum (°C)	-18.6	-16.6	-10.4	-2.2	5.3	10.4	13.3	12.3	7.2	1.5	-5.1	-13.9	-1.4	A
Extreme Maximum (°C)	17.2	9.4	17.3	29.8	33.9	35.7	**38.3**	36.7	31.1	25	17.8	14.4		
Date (yyyy/dd)	1988/26	2000/26	1999/31	1986/28	1986/29	1995/19	**1975/31**	1975/01	1973/02	1968/16	1961/03	1982/03		
Extreme Minimum (°C)	**-39.3**	-37.8	-30.2	-21.1	-6.7	-1.6	3.8	-1.1	-5.7	-10	-25	-36		
Date (yyyy/dd)	**1982/10**	1967/12	1989/07	1954/03	1957/16	1980/10	1992/21	1976/30	1993/30	1966/30	1958/30	1993/26		
Precipitation:														
Rainfall (mm)	12.5	7.1	29.8	47	75.9	77.7	76.6	90.7	101.2	76.8	47.6	13.7	656.5	A
Snowfall (cm)	63.8	50	38.9	18.3	1.5	0	0	0	0.1	5.3	32.4	64.2	274.4	A
Precipitation (mm)	68.6	50.6	65.9	64.9	77.5	77.8	76.6	90.5	101.3	82.1	76.5	67.1	899.3	A
Average Snow Depth (cm)	34	40	29	4	0	0	0	0	0	0	3	17	11	A
Median Snow Depth (cm)	33	40	29	2	0	0	0	0	0	0	1	16	10	A
Snow Depth at Month-end (cm)	40	39	11	0	0	0	0	0	0	0	7	29	11	A
Extreme Daily Rainfall (mm)	50.8	19.3	47	49.9	62.8	86.9	91.8	77.7	**112**	55.6	37.1	42.9		
Date (yyyy/dd)	1980/11	1954/28	1963/26	1979/26	1990/17	1961/12	1977/24	1972/21	**1970/03**	1954/15	1957/14	1971/10		

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Extreme Daily Snowfall (cm)	37	37.8	**38.8**	33.5	9.9	0.4	0	0	2.6	25.2	27	27.2		
Date (yyyy/dd)	1978/26	1974/22	**1992/10**	1961/01	1957/15	1992/21	1954/01	1954/01	2001/25	1981/01	1999/03	1978/31		
Extreme Daily Precipitation (mm)	51.6	37.8	47	49.9	62.8	86.9	91.8	77.7	**112**	55.6	44	42.9		
Date (yyyy/dd)	1980/11	1974/22	1963/26	1979/26	1990/17	1961/12	1977/24	1972/21	**1970/03**	1954/15	1995/11	1971/10		
Extreme Snow Depth (cm)	94	119	**145**	81	5	0	0	0	0	15	38	69		
Date (yyyy/dd)	1962/16	1959/27	**1959/16**	1959/04	1959/15	1955/01	1955/01	1955/01	1955/01	1962/26	2000/21	1956/31		
Days with Maximum Temperature:														
<= 0 °C	27.3	23.1	15.4	2.4	0	0	0	0	0	0.67	11.1	23.9	103.9	A
> 0 °C	3.7	5.1	15.6	27.6	31	30	31	31	30	30.3	18.9	7.1	261.4	A
> 10 °C	0.03	0	1.3	11.3	27.1	29.8	31	31	28	15.3	2.7	0.17	177.7	A
> 20 °C	0	0	0	1.5	10.1	19.9	27.7	23.9	8.4	0.77	0	0	92.2	A
> 30 °C	0	0	0	0	0.47	1.2	2.6	0.93	0.17	0	0	0	5.4	A
> 35 °C	0	0	0	0	0	0.03	0.17	0.07	0	0	0	0	0.27	A
Days with Minimum Temperature:														
> 0 °C	0.07	0.37	2.1	9.9	26.6	29.9	31	31	28.4	18.5	4.6	0.70	183	A
<= 2 °C	31	28.2	30.6	24.6	8.5	0.83	0	0.13	4.1	18	27.6	30.9	204.5	A
<= 0 °C	30.9	27.9	28.9	20.1	4.4	0.13	0	0.03	1.6	12.5	25.4	30.3	182.3	A
< -2 °C	30.5	27.2	26.8	14.2	1.2	0	0	0	0.50	6.2	19.6	28.7	154.9	A
< -10 °C	25.8	22.4	15.6	2.1	0	0	0	0	0	0	5.7	19.9	91.5	A
< -20 °C	14.5	10.4	3.1	0	0	0	0	0	0	0	0.31	8.1	36.4	A
< - 30 °C	2.6	0.73	0.03	0	0	0	0	0	0	0	0	0.53	3.8	A
Days with Rainfall:														
>= 0.2 mm	2.6	1.9	4.9	7.7	11	12.4	11.5	11.8	12.9	12.6	8	3.7	101.1	A
>= 5 mm	0.73	0.67	1.8	3.1	5.2	4.6	4.5	5	5.4	4.9	3.2	0.97	40	A

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
>= 10 mm	0.40	0.17	1.1	1.7	2.4	2.5	2.6	2.8	3.3	2.7	1.6	0.43	21.8	A
>= 25 mm	0.07	0	0.13	0.30	0.33	0.60	0.57	0.80	1	0.47	0.27	0.03	4.6	A
Days With Snowfall:														
>= 0.2 cm	18.2	13.3	10.6	5.6	0.97	0.03	0	0	0.07	2.7	10.3	16.7	78.4	A
>= 5 cm	4.1	3.5	2.7	1.4	0.07	0	0	0	0	0.33	2	4.3	18.3	A
>= 10 cm	1.5	1.1	0.93	0.40	0	0	0	0	0	0.10	0.63	1.6	6.2	A
>= 25 cm	0.10	0.03	0.10	0	0	0	0	0	0	0.03	0.07	0.03	0.36	A
Days with Precipitation:														
>= 0.2 mm	18.4	13.6	13	11.1	11.5	12.4	11.5	11.7	13	14	15.6	18.1	163.9	A
>= 5 mm	4.3	3.4	4	4.3	5.2	4.6	4.5	5	5.4	5.4	5	4.7	55.7	A
>= 10 mm	1.7	1.1	1.9	2.3	2.5	2.5	2.6	2.8	3.3	3	2.4	1.7	27.8	A
>= 25 mm	0.20	0.10	0.50	0.30	0.33	0.60	0.57	0.80	1	0.47	0.37	0.07	5.3	A
Days with Snow Depth:														
>= 1 cm	31	28.1	28.6	11.4	0.27	0	0	0	0	0.80	12.6	28.2	141	A
>= 5 cm	30	28	26.5	7	0.03	0	0	0	0	0.27	7	24.5	123.3	A
>= 10 cm	29	27.3	23.5	3.6	0	0	0	0	0	0.07	4	20.7	108.2	A
>= 20 cm	24	24.2	19.4	1.7	0	0	0	0	0	0	1	12	82.4	A
Wind:														
Speed (km/h)	16.6	16.1	17.2	17.4	15.9	14.8	13.5	13.2	14.6	16	16.7	16	15.7	A
Most Frequent Direction	SW	N	N	N	N	SW	SW	SW	S	S	SW	NW	SW	A
Maximum Hourly Speed (km/h)	82	89	87	**90**	72	87	77	64	71	84	89	80		
Date (yyyy/dd)	1971/26	1965/25	1973/17	**1963/30**	1956/14	1964/19	1968/21	1956/13	1963/12	1958/10	1956/21	1959/09		
Maximum Gust Speed (km/h)	109	113	108	**137**	103	126	121	129	105	102	122	119		
Date (yyyy/dd)	1975/11	1965/25	1964/26	**1964/14**	1964/19	1964/19	1968/21	1965/06	1962/18	1985/04	1956/21	1971/10		

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Direction of Maximum Gust	S	N	NE	S	W	SW	S	SW	NW	E	S	SW	S	
Days with Winds >= 52 km/h	1.6	0.6	1.2	0.9	0.8	0.5	0.3	0.3	0.7	1	1.4	1.2	10.5	A
Days with Winds >= 63 km/h	0.3	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	1.9	A
Degree Days:														
Above 24 °C	0	0	0	0	0.1	0.5	2.5	1.1	0.1	0	0	0	4.2	A
Above 18 °C	0	0	0	0.5	7.6	27.2	57.2	38.9	6.8	0.1	0	0	138.2	A
Above 15 °C	0	0	0	1.9	24.1	69.9	129.6	96.9	22.1	0.7	0	0	345.1	A
Above 10 °C	0	0	0	9.9	85.1	190.2	280.1	239.5	92.7	13.7	0.4	0	911.6	A
Above 5 °C	0	0	2.4	40.8	200.1	336.3	435.1	393.8	219.4	69	7.9	0.3	1705.1	A
Above 0 °C	0.6	2.6	20.4	122.3	349.5	486.1	590.1	548.8	367.5	184.5	44.6	4.9	2722	A
Below 0 °C	423.6	323.6	184.4	28.4	0.1	0	0	0	0	5.1	88.6	298.7	1352.5	A
Below 5 °C	578	462.4	321.4	96.8	5.6	0.2	0	0	1.9	44.6	201.9	449.1	2161.9	A
Below 10 °C	733	603.7	474	215.9	45.7	4.2	0	0.7	25.2	144.2	344.4	603.8	3194.7	A
Below 15 °C	888	745	629	357.9	139.7	33.8	4.5	13	104.6	286.3	494.1	758.8	4454.6	A
Below 18 °C	981	829.8	722	446.5	216.1	81.1	25.1	48.1	179.4	378.6	584.1	851.8	5343.5	A
Bright Sunshine:														
Total Hours	91.2	122.2	155.7	196	236.3	245.6	277.9	244.4	156.1	120.4	73.5	69.6	1988.9	A
Days with measureable	20.3	21.5	24.8	24.9	27.6	28.2	30	29.4	25.8	25.1	18.6	17.4	293.6	A
% of possible daylight hours	32.6	42.1	42.3	48.2	50.8	51.9	58.1	55.6	41.3	35.5	26	26	42.5	A
Extreme Daily	9.1	10.6	11.9	13.8	15	**15.4**	15.4	14.5	12.7	11.8	9.6	8.9		A
Date (yyyy/dd)	1995/28	1986/26	1997/31	1974/26	1973/30	**1979/19**	1979/05	1985/01	1989/02	1988/10	1977/05	1980/21		
Humidex:														
Extreme Humidex	7.1	10	16.7	30.7	36.2	41.4	42.9	**49.2**	38.7	30.1	20	17.7		

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Date (yyyy/dd)	1996/18	2000/26	1999/31	1990/26	1969/28	1995/19	1975/31	**1955/19**	1973/02	1968/16	1956/02	1982/03		
Days with Humidex >= 30	0	0	0	0.1	1.4	4.2	8.5	6.2	1.3	0	0	0	21.8	A
Days with Humidex >= 35	0	0	0	0	0.1	0.6	2.1	1.4	0.2	0	0	0	4.4	A
Days with Humidex >= 40	0	0	0	0	0	0.1	0.2	0.1	0	0	0	0	0.4	A
Wind Chill:														
Extreme Wind Chill	**-53.1**	-50	-43.2	-32.4	-15.2	-8.6	1.3	-5	-9.2	-16.6	-36.3	-51		
Date (yyyy/dd)	**1982/10**	1995/05	1962/01	1964/03	1966/09	1972/10	1963/08	1976/30	1993/30	1955/24	1958/30	1993/26		
Days with Wind Chill < -20	23	19.6	11.6	1.1	0	0	0	0	0	0	2.5	16.5	74.2	A
Days with Wind Chill < -30	12.3	8.3	2.4	0	0	0	0	0	0	0	0.1	6.4	29.4	A
Days with Wind Chill < -40	2.7	1.1	0.1	0	0	0	0	0	0	0	0	0.7	4.6	A
Humidity:														
Average Vapour Pressure (kPa)	0.2	0.2	0.3	0.5	0.8	1.2	1.5	1.5	1.1	0.8	0.5	0.3	0.8	A
Average Relative Humidity - 0600LST (%)	77.9	76.3	74.7	74.1	75.6	81.2	84.4	88.5	90.6	86.6	86.5	83.1	81.6	A
Average Relative Humidity - 1500LST (%)	70.3	64.4	58.3	50.6	47.3	50.8	51.2	55.4	60.5	64.1	73.2	75.3	60.1	A
Pressure:														
Average Station Pressure (kPa)	97.2	97.4	97.3	97.3	97.3	97.3	97.3	97.5	97.5	97.5	97.3	97.3	97.3	A
Average Sea Level Pressure (kPa)	101.6	101.7	101.6	101.5	101.4	101.4	101.4	101.6	101.7	101.7	101.6	101.7	101.6	A
Visibility (hours with):														

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
< 1 km	27.1	29.4	39.9	21.9	15	11.6	5.7	15.9	24.7	28.5	46.3	38.9	305	C
1 to 9 km	149	121.3	95.5	67.6	61.3	71.8	71.5	97	90.8	82.5	108.9	147.3	1164.5	C
> 9 km	568	527.3	608.6	630.5	667.7	636.7	666.8	631.1	604.5	632.9	564.8	557.8	7296.6	C
Cloud Amount (hours with):														
0 to 2 tenths	192.4	195.9	232.9	206.6	200.5	178.3	209.7	208.8	171.9	157.2	113.1	156.4	2223.8	C
3 to 7 tenths	107.5	111.8	117.3	132.2	172.6	201.1	223.5	203.4	162.8	144.6	104.3	108.3	1789.6	C
8 to 10 tenths	444.1	370.3	393.8	381.2	370.9	340.6	310.8	331.8	385.3	442.2	502.6	479.3	4752.7	C

CHAPLEAU A
ONTARIO

Latitude: 47°49'12.000" N **Longitude**: 83°20'48.000" W **Elevation**: 448.10 m

Climate ID: 6061361 **WMO ID**: 71642 **TC ID**: YLD

January-June January-December+Year July-December

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-16	-13.2	-7.2	1.4	9.4	14.5	17	15.7	10.6	3.9	-3.8	-11.8	1.7	C
Standard Deviation	3.2	3.4	2.2	2.5	2.3	1.6	1.2	1.2	1.2	1.7	2.3	4	1.1	C
Daily Maximum (°C)	-9.7	-6.5	-0.5	7.6	16.2	21	23.3	21.6	15.8	8.4	0.2	-6.5	7.6	C
Daily Minimum (°C)	-22.4	-19.9	-13.8	-4.8	2.5	8	10.6	9.8	5.3	-0.6	-7.8	-17.1	-4.2	C
Extreme Maximum (°C)	5	10.5	19	30	32.5	**36.5**	35	34	31	25.5	18.3	22		
Date (yyyy/dd)	1980/11	1981/17	1995/14	1986/27	1998/15	**1995/19**	1988/08	2001/07	1983/03	1995/12	1999/09	1982/16		
Extreme Minimum (°C)	**-50**	-43.5	-41.5	-24	-9.5	-6	-3	-1	-7.5	-17	-31	-42		
Date (yyyy/dd)	**1984/11**	1996/03	1984/08	1982/05	1996/04	1983/06	1983/05	1982/29	1981/30	1981/24	1989/24	1983/19		
Precipitation:														
Rainfall (mm)	1.6	2	13.1	24.1	69.5	76.8	86.7	76.2	87.4	69.1	22.6	2.6	531.8	D
Snowfall (cm)	58.3	41.1	36.8	21.8	3.3	0	0	0	0.5	8.5	39.4	67.2	276.9	D
Precipitation (mm)	55.9	41.1	48.5	46.3	72.7	76.8	86.7	76.2	87.8	78.3	60.1	66.2	796.6	D
Extreme Daily Rainfall (mm)	6.6	12.4	21	25.8	47	**82.6**	53.4	56	71.8	57.2	28.6	17.4		
Date (yyyy/dd)	1996/18	1999/11	1998/27	2001/21	1980/30	**1991/27**	1978/07	1988/13	1993/13	1990/17	1988/05	2001/05		
Extreme Daily Snowfall (cm)	31	**39**	31	26.6	22	0	0	0	3.4	19.6	33	36.5		
Date (yyyy/dd)	1990/25	**1999/28**	1986/09	1996/30	1997/19	1979/01	1978/01	1978/01	1991/26	1989/19	1989/16	1998/23		
Extreme Daily Precipitation (mm)	31	29.4	31	34	47	**82.6**	53.4	56	71.8	57.2	33	36.4		

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Date (yyyy/dd)	1990/25	1996/10	1986/09	1996/30	1980/30	**1991/27**	1978/07	1988/13	1993/13	1990/17	1989/16	1998/23		
Extreme Snow Depth (cm)	113	116	**132**	115	80	0	0	0	0	21	35	60		
Date (yyyy/dd)	1997/31	1997/03	**1997/15**	1997/01	1996/01	1983/01	1983/01	1983/01	1983/01	1992/17	1995/26	1996/28		
Days with Maximum Temperature:														
<= 0 °C	28.9	23.5	16.7	3.3	0.09	0	0	0	0	2.2	15.4	25.6	115.6	C
> 0 °C	2.2	4.8	14.3	26.7	30.9	30	31	31	30	28.8	14.7	5.4	249.7	C
> 10 °C	0	0.10	1.6	9.5	25.2	29	31	30.7	25.6	11	1.7	0.14	165.5	C
> 20 °C	0	0	0	1.3	9.1	17	24.4	19.8	6.2	0.78	0	0.05	78.6	C
> 30 °C	0	0	0	0	0.41	0.86	1.2	0.32	0.09	0	0	0	2.9	C
> 35 °C	0	0	0	0	0	0.05	0	0	0	0	0	0	0.05	C
Days with Rainfall:														
>= 0.2 mm	0.64	0.68	2.8	5	12.2	13.9	13.3	14.5	16.8	12.8	5	1.4	99.1	D
>= 5 mm	0.18	0.14	0.89	1.7	4.1	4.3	5.4	4.4	5.7	4.4	1.4	0.17	32.9	D
>= 10 mm	0	0.05	0.53	0.89	2.5	2.4	3	2.7	2.7	2.4	0.70	0.04	17.7	D
>= 25 mm	0	0	0	0	0.41	0.50	0.57	0.35	0.35	0.30	0.04	0	2.5	D
Days With Snowfall:														
>= 0.2 cm	16.2	12.2	9.7	5.6	0.68	0	0	0	0.30	3.6	12	16.3	76.5	C
>= 5 cm	3.9	2.6	2.6	1.3	0.18	0	0	0	0	0.52	2.7	4.5	18.2	C
>= 10 cm	1.2	0.82	1.2	0.43	0.09	0	0	0	0	0.22	0.78	1.7	6.5	C
>= 25 cm	0.14	0.18	0.05	0.10	0	0	0	0	0	0	0.13	0.22	0.82	C
Days with Precipitation:														
>= 0.2 mm	16.2	12.5	11.6	9.6	12.6	13.9	13.3	14.5	16.9	15	15.2	16.7	167.9	D
>= 5 mm	3.5	2.6	3.5	3.2	4.3	4.3	5.4	4.4	5.7	5	4	4.4	50.2	D
>= 10 mm	1.2	0.82	1.8	1.5	2.6	2.4	3	2.7	2.7	2.7	1.6	1.6	24.5	D
>= 25 mm	0.14	0.18	0.05	0.11	0.45	0.50	0.57	0.35	0.35	0.30	0.17	0.22	3.4	D

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Wind:														
Maximum Hourly Speed (km/h)	33	46	39	37	41	41	37	39	41	41	39	**52**		
Date (yyyy/dd)	2000/24	1997/17	1998/25	1994/09	2002/22	1999/07	1999/06	1995/30	1997/24	1997/09	1994/18	**1999/20**		
Maximum Gust Speed (km/h)	61	72	59	67	80	67	**89**	59	74	83	74	63		
Date (yyyy/dd)	2000/04	2000/06	1999/29	1997/07	1999/07	2001/19	**2000/09**	1999/16	1997/24	1997/09	1998/11	1999/20		
Direction of Maximum Gust	N	SW	W	SW	S	W	N	SW	SW	S	SW	S	N	
Humidex:														
Extreme Humidex	6	9	19	27.8	34	40.8	**41.8**	41	37.2	29.2	18	10.7		
Date (yyyy/dd)	1996/18	1994/18	1995/14	2002/16	1998/15	1995/18	**2002/01**	2001/06	2002/08	2002/01	1999/09	2001/05		
Wind Chill:														
Extreme Wind Chill	-44.5	**-45.7**	-40.8	-30.2	-9.9	-4.4	-0.5	1	-6	-14.2	-30.2	-41.4		
Date (yyyy/dd)	1997/26	**1994/10**	1995/02	1995/04	1996/01	1998/01	2001/01	1994/04	1995/24	1997/27	2000/23	1996/25		

TIMMINS VICTOR POWER A *
ONTARIO

Latitude: 48°34'11.000" N **Longitude**: 81°22'36.000" W **Elevation**: 294.70 m

Climate ID: 6078285 **WMO ID**: 71739 **TC ID**: YTS

*** This station meets WMO standards for temperature and precipitation.**

January-June January-December+Year July-December

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Daily Average (°C)	-17.5	-14.4	-7.7	1.2	9.6	14.7	17.4	15.7	10.3	4.2	-4	-13.2	1.3	A
Standard Deviation	3	3.2	2.7	2.2	2.1	1.7	1.1	1.4	1.5	1.9	2.2	3.8	1	A
Daily Maximum (°C)	-11	-7.5	-0.9	7.6	16.6	21.7	24.2	22.3	16.1	8.9	0.1	-7.8	7.5	A
Daily Minimum (°C)	-23.9	-21.3	-14.5	-5.2	2.5	7.5	10.5	9.1	4.4	-0.6	-8.1	-18.7	-4.9	A
Extreme Maximum (°C)	6.4	11.7	19.9	29.9	33.3	38.8	**38.9**	36.7	32.2	28.3	18.9	14.2		
Date (yyyy/dd)	1996/18	1994/19	1990/15	1986/28	1962/17	1995/18	**1975/31**	1976/20	1973/02	1968/16	1975/06	1982/03		
Extreme Minimum (°C)	-44.2	**-45.6**	-37.8	-29.4	-11.1	-3.2	-0.5	-1.7	-6.4	-13	-33.9	-43.9		
Date (yyyy/dd)	1982/18	**1962/01**	1989/03	1964/01	1958/02	1980/19	1992/01	1965/30	2000/28	1981/24	1975/26	1975/19		
Precipitation:														
Rainfall (mm)	2.9	1.6	14.7	26.6	62.7	89.1	91.5	82	86.7	64	29.5	7	558.1	A
Snowfall (cm)	61.7	40.6	49.9	27.5	6.7	0.4	0	0	1.6	14	45.7	65.4	313.4	A
Precipitation (mm)	53.9	36.6	59.4	52.8	69.2	89.4	91.5	82	88.3	76.8	69.6	61.9	831.3	A
Average Snow Depth	58	66	58	25	1	0	0	0	0	0	7	29	20	A

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
(cm)														
Median Snow Depth (cm)	58	66	58	25	0	0	0	0	0	0	6	29	20	A
Snow Depth at Month-end (cm)	67	62	44	6	0	0	0	0	0	0	14	44	20	A
Extreme Daily Rainfall (mm)	14.2	9	32.5	32.8	53.3	77.4	**87.6**	86.8	43.9	47.5	37.6	28.7		
Date (yyyy/dd)	1995/14	1983/20	1973/11	1992/21	1972/29	1984/24	**1990/29**	1986/10	1961/01	1966/15	1988/05	1971/10		
Extreme Daily Snowfall (cm)	33	37	**48.2**	36	17	2.6	0	0	7.2	19.3	28.4	39.6		
Date (yyyy/dd)	1962/07	1999/28	**1983/19**	1985/06	1986/01	1980/10	1955/01	1955/01	1989/23	1976/15	1966/28	1985/01		
Extreme Daily Precipitation (mm)	33	35.6	48.2	35.8	53.8	77.4	**87.6**	86.8	43.9	47.5	37.6	39.2		
Date (yyyy/dd)	1962/07	1999/28	1983/19	1985/06	1972/29	1984/24	**1990/29**	1986/10	1961/01	1966/15	1988/05	1985/01		
Extreme Snow Depth (cm)	127	137	130	96	70	0	0	0	4	15	64	**157**		
Date (yyyy/dd)	1967/29	1960/27	1960/01	1978/02	1996/01	1955/01	1955/01	1955/01	1980/26	1969/27	1966/30	**1968/24**		
Days with Maximum Temperature:														
<= 0 °C	29	23.6	16.6	4.1	0.03	0	0	0	0	2	15.3	26.1	116.7	A
> 0 °C	2	4.7	14.4	25.9	31	30	31	31	30	29	14.7	4.9	248.5	A
> 10 °C	0	0.10	1.8	10.1	24.9	29.1	31	31	25.6	12.1	2.1	0.03	167.8	A
> 20 °C	0	0	0	1.6	10.3	18.8	25.6	20.7	7.4	1.3	0	0	85.7	A
> 30 °C	0	0	0	0	0.80	1.6	2.5	1.3	0.21	0	0	0	6.4	A

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
> 35 °C	0	0	0	0	0	0.03	0.14	0.07	0	0	0	0	0.24	A
Days with Minimum Temperature:														
> 0 °C	0	0.37	1.3	5.5	19.6	28	31	30.7	23.7	11.8	2.6	0.27	154.8	A
<= 2 °C	31	28.2	30.6	27.4	16.7	4.5	0.39	1.4	10.3	23.4	29	30.9	233.9	A
<= 0 °C	31	27.9	29.7	24.5	11.4	2	0.04	0.28	6.3	19.2	27.4	30.7	210.5	A
< -2 °C	30.9	27.5	28	20.2	5.6	0.27	0	0	1.9	12.4	23.7	29.9	180.3	A
< -10 °C	28.1	24.6	20.7	6.4	0	0	0	0	0	0.29	10.3	24.3	114.6	A
< -20 °C	20.8	17.4	8.8	0.57	0	0	0	0	0	0	1.9	14.1	63.7	A
< - 30 °C	8	4.6	0.86	0	0	0	0	0	0	0	0.03	4	17.4	A
Days with Rainfall:														
>= 0.2 mm	1.6	1	3.3	6.5	11.1	14.4	14	13.9	16.3	13	6	2.1	103.1	A
>= 5 mm	0.20	0.07	0.93	2	4.1	5.5	5.4	4.9	5.8	4.5	1.9	0.40	35.7	A
>= 10 mm	0.03	0	0.40	0.73	2.3	2.8	3	2.7	2.7	1.8	0.90	0.20	17.5	A
>= 25 mm	0	0	0.03	0.03	0.17	0.47	0.63	0.59	0.37	0.21	0.10	0.07	2.7	A
Days With Snowfall:														
>= 0.2 cm	18.1	13.9	11.9	7	2.2	0.30	0	0	0.87	6.6	15.6	19.1	95.6	A
>= 5 cm	4	2.5	3.1	1.9	0.43	0	0	0	0.10	0.68	2.5	4.6	19.6	A
>= 10 cm	1.4	0.77	1.4	0.53	0.17	0	0	0	0	0.18	1.1	1.5	7	A
>= 25 cm	0.03	0.03	0.13	0.07	0	0	0	0	0	0	0.03	0.03	0.32	A
Days with Precipitation:														
>= 0.2 mm	17.7	13.6	13.3	11	12.1	14.4	14	13.9	16.6	16.4	18.7	19	180.7	A
>= 5 mm	3	2.2	3.8	3.8	4.6	5.5	5.4	4.9	5.9	5.2	4.2	3.9	52.4	A
>= 10 mm	1.2	0.60	1.7	1.4	2.6	2.8	3	2.7	2.7	2.1	2	1.3	23.9	A
>= 25 mm	0.03	0.03	0.17	0.20	0.27	0.47	0.63	0.59	0.37	0.25	0.21	0.10	3.3	A
Days with Snow Depth:														

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
>= 1 cm	31	28.3	30.8	22.3	2.2	0	0	0	0.13	3.1	20.7	30.4	168.9	A
>= 5 cm	30.8	28.3	30.2	19.5	1.4	0	0	0	0	0.93	12.7	28.3	152.1	A
>= 10 cm	30.7	28.3	29.7	16.6	0.90	0	0	0	0	0.29	8.4	25.3	140.2	A
>= 20 cm	30	28.3	28.7	13.6	0.40	0	0	0	0	0	3.2	19.7	123.9	A
Wind:														
Speed (km/h)	12.3	12.3	13.4	13.5	12.4	11.5	10.3	9.8	11.2	12.3	12.5	11.8	11.9	A
Most Frequent Direction	W	NW	NW	NW	N	S	S	S	S	S	S	S	S	A
Maximum Hourly Speed (km/h)	57	59	58	56	64	56	48	**72**	56	56	61	56		
Date (yyyy/dd)	1978/26	2002/12	1974/03	1962/15	1956/22	1964/16	1956/28	**1967/03**	1955/06	1958/04	1955/10	1971/11		
Maximum Gust Speed (km/h)	105	96	108	89	93	**158**	85	105	105	89	89	105		
Date (yyyy/dd)	1962/26	1999/12	1974/03	1967/02	1959/06	**1956/14**	2001/21	1969/23	1970/10	1962/16	1958/18	1970/02		
Direction of Maximum Gust	NW	SW	SW	NW	SW	W	N	NW	W	SW	S	SW	W	
Days with Winds >= 52 km/h	0.2	0.1	0.2	0	0.1	0.2	0	0.1	0.2	0	0.1	0.1	1.4	A
Days with Winds >= 63 km/h	0.1	0	0.1	0	0	0	0	0	0	0	0	0	0.2	A
Degree Days:														
Above 24 °C	0	0	0	0	0.1	0.5	1.7	0.5	0.1	0	0	0	2.8	A
Above 18 °C	0	0	0	0.3	6.2	20.4	35.4	23	4.1	0.1	0	0	89.6	A
Above 15 °C	0	0	0	1.3	18.8	52	89.9	62.1	12.9	1.1	0	0	238	A

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
Above 10 °C	0	0	0.3	7	64.8	151.9	229.7	180	58.4	10.5	0.3	0	702.8	A
Above 5 °C	0	0.1	2.2	27.6	158.3	290.6	384.3	332.6	161.9	47.5	4.6	0.2	1409.9	A
Above 0 °C	0.1	3	18.3	90.9	297.1	439.8	539.3	487.6	305.6	140.7	27.1	1.8	2351.3	A
Below 0 °C	541.4	411.2	253.4	55	0.9	0	0	0	0.1	13.7	147.8	412.3	1835.7	A
Below 5 °C	696.3	549.7	392.3	141.7	17	0.8	0	0	6.4	75.5	275.3	565.7	2720.6	A
Below 10 °C	851.3	690.9	545.3	271.1	78.6	12.2	0.4	2.5	52.8	193.4	421	720.5	3839.9	A
Below 15 °C	1006.3	832.2	700.1	415.4	187.6	62.2	15.6	39.5	157.3	339	570.7	875.5	5201.4	A
Below 18 °C	1099.3	917	793.1	504.4	268	120.7	54.2	93.4	238.6	431	660.7	968.5	6148.8	A
Humidex:														
Extreme Humidex	6.1	10.7	21.8	31.5	37.5	43	**44**	42	40.1	32.9	20.8	17.1		
Date (yyyy/dd)	1975/11	1994/19	1990/15	1990/26	1962/16	1995/18	**1963/01**	1975/01	2002/08	1968/16	1961/03	1982/03		
Days with Humidex >= 30	0	0	0	0	1.4	4.3	7.6	5.7	1.2	0.1	0	0	20.4	A
Days with Humidex >= 35	0	0	0	0	0.1	0.6	1.8	1	0.3	0	0	0	3.8	A
Days with Humidex >= 40	0	0	0	0	0	0.1	0.3	0.1	0	0	0	0	0.5	A
Wind Chill:														
Extreme Wind Chill	**-54.2**	-53.7	-45.8	-37.1	-18.8	-8.5	-2.4	-4	-9.3	-19.2	-38	-53.1		
Date (yyyy/dd)	**1957/13**	1962/10	1967/18	1964/03	1986/02	1972/10	2001/01	1965/30	1965/27	1988/30	1958/30	1993/26		
Days with Wind Chill < -20	26	21.7	15.6	2.6	0	0	0	0	0	0	5.1	20.1	91.1	A
Days with Wind Chill < -	16.9	12.4	5.8	0.2	0	0	0	0	0	0	0.8	11	47.1	A

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
30														
Days with Wind Chill < -40	5.6	2.7	0.3	0	0	0	0	0	0	0	0	1.8	10.4	A
Humidity:														
Average Vapour Pressure (kPa)	0.2	0.2	0.3	0.4	0.8	1.1	1.4	1.4	1	0.7	0.4	0.2	0.7	A
Average Relative Humidity - 0600LST (%)	75	76.3	76.9	78.4	79.4	84.6	88.6	91.8	92.3	88.5	86.7	80.3	83.2	A
Average Relative Humidity - 1500LST (%)	68.2	61	55.3	49.1	46.3	49.8	52.4	55.6	61.7	65.7	74.6	74.7	59.5	A
Pressure:														
Average Station Pressure (kPa)	97.8	98	98	97.9	97.9	97.8	97.8	98	98	98	97.9	97.9	97.9	A
Average Sea Level Pressure (kPa)	101.6	101.8	101.7	101.6	101.5	101.3	101.3	101.6	101.6	101.6	101.6	101.7	101.6	A
Visibility (hours with):														
< 1 km	11.1	6.3	13.6	10.8	6.5	4	4.6	8.7	10.9	13.3	12.2	9.4	111.4	C
1 to 9 km	161.1	123.7	112.3	82.7	62.2	63.6	49.8	67.5	90.1	97.7	143.1	173.1	1226.8	C
> 9 km	571.8	547.6	618.1	626.6	675.3	652.4	689.6	667.7	619	633	564.7	561.6	7427.3	C
Cloud Amount (hours with):														
0 to 2 tenths	214.5	209.9	234.7	214.6	192.1	170.9	182.6	203.5	148.6	139.6	104.8	171.6	2187.4	C
3 to 7 tenths	106.2	106.7	117.4	118.4	146.4	175.9	209	195.6	144.4	112.9	80.4	97	1610.3	C
8 to 10	423.2	361	391.9	387	405.5	373.2	352.4	344.9	427	491.5	534.8	475.4	4967.9	C

Temperature:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Code
tenths														

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APPENDIX C

Species with Potential to Occur in the Regional Study Area

Common Name	Scientific Name	SRank*
Birds		
alder flycatcher	*Empidonax alnorum*	S5B
American bittern	*Botaurus lentiginosus*	S4B
American black duck	*Anas rubripes*	S4
American crow	*Corvus brachyrhynchos*	S5B
American goldfinch	*Carduelis tristis*	S5B
American kestrel	*Falco sparverius*	S4
American redstart	*Setophaga ruticilla*	S5B
American robin	*Turdus migratorius*	S5B
American wigeon	*Anas americana*	S4
American woodcock	*Scolopax minor*	S4B
bald eagle	*Haliaeetus leucocephalus*	not listed
bank swallow	*Riparia riparia*	S4B
barn swallow	*Hirundo rustica*	S4B
barred owl	*Strix varia*	S5
bay-breasted warbler	*Dendroica castanea*	S5B
belted kingfisher	*Ceryle alcyon*	S4B
black-and-white warbler	*Mniotilta varia*	S5B
black-backed woodpecker	*Picoides arcticus*	S4
black-billed cuckoo	*Coccyzus erythropthalmus*	S5B
blackburnian warbler	*Dendroica fusca*	S5B
black-capped chickadee	*Poecile atricapilus*	S5
black-throated blue warbler	*Dendroica caerulescens*	S5B
black-throated green warbler	*Dendroica virens*	S5B
blue jay	*Cyanocitta cristata*	S5
blue-headed vireo	*Vireo solitarius*	S5B
blue-winged teal	*Anas discors*	S4
boreal chickadee	*Poecile hudsonica*	S5
broad-winged hawk	*Buteo platypterus*	not listed
brown creeper	*Certhia americana*	S5B
brown thrasher	*Toxostoma rufum*	S4B
brown-headed cowbird	*Molothrus ater*	S4B
Canada goose	*Branta canadensis*	S5
Canada warbler	*Wilsonia canadensis*	S4B
Cape May warbler	*Dendroica tigrina*	S5B
cedar waxwing	*Bombycilla cedrorum*	S5B

Common Name	Scientific Name	SRank*
chestnut-sided warbler	*Dendroica pensylvanica*	S5B
chipping sparrow	*Spizella passerina*	S5B
clay-coloured sparrow	*Spizella pallida*	S4B
cliff swallow	*Petrochelidon pyrrhonota*	S4B
common goldeneye	*Bucephala clangula*	S5
common grackle	*Quiscalus quiscula*	S5B
common loon	*Gavia immer*	S5B,S5N
common merganser	*Mergus merganser*	S5B, S5N
common nighthawk	*Chordeiles minor*	S4B
common raven	*Corvus corax*	S5
common snipe	*Gallinago gallinago*	not listed
common tern	*Sterna hirundo*	S4B
common yellowthroat	*Geothlypis trichas*	S5B
Cooper's hawk	*Accipiter cooperii*	S4
dark-eyed junco	*Junco hyemalis*	S5B
downy woodpecker	*Picoides pubescens*	S5
eastern bluebird	*Sialia sialis*	S5B
eastern kingbird	*Tyrannus tyrannus*	S4B
eastern phoebe	*Sayornis phoebe*	S5B
eastern wood-pewee	*Contopus virens*	S4B
European starling	*Sturnus vulgaris*	SNA
evening grosbeak	*Coccothraustes vespertinus*	S4B
golden-crowned kinglet	*Regulus satrapa*	S5B
gray catbird	*Dumetella carolinensis*	S4B
gray jay	*Perisoreus canadensis*	S5
great blue heron	*Ardea herodias*	S4
great gray owl	*Strix nebulosa*	S4
great horned owl	*Bubo virginianus*	S4
green-winged teal	*Anas crecca*	S4
hairy woodpecker	*Picoides villosus*	S5
hermit thrush	*Catharus guttatus*	S5B
herring gull	*Larus argentatus*	S5B,S5N
hooded merganser	*Lophodytes cucullatus*	S5B,S5N
house finch	*Carpodacus mexicanus*	SNA
house wren	*Troglodytes aedon*	S5B
indigo bunting	*Passerina cyanea*	S4B

Common Name	Scientific Name	SRank*
killdeer	*Charadrius vociferus*	S5B,S5N
least flycatcher	*Empidonax minimus*	S4B
Lincoln's sparrow	*Melospiza lincolnii*	S5B
magnolia warbler	*Dendroica magnolia*	S5B
mallard	*Anas platyrhynchos*	S5
merlin	*Falco columbarius*	S5B
mourning warbler	*Oporornis philadelphia*	S4B
Nashville warbler	*Vermivora ruficapilla*	S5B
northern flicker	*Colaptes auratus*	S4B
northern goshawk	*Accipiter gentilis*	S4
northern harrier	*Circus cyaneus*	S4B
northern parula	*Parula americana*	S4B
northern waterthrush	*Seiurus noveboracensis*	S5B
olive-sided flycatcher	*Contopus cooperi*	S4B
osprey	*Pandion haliaetus*	S5B
ovenbird	*Seiurus aurocapilla*	S4B
Philadelphia vireo	*Vireo philadelphicus*	S5B
pileated woodpecker	*Dryocopus pileatus*	S5
pine siskin	*Carduelis pinus*	S4B
pine warbler	*Dendroica pinus*	S5B
purple finch	*Carpodacus purpureus*	S4B
red crossbill	*Loxia curvirostra*	S4B
red-breasted nuthatch	*Sitta canadensis*	S5
red-eyed vireo	*Vireo olivaceus*	S5B
red-tailed hawk	*Buteo jamaicensis*	S5
red-winged blackbird	*Agelaius phoeniceus*	S4
ring-necked duck	*Aythya collaris*	S5
rose-breasted grosbeak	*Pheucticus ludovicianus*	S4B
ruby-crowned kinglet	*Regulus calendula*	S4B
ruby-throated hummingbird	*Archilochus colubris*	S5B
ruffed grouse	*Bonasa umbellus*	S4
rusty blackbird	*Euphagus carolinus*	S4B
sandhill crane	*Grus canadensis*	S5B
savannah sparrow	*Passerculus sandwichensis*	S4B
scarlet tanager	*Piranga olivacea*	S4B
sharp-shinned hawk	*Accipiter striatus*	not listed

Common Name	Scientific Name	SRank*
solitary sandpiper	*Tringa solitaria*	S4B
song sparrow	*Melospiza melodia*	S5B
spotted sandpiper	*Actitis macularia*	S5
spruce grouse	*Falcipennis canadensis*	S5
Swainson's thrush	*Catharus ustulatus*	S4B
swamp sparrow	*Melospiza georgiana*	S5B
Tennessee warbler	*Vermivora peregrina*	S5B
tree swallow	*Tachycineta bicolor*	S4B
veery	*Catharus fuscescens*	S4B
vesper sparrow	*Pooecetes gramineus*	S4B
whip-poor-will	*Caprimulgus vociferus*	S4B
white-breasted nuthatch	*Sitta carolinensis*	S5
white-throated sparrow	*Zonotrichia albicollis*	S5B
white-winged crossbill	*Loxia leucoptera*	S5B
Wilson's warbler	*Wilsonia pusilla*	S4B
winter wren	*Troglodytes troglodytes*	S5B
yellow warbler	*Dendroica petechia*	S5B
yellow-bellied flycatcher	*Empidonax flaviventris*	S5B
yellow-bellied sapsucker	*Sphyrapicus varius*	S5B
yellow-throated vireo	*Vireo flavifrons*	S4B
Mammals		
beaver	*Castor canadensis*	S5
big brown bat	*Eptesicus fuscus*	S5
black bear	*Ursus americanus*	S5
bobcat	*Lynx rufus*	S4
Canada lynx	*Lynx canadensis*	S5
common shrew	*Sorex araneus*	not listed
coyote	*Canis latrans*	S5
deer mouse	*Peromyscus maniculatus*	S5
eastern chipmunk	*Tamias striatus*	S5
eastern small-footed bat	*Myotis leibii*	S2S3
eastern wolf	*Canis lupus lycaon*	S4
ermine	*Mutela erminea*	S5
fisher	*Martes pennanti*	S5
gray squirrel	*Sciurus carolinensis*	S5
gray wolf	*Canis lupus*	S4

Common Name	Scientific Name	SRank*
hairy-tailed mole	*Parascalops breweri*	S4
heather vole	*Phenacomys ungava*	S4
house mouse	*Mus musculus*	SNA
least chipmunk	*Tamias minimus*	S5
little brown bat	*Myotis lucifuga*	S4
long-tailed weasel	*Mustela frenata*	S4
marten	*Martes americana*	S5
meadow jumping mouse	*Zapus hudsonius*	S5
meadow vole	*Microtus pennsylvanicus*	S5
mink	*Mustela vison*	S4
moose	*Alces alces*	S5
muskrat	*Ondatra zibethicus*	S5
northern flying squirrel	*Glaucomys sabrinus*	S5
northern long-eared bat	*yotis septentrionalis*	S3
northern short-tailed shrew	*Blarina brevicauda*	S5
Norway rat	*Rattus norvegicus*	SNA
porcupine	*Erethizon dorsatum*	S5
pygmy shrew	*Sorex hoyi*	S4
raccoon	*Procyon lotor*	S5
red fox	*Vulpes vulpes*	S5
red squirrel	*Tamiasciurus hudsonicus*	S5
river otter	*Lontra canadensis*	S5
rock vole	*Microtus chrotorrhinus*	S4
smoky shrew	*Sorex fumeus*	S5
snowshoe hare	*Lepus americanus*	S5
southern bog lemming	*Synaptomys cooperi*	S4
southern red-backed vole	*Clerithrionomys gapperi*	S5
star-nosed mole	*Condylura cristata*	S5
striped skunk	*Mephitis mephitis*	S5
tri-coloured bat	*Pipistrellus subflavus*	S3?
water shrew	*Sorex palustris*	S5
white-tailed deer	*Odocoileusvirginianus*	S5
woodchuck	*Marmota monax*	S5
woodland jumping mouse	*Napaeozapus insignis*	S5
Reptiles		
Blanding's turtle	*Emydoidea blandingi*	S3

Common Name	Scientific Name	SRank*
common snapping turtle	*Chelydra serpentina*	S3
eastern gartersnake	*Thamnophis sirtalis sirtalis*	S5
Midland painted turtle	*Chrysemys picta marginata*	S5
northern red-bellied snake	*Storeria occipitomaculata occipitomaculata*	S5
ring-necked snake	*Diadophis punctatus edwardsi*	S4
smooth green snake	*Liochlorophis vernalis*	S4
Amphibians		
American toad	*Bufo americanus*	S5
boreal chorus frog	*Pseudacris maculata*	S5
green frog	*Rana clamitans*	S5
Jefferson-blue spotted newt salamander complex	*Ambystoma jeffersonianum-laterale "complex"*	S2
mink frog	*Rana septentrionalis*	S5
northern leopard frog	*Rana pipiens*	S5
northern red-backed salamander	*Plethodon cinereus*	S5
red-spotted newt	*Notophthalmus viridescens viridescens*	S5
spotted salamander	*Ambystoma maculatum*	S4
wood frog	*Rana sylvatica*	S5
Odonates		
American emerald	*Cordulia shurtleffi*	S5
ashy clubtail	*Gomphus lividus*	S4
belted whiteface	*Leucorrhinia proxima*	S5
boreal snaketail	*Ophiogomphus colubrinus*	S4
chalk-fronted corporal	*Ladona julia*	S5
common spreadwing	*Lestes disjunctus*	S5
dragon hunter	*Hagenius brevistylus*	S5
eastern forktail	*Ischnura verticalis*	S5
four spotted skimmer	*Libellula quadrimaculata*	S5
frosted whiteface	*Leucorrhinia frigida*	S5
Hagen's bluet	*Enallagma hageni*	S5
lancet clubtail	*Gomphus exilis*	S5
marsh bluet	*Enallagma ebrium*	S5
moustashed clubtail	*Gomphus adelphus*	S4
powdered dancer	*Argia moesta*	S5
river jewelwing	*Calopteryx aequabilis*	S5
rusty snaketail	*Ophiogomphus rupinsulensis*	S4

Common Name	Scientific Name	SRank*
sedge sprite	*Nehalennia irene*	S5
spiny baskettail	*Epitheca spinigera*	S5
sweetflag spreadwing	*Lestes forcipatus*	S4
swift river cruiser	*Macromia illinoiensis*	S4

Notes:
Sensitive species are underlined.
*SRanks are based on Provincial ranking definitions:
S1 – Critically imperiled in Ontario
S2 – Imperiled in Ontario
S3 – Vulnerable in Ontario
S4 – Apparently secure in Ontario
S5 – Secure in Ontario
SZN – Non-breeding migrants
S#B – Breeding individuals

APPENDIX D

Species at Risk with Potential to Occur in the Regional Study Area

Common Name	Scientific Name	NHIC[1] (SRank*)	COSEWIC[1]	SARA[2] (Sch. 1)	SARO[3]	Habitat Requirements	Potential to Occur in the RSA[4]	Rationale
bald eagle	*Haliaeetus leucocephalus*	not tracked	not at risk	not at risk	special concern	Most bald eagle nests are associated with large lakes, rarely small lakes or large rivers. Lakes with <5 km of shoreline are not used unless there is a larger lake within 1 km. This species shows a distinct preference for islands, but no preference for mixed, coniferous, or deciduous forest. Forest structure is important. Bald eagles nest in mature or old-growth forest with discontinuous or open canopy, usually where there is 20% to 50% crown coverage. They show a preference for live trees and conifers in Ontario [Ontario Ministry of Natural Resources (MNR) 1987].	High	Large bodies of water with shorelines exceeding 5 km are present near both Study Areas. Several incidental sightings of bald eagle were documented during field surveys and one active nest was identified in the mine site by field biologists in 2012 and 2012.
barn swallow	*Hirundo rustica*	S4B	threatened	no status	no status	Open habitat, especially fields and agricultural land and around buildings near water.	Low	While this species was recorded as being present in the Ontario Breeding Bird Atlas (OBBA 2006; 2009) squares containing the Regional Study Area (RSA), the RSA is forested and grassland habitat is not present.
black tern	*Chlidonias niger*	S3B	not at risk	not at risk	special concern	Builds floating nests in loose colonies in shallow marshes, especially in cattails [Royal Ontario Museum (ROM) 2013].	Low	Marsh habitat suitable to support black tern was not observed in the Local Study Area (LSA).
bobolink	*Dolichonyx oryzivorus*	S4B	threatened	not at risk	threatened	Hayfields and associated pastures are its preferred habitat due to the plant cover present at the start of the nesting season. The bobolink also occurs in wet prairie, graminoid peatlands, and abandoned fields dominated by tall grasses, remnants of uncultivated tall-grass prairie, no-till cropland, small-grain fields, reed beds, and irrigated fields in arid regions. This species is also known to use sites that have been restored to grassland habitat Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2013).	Low	The RSA is forested and grassland habitat is not present.
Canada warbler	*Cardellina canadensis*	S4B	threatened	threatened	special concern	The Canada warbler breeds in a range of deciduous and coniferous trees, usually wet forest types, all with a well-developed, dense shrub layer. Dense shrub and understory vegetation helps conceal Canada warbler nests that are usually located on or near the ground on mossy logs or roots, along stream banks or on hummocks (MNR 2009a).	High	Canada warbler was observed in the RSA by field biologists during the 2012 surveys and in the LSA during the 2012 and 2013 field surveys. A large proportion of the RSA habitat consists of dense coniferous regeneration stands. However, there are some streams present with relatively undisturbed forest habitat adjacent that would provide suitable habitat for Canada warblers.
chimney swift	*Chaetura pelagica*	S4B,S4N	threatened	threatened	threatened	Chimney swifts used to nest and roost in hollow trees, but they have almost completely adapted to man-made structures, in particular chimneys (SARA 2013).	Low	There are few large diameter snags to provide habitat for chimney swifts. It has not been reported by the OBBA (2006; 2009; Appendix A) or the Natural Heritage Information Center (NHIC 2013) as being present in the squares containing the RSA. Additionally, no individuals were heard or observed.

Common Name	Scientific Name	NHIC[1] (SRank*)	COSEWIC[1]	SARA[2] (Sch. 1)	SARO[3]	Habitat Requirements	Potential to Occur in the RSA[4]	Rationale
common nighthawk	*Chordeiles minor*	S4B	threatened	threatened	special concern	They can be found in a wide variety of habitats, in particular those with open or semi-open areas such as farmland, open woodlands, clearcuts, burns, rock outcrops, bogs, fens, prairies, gravel pits and urban rooftops (SARA 2013).	High	Common nighthawks were observed by field biologists during the 2013 surveys within the RSA. Open habitat preferred by the common nighthawk was proportionately low in comparison to other available habitat in the LSA.
eastern meadowlark	*Sturnella magna*	S4B	threatened	no status	threatened	The eastern meadowlark prefers native grasslands and will nest in pastures and agricultural fields, especially those in alfalfa and hay. It also uses old fields and meadows, often overgrown with shrubs, and prefers dry habitat to wet and tall grass to short. Occasionally it will use other areas such as golf courses or sand dunes (Cadman et al. 2007).	Low	The RSA is forested and grassland habitat is not present.
olive-sided flycatcher	*Contopus cooperi*	S4B	threatened	threatened	special concern	The olive-sided flycatcher is most often found along natural forest edges and openings. It will use forests that have been logged or burned if there are ample tall snags and trees to use for foraging perches. Olive-sided flycatchers' breeding habitat usually consists of coniferous or mixed forest adjacent to rivers or wetlands. In Ontario, olive-sided flycatchers commonly nest in conifers such as white spruce (*Picea glauca*), black spruce (*Picea mariana*), jack pine (*Pinus banksiana*) and balsam fir (*Abies balsamea*) (MNR 2009b).	High	Olive-sided flycatcher was observed within the RSA and LSA by field biologists during the 2012 surveys. Olive-sided flycatchers were recorded in the OBBA squares containing the Study Areas (OBBA 2006; 2009).
peregrine falcon	*Falco peregrinus anatum*	not tracked	special concern	special concern	special concern	Nests are usually scrapes made on cliff ledges on steep cliffs, usually near wetlands - including artificial cliffs such as quarries and buildings; prefers to hunt in open habitats such as wetlands, tundra, savannah, sea coasts and mountain meadows, but will also hunt over open forest (SARA 2013).	Low	The area lacks the steep cliffs generally associated with peregrine falcon nests. It has not been reported by the OBBA (2006; 2009; Appendix A) or the NHIC (2013) as being present in the square that contains the RSA. Additionally, no individuals were heard or observed during field surveys.
rusty blackbird	*Euphagus carolinus*	S4B	special concern	special concern	no status	The rusty blackbird nests in the boreal forest and favours the shores of wetlands such as slow-moving streams, peat bogs, marshes, swamps, beaver ponds and pasture edges. In wooded areas, the rusty blackbird only rarely enters the forest interior. During the winter, the rusty blackbird mainly frequents damp forests and, to a lesser extent, cultivated fields (SARA 2013).	High	Rusty blackbirds were observed in the RSA by field biologists during the 2012 surveys. A large proportion of the RSA habitat consisted of dense coniferous regeneration stands. However, there are some streams present with relatively undisturbed forest habitat adjacent that may provide suitable habitat for rusty blackbirds.
short-eared owl	*Asio flammeus*	S2N, S4B	special concern	special concern	special concern	The short-eared owl makes use of a wide variety of open habitats, including arctic tundra, grasslands, peat bogs, marshes, sand-sage concentrations and old pastures. It also occasionally breeds in agricultural fields (SARA 2013).	Low	The RSA is forested and grassland habitat is not present.
whip-poor-will	*Caprimulgus vociferus*	S4B	threatened	threatened	threatened	Typically found in areas with a mix of open and forested habitat, such as savannahs, open woodlands or openings in more mature, deciduous, coniferous and mixed forests. It forages in these open areas and uses forested areas for roosting (resting and sleeping) and nesting (MNR 2009c).	High	Whip-poor-will were not observed in the LSA but were identified during surveys conducted within the RSA where many clear-cut areas were present.

Common Name	Scientific Name	NHIC[1] (SRank*)	COSEWIC[1]	SARA[2] (Sch. 1)	SARO[3]	Habitat Requirements	Potential to Occur in the RSA[4]	Rationale
eastern cougar	*Puma concolor*	SU	data deficient	not at risk	endangered	Historically, cougars in the east occupied large forested areas that were relatively undisturbed by humans (ROM 2013).	Low	Eastern cougars generally occur in low densities (i.e. 3 to 4 individuals/100 km^2) (NatureServe 2010). Now associated generally with mountainous or undisturbed areas and may occupy a wide variety of habitats including swamps, riparian woodlands, broken country with good cover of brush or woodlands (NatureServe 2010).
tri-coloured bat	*Pipistrellus subflavus*	S3?	endangered	no status	no status	They live in shrubby areas and open forests close to water. They will sometimes be found close to the edge of urban areas. They are seldom found in buildings (Georgian Bay Biosphere Reserve 2012).	Low to moderate	Although no element occurrences were reported for this species, habitat suitable for supporting this species was present in the RSA. Acoustic recordings did not confirm the presence of this species within the LSA.
eastern wolf	*Canis lupus lycaon*	S4	special concern	special concern	special concern	The eastern wolf requires large areas of contiguous forest in which to range that support stable populations of its preferred prey; a pack will roam an area of at least 100 km^2 (Michigan Department of Natural Resources 2011).	Moderate	The RSA is located along the edge of a large contiguous forest habitat and may provide potential habitat for the eastern wolf if present in the region. Habitat observed within the RSA is a small portion of the surrounding forested habitat, is typical of the region and does not appear unique.
little brown myotis	*Myotis lucifugus*	S4	endangered	no status	endangered	This species forages over water where their diet consists of aquatic insects, mainly midges, mosquitoes, mayflies, and caddisflies. They also feed over forest trails, cliff faces, meadows, and farmland where they consume a wide variety of insects, from moths and beetles to crane flies. This species is especially associated with humans, often forming nursery colonies containing hundreds, sometimes thousands of individuals in buildings, attics, and other man-made structures. (COSEWIC 2013)	High	Habitat similar to that required by this species was present in the Study Area. Acoustic recording confirmed the present of this species within the LSA.
northern myotis	*Myotis septentrionalis*	S3	endangered	not at risk	endangered	Hibernating bats seek out caves or other similar structures which provide protection from freezing temperatures and predators. Caves, abandoned mines, and crevices provide safe and undisturbed hibernation sites from early autumn to mid spring when flying insects are inactive (MNR 1984).	Low to moderate	Although no element occurrences were reported for this species, habitat similar to that required by this species was present in the Study Area. Acoustic recordings did not confirm the presence of this species within the LSA.
small –footed bat	*Myotis leibii*	S2S3	not at risk	no status	no status	Habitat is mostly hilly or mountainous areas, in or near deciduous or evergreen forest, sometimes in mostly open farmland. Warm-season roosts include buildings, bridges (e.g. in expansion joints), towers, hollow trees, spaces beneath the loose bark of trees, cliff crevices, caves, and mines. Hibernation occurs in solution and fissure caves and mine tunnels. Roost sites often are deep in crevices, or under rocks on the cave floor. Like many other bat species, this one typically forages over ponds and streams.	Low to moderate	Although no element occurrences were reported for this species, habitat similar to that required by this species was present in the Study Areas. Acoustic recordings did not confirm the presence of this species within the LSA.

Common Name	Scientific Name	NHIC[1] (SRank*)	COSEWIC[1]	SARA[2] (Sch. 1)	SARO[3]	Habitat Requirements	Potential to Occur in the RSA[4]	Rationale
Jefferson-blue spotted newt salamander complex	*Ambystoma jeffersonianum-laterale "complex*	S2	not at risk	not at risk	not at risk	Throughout their range, they are found in deciduous or mixed upland forests containing or adjacent to suitable breeding pools. Breeding ponds are normally ephemeral or vernal, woodland pools that dry in late summer. Terrestrial habitat is in mature woodlands that have small mammal furrow or rock fissures that enable adults to overwinter underground below the frost line (COSEWIC 2010).	Moderate to high	A salamander with blue spots was observed in the LSA; however, field crews were unable to capture the salamander to identify if the individual was a Jefferson-blue spotted newt salamander-complex or a blue-spotted salamander. In the absence of species confirmation a conservative assessment of its potential to occur in the LSA has been applied. No salamanders were observed in the RSA.
Blanding's turtle	*Emydoidea blandingii*	S3	threatened	threatened	threatened	Inhabits a network of lakes, streams, and wetlands, preferring shallow wetland areas with abundant vegetation. It can also spend significant portions of time in upland areas moving between wetlands. In a single season this highly mobile turtle has been known to travel up to 7 km in search of food or a mate (ROM 2013).	Low to moderate	No element occurrences recorded for this species in the Study Area (NHIC 2013). While there are several small streams and wetlands that may provide suitable habitat for Blanding's turtle, the RSA is located at the furthest extent of its documented range in Ontario (Oldham 2000).
snapping turtle	*Chelydra serpentina*	S3	special concern	special concern	special concern	Snapping turtles spend most of their lives in water and prefer shallow waters so they can hide under the soft mud and leaf litter (ROM 2013).	Low to moderate	No element occurrences recorded for this species in the Study Area (NHIC 2013). While there are several small streams and wetlands that may provide suitable habitat for snapping turtles, the RSA is located at the furthest extent of its range in Ontario.
monarch	*Danaus plexippus*	S2N,S4B	special concern	special concern	special concern	Found in Ontario wherever there are milkweed plants for its caterpillars and wildflowers for a nectar source; often found on abandoned farmland and roadsides, but also in city gardens and parks (ROM 2013).	Low	Although there is potential for the monarch to be present in the RSA, no unusual concentrations are expected because milkweed was absent from the RSA and wildflowers did not form a major component of the plant community.

Notes:
[1] NHIC = Natural Heritage Information Center
[2] COSEWIC - Committee on the Status of Endangered Wildlife in Canada
[3] SARA - *Species at Risk Act* - Species listed under Schedule 1 and their habitats are protected under the ESA
Only species listed in Schedule 1and their habitats are protected the ESA.
* Based on Provincial ranking definitions:
S1 – Critically imperiled in Ontario
S2 – Imperiled in Ontario
S3 – Vulnerable in Ontario
S4 – Apparently secure in Ontario
S5 – Secure in Ontario
SZN – Non-breeding migrants
S#B – Breeding individuals
SU – Species unrankable

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APPENDIX E

Vegetation Inventory for the Local Study Area

Scientific Name[a]	Common Name[b]	Origin[b]	G Rank[c]	S Rank[c]	Ecosite Type																								
					B009S	B010S	B012Tt/Tl	B014Tt	B016Tt/Tl	B018Tt	B034Tl	B047S	B049Tl	B053Tl	B088Tt	B096S	B098Tt/Tl	B099Tt/Tl	B104Tt	B108Tl	B120Tl	B126Tt/Tl	B130Tl	B136Tl	B137Tt	B138S	B139N	B142N	B224Tt
Trees (11 taxa)																													
Abies balsamea	Balsam fir	N	G5	S5		X	X	X	X	X			X	X	X		X	X	X	X	X	X	X		X	X			X
Acer rubrum	Red maple	N	G5	S5			X	X	X	X					X			X	X	X									
Betula papyrifera	White birch	N	G5	S5		X	X	X	X	X		X	X		X	X	X		X	X	X	X	X			X			X
Fraxinus nigra	Black ash	N	G5	S5																	X								
Larix laricina	Tamarack	N	G5	S5							X		X	X				X				X		X	X	X	X		
Picea glauca	White spruce	N	G5	S5		X	X		X	X		X	X		X	X		X		X						X			X
Picea mariana	Black spruce	N	G5	S5	X		X	X	X		X		X	X		X	X	X	X			X		X	X	X	X		X
Pinus banksiana	Jack pine	N	G5	S5	X	X	X		X	X	X	X	X	X			X	X	X	X			X			X			
Pinus strobus	White pine	N	G5	S5			X				X																		
Populus tremuloides	Trembling aspen	N	G5	S5			X	X	X	X		X	X		X	X		X	X	X			X						
Thuja occidentalis	Eastern white cedar	N	G5	S5		X	X		X	X			X						X		X				X				
Small trees, shrubs and woody vines (39 taxa)																													
Acer spicatum	Mountain maple	N	G5	S5			X	X	X			X	X		X	X		X	X	X	X	X	X						X
Alnus incana	Speckled alder	N	G5	S5													X					X				X			
Alnus viridus	Green alder	N	G5	S5									X				X	X											
Amelanchier sp.	Serviceberry	-	-	-			X	X	X		X						X	X				X	X						
Andromeda polifolia	Bog rosemary	N	G5T5	S5																		X		X		X	X		
Aralia hispida	Bristly sarsaparilla	N	G5	S5												X													
Betula pumila	Dwarf birch	N	G5	S5																				X					
Chamaedaphne calyculata	Leatherleaf	N	G5	S5																		X		X		X	X	X	
Comptonia peregrina	Sweetfern	N	G5	S5												X	X												
Cornus canadensis	Bunchberry	N	G5	S5		X	X	X	X	X		X	X	X	X	X	X	X	X			X	X		X				X
Corylus cornuta	Beaked hazel	N	G5	S5			X	X	X	X					X	X	X	X	X	X									
Diervilla lonicera	Bush-honeysuckle	N	G5	S5			X		X	X	X		X			X	X	X	X	X			X						
Epigaea repens	Trailing arbutus	N	G5	S5		X	X				X		X			X	X	X											
Gaultheria hispidula	Creeping snowberry	N	G5	S5	X		X				X		X	X			X	X				X		X	X	X			
Gaultheria procumbens	Wintergreen	N	G5	S5	X													X											X
Kalmia angustifolia	Sheep-laurel	N	G5	S5	X		X				X		X	X			X	X				X			X	X			
Kalmia polifolia	Bog-laurel	N	G5	S5																				X					
Ledum groenlandicum	Labrador-tea	N	G5	S5	X									X			X	X				X		X	X	X			
Linnaea borealis	Twinflower	N	G5	S5			X	X	X				X		X		X	X	X				X						X
Lonicera canadensis	Fly-honeysuckle	N	G5	S5			X	X							X	X	X		X	X									
Lonicera dioica	Twining honeysuckle	N	G5	S5															X										
Lonicera villosa	Fly-honeysuckle	N	G5	S5																					X				
Myrica gale	Sweet gale	N	G5	S5																				X			X	X	
Nemopanthus mucronatus	Mountain holly	N	G5	S5																		X							
Prunus pensylvanica	Pin cherry	N	G5	S5		X	X		X	X		X	X	X	X	X	X	X	X		X		X			X			
Prunus virginiana	Choke cherry	N	G5	S5					X																				
Rhamnus alnifolia	Alder-leaved buckthorn	N	G5	S5					X																				
Ribes lacustre	Bristly black currant	N	G5	S5																	X		X						
Ribes triste	Swamp red currant	N	G5	S5		X	X		X									X			X					X			
Rosa acicularis	Prickly rose	N	G5	S5															X				X						
Rubus idaeus	Red raspberry	N	G5T5	S5		X	X		X			X	X			X		X	X							X			
Rubus pubescens	Dwarf raspberry	N	G5	S5			X		X										X		X		X		X				
Salix candida	Hoary willow	N	G5	S5																								X	
Salix sp.	Willow	-	-	-	X	X	X		X			X				X	X	X								X		X	
Sorbus decora	Showy mountain-ash	N	G4G5	S5		X	X	X	X	X			X				X	X			X	X	X		X	X			X
Vaccinium angustifolium	Sweet blueberry	N	G5	S5		X	X	X		X	X	X	X	X		X	X	X	X	X		X	X		X	X			X
Vaccinium myrtilloides	Velvet-leaf blueberry	N	G5	S5			X					X	X				X	X								X			
Vaccinium oxycoccos	Bog cranberry	N	G5	S5																				X		X			
Viburnum trilobum	Highbush cranberry	N	G5T5	S5				X																					
Ferns and allies (10 taxa)																													
Athyrium filix-femina	Lady fern	N	G5T5	S5					X				X					X			X	X	X						
Dryopteris carthusiana	Spinulose woodfern	N	G5	S5				X	X										X										
Equisetum fluviatile	Water horsetail	N	G5	S5																							X		
Equisetum sylvaticum	Woodland horsetail	N	G5	S5																	X	X							
Lycopodium annotinum	Stiff clubmoss	N	G5	S5										X											X				
Lycopodium clavatum	Running ground-pine	N	G5	S5		X	X						X	X															
Lycopodium dendroideum	Ground-pine	N	G5	S5		X	X	X		X								X	X	X			X						X
Onoclea sensibilis	Sensitive fern	N	G5	S5																	X								
Osmunda claytoniana	Interrupted fern	N	G5	S5			X						X					X	X				X						
Pteridium aquilinum	Bracken fern	N	G5	S5		X	X		X	X	X		X		X	X	X	X	X	X									
Graminoids (15 taxa)																													
Agrostis scabra	Rough hair grass	N	G5	S5												X													
Brachyelytrum erectum	Bearded short-husk	N	G5T4T5	S4S5									X						X										
Calamagrostis canadensis	Canada blue-joint	N	G5	S5			X											X				X							
Carex aquatilis	Water sedge	N	G5	S5																		X					X		
Carex bebbii	Sedge	N	G5	S5								X				X													

Scientific Name[a]	Common Name[b]	Origin[b]	G Rank[c]	S Rank[c]	Ecosite Type																								
					B009S	B010S	B012Tt/Tl	B014Tt	B016Tt/Tl	B018Tt	B034Tl	B047S	B049Tl	B053Tl	B088Tt	B096S	B098Tt/Tl	B099Tt/Tl	B104Tt	B108Tl	B120Tl	B126Tt/Tl	B130Tl	B136Tl	B137Tt	B138S	B139N	B142N	B224Tt
Carex disperma	Sedge	N	G5	S5																	X		X						
Carex michauxiana	Sedge	N	G5	S5?								X																	
Carex sp.	Sedge	-	-	-		X	X	X	X			X		X	X	X	X	X	X		X			X		X			
Carex stricta	Sedge	N	G5	S5																								X	
Carex tribuloides	Sedge	N	G5	S4S5																					X				
Carex trisperma	Sedge	N	G5T5	S5																		X							
Carex utriculata	Sedge	N	G5	S5																							X		
Deschampsia flexuosa	Hair grass	N	G5	S5													X												
Oryzopsis asperifolia	White rice-grass	N	G5	S5		X	X				X					X	X	X	X										
Scirpus sp.	Bulrush	-	-	-								X																X	
Forbs (27 taxa)																													
Achillea millefolium	Common yarrow	I	G5T?	SE					X																				
Anaphalis margaritacea	Pearly everlasting	N	G5	S5					X								X												
Apocynum androsaemifolium	Spreading dogbane	N	G5	S5			X																						
Aralia hispida	Bristly sarsaparilla	N	G5	S5								X																	
Aralia nudicaulis	Wild sarsaparilla	N	G5	S5			X	X	X	X						X	X	X	X	X			X						X
Clintonia borealis	Blue-bead lily	N	G5	S5		X	X	X		X				X		X	X	X	X			X	X						
Coptis trifolia	Goldthread	N	G5	S5			X	X	X				X	X			X	X	X			X	X		X				X
Drosera rotundifolia	Round-leaved sundew	N	G5	S5																							X		
Epilobium angustifolium	Fireweed	N	G5	S5		X							X			X	X												
Eurybia macrophylla	Large-leaved aster	N	G5	S5		X	X		X	X			X		X	X	X	X	X	X									
Fragaria vesca	Woodland strawberry	N	G5	S5												X													
Galium triflorum	Sweet-scented bedstraw	N	G5	S5																	X								
Hieracium sp.	Hieracium	-	-	-					X																				
Maianthemum canadense	Canada mayflower	N	G5	S5			X	X	X	X			X	X	X	X	X	X	X	X		X	X		X				X
Maianthemum trifolium	Three-leaved Solomon's-seal	N	G5	S5																				X	X	X			
Menyanthes trifoliata	Bog-bean	N	G5	S5																							X		
Mitella nuda	Naked mitrewort	N	G5	S5															X										
Polygonum cilinode	Black fringed bindweed											X				X													
Potentilla palustris	Marsh cinquefoil	N	G5	S5																								X	
Pyrola asarifolia	Pink pyrola	N	G5	S5																			X						
Pyrola elliptica	Shinleaf	N	G5	S5									X																
Sarracenia purpurea	Pitcher-plant	N	G5	S5																							X		
Solidago rugosa	Rough goldenrod	N	G5	S5					X								X			X									
Streptopus lanceolatus	Rose twisted-stalk	N	G5	S5			X								X				X										
Trientalis borealis	Starflower	N	G5	S5			X	X	X				X				X	X	X		X		X		X				
Utricularia vulgaris	Common bladderwort	N	G5	S5																							X		
Viola sp.	Violet	-	-	-			X										X	X	X										
Mosses (9 taxa)																													
Dicranum sp.	Dicranum moss	-	-	-		X	X	X	X		X	X	X	X		X	X	X				X				X			X
Hylocomium splendens	Stair-step moss	N	G5	S5			X	X																					X
Pleurozium schreberi	Schreber's moss	N	G5	S5			X	X	X	X	X	X	X	X			X	X	X	X				X		X			X
Pohlia nutans	Nodding pohlia moss	N	G5	S5												X		X											
Polytrichum commune	Common hair-cap moss	N	GT5	S5	X	X	X		X		X	X				X	X	X	X										X
Ptilium crista-castrensis	Plume moss	N	G5	S5																		X							
Rhytidiadelphus triquetrus	Electrified cat's tail moss	N	G5	S5																	X								
Sphagnum sp.	Sphagnum moss	-	-	-	X		X		X					X			X				X	X		X	X	X	X		
unidentified moss	moss	-	-	-															X										
Lichens (10 taxa)																													
Bryoria sp.	Lichen	-	-	-																		X		X		X			X
Cladina mitis	Yellow-green lichen	N	G5	S5	X							X														X			
Cladina rangiferina	Reindeer lichen	N	G5	S5	X	X	X				X	X	X	X			X	X	X					X		X			X
Cladina stellaris	Star reindeer lichen	N	G5	S4?										X															
Cladonia chlorophaea	False pixie-cup	N	GU	S5		X					X	X		X				X								X			
Cladonia coniocraea	Powder horn lichen	N	G5	S5		X		X			X	X														X			
Cladonia cristatella	British soldiers	N	G5	S5	X	X					X			X												X			
Peltigera canina	Dog's tooth lichen	N	G5	S5?					X										X										
Stereocaulon tomentosum	Woolly foam lichen	N	G5	S?	X						X																		
Usnea sp.	Old man's beard	-	-	-	X									X			X					X		X	X	X			X

[a] Scientific names follow Morton & Venn (1990) and published volumes of the Flora of North America (1993-2006).
[b] Common names and origin based upon Varga *et al*. (2000) and NHIC (2007).
Origin: N = Native; (N) = Native but not in study area region; I = Introduced.
Status: P = Provincial; R = Regional (OMNR Central Region); L = Local (County or R.M.).
END= Endangered; SC = Special Concern; THR = Threatened; UN = Undetermined.
[c] Ranks based upon determinations made by the Natural Heritage Information Centre (2007).
G = Global; S = Provincial; Ranks 1-3 are considered imperiled or rare; Ranks 4 and 5 are considered secure.
E = Exotic; Q = Taxonomic questions not fully resolved; T = sub-specific taxon (taxa) present in the province.

APPENDIX F

Ecosite Descriptions for the Local Study Area

Ecosite	Soil Type	Description
B009S (Photo 1; Appendix G)	VS1	**Very Shallow, Dry to Fresh: Sparse Shrub (Shrub)** **Very Shallow, Coarse Mineral** Trees species within the canopy include jack pine (*Pinus banksiana*) and black spruce (*Picea mariana*) which provide 1% cover. The shrub layer is dominated by sheep laurel (*Kalmia angustifolia*) and low sweet blueberry (*Vaccinium angustifolium*) which each provide 8% cover. The ground layer is dominated by reindeer lichen (*Cladina rangiferina*) and yellow-green lichen (*Cladina mitis*) which provide 40% cover. Other species in the ground layer include wintergreen (*Gaultheria procumbens*), creeping snowberry (*Gaultheria hispidula*) and sphagnum moss (*Sphagnum* sp.). Soil within this ecosite is dry, very rapidly drained, coarse sand. The depth of organics is 5 cm and the depth to bedrock is 11 cm. No mottles or gleying were observed.
B010S (Photo 2; Appendix G)	R4/VS1	**Very Shallow, Dry to Fresh: Shrub (Shrub)** **Folic – Bedrock/Very Shallow, Coarse Mineral** No canopy or subcanopy is present. The tall shrub layer provides 18 - 26% cover and is dominated by white spruce (*Picea glauca*), jack pine, and white birch (*Betula papyrifera*). Species in the low shrub layer include pin cherry (*Prunus pensylvanica*), white birch, red raspberry (*Rubus idaeus*), low sweet blueberry, and showy mountain ash (*Sorbus decora*). The ground layer includes bunchberry (*Cornus canadensis*), bracken fern (*Pteridium aquilinum*), bluebead lily (*Clintonia borealis*), large leaf aster (*Eurybia macrophylla*), trailing arbutus (*Epigaea repens*), common hair-cap moss (*Polytrichum commune*), dicranum moss (*Dicranum* sp.), and reindeer lichen. These species are evenly distributed throughout the ground layer. Soils within the ecosite are rapidly-drained, silt loam and silty sand with a dry moisture regime. The depth of oranics ranges from 2 to 8 cm and the dept the bedrock is approximately 10 to 13 cm. No mottles or gleying were observed.
B012Tt/Tl (Photo 3; Appendix G)	R4/VS2/O1	**Very Shallow, Dry to Fresh: Pine - Spruce Conifer (Tall treed/Low treed)** **Folic – Bedrock/Very Shallow, Fine Mineral/Shallow Folic** The canopy and subcanopy are dominated by white birch, black spruce, balsam fir (*Abies balsamea*), jack pine, and pin cherry, which provide 10 to 40% and 2 to 5% cover within each layer, respectively. Species in the shrub layer include black spruce, bush honeysuckle (*Diervilla lonicera*), white spruce, low sweet blueberry, sheep laurel (*Kalmia angustifolia*), trembling aspen (*Populus tremuloides*), green alder (*Alnus viridus*), beaked hazel (*Corylus cornuta*), serviceberry (*Amelanchier* sp.), willow (*Salix* sp.), balsam fir, pin cherry, mountain maple (*Acer spicatum*), and eastern white cedar (*Thuja occidentalis*).

Ecosite	Soil Type	Description
		The ground layer is dominated by Schreber's moss (*Pleurozium schreberi*), Canada mayflower (*Maianthemum* *canadense*), dicranum moss, and bunchberry. Other species in the ground layer include bluebead lily, large leaf aster, bracken fern, creeping snowberry, goldthread (*Coptis trifolia*), twinflower (*Linnaea borealis*), running ground-pine (*Lycopodium clavatum*), common hair-cap moss, sphagnum moss, and reindeer lichen. These species were evenly distributed throughout the ground layer with no strong dominance exhibited. Soil within the ecosite is a rapidly drained silt loam with a dry to moderately dry moisture regime. The depth of the organics ranged from 1 to 10cm and the depth to bedrock ranged from 10 to 35 cm. No mottles or gleying were observed.
B014Tt (Photo 4; Appendix G)	R4	**Very Shallow, Dry to Fresh: Conifer (Tall treed)** **Folic – Bedrock** The canopy and subcanopy are dominated by black spruce, trembling aspen, and balsam fir, which provide 5 to 12% and 3 to 20% cover within each layer, respectively. Species observed in the shrub layer include balsam fir and mountain maple. The ground layer is dominated by Schreber's moss and dicranum moss. Other species in the ground layer include twinflower, spinulose woodfern (*Dryopteris carthusiana*), bunchberry, and bluebead lily. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil within the ecosite is a rapidly-drained silt loam with a moderately dry to dry moisture regime. The depth of the organics is between 5 and 9cm and the depth to bedrock varies between 5 and 12cm. No mottles or gleying were observed.
B016Tt/Tl (Photo 5; Appendix G)	R4/VS1/VS2	**Very Shallow, Dry to Fresh: Apsen – Birch Hardwood (Tall treed/Low treed)** **Folic – Bedrock/Very Shallow, Coarse Mineral/Very Shallow, Fine Mineral** The canopy and subcanopy are dominated by white birch, trembling aspen, black spruce, and jack pine, which provide 10-25% cover in each layer, respectively. Species observed in the shrub layer include green alder, black spruce, white spruce, balsam fir, white birch, mountain maple, and beaked hazel. The ground layer is dominated by bunchberry, Canada mayflower, large leaf aster, and dicranum moss. Other species observed in the ground layer include pearly everlasting (*Anaphalis margaritacea*), Schreber's moss, common hair cap-moss, bracken fern, and starflower (*Trientalis borealis*). These species are evenly distributed throughout the ground layer with no strong dominance exhibited.

Ecosite	Soil Type	Description
		Soil with the ecosite is a rapidly-drained fine sand, silt loam and loam with a moderately dry to dry moisture regime. The depth of the organics is between 1 and 8cm and the depth to bedrock varies between 12 to 22cm. No mottles or gleying were observed.
B018Tt (Photo 6; Appendix G)	R4	**Very Shallow, Dry to Fresh: Maple Hardwood (Tall treed)** **Folic – Bedrock** The canopy is dominated by jack pine, trembling aspen, red maple (*Acer rubrum*), white birch, and pin cherry, which provide 30%. No subcanopy is present. Species observed in the shrub layer include beaked hazel, balsam fir, red maple, and mountain maple. The ground layer is dominated by Schreber's moss. Other species observed in the ground layer include wild sarsaparilla (*Aralia nudicaulis*),bluebead lily, bracken fern, buncherry, and Canada mayflower. These species are evenly distributed throughout the groundlayer with no strong dominance exhibited. Soil in the ecosite is a rapidly-drained silt loam with a moderately dry moisture regime. The depth of the organics is approximately 7 cm and the depth to bedrock 11 cm. No mottles or gleying were observed.
B034Tl (Photo 7; Appendix G)	S1	**Dry, Sandy: Jack Pine – Black Spruce Dominated (Low treed)** **Shallow, Coarse Mineral** The canopy is dominated by black spruce and jack pine, which provides 10% cover. Black spruce dominates the shrub layer. The ground layer is dominated by low sweet blueberry, reindeer lichen, and yellow-green lichen. Other species observed in the ground layer include trailing arbutus, sheep laurel, and bush honeysuckle. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a very rapidly-drained medium sand with a dry moisture regime. The depth of the organics is approximately 3cm and the depth to bedrock is 17cm. No mottles or gleying were observed.
B047S (Photo 8; Appendix G)	M4/MD4	**Dry to Fresh, Coarse: Shrub (Shrub)** **Moderate, Coarse Loamy/Moderately Deep, Coarse Loamy, Fresh** No canopy or subcanopy are present. The shrub layer is dominated by white spruce, pin cherry, red raspberry, and low sweet blueberry. The ground layer is dominated by common hair-cap moss. Other species observed in the ground layer include bebb's sege (*Carex bebbii*), wild sarsaparilla, and dicranum moss. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a rapidly-drained very fine sand and loamy coarse sand with a moderately dry to moderately fresh moisture regime. The depth of the organics ranges from less than 1cm to 15cm and the depth

Ecosite	Soil Type	Description
		to bedrock is between 52 to 65 cm. No mottles or gleying were observed.
B049TI (Photo 9; Appendix G)	M4/MD2	**Dry to Fresh, Coarse: Jack Pine – Black Spruce Dominated (Low treed)** **Moderate, Coarse Loamy/Moderately Deep, Sandy, Fresh** The canopy is dominated by jack pine, which provides 15 to 35% cover. Species observed in the shrub layer include white spruce and pin cherry. The ground layer is dominated by low sweet blueberry. Other species observed in the ground layer include bracken fern, dicranum moss, Schreber's moss, bunchberry, and large leaf aster. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a rapid- to well-drained fine sand and loam with a moderately fresh to fresh moisture regime. The depth of the organics is between 3 and 8 cm and the depth to bedrock is between 44 and 97 cm. No mottles or gleying were observed.
B053TI (Photo 10; Appendix G)	D4	**Dry to Fresh, Coarse: Conifer (Low treed)** **Deep, Coarse Loamy, Fresh** The canopy is dominated by tamarack (*Larix laricina*), jack pine, and black spruce, which provides 20% cover. Species observed in the shrub layer include black spruce, tamarack, and balsam fir. The ground layer is dominated by Schreber's moss. Other species observed in the ground layer include reindeer lichen, sphagnum moss, bunchberry, bluebead lily, dicranum moss, and creeping snowberry. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a moderately well-drained very fine sand with a very fresh moisture regime. The depth of the organics is approximately 8 cm and the depth to bedrock exceeded 120 cm. Mottles were observed at a depth of 70 cm. No gleying was observed.
B088Tt (Photo 11; Appendix G)	S2	**Fresh, Clayey: Aspen – Birch Hardwood (Tall treed)** **Shallow, Fine Mineral** The canopy and subcanopy are dominated by trembling aspen and balsam fir, which provide10 to 25% and 25 to 50% cover within each layer, respectively. Species observed in the shrub layer include balsam fir, mountain maple, showy mountain ash, and fly honeysuckle (*Lonicera canadensis*). The ground layer is dominated by Canada mayflower. Other species observed in the ground layer include bluebead lily, mountain maple and dicranum moss. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a rapidly-drained silty clay with a moderately dry moisture regime. The depth of the organics is approximately 5 cm and

Ecosite	Soil Type	Description
		the depth to bedrock is 25 cm. No mottles or gleying were observed.
B096S (Photo 12; Appendix G)	VS2	**Fresh, Silty to Fine Loamy: Shrub (Shrub)** **Very Shallow, Fine Mineral** No canopy or subcanopy are present. The shrub layer is dominated by pin cherry, red raspberry, willow species, white birch, and bush honeysuckle. The ground layer is dominated by pohlia moss and common hair-cap moss. Other species observed in the ground layer include large leaf aster, bracken fern, sweetfern (*Comptonia peregrina*), and low sweet blueberry. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a rapidly-drained silt with a moderately dry moisture regime. The depth of the organics is less than 1 cm and the depth to bedrock is 15 cm. No mottles or gleying were observed.
B098Tt/Tl (Photo 13; Appendix G)	S2	**Fresh, Silty to Fine Loamy: Jack Pine – Black Spruce Dominated (Tall treed/Low treed)** **Shallow, Fine Mineral** The canopy and subcanopy are dominated by black spruce, jack pine, and white birch, which provide10 to 25% and 2 to 5% cover within each layer, respectively. Species observed in the shrub layer include beaked hazel, pin cherry, black spruce, and speckled alder (*Alnus incana*). The ground layer is dominated by Schreber's moss, dicranum moss, low sweet blueberry, and velvet leaf blueberry (*Vaccinium myrtilloides*). Other species observed in the ground layer include large leaf aster, bunchberry, bracken fern, sphagnum moss, creeping snowberry, and Canada mayflower. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is moderately well- to rapidly-drained silt loam and silty clay loam with a dry to fresh moisture regime. The depth of the organics is 2 to 15 cm and the depth to bedrock is between 16 to over 50 cm. Not mottles or gleying were observed.
B099Tt/Tl (Photo 14; Appendix G)	S2/M6	**Fresh, Silty to Fine Loamy: Pine – Black Spruce Conifer (Tall treed/Low treed)** **Shallow, Fine Mineral/Moderate, Silty, Fine Loamy or Clayey Fresh** The canopy and subcanopy are dominated by jack pine, balsam fir, and trembling aspen, which provide 10 to 35% and 5 to 37% cover within each layer, respectively. Species observed in the shrub layer include pin cherry, bush honeysuckle, green alder, balsam fir, and mountain maple. The ground layer is dominated by low sweet blueberry, Schreber's moss, and dicranum moss. Other species observed in the understory include common hair-cap moss, bluebead lily, bunchberry, large leaf aster, and bracken fern. These species are evenly distributed throuhout the ground

Ecosite	Soil Type	Description
		layer with no strong dominance exhibited. Soil in the ecosite is a rapidly- drained silt, silt loam, and silty clay loam with a moderately dry moisture regime. The depth of the organics is 5 to 15 cm and the depth to bedrock is 16 to 28 cm. No mottles or gleying were observed.
B104Tt (Photo 15; Appendix G)	S2/M6	**Fresh, Silty to Fine Loamy: Aspen – Birch Hardwood (Tall treed)** **Shallow, Fine Mineral/Moderate, Silty, Fine Loamy or Clayey Fresh** The canopy and subcanopy are dominated by trembling aspen, white birch, balsam fir, and jack pine, which provide 20 to 30% and 5 to 15% cover within each layer, respectively. Species observed in the shrub layer include mountain maple, beaked hazel, balsam fir, bush honeysuckle, and red maple. The ground layer is dominated by Schreber's moss, bunchberry, and large leaf aster. Other species observed in the ground layer include Canada mayflower, twinflower, common hair-cap moss, wild sarsaparilla, and bracken fern. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a rapidly-drained silt, silt loam, and silty clay loam with a moderately dry to fresh moisture regime. The depth of the organics is 3 to 10 cm and the depth to bedrock is 17 to 45 cm. No mottles or gleying were observed.
B108Tl (Photo 16; Appendix G)	M6	**Fresh, Silty to Fine Loamy: Mixedwood (Low treed)** **Moderate, Silty, Fine Loamy or Clayey Fresh** The canopy and subcanopy are dominated by red maple, trembling aspen, and jack pine, which provide 15% and 20% cover within each layer, respectively. Species observed in the shrub layer include white spruce, beaked hazel, and green alder. The ground layer is dominated by Shcreber's moss and large leaf aster. Other species observed in the ground layer include wild sarsaparilla, Canada mayflower, and bracken fern. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a rapidly-drained silt with a moderately fresh moisture regime. The depth of the organics is approximately 4 cm and the depth to bedrock is 48 cm. No mottles or gleying were observed.
B120Tl (Photo 17; Appendix G)	D4	**Moist, Fine: Elm – Ash Hardwood (Low treed)** **Deep, Coarse Loamy, Fresh** The canopy and subcanopy are dominated by black ash (*Fraxinus nigra*) and balsam fir, which provide 30% and 10% cover within each layer, respectively. Species observed in the shrub layer include mountain maple and pin cherry. The ground layer is dominated by sphagnum moss. Other species

Ecosite	Soil Type	Description
		observed in the ground layer include electrified cat's tail moss (*Rhytidiadelphus triquetrus*), lady fern (*Athyrium felix-femina*), starflower, and dwarf raspberry (*Rubus pubescens*). These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a rapidly-drained silty fine sand with a fresh moisture regime. The depth of the organics is 8 cm and the depth to bedrock exceeds 120 cm. No mottles or gleying were observed.
B126Tt/Tl (Photo 18; Appendix G)	O5/O6	**Treed Bog (Tall treed/Low treed)** **Fibric Peat/Mesic and Humic Peat** The canopy and subcanopy are dominated by black spruce, white birch, and balsam fir, which provide 2 to 5% and 5 to 10% cover within each layer, respectively. Species observed in the shrub layer include Labrador-tea (*Ledum groenlandicum*), leatherleaf (*Chamaedaphne calyculata*), and black spruce. The ground layer is dominated by sphagnum moss. Other species observed in the ground layer include bunchberry, three-fruited sedge (*Carex trisperma*), bunchberry, Canada mayflower, and creeping snowberry. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a very poorly-drained fibric to mesic peat with a wet moisture regime. The depth of the organics exceeds 120 cm.
B130Tl (Photo 19; Appendix G)	D12	**Intolerant Hardwood Swamp (Low treed)** **Deep, Coarse Mineral, Very Moist** The canopy and subcanopy are dominated by trembling aspen, jack pine, white birch, and balsam fir, which provide 10 to 25% cover within each layer. Species observed in the shrub layer include white birch, balsam fir, mountain maple, and showy mountain ash. The ground layer is dominated by Canada mayflower, bunchberry, twinflower, and wild sarsaparilla. Other species observed in the ground layer include soft-leaved sedge (*Carex disperma*), starflower, bluebead lily, goldthread, and interrupted fern (*Osmunda claytonia*). These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is an imperfectly-drained loam with a moist moisture regime. The depth of the organics is 6 cm and the depth to bedrock exceeds 120 cm. Mottles were observed at a depth of 20 cm and gleying was observed at 60 cm.
B136Tl (Photo 20; Appendix G)	O6	**Sparse Treed Fen (Low treed)** **Mesic and Humic Peat** The canopy is dominated by black spruce and tamarack, which provides 10% cover. No subcanopy is present. Species observed in the shrub

Ecosite	Soil Type	Description
		layer include black spruce, Labrador-tea, and leatherleaf. The ground layer is dominated by sphagnum moss. Other species present in the ground layer include Schreber's moss, bog cranberry (*Vaccinium oxycoccus*), three-leaved Solomon's seal (*Mainthemum trifolium*), and creeping snowberry. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a very poorly-drained mesic peat with a wet moisture regime. The depth of the organics exceeds 120 cm.
B137Tt (Photo 21; Appendix G)	O6	**Sparse Treed Bog (Tall treed)** **Mesic and Humic Peat** The canopy and subcanopy are dominated by tamarack and black spruce, which provide 15% and 5% cover in each layer, respectively. Species observed in the shrub layer include Labrador-tea, speckled alder, sheep laurel, and eastern white cedar. The ground layer is dominated by sphagnum moss. Other species observed in the ground layer include creeping snowberry, three-fruited sedge, bunchberry, three-leaved Solomon's seal, and stiff clubmoss (*Lycopodium annotinum*). These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a very poorly-drained mesic peat with a wet moisture regime. The depth of the organics exceeds 120 cm.
B138S (Photo 22; Appendix G)	O2	**Open Bog (Shrub)** **Shallow Peat** No canopy or subcanopy are present. The shrub layer is dominated by Labrador-tea and leatherleaf. Other species observed in the shrub layer include sheep laurel, black spruce, speckled alder, and low sweet blueberry. The ground layer is dominated by sphagnum moss. Othe species observed in the groud layer include buncherry, creeping snowberry, bog cranberry, three-leaved mainthemum, and woodland horsetail (*Equisetum sylvaticum*). Soil in the ecosite is very poorly-drained fibric peat with a moist moisture regime. The depth of the organics and the depth to bedrock is 38 cm.
B139N (Photo 23; Appendix G)	O6	**Poor Fen (Non-woody)** **Mesic and Humic Peat** No canopy or subcanopy are present. The shrub layer is dominated by leatherleaf and sweetgale (*Myrica gale*). The ground layer is dominated by sphagnum moss and beaked sedge (*Carex utricularia*). Other species observed in the ground layer include water sedge (*Carex aquatilis*) and bogbean (*Menyanthes trifoliata*). These species are evenly distributed throughout the ground layer with no

Ecosite	Soil Type	Description
		strong dominance exhibited. Soil in the ecosite is a very poorly-drained fibric peat with a very wet moisture regime. The depth of the organics and the depth to bedrock exceeds 120 cm.
B142N (Photo 24; Appendix G)	O5	**Mineral Meadow Marsh (Non-woody)** **Fibric Peat** No canopy or subcanopy are present. The shrub layer is dominated by leatherleaf and sweetgale. Willow species are also present in the shrub layer. The ground layer is dominated by bulrush species (*Scirpus* sp.) and tussock sedge (*Carex stricta*). Marsh cinquefoil (*Potentilla palustris*) is the only other species observed in the ground layer. Soil in the ecosite is a very poorly-drained very coarse sand over a silty clay with a very wet moisture regime. The depth of the organics is 23 cm and the depth to bedrock exceeds 100 cm.
B224Tt (Photo 25; Appendix G)	R5	**Mineral Rich Conifer Swamp (Tall treed)** **Peat – Bedrock** The canopy and subcanopy are dominated by black spruce, white spruce, white birch, and balsam fir, which provide 10% cover within each layer. Species observed in the shrub layer include white spruce, balsam fir, mountain maple, and white birch. The ground layer is dominated by Shreber's moss. Other species observed in the ground layer include stair-step moss, dicranum moss, and common hair-cap moss. These species are evenly distributed throughout the ground layer with no strong dominance exhibited. Soil in the ecosite is a rapidly-drained, saturated fibric peat. The depth of the organics and the depth to bedrock is 11 cm.

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APPENDIX G

Ecosite Photographs for the Local Study Area


Photo 1: B009S – Photo faces west from plot centre


Photo 2: B010S – Photo faces south from plot centre


Photo 3: B012Tt/Tl – Photo faces west from plot centre


Photo 4: B014Tt – Photo faces south from plot centre


Photo 5: B016Tt/Tl – Photo faces east from plot centre


Photo 6: B018Tt – Photo faces north from plot centre


Photo 7: B034TI – Photo faces north from plot centre


Photo 8: B047S – Photo faces north from plot centre


Photo 9: B049TI – Photo faces north from plot centre


Photo 10: B053TI – Photo faces north from plot centre


Photo 11: B088Tt – Photo faces north from plot centre


Photo 12: B096S – Photo faces north from plot centre


Photo 13: B098Tt/Tl – Photo faces north from plot centre


Photo 14: B099Tt/Tl – Photo faces east from plot centre


Photo 15: B104Tt – Photo faces north from plot centre


Photo 16: B108Tl – Photo faces west from plot centre


Photo 17: B120Tl – Photo faces north from plot centre


Photo 18: B126Tt/Tl – Photo faces east from plot centre


Photo 19: B130Tl – Photo faces west from plot centre


Photo 20: B136Tl – Photo faces east from plot centre


Photo 21: B137Tt – Photo faces west from plot centre


Photo 22: B138S – Photo faces north from plot centre


Photo 23: B139N – Photo faces south from plot centre


Photo 24: B142N – Photo faces south from plot centre

Photo 25: B224Tt – Photo faces west from plot centre

APPENDIX H

Tree Core Data

Ecosite	Common Name	Scientific Name	DBH (cm)	Height (m)	Age (years)
B016Tl	Jack Pine	*Pinus banksiana*	9.1	3.5	9
B012Tt	Jack Pine	*Pinus banksiana*	8.6	6.3	10
B012Tt	Jack Pine	*Pinus banksiana*	8.3	5.3	10
B016Tl	Black Spruce	*Picea mariana*	7.1	5.8	13
B104Tt	Jack Pine	*Pinus banksiana*	15.4	9.8	15
B018Tt	Jack Pine	*Pinus banksiana*	14.4	12.9	16
B053Tl	Tamarack	*Larix laricina*	5.6	8.2	16
B098Tl	Jack Pine	*Pinus banksiana*	12.8	5.3	16
B034Tl	Jack Pine	*Pinus banksiana*	15.0	7.4	17
B034Tt	Jack Pine	*Pinus banksiana*	14.8	12.8	17
B049Tl	Jack Pine	*Pinus banksiana*	11.2	7.9	17
B034Tl	Jack Pine	*Pinus banksiana*	11.6	6.1	18
B098Tl	Jack Pine	*Pinus banksiana*	13.5	7.9	18
B012Tt	Jack Pine	*Pinus banksiana*	13.8	11.8	19
B049Tl	Jack Pine	*Pinus banksiana*	13.1	8.4	19
B098Tl	Jack Pine	*Pinus banksiana*	15.7	10.6	19
B098Tl	Jack Pine	*Pinus banksiana*	14.3	11.0	19
B099Tl	Jack Pine	*Pinus banksiana*	15.5	9.3	19
B099Tl	Balsam Fir	*Abies balsamea*	13.4	5.8	19
B114Tl	Jack Pine	*Pinus banksiana*	16.3	7.6	19
B114Tl	Jack Pine	*Pinus banksiana*	19.0	8.0	19
B034Tt	Jack Pine	*Pinus banksiana*	13.6	9.4	20
B049Tl	Jack Pine	*Pinus banksiana*	19.1	9.6	20
B049Tl	Jack Pine	*Pinus banksiana*	12.5	13.3	20
B098Tl	Jack Pine	*Pinus banksiana*	16.5	9.4	20
B099Tl	Jack Pine	*Pinus banksiana*	17.1	11.3	20
B104Tt	Balsam Fir	*Abies balsamea*	6.5	5.7	20
B012Tt	Jack Pine	*Pinus banksiana*	15.8	13.5	21
B016Tl	Jack Pine	*Pinus banksiana*	18.8	7.5	21
B098Tl	Jack Pine	*Pinus banksiana*	14.0	9.7	21
B012Tt	Jack Pine	*Pinus banksiana*	15.2	7.5	22
B012Tt	Jack Pine	*Pinus banksiana*	18.6	12.8	22
B018Tt	Jack Pine	*Pinus banksiana*	15.6	12.7	22
B049Tl	Jack Pine	*Pinus banksiana*	13.3	12.5	22
B099Tl	Balsam Fir	*Abies balsamea*	14.7	13.2	22

Ecosite	Common Name	Scientific Name	DBH (cm)	Height (m)	Age (years)
B012Tl	Jack Pine	*Pinus banksiana*	16.7	12.3	23
B016Tt	Trembling aspen	*Populus tremuloides*	22.0	18.0	23
B050Tt	Jack Pine	*Pinus banksiana*	16.0	7.1	23
B099Tt	Jack Pine	*Pinus banksiana*	16.7	10.7	23
B104Tt	Trembling aspen	*Populus tremuloides*	24.3	12.6	23
B108Tl	Jack Pine	*Pinus banksiana*	17.1	9.3	23
B049Tl	Jack Pine	*Pinus banksiana*	17.1	9.8	24
B053Tl	Tamarack	*Larix laricina*	9.3	7.6	24
B099Tt	Jack Pine	*Pinus banksiana*	15.2	12.0	24
B104Tt	Jack Pine	*Pinus banksiana*	14.8	9.8	24
B108Tl	Jack Pine	*Pinus banksiana*	17.4	10.1	24
B016Tl	Jack Pine	*Pinus banksiana*	17.4	6.7	26
B099Tl	Jack Pine	*Pinus banksiana*	17.0	10.0	26
B009S	Black Spruce	*Picea mariana*	7.7	5.5	27
B012Tl	Jack Pine	*Pinus banksiana*	15.0	8.2	27
B049Tl	Jack Pine	*Pinus banksiana*	14.5	7.4	27
B126Tt	Black Spruce	*Picea mariana*	11.0	11.2	27
B012Tt	Jack Pine	*Pinus banksiana*	17.7	9.5	28
B104Tt	Jack Pine	*Pinus banksiana*	22.5	12.5	28
B012Tt	Balsam Fir	*Abies balsamea*	19.3	10.0	29
B014Tt	Balsam Fir	*Abies balsamea*	13.5	13.7	29
B049Tl	Jack Pine	*Pinus banksiana*	15.5	7.6	29
B050Tt	Jack Pine	*Pinus banksiana*	17.3	13.8	29
B016Tt	Trembling aspen	*Populus tremuloides*	21.5	18.0	30
B099Tt	Jack Pine	*Pinus banksiana*	21.0	16.0	33
B104Tt	Balsam Fir	*Abies balsamea*	17.1	12.4	34
B138S	Black Spruce	*Picea mariana*	8.0	4.2	34
B098Tl	Jack Pine	*Pinus banksiana*	20.1	9.7	35
B009S	Black Spruce	*Picea mariana*	8.4	5.8	36
B120Tl	Black Ash	*Fraxinus nigra*	9.9	10.0	36
B099Tt	Black Spruce	*Picea mariana*	18.6	9.8	37
B098Tl	Jack Pine	*Pinus banksiana*	14.4	10.4	40
B104Tt	Balsam Fir	*Abies balsamea*	18.4	12.3	40
B099Tt	Jack Pine	*Pinus banksiana*	26.6	16.4	41
B137Tt	Tamarack	*Larix laricina*	19.5	13.3	41

Ecosite	Common Name	Scientific Name	DBH (cm)	Height (m)	Age (years)
B099Tt	Jack Pine	*Pinus banksiana*	20.5	11.1	43
B137Tl	Black Spruce	*Picea mariana*	6.7	4.3	43
B224Tt	Black Spruce	*Picea mariana*	20.8	12.9	44
B014Tt	Black Spruce	*Picea mariana*	15.8	12.8	45
B137Tt	Tamarack	*Larix laricina*	17.4	16.9	45
B014Tt	Balsam Fir	*Abies balsamea*	17.5	17.2	49
B034Tt	Jack Pine	*Pinus banksiana*	21.8	13.9	50
B137Tl	Black Spruce	*Picea mariana*	8.8	6.6	50
B138S	Black Spruce	*Picea mariana*	10.3	3.7	50
B034Tt	Jack Pine	*Pinus banksiana*	25.5	17.1	52
B012Tl	Black Spruce	*Picea mariana*	19.8	17.1	53
B126Tt	Black Spruce	*Picea mariana*	17.0	17.0	53
B137Tl	Black Spruce	*Picea mariana*	6.0	3.9	53
B104Tt	Balsam Fir	*Abies balsamea*	16.4	12.3	55
B014Tt	Trembling aspen	*Populus tremuloides*	32.8	24.8	57
B012Tl	Black spruce	*Picea mariana*	22.8	19.4	58
B012Tl	Black Spruce	*Picea mariana*	17.0	19.0	58
B012Tl	Black Spruce	*Picea mariana*	23.0	15.0	58
B098Tt	Black Spruce	*Picea mariana*	19.3	11.9	58
B104Tt	Balsam Fir	*Abies balsamea*	17.0	11.4	60
B101Tt	White Spruce	*Picea glauca*	20.3	17.4	61
B099Tt	Black Spruce	*Picea mariana*	19.0	20.0	62
B104Tt	Black Spruce	*Picea mariana*	23.5	13.8	62
B099Tt	Black Spruce	*Picea mariana*	19.8	20.4	63
B104Tt	Balsam Fir	*Abies balsamea*	15.5	13.6	64
B104Tt	White Spruce	*Picea glauca*	23.6	15.8	64
B136Tl	Black Spruce	*Picea mariana*	10.1	6.3	64
B224Tt	White Spruce	*Picea glauca*	27.2	18.2	64
B101Tt	Balsam Fir	*Abies balsamea*	17.4	18.1	67
B164Tt	Jack Pine	*Pinus banksiana*	27.7	27.7	69
B136Tl	Black Spruce	*Picea mariana*	8.0	5.6	72
B120Tl	Eastern White Cedar	*Thuja occidentalis*	20.8	10.0	73
B137Tt	Black Spruce	*Picea mariana*	21.0	12.0	75
B050Tt	Jack Pine	*Pinus banksiana*	30.0	20.3	76
B164Tt	Jack Pine	*Pinus banksiana*	32.3	27.5	76

Ecosite	Common Name	Scientific Name	DBH (cm)	Height (m)	Age (years)
B049Tt	Jack Pine	*Pinus banksiana*	25.4	15.1	82
B049Tt	Jack Pine	*Pinus banksiana*	39.6	19.4	85
B098Tt	Black Spruce	*Picea mariana*	17.5	13.2	86
B050Tt	Jack Pine	*Pinus banksiana*	30.0	20.9	88
B137Tl	Black Spruce	*Picea mariana*	8.6	5.5	90
B098Tt	Black Spruce	*Picea mariana*	21.5	12.1	94
B137Tl	Black Spruce	*Picea mariana*	6.9	4.2	102
B137Tl	Black Spruce	*Picea mariana*	10.5	6.9	108
B098Tt	Black Spruce	*Picea mariana*	20.7	15.0	122
B126Tl	Black Spruce	*Picea mariana*	14.8	14.7	130
B126Tl	Black Spruce	*Picea mariana*	19.5	14.0	134
B137Tt	Black Spruce	*Picea mariana*	23.6	13.1	190

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APPENDIX I

Breeding Bird Observation Summary

Breeding Bird Observations Summary

Common Name	Scientific Name	SRank	Landcover Type							
			Bog - treed	Wetland	Forest - dense coniferous	Forest - dense deciduous	Forest - Dense Mixed	Forest - sparse	Forest Depletion - cuts	Jack Pine Regeneration/Cut
alder flycatcher	*Empidonax alnorum*	S5B		X		X	X		X	X
American bittern	*Botaurus lentiginosus*	S4B					X		X	
American crow	*Corvus brachyrhynchos*	S5B			X		X	X		X
American kestrel	*Falco sparverius*	S4								X
American redstart	*Setophaga ruticilla*	S5B				X	X		X	
American robin	*Turdus migratorius*	S5B	X	X	X		X	X	X	X
bald eagle	***Haliaeetus leucocephalus***	**not listed**						X		
belted kingfisher	*Ceryle alcyon*	S4B		X			X			X
black-and-white warbler	*Mniotilta varia*	S5B		X	X		X	X	X	X
black-backed woodpecker	*Picoides arcticus*	S4								
black-billed cuckoo	*Coccyzus erythropthalmus*	S5B					X			
blackburnian warbler	*Dendroica fusca*	S5B			X		X	X	X	
black-capped chickadee	*Poecile atricapilus*	S5			X	X	X	X		X
black-throated blue warbler	*Dendroica caerulescens*	S5B			X	X	X			X
black-throated green warbler	*Dendroica virens*	S5B			X	X		X		
blue jay	*Cyanocitta cristata*	S5		X		X	X		X	X
blue-headed vireo	*Vireo solitarius*	S5B		X	X		X			X
boreal chickadee	*Poecile hudsonica*	S5			X		X			
broad-winged hawk	*Buteo platypterus*	not listed					X			
brown creeper	*Certhia americana*	S5B			X		X			
Canada warbler	***Cardellina canadensis***	**S4B**		X	X	X	X		X	
cedar waxwing	*Bombycilla cedrorum*	S5B			X		X	X		
chestnut-sided warbler	*Dendroica pensylvanica*	S5B		X			X	X	X	X
chipping sparrow	*Spizella passerina*	S5B					X			X
common grackle	*Quiscalus quiscula*	S5B						X		
common loon	*Gavia immer*	S5B,S5N		X	X		X	X	X	
common merganser	*Mergus merganser*	S5B, S5N						X		
common raven	*Corvus corax*	S5	X	X	X	X	X		X	X
common yellowthroat	*Geothlypis trichas*	S5B		X	X			X	X	X
downy woodpecker	*Picoides pubescens*	S5								X
eastern towhee	*Pipilo erythrophthalmus*	S4B								X
golden-crowned kinglet	*Regulus satrapa*	S5B			X	X	X	X		X
gray jay	*Perisoreus canadensis*	S5			X		X	X		X
hermit thrush	*Catharus guttatus*	S5B		X	X	X	X			X
least flycatcher	*Empidonax minimus*	S4B			X		X			X
Lincoln's sparrow	*Melospiza lincolnii*	S5B		X				X		X
magnolia warbler	*Dendroica magnolia*	S5B			X	X	X	X	X	X
marsh wren	*Cistothorus palustris*	S4B		X						
merlin	*Falco columbarius*	S5B								
mourning warbler	*Oporornis philadelphia*	S4B		X					X	X
Nashville warbler	*Vermivora ruficapilla*	S5B	X	X	X	X	X	X	X	X
northern flicker	*Colaptes auratus*	S4B		X	X	X	X	X	X	X
northern parula	*Parula americana*	S4B			X	X	X	X		X
northern waterthrush	*Seiurus noveboracensis*	S5B	X		X	X	X	X		X

Common Name	Scientific Name	SRank	Landcover Type							
			Bog - treed	Wetland	Forest - dense coniferous	Forest - dense deciduous	Forest - Dense Mixed	Forest - sparse	Forest Depletion - cuts	Jack Pine Regeneration/Cut
ovenbird	*Seiurus aurocapilla*	S4B		X	X	X	X	X	X	X
pileated woodpecker	*Dryocopus pileatus*	S5		X	X		X			X
pine siskin	*Carduelis pinus*	S4B		X			X		X	
pine warbler	*Dendroica pinus*	S5B			X		X			
purple finch	*Carpodacus purpureus*	S4B								X
red-breasted nuthatch	*Sitta canadensis*	S5		X	X	X	X	X	X	X
red-eyed vireo	*Vireo olivaceus*	S5B		X	X	X	X	X	X	X
ring-necked duck	*Aythya collaris*	S5								X
ruby-crowned kinglet	*Regulus calendula*	S4B		X	X	X	X	X	X	X
ruby-throated hummingbird	*Archilochus colubris*	S5B					X			
ruffed grouse	*Bonasa umbellus*	S4				X	X	X		X
sandhill crane	*Grus canadensis*	S5B					X			
song sparrow	*Melospiza melodia*	S5B						X		X
spotted sandpiper	*Actitis macularia*	S5						X		
Swainson's thrush	*Catharus ustulatus*	S4B		X	X	X	X	X	X	X
swamp sparrow	*Melospiza georgiana*	S5B		X						
Tennessee warbler	*Vermivora peregrina*	S5B					X			
three-toed woodpecker	*Picoides dorsalis*	S4		X			X			
veery	*Catharus fuscescens*	S4B				X	X	X		
white-throated sparrow	*Zonotrichia albicollis*	S5B	X	X	X	X	X	X	X	X
white-winged crossbill	*Loxia leucoptera*	S5B		X			X	X		
willow flycatcher	*Empidonax traillii*	S5B						X		
winter wren	*Troglodytes troglodytes*	S5B		X	X	X	X	X		X
yellow-bellied flycatcher	*Empidonax flaviventris*	S5B	X	X	X		X	X	X	X
yellow-bellied sapsucker	*Sphyrapicus varius*	S5B		X	X	X	X		X	X
yellow-rumped warbler	*Dendroica coronata*	S5B		X	X	X	X		X	X
unidentified woodpecker	-	-				X	X			
unidentified blackbird	-	-							X	

Notes:
Species in bold represent SAR species.
Species underlined are listed as Conservation Priority Species in North American Bird Conservation Region 12 (PIF 2008).
Sranks - Based on Provincial ranking definitions:
S1 – Critically imperiled in Ontario
S2 – Imperiled in Ontario
S3 – Vulnerable in Ontario
S4 – Apparently secure in Ontario
S5 – Secure in Ontario
SZN – Non-breeding migrants
S#B – Breeding individuals
SU – Species unrankable

APPENDIX J

Basking Turtle Survey Observations in the Local Study Area

Table J-1: Basking Turtle Survey Observations - Bagsverd Creek

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date(s)	Number of Individuals	Species
BT001	Low to moderate	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ basking locations available on vegetation hummocks, boulders, and logs	1	10-May-12	0	Painted turtle
				17-May-13	0	
				27-May-13	0	
				28-May-13	0	
				05-June-13	1	
				06-June-13	0	
BT002	Low	■ no turtles observed ■ shoreline is densely vegetated with shrubs limiting basking potential ■ limited cover provided by aquatic vegetation	2	10-May-12	0	-
BT003	Low	■ no turtles observed ■ shoreline is densely vegetated with shrubs limiting basking potential ■ limited cover provided by aquatic vegetation	3	10-May-12	0	-
BT004	Low	■ no turtles observed ■ shoreline is densely vegetated with shrubs limiting basking potential ■ limited cover provided by aquatic vegetation	4	10-May-12	0	-

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date(s)	Number of Individuals	Species
BT005	Low	■ no turtles observed ■ shoreline is densely vegetated with shrubs limiting basking potential ■ limited cover provided by aquatic vegetation	5	10-May-12	0	-
BT006	Low	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ basking locations available on vegetation hummocks	6	10-May-12	0	-
BT007	Low	■ no turtles observed ■ shoreline is densely vegetated with shrubs limiting basking potential ■ limited cover provided by aquatic vegetation	7	10-May-12	0	-
BT010	Low	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ shoreline is densely vegetated with shrubs limiting basking potential	8	11-May-12	0	-
BT019A	Low	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ shoreline is densely vegetated with shrubs limiting basking habitat	9	08-June-12	0	-
BT020A	Low to Moderate	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ shoreline is densely vegetated with shrubs limiting basking habitat	10	08-June-12	0	-
BT022	Low to	■ no turtles observed	11	09-June-12	0	-

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date(s)	Number of Individuals	Species
	Moderate	■ limited cover provided by aquatic vegetation ■ suitable basking locations available along shore		17-May-13 27-May-13 06-June-13 08-June-13		
BT023	Low	■ no turtles observed ■ shoreline is densely vegetated with shrubs limiting basking habitat	12	09-June-12	0	-

Table J-2: Basking Turtle Survey Observations - Unnamed Lake

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date(s)	Number of Individuals	Species
Unnamed Lake	Low to Moderate	■ overall assessment of habitat available in unnamed lake ■ habitat characteristics preferred by blanding's turtle were only present at basking survey locations	-	07-June-12	0	-
BT018C	Low to Moderate	■ no turtles observed ■ basking locations available on boulders	13	07-June-12 04-June-13 05-June-13 06-June-13 07-June-13 08-June-13	0	-
BT019B	Low	■ no turtles observed ■ limited cover provided by aquatic vegetation	14	07-June-12	0	-
BT020B	Moderate to high	■ painted turtle observed ■ aquatic vegetation cover present ■ potential basking habitat available	15	07-June-12	1	Painted Turtle
				17-May-13	2	
				27-May-13	2	
				28-May-13	2	
				06-June-13	3	
				07-June-13	3	

Table J-3: Basking Turtle Survey Observations - Clam Lake

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date	Number of Individuals	Species
Clam Lake	Low to Moderate	■ overall assessment of habitat available in clam lake ■ habitat characteristics preferred by blanding's turtle were only present at basking survey locations	-	06-June-12	0	-
BT011	Low to Moderate	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ suitable basking locations available along shore	16	06-June-12 17-May-13 28-May-13 05-June-13 06-June-13 07-June-13 12-June-13	0	-
BT012A	Low	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ rocky shoreline	17	06-June-12	0	-
BT013A	Moderate	■ painted turtle observed ■ aquatic vegetation cover present ■ potential basking habitat available	18	06-June-12	0	-
				07-June-12	1	Painted Turtle
BT014B	Low	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ rocky shoreline	19	06-June-12	0	-
BT015B	Low to Moderate	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ potential basking habitat only available on the shoreline	20	06-June-12 17-May-13 27-May-13 28-May-13 07-June-13 07-June-13	0	-
BT016B	Low	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ rocky shoreline ■ potential basking	21	07-June-12	0	-

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date	Number of Individuals	Species
		habitat only available on the shoreline				
BT017B	Low	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ steep rocky shoreline ■ potential basking habitat only available on the shoreline	22	06-June-12	0	
BT008	Moderate	■ no turtles observed ■ aquatic vegetation present ■ potential basking habitat available	23	12-May-12 06-June-12 17-May-13 27-May-13 28-May-13 04-June-13 05-June-13	0	-

Table J-4: Basking Turtle Survey Observations – Upper Duck Lake

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date(s)	Number of Individuals	Species
UD-1	Low	■ no turtles observed ■ limited cover by aquatic vegetation ■ few potential basking opportunities	24	28-May-13 04-June-13 05-June-13 06-June-13 08-June-13	0	-

Table J-5: Basking Turtle Survey Observations – Côté Lake

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date(s)	Number of Individuals	Species
C-1	Low	■ no turtles observed ■ limited cover by aquatic vegetation ■ potential shoreline basking habitat available	25	28-May-13 04-June-13 05-June-13 06-June-13 08-June-13	0	-
C-2	Low	■ no turtles observed ■ limited cover by aquatic vegetation ■ potential shoreline basking habitat available	26	28-May-13 04-June-13 05-June-13 06-June-13 08-June-13	0	-

Table J-6: Basking Turtle Survey Observations – Intensively Surveyed Ponds and Wetland Features within the Mine Site Local Study Area

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date(s)	Number of Individuals	Species
BT009	Moderate	■ no turtles observed ■ aquatic vegetation cover present ■ potential basking habitat available	27	12-May-12 07-June-12 17-May-13 27-May-13 28-May-13 05-June-13 06-June-13	0	-
BT014A	Low	■ no turtles observed ■ limited availability of in-water basking habitat ■ limited cover provided by aquatic vegetation	28	06-June-12	0	-
BT015A	Low	■ no turtles observed ■ limited availability of basking habitat ■ densely vegetated shoreline limits shoreline basking locations ■ limited cover provided by aquatic vegetation	29	06-June-12	0	-
BT016A	Low	■ no turtles observed ■ limited availability of basking habitat ■ limited cover provided	30	07-June-12	0	-

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date(s)	Number of Individuals	Species
		by aquatic vegetation				
BT017A	Low to Moderate	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ potential basking habitat present	31	07-June-12 17-May-13 17-May-13 27-May-13 28-May-13 04-June-13 05-June-13	0	-
BT018A	Low to Moderate	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ potential shoreline basking habitat available	32	07-June-12	0	-
BT018B	Moderate	■ no turtles observed ■ limited cover provided by aquatic vegetation ■ potential shoreline basking habitat available	33	08-June-12 17-May-13 27-May-13 28-May-13 06-June-13 07-June-13	0	-
BT024	Moderate	■ no turtles observed ■ aquatic vegetation cover present ■ potential basking habitat available	34	09-June-12 17-May-13 27-May-13 28-May-13 05-June-13 06-June-13	0	-
T01	Low to moderate	■ no turtles observed ■ aquatic vegetation cover present ■ potential basking opportunities available	35	17-May-13 27-May-13 04-June-13 07-June-13 12-June-13	0	-
T03	Low to moderate	■ no turtles observed ■ some aquatic vegetation cover ■ potential basking opportunities available	36	17-May-13 27-May-13 28-May-13 04-June-13 12-June-13	0	-
T05	Moderate	■ no turtles observed ■ aquatic vegetation cover abundant ■ potential basking opportunities available	37	17-May-13 27-May-13 28-May-13 04-June-13 12-June-13	0	-

Location	Habitat Potential	Rationale	Photo (Appendix K)	Survey Date(s)	Number of Individuals	Species
T06	Low to moderate	■ no turtles observed ■ some aquatic vegetation cover ■ potential basking habitat along shoreline	38	17-May-13 27-May-13 28-May-13 04-June-13 12-June-13	0	-
T09	Low to moderate	■ no turtles observed ■ limited aquatic vegetation cover ■ potential basking locations on logs and boulders	39	17-May-13 28-May-13 05-June-13 06-June-13 07-June-13	0	-
T11	Low	■ no turtles observed ■ potential basking opportunities available ■ likely dries up in summer	40	17-May-13 27-May-13 28-May-13 07-June-13 08-June-13	0	-
T13	Low to moderate	■ no turtles observed ■ some aquatic vegetation cover ■ potential basking opportunities on logs and boulders	41	17-May-13 28-May-13 05-June-13 06-June-13 07-June-13	0	-
T14	Low	■ no turtles observed ■ some aquatic vegetation cover ■ few potential basking opportunities	42	17-May-13 28-May-13 05-June-13 06-June-13 07-June-13	0	-

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APPENDIX K

Basking Turtle Survey Observation Photographs in the Local Study Area


Photo 1: BT001 - Bagsverd Creek


Photo 2: BT002 - Bragsverd Creek


Photo 3: BT003 - Bagsverd Creek


Photo 4: BT004 - Bagsverd Creek


Photo 5: BT005 - Bagsverd Creek


Photo 6: BT006 - Bagsverd Creek


Photo 7: BT007 - Bagsverd Creek


Photo 8: BT0010 - Bagsverd Creek


Photo 9: BT019A - Bagsverd Creek


Photo 10: BT020A - Bagsverd Creek


Photo 11: BT022 - Bagsverd Creek


Photo 12: BT023 - Bagsverd Creek


Photo 13: BT018C - Unnamed Lake


Photo 14: BT019B - Unnamed Lake


Photo 15: BT020B - Unnamed Lake


Photo 16: BT011 - Clam Lake


Photo 17: BT012A - Clam Lake


Photo 18: BT0013A - Clam Lake


Photo 19: BT014B - Clam Lake


Photo 21: BT016B - Clam Lake


Photo 23: BT008 - Clam Lake


Photo 20: BT015B - Clam Lake


Photo 22: BT017B - Clam Lake


Photo 24: UD1 - Upper Duck Lake


Photo 25: C1 - Côté Lake


Photo 26: C2 - Côté Lake


Photo 27: BT009


Photo 28: BT014A


Photo 29: BT015A


Photo 30: BT016A


Photo 31: BT017A


Photo 32: BT018A


Photo 33: BT018B


Photo 34: BT024


Photo 35: T01


Photo 36: T03


Photo 37: T05


Photo 38: T06


Photo 39: T09


Photo 40: T11


Photo 41: T13


Photo 42: T14

APPENDIX L

Basking Turtle Survey Weather Conditions

Table 1: Basking Turtle Survey Observations - Bagsverd Creek

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
BT001	10-May-12	Bedrock Boulder Cobble Gravel Mud Peat Sand	16	0	1
	17-May-13		17	1	2
	27-May-13		22	0	1
	28-May-13		23	1	2
	05-June-13		19	1	1
	06-June-13		22	0	2
BT002	10-May-12	Bedrock Boulder	16	0	1
BT003	10-May-12	Boulder Peat	16	0	1
BT004	10-May-12	Bedrock Boulder	15	0	1
BT005	10-May-12	Sand Peat	16	0	4
BT006	10-May-12	Sand Cobble Boulder	15	0	3
BT007	10-May-12	Sand Cobble Boulder	15	0	4
BT010	11-May-12	Boulder Cobble	15	0	1
BT019A	08-June-12	Mud Peat	22	1	2
BT020A	08-June-12	Sand Mud Peat	26	1	1
BT022	09-June-12	Bedrock Boulder Gravel Mud Peat Sand	24	0	1
	17-May-13		17	1	2
	27-May-13		23	0	-
	06-June-13		21	0	1

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
	08-June-13		21	0	1
BT023	09-June-12	Mud Peat	22	1	2

Notes:
[1] Cloud Cover: **0** = clear/few clouds, **1** = partly cloudy, **2** = cloudy/overcast
[2] Wind: **0** = vertical smoke,**1** = smoke drifts, **2** = wind felt on face & leaves rustle, **3** = leaves/twigs in constant motion

Table 2: Basking Turtle Survey Observations - Unnamed Lake

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
Unnamed Lake	07-June-12	-	21	0	1
BT018C	07-June-12	Boulder Mud	25	1	3
	04-June-13		13	1	2
	05-June-13		15	1	1
	06-June-13		19	0	2
	07-June-13		22	1	2
	08-June-13		21	0	1
BT019B	07-June-12	Mud	25	1	3
BT020B	07-June-12	Bedrock Mud Peat	24	1	2
	17-May-13		15	1	2
	27-May-13		19	0	0
	28-May-13		23	2	2
	06-June-13		18.5	-	-
	07-June-13		22	1	2

Notes:
[1] Cloud Cover: **0** = clear/few clouds, **1** = partly cloudy, **2** = cloudy/overcast
[2] Wind: **0** = vertical smoke,**1** = smoke drifts, **2** = wind felt on face & leaves rustle, **3** = leaves/twigs in constant motion

Table 3: Basking Turtle Survey Observations - Clam Lake

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
Clam Lake	06-June-12	-	17	1	3
BT011	06-June-12	Boulder Cobble Mud Peat Sand	24	1	1
	17-May-13		20	1	3
	28-May-13		16	1	1
	05-June-13		17	-	-
	06-June-13		18	0	2
	07-June-13		19	0	1
	12-June-13		21	0	1
BT012A	06-June-12	Mud Gravel Cobble	24	1	1
BT013A	06-June-12	Sand Mud Cobble Boulder	24	1	1
	07-June-12		24	1	2
BT014B	06-June-12	Sand Cobble Mud Peat	24	1	1
BT015B	06-June-12	Boulder Cobble Gravel Mud Peat Sand	24	1	1
	17-May-13		15	1	2
	27-May-13		20	0	2
	28-May-13		24.5	0	0
	07-June-13		21	0	2
	07-June-13		20	2	2
BT016B	07-June-12	Mud Peat	24	1	1
BT017B	06-June-12	Mud Peat	24	1	1

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
BT008	12-May-12	Bedrock Mud Peat	18	0	3
	06-June-12		26	1	0
	17-May-13		18	1	2
	27-May-13		19	0	1
	28-May-13		20	0	2
	04-June-13		15	1	2
	05-June-13		15	1	1

Notes:
[1] Cloud Cover: **0** = clear/few clouds, **1** = partly cloudy, **2** = cloudy/overcast
[2] Wind: **0** = vertical smoke,**1** = smoke drifts, **2** = wind felt on face & leaves rustle, **3** = leaves/twigs in constant motion

Table 4: Basking Turtle Survey Observations - Upper Duck Lake

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover	Wind
UD-1	28-May-13	Mud Sand	22	0	2
	04-June-13		14	1	2
	05-June-13		15	1	2
	06-June-13		21	0	2
	08-June-13		24	2	1

Notes:
[1] Cloud Cover: **0** = clear/few clouds, **1** = partly cloudy, **2** = cloudy/overcast
[2] Wind: **0** = vertical smoke,**1** = smoke drifts, **2** = wind felt on face & leaves rustle, **3** = leaves/twigs in constant motion

Table 5: Basking Turtle Survey Observations - Côté Lake

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
C-1	28-May-13	Boulder Gravel Mud Sand	18	1	2
	04-June-13		15	1	2
	05-June-13		15	1	1

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
	06-June-13		21	0	1
	08-June-13		23	2	1
C-2	28-May-13	Gravel Mud Sand	20	1	2
	04-June-13		14	1	2
	05-June-13		15	1	1
	06-June-13		21	0	1
	08-June-13		25	2	2

Notes:
[1] Cloud Cover: **0** = clear/few clouds, **1** = partly cloudy, **2** = cloudy/overcast
[2] Wind: **0** = vertical smoke,**1** = smoke drifts, **2** = wind felt on face & leaves rustle, **3** = leaves/twigs in constant motion

Table 6: Basking Turtle Survey Observations – Ponds and Wetland Features

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
BT009	12-May-12	Sand Mud Peat	19	1	1
	07-Jun-12		24	0	1
	17-May-13		21.5	1	4
	27-May-13		23	0	0
	28-May-13		20	1	1
	05-June-13		12	2	1
	06-June-13		18	0	2
BT014A	06-Jun-12	Sand Mud Peat	26	1	1
BT015A	06-Jun-12	Mud Peat	26	1	0
BT016A	07-Jun-12	Peat	24	1	1
BT017A	07-Jun-12	Bedrock Boulder Gravel	24	1	1
	17-May-13		18	0	2

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
	17-May-13	Mud Peat Sand	21	1	2
	27-May-13		23	0	2
	28-May-13		24.5	0	1
	04-June-13		19	-	-
	05-June-13		19	2	1
BT018A	07-Jun-12	Sand Mud Peat	24	1	1
BT018B	08-Jun-12	Boulder Mud Peat Sand	25	1	2
	17-May-13		19	1	2
	27-May-13		22	0	1
	28-May-13		23	1	3
	06-June-13		19	0	2
	07-June-13		22	0	3
BT024	09-Jun-12	Mud Peat	25	1	1
	17-May-13		18	1	2
	27-May-13		23	0	1
	28-May-13		23	0	2
	05-June-13		15	1	1
	06-June-13		17	0	1
T01	17-May-13	Gravel Mud	15	1	2
	27-May-13		21	0	1
	04-June-13		17	1	1
	07-June-13		22	0	2
	12-June-13		18	0	1

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
T03	17-May-13	Mud	16	1	2
	27-May-13		21	0	1
	28-May-13		21	0	1
	04-June-13		18	1	1
	12-June-13		22	0	1
T05	17-May-13	Mud	20	1	2
	27-May-13		23	0	1
	28-May-13		23	0	3
	04-June-13		17	1	1
	12-June-13		19	0	1
T06	17-May-13	Bedrock Mud	19	1	2
	27-May-13		23	0	1
	28-May-13		24	0	1
	04-June-13		18	1	1
	12-June-13		21	0	1
T09	17-May-13	Bedrock Boulder	13	0	1
	28-May-13		23.5	1	1
	05-June-13		19	1	1
	06-June-13		16	0	2
	07-June-13		16	0	1
T11	17-May-13	Boulder Peat Sand	13	1	2
	27-May-13		23	0	1
	28-May-13		23	0	1
	07-June-13		24	0	2

Location	Survey Date	Substrate	Air Temperature (°C)	Cloud Cover[1]	Wind[2]
	08-June-13		20	0	1
T13	17-May-13	Boulder Cobble Mud Peat Sand	10	1	1
	28-May-13		17	0	0
	05-June-13		15	1	1
	06-June-13		17	0	2
	07-June-13		16	0	2
T14	17-May-13	Peat	20	1	2
	28-May-13		17	1	1
	05-June-13		15	2	1
	06-June-13		22.5	0	1
	07-June-13		19	0	2

Notes:
[1] Cloud Cover: **0** = clear/few clouds, **1** = partly cloudy, **2** = cloudy/overcast
[2] Wind: **0** = vertical smoke,**1** = smoke drifts, **2** = wind felt on face & leaves rustle, **3** = leaves/twigs in constant motion

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APPENDIX M

Basking Turtle Observations in the Regional Study Area

Location	Habitat Potential	Rationale	Survey Date	Number of Individuals	Species
WB002			11-May-12	0	-
			13-May-12	0	-
			07-Jun-12	0	-
WB013	Low to Moderate	■ no turtles observed ■ shoreline is densely vegetated with shrubs limiting shoreline basking habitat ■ limited cover provided by aquatic vegetation ■ limited availability of in-water basking habitat	13-May-12 08-Sep-12	0	-
WB030	Moderate	■ no turtles were observed ■ potential shoreline basking habitat available ■ limited cover provided by aquatic vegetation	12-May-12 09-Sep-12	0	-
WB033	Low	■ no open water present ■ wetland filled in with sedges (*carex* sp.)	12-May-12 09-Sep-12	0	-
WB059	Low	■ no turtles were observed ■ shoreline is densely vegetated with shrubs limiting shoreline basking habitat ■ limited cover provided by aquatic vegetation ■ limited basking opportunities	12-May-12 09-Sep-12	0	-
WB060	Low	■ no turtles were observed ■ shoreline is densely vegetated with shrubs limiting shoreline basking habitat ■ limited cover provided	13-May-12 10-Sep-12	0	-

Location	Habitat Potential	Rationale	Survey Date	Number of Individuals	Species
		by aquatic vegetation ■ limited basking opportunities			
WB058	Low	■ no turtles observed ■ shoreline is densely vegetated with shrubs ■ limited availability of basking habitat	12-May-12 08-Sep-12	0	-
WB044	Moderate	■ no turtles observed ■ aquatic vegetation cover present ■ potential basking habitat available	12-May-12 08-Sep-12	0	-
WB045	Low	■ limited availability of basking habitat ■ densely vegetated shoreline limits shoreline basking locations ■ limited cover provided by aquatic vegetation	12-May-12 08-Sep-12	0	-

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APPENDIX N

Minnow Environmental Inc. Turtle Observations

Turtles and Amphibians Observed in Waterbodies Assessed int he Fisheries Studies Conducted in Support of the Côté Lake Mine

Waterbody		Dates Sampled	Fishing Equipment Used	Species Observed		
				Turtles	Amphibians Common Name	Amphibians Scientific Name
Lakes	Côté Lake	July 4-11, 2012	Large, medium and small hoop nets, seine net, minnow traps, boat electrofisher, gill nets	None observed	Green Frogs	*Lithobates clamitans*
Lakes	Unnamed Lake	July 11-16, 2012	Large, medium and small hoop nets, seine net, minnow traps, gill nets	5 Painted Turtles (*Chrysemys picta marginata*) captured in medium hoop net (3 died in net)	Green Frogs	*Lithobates clamitans*
Lakes	Bagsverd Lake (south and east arms only)	July 11-12, 2012	Medium and small hoop nets, minnow traps, gill nets	None observed	Green Frogs	*Lithobates clamitans*
Lakes	Clam Lake (main basin)	July 5-7, 2012	Medium and small hoop nets, minnow traps, gill nets, seine net	None observed	Green Frogs 7 Eastern Newts captured	*Lithobates clamitans* *Notophthalmus viridescens*
Lakes	Clam Lake (east arm)	July 4-5, 2012	Medium and small hoop nets, minnow traps, gill nets, seine net	None observed	Green Frogs 31 Eastern Newts captured Tadpoles	*Lithobates clamitans* *Notophthalmus viridescens*
Lakes	Little Clam Lake	July 4-6, 2012	Medium and small hoop nets, minnow traps, gill nets, seine net	None observed	Green Frogs 2 Eastern Newts captured	*Lithobates clamitans* *Notophthalmus viridescens*
Lakes	Three Duck Lakes	July 15, 2012	None Used	None observed	Green Frogs	*Lithobates clamitans*
River/ Creeks	Mollie River	July 11, 2012	Boat Electrofisher	None observed	Green Frogs	*Lithobates clamitans*
River/ Creeks	Bagsverd Creek	July 7-18, 2012	Medium and small hoop nets, minnow traps, backpack electrofisher	None observed	Green Frogs Tadpoles	*Lithobates clamitans*
River/ Creeks	Clam Creek	July 14, 2012	None Used	None observed	Green Frogs	*Lithobates clamitans*
Ponds	Beaver Pond	July 10-11, 2012	Small hoop nets, minnow traps	None observed	Green Frogs Wood Frogs Tadpoles 5 Eastern Newts captured	*Lithobates clamitans* *Rana sylvatica* *Notophthalmus viridescens*
Ponds	Unnamed Pond	July 10-11, 2012	Medium and small hoop nets, minnow traps, gill nets, seine net	None observed	Green Frogs Wood Frogs 2 Eastern Newts captured	*Lithobates clamitans* *Rana sylvatica* *Notophthalmus viridescens*
Ponds	East Beaver Pond	July 13-14, 2012	Minnow traps	None observed	Green Frogs Wood Frogs	*Lithobates clamitans* *Rana sylvatica*
Ponds	North Beaver Pond	July 14-15, 2012	Minnow traps	None observed	Green Frogs Wood Frogs	*Lithobates clamitans* *Rana sylvatica*
Ponds	Bagsverd Pond	July 14-15, 2012	Medium and small hoop nets, minnow traps, gill nets, seine net	None observed	Green Frogs Wood Frogs Tadpoles	*Lithobates clamitans* *Rana sylvatica*
Ponds	West Beaver Pond	July 15-16, 2012	Medium and small hoop nets, minnow traps, gill nets	None observed	Green Frogs Wood Frogs	*Lithobates clamitans* *Rana sylvatica*

Equipment Details	Dimensions
Large Hoop Net	3' [0.9 m] diameter hoops, 1.5” [3.8 cm] stretched mesh
Medium Hoop Net	2.5' [0.75 m] diameter hoops, 1” [2.5 cm] stretched mesh
Small Hoop Net	2' [0.61 m] diameter hoops, 0.5" [1.3 cm] stretched mesh
Seine Net	50’ [15 m] x 3’ [0.9 m], 0.3 cm mesh size
Gill Net	Experimental: 150’ x 6’ [45.4 m x 1.82 m] with mesh size from 1” [2.5 cm] to 4” [10.2 cm]
Minnow Trap	16.5” [42 cm] length, 0.25” [0.6 cm] mesh, 1” [2.5 cm] diameter opening
Boat Electrofisher	Generator-operated Smith-Root Model 5.0 GPP
Backpack Electrofisher	Smith-Root LR-24

Source: Weech, Shari. 2012. Personal Communication. Minnow Environmental Inc. August 20, 2012.

Prepared By: BW
Reviewed By: DJ

APPENDIX O

Amphibian Observations in the Local and Regional Study Areas

Station			Regional Study Area																	
			CA-4 Pond			CA-3B Creek			CA-5 Creek			CA-2B River			CA-1B			MA-1		
Common Name	**Scientific Name**	**SRank***	**CC**	**Count**	**In/Out**	**CC**	**MA-1 Pond**	**In/Out**	**CC**	**Count**	**In/Out**	**CC**	**Count**	**In/Out**	**CC**	**Count**	**In/Out**	**CC**	**Count**	**In/Out**
gray treefrog	*Hyla versicolor*	S5	0	0	-	1	**CC**	**Count**	**In/Out**	0	-	0	0	-	1	3	in	0	0	-
American toad	*Bufo americanus*	S5	1	1	in	0	0	0	-	0	-	2	3	in	3	-	in	3	-	In
spring peeper	*Pseudacris crucifer*	S5	3	3	in	2	3	-	in	7	7 in 2 out	3	-	in	2	> 4	in	3	-	In
bullfrog	*Rana catesbeiana*	S5	0	0	-	0	0	-	0	0	-	0	0	-	0	0	-	1	1	in

Notes:
S5 - Secure in Ontario
1 – CC = Calling Code (Relative Abundance), where **0** = none; **1** = few individuals; **2** = several, calls distinguishable but overlapping; **3** = large numbers, full continuous chorus.
*Based on MNR provincial ranking definitions
S5 - Secure in Ontario

Property			Local Study Area											
Station			MA-2 Creek			MA-3			MA-4 River			MA-6 Pond		
Common Name	**Scientific Name**	**SRank***	**CC**	**Count**	**In/Out**	**CC**	**Count**	**In/Out**	**CC**	**Count**	**In/Out**	**CC**	**Count**	**In/Out**
gray treefrog	*Hyla versicolor*	S5	1	3	in	0	0	-	1	2	in	0	0	-
American toad	*Bufo americanus*	S5	1	1	in	3	-	out	2	3	in	1	1	in
spring peeper	*Pseudacris crucifer*	S5	2	6	in	2	4	in	3	-	in	1	3	in
bullfrog	*Rana catesbeiana*	S5	0	0	-	0	0	-	0	0	-	0	0	-

Notes:
S5 - Secure in Ontario
1 – CC = Calling Code (Relative Abundance), where **0** = none; **1** = few individuals; **2** = several, calls distinguishable but overlapping; **3** = large numbers, full continuous chorus.
*Based on MNR provincial ranking definitions

APPENDIX P

Candidate Bat Hibernacula Photographs


Photo 1: Boulder field at 112med/high


Photo 2: Lichen covered rock outcrop at 75lo


Photo 3: Cleared rock outcrop at 92lo


Photo 4: Rock flat at 55med


Photo 5: Crevice observed in large boulder at 71lo


Photo 6: Cleared boulders at 71lo


Photo 7: Crevice observed at 98med


Photo 8: Lichen covered rock outcrop at 98med


Photo 9: Lichen covered rock outcrop at 114lo

Photo 10: Crevice observed at 114lo


Photo 11: Lichen covered rock outcrop at 115lo


Photo 12: Crevice observed at 115lo


Photo 13: Crevice observed at 117lo


Photo 15: Crevice observed at 117lo


Photo 17: Crevice observed at 100med


Photo 14: Crevice observed at 117lo


Photo 16: Lichen covered rock outcrop at 117lo


Photo 18: Rock outcrop at 100med


Photo 19: Man-made rock piles in cleared outcrop at 102med


Photo 21: Crevice observed at 79lo


Photo 23: Fractured rocks observed at 68med


Photo 20: Man-made rock piles in cleared outcrop at 102med


Photo 22: Lichen covered outcrop at 79lo


Photo 24: Fractured rocks observed at 51lo


Photo 25: Opening observed at 48lo

APPENDIX Q

Winter Track Count Survey Photographs

Photo 1: 01. Weasel Track

Photo 2: 02. River Otter Track

Photo 3: 03. Lynx Track

ATTACHMENT II

Côté Gold Project, Draft Environmental Assessment Report Technical Support Document: Terrain and Soil

May 8, 2014 Project No. 13-1197-0003

David Brown and Steve Wolfenden
IAMGOLD CORPORATION
3200 - 401 Bay Street
P.O. Box 153
Toronto, Ontario M5H 2Y4

uploaded via Buzzsaw

TERRAIN AND SOIL
PREDICTIONS OF POTENTIAL EFFECTS TO TERRAIN AND SOIL

Dear Mr. Brown and Mr. Woolfenden:

1.0 INTRODUCTION

IAMGOLD Corporation (IAMGOLD) is proposing to construct, operate and eventually reclaim a new open pit gold mine at the Côté Gold Project (the Project) in Ontario located approximately 20 kilometre (km) southwest of Gogama, 130 km southwest of Timmins and 150 km northwest of Sudbury in Chester and Neville Townships, District of Sudbury (Project site) (Figure 1 and Figure 2).

To support the completion of an Environmental Assessment (EA) for the Project, Golder Associates Ltd. (Golder) was retained by IAMGOLD in early 2012 to conduct studies of the existing hydrological, climatological, hydrogeological, water quality and terrain and soil conditions. These studies are ongoing, concurrent with the assessment of effects associated with the construction, operation and closure of the Project.

This memorandum is based on results of the baseline terrain and soil studies completed between April 2012 and July 2013. The scope of the terrain and soil component includes the characterisation of existing terrain and soil conditions and predicted effects of the Project to the terrain and soil environment that could potentially occur from construction, operation and closure of the Project. This memorandum is intended to provide support for the vegetation assessment. It is also intended to provide IAMGOLD and AMEC Environment & Infrastructure (AMEC) with key information to support the impact assessment for other physical discipline study components, as well as allowing AMEC to progress with their assessment of the significance of the predicted effects and associated EA reporting for the Project.

2.0 EFFECTS ASSESSMENT PROCESS

The assessment of terrain and soil effects associated with the Project includes the following tasks, which are further described in the following sections:

- identify the Project interactions with the terrain and soil environment;
- define the spatial and temporal boundaries over which the effects assessment is to be conducted;

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- select ecological/physical indicators that are representative of the terrain and soil environment and identify the associated assessment measures and magnitudes;
- characterize the existing terrain and soil conditions of the area; and
- predict potential changes to terrain and soil map units and quality at the Project site.

2.1 Project Interactions with the Terrain and Soil Environment

The primary Project components and associated activities that could potentially affect the terrain and soil environment within the Project site include:

- clearing and preparation;
- open-pit mining activities including new open pit mine and associated dewatering;
- overburden and mine rock management;
- process plant effluent and tailings management;
- Project infrastructure;
- water supply and drainage works and facilities;
- aggregate mining and stockpiles (gravel pit[s] and/or quarry[ies]);
- fuel and material management;
- domestic sewage treatment and disposal;
- solid waste management, industrial waste handling/treatment including hazardous materials;
- on-site power supply and power infrastructure (including temporary diesel generation);
- on-site access roads and related infrastructure;
- watercourse realignments and fish habitat compensation;
- water withdrawal; and
- effluent discharge.

2.2 Study Areas (Spatial Boundaries)

The study areas selected for the Project define spatial boundaries within which the effects of the Project on the terrestrial environment are considered. For the purpose of the Project, study areas and spatial boundaries will be referred to collectively as study areas.

The Terms of Reference (ToR) and Environmental Impact Statement (EIS) Guidelines require that the study areas defined therein, and described below, encompass the physical works and activities of the Project where effects are expected or likely to occur, and where effects will be studied. The study areas were selected to incorporate the likely spatial extent of likely effects, as well as considering traditional and local knowledge, and ecological, technical, social and cultural aspects.

2.2.1 Local Study Area

The Local Study Area (LSA) is common to each terrestrial discipline, provided by AMEC (Theben 2013, pers. comm.), and extends beyond the footprint to include the area around the footprint where direct and indirect effects are likely to occur on surrounding soil, terrain and soil and wildlife. The LSA encompasses a 2 km buffer around the footprint and extends to the south-west to include Chester Lake (Figure 3). The terrain and soil discipline did not include an RSA as effects to this discipline are localized to the footprints.

2.3 Project Phases (Temporal Boundaries)

Project activities and the areas over which these activities are conducted vary throughout the Project. Thus, effects of project related activities vary throughout the Project phases. In general, effects on the terrain and soil are expected to be greatest during the construction phase, when site clearing has reached its maximum extent. Effects on the terrain and soil were considered for the following project phases: construction, operations, closure, and post-closure.

The approximate duration of the key Project phases are as follows:

- Construction: 2 years;
- Operation: 15 years;
- Active reclamation: 2 years; and
- Post-closure: 50 to 80 years.

2.4 Ecological Indicators

While all components of the environment are important, it is neither practical nor necessary to assess every potential effect of the Project on every component of the environment. Consequently, this assessment focuses on the components that have the greatest relevance in terms of value and sensitivity, and which are likely to be affected by the Project. To achieve this focus, specific Ecological Indicators (EIs) are identified for consideration during the environmental effects assessment. Identified EIs are used to predict the effects of the Project on all elements of the environment and the interaction among these elements. The following sections provide summaries of the proposed EIs for the terrain and soil components (terrain and soil) of the EA (Table 1), including the rationale for selection, measures, and measurement endpoints for each EI.

Table 1: Terrain and Soil Ecological Indicators

Ecological Indicator	Rationale for Selection	Measures	Measurement Endpoints
Terrain and Soil Map Unit Types	The naturally-occurring terrain and soil in the study area-the basis of biological processes. Habitat for vegetation and wildlife. Basis for biological resources.	Terrain and Soil Map Units	Terrain and soil quantity Abundance and distribution of terrain and soil map units
Soil Quality	Soil quality affects vegetation quality and erosion can affect aquatic health.	Erosion Risk Reclamation Suitability	Erosion risk ratings Reclamation suitability ratings

3.0 METHODOLOGY (BACKGROUND REVIEW, FIELD STUDY METHODS AND ANALYSIS)

3.1 Desktop Review

For the purpose of characterizing the terrain and soil conditions within the terrestrial Mine Site LSAs, the following reports and maps were included in the compilation and review of existing information:

- **Surficial Geology**: Ontario Geological Survey, Ontario Ministry of Northern Development and Mines, and Northeast Science and Information Section, Ontario Ministry of Natural Resources 2005.
- **Soils**: Digitized from Soils report No. 59 Soils of Gogama Area Map Sheet (41P); and
- **Geotechnical Drill Hole Information**: 2012 Summer Site Investigation Summary (Knight Piésold 2013).

3.2 Field Study Methods

In addition to a review of available site specific information, field studies were completed on July 5 to 7, 2013, as part of the vegetation baseline studies to support the description of existing environment conditions for the Mine Site, as outlined in the following sections.

The sampling strategy of the vegetation and soil survey was designed to select a cross-section of land cover classes within the study areas, while considering size and distribution of the Ecological Land Classification (ELC) types and access constraints. Detailed soil characterizations following the Canadian System of Soil Classification were completed at 22 locations within the LSA. Soil characterization plots were located in the LSA at different landscape positions to capture a broad range of variables.

Information collected at each survey location included the following variables:

- land cover class and ELC type;
- slope position, degree of slope and aspect;
- surface expression and shape;
- drainage class;
- moisture and nutrient regime;
- soil horizon designation; and
- soil horizon textures.

Terrain and soil were only mapped for the LSA as changes on the terrain and soil environment as a result of the Mine site will be localized and no regional changes are expected.

4.0 EXISTING CONDITIONS

4.1 General Setting

The Project site is located within the Mattagami River Watershed, which has headwaters at the James Bay/Great Lakes divide and flows north for approximately 420 km to a confluence with the Moose River, which subsequently flows to James Bay. The Project site is drained by Mesomikenda Lake or the Mollie River, both of which flow north to Minisinakwa Lake and subsequently to the Mattagami River. Located in the Boreal Shield ecozone of Ontario, the climate of the Project site is characterized by cold winters (-10˚C to -35˚C) and warm summers (10˚C to 35˚C).

The Project is located in a narrow greenstone belt of the Ridout syncline that extends from the southeast corner of the Swayze greenstone belt. The Chester Granitoid Complex (CGC), which hosts the Côté Gold deposit, was emplaced along the southern margin of the Ridout syncline. Breccias developed as the intrusive contacts and provided a pathway for hydrothermal alteration fluids and the mineralizing fluids. The host granitoid rocks locally consist of tonalite and quartz diorite. As reported by IAMGOLD geologists, gold mineralization is disseminated (porphyry style) and also occurs along the quartz veining.

The study area displays relatively subdued topography reflecting the effects of glaciation with low bedrock knobs separated by numerous low-lying wetland areas. Elevations range from about 350 metres above sea level to 410 metres above sea level. Higher elevation ground is comprised of bedrock outcrops or bedrock covered with a thin veneer of granular till, generally less than 1 m thick. Low-lying areas generally consist of organics (often peat) that may overlie silt, sand and/or granular till to a limited depth. Within the study area, bedrock is encountered typically within 4 m depth of ground surface with the greatest depth to rock of 22.6 m observed. East of the Project site, glaciofluvial ice-contact deposits, including esker, kame and moraine material has been mapped in a narrow north-south band near the eastern boundary of Chester Township.

4.2 Local Terrain and Soil Environment

4.2.1 Terrain Distribution in the Local Study Area

According to the Ontario Geological Survey (2005), the dominant glacial deposits in the LSA are as follows (see Figure 4):

- **Bedrock Knob**: bedrock outcrops with very little cover.
- **Morainal**: ground and hummocky moraine which a heterogeneous mixture of clay to boulder size material, deposited directly by glacier ice (as ground moraine) or from stagnant ice melting out in place (forming ablation moraine).
- **Glaciofluvial**: which are sediments laid down by meltwater, as outwash plains (along River valleys primarily) and esker and kame deposits that occur throughout the region.

Since deglaciation, terrain in the LSA has been modified by a variety of earth processes, resulting in the development of:

- Organic bog and fen deposits that infill many terrain depressions in the region.

4.2.2 Soil Types in the Local Study Area

The following soil types were identified in the LSA (Soil Classification Working Group 1998) with soil order descriptions from Soils of Canada (Department of Soil Science University of Saskatchewan 2013).

Podzolic

Podzolic soils are forested soils found primarily on sandy parent materials in areas underlain by igneous rocks, most prominently on the Canadian Shield, but are also found in other regions on sandy glacio-fluvial deposits.

They are dominant on sandy deposits in ecozones or parts of ecozones where the mean annual precipitation is above about 700 mm. At mean annual precipitation levels below this Brunisolic soils are found on the same types of sandy deposits, most notably through northwestern Ontario. Coniferous-dominated plant communities are the major vegetation type found on Podzolic soils.

The sandy glacial sediments derived from igneous rocks typically have an acidic pH because of the mineralogical composition of the sediments. The acidity of the upper soil is further increased by the organic decomposition products from the coniferous leaf litter. This creates an intense chemical weathering zone in the upper part of the soil where primary minerals containing aluminum, iron, and other metal ions are weathered and the ions released into the soil solution. These metal ions form complexes with the organic decomposition products (also called chelates), and the complexes move with the vertically draining water into the B horizon where they are deposited.

Gleysolic

Gleysolic soils result from prolonged water saturation of the soil profile. In regions such as the Clay Belt in northern Ontario, landscapes with clay-dominated soil textures have very slow rates of water movement through the soil, which causes period of water saturation. In the grassland and non-boreal regions of the Prairies, saturated conditions result from both concentration of surface water flows (runoff) into depressions or from the groundwater table rising to an elevation where it intersects with soil forming processes. In this region Gleysolic soils are the dominant wetland soil.

Regosolic

Regosolic soils do not contain a recognizable B horizon at least 5 cm thick and are therefore referred to as weakly developed. The lack of a developed pedogenic B horizon may result from any of a number of factors: youthfulness of the material, recent alluvium; instability of the material, colluvium on slopes subject to mass wasting; nature of the material, nearly pure quartz sand; and climate consisting of dry cold conditions. Regosolic soils are generally rapidly to imperfectly drained. They occur under a wide range of ELC types and climates.

Regosolic soils occur in every ecozone, but are rarely dominant on the landscape.

Organic

Organic soils have developed dominantly from organic deposits. The majority of Organic soils are saturated for most of the year, unless artificially drained, but some of them are not usually saturated for more than a few days. They contain 17% or more organic carbon, and: (1) if the surface layer consists of fibric organic material and the bulk density is less than 0.1 (with or without a mesic or humic Op less than 15 cm thick), the organic material must extend to a depth of at least 60 cm; or (2) if the surface layer consists of organic material with a bulk density of 0.1 or more, the organic material must extend to a depth of at least 40 cm; or (3) if a lithic contact occurs at a depth shallower than stated in 1) or 2) above, the organic material must extend to a depth of at least 10 cm.

Soils of the Organic order are the dominant wetland soils found in forested regions of Canada and they occur in wetlands throughout the boreal forest. Organic soils in these regions are commonly referred to as peats, bog or fen soils, or mucks.

The soil map units found in the LSA include (Figure 3):

- English soil units which are Orthic Humo-Ferric Podzol developed on non-calcareous very stony sand or sandy loam glacial till materials with poor drainage.
- Hanna which are Orthic Humo-Ferric Podzol developed on non-calcareous very stony sand or sandy loam glacial till materials and are rapidly drained.
- Jeannie which are Orthic Humo-Ferric Podzol developed on non-calcareous coarse sandy and gravelly outwash materials and are rapidly drained.
- Ketchinig which are Terric Humisol developed on humic organic material 40 cm to 160 cm thick derived from sphagnum moss, grass, and wood, overlying gray clay and are very poorly drained.
- Kushog which are Terric and Typic Fibrisols which are developed on bog peat material 40 to greater than 160 cm thick.
- Makobe which are Gleyed Humo-Ferric Podzol developed on non-calcareous stony loam glacial till materials and are imperfectly drained.
- Rockland which are Regosol developed on exposed bedrock or less than 10 cm soil material overlying bedrock with variable drainage.

5.0 PREDICTED EFFECTS

5.1 Changes in Terrain Units, Soil Quantity and Distribution

Clearing and construction for the Project site, particularly through the processes of soil stripping and storage, will result in changes to soil quantity and distribution, as well as changes to terrain. Soil removal will be initiated during the Construction Phase of the Project and continue during the Operation Phase as mining progresses. During closure and reclamation, the soil (i.e., growth media) will be re-constructed as outlined in the Conceptual Closure and Post-Closure Plan for the Côté Gold Project (AMEC 2013).

All areas are expected to be reclaimed at closure including the Plant Site, Mine Rock Area, Tailings Management Facility (TMF), Mine Site access roads, and borrow areas, except for the pit lake in the final Open Pit. The pit lake will be a permanent soil disturbance. However, soil quality can be altered or lost through the following Project components and activities:

- wind and water erosion during the Construction and Retirement Phases;
- changes to terrain during blasting and excavation of the open pit; and
- permanent residual ground disturbance from Project components.

Changes to terrain and soil map units were assessed for the maximum predicted point of development of the Project footprint (operations case). Changes to terrain and soil distribution directly affected by the Project were quantified by GIS analysis using the following process:

- GIS quantified areas of terrain and soil map units within the LSA for the existing baseline conditions, operation, and retirement phases; and
- the net changes in terrain and soil map unit distribution were calculated between the baseline and retirement phase.

During the Retirement Phase, infrastructure is dismantled and initial reclamation of the project surface footprint is completed, which will involve replacement of topsoil and peat materials over overburden. The only areas that are not expected to be reclaimed include the open pit. Following closure, it is anticipated that all plant site structures will be dismantled or demolished and removed. The remainder of the Mine Site footprint, and borrow areas used to construct the roads and plant site will be reclaimed.

With appropriate reclamation techniques terrain can be contoured, to the extent practical, to blend with the surrounding landscape.

Surface disturbance from the Project may result in the following soil quality impacts:

- soil wind and water erosion that could alter and/or decrease soil quality;
- soil compaction that could alter soil structure and decrease soil quality;
- soil moisture depletion that could decrease plant growth;
- soil admixing that could decrease soil fertility;
- soil disturbance that could alter and decrease soil capability for forestry;
- soil contamination that could decrease soil quality; and
- reclamation that could restore soil quality/capability.

The maximum amount of terrain and soil disturbance area from the Mine Project footprint from the Operation Case is predicted to be approximately 1,941 ha (16% of the mine LSA) (Tables 2 and 3), of which 193 ha will be permanent disturbance due to the pit lake. Since all disturbed areas will eventually be reclaimed, the net effects of terrain and soil are only expected to be minor over time.

Table 2: Comparison of Terrain Map Unit Distribution between the Baseline Case and Retirement Case in the Mine Site Local Study Area

Terrain Map Unit	Baseline (ha)	% LSA	Application Case	% LSA	Closure	%LSA	Net Change	% LSA
Bedrock	7,430	63	1,086	9	6,344	54	-1,086	-9
Glaciofluvial	1,324	11	525	4	800	7	-525	-4
Morainal	1,001	8	118	1	883	7	-118	-1
Water	1,502	13	33	0	1,469	12	-33	<1
Organic	598	5	179	2	419	4	-179	-2
Reclaimed	0	0	0	0	1,748	15	1,933	16
Permanent Disturbance	0	0	0	0	193	2	193	2
Total	11,856	100	1,941	16	11,856	100	0	0

Note:
ha = hectare
% LSA = Percent of Local Study Area

Table 3: Comparison of Soil Map Unit Distribution between the Baseline Case and Retirement Case in the Mine Site Local Study Area

Soil Map Unit	Baseline (ha)	% LSA	Application Case	% LSA	Closure	% LSA	Net Change	% LSA
English	204	2	0	0.0	204	2	0.0	0.0
Hanna	7,263	61	1,629	14	5,634	48	-1629	-14
Jeannie	422	4	10	<1	411	4	-10	-<1
Ketchinig	985	8	170	1	815	7	-170	-1
Kushog	108	1	33	<1	75	1	-33	-<1
Makobe	584	5	19	<1	565	5	-19	-<1
Rockland	788	7	46	<1	742	6	-46	-<1
Water	1,502	13	33	<1	1,469	12	-33	-<1
Reclaimed	0	0.0	0	0.0	1,748	15	1,941	16
Permanent Disturbance	0	0	0	0	193	2	193	2
Total	11,856	100.0	1,941	16.4	11,856	100.0	0	0.0

Note:
ha = hectare
% LSA = Percent of Local Study Area

6.0 SUMMARY AND CONCLUSIONS

This summary presents a review and interpretation of qualitative and quantitative information from literature, and data collected during the 2013 field programs for terrain and soil. Terrain and soil were only mapped for the LSA as changes on the terrain and soil environment as a result of the Mine site will be localized and no regional changes are expected. Detailed impact predictions are not planned for terrain and soil because changes to each will be captured in both the vegetation and wildlife disciplines. Any affect on vegetation, which ultimately leads to habitat fragmentation or loss of habitat for wildlife will be captured in these disciplines. Therefore, the changes to the terrain and soil environment are passed on to the vegetation and wildlife discipline summaries where they are discussed in terms of their effects to vegetation and wildlife valued ecologic communities.

7.0 REFERENCES

AMEC Environment & Infrastructure. 2013. Conceptual Closure Plan and Post-Closure Plan for the Côté Gold Project: September 9, 2013. Mississauga, Ontario.

Government of Canada-Canadian Soil Information Service. 2013. Soils of the Gogama Area Map Sheet (41P): Digitized from Soils report No. 59 Soils of Gogama Area Map Sheet (41P).

Knight Piésold. 2013. Geotechnical drill hole information: 2012 Summer Site Investigation Summary.

Ontario Geological Survey. 2005. Surficial Geology: Ontario Geological Survey, Ministry of Northern Development and Mines, and Northeast Science and Information Section, Ministry of Natural Resources 2005.

Soil Classification Working Group. 1998. The Canadian System of Soil Classification. Agriculture Canada Expert Committee on Soil Survey. 3rd Agriculture Canada Publication. No. 1646. 164 pp.

Yours very truly,

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Attachments: Figures 1 to 4

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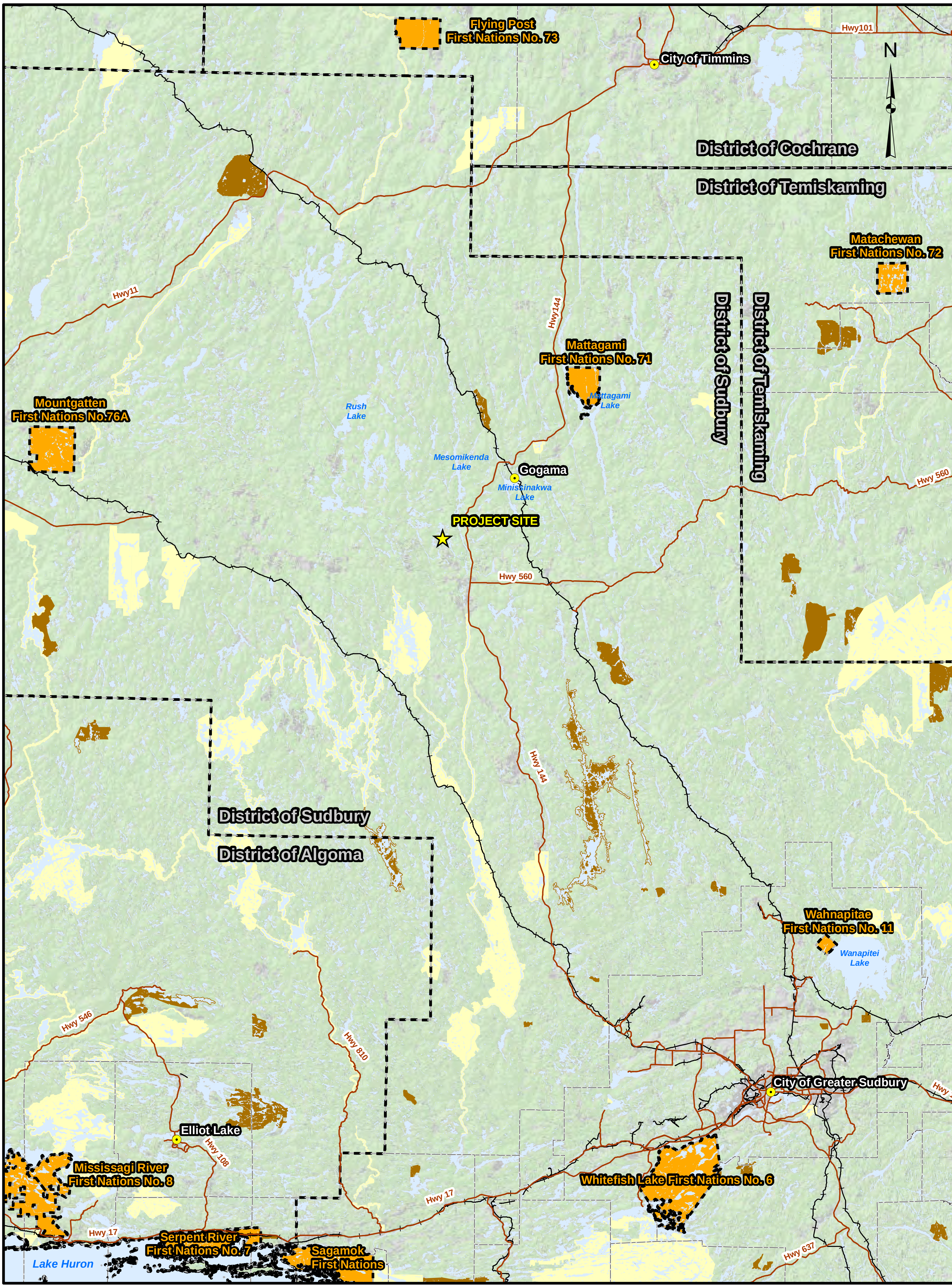

LEGEND

- ★ Project Site Location
- Regional Communities
- Major Roads
- Railway
- Upper Tier Municipal Boundary
- Lower Tier Municipal Boundary
- Waterbody / Large Watercourse
- Wooded Areas
- Conservation Reserve (Regulated)
- Provincial Park
- First Nation Reserve

35,000 0 35,000

SCALE 1:850,000 METRES

REFERENCE

*Figure1 Based on info provided by AMEC(Feb. 26, 2013)
Base Data - MNR NRVIS, CANMAP v2008.4
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 17

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Key Plan

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003		SCALE AS SHOWN	REV. 0
DESIGN	RRD	Feb. 2013	FIGURE: 1
GIS	JMC/RRD	July. 2013	
CHECK	JB	July. 2013	
REVIEW	DJ	July. 2013	

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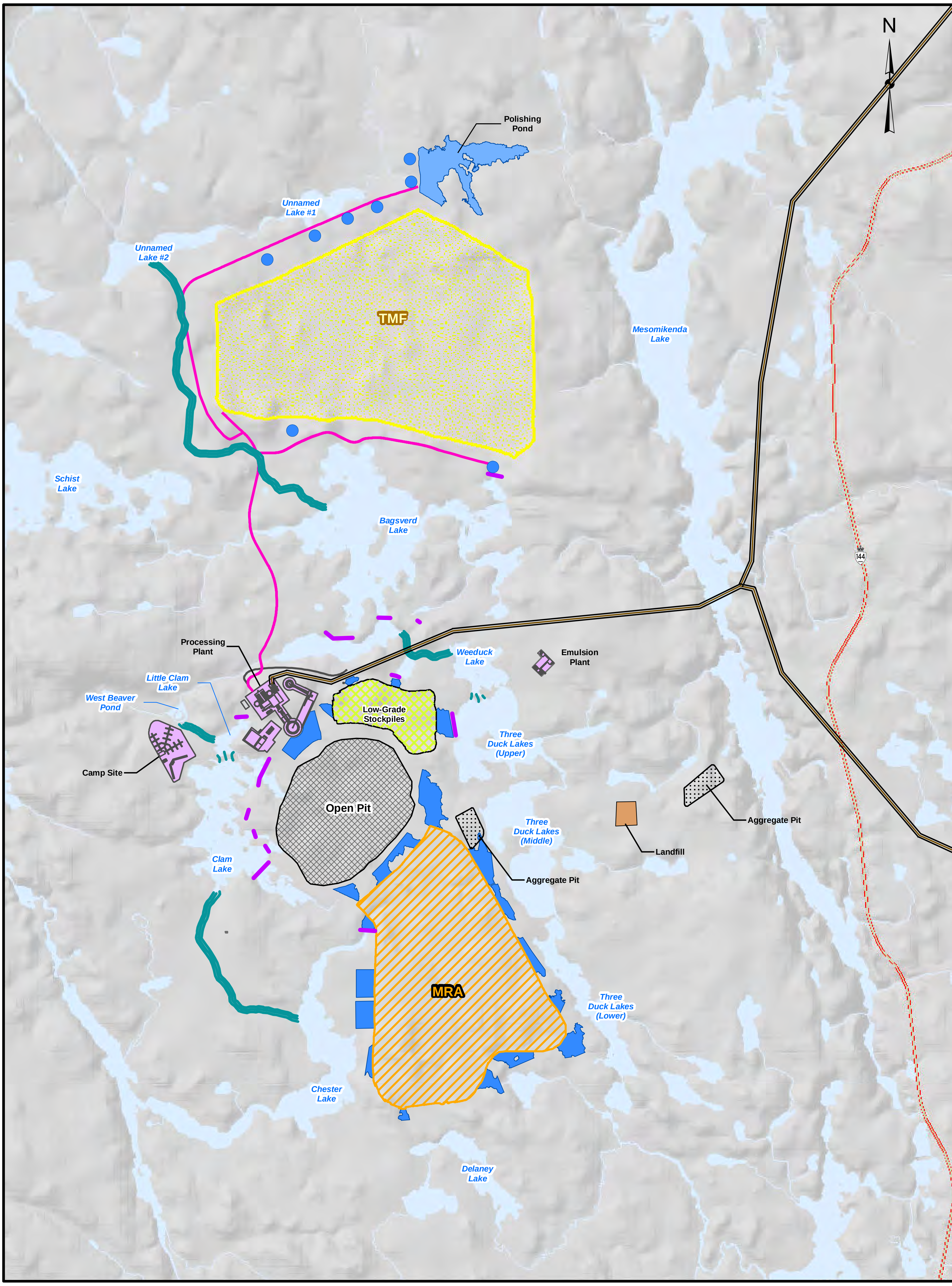


LEGEND

- Realignment Dams
- Transmission Line
- Watercourse Realignment
- Tailings and Reclaim Pipeline
- Highway 144
- Low-Grade Stockpiles
- Aggregate Pit
- Polishing Pond
- Facilities
- Landfill
- Open Pit
- Mine Rock Area (MRA)
- Collection Ponds
- Tailings Management Facility (TMF)
- Waterbodies
- Creek / River

2,000 0 2,000

SCALE 1:45,000 METRES

REFERENCE

Open Pit Shell provided by IAMGOLD, May 2013
Base Data - MNR NRVIS, CANMAP v2008.4
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources,

Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

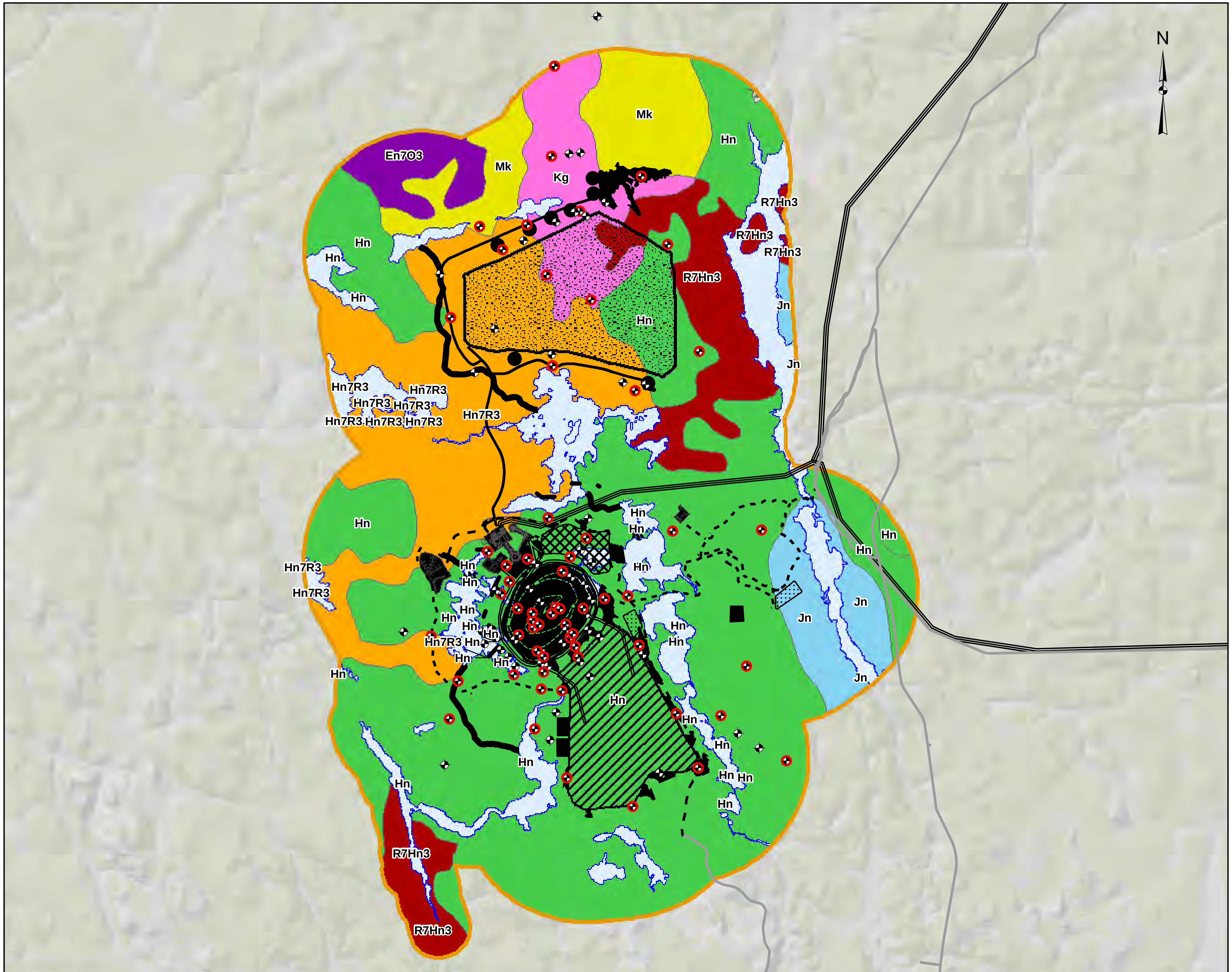
PROJECT
IAMGOLD CÔTÉ GOLD PROJECT

TITLE
Site Plan

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Feb. 2013	FIGURE: 2	
GIS	AL	Oct. 2013		
CHECK	BW	Oct. 2013		
REVIEW	DJ	Nov. 2013		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Fig2_SitePlan.mxd



LEGEND

- Borehole
- Borehole with Monitoring Well Install
- Roads
- Site Access Roads
- Project Site Footprint
- Terrestrial Local Study Area
- Water

Soil Unit / Name

- En7O3 (English)
- Hn (Hanna)
- Hn7R3 (Hanna/Rockland)
- Jn (Jeannie)
- Kg (Ketchinig)
- Mk (Makobe)
- R7Hn3 (Rockland)

REFERENCE

IAMGOLD Open Pit, May 2013.
Soils Digitized fromSoils report No. 59
Soils of Gogama Area Map Sheet (41P)
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

1,600 0 1,600
SCALE 1:68,000 METRES

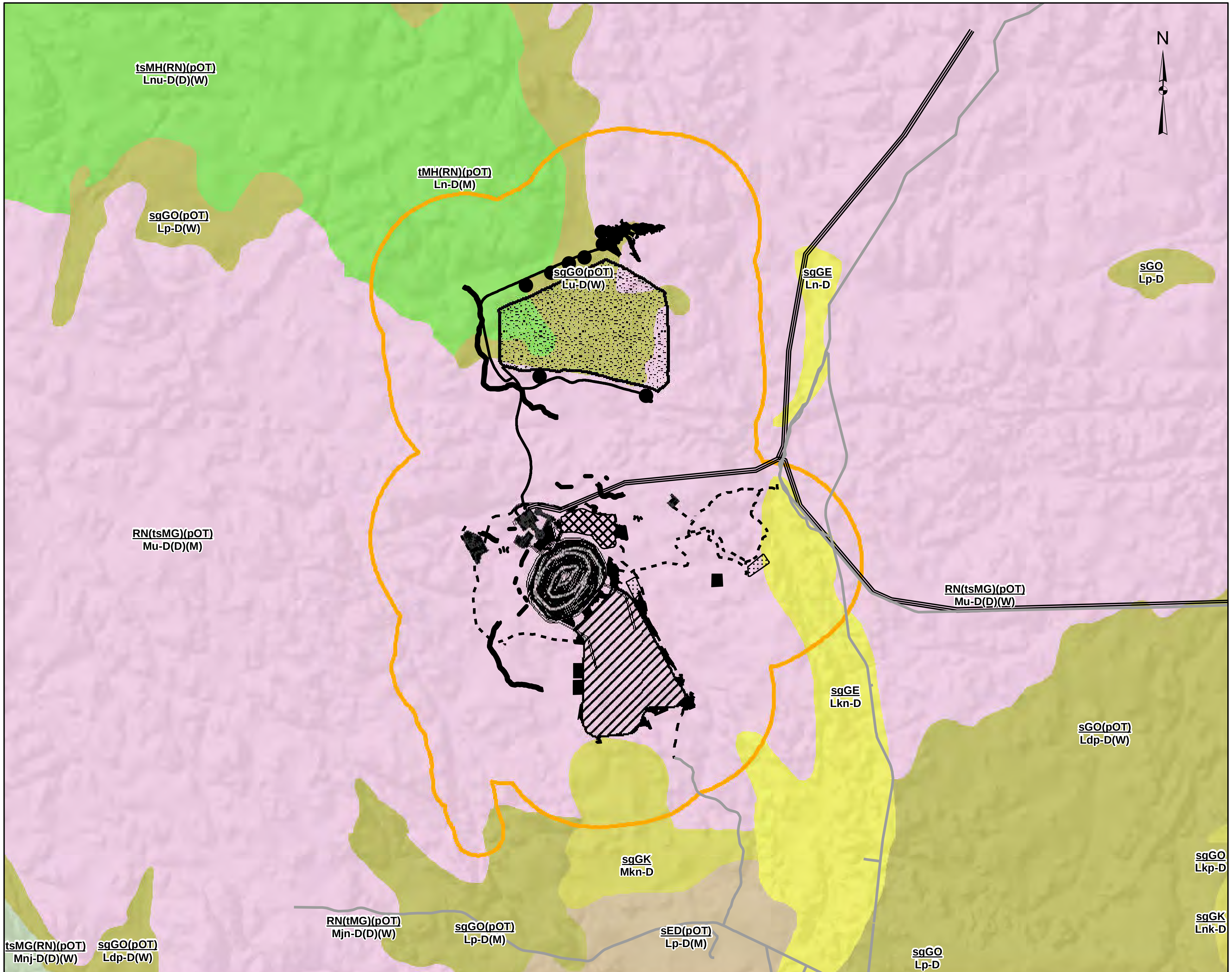
PROJECT
IAMGOLD CÔTÉ GOLD PROJECT

TITLE
Soil Map Units in the Terrestrial Local Study Area

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Aug. 2013	FIGURE: 3	
GIS	AL	Aug. 2013		
CHECK	DD	Oct. 2013		
REVIEW	CD	Oct. 2013		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Fig2_SoilMapUnits_LSA.mxd



LEGEND

- Roads
- Site Access Roads
- Project Site Footprint
- Terrestrial Local Study Area

NOEGTS

Bedrock

- Bedrock knob

Eolian

- Sand dunes

Glaciofluvial

- Esker, esker complex, crevasse filling
- Kame, kame field, Kmae terrace, kame moraine
- Outwash plain, valley train

Morainal

- Ground Moraine
- Hummocky moraine

REFERENCE

IAMGOLD Open Pit, May 2013.
Ontario Geological Survey, Ministry of Northern Development and Mines, and Northeast Science and Information Section, Ministry of Natural Resources 2005.
Digital Northern Ontario Engineering Geology Terrain Study (NOEGTS);
Ontario Geological Survey, Miscellaneous Release--Data 160
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17

2,000 0 2,000

SCALE 1:85,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Terrain Map Units in the Terrestrial Local Study Area

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Aug. 2013	FIGURE: 4	
GIS	AL	Oct. 2013		
CHECK	DD	Oct. 2013		
REVIEW	CD	Oct. 2013		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Fig3_TerrainMapUnits_LSA.mxd

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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