APPENDIX L
WILDLIFE TECHNICAL SUPPORT DOCUMENT

IAMGOLD

amec

May 8, 2014

IAMGOLD CORPORATION

CÔTÉ GOLD PROJECT

ENVIRONMENTAL ASSESSMENT REPORT

TECHNICAL SUPPORT DOCUMENT: WILDLIFE

Version 2.0

Submitted to:
IAMGOLD Corporation
401 Bay Street, Suite 3200
Toronto, Ontario
M5H 2Y4

Uploaded via Buzzsaw

REVISED REPORT

Report Number: 13-1197-0003R2

Distribution:

1 e-copy - IAMGOLD Corporation
3 copies - Golder Associates Ltd.

Executive Summary

INTRODUCTION

IAMGOLD Corporation (IAMGOLD) is proposing to construct, operate and eventually reclaim a new open pit gold mine and transmission line 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. The Project, as discussed in this 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 wildlife.

METHODS

Spatial Boundaries

The study areas selected for the Project define spatial boundaries within which the effects of the Project on the wildlife 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 and Environmental Impact Statement 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 mine footprint to include the area around the footprint 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 footprint and extends to the south-west to include Chester Lake. The LSA is approximately 120 km^2.

Regional Study Area

The RSA is anticipated to be an appropriate spatial boundary for quantifying baseline conditions and assessing Project-specific effects on wildlife with small to medium-sized home ranges as well as larger ranging species (i.e., moose (*Alces alces*), black bear black bear (*Ursus americanus)* and eastern wolf eastern wolf (*Canis lupus lycaon*). The RSA is defined as a 30 km buffer from the boundary of the LSA (i.e., extends 32 km beyond the anticipated Mine Site footprint). The RSA is approximately 3,788 km^2. This area is likely large enough to contain all or most individuals that comprise the seasonal and annual populations of American marten (*Martes americana)*, beaver (*Castor canadensis)*, upland breeding birds, waterbirds and raptors that inhabit the area. The RSA is also expected to be large enough to assess the effects from the Project and other developments on most individuals comprising the populations of moose, black bear and wolf that form part of the larger metapopulation (regional populations connected by emigration and immigration). As changes to sub-populations can influence metapopulation persistence (Levins 1969; Hanski and Gilpin 1991; Hanski 1996), especially for these EAIs that can make long-distance movements, predicted effects from the Project and other developments in the RSA can be used to assess effects to the larger metapopulation.

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.

Effects to wildlife 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 wildlife 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 wildlife abundance and distribution, which provides confident and ecologically relevant effects predictions.

Effects Assessment Indicators

The wildlife assessment focuses on the species 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 section provides a summary of the proposed wildlife EAIs for the environmental assessment (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 wildlife EAIs.

Table E1: Summary of the Wildlife Effect Assessment Indicators and Measures

Effect Assessment Indicator	Measures
■ moose (*Alces alces*) ■ black bear (*Ursus americanus*) ■ eastern wolf (*Canis lupus lycaon*)	**Habitat State and Condition** ■ change in habitat quantity ■ change in habitat arrangement and connectivity (fragmentation)

Effect Assessment Indicator	Measures
■ American marten (*Martes americana*) ■ beaver (*Castor canadensis*) ■ upland breeding birds (includes Species at Risk) ■ waterbirds ■ raptors (includes Species at Risk) ■ Species at Risk: ▪ little brown bat (*Myotis lucifugus*) ▪ northern myotis (*Myotis septentrionalis*)	■ change in density of linear features ■ change in area of non-linear disturbances
	Habitat Occupancy and State ■ change in habitat quality ■ change in high use areas and features ■ change in occupancy, movement and behaviour
	Individuals ■ change in survival and reproduction
	Population State ■ change in abundance and distribution ■ change in current population trends (if known)

Table E2: Rationale for Selection of Wildlife Effect Assessment Indicators

Group	Effect Assessment Indicator	Rationale
ungulates	moose	Large home range size; important subsistence and cultural species; prey species for large carnivores.
furbearers	black bear	Large home range size; top predator in ecosystem; can be attracted to human disturbance; long generation time means several individuals may be affected by disturbance over multiple years resulting in potential regional population effects.
	eastern wolf	Large home range size; listed as a species of 'special concern' in Ontario and federally.
	American marten	Valued economic species. Mid-trophic level predator in boreal ecosystem.
	beaver	Beaver is a species which may be reactive to hydrological and vegetation changes, and has cultural value.
migratory birds	upland breeding birds	Small territory size means large numbers of upland birds may be affected by habitat loss; migratory birds are susceptible to population declines as a result of changing environmental conditions on breeding and overwintering habitats; some species are considered conservation priority species, listed as "special concern", or "threatened" in Ontario and "special concern" and "threatened" federally.
	waterbirds	May be affected by loss of shoreline habitat for breeding; important staging habitat may also be lost; can be sensitive to noise disturbance and human activity; some species are important for subsistence; some species are considered conservation priority species, and are listed as

Group	Effect Assessment Indicator	Rationale
		“special concern” in Ontario and federally.
	raptors	Breeding habitat is limited; sensitive to noise disturbance and human activity during nesting; some species are considered conservation priority species, listed as “special concern” or “endangered” in Ontario and “special concern” federally.
Species at Risk	little brown bat	Listed as “endangered” in Ontario because of population declines due to white nose syndrome.
	northern myotis	Listed as “endangered” in Ontario because of population declines due to white nose syndrome.

Snapping turtle (*Chelydra serpentina*) was initially considered an EAI but was removed because there are no historical reported observations of this species in the regional study area (RSA) (Natural Heritage Information Centre 2013).

Prediction of Effects

Project Interactions with Wildlife

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

- clearing and preparation;
- open pit mining activities including new open pit mine and associated dewatering;
- overburden and mine rock management;
- ore processing 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 roads and related infrastructure;
- watercourse realignments;
- water taking; and

- effluent discharge.

Residual Effects

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

- direct habitat loss/alteration and fragmentation from the physical footprint of the Mine Site and access road can affect wildlife abundance and distribution;
- habitat loss/alteration and fragmentation from the transmission line can affect wildlife connectivity, abundance and distribution; and
- sensory disturbance (e.g., noise, dust, lights, smells, human presence) can decrease habitat quality, and alter movement and behaviour.

Decreases in habitat area can directly influence wildlife population sizes 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 of the existing landscape. Fragmentation can influence several ecological processes including movement between foraging areas and predation along habitat edges. In addition to direct habitat effects, wildlife habitat quality may change in the vicinity of the Project. Local-scale habitat quality may be affected by sensory disturbance (e.g., light, noise, presence of humans).

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 wildlife populations 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 wildlife EAIs. Direct habitat effects (e.g., changes to habitat amount and fragmentation) to wildlife 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). An assessment of effects from changes in habitat state and condition was based on the calculation of the amount of potential suitable habitat altered or lost for EAI populations in the RSA. Potential suitable habitat is defined as habitat that provides foraging, protection from predators (or other potential limiting factors) and resting elements.

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 predicted to exist prior to 1942. The existing conditions case includes all previous, existing and approved 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

It is recognised that local-scale habitat quality for wildlife EAIs may be affected by sensory disturbance from the Project (e.g., light, noise, presence of humans). The predicted effects from changes in habitat quality due to sensory disturbance from the Project on EAIs were qualitatively assessed by reviewing existing scientific literature and government publications.

Residual Effects Summary

Ungulates: Moose

Suitable potential summer habitat for moose was determined to be dense mixed forest, dense deciduous forest, regenerating, treed bog, treed fen, and wetland habitats. Potential suitable winter habitat was determined to be dense coniferous and dense mixed forest.

Previous and existing developments have removed 10.3% and 11.2% of potential suitable summer and winter habitats for moose, respectively, relative to reference conditions. The Project is anticipated to remove 0.4% and 0.6% of summer and winter moose habitat, respectively, relative to 2012 baseline conditions.

Forestry is expected to have a larger influence on the moose population 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 1837, 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 ha) and dense mixed forest (46.5% of harvested area; 7,653 ha) habitats. Regenerating dense coniferous and dense mixed forest habitats are not likely to have a high abundance of deciduous browse, which is suitable for moose, especially as most silvicultural applications select for coniferous species (e.g., by thinning deciduous tree species). As such, regenerating coniferous and mixed forest habitats are not anticipated to be suitable for moose until these habitats reach a more mature forest stage. Regenerating deciduous forest may provide summer habitat for moose.

Habitat quality and quantity are probably not limiting for the moose population in the RSA. Moose have flexible habitat requirements and some types of human disturbance (e.g., regenerating clearcuts in deciduous forest habitat) can create moderate to high quality habitat (Allen et al. 1987; Maier et al. 2005). Generally, species are limited by habitat loss more than 40% of preferred habitats are removed from an area (e.g., RSA) (Andrén 1994, 1999; Fahrig 1997; Flather and Bevers 2002; Swift and Hannon 2010). Loss of potential suitable summer and winter habitats for moose in the RSA, from previous and existing developments and the Project, is 10.9% and 11.5%.

Sensory disturbance associated with human activities such as forestry operations and mineral exploration has occurred in the RSA since 1800. As such, the moose population in the RSA is expected to have adapted to human-related sensory disturbance. The Project is predicted to result in a minor and local change in the occupancy and distribution of moose. Benitez-Lopez et al. (2010) found that large mammal abundance was lower within 5 km of human infrastructure. Additionally, the change in fragmentation for important moose habitats and linear disturbance density within the RSA from reference to application conditions will be negligible.

Moose populations are most vulnerable to changes in hunter-related or predation mortality (Patterson et al. 2013; McNay et al. 2013). Moose populations in northeastern Ontario are increasing (Rodgers 2007).

In summary, sensory disturbance during construction, operation and active reclamation is expected to result in measurable changes to the occupancy of habitat by moose near the Mine Site as large mammals have been found to have lower abundance within 5 km of human developments (Benitez-Lopez et al. 2010). There will likely be measurable changes in the movement and behaviour of moose during construction and operation of the Mine Site and transmission line (e.g., by avoidance or increased use), but effects should be partially reversible at the end of closure. Although the MRA will be partially vegetated during early post-closure, full reclamation of this structure is not anticipated to occur within the temporal boundaries of the Project assessment. Effects from habitat loss and fragmentation are expected to be partially reversible with a duration of greater than 15 years after Project closure. However, the local changes in habitat quantity and quality from the Project are anticipated to have no measurable effect on the abundance and distribution of the moose population.

Effects from previous and existing human developments and the Project are expected to be measurable but within the predicted adaptive capacity and resilience limits of this species. Forestry likely explains most of the regional effects to the population, while the Project and other types of human development are expected to have no to little measurable residual effect on the moose population. The moose population in Ontario is increasing, and there should be sufficient undisturbed habitat in the RSA for a self-sustaining population.

Furbearers: Black Bear, Eastern Wolf, American Marten, and Beaver

Potential suitable habitats for eastern wolf were determined to be dense coniferous forest, dense mixed forest, dense deciduous forest, regenerating, treed bog, treed fen, and wetland habitats. Suitable habitats for black bear were determined to be dense deciduous forest, dense mixed forest, regenerating, wetland, and sparse forest habitats. Potential suitable habitat for American marten in the RSA was considered to be dense coniferous forest, dense mixed forest, dense deciduous forest, treed bog, and treed fen habitats. Suitable habitats for beaver within the RSA were determined as dense deciduous forest, dense mixed forest, and regenerating habitats that were within 200 m of wetlands and other water bodies.

Previous and existing developments have removed 10.3%, 10.2%, 10.7%, and 1.9% of potential suitable habitat for eastern wolf, black bear, American marten, and beaver in the RSA, respectively, relative to reference conditions. The Project is predicted to remove between 0.4% and 0.6% of potential suitable wolf, bear, marten, and beaver habitat in the RSA, relative to 2012 baseline conditions.

Forestry is expected to have a larger influence on the wolf and black bear 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 1837, 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 ha) and dense mixed forest (46.5% of harvested area; 7,653 ha) habitats. Regenerating dense coniferous and dense mixed forest habitats are not likely to have a high abundance of deciduous browse, which is suitable for moose (which is a key prey species for wolves and bears), especially as most silvicultural applications select for coniferous species (e.g., by thinning deciduous tree species). As such, regenerating coniferous and mixed forest habitats are not anticipated to be suitable for eastern wolf and black bear until these habitats reach a more mature forest stage. Regenerating deciduous forest may provide summer habitat for wolf (because of prey densities) and black bear (because of prey and other food resources such as berries).

Previous and existing developments have not likely adversely affected marten habitat in the RSA. Forests 30 to 60 years old were found to be capable of supporting self-sustaining marten populations, although densities may be lower and there is a higher risk of population decline due to chance events than populations in forests greater than 60 years of age (Fryxell et al. 2008). Regenerating forests that are younger than 30 years may also be used by marten (e.g., for foraging) (Andruskiw et al. 2008; Mergey et al. 2011; Caryl et al. 2012). Marten are not likely not limited by habitat loss and fragmentation until it covers 20% to 40% of an area (e.g., RSA) (Chapin et al. 1998, Hargis et al. 1999, Potvin et al. 2000). Human development, including forestry operations, currently covers 9.5% of the RSA.

Sensory disturbance associated with human activities such as forestry operations and mineral exploration has occurred in the RSA since 1800. As such, the wolf and bear populations in the RSA are expected to have adapted to human-related sensory disturbance. The Project is predicted to result in a minor and local change in the occupancy and distribution of these wildlife EAIs. Benitez-Lopez et al. (2010) found that large mammal abundance was lower within 5 km of human infrastructure. Additionally, the change in fragmentation for important wolf and bear habitats and linear disturbance density within the RSA from reference to application conditions will be negligible.

The effects of sensory disturbance on marten are unclear. Some studies suggest that detection rates decrease with increasing levels of disturbance from roads, seismic lines, and pipelines (Moses et al. 2002). Alternately, a study by Zielinski et al. (2008) in California showed that there was no effect from off-highway vehicle use on habitat occupancy or probability of detection of marten. Construction and operation of the Project is predicted to have a minor influence on the local abundance of marten.

Literature is not available for the effects of sensory disturbance on beavers. Sensory disturbance could result in local changes to the movement and behaviour, and habitat occupancy of individuals. Human activities such as forestry operations and mineral exploration has occurred in the RSA since 1800, and the beaver population is expected to have adapted to human-related sensory disturbance.

Wolf and bear populations are most vulnerable to changes in hunter-related mortality (Howe et al. 2001; Ontario Ministry of Natural Resources [MNR] 2005; MNR 2009). Although long-term trends for the black bear population in Ontario are unknown, there are estimated to be 75,000 to 100,000 individuals in Ontario (MNR 2009). Wolf populations are likely increasing or stable (MNR 2005). At a local level marten populations are linked to small mammal abundance (Zalewski et al. 1995; Jensen et al. 2012), while at a larger spatial scale marten are limited by harvest mortality (Fryxell et al. 1999; Helldin 2000; Fryxell et al. 2008). There has not been a decline in marten harvest throughout Ontario, which suggests that marten populations are stable (Novak et al. 1987). Beaver populations were almost eradicated in Ontario before 1900 but control of harvesting and good habitat conditions throughout the province have contributed to large beaver populations in Ontario (Ontario Fur Managers Federation 2012).

To summarize, measurable changes in the movement and behaviour of wolf, bear, marten, and beaver are predicted near the Mine Site as small and large mammals were found to have lower abundances with 1 km and 5 km of human developments, respectively (Benitez-Lopez et al. 2010). Local effects are anticipated to continue from construction through closure of the Mine Site and throughout the life of the transmission line, but should be partially reversible at the end of closure. Post-closure and rehabilitation timelines are expected to result in a long-term decrease in habitat for wolf, bear, and marten in the LSA, but these local changes in abundance and distribution should not be measurable at the population level. The MRA will be partially vegetated during early post-closure but full reclamation of this structure is not anticipated to occur within the temporal boundaries of the Project assessment. Effects from habitat loss and fragmentation are expected to be partially reversible with a duration of greater than 15 years after Project closure.

Effects from the Project and previous and existing developments on black bear and eastern wolf populations are predicted to be measurable but within the predicted adaptive capability and resilience limits for these EAIs. Previous and existing human developments, including forestry operations, and the Project are anticipated to have no measureable effect on the abundance and distribution of American marten and beaver populations in the RSA. Forestry likely explains most of the regional effects to populations, while the Project and other types of human development are expected to have no measurable residual effect on wolf and black bear populations. Current forest practices retain riparian buffers around most water bodies and there is anticipated to be sufficient undisturbed habitat in the RSA for all furbearer EAIs as other human developments cover 2.1% of the RSA. Populations are believed to be increasing or stable; as such, and given the small footprint of the Project relative to the RSA, there should be sufficient undisturbed habitat to sustain existing populations of black bear, wolf, marten and beaver.

Upland Migratory Birds

Nine upland breeding bird species with breeding ranges that overlap the RSA are currently listed or recommended to be listed under provincial or federal legislation. Bobolink (*Dolichonyx oryzivorus*) and eastern meadowlark (*Sturnella magna*) are protected under the *Endangered Species Act* (2007). Chimney swift (*Chaetura pelagica*), Canada warbler (*Cardellina canadensis*), common nighthawk (*Chordeiles minor*), olive-sided flycatcher (*Contopus borealis*), and whip-poor-will (*Caprimulgus vociferous*) are species that are protected provincially under the *Endangered Species Act* (2007) and federally under Schedule 1 of the *Species at Risk Act* (2012). Rusty blackbird (*Euphagus carolinus*) is protected under Schedule 1 of the SARA. Although barn swallow (*Hirundo rustica*) is not currently protected under provincial or federal legislation, it has been recommended by the Committee on the Status of Endangered Wildlife in Canada (2013) to be listed as Threatened under the *Species at Risk Act* (2013).

Bobolink and eastern meadowlark nest in open areas such as grasslands, hay fields, alfalfa fields, and pastures (Martin and Gavin 1995; Jaster et al. 2012). Although barn swallows historically nested in caves and hollow trees, they currently primarily breed on human-made structures that are close to open meadows and fields (Brown and Bomberger Brown 1999). There was no agricultural land identified by the ELC in the RSA. As such, bobolink, eastern meadowlark, and barn swallow are considered to have a low potential for occurrence in the RSA and Project-related changes to habitat loss, alteration, and fragmentation to these species are anticipated to be negligible.

Chimney swifts nest in chimneys and natural habitat features, such as caves and hollows trees (Cink and Collins 2002), which cannot be determined from the Land Cover Data Base (MNR 2000). However, changes to chimney swift habitat from the Project are anticipated to be negligible because forestry operations are likely the limiting factor for providing suitable natural nesting habitat (i.e., hollow trees) (Natural Heritage Information Centre 2013).

Whip-poor-will and common nighthawk are nightjar species that require similar habitat for nesting. Whip-poor-wills were heard at two locations during whip-poor-will and common nighthawk surveys in 2012. No common nighthawks were recorded during the surveys. Survey sites where the whip-poor-wills were heard were located in dense coniferous forest. However, the birds were heard greater than 50 m from observers and so habitat may be different where the whip-poor-wills were located. Potential suitable habitat for common nighthawk and whip-poor-will (nightjars) was considered to exist in sparse forest habitat. There has been a 9.5% decrease in potential suitable habitat for nightjars from reference to 2012 baseline conditions. The Project is predicted to remove 0.5% of potential suitable habitat for nightjars, relative to 2012 baseline conditions. Human developments (including the Project) in the RSA have removed 10.0% of potential suitable nightjar habitat, relative to reference conditions.

Potential suitable habitat for olive-sided flycatcher was considered to be sparse forest, recent logged, and recent burn habitat. Approximately 6.6% of the RSA was comprised of potential suitable olive-sided flycatcher habitat, under reference conditions. There has been a 2.7% decrease in the amount of olive-sided flycatcher habitat from reference to baseline conditions. The Project is predicted to remove 0.6% of potential suitable olive-sided flycatcher habitat in the RSA. There is anticipated to be a 3.3% decrease in olive-sided flycatcher habitat in the RSA from reference to application conditions.

Data from baseline upland breeding bird surveys shows that Canada warbler had the highest density in recent logged/regenerating habitat, followed by dense mixed forest; Canada warblers were not recorded in other habitat types. Potential suitable Canada warbler habitat was considered to be dense mixed forest, dense deciduous forest, dense coniferous forest, treed bog, treed fen, and regenerating habitats. Previous and existing developments have removed 10.7% of potential suitable Canada warbler habitat. The Project is predicted to remove 0.4% of potential suitable Canada warbler habitat in the RSA. There is predicted to be an 11.1% decrease in potential Canada warbler habitat from reference to application conditions.

No rusty blackbirds were observed during upland breeding bird surveys but this species was recorded during general wildlife surveys at the Mine Site and during wetland surveys in the LSA. Potential suitable rusty blackbird habitat (i.e., treed bog, treed fen, and wetland) covered 4.1% of the RSA under reference conditions. Previous and existing developments have removed 9.7% of potential rusty blackbird habitat in the RSA. The Project is predicted to remove 1.5% of potential rusty blackbird habitat, relative to 2012 baseline conditions.

Human developments in the RSA, including the Project, are anticipated to have removed 11.2% of potential rusty blackbird habitat, relative to reference conditions.

Forestry is expected to have a larger influence on the upland breeding bird populations in the RSA than other human developments including the Project. Non-forestry related human activities have disturbed about 2.1% of the RSA since reference conditions, while recent harvested areas (less than 18 years old) currently cover 7.4% of the RSA. Forest harvesting operations have occurred in the RSA since 1837, 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 ha) and dense mixed forest (46.5% of harvested area; 7,653 ha) habitats but treed bog (679 ha), dense deciduous forest (370 ha), and sparse forest (165 ha) habitats have also be harvested. The Canada warbler population in the RSA may be negatively affected by the loss of dense mixed forest, dense coniferous forest, dense deciduous forest, and treed bog habitats. The loss of sparse forest may have negatively affected the nightjar populations, while the loss of treed bog may have negatively affected the rusty blackbird population.

Logging operations are likely to have a positive influence on the olive-sided flycatcher population in the RSA as this species has been found to be more abundant in areas with clear cuts (Altman and Sallabanks 2012). Similarly, recent harvested areas may provide suitable secondary habitat for nightjars (Cink 2002; Brigham et al. 2011). Regenerating clearcuts may provide suitable habitat for Canada warbler (Reitsma et al. 2010).

Habitat loss and fragmentation in the RSA is below the thresholds (e.g., 40% habitat loss) identified for highly mobile species (such as most birds) (With and Crist 1995; Flather and Bevers 2002; Swift and Hannon 2010). As such, habitat for listed upland breeding bird species in the RSA is not considered to be limiting to these species' populations.

Few studies have focused on the effects of noise and disturbance to upland bird behaviour and movement. Behaviours most likely to be affected are nest site selection, territory selection, mate attraction, and foraging. Noise may also inhibit predator detection and interfere with mate/chick communication (Habib et al. 2007). Many boreal upland breeding bird species have lower abundance in noisy areas than pristine areas (Habib et al. 2007; Bayne et al. 2008). According to Trombulak and Frissell (2000), disturbances such as roads have the potential to change the reproductive success of wildlife species. Habib et al. (2007) found that pairing success of ovenbirds (*Seiurus aurocapilla*) was significantly lower in areas near compressor stations. Conversely, a study by Canaday and Rivadeneyra (2001) found noise to be a disturbance to birds over distances less than 300 m. A study of Lapland longspurs by Male and Nol (2005) showed no difference in nest success between sites with high and low levels of human noise at the Ekati Diamond Mine. Overall, it appears that some bird species may benefit from human disturbance while others do not (Spellerberg and Morrison 1998).

Bird populations in the RSA are likely to have adapted to human-related sensory disturbance because human activities including forestry and mineral exploration have been carried out in the RSA since 1800. Also, changes in habitat quality from sensory disturbance do not necessarily result in demographic consequences to populations (Gill et al. 2001). Most of the effects from indirect changes in habitat quality may be related to a local shift in distribution with little influence on survival and reproduction rates.

Common nighthawk populations in Ontario have been declining dramatically in recent years with annual declines in Ontario of 11% between 1981 and 2005 (Cadman et al. 2007). Whip-poor-will has also experienced substantial population declines in Ontario since the mid-20th century. Chimney swifts have declined by 8.9% per year between 1968 and 2005. Chimney swifts are most commonly found in southern Ontario. Although the olive-sided flycatcher population in Ontario has declined by 13.9% per year since 1981, this species has been found to respond positively to a variety of forest harvest regimes. The RSA is located in an area that supports a low to moderate abundance of olive-sided flycatchers. The Canada warbler population in Ontario has not appeared to have declined between 1981 and 2005. The RSA is located in an area that contains a moderate abundance of Canada warblers. The probability of observation for rusty blackbird in the northern shield region of Ontario decreased by 32% between the first breeding bird atlas (1981 to 1985) and the second atlas (2001 to 2005). The highest densities of rusty blackbirds in Ontario are found in the Hudson Bay Lowlands; no rusty blackbirds were recorded in the area surrounding the RSA during the second breeding bird atlas (2001 to 2005). Rusty blackbirds are not likely to have a high probability of detection during the atlas surveys because rusty blackbirds are typically associated with wetland edge habitat and rarely enter the forest interior (Avery 2013).

In summary, measurable changes in the movement and behaviour of listed and non-listed upland breeding birds are predicted near the Project as bird abundances were found to generally be lower within 1 km of human developments (Benitez-Lopez et al. 2010). Local effects are expected to continue from construction through closure of the Mine Site. The transmission line will likely result in localized changes in habitat quality during construction, and may influence some populations throughout operation as songbirds can be hesitant to move through more open and higher risk habitats (Swift and Hannon 2010). Effects from sensory disturbance are expected to be partially reversible at the end of closure. Non-reclaimed areas (e.g., MRA) on the Mine Site are expected to result in a permanent decrease in habitat, but these local changes in abundance and distribution are anticipated to have no measurable effect on listed and unlisted upland breeding bird populations. Effects from habitat loss and fragmentation are expected to be partially reversible with a duration of greater than 15 years after Project closure.

The Project, forestry operations, and other developments in the RSA are anticipated to have no to little measurable effect (olive-sided flycatcher) or measurable effects that are within the adaptive capability and resilience limits (Canada warbler, rusty blackbird, nightjars) on the abundance and distribution of listed upland breeding bird species' populations. Recent harvested areas may have a positive influence on olive-sided flycatchers and provide suitable habitat for nightjars. Although harvesting operations have mostly removed dense mixed and dense coniferous forest habitat, these are the most common habitat types in the RSA and effects to species that rely on these habitats are anticipated to be small.

Waterbirds

Breeding habitat for waterbirds was considered to be wetlands, treed fen within 200 m of wetlands and water bodies, and shorelines of large lakes (100 m buffer). Previous and existing developments have removed 12.0% of waterbird habitat, relative to reference conditions. The Project is predicted to remove 0.8% of waterbird habitat.

Few studies have focused on the effects of noise and disturbance to waterbird behaviour and movement. However, some studies have found that noise and motion disturbances originating from man-made sources can negatively affect waterbird behaviour (Korschgren et al. 1985; Ward and Stein 1989; Dahlgren and Korschgren 1992). Disturbance effects on waterbirds may include displacement, nest abandonment, reduced nest success, or reduced foraging efficiency (Hockin et al. 1992; Dahlgren and Korschgren 1992). Some types of noise can startle or disturb nesting birds. Other studies have found that several waterbird species may eventually become habituated to high noise levels (Busnel and Briot 1980; Ronconi et al. 2004).

Although noise and sensory disturbance can alter the movement and behaviour of waterbirds (Bommer and Bruce 1996), the specific effects of disturbance-related sensory disturbance on many species of waterbirds are unknown. Loons are relatively sensitive to human disturbance (Ehrlich et al. 1988). Alternately, analysis of information collected at the Ekati Diamond Mine suggested that the level of mining activities had not negatively influenced the presence of loons adjacent to the mine site (BHP Billiton Diamonds Inc. 2003). Minimum distance recommendations to reduce the effects to waterbird behaviour from man-made noise are 200 m to 300 m for traffic disturbance (Fruzinski 1977; Mooij 1982; Madsen 1985).

Waterbirds may also use the TMF reclaim pond for staging and roosting during spring and fall migrations, and for roosting and foraging during the breeding season. Waterbirds are not anticipated to breed on the TMF reclaim pond because there is expected to be a high level of human activity and little to no vegetation cover around the reclaim pond. The use of the TMF reclaim pond by waterbirds will be monitored and deterrent measures (e.g., noise making devices) will be implemented if waterbirds are observed to frequently use the reclaim pond.

In summary, measurable changes in the movement and behaviour of waterbirds may occur near the Project as bird abundance can be influenced within 1 km of developments (Benitez-Lopez et al. 2010). Effects are anticipated to continue from construction through closure of the Mine Site, and be partially reversible at the end of closure. The transmission line will likely result in localized changes in habitat quality during construction, but have no measurable influence on movement and behaviour of waterbirds during operation. Eventually, waterbirds may use the refilled open pit as a staging or roosting area. Project effects are expected to be partially reversible with a duration of greater than 15 years after closure. Overall, local changes in abundance and distribution of waterbird populations from the Project are anticipated to have no measurable effect on waterbird populations in the RSA.

The Project, forestry, and other human developments are predicted to have no measurable effect on the abundance and distribution of waterbird populations in the RSA. Current forest practices retain riparian buffers around most water bodies and there is anticipated to be sufficient undisturbed habitat in the RSA as other human developments cover 2.1% of the RSA. Waterbird population estimates for eastern Canada in 2013 were higher than the long-term average (1990 to 2012) (Zimpfer et al. 2013).

Raptors

The majority of raptor species in northern Ontario nest in large trees, which are typically found in mature upland forest habitats (e.g., dense coniferous forest, dense deciduous forest, dense mixed forest, and sparse forest) (Kirk 2003). One exception is short-eared owl (*Asio flammeus*), which typically nests in open areas such as open bog habitat (potential suitable short-eared owl habitat) (Wiggins et al. 2006). Potential suitable tree-nesting raptor habitat was considered to be dense coniferous forest, dense deciduous forest, dense mixed forest, and sparse forest. Other habitat features, such as cliffs, may also be selected by raptors for nesting but these habitats are uncommon within the LSA. One bald eagle nest was located in the LSA during baseline studies. The nest is approximately 150 m from the expected MRA and 400 m from the anticipated open pit. In an effort to mitigate and manage effects to this nest site, IAMGOLD will follow the guidelines provided by MNR in the document titled Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (MNR

2010). However, if the nest site needs to be removed because of operational constraints, IAMGOLD will consult with the MNR for guidance on how best to proceed..

Previous and existing developments have removed 10.7% of potential suitable tree-nesting raptor habitat in the RSA, relative to reference conditions. Approximately 18.7% of potential suitable short-eared owl habitat in the RSA has been removed by previous and existing developments. The Project is predicted to remove 0.4% of potential suitable tree-nesting raptor habitat, relative to 2012 baseline conditions. The Project is not predicted to remove any potential suitable short-eared owl habitat.

Forestry operations are expected to have more of an influence on raptor habitat quantity and quality than other human developments because recent logged habitat covers approximately 3.5 times more area in the RSA than other human developments. Although some raptor species and individuals may avoid areas with human activities, many species (including peregrine falcon [*Falco peregrinus*], which is a species at risk in Ontario) are able to habituate to human disturbance. The abundance of raptors observed near the Project during baseline surveys was low, which is likely due to natural limited availability of quality nesting habitat in the LSA.

In summary, there will likely be measurable changes to the occupancy of habitat by raptors near the Mine Site (Benitez-Lopez et al. 2010). The transmission line will likely result in localized changes in habitat quality during construction, but have little measurable influence on the movement and behaviour of raptors during operation. Sensory disturbance effects should be partially reversible at the end of closure. The residual footprint from the Project is predicted to cause a long-term decrease in potential suitable habitat within the LSA. Eventually, refilling of the open pit may attract waterbirds, and increase local prey abundance for some raptors (e.g., peregrine falcon and bald eagle [*Haliaeetus leucocephalus*]). Project effects are expected to be partially reversible with a duration of greater than 15 years after closure. Overall, the local changes in habitat quantity and quality from the Project are anticipated to have no measurable effect on the abundance and distribution of raptor populations in the RSA.

Effects from the Project and previous and existing developments on raptor populations are predicted to be of measurable but within the adaptive capability and resilience limits for species. Most of the regional effect to populations can be attributed to forestry activities, while the Project and other types of human development are expected to have no to little measurable effect on raptor populations. Forestry operations may have had a positive effect on the short-eared owl population by providing suitable nesting habitat.

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

During the summer, bats occupy a variety of day and night roosts including buildings, caves, and trees (Caceres and Barclay 2000). These habitat features cannot be determined from the Land Cover Data Base but suitable habitat was considered to be present in dense coniferous forest, dense deciduous forest, dense mixed forest, and sparse forest habitats. Previous and existing developments have removed 10.7% of potential suitable bat habitat, relative to reference conditions. The Project is anticipated to remove 0.4% of potential bat habitat.

Habitat quality and quantity are probably not limiting for bat populations in the RSA. White nose syndrome is considered to be the primary cause of bat population declines in Ontario. Although no numbers are available for Ontario, white nose syndrome has killed more than five million bats in the northeastern United States since 2006 (MNR 2012).

Local effects on bat abundance and distribution are anticipated to be measurable near the Project as small mammal and bird abundances have been found to be lower within 1 km of human developments (Benitez-Lopez et al. 2010). However, these local effects are expected to have no measurable effect at the population level. Local changes in bat habitat and occupancy near the Project are likely to occur from construction through closure, but effects are expected to be partially reversible at the end of closure. Localized changes in movement and behaviour could also occur during construction of the transmission line, but should not be measurable during operation. Changes in habitat quantity and quality from the Project are expected to have no measurable effect on the abundance and distribution of bat populations. The Project and other human disturbance (including forestry) are anticipated to have no measurable effect on bat populations in the RSA.

Effects to other listed species such as eastern wolf, upland breeding birds, and raptors have been assessed above.

Table of Contents

TABLES

FIGURES

GRAPHICS

ATTACHMENTS

GLOSSARY AND ABBREVIATIONS

the Agency	Canadian Environmental Assessment Agency
AAQC	Ambient Air Quality Criteria
AFRI	Assessment File Database
AMEC	AMEC Environment & Infrastructure
BMP	Best Management Practices
CCME	Canadian Council of Ministers of the Environment
cm	centimetres
CNFDB	Canadian National Fire Database
CO	carbon dioxide
COPC	chemicals of potential concern
COSSARO	Committee on the Status of Species at Risk in Ontario
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
dBA	A-weighted decibels
EA	environmental assessment
EAI	effects assessment indicator
EIS	Environmental Impact Statement
ELC	Ecological Landscape Classification
ESA	*Endangered Species Act*
FRI	Forest Resource Inventory
GIS	Geographic Information System
ha	hectare
LSA	Local Study Area
km	kilometre
km^2	square kilometres
km/h	kilometres per hour
kV	kilovolt
m	metre
m^3	cubic metres
m^3/yr	cubic metres per year
m^3/d	cubic metres per day
m^3/s	cubic metres per second
MBCA	*Migratory Birds Convention Act*
mg/kg	milligrams per kilogram

MMER	Metal Mining Effluent Regulations
MNDM	Ministry of Northern Development and Mines
MNR	Ministry of Natural Resources
MOE	Ministry of the Environment
MRA	Mine Rock Area
NHIC	Natural Heritage Information Centre
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
SO_x	sulphur oxide
ToR	Terms of Reference
TMF	Tailings Management Facility
TSD	Technical Support Document
TSP	total suspended particulates

COMMON AND SCIENTIFIC NAMES

Common Name	Scientific Name
American marten	*Martes americana*
bald eagle	*Haliaeetus leucocephalus*
barn swallow	*Hirundo rustica*
beaver	*Castor canadensis*
black bear	*Ursus americanus*
bobolink	*Dolichonyx oryzivorus*
Canada warbler	*Cardellina canadensis*
chimney swift	*Chaetura pelagica*
common nighthawk	*Chordeiles minor*
eastern wolf	*Canis lupus lycaon*
meadowlark	*Sturnella magna*
moose	*Alces alces*
olive-sided flycatcher	*Contopus borealis*
peregrine falcon	*Falco peregrinus*
short-eared owl	*Asio flammeus*
snapping turtle	*Chelydra serpentina*
whip-poor-will	*Caprimulgus vociferous*

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 wildlife 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 wildlife studies completed between April 2012 and July 2013 (Appendix I). The scope of the wildlife component includes the characterization of existing terrestrial biological conditions and potential effects to wildlife populations that could occur from construction, operation and closure of the Project. 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 Mine 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 the Mine Site mineral waste handling facilities, including the TMF dams; and
- construction and energizing of a 230 kilovolt (kV) feeder transmission line including the Mine 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 Mine 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 Project operations phase, overburden, mine rock and ore will be extracted from the pit for stockpiling or the ore will be 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 doré bars for periodic transportation by road off the Mine Site by secure means. 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 to ensure 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 Mine Site reclamation, where practical.

1.1.3 Closure and Post-Closure Phase

Closure of the Côté Gold 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 2013). The terms naturalized and productive are interpreted to mean a rehabilitated Mine 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 employed 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 the Mine Site landfill;
- revegetation of the stockpiles, TMF, roads and the Mine Site landfill.

1.2 Wildlife

The purpose of the wildlife section is to describe the terrestrial environment that may be affected by the Project and to assess the effects to wildlife Effects Assessment Indicators (EAIs). The scope of the wildlife section includes an analysis of Project-related effects during construction, operations, closure and post-closure. To provide more confident and ecologically relevant predictions, Project effects on wildlife 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 the wildlife 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 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 indicators (EAI; Section 2.3) and extends beyond the footprint provided by AMEC (pers. comm.) to include the area around the footprint where immediate direct and indirect effects are likely to occur on surrounding soil, vegetation and wildlife. The LSA encompasses a 2 km buffer around the footprint and extends to the south-west to include Chester Lake (Figure 2-1). The LSA is approximately 120 km^2.

2.1.2 Regional Study Area

The RSA is anticipated to be an appropriate spatial boundary for quantifying baseline conditions and assessing Project-specific effects on wildlife with small to medium-sized home ranges as well as larger ranging species (i.e., moose [*Alces americanus*], black bear [*Ursus americanus]* and eastern wolf [*Canis lupus lycacon]*). The RSA is defined as a 30 km buffer from the boundary of the LSA (i.e., extends 32 km beyond the expected Mine Site footprint) (Figure 2-1). The RSA is approximately 3,788 km^2. This area is likely large enough to contain all or most individuals that comprise the seasonal and annual populations of American marten, beaver, upland breeding birds, waterbirds and raptors that inhabit the area. The RSA is also expected to be large enough to assess the effects from the Project and other developments on most individuals comprising the populations of moose, black bear and eastern wolf that form part of the larger metapopulation (regional populations connected by emigration and immigration). As changes to populations can influence metapopulation persistence (Levins 1969; Hanski and Gilpin 1991; Hanski 1996), especially for these EAIs that can make long-distance movements, predicted effects from the Project and other developments in the RSA can be used to assess effects to the larger metapopulation.

2.2 Temporal Boundaries

The temporal boundaries of the EA will span all phases of the Project:

- construction: 2 years;
- operations: 15 years;
- closure: 2 years; and
- post-closure: 50 to 80 years.

Effects to wildlife 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 wildlife are analyzed and 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 wildlife abundance and distribution, which provides confident and ecologically relevant effects predictions.

2.3 Selection of Effects Assessment Indicators

The wildlife 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 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 wildlife EAIs (Table 2-1), including the rationale for selection of EAIs (Table 2-2). Changes in measures (Table 2-1) are used to predict effects to the abundance and distribution of wildlife EAIs.

Snapping turtle was initially considered an EAI but was removed because there are no historical reported observations of this species in the RSA (Natural Heritage Information Centre [NHIC] 2013).

Table 2-1: Summary of the Wildlife Effect Assessment Indicators and Measures

Effect Assessment Indicator	Measures
■ moose (*Alces alces*) ■ black bear (*Ursus americanus*) ■ eastern wolf (*Canis lupus lycacon*) ■ American marten (*Martes americana*) ■ beaver (*Castor candensis*) ■ upland breeding birds (including Species at Risk) ■ waterbirds	**<u>Habitat State and Condition</u>** ■ change in habitat quantity ■ change in habitat arrangement and connectivity (fragmentation) ■ change in density of linear features ■ change in area of non-linear disturbances
	<u>Habitat Occupancy and State</u> ■ change in habitat quality ■ change in high use areas and features ■ change in occupancy, movement and

Effect Assessment Indicator	Measures
■ raptors (including Species at Risk) ■ Species at Risk ▪ little brown bat (*Myotis lucifugus*) ▪ northern myotis (*Myotis septentrionalis*)	behaviour **Individuals** ■ change in survival and reproduction **Population State** ■ change in abundance and distribution ■ change in current population trends (if known)

Table 2-2: Rationale for Selection of Wildlife Effect Assessment Indicators

Group	Effect Assessment Indicator	Rationale for Selection
ungulates	moose	Large home range size; important subsistence and cultural species; prey species for large carnivores.
furbearers	black bear	Large home range size; top predator in ecosystem; can be attracted to human disturbance; long generation time means several individuals may be affected by disturbance over multiple years resulting in potential regional population effects.
	eastern wolf	Large home range size; listed as a species of 'special concern' in Ontario and federally.
	American marten	Valued economic species. Mid-trophic level predator in boreal ecosystem.
	beaver	Beaver is a species which may be reactive to hydrological and vegetation changes, and has cultural value.
migratory birds	upland breeding birds	Small territory size means large numbers of upland birds may be affected by habitat loss; migratory birds are susceptible to population declines as a result of changing environmental conditions on breeding and overwintering habitats; some species are considered conservation priority species, listed as "special concern", or "threatened" in Ontario and "special concern" and "threatened" federally.
	waterbirds	May be affected by loss of shoreline habitat for breeding; important staging habitat may also be lost; can be sensitive to noise disturbance and human activity; some species are important for subsistence; some species are considered conservation priority species, and are listed as "special concern" in Ontario and federally.
	raptors	Breeding habitat is limited; sensitive to noise disturbance and human activity during nesting; some species are considered conservation priority species, listed as "special

Group	Effect Assessment Indicator	Rationale for Selection
		concern" or "endangered" in Ontario and "special concern" federally.
Species at Risk	little brown bat	Listed as "endangered" in Ontario because of population declines due to white nose syndrome.
	northern myotis	Listed as "endangered" in Ontario because of population declines due to white nose syndrome

2.4 Prediction of Potential Effects and Mitigation Measures

Mine 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 wildlife EAIs (Table 2-3). The primary Project components and associated activities that could potentially affect wildlife include:

- clearing and preparation;
- open pit mining activities including new open pit mine and associated dewatering;
- overburden and mine rock management;
- ore processing 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;
- the Mine Site power supply and power infrastructure (including temporary diesel generation);
- the Mine Site roads and related infrastructure;
- watercourse realignments;
- water taking; and
- effluent discharge.

Although Project designs include the incorporation of Best Management Practices (BMPs) and other mitigation policies and practices during all phases of the Project, residual effects to the abundance and distribution of wildlife populations are expected. Many of the direct and indirect changes to wildlife habitat are linked to alterations in ground and surface water flows, air quality, soils and vegetation (Table 2-3). Exceptions include direct mortality of animals from vehicle collisions and high-risk interactions with humans (e.g., destruction of a black bear attracted to the Mine Site as it presents a risk to human safety).

The objective of this section of the EA is to determine those Project-environment interactions (pathways) that are predicted to result in residual adverse effects to wildlife 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 physical measures of indicators (e.g., amount and arrangement of habitat) and biological measures such as animal occupancy of habitat, movement and behaviour and survival.

Each potential interaction is evaluated to determine if mitigation can be developed and incorporated to remove the interaction or limit the potential effects to wildlife. Mitigation includes Project design elements, environmental best practices and management policies and procedures. Mitigation is developed through an iterative process that 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 wildlife.

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 wildlife 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 wildlife 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 wildlife relative to baseline values.

Primary interactions are anticipated to result in residual effects to the abundance and distribution of wildlife populations 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 wildlife populations.

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

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

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Mine footprint (e.g., open pit, TMF, MRA, Ore Stockpile, Mine Site roads, storage facilities). Access Road.	Direct habitat loss/alteration and fragmentation from the physical footprint of the Mine Site and Access Road can affect wildlife abundance and distribution.	Limit ground clearing and size of Project footprint. Existing access roads and infrastructure will be used to the extent practical. Typically, clearing and grubbing of vegetation will take place during the winter period to minimize potential effects to migratory birds. Where construction cannot be limited to avoid breeding and nesting periods of migratory birds (May 9 to August 8), nest surveys will be completed by qualified individuals prior to commencing work and a mitigation/ management plan will be developed in consultation with Environment Canada and the MNR to address potential impacts to breeding birds. Progressive rehabilitation and revegetation will be implemented where practical to reduce the amount of disturbed habitat during the Project lifecycle. Apply and enforce speed limits. Wildlife will be given the right-of-way. Restrict vehicle use to designated roads and prohibit recreational off-road use of vehicles. Rehabilitation will include active seeding of areas to promote vegetation growth, stabilize the substrate, reduce potential erosion and enhance natural recovery for future use by wildlife.	primary
moose black bear eastern wolf	230 kV Transmission Line.	Habitat loss/alteration and fragmentation from the transmission line can affect wildlife	Limit ground clearing and area of physical footprint. Align corridor adjacent to existing linear features as much as	primary

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
American marten upland breeding birds waterbirds raptors little brown bat northern myotis		connectivity, abundance and distribution.	practical.	
upland breeding birds waterbirds raptors little brown bat northern myotis	230 kV Transmission Line.	Operation of the 230 kV transmission line can result in bird and bat strikes and increase mortality of migratory and non-migratory bird species and bat species.	Use of bird deterrents/deflectors on transmission line in high use areas (e.g., waterfowl movement corridors).	secondary
upland breeding birds waterbirds raptors	Construction, operations and closure.	Mine Site preparation, construction, operation and closure activities can increase the risk of nest destruction and mortality of migratory birds (incidental take).	Clearing land outside of the breeding season (May 9 to August 8). Avoid disturbance to active nest sites. Where construction cannot be limited to avoid breeding and nesting periods of migratory birds (May 9 to August 8), nest surveys will be completed by qualified individuals prior to commencing work and a mitigation/management plan will be developed in consultation with Environment Canada and the MNR to address potential impacts to breeding birds. Prevent birds from nesting on man-made structures.	secondary
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing and hauling).	Accidental releases of deleterious substances can cause negative changes to the health or mortality of individual animals.	An Emergency Response Plan will be developed that conforms to the BMPs 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	no linkage

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
little brown bat northern myotis			30 m from a watercourse or a drainage structure that leads to a watercourse.	
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing and hauling).	Dust deposition may cover vegetation and decrease abundance of forage for wildlife (i.e., habitat quantity).	Application of water and/or approved dust suppressants to unpaved roadways. Enforced speed limits to limit dust production. 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
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing and hauling).	Dust deposition may cover vegetation and change the amount of different quality habitats, and alter wildlife movement and behaviour.		secondary
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing and hauling).	Dust deposition and air emissions may change the amount of different quality habitats (through chemical changes in soil and vegetation), and alter wildlife movement and behaviour.		secondary
moose	Construction, operations	Sensory disturbance	Application of water and/or approved dust suppressants to	primary

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	and closure (e.g., equipment operation, vehicles, ore production and processing and hauling).	(e.g., noise, dust, lights, smells, human presence) can decrease habitat quality, and alter movement and behaviour.	unpaved roadways. Enforced speed limits to limit dust production. Noise reduction measures such as partially enclosing crushing and grinding operations. 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. The ore crushing facility, ore concentrator and concentrate stockpiles will be located in covered buildings to minimize dust emissions. Emission controls will be provided in areas where airborne particulate may be generated. Stationary equipment will be housed within buildings whenever possible to reduce noise levels. Construction equipment will meet the required sound level limits. Restrict vehicle use to designated roads and prohibit recreational off-road use of vehicles. Recreational use of all-terrain vehicles will be prohibited. At closure, rehabilitation will include active seeding of areas to	

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
			promote vegetation growth, stabilize the substrate, reduce potential erosion and enhance natural recovery for future use by wildlife.	
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing and hauling).	Ingestion of soil, vegetation, and water, or inhalation of air that has been chemically altered by air and dust emissions may affect wildlife survival and reproduction.	An Emergency Response Plan will be developed that conforms to the BMPs 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
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing and hauling).	Wildlife-vehicle collisions and physical hazards on the Mine Site may cause injury/mortality to individual animals.	Enforced speed limits. The presence of wildlife will be monitored and communicated to Mine Site personnel. All employees, contractors and sub-contractors will be provided with environmental awareness training. Vehicles will yield right-of-way to wildlife. Vehicle use restricted to designated areas and use of off-road recreational vehicles prohibited. The MRA, TMF polishing pond and low-grade ore stock pile will be regularly monitored for wildlife activity and hazards. Temporary suspension of surface blasting if moose, black bear, wolf and other wildlife are observed within the danger zone identified by the blast supervisor. If species at risk are identified within the Project during	secondary

<table>
<tr><th>Effects Assessment Indicator</th><th>Project Component/Activity</th><th>Predicted Likely Effects</th><th>Project Design Features and Mitigation</th><th>Assessment Result</th></tr>
<tr><td></td><td></td><td></td><td>construction, work within the vicinity of the observed occurrence will be modified to avoid disturbance and the MNR may be consulted if deemed necessary.

The open pit will be surrounded by a fence, berm or waste rock stockpiles during operation.

At closure, disturbed areas associated with infrastructure, buildings at the Mine Site area will be re-contoured to promote natural drainage. Waste rock and tailings stockpile will have contoured stable side slopes. These regrading activities will also reduce hazards to wildlife.</td><td></td></tr>
<tr><td>moose
american marten
beaver
upland breeding birds
waterbirds
raptors</td><td>Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing and hauling).</td><td>Attractants (e.g., food waste, oil products) may increase predator numbers and predation risk.</td><td rowspan="2">Education and reinforcement of proper waste management practices will be provided to all Project staff, contractor, sub-contractors and visitors to the Mine Site.

Prohibit littering.

Prohibit feeding of wildlife.

Separate food waste and non-food waste at the source.

Dispose of waste in accordordance with a waste management plan, which will limit the presence of food attractants.

Collect, sort and place non-food waste products that cannot be incinerated in designated areas until they can be shipped off the Mine Site.

Provide specific areas for lunch and coffee breaks with appropriate containers for food waste.

Designated landfill for management of domestic waste (either on or off the Mine Site).</td><td>secondary</td></tr>
<tr><td>black bear
eastern wolf
American marten</td><td>Construction, operations and closure (e.g., equipment operation, vehicles, ore production and processing and hauling).</td><td>Attractants (e.g., food waste, oil products) may increase carnivore-human encounters and result in the loss (destruction or relocation) of individual animals.</td><td>secondary</td></tr>
</table>

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
			All employees, contractors and sub-contractors will be provided with environmental awareness training. Presence of wildlife will be monitored and communicated to Mine Site personnel. Designated landfill for management of domestic waste (either on or off the Mine Site).	
moose black bear eastern wolf American marten beaver upland game birds waterbirds	Access Road.	Increased access for traditional and non-traditional hunting/ trapping may decrease survival and reproduction.	Prohibit hunting, trapping and harvesting by Mine Site employees and contractors. Wildlife and species at risk awareness training will be provided to all Project staff, contractors, sub-contractors and visitors to the Mine Site. Restrict vehicle use to designated roads and prohibit recreational off-road use of vehicles. Project design uses existing roads as much as possible so there is limited new access to undisturbed areas.	no linkage
moose american marten beaver upland breeding birds waterbirds raptors	Access Road.	Increased access for predators and prey may increase predation risk, and decrease habitat quality and connectivity for prey species.		no linkage
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Mine Rock Management.	Leaching of potential acid-generating mine rock may change the amount of different quality habitats, and alter wildlife movement and behaviour.	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-	no linkage
moose black bear	Mine Rock Management.	Ingestion of soil, vegetation, or water		no linkage

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis		that has been chemically altered by leaching of potential acid-generating mine rock may affect wildlife survival and reproduction.	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.	
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Mine Site Water Management.	Run-off, erosion and sedimentation may alter habitat 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. 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. Runoff from the Mine Site will be captured and diverted to the effluent treatment facility or the ore processing plant.	no linkage

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
			Sewage will be treated prior to discharging the effluent to the environment. Open pit outflow will be monitored and treated, if necessary. Vehicle movement will be restricted to designated access roads only and recreational off-road use of vehicles prohibited. Sediment traps and basins will be sized in accordance with the MTO Environmental Guide for Erosion and Sediment Control During Construction of Highway Projects (2007) for sites less than 2 ha (traps) and between 2 ha and 5 ha (basins). Establish and maintain adequate vegetation to control erosion of stockpiles of topsoil or overburden. Discharged water shall be encouraged to follow natural drainage patterns.	
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Mine Site Water Management.	Release of seepage and surface water runoff (including erosion) from the MRA and overburden stockpile may change the amount of different quality habitats, and alter wildlife movement and behaviour.	Capture and treatment of all mine effluent and leachate prior to being discharged into the environment.	no linkage
moose black bear eastern wolf American marten beaver upland breeding birds	Mine Site Water Management.	Ingestion of seepage and surface water runoff from the MRA and overburden stockpile, or ingestion of soil, vegetation, or		no linkage

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
waterbirds raptors little brown bat northern myotis		water that has been chemically altered by seepage and runoff, may affect wildlife survival and reproduction.		
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Mine Site Water Management.	Seepage from the TMF can decrease habitat quality and alter movement and behaviour.	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
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Mine Site Water Management.	Ingestion of soil, vegetation, or water that has been chemically altered by seepage from the TMF may affect wildlife survival and reproduction.		no linkage
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds	Dewatering and Water Re-alignment.	Changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from dewatering of Coté Lake and realigning portions of	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	secondary

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
raptors little brown bat northern myotis		Three Duck Lakes, Chester Lake, Clam Lake, Bagsherd Creek and the Mollie River system may affect the quantity of riparian habitat, which could alter wildlife movement and behaviour.	existing conditions. Lakes that remain connected to realignment features in this Stage are expected to have higher daily average streamflow than during existing 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 breeding birds waterbirds raptors	Dewatering and Water Re-alignment.	Changes in downstream flows and water levels from dewatering of Coté Lake and realigning portions of Three Duck Lakes, Chester Lake, Clam Lake, Bagsherd Creek and the Mollie River system may result in the flooding of migratory birds nests (incidental take).	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 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). Alter water levels outside the breeding/nesting season (May 9 to August 8). Grub vegetation in the predicted flooded area prior to flooding to limit the potential for nesting birds. If water levels are altered during the breeding/nesting season, then nest searches will be completed within a week of flooding activities in the areas with potential for flooding. Environment Canada and MNR will be consulted on mitigation for	secondary

Effects Assessment Indicator	Project Component/Activity	Predicted Likely Effects	Project Design Features and Mitigation	Assessment Result
			nests that are located in the areas to be flooded.	
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Closure.	Long-term seepage from the MRA and TMF may result in local changes in habitat quality, and alter wildlife movement and behaviour.	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. Effluent will be treated to meet federal and provincial metal mining sector effluent limits prior to being discharged to the environment.	no linkage
moose black bear eastern wolf American marten beaver upland breeding birds waterbirds raptors little brown bat northern myotis	Closure.	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 habitat, which may alter wildlife movement and behaviour.	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.	secondary

2.4.1 Pathways with No Linkage

An interaction may have no linkage to environmental effects if the activity does not occur (e.g., Mine 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 wildlife effects assessment measures. Subsequently, no residual effect to the abundance and distribution of wildlife populations is expected. The following interactions are anticipated to have no linkage to effects on wildlife and will not be carried through the residual effects assessment.

- Accidental releases of deleterious substances can cause negative changes to the health or mortality of individual animals.

Measurable changes to the health and mortality of wildlife from the unplanned (accidental) release of deleterious substances (e.g., chemicals) are not predicted to occur because current mitigation and BMPs are known to be effective. Chemical spills are typically localized, and are quickly reported and managed. Chemical spills have not been reported as a cause of wildlife mortality at operating diamond mines in the Northwest Territories and Nunavut (Tahera 2008; BHPB 2010; DDMI 2010; De Beers 2010). Mitigation measures identified in 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 Mine Site (Table 2-3). Consequently, chemical spills are predicted to have no residual adverse effects on the abundance and distribution of wildlife populations.

- Ingestion of soil, vegetation and water, or inhalation of air that has been chemically altered by air and dust emissions may affect wildlife survival and reproduction.
- Ingestion of soil, vegetation, or water that has been chemically altered by leaching of potential acid-generating mine rock may affect wildlife survival and reproduction.
- Ingestion of soil, vegetation, or water that has been chemically altered by seepage from the TMF may affect wildlife survival and reproduction.
- Ingestion of seepage and surface water runoff from the MRA and overburden stockpile, or ingestion of soil, vegetation, or water that has been chemically altered by seepage and runoff, may affect wildlife survival and reproduction

An Ecological Risk Assessment (see Human and Ecological Health Risk TSD) was completed to characterize potential adverse effects, if any, to wildlife health associated with exposure to chemical releases from the Project (e.g., seepage from the TMF, leaching from the MRA). Several Project design features, BMPs, and mitigation policies will be implemented to limit the magnitude and spatial extent of chemical changes to the environment from the Project (Table 2-3). As part of the Ecological Risk Assessment, a conservative screening process was used to identify chemicals of potential concern (COPCs), by comparing chemical concentrations in soil and water that are predicted to occur during the life of the Project to baseline concentrations and applicable guideline values.

Air emissions originating from the Project may deposit particulates to the soil which could then be available for uptake by ecological receptors via various pathways including: direct contact, consumption of terrestrial plants, and mammals and birds that have consumed vegetation grown in the soil and/or soil organisms. To determine if this could be a possible issue requiring further investigation, soil modeling was conducted to predict concentrations of inorganics that may be present as a result of deposition. These values were compared to ministry values that are considered protective of plants, soil organisms and mammals and birds. Comparison of the predicted soil values to the ministry guideline values indicated that there was no incremental change to background soil quality resulting from deposition. Therefore, it was concluded that exposure to soil via the identified pathways would not result in unacceptable risk and was therefore not considered further.

With respect to inhalation of air emissions, ambient air standards that have been used for evaluating airborne emissions are considered protective of both human and ecological receptors based on direct inhalation. As such, this exposure pathway is not considered further in the ecological risk assessment.

Predicted soil concentrations compared to ministry values that are considered protective of plants, soil organisms and mammals and birds did not indicate that there was an incremental change to background soil quality resulting from deposition.

With respect to surface water, surface water quality modeling was conducted to predict changes that may occur as a result of the Project and its various phases. The maximum predicted concentrations were compared to Aquatic Health Benchmarks (set at the most recent PWQG or CWQG or BC MOE value). With parameters with no guideline, the baseline concentration (i.e., upper 95th percentile) was used as the benchmark. Parameters requiring further assessment were identified (i.e., COPCs were identified). However, further evaluation of the parameters that exceeded when compared to risk-based toxicological reference values relevant for aquatic species indicated no unacceptable risks.

Construction and operation of the Project will generate air emissions such as carbon monoxide (CO), oxides of sulphur (SO_x), includes sulphur dioxide (SO_2), oxides of nitrogen (NO_x), particulate matter ($PM_{2.5}$, PM_{10}) and total suspended particulates (TSP). Results of the air quality modelling indicate that the maximum annual, 1-hour and 24-hour ground-level concentrations of SO_2 and NO_2 are all below the Ontario's Ambient Air Quality Criteria (Ministry of the Environment 2012), and are limited to the immediate vicinity of the Project (Air Quality TSD). Concentrations of TSP, PM10 and PM2.5 were found to have potential exceedences at the property boundary. The 24-hour AAQC for PM2.5, PM10 and TSP are expected to be exceeded 1 day, 14 days and 7 days per year, respectively. Overall, air and dust emissions and subsequent deposition are expected to result in minor changes to air quality and surface water, sediment, soil and vegetation chemistry.

In summary, no COPCs have been identified for the Project and air emissions are generally predicted to be below AAQC. Therefore, it is predicted that the Project will have no residual adverse health effects on wildlife EAIs.

- Run-off, erosion and sedimentation may alter habitat quantity and quality.

Project activities such as Mine 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 wildlife habitat within and adjacent to the Project footprint. Increased levels of soil erosion can lead to increased sediment loads in wetlands, thus 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, 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, thus 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.

In general, coarse (sandy) textured soils 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.

It is expected that BMPs 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 consequence of erosion will increase, and additional erosion control may be required. General Mine Site runoff and seepage collection systems, including associated settling ponds, will be developed to capture and treat seepage and runoff from the major Mine 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 Metal Mining Effluent Regulations (MMER) and provincial approval requirements.

Implementation of Project design features and appropriate mitigation is expected to eliminate potential effects from Mine Site runoff and erosion. Subsequently, this pathway was determined to have no linkage to effects on the abundance and distribution of wildlife populations.

- increased access for traditional and non-traditional hunting/trapping may decrease survival and reproduction; and
- increased access for predators and prey may increase predation risk, and decrease habitat quality and connectivity for prey species.

Roads can increase potential for wildlife mortality by increasing access for hunters and predators. A road network currently exists within the RSA, which provides access for traditional and non-traditional hunters using vehicles and can facilitate predator (and prey) movements. 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 hunters or predators in the RSA, relative to baseline conditions.

- leaching of potential acid-generating mine rock may change the amount of different quality habitats, and alter wildlife movement and behaviour;

- release of seepage and surface water runoff (including erosion) from the MRA and overburden stockpile may change the amount of different quality habitats, and alter wildlife movement and behaviour;
- seepage from the TMF can decrease habitat quality and alter movement and behaviour; and
- long-term seepage from the MRA and TMF may result in local changes in habitat quality, and alter wildlife movement and behaviour.

General Mine 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.

Implementation of these Project design features and mitigation are expected to result in no detectable changes in groundwater, surface water and soil quality. Therefore, these interactions were determined to have no linkage to effects on the abundance and distribution of wildlife populations.

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 wildlife abundance and distribution. The following interactions are expected to be minor and will not be carried through the residual effects assessment.

- wildlife-vehicle collisions and physical hazards on the Mine Site may cause injury/mortality to individual animals.
- operation of the 230 kV transmission line can result in bird and bat strikes and increase mortality of migratory and non-migratory bird species and bat species; and

The Project will increase the amount of vehicle traffic in the RSA, which may result in increased injury and mortality to wildlife (Romin and Bissonette 1996; Hussain et al. 2007). Wildlife (primarily mammals, reptiles and amphibians) are often attracted to roads where they forage for food, bask on the road surface, scavenge for carrion and use corridors for travel (Smith-Patten and Patten 2008; Fahrig and Rytwinski 2009).

Traffic speed and volume are the primary factors that contribute to road-related mortality (Alexander et al., 2005; Jaarsma et al. 2006; Hussain et al. 2007; Danks and Porter 2010). An increase in either factor reduces the probability of an animal crossing safely (Underhill and Angold 2000). Songbirds and bats are thought to be most vulnerable to collisions with vehicles (Bickmore 2003; Altringham 2008; Bishop and Brogan 2013). Studies suggest that roads with traffic volumes greater than 1,000 vehicles per day may create barriers to mammal movements and could affect population connectivity for some species (Alexander et al. 2005; Dussault et al. 2007; Altringhamn 2008). Roads with lower traffic volumes have not been observed to negatively influence mammal movements (Paquet and Callaghan 1996; Coady 2001; Hammond 2002; Fecske et al. 2002;

Gurarie et al. 2011). Roads in Banff National Park with traffic volumes between 800 and 20,000 vehicles per day did not seem to create barriers to songbird movements (St. Clair 2003).

Existing road traffic volumes in the RSA are low and expected to be less than 800 vehicles per day during construction (Socio-economic TSD). Subsequently, roads and associated traffic are predicted to result in minor changes to wildlife population connectivity and survival and reproduction relative to existing conditions.

Birds and bats may be injured or killed if they collide with transmission lines and buildings. Upland breeding birds and raptors are most vulnerable to collisions with buildings (Calvert et al. 2013), while waterfowl are most vulnerable to collisions with electrical lines (Brown and Drewien 1995; Rioux et al. 2013; Calvert et al. 2013). Collisions with buildings and transmission lines is not considered a major cause of bat mortality (Johnson and Strickland 2004).

Markers on electric lines have been found to be effective at reducing bird collisions (Barrientos et al. 2011) and will be used on the transmission line in high use areas (e.g., waterfowl movement corridors) to limit waterfowl collisions. Similarly, appropriate mitigation around Project buildings (e.g., directing lights to illuminate the ground and not the sky) are expected to limit bird and bat collisions with Project buildings. As such, bird and bat mortality from collisions with the proposed power line and buildings is anticipated to be minor relative to baseline values and have a negligible influence on the local abundance and distribution of bird and bat populations.

- Mine Site preparation, construction, operation and closure activities can increase the risk of nest destruction and mortality of migratory birds (incidental take); and
- changes in downstream flows and water levels from dewatering of Coté Lake and realigning portions of Three Duck Lakes, Chester Lake, Clam Lake, Bagsherd Creek and the Mollie River system may result in the flooding of migratory birds nests (incidental take).

The *Migratory Birds Convention Act* (MBCA 1994) prohibits the destruction of migratory bird nests (passerine, waterfowl and raptor) during the breeding season. Bird nests could be destroyed during grubbing and clearing activities that will occur during Project construction, as well as during dewatering of Cote Lake (i.e., flooding of downstream areas). To limit the potential for the destruction of bird nests, clearing and grubbing of vegetation and water realignments will typically take place during the winter period. If construction and dewatering activities cannot be completed outside of the breeding and nesting period of migratory birds (May 9th to August 8th), then nest surveys will be completed by qualified individuals prior to commencing construction or dewatering work. A mitigation/management plan will also be developed in consultation with Environment Canada and the MNR to address potential effects to breeding birds.

Overall, it is expected that mitigation policies and practices for construction and dewatering activities will limit incidental take of migratory bird nests. As such, these interactions were considered to have negliglible effects on the abundance and distribution of migratory bird populations.

- dust deposition may cover vegetation and decrease abundance of forage for wildlife (i.e., habitat quantity);
- dust deposition may cover vegetation and change the amount of different quality habitats, and alter wildlife movement and behaviour; and
- dust deposition and air emissions may change the amount of different quality habitats (through chemical changes in soil and vegetation), and alter wildlife movement and behaviour.

Air quality modelling was completed to predict the spatial extent of air and dust emissions and deposition from the Project (Air Quality TSD). Assumptions were incorporated into the model to contribute to 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 (i.e., wildlife habitat), 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 m of the source and typically do not extend beyond the local 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 wildlife habitat (Bobbink et al. 1998).

Results of the air quality modelling indicate that the maximum annual, 1-hour and 24-hour ground-level concentrations of SO_2 and NO_2 are all below the Ontario's Ambient Air Quality Criteria (Ministry of the Environment 2012) and are limited to the immediate vicinity of the Project (Air Quality TSD). Concentrations of TSP, PM10 and PM2.5 were found to have potential exceedences at the property boundary. The 24-hour AAQC for PM2.5, PM10 and TSP are expected to be exceeded 1 day, 14 days and 7 days per year, respectively. 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 on the abundance and distribution of wildlife populations in the RSA.

- attractants (e.g., food waste, oil products) may increase predator numbers and predation risk; and
- attractants (e.g., food waste, oil products) may increase carnivore-human encounters and result in the loss (destruction or relocation) of individual animals.

Food smells and other aromatic compounds such as petroleum-based chemicals, grey water and sewage can attract carnviores to human developments (Benn and Herrero 2002; Pierce and Van Daele 2006; CWS 2007; Beckmann and Lackey 2008). In addition, infrastructure may also attract carnivores as it can serve as a temporary refuge to escape extreme heat or cold (Canadian Wildlife Service 2007). Corvids (e.g., crows and ravens) and raptors may also be attracted to infrastructure and anthropogenic food sources (Restani et al. 2001; Marzluff and Netherland 2006; Canadian Wildlife Service 2007; Kristan and Boarman 2007; Baxter and Allan 2008). Moose may be attracted to the Mine Site if salt is used to de-ice roads in the winter (Leblond et al., 2007; Laurian et al. 2008a; Grosman et al. 2011). Attraction of wildlife to the Project can increase predation pressure on prey species (e.g., moose, passerines and waterfowl), and may cause local population declines for these prey species (Monda et al. 1994; Canadian Wildlife Service 2007; Liebezeit et al. 2009).

The attraction of wildlife to the Mine Site has the potential to increase human-wildlife interactions, which may result in the removal of individuals by mortality or relocation. Wildlife species have been intentionally destroyed at existing mines in the Northwest Territories and Nunavut, either by government biologists or with government permission (Tahera 2008; BHPB 2010; DDMI 2010). Intentional destruction of individuals generally followed habituation of an individual animal to operating mines over an extended period of time, and after multiple deterrent attempts failed with the same individual. Lessons learned from these mines in the Northwest Territories and Nunavut have shown that proper waste management practices and staff education can substantially decrease the frequency of attractants and the number of carnivore incidents.

A number of mitigation policies and procedures will be implemented at the Mine Site to limit the attraction of wildlife, and the associated increased risk of mortality from human-wildlife interactions and predation (Table 2-3). These mitigation strategies are similar to the management measures and practices implemented at operating mines in the Northwest Territories and Nunavut that have proven to be effective at limiting the attraction of carnivores to human developments. Some mitigation procedures that will be implemented at the Mine Site include:

- educating Project staff, contractors, sub-contractors and visitors to the Mine Site of proper waste management practices;
- providing Project staff, contractors sub-contractors and visitors to the Mine Site with MNR Bear-Wise training;
- prohibiting littering and the feeding of wildlife;
- separating food waste and non-food waste at the source; and
- disposal of food waste and non-toxic combustible waste according to a waste management plan to limit the presence of food attractants.

Mitigation should be effective at limiting attractants at the Mine Site and result in a minor increase in wildlife mortality risk from human-wildlife interactions and predation relative to baseline conditions. Therefore, these pathways (linkages) are predicted to have a negligible residual effect on the abundance and distribution of wildlife populations.

- changes in downstream flows (e.g., isolation and diversion, altered drainage patterns) and water levels from dewatering of Coté Lake and realigning portions of Three Duck Lakes, Chester Lake, Clam Lake, Bagsherd Creek and the Mollie River system may affect the quantity of riparian habitat, which could alter wildlife movement and behaviour; and
- 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 habitat, which may alter wildlife movement and behaviour.

Realignment of watercourses will cause changes to drainage flow patterns and surface water elevations in some lakes. For example, the realignment of Clam Creek will divert drainage flows from Chester Lake to Clam Lake (Hydrology TSD). The realignment of Bagsverd Creek will increase flow into Unnamed Lake #2. In addition to diversion of drainage flows, the realignment of watercourses will also raise baseline surface water elevations in Clam Lake, Chester Lake, Unnamed Lake #1, Unnamed Lake #2 and the south arm of Bagsverd Lake. The greatest increase in lake levels is predicted to be in Chester Lake (Hydrology TSD).

Vegetation ecosystems and plants downstream of realigned watercourses and Cote Lake could be affected by rising water levels during the dewatering of Côté Lake. Wetland and riparian plant species are better adapted to fluctuating water levels and should be able to withstand and recover from high water level conditions more successfully than their upland counterparts. Upland ecosystem types with more freely drained soils will likely be less resilient to prolonged flooding, and are expected to display a more adverse response to these conditions.

During closure, precipitation and groundwater are expected to be the primary sources of water contributing to refilling the open pit. Active filling of the open pit will primarily be from water collected in the MRA seepage collection ponds. Freshwater inputs from nearby streams may be used during seasonal high flows (i.e., the spring) but it is expected that changes to water levels will be small and surface water flows and levels will remain within the natural range of variability.

Overall, the change in drainage flows and surface water elevations associated with the realignment plans and the refilling of the open pit at closure is localized and is expected to have a minor influence on downstream habitat quantity for wildlife, relative to baseline conditions. These pathways were determined to have a negligible effect on the abundance and distribution of wildlife populations.

2.4.3 Primary Pathways

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

- direct habitat loss/alteration and fragmentation from the physical footprint of the Mine Site and access road can affect wildlife abundance and distribution;
- habitat loss/alteration and fragmentation from the transmission line can affect wildlife connectivity, abundance and distribution; and
- sensory disturbance (e.g., noise, dust, lights, smells, human presence) can decrease habitat quality, and alter movement and behaviour.

2.5 Prediction of Effects

Decreases in habitat area can directly influence wildlife population abundance 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 movement between foraging areas and predation along habitat edges. In addition to direct habitat effects, wildlife habitat quality may change in the vicinity of the Project. Local-scale habitat quality may be affected by sensory disturbance (e.g., light, noise, presence of humans). Human-disturbance has been found to influence bird (excluding raptor) and large mammal populations within 1 km and 5 km of human activities or developments, respectively (Benitez-Lopez et al. 2010). Raptor abundance was found to be affected within 5 km of developments.

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 wildlife populations 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 wildlife EAIs. Direct habitat effects (i.e., changes to habitat amount and fragmentation) to wildlife 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 that were calculated for each habitat identified in the Ecological Landscape Classification (ELC) included total area 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 Inc. 2004). An assessment of likely effects from changes in habitat state and condition is based on the calculation of the amount of potential suitable habitat altered or lost for EAI populations in the RSA. Potential suitable habitat is defined as habitat that provides foraging, protection from predators (or other potential limiting factors) and resting elements.

Landscape metrics were determined for the reference, existing conditions (2012 baseline) and application case (Table 2-4). 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 (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 2-4: 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 2-5)	■ development database (Table 2-5) ■ IAMGOLD Mine Site footprint and transmission line footprint that is located within the RSA

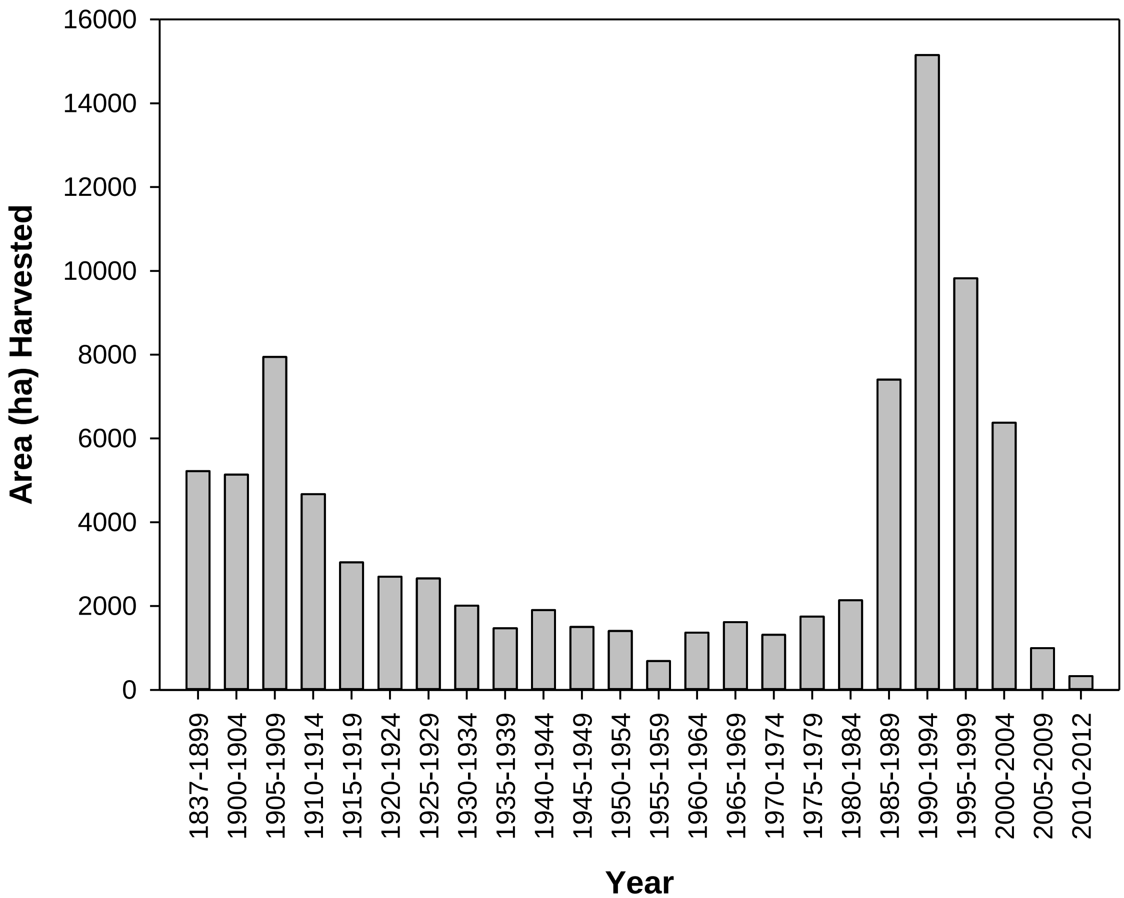
Table 2-5: Previous and Existing Developments in the Regional Study Area

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
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

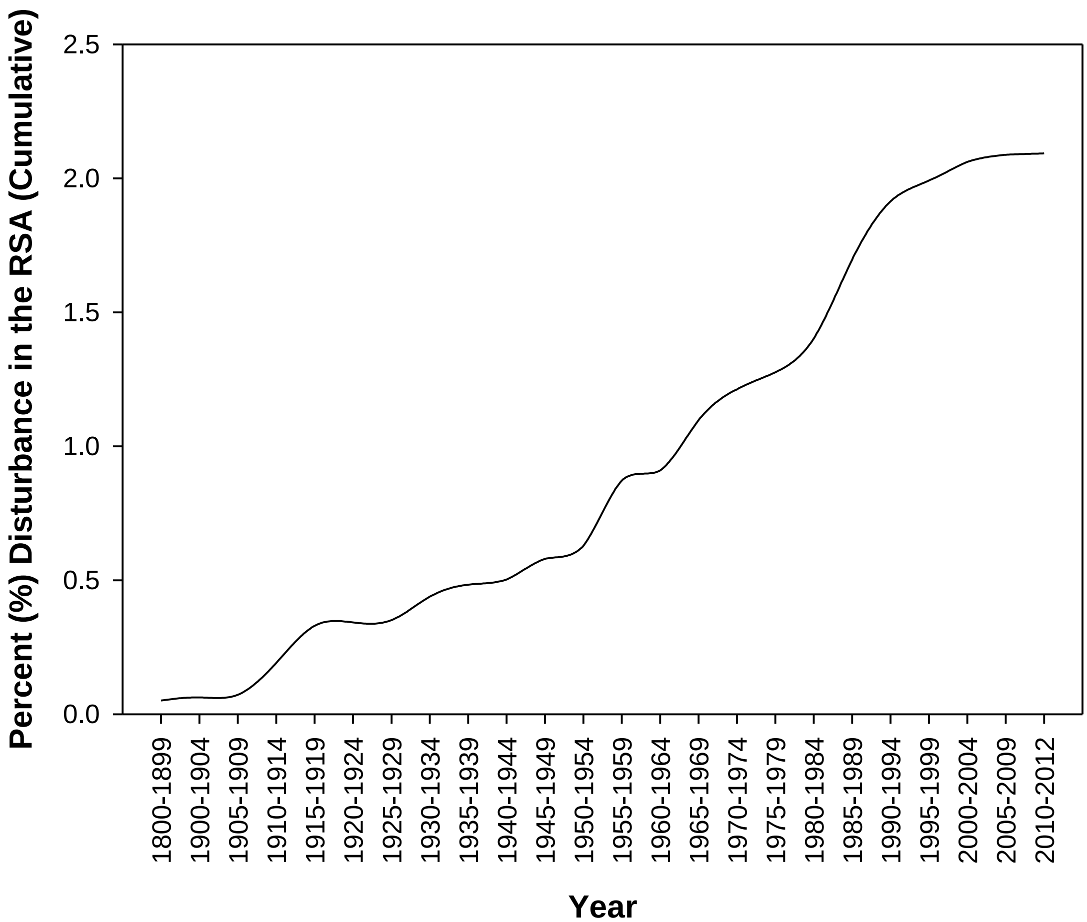
Notes:
Less than (<) indicates that values are approaching zero.
(a) Based on actual and hypothetical footprints presented in Table 2-6.
(b) All mines are currently inactive
(c) Includes prospecting activities; there are 35 mines that were in operation for more than 2 years.
(d) The number of developments 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 Inc. 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: Cumulative 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.

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 2-4). The year 2012 was used for the baseline case because information used in compiling the development database (Table 2-5) 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 Inc. 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 2-5), 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 footprint area for each development type using actual polygons or shapes files, or estimated buffers (Table 2-6).

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 2-6: 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

Note:
(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 relevant to wildlife habitat use. 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; and
  - 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 km^2:
  - 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.

It is recognised that local-scale habitat quality for wildlife EAIs may be affected by sensory disturbance from the Project (e.g., light, noise, presence of humans). The predicted magnitude of effects from changes in habitat quality due to sensory disturbance from the Project on EAIs were qualitatively assessed by reviewing existing scientific literature and government publications.

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. For wildlife, magnitude is a function of the numerical and qualitative changes in measures (Table E1) and the associated influence on the abundance and distribution of EAIs. Changes in physical (e.g., habitat quantity, quality and fragmentation) and biological (e.g., survival, reproduction, movement and behaviour) measures result in effects on the abundance and distribution of populations. Therefore, the magnitude of residual effects is assessed at the population level (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 EAI to absorb or otherwise accommodate disturbance. The evaluation and classification of magnitude considers the adaptive capacity and resilience of EAIs to absorb effects from the Project and other disturbances and persist as self-sustaining populations. Adaptable EAIs can change their behaviour, physiology, or population characteristics (e.g., birth rate) in response to a disturbance such that there is little change in abundance and distribution. For example, behavioural plasticity that allows for adaptation to disturbance, high birth rates that allow for replacement of harvested individuals and good dispersal ability that allow for connection of fragmented populations (Weaver et al. 1996). Less adaptable EAIs will be more strongly influenced by human and natural disturbance than EAIs with greater adaptive capability.

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. Definitions for the three categories of magnitude are:

Negligible to Low: There is no measurable residual effect to population abundance and distribution.

Moderate: The residual effect to population abundance and distribution is measurable, but the changes are well within the predicted adaptive capability and resilience limits of the EAI.

High: The residual effect to population abundance and distribution is large enough that the changes are near or exceeding the predicted adaptive capability and resilience limits of the EAI.

2.6 Existing and Previous Habitat Conditions

Under 2012 baseline conditions, the LSA is mainly comprised of dense mixed forest habitat (41.6%; 4,938 ha) (Terrestrial Baseline Report, Section 5.1.3.2). 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.

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 (Terrestrial Baseline Report, Section 5.1.3.1). 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 2-7). 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 2-7: 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

Habitat	Reference (ha)	Reference to 2012 Baseline (%)
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

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 footprint) will be located in recent harvested forest area. The remainder of the Project 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 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 landcover 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, or open fen. 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.

3.1 Construction Phase

3.1.1 Ungulates: Moose

Moose select various habitat types during different seasons. Dense coniferous forest is preferred during the winter as it provides easier movement and protection from inclement weather and predators (MNR 2000). Suitable winter habitat may also be provided by mixedwood forest (Allen et al. 1987). In the summer, moose select habitats that have an abundance of deciduous browse, such as regenerating areas, deciduous forest and mixedwood forest (Allen et al. 1987). Moose obtain the majority of their annual salt requirements from aquatic plants such as pondweed (*Potomageton* spp.), yellow water lily (*Nuphar lutea*) and water milfoil (*Myriophyllum* spp.) (Peek 1974; MNR 2000). In the RSA, wetland habitat may provide access to this type of aquatic vegetation. Moose are adapted to withstand cold temperatures but are intolerant of high temperatures; upper critical temperatures are thought to be between 14°C and 20°C during the summer (Renecker and Hudson 1986). As such, treed lowland areas (e.g., treed bog and treed fen) are important for moose during the summer because of their cooler microclimates (Allen et al. 1987). Habitats in which incidental observations of moose were recorded during baseline studies included dense coniferous forest, dense deciduous forest, dense mixed forest, sparse forest and recent logged areas (Terrestrial Baseline Report).

There was predicted to be 74.6% potential suitable winter habitat for moose (i.e., dense coniferous forest and dense mixed forest) in the RSA under reference conditions. Potential summer habitat (i.e., dense deciduous forest, dense mixed forest regenerating, treed bog, treed fen and wetland habitats) covers 54.3% of the RSA under reference conditions.

Previous and existing developments have removed 11.5% and 10.9% of potential winter and summer habitats for moose, respectively, relative to reference conditions (Table 3-1). The Project is anticipated to remove 0.4% of potential suitable winter habitat and 0.6% of potential summer habitat for moose.

Table 3-1: Percent Change of Winter and Summer Habitats for Moose in the Regional Study Area from Reference to 2012 Baseline and 2012 Baseline to Application Conditions

Habitat	Reference (ha)	Reference to 2012 Baseline	2012 Baseline to Application
Winter ■ dense coniferous forest ■ dense mixed forest	282,684	-11.2	-0.4
Summer ■ dense deciduous forest ■ dense mixed forest ■ regenerating ■ treed bog ■ treed fen ■ wetland	205,874[a]	-10.3	-0.6

Note:
(a) Area does not include regenerating habitat as there was no modelled regenerating habitat under reference conditions (Section 2.5).
ha - hectares

Changes in distance between similar habitat patches may affect the ability of moose to travel across the land (Stewart and Komers 2012) and access important habitats (e.g., winter refuge habitat) (Naylor et al. 1999). Moose may travel 200 m through habitats that provide no cover (vegetation cover height less than 3 m; Naylor et al. 1999). Travel distances in habitats that provide good cover (vegetation cover height greater than 10 m) may be up to 1,600 m.

Under reference conditions, the distance between potential suitable moose habitat patches (excluding regenerating habitat) is between 87 m (dense mixed forest) and 642 m (treed fen) (Table 3-2). Previous and existing developments have increased the distance between equivalent habitat patches (MDNN) for potential suitable moose habitats by less than or equal to 83 m. The mean distance between regenerating habitat patches under baseline conditions is 125 m. The Project is anticipated to increase the distance between potential suitable moose habitats by less than or equal to 3 m. The mean distance between regenerating habitat patches under application conditions is 128 m. As moose are highly mobile and will cross gaps with no vegetation cover, the increases in distance between primary and secondary moose habitat patches is not likely to influence moose abundance and distribution in the RSA.

There is a positive correlation between wolf numbers and road density in areas with low use of roads by humans (Thurber et al. 1994; Houle et al. 2010; Bowman et al. 2010), which is related to the ease of travel and increased access to prey populations. As such, wolf density and potential for predation on moose may increase near the Project with the construction of Mine Site roads. The overall density of linear features in the RSA under existing conditions is <0.01 km/km^2 (Table 2-5). The construction of the Mine Site roads and transmission line is expected to result in a minor increase in linear density within the RSA as access roads will follow existing trails and local roads as much as possible. The current linear density estimate for the RSA is much lower than observed values for effects to wildlife in forested environments (0.6 km/km^2 to 1.5 km/km^2) (Frair et al. 2008; Nielsen et al. 2009).

Table 3-2: Change in Mean Distance to Nearest Neighbour (MDNN) for Habitat Types within the Regional Study Area from Reference to 2012 Baselin and 2012 Baseline to Application Conditions

Habitat Type	Reference (m)	Reference to 2012 Baseline (m)	2012 Baseline to Application (m)
dense coniferous forest	102	3	<1
dense deciduous forest	178	-1	-1
dense mixed forest	87	3	<-1
sparse forest	153	0	<1
treed fen	642	5	0
treed bog	245	83	1
open bog	629	836	0
wetland	431	-37	-1
water	323	37	2
regenerating	0	125	3
recent burn	167	87	0
recent logged	0	107	1

Note:
Less than (<) indicates that values are approaching zero
m - metres; < - less than

Moose were less likely to be found within 1 km of seismic lines during seismic operations (Horesji 1979). Humans elicit flight responses in moose at greater distances than disturbances that were recognized as mechanical (Andersen et al. 1996). For example, the noise of a jet flying at an altitude of 150 m did not trigger any flight response in moose, while people approaching moose on foot or skis from a distance of 200 to 400 m caused the animals to run. Andersen et al. (1996) found that the home range size for moose increased during active military manoeuvres (e.g., using helicopters and jet fighters), but no collared individuals abandoned the area. Moose have been found to avoid roads, although they may venture nearer to roads to access scarce resources (e.g., salt) (Leblond et al. 2007; Laurian et al. 2008a, 2008b; Grosman et al. 2011).

Sensory disturbance associated with human activities such as forestry operations and mineral exploration has occurred in the RSA since 1800. As such, the moose population in the RSA is expected to have adapted to human-related sensory disturbance. Benitez-Lopez et al. (2010) found that large mammal abundance was lower within 5 km of human infrastructure.

Forestry is expected to have a larger influence on the moose population 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 around 1800, with most harvesting activities occurring in the last 25 to 30 years (Graphic 2-1). Most harvesting has occurred in dense coniferous forest (46.1% of harvested area; 7,590 ha) and dense mixed forest (46.5% of harvested area; 7,653 ha) habitats. Regenerating dense coniferous and dense mixed forest habitats are not likely to have a high abundance of deciduous browse, which is suitable for moose, especially as most silvicultural applications select for coniferous species (e.g., by thinning deciduous tree species). As such, regenerating coniferous and mixed forest habitats are not anticipated to be suitable for moose until these habitats reach a more mature forest stage. Regenerating deciduous forest may provide summer habitat for moose.

In summary, sensory disturbance during construction is expected to result in measurable changes to the occupancy of habitat by moose near the Mine Site as large mammals have been found to have lower abundance within 5 km of human developments (Benitez-Lopez et al. 2010). There will likely be measurable changes in the movement and behaviour of moose throughout construction of the transmission line (e.g., avoidance). However, habitat quality and quantity in the RSA are probably not limiting for the moose population. Moose have flexible habitat requirements and some types of human disturbance (e.g., regenerating clearcuts in deciduous forest habitat) can create moderate to high quality habitat (Allen et al. 1987; Maier et al. 2005). Generally, species are limited by habitat loss when more than 40% of preferred habitats are removed from an area (e.g., RSA) (Andrén 1994; Fahrig 1997; Andrén 1999; Flather and Bevers 2002; Swift and Hannon 2010). The local changes in habitat quantity and quality from the Project are anticipated to have no measurable effect on the abundance and distribution of the moose population in the RSA. Local changes to moose habitat and occupancy near the Project are likely to occur continuously throughout the construction phase and are expected to be partially reversible at the end of construction (two years).

Effects from the Project and previous and existing developments on the moose population are predicted to be measurable but within the predicted adaptive capability and resilience limits of this species. Forestry likely explains most of the regional effect to the population, while the Project and other types of human development are expected to have no to little measurable residual effect on the moose population. Moose populations are most vulnerable to changes in hunter-related or predation mortality (Patterson et al. 2013; McNay et al. 2013). Moose numbers in northeastern Ontario are increasing (Rodgers 2007) and there should be sufficient undisturbed habitat in the RSA for a self-sustaining population.

3.1.2 Furbearers: Eastern Wolf, Black Bear, American Marten, and Beaver

3.1.2.1 Eastern Wolf

Suitable habitat for eastern wolf includes habitats that have high densities of moose and other prey species (Theuerkauf et al. 2003; Theberge and Theberge 2004; MNR 2005). Potential suitable habitat for eastern wolf was considered to be the same as potential suitable summer habitat for moose (i.e., dense deciduous forest, dense mixed forest, regenerating, treed bog, treed fen, and wetland habitats) (Section 3.1.1). Dense coniferous forest was not considered a potential suitable habitat for wolf as this habitat is expected to provide protection for moose from predators (MNR 2000).

The RSA is predicted to contain approximately 54.3% potential suitable habitat for eastern wolf, under reference conditions. Previous and existing developments have removed 10.3% of potential wolf habitat in the RSA relative to reference conditions (Table 3-3). The Project is predicted to remove 0.6% of potential wolf habitat.

Wolves have a positive correlation with road density in areas with low road density and use by humans (Thurber et al. 1994; Houle et al. 2010; Bowman et al. 2010). Roads with high traffic volumes may be a partial barrier to wolf movement, but other linear developments (e.g., roads with low traffic, power line corridors) may be preferred travel corridors for wolves, especially when snow is deep (Paquet and Callaghan 1996; Gurarie et al. 2011). However, road densities greater than 0.6 km/km^2 have been found to negatively affect wolf populations (Thiel 1985; Jensen et al. 1986; Mech et al. 1988; Mladenoff et al. 1995; Potvin et al. 2005). The overall density of linear features in the RSA under existing conditions is <0.01 km/km^2 (Table 2-5). The Project is predicted to result in a negligible increase in road density in the RSA as access roads will follow existing roads as much as possible. Changes to the distances between equivalent habitat patches in the RSA are not anticipated to affect eastern wolf as wolves are highly mobile (Gese and Mech 1991; Jedrzejewski et al. 2001) and are considered habitat generalists (Mladenoff et al. 1995; Kuzyk et al. 2004; Houle et al. 2010; Gurarie et al. 2011; Milakovic et al. 2011).

Table 3-3: Percent Change of Potential Suitable Habitats for Eastern Wolf in the Regional Study Area from Reference to 2012 Baseline and 2012 Baseline to Application Conditions

Habitat	Reference (ha)	Reference to 2012 Baseline	2012 Baseline to Application
■ dense mixed forest ■ dense deciduous forest ■ regenerating ■ treed bog ■ treed fen ■ wetland	205,874[a]	-10.3	-0.6

Note:
(a) Area does not include regenerating habitat as there was no modelled regenerating habitat under reference conditions (Section 2.5).
ha - hectares

Literature on eastern wolves is limited. However, research shows that gray wolves can adapt to the presence of humans and may select areas closer to human activity (Mech 1995; Thiel et al. 1998; Boitani 2000; Hebblewhite and Merrill 2008). Sensory disturbance associated with human activities such as forestry operations and mineral exploration has occurred in the RSA since 1800. As such, the eastern wolf population in the RSA is expected to have adapted to human-related sensory disturbance, but construction activities will likely result in a minor and local change in the occupancy and distribution of eastern wolf (within 5 km of the Project; Benitez-Lopez et al. 2010).

Forestry is expected to have a larger influence on the eastern wolf population in the RSA as forestry has disturbed approximately 3.5 times more habitat than other human developments (7.4% of the RSA for forestry versus 2.1% for other human developments). Forest harvesting operations have occurred in the RSA since around 1800, with most harvesting activities occurring in the last 25 to 30 years (Graphic 2-1). Most harvesting has occurred in dense coniferous forest and dense mixed forest habitats. Regenerating coniferous and mixed forest habitats are not anticipated to be suitable for eastern wolf until these habitats reach a more mature forest stage to support moose. Regenerating deciduous forest that supports prey species (moose and beaver) may provide suitable habitat for eastern wolf.

In summary, sensory disturbance from construction of the Project may result in measurable changes to the occupancy of habitat by eastern wolf near the Mine Site and transmission line as large mammals were found to have lower abundances within 5 km of human developments (Benitez-Lopez et al., 2010). However, wolves have flexible habitat requirements and habitat quality and quantity in the RSA are probably not limiting for the eastern wolf population. Habitat loss generally affects species when more than 40% of preferred habitat is removed from an area (e.g., RSA) (Andrén 1994; Fahrig 1997; Andrén 1999; Flather and Bevers 2002; Swift and Hannon 2010). Loss of preferred habitat for eastern wolf from previous and existing developments and the Project is 10.9%. The local changes in habitat quantity and quality from the Project are anticipated to have no measurable effect on the abundance and distribution of the eastern wolf population. Local changes in wolf habitat and occupancy near the Project are likely to occur continuously throughout the construction phase and are expected to be partially reversible at the end of construction (two years).

Effects from the Project and previous and existing developments on the eastern wolf population are predicted to be measurable but within the predicted adaptive capability and resilience limits of this species. Forestry likely explains most of the regional effect to populations, while the Project and other types of human development are expected to have no measurable residual effect on the eastern wolf population in the RSA. Wolf populations are most vulnerable to changes in hunter-related mortality and wolf populations in Ontario are thought to be increasing or stable (MNR 2005). There should be sufficient undisturbed habitat in the RSA for a self-sustaining eastern wolf population.

3.1.2.2 Black Bear

Generally black bears prefer mixed forest, deciduous forest and regenerating habitats (Pelchat and Ruff 1986; Vander Heyden and Meslow 1999; Fecske et al. 2002; Mosnier and Ouellet 2008; Latham et al. 2011a). Wetlands may be important during the spring and summer (Rogers and Allen 1987; Fecske et al. 2002; Latham et al. 2011a). Jack pine (*Pinus banksiana*) forest may be selected if there is a high abundance of berries (Pelchat and Ruff 1986). Black bears in the boreal forest of Alberta selected mature deciduous and coniferous forests for denning (Tietje and Ruff 1980). During baseline studies, incidental observations of black bears and/or sign occurred in dense coniferous forest, dense mixed forest, recent logged and wetland habitat (Terrestrial Baseline Report). Potential suitable habitat for black bears was considered to be dense deciduous forest, dense mixed forest regenerating wetland and sparse forest habitats.

The RSA is predicted to contain approximately 56.6% potential suitable black bear habitat under reference conditions. Previous and existing developments have removed 10.2% of potential black bear habitat in the RSA, relative to reference conditions (Table 3-4). The Project is anticipated to remove 0.6% of potential suitable black bear habitat.

Table 3-4: Percent Change of Potential Suitable Habitats for Black Bear in the Regional Study Area from Reference to 2012 Baseline and 2012 Baseline to Application Conditions

Habitat	Reference (ha)	Reference to 2012 Baseline	2012 Baseline to Application
■ dense deciduous forest ■ dense mixed forest ■ regenerating ■ wetland ■ sparse forest	214,370[a]	-10.2	-0.6

Note:
(a)Area does not include regenerating habitat as there was no modelled regenerating habitat under reference conditions (Section 2.5).
ha - hectares

Increases in distance between similar habitat patches in highly disturbed areas (e.g., southern Florida) have been found to reduce black bear genetic variation by impeding dispersal and long-distance movements (Proctor 2003; Dixon et al. 2007). As human disturbance (excluding forestry) covers 2.1% of the RSA, changes to the MDNN for potential black bear habitats is not expected to negatively affect black bears in the RSA.

Previous and existing developments have produced a total linear feature density of <0.01 km/km^2 in the RSA (Table 2-4). The construction of the access roads and transmission line is expected to result in a negligible increase in linear density within the RSA as access roads will follow existing trails and local roads as much as possible. The current linear density estimate for the RSA is much lower than observed values for effects to wildlife in forested environments (0.6 km/km^2 to 1.5 km/km^2) (Frair et al. 2008; Nielsen et al. 2009).

Studies have documented varying responses of black bears to human-created sensory disturbance. Bears seem to avoid roads with high traffic volumes (Carr and Pelton 1984; Beringer et al. 1989; Vander Heyden and Meslow 1999; Fecske et al. 2002). Similarly, bears in Colorado avoided developed areas (McCutchen 1990). However, military weapons training activities seemed to have less of an effect on use of areas by black bears than habitat type (Telesco and Van Manen 2006). Bears may be attracted to areas of human disturbance if there are attractants such as garbage (Rogers and Allen 1987). Bears may be especially sensitive to human disturbance during the denning season (Linnell et al. 2000; Gaines 2003) and females are more sensitive to disturbance when they have cubs (Fecske et al. 2002; Reynolds-Hogland and Mitchell 2007). Black bears select den locations that are greater than 500 m to 2 km from roads (Linnell et al. 2000; Gaines 2003). Denning bears may be disturbed when human activities are less than 1 km from the den (Linnell et al. 2000).

Forestry is expected to have a larger influence on the black bear population 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 landscape 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 (Graphic 2-1). Most harvesting has occurred in dense coniferous forest and dense mixed forest habitats. Regenerating habitats that contain berry-producing plants may provide suitable habitat for black bear.

In summary, sensory disturbance during construction is expected to result in measurable changes to the occupancy of habitat by black bear near the Mine Site and transmission line as large mammals have been found to have lower abundance within 5 km of human developments (Benitez-Lopez et al. 2010). However, habitat quality and quantity in the RSA are probably not limiting for the black bear population. Black bears have flexible habitat requirements and some types of human disturbance (e.g., regenerating clearcuts in deciduous forest habitat) can create moderate to high quality habitat (Vander Heyden and Meslow 1999; Fecske et al. 2002; Mosnier and Ouellet 2008) Local changes in black bear habitat and occupancy near the Project are likely to occur continuously throughout the construction phase but are not expected to have a measurable effect on the abundance and distribution of the black bear population as effects are expected to be partially reversible at the end of construction.

Effects from the Project and previous and existing developments on the black bear population are expected to be measurable but within the predicted adaptive capability and resilience limits for this species. Forestry likely explains most of the regional effect to the population, while the Project and other types of human development are expected to have no measurable residual effect on the black bear population. There should be sufficient undisturbed habitat in the RSA for a healthy and self-sustaining black bear population. Black bear populations are most vulnerable to changes in hunter-related female mortality (Howe et al. 2001; MNR 2009). Although population trends for black bear in Ontario are unknown, there are estimated to be 75,000 to 100,000 individuals in the province (MNR 2009).

3.1.2.3 American Marten

Potential suitable habitat for marten in the RSA was considered to be dense coniferous forest, dense mixed forest, dense deciduous forest, treed bog and treed fen habitats as these habitats may have specific vertical and horizontal structural components that can provide foraging habitat or a den site (Poole et al. 2004). The RSA is predicted to be comprised of 88.0% potential suitable habitat for American marten, under reference conditions. Previous and existing developments have removed 10.7% of potential habitat for marten in the RSA (Table 3-5). The Project is predicted remove 0.4% of potential suitable marten habitat in the RSA.

Habitat fragmentation may have negative effects on marten abundance and habitat use. A 60% decline in marten occupancy over 30 years in an experimental forest area in California was likely related to increased distance between habitat patches (Moriarty et al. 2011). In Maine, American marten were observed to use habitats closer to large forest patches more than areas that were farther from large forest patches (Chapin et al. 1998). The distance between potential marten habitats is between 87 m (dense mixed forest) and 642 m (treed fen) under reference conditions (Table 3-2). Previous and existing developments in the RSA have changed the MDNN for marten habitats (except treed bog habitat) by less than or equal to 5 m. The mean distance between treed bog patches has decreased by 83 m from reference to 2012 baseline conditions. The Project is predicted to change the distance between marten habitat patches by less than or equal to 1 m.

Table 3-5: Percent Change of Potential Suitable Habitats for American Marten in the Regional Study Area from Reference to 2012 Baseline and 2012 Baseline to Application Conditions

Habitat	Reference (ha)	Reference to 2012 Baseline	2012 Baseline to Application
Primary ■ dense coniferous forest ■ dense mixed forest ■ dense deciduous forest ■ sparse forest ■ treed bog ■ treed fen	333,364	-10.7	-0.4

Note:
ha - hectares

Previous and existing developments have produced a total linear feature density of <0.01 km/km^2 in the RSA (Table 2-5). The construction of the access roads and transmission line is expected to result in a negligible increase in linear density within the RSA as access roads will follow existing trails and local roads as much as possible. The current linear density estimate for the RSA is much lower than observed values for effects to wildlife in forested environments (0.6 km/km^2 to 1.5 km/km^2) (Frair et al. 2008; Nielsen et al. 2009). The small changes in MDNN for most marten habitats from the Project, combined with the relatively low density of linear features, are not anticipated to change marten abundance and distribution in the RSA.

Effects from previous and existing developments have not likely adversely affected marten habitat in the RSA. Forests 30 to 60 years old were found to be capable of supporting self-sustaining marten populations, although densities may be lower and there is a higher risk of population decline due to chance events than populations in forests greater than 60 years of age (Fryxell et al. 2008). Regenerating forests that are younger than 30 years may also be used by marten (e.g., for foraging) (Andruskiw et al. 2008; Mergey et al. 2011; Caryl et al. 2012).

The effects of sensory disturbance on marten are unclear. Some studies suggest that detection rates decrease with increasing levels of disturbance from roads, seismic lines and pipelines (Moses et al. 2002). Alternately, a study by Zielinski et al. (2008) in California showed that there was no effect from off-highway vehicle use on habitat occupancy or probability of detection of marten. Construction of the Project is predicted to have a minor influence on the local abundance and distribution of marten.

To summarize, local effects from the Project on marten abundance and distribution are anticipated to be measurable as small mammal abundance has been found to be lower within 1 km human developments (Benitez-Lopez et al. 2010). However, these local effects are not expected to be measurable at the population level. Local changes in marten habitat and occupancy near the Project are likely to occur continuously throughout the construction phase but habitat quality and quantity are not anticipated to be limiting to marten in the RSA. Also, effects are expected to be partially reversible at the end of the construction phase. Although historically considered to be a mature forest-dependent species, recent studies suggest that marten may be dependent on the presence of trees but habitat age is not as important (Pereboom et al. 2008; Fryxell et al. 2008). Marten are not likely not limited by habitat loss and fragmentation until it covers 20% to 40% of an area (e.g., RSA) (Chapin et al. 1998, Hargis et al. 1999, Potvin et al. 2000). Human development (excluding forestry operations) currently covers 2.1% of the RSA.

Human developments, including forestry operations and the Project, are not anticipated to have a measurable effect on the abundance and distribution of the marten population in the RSA. Small mammal abundance (Zalewski et al. 1995; Jensen et al. 2012) and harvest mortality (Fryxell et al. 1999; Helldin 2000; Fryxell et al. 2008) are considered to be the key limiting factors for marten populations when suitable habitat is abundant. The marten population in Ontario appears to be stable (Novak et al. 1987).

3.1.2.4 Beaver

Beavers are dependent on aquatic habitats. However, riparian and upland vegetation that surrounds water bodies is an important determinant of beaver use. Beaver prefer aspen (*Populus tremuloides*), willow (*Salix* spp.) and balsam poplar (*Populus balsamifera*) and typically forage for these species within 30 m of a waterbody, although foraging of up to 200 m from the water's edge has been reported (Allen 1982). To be conservative, potential suitable habitats for beaver within the RSA were determined as dense deciduous forest, dense mixed forest and regenerating habitats that were within 200 m of wetlands and other water bodies. The RSA is predicted to consist of approximately 13.3% potential habitat for beaver under reference conditions.

Previous and existing developments have removed 12.0% of potential suitable beaver habitat in the RSA, relative to reference conditions (Table 3-6). The Project is predicted to remove 0.8% of potential beaver habitat.

Table 3-6: Percent Change of Potential Suitable Habitats for Beaver in the Regional Study Area from Reference to 2012 Baseline and 2012 Baseline to Application Conditions

Habitat	Reference (ha)	Percent Change Reference to 2012 Baseline	Percent Change 2012 Baseline to Application
■ dense mixed forest, dense deciduous forest and regenerating habitats within 200 m of water and wetland	50,439	-12.0	-0.8

Note:
ha - hectares

Beaver can travel long distances during juvenile dispersal (range 0.4 km to 21 km; McNew and Woolf 2005). The mean distance between wetland and water habitat patches is 431 m and 323 m, respectively, under reference conditions (Table 3-2). Previous and existing developments have increased the MDNN for both wetland and water habitats by 37 m. The Project is anticipated to increase the distance between wetland and water habitats by less than or equal to 2 m.

Wolf numbers increase with road density in areas with low road and human density (Thurber et al. 1994; Houle et al. 2010; Bowman et al. 2010), which is related to the ease of travel and increased access to prey populations. As such, wolf density and potential for predation on beaver may increase near the Project. The overall density of linear features in the RSA under existing conditions is <0.01 km/km^2 (Table 2-5). The construction of the access roads and transmission line is expected to result in a negligible increase in linear density within the RSA as access roads will follow existing local roads as much as possible. The current linear density estimate for the RSA is much lower than observed values for effects to wildlife in forested environments (0.6 to 1.5 km/km^2)

(Frair et al. 2008; Nielsen et al. 2009). The small increases in distances between wetland and water habitats and linear density in the RSA is anticipated to have no measurable influence on beaver abundance and distribution.

Literature is not available for the effects of sensory disturbance on beavers. Sensory disturbance could result in local changes to the movement and behaviour, and habitat occupancy of individuals. Sensory disturbance associated with human activities such as forestry operations and mineral exploration has occurred in the RSA since 1800. As such, the beaver population in the RSA is expected to have adapted to human-related sensory disturbance. The Project is predicted to result in a minor and local change in the occupancy and distribution of this species.

Project-specific changes to beaver habitat and occupancy are likely to occur continuously throughout the construction phase and to be measurable at the local scale. Changes are expected to be partially reversible at the end of the construction phase. Changes to beaver habitat may also be measurable during the operations phase due to the need to manage beaver activity within waterbodies to limit the risk of flooding of roads and infrastructure. However, changes are expected to have no measurable effect on abundance and distribution of beaver at the population level (i.e., RSA). Habitat quality and quantity are not expected to be limiting factors for beaver in the RSA, and should be sufficient for self-sustaining beaver populations.

The Project, forestry and other human developments are predicted to have no measurable effect on the abundance and distribution of the beaver population in the RSA. Current forest practices retain riparian buffers around most water bodies and there is anticipated to be sufficient undisturbed habitat in the RSA as other human developments cover 2.1% of the RSA. Beaver populations in Ontario are considered to be large (Ontario Fur Managers Federation 2012).

3.1.3 Migratory Birds

3.1.3.1 Upland Migratory Birds

Nine upland breeding bird species with breeding ranges that overlap the RSA are currently listed or recommended to be listed under provincial or federal legislation. Barn swallow (*Hirundo rustica*), bobolink (*Dolichonyx oryzivorus*) and eastern meadowlark (*Sturnella magna*) are protected under the *Endangered Species Act* (ESA; 2007). Chimney swift (*Chaetura pelagica*), Canada warbler (*Cardellina canadensis*), common nighthawk, olive-sided flycatcher and whip-poor-will are species that are protected provincially under the ESA (2007) and federally under Schedule 1 of the *Species at Risk Act* (SARA 2012). Rusty blackbird is protected under Schedule 1 of the SARA.

Bobolink and eastern meadowlark nest in open areas such as grasslands, hay fields, alfalfa fields and pastures (Martin and Gavin 1995; Jaster et al. 2012). Although barn swallows historically nested in caves and hollow trees, they currently primarily breed on human-made structures that are close to open meadows and fields (Brown and Bomberger Brown 1999). There was no agricultural land identified by the ELC in the RSA. As such, bobolink, eastern meadowlark and barn swallow are expected to have a low potential for occurrence in the RSA and Project-related changes to habitat loss, alteration and fragmentation to these species are anticipated to be not measurable at the population level.

Chimney swifts nest in chimneys and natural habitat features, such as caves and hollows trees (Cink and Collins 2002), which cannot be determined from the Land Cover Data Base (Spectranalysis Inc. 2004). However, local changes to chimney swift habitat from the Project are anticipated to be negligible because forestry operations are likely the limiting factor for providing suitable natural nesting habitat (i.e., hollow trees) (NHIC 2013).

Whip-poor-will and common nighthawk are nightjar species that require similar habitat for nesting. Whip-poor-wills were heard at two locations outside of the LSA during whip-poor-will and common nighthawk surveys in 2012 (Terrestrial Baseline Report). No common nighthawks were recorded during the surveys. Survey sites where the whip-poor-wills were heard were located in dense coniferous forest (Terrestrial Baseline Report). However, the birds were heard greater than 50 m from observers and so habitat may be different where the whip-poor-wills were located. Whip-poor-will are typically found in open forest with little to no understory (Cink 2002). Forest openness is more important than composition and whip-poor-will are generally absent from dense forest habitats. Common nighthawk nest in open forests and woodland clearings (Brigham et al. 2011). Potential suitable habitat for common nighthawk and whip-poor-will (nightjars) was considered to exist in sparse forest habitat.

There was predicted to be 5.9% potential suitable habitat for nightjars, under reference conditions. There has been a 9.5% decrease in potential suitable habitat for nightjars from reference to 2012 baseline conditions (Table 3-7). The Project is predicted to remove 0.5% of potential suitable habitat for nightjars.

Olive-sided flycatchers prefer to nest in open to semi-open conifer habitats and forest edges (Altman and Sallabanks 2012). Fire has a positive influence on olive-sided flycatchers and sometimes flycatchers are found exclusively in recent burn habitat (Bock and Lynch 1970; Altman and Sallabanks 2012). Olive-sided flycatchers have also been found to be more abundant in areas with clear cuts (Altman and Sallabanks 2012). No olive-sided flycatchers were observed during upland breeding bird surveys (Terrestrial Baseline Report). Potential suitable habitat for olive-sided flycatcher was considered to be sparse forest, recent logged and recent burn habitat. There was predicted to be approximately 6.6% potential olive-sided flycatcher habitat in the RSA under reference conditions. There has been a 2.7% decrease in the amount of potential olive-sided flycatcher habitat from reference to baseline conditions (Table 3-7). The Project is predicted to remove 0.6% of potential olive-sided flycatcher habitat in the RSA.

Canada warblers nest in a variety of deciduous and coniferous forests but are most abundant in moist mixed forests (Reitsma et al. 2010). Canada warblers have been found nesting in treed bogs, treed fens and regenerating habitats. Data from upland breeding bird surveys shows that Canada warbler had the highest density in recent logged/regenerating habitat, followed by dense mixed forest; Canada warblers were not recorded in other habitat types (Terrestrial Baseline Report). Potential suitable Canada warbler habitat was considered to be dense mixed forest, dense deciduous forest, dense coniferous forest, treed bog, treed fen, and regenerating habitats.

There was predicted to be 82.1% potential suitable Canada warbler habitat in the RSA under reference conditions. Previous and existing developments have removed 10.7% of potential Canada warbler habitat (Table 3-7). The Project is predicted to remove 0.4% of potential Canada warbler habitat in the RSA.

Rusty blackbirds primarily nest in treed bogs, treed fens and edges of wetlands (Avery 2013). No rusty blackbirds were observed during upland breeding bird surveys. Potential suitable rusty blackbird habitat (i.e., treed bog, treed fen and wetland) is predicted to have covered 4.1% of the RSA under reference conditions.

Previous and existing developments have removed 9.7% of potential rusty blackbird habitat in the RSA (Table 3-7). The Project is predicted to remove 1.5% of potential rusty blackbird habitat.

Table 3-7: Percent Change of Potential Suitable Habitats for Upland Breeding Bird Species at Risk in the Regional Study Area from Reference to 2012 Baseline and 2012 Baseline to Application Conditions

Common Name	Scientific Name	Potential Habitat	Reference (ha)	Reference to 2012 Baseline	2012 Baseline to Application
nightjars (common nighthawk and whip-poor-will)	*Chordeiles minor* and *Antrostomus vociferus*	■ sparse forest ■ recent logged ■ recent burn	22,375	-9.5	-0.5
olive-sided flycatcher	*Contopus cooperi*	■ sparse forest ■ recent logged ■ recent burn	25,128[(a)]	-2.7	-0.6
Canada warbler	*Cardellina canadensis*	■ dense mixed forest ■ dense coniferous forest ■ dense deciduous forest ■ treed bog ■ treed fen ■ regenerating	310,988[(b)]	-10.7	-0.4
rusty blackbird	*Euphagus carolinus*	■ treed bog ■ treed fen ■ wetland	15,579	-9.7	-1.5

Note:
(a) Area does not include recent logged habitat as there was no modelled recent logged habitat under reference conditions (Section 2.5).
(b) Area does not include regenerating habitat as there was no modelled regenerating habitat under reference conditions (Section 2.5).
ha - hectares

Forestry is expected to have a larger influence on the upland breeding bird populations in the RSA than other human developments including the Project. Non-forestry related human activities have disturbed about 2.1% of the RSA since reference conditions, while 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 ha) and dense mixed forest (46.5% of harvested area; 7,653 ha) habitats but treed bog (679 ha), dense deciduous forest (370 ha) and sparse forest (165 ha) habitats have also been harvested. The Canada warbler population in the RSA may be negatively affected by the loss of dense mixed forest, dense coniferous forest, dense deciduous forest and treed bog habitats. The loss of sparse forest may have negatively affected the nightjar populations, while the loss of treed bog may have negatively affected the rusty blackbird population.

Logging operations are likely to have a positive influence on the olive-sided flycatcher population in the RSA as this species has been found to be more abundant in areas with clear cuts (Altman and Sallabanks 2012). Similarly, recent harvested areas may provide suitable secondary habitat for nightjars (Cink 2002; Brigham et al. 2011). Regenerating clearcuts may provide suitable habitat for Canada warbler (Reitsma et al. 2010).

Habitat loss and fragmentation in the RSA is below the thresholds (e.g., 40% habitat loss) identified for highly mobile species (such as most birds) (With and Crist 1995; Flather and Bevers 2002; Swift and Hannon 2010). As such, potential habitat for listed upland breeding bird species in the RSA is not considered to be limiting to these species' populations.

Few studies have focused on the effects of noise and disturbance to upland bird behaviour and movement. Behaviours most likely to be affected are nest site selection, territory selection, mate attraction and foraging. Noise may also inhibit predator detection and interfere with mate/chick communication (Habib et al. 2007). Many boreal upland breeding bird species have lower abundance in noisy areas than pristine areas (Habib et al. 2007; Bayne et al. 2008). According to Trombulak and Frissell (2000), disturbances such as roads have the potential to change the reproductive success of wildlife species. Habib et al. (2007) found that pairing success of ovenbirds was significantly lower in areas near compressor stations. Conversely, a study by Canaday and Rivadeneyra (2001) found noise to be a disturbance to birds over distances less than 300 m. A study of Lapland longspurs by Male and Nol (2005) showed no difference in nest success between sites with high and low levels of human noise at the Ekati Diamond Mine. Overall, it appears that some bird species may benefit from human disturbance while others do not (Spellerberg and Morrison 1998).

Bird populations in the RSA are likely to have adapted to human-related sensory disturbance because human activities including forestry and mineral exploration have been carried out in the RSA since 1800. Also, changes in habitat quality from sensory disturbance do not necessarily result in demographic consequences to populations (Gill et al. 2001). Most of the effects from indirect changes in habitat quality may be related to a local shift in distribution with little influence on survival and reproduction rates.

Common nighthawk populations in Ontario have been declining dramatically in recent years with annual declines in Ontario of 11% between 1981 and 2005 (Cadman et al. 2007). Whip-poor-will has also experienced substantial population declines in Ontario since the mid-20th century. Nightjars are more common south of the study area. Chimney swifts have declined by 8.9% per year between 1968 and 2005. Chimney swifts are most commonly found in southern Ontario. Although the olive-sided flycatcher population in Ontario has declined by 13.9% per year since 1981, this species has been found to respond positively to a variety of forest harvest regimes. The RSA is located in an area that supports a low to moderate abundance of olive-sided flycatchers.

The Canada warbler population in Ontario has not appeared to have declined between 1981 and 2005 (Cadman et al. 2007). The RSA is located in an area that contains a moderate abundance of Canada warblers. The probability of observation for rusty blackbird in the northern shield region of Ontario decreased by 32% between the first breeding bird atlas (1981 to 1985) and the second atlas (2001 to 2005). The highest densities of rusty blackbirds in Ontario are found in the Hudson Bay Lowlands; no rusty blackbirds were recorded in the area surrounding the RSA during the second breeding bird atlas (2001 to 2005). Rusty blackbirds are not likely to have a high probability of detection during the atlas surveys because rusty blackbirds are typically associated with wetland edge habitat and rarely enter the forest interior (Avery 2013). No rusty blackbirds were observed during breeding bird surveys in the RSA but rusty blackbirds were observed during other wildlife surveys and wetland surveys in the LSA (Terrestrial Baseline Report).

In conclusion, local effects from the Project on upland breeding bird abundance and distribution are anticipated to be measurable as birds have been found to have lower abundance within 1 km of human developments (Benitez-Lopez et al. 2010). However, these local effects are not anticipated to influence the populations occupying the RSA. Local changes to upland breeding bird habitat and occupancy near the Project are likely to occur continuously throughout the construction phase and to be partially reversible at the end of the construction (two years). Habitat quantity may be limiting for some upland breeding bird species at risk in the RSA. However, the Project is anticipated to remove less than or equal to 1.5% of potential suitable habitats for upland breeding bird species at risk.

Habitat loss and fragmentation from the transmission line may change the local abundance and distribution of populations. Individuals may be displaced (Hagan et al. 1996) and territory size for individuals that have home ranges overlapping the transmission line may increase (Machtans 2006). Additionally, some birds may avoid the transmission line even after sensory disturbance from construction has ceased. For example, reduced forest cover of 50 m to 200 m were found to limit bird movements in the boreal forest (Desrochers and Hannon 1997; Schmiegelow et al. 1997; St. Clair et al. 1998). Ground nesting birds may also experience increased mortality from predators such as raccoon, weasel and marten. The use of line markers on the transmission line should limit effects to bird and bat mortality. Effects from the transmission line are anticipated to be within the resilience limits for upland migratory bird EAI populations in the RSA.

The Project, forestry operations and other developments in the RSA are anticipated to have no to little measurable effect (olive-sided flycatcher) or measurable effects that are within the adaptive capability and predicted resilience limits (Canada warbler, rusty blackbird, nightjars) on the abundance and distribution of listed upland breeding bird species' populations. Recent harvested areas may have a positive influence on olive-sided flycatchers and provide suitable habitat for nightjars. Although harvesting operations have primarily removed dense mixed and dense coniferous forest habitat, these are the most common habitat types in the RSA and effects to species that rely on these habitats are anticipated to be negligible.

3.1.3.2 Waterbirds

Horned grebe (*Podiceps aurtius*), yellow rail (*Coturnicops noveboracensis*) and American white pelican (*Pelecanus erythrorhynchos*) are protected in Ontario under the ESA (2007). The ESA prohibits the destruction of habitat for species listed in the ESA (Ontario 2007). Horned grebe and yellow rail are also listed federally under Schedule 1 of the SARA (2012). Yellow rails, American white pelicans, horned grebes were not recorded in the area surrounding the RSA during the first or second Ontario breeding bird atlas surveys (Cadman et al. 2007).

Waterbirds occupy a wide variety of habitats, but all share strong associations to aquatic habitat. Dabbling ducks occupy littoral and shoreline habitat while diving ducks and horned grebes use open-water habitat. Lakes in the region provide breeding habitat for loons, American white pelican, gulls and terns. Another important habitat may be treed fen. However, this terrestrial habitat type is considered most suitable when it is adjacent to open water. Yellow rails breed in sedge-dominated wetlands; however, this habitat type could not be identified on the ELC. Potential breeding habitat for waterbirds was considered to be wetlands, treed fen within 200 m of wetlands and water bodies and shorelines of large lakes (100 m buffer).

Potential breeding habitat for waterbirds is predicted to have covered approximately 8.2% of the RSA under reference conditions. Previous and existing developments have removed 4.1% of potential waterbird habitat in the RSA, relative to reference conditions (Table 3-8). The Project is predicted to remove 0.7% of potential waterbird habitat. Previous and existing developments and the Project are predicted to decrease the amount of waterbird habitat in the RSA by 4.8% relative to reference conditions. Changes to the MDNN for water and wetland habitats (increase of 38 m and 35 m, respectively, from reference to application conditions; Table 3-2) in the RSA are not anticipated to affect waterbirds as species are highly mobile.

Table 3-8: Percent Change of Potential Breeding Habitat for Waterbirds in the Regional Study Area from Reference to 2012 Baseline and 2012 Baseline to Application Conditions

Habitat	Reference (ha)	Reference to 2012 Baseline	2012 Baseline to Application
▪ wetland ▪ treed fen within 200 m of water and wetland ▪ shoreline (100 m) of water	31,043	-4.1	-0.7

Note:
ha - hectares; m - metres

Few studies have focused on the effects of noise and disturbance to waterbird behaviour and movement. However, some studies (Korschgren et al. 1985; Ward and Stein 1989; Dahlgren and Korschgren 1992) have found that noise and motion disturbances originating from man-made sources can negatively affect waterbird behaviour. Disturbance effects on waterbirds may include displacement, nest abandonment, reduced nest success, or reduced foraging efficiency (Hockin et al. 1992; Dahlgren and Korschgren 1992). Some types of noise may startle or disturb nesting birds. Other studies have found that several waterbird species may eventually become habituated to high noise levels (Busnel and Briot 1980; Ronconi et al. 2004).

Although noise and sensory disturbance can alter the movement and behaviour of waterbirds (Bommer and Bruce 1996), the specific effects of human-related sensory disturbance on many species of waterbirds are unknown. Loons are thought to be relatively sensitive to human disturbance (Ehrlich et al. 1988). However, analysis of information collected at the Ekati Diamond Mine suggested that the level of mining activities had not negatively influenced the presence of loons adjacent to the Mine Site (BHPB 2003). Minimum distance recommendations to reduce the effects to waterbird behaviour from man-made noise are 200 to 300 m for traffic disturbance (Fruzinski 1977; Mooij 1982; Madsen 1985) and 3 km to 4 km for aircraft disturbances (Davis and Wisely 1974; Berger 1977).

Sensory disturbance associated with human activities such as forestry operations and mineral exploration has occurred in the RSA since 1800. As such, waterbird populations in the RSA are expected to have adapted to human-related sensory disturbance. The Project is predicted to result in a minor and local change in the occupancy and distribution of waterbird species throughout the construction phase and effects are expected to be partially reversible at the end of the construction (two years). Changes to waterbird abundance and distribution (including listed species) from the Project are anticipated to be measurable within 1 km (Benitez-Lopez et al. 2010) but are expected to have no measurable effect on the populations in the RSA. There is predicted to be sufficient undisturbed habitat in the RSA for self-sustaining waterbird populations.

The Project, forestry and other human developments are predicted to have no measurable effect on the abundance and distribution of waterbird populations in the RSA. Current forest practices retain riparian buffers around most water bodies and there is anticipated to be sufficient undisturbed habitat in the RSA as other human developments cover 2.1% of the RSA. Waterbird population estimates for eastern Canada in 2013 were higher than the long-term average (1990 to 2012) (Zimpfer et al. 2013).

3.1.3.3 Raptors

The majority of raptor species in northern Ontario nest in large trees, which are typically found in mature upland forest habitats (e.g., dense coniferous forest, dense deciduous forest, dense mixed forest and sparse forest) (Kirk 2003). One exception is short-eared owl, which typically nests in open areas such as open bog habitat (potential suitable short-eared owl habitat) (Wiggins et al. 2006). Potential suitable tree-nesting raptor habitat was considered to be dense coniferous forest, dense deciduous forest, dense mixed forest and sparse forest. Other habitat features, such as cliffs, may also be selected by raptors for nesting but these topographic features are uncommon in the LSA. One bald eagle nest was located in the LSA during baseline studies (Terrestrial Baseline Report). The nest is approximately 150 m from the expected MRA and 400 m from the anticipated open pit. In an effort to mitigate and manage effects to this nest site, IAMGOLD will follow the guidelines provided by MNR in the document titled Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales (MNR 2010). However, if the nest site needs to be removed because of operational constraints, IAMGOLD will consult with the MNR for guidance on how best to proceed.

The reference RSA is predicted to have contained approximately 84.3% potential suitable tree-nesting raptor habitat and 0.2% potential suitable short-eared owl habitat. Previous and existing developments have removed 10.7% of potential tree-nesting raptor habitat in the RSA, relative to reference conditions (Table 3-9). Approximately 18.7% of potential short-eared owl habitat in the RSA has been removed by previous and existing developments. The Project is predicted to remove 0.4% of potential tree-nesting raptor habitat (Table 3-9). The Project is not predicted to remove any potential short-eared owl habitat.

Forestry operations are expected to have more of an influence on raptor habitat quantity and quality than other human developments because recent logged habitat covers approximately 3.5 times more area in the RSA than other human developments. Although some raptor species and individuals may avoid areas with human activities, many species (including peregrine falcon, which is a species at risk in Ontario) are able to habituate to human disturbance. The abundance of raptors observed near the Project during baseline surveys was low (Terrestrial Baseline Report), which is likely due to natural limited availability of quality nesting habitat in the LSA.

Local changes in raptor habitat and occupancy are likely to occur continuously throughout construction and to be measurable within 5 km of Project activities (Benitez-Lopez et al. 2010). However, these local effects are not anticipated to be measurable at the population level and are expected to be partially reversible at the end of the construction phase. Habitat for tree-nesting species is not expected to be a limiting factor for populations. There is little potential habitat for short-eared owl in the RSA under existing conditions (0.2% of the RSA) and the Project is not anticipated to remove any open bog habitat.

Effects from the Project and previous and existing developments on raptor populations are expected to be measurable but within the adaptive capability and predicted resilience limits for species. Forestry likely explains most of the regional effect to populations, while the Project and other types of human development are expected to have no to little measurable effect on raptor populations.

Table 3-9: Percent Change of Potential Suitable Habitats for Raptors in the Regional Study Area from Reference to 2012 Baseline and 2012 Baseline to Application Conditions

Common Name	Scientific Name	Potential Habitat	Reference (ha)	Reference to 2012 Baseline	2012 Baseline to Application
tree-nesting raptors	-	■ dense coniferous forest ■ dense deciduous forest ■ dense mixed forest ■ sparse forest	319,484	-10.7	-0.4
short-eared owl	*Asio flammeus*	■ open bog	908	-18.7	0.0

Notes:
ha - hectares; NA - not applicable

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

Bats

During the summer, bats occupy a variety of day and night roosts including buildings, caves and trees (Caceres and Barclay 2000). These habitat features cannot be determined from the LC2000 data base but suitable habitat was considered to be present in dense coniferous forest, dense deciduous forest, dense mixed forest and sparse forest habitats.

During baseline studies, station acoustic monitors were deployed at potential maternity roosting locations (i.e., mixedwood or deciduous forest with deciduous trees >25 cm diameter at breast height [DBH]). Seven species of bat and one unidentified species of bat were recorded at the stationary monitoring locations (Terrestrial Baseline Report). Little brown myotis was recorded at five of the six stationary stations within the LSA with a maximum of 117 observations in one night at one monitoring station. Northern myotis was not recorded within the LSA (Terrestrial Baseline Report).

There was predicted to be 84.3% potential suitable bat habitat in the RSA under reference conditions. Previous and existing developments have removed 10.7% of potential bat habitat, relative to reference conditions (Table 3-10). The Project is anticipated to remove 0.4% of potential bat habitat.

Fragmentation has been found to have positive (Estrada and Coates-Estrada 2002; Gorresen and Willig 2004; Struebig et al. 2008; Klingbeil and Willig 2009) and negative (Estrada et al. 1993; Cosson et al. 1999; Estrada and Coates-Estrada 2002; Struebig et al. 2008; Meyer and Kalko 2008) effects on bat diversity and abundance. In Panama, islands further from the mainland were found to have fewer species than islands closer to the mainland (Meyer and Kalko 2008). Isolation distance was also found to have an important influence on species richness in forest and agricultural areas in Mexico (Estrada et al. 1993).

Under reference conditions, the distance between similar habitat patches for potential suitable habitat for bats ranged from 87 m (dense mixed forest) to 178 m (dense deciduous forest) (Table 3-2). The MDNN for potential bat habitat has increased by less than or equal to 3 m from reference to 2012 baseline conditions. The Project is anticipated to increase distance between potential suitable habitat patches for bats by less than or equal to 1 m. The greatest distance between habitat patches under application conditions is 176 m, for dense deciduous forest habitat. The largest increase in MDNN from reference to application conditions is predicted for dense deciduous forest and dense coniferous forest habitat (3 m for both habitats). The small increase in MDNN for potential suitable bat habitat is unlikely to influence population abundance and distribution as bats are highly mobile.

Little information is available on the effects of sensory disturbance on bats. Noisy environments may limit the foraging effectiveness of bats that forage for large, ground-running insects that they find by listening to rustling sounds (Schaub et al. 2008; Jones 2008; Siemers and Schaub 2010). However, traffic noise is unlikely to affect aerial-feeding bats (e.g., little brown myotis and northern myotis) as echolocation frequencies are typically higher than traffic noise frequencies (Jones 2008).

Local effects on bat abundance and distribution are anticipated to be measurable near the Project as small mammal and bird abundances have been found to be lower within 1 km of human developments (Benitez-Lopez et al. 2010). However, these local effects are expected to have no measurable effect at the population level. Local changes in bat habitat and occupancy near the Project are likely to occur throughout the construction phase and effects are expected to be partially reversible at the end of construction. Habitat quantity and quality are not likely to be limiting factors for bat populations in the RSA. White nose syndrome is considered to be the primary cause of bat population declines in Ontario. Although no numbers are available for Ontario, white nose syndrome has killed more than five million bats in the northeastern United States since 2006 (MNR 2012b). Subsequently, effects from the Project and other human disturbance (including forestry) are predicted to have no measurable effect on bat populations in the RSA.

Table 3-10: Percent Change of Potential Suitable Habitats for Bats in the Regional Study Area from Reference to 2012 Baseline and 2012 Baseline to Application Conditions

Habitat	Reference (ha)	Reference to 2012 Baseline	2012 Baseline to Application
■ dense coniferous forest ■ dense deciduous forest ■ dense mixed forest ■ sparse forest	319,484	-10.7	-0.4

Notes:

ha - hectares; NA - not applicable

Eastern Wolf

Effects from Project construction to eastern wolf, which is a provincially and federally listed species, are discussed in Section 3.1.2.

Upland Migratory Birds

Effects from Project construction on federally and provincially listed upland migratory birds are discussed in Section 3.1.3.

Waterbirds

Effects from Project construction on federally and provincially listed waterbirds are discussed in Section 3.1.4.

Raptors

Effects from Project construction on federally and provincially listed raptor species are discussed in Section 3.1.5.

3.2 Operations Phase

Effects to all wildlife EAIs from Project operations are expected to be similar to those predicted during construction (Section 3.1.1 through Section 3.1.6). 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 wildlife EAIs from Project closure are expected to be similar to those predicted during construction (Section 3.1.1 through Section 3.1.6). Effects are likely to occur throughout the closure phase for all EAIs and are anticipated to be partially reversible at the end of closure (two 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 3.1.6) but should decrease over time. Effects from sensory disturbance are expected to be reversed within two to three years of the start of the post-closure phase after wildlife EAIs adjust to the reduced level of activity on the Mine Site.

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. For wildlife EAIs to use the MRA and TMF after Project closure there will need to be adequate vegetation to provide forage or breeding/resting areas. Therefore, local effects from habitat loss 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). Effects from habitat loss 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 to provide suitable nesting habitat for riparian species, which will likely happen after water levels are constant. Also, the open pit will not likely provide foraging habitat for fish-eating species (e.g., bald eagle and osprey) until a fish population is established in the refilled open pit.

Mortality effects from the transmission line on birds and bats are expected to be reversed within a few generations after the decommissioning of the transmission line during Project closure. Sensory disturbance and habitat loss from the transmission line on wildlife EAIs are expected to be reversed within a few years after Project closure.

4.0 CONCLUSIONS

The Project is predicted to have local effects on the abundance and distribution of wildlife EAIs (i.e., within 1 to 5 km of the Project) but effects are anticipated to be not measurable at the population level (i.e., RSA scale). Project effects are predicted to begin during construction and will continue until two to three years into the post-closure phase. The exception is the effects on wildlife habitats from the residual footprint of the Project (3% of the LSA, 0.1% of the RSA), which are predicted to be partially reversible with a duration of greater than 15 years after closure. The Project is predicted to remove between 0.0% and 1.5% of potential suitable habitats for wildlife EAIs.

Forestry is expected to have a larger influence on wildlife EAI populations in the RSA as forestry has disturbed approximately 3.5 times more habitat than other human developments. Sensory disturbance associated with human activities such as forestry operations and mineral exploration has occurred in the RSA since 1800. As such, wildlife EAI populations in the RSA are expected to have adapted to human-related sensory disturbance. Overall changes to habitat from the Project and other developments are predicted to be within the resilience limits of populations. Habitat quantity and quality in the RSA are expected to be sufficient for self-sustaining EAI populations.

5.0 REFERENCES

Alexander, S.M., N.M. Waters, and P.C. Paquet. 2005. Traffic volume and Highway Permeability for a Mammalian Community in the Canadian Rocky Mountains. The Canadian Geographer 49: 321-331.

Allen, A.W. 1982. Habitat Suitability Index Models: Beaver. United States Department of the Interior, Fish and Wildlife Service. Report: FWS/OBS-82/10.30. 20 pp.

Allen, A.W., P.A. Jordan, and J.W. Terrell. 1987. Habitat Suitability Index Models: Moose, Lake Superior Region. U.S. Department of the Interior Fish and Wildlife Service Biological Report 82(10.155). 60 pp.

Altman, B. and R. Sallabanks. 2012. Olive-sided Flycatcher (*Contopus cooperii*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/502. Accessed: August 26, 2013.

Altringham, J. 2008. Bat Ecology and Mitigation. Public Inquiry Into the A350 Westbury Bypass. 37 pp.

AMEC. 2013. Technical Memorandum: Conceptual Closure and Post-Closure Plan for the Côté Gold Project, September 9, 2013

Andersen, R.J., D.C. Linnell, and R. Langvatn. 1996. Short Term Behavioural and Physiological Response of Moose (*Alces alces*) to Military Disturbance in Norway. Biological Conservation 77:169-176.

Andrén, H. 1994. Effects of Habitat Fragmentation on Birds and Mammals in Landscapes with Different Proportions of Suitable Habitat: A Review. Oikos 71:355-366.

Andrén, A. 1999. Habitat Fragmentation, the Random Sample Hypothesis, and Critical Thresholds. Oikos 84:306-308.

Andruskiw, M., J.M. Fryxell, I.D. Thompson, and J.A. Baker. 2008. Habitat-Mediated Variation in Predation Risk by the American Marten. Ecology 89: 2273-2280.

Avery, M.L. 2013. Rusty Blackbird (*Euphagus carolinus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/200. Accessed: January 10, 2013.

Barrientos, R., C. Ponce, C. Palacin, C.A. Martin, B. Martin, J.C. Alonso. 2012. Wire Marking Results in a Small but Significant Reduction in Avian Mortality at Power Lines: A BACI Designed Study. PLoS ONE 7:e32569.

Baxter, A.T., and J.R. Allan. 2008. Use of Lethal Control to Reduce Habituation to Blank Rounds by Scavenging Birds. Journal of Wildlife Management 72:1653-1657.

Bayne, E.M., L. Habib, and S. Boutin. 2008. Impacts of Chronic Anthropogenic Noise from Energy-Sector Activity on Abundance of Songbirds in the Boreal Forest. Conservation Biology 22:1186-1193.

Beckmann, J.P. and C.W. Lackey. 2008. Carnivores, Urban Landscapes, and Longitudinal Studies: a Case History of Black Bears. Human-Wildlife Conflicts 2: 168-174.

Benitez-Lopez, A., Alkemade, R., and P.A. Verweij. 2010. The Impacts of Roads and Other Infrastructure on Mammal and Bird Populations: A Meta-Analysis. Biological Conservation 143:1307-1316.

Benn, B. and S. Herrero. 2002. Grizzly Bear Mortality and Human Access in Banff and Yoho National Parks, 1971-98. Ursus 13:213-221.

Berger, T.R. 1977. The Berger report: northern frontier, northern homeland. The Living Wilderness 41: 4-33.

Beringer, J.J., S.G Seibert, and M.R. Pelton. 1989. Incidence of Road Crossing by Black Bears on Pisgah National Forest, North Carolina. International Association of Bear Research and Management 8:85-92.

BHP Billiton Diamonds Inc. (BHPB). 2003. 2002 Wildlife Effects Monitoring Program. Prepared for BHP Billiton Diamonds Inc. by Golder Associates Ltd. January, 2003.

BHPB. 2010. Ekati Diamond Mine 2009 Wildlife Effects Monitoring Program. Prepared by Rescan Environmental Services Ltd. for BHP Billiton Diamonds Inc. March 2010.

Bickmore, C.B. 2003. Review of Work Carried out on the Truck Road Network in Wales for Bats. Countryside Council for Wales Contract Science Report No. 585. 72 pp.

Bishop, C.A. and J.M. Brogan. 2013. Estimates of Avian Mortality Attributed to Vehicle Collisions in Canada. Avian Conservation and Biology 8:2.

Bobbink, R., M. Hornung, and J.G.M. Roelofs. 1998. The Effects of Air-Borne Nitrogen Pollutants on Species Diversity in Natural and Semi-Natural European Vegetation. Journal of Ecology 86:717-738.

Bock, C.E. and J.F. Lynch. 1970. Breeding Bird Populations of Burned and Unburned Conifer Forest in the Sierra Nevada. Condor 72: 182-189.

Boitani, L. 2000. Action Plan for the Conservation of the Wolves (*Canis lupus*) in Europe. Nature and Environment 113. 84pp.

Bommer, A.S. and R.D Bruce. 1996. The Current Level of Understanding into the Impacts of Energy Industry Noise on Wildlife and Domestic Animals. Proceedings of an EUB Spring Conference on Environmental Noise, Banff, AB, April 1996.

Bowman, J., J.C. Ray, A.J. Magoun, D.S. Johnson, and F.N. Dawson. 2010. Roads, Logging, and the Large-Mammal Community of an Eastern Canadian Boreal Forest. Canadian Journal of Zoology 88: 454-467.

Brigham, R.M., J. Ng, R.G. Poulin and S.D. Grindal. 2011. Common Nighthawk (*Chordeiles minor*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/213. Accessed: January 10, 2013.

Brown, C.R., and M. Bomberger Brown. 1999. Barn Swallow (*Hirundo rustica*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/452 . Accessed: January 10, 2013.

Brown, W.M. and R.C. Drewien. 1995. Evaluation of Two Power Line Markers to Reduce Crane and Waterfowl Collision Mortality. Wildlife Society Bulletin 23:217-227.

Busnel, R.G., and J.L. Briot. 1980. Wildlife and Airfield Noise in France. Pages 621-631 in J.V. Tobias, G. Jansen, and W.D. Ward, eds. Proceedings of the Third International Congress on Noise as a Public Health Problem. American Speech-Language-Hearing Association, Rockville, MD.

Caceres, M.C. and R.M.R. Barclay. 2000. *Myotis septentrionalis*. Mammalian Species 634: 1-4.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier. 2007. Atlas of the Breeding Birds of Ontario. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature. 728 pp.

Calvert, A.M. C.A. Bishop, R.D. Elliot, E.A. Krebs, T.M. Kydd, C.S. Mactans, and G.J. Robertson. 2013. A Synthesis of Human-Related Avian Mortality in Canada. Avian Conservation and Ecology 8: 11.

Campbell, D.R., C. Lavoie, and L. Rochefort. 2002. Wind Erosion and Surface Stability in Abandoned Milled Peatlands. Canadian Journal of Soil Science 82:85-95.

Canaday, C., and J. Rivadeneyra. 2001. Initial Effects of a Petroleum Operation on Amazonian Birds: Terrestrial Insectivores Retreat. Biodiversity and Conservation 10: 567–595.

Canadian Wildlife Service (CWS). 2007. Preventing Wildlife Attraction to Northern Industrial Sites. Environment Canada. 30 p.

Carr, P.C. and M.R. Pelton. 1984. Proximity of Adult Female Black Bears to Limited Access Roads. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 38: 70-77.

Caryl, F.M., C.P. Quine, and K.J. Park. 2012. Martens in the Matrix: The Importance of Nonforested Habitats for Forest Carnivores in Fragmented Landscapes. Journal of Mammalogy 93: 464-474.

Chapin, T.G., D.J. Harrison, and D.D. Katnik. 1998. Influence of Landscape Pattern on Habitat Use by American Marten in an Industrial Forest. Conservation Biology 12: 1327-1337.

Cink, C.L. 2002. Eastern Whip-Poor-Will (*Antrostomus vociferus*).The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/620. Accessed: May 21, 2013.

Cink, C.L. and C.T. Collins. 2002. Chimney Swift (*Chaetura pelagica*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/646. Accessed: August 30, 2013.

Coady, M. 2001. The Effects of Roads on Black Bear Movements. Leading Edge 2001: Focus on the Biosphere Reserve. Niagara Escarpment Commission. October 19-17, 2001.

Dahlgren, R.B., and C.E. Korschgren. 1992. Human Disturbances on Waterfowl: An Annotated Bibliography. Resource Publication Number 188, U.S. Department of the Interior, Washington, D.C.

Danks, Z.D., and W.F. Porter. 2010. Temporal, Spatial, and Landscape Habitat Characteristics of Moose-Vehicle Collisions in Western Maine. Journal of Wildlife Management. 74: 1229-1241.

Davis, R.A. and A.N. Wisely. 1974. Normal Behaviour of Snow Geese on the Yukon-Alaska North Slope and the Effects of Aircraft-Induced Disturbance on this Behaviour. September 1973. in W.W.H. Gunn, W.J. Richardson, R.E. Schweinsburg, and T.D. Wright (eds.), Studies on Snow Geese and Waterfowl in the Northwest Territories, Yukon Territory and Alaska, 1973. Arctic gas Biological Report Series Vol. 27. Prepared by LGL Ltd.

Diavik Diamond Mines Inc. (DDMI). 2010. 2009 Wildlife Monitoring Program. Prepared by Diavik Diamond Mines Inc. April 2010.

De Beers Canada Inc. (De Beers). 2010. Snap Lake Mine: Wildlife Effects Monitoring Program 2009 Annual Report. Prepared for De Beers Canada Inc. by Golder Associates Ltd., Yellowknife, NWT. July 2010.

Desrochers, A., and S.J. Hannon. 1997. Gap Crossing Decisions by Forest Songbirds During the Post-Fledging Period. Conservation Biology 11: 1204-1210.

Dixon, J.D., M.K. Oli, M.C. Wooten, T.H. Eason, J.W. McCown, and M.W. Cunningham. 2007. Genetic Consequences of Habitat Fragmentation and Loss: the Case of the Florida Black Bear (*Ursus americanus floridanus*). Conservation Genetics. 8: 455-464.

Dussault, C. J-P. Ouellet, C. Laurian, R. Courtois, M. Poulin, and L. Breton. 2007. Moose Movement Rates Along Highways and Crossing Probability Models. Journal of Wildlife Management 71: 2338-2345.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. The Birder's Handbook: A Field Guide to the Natural History of North American Birds. Simon and Shuster Inc., New York.

Endangered Species Act (ESA). 2007. S.O. 2007, c. 6. Government of Ontario.

Estrada, A., R. Coates-Estrada, and D. Merrit Jr. 1993. Bat Species Richness and Abundance in Tropical Rain Forest Fragments and in Agricultural Habitats at Los Tuxtlas, Mexico. Ecography 16: 309-318.

Estrada, A. and R. Coates-Estrada. 2002. Bats in Continuous Forest, Forest Fragments, and in an Agricultural Mosaic Habitat-Island at Los Tuxtlas, Mexico. Biological Conservation 103: 237-245.

Everett, K.R. 1980. Distribution and Properties of Road Dust along the Northern Portion of the Haul Road. In J. Brown and R. Berg (eds.). Environmental engineering and ecological baseline investigations along the Yukon River-Prudhoe Bay Haul Road. U.S. Army Cold Regions Research and Engineering Laboratory, CRREL Report, 80-19: 101-128.

Fahrig, L. 1997. Relative Effects of Habitat Loss and Fragmentation on Population Extinction. Journal of Wildlife Management 61:603-610.

Fahrig, L. and T. Rytwinski. 2009. Effects of Roads on Animal Abundance: An Empirical Review and Synthesis. Ecology and Society 14:21. Available at: http://www.ecologyandsociety.org/vol14/iss1/art21/. Accessed: July 10, 2012.

Fecske, D.M., R.E. Barry, F.L. Precht, H.B. Quigley, S.L. Bittner, and T. Webster. 2002. Habitat Use by Female Black Bears in Western Maryland. Southeastern Naturalist. 1: 77-92.

Flather, C.H., and M. Bevers. 2002. Patchy Reaction-Diffusion and Population Abundance: The Relative Importance of Habitat Amount and Arrangement. The American Naturalist 159:40-56.

Forman, R. T. and L.E. Alexander. 1998. Roads and their major ecological effects. Annual Review of Ecology and Systematics 29: 207-231+C1.

Frair, J.L., E.H. Merrill, H.L. Beyer, and J.M. Morales. 2008. Thresholds in Landscape Connectivity and Mortality Risks in Response to Growing Road Networks. Journal of Applied Ecology. 45: 1504-1513.

Fruzinski, B. 1977. Feeding Habits of Pink-Footed Geese (*Anser fabalis brachyrhynchus*) in Demark during the Spring Passage in April 1975. Danish Review of Game Biology 10: 1-11.

Fryxell, J.M. B. Falls, E.A. Falls, R.J. Brooks, L. Dix, and M.A. Strickland. 1999. Density Dependence, Prey Dependence, and Population Dynamics of Marten in Ontario. Ecology 80: 1311-1321.

Fryxell, J.M. I. Thompson, and J. Baker. 2008. Population Ecology of Marten (*Martes americana*) in the Boreal Forests of Northern Ontario. Final Report for NSERC, Forest Ecosystem Research Cooperative Inc., Canadian Forest Service, and Ontario Ministry of Natural Resources. 21 pp.

Gaines, W.L. 2003. Black Bear, *Ursus americanus*, Denning Chronology and Den Site Selection in the Northeastern Cascades of Washington. Canadian Field-Naturalist. 117: 626-633.

Gese, E.M. and L.D. Mech. 1991. Dispersal of Wolves (*Canis lupus*) in Northeastern Minnesota, 1969-1989. Canadian Journal of Zoology 69: 2946-2955.

Ghose, M.K. 2001. Management of topsoil for geoenvironmental reclamation of coal mining areas. Environmental Geology 40: 1405-1410.

Gill, J.A., K. Norris, and W.J. Sutherland. 2001. Why Behavioural Responses may not Reflect the Population Consequences of Human Disturbance. Biological Conservation 97: 265-268.

Gorresen, P.M. and M.R. Willig. 2004. Landscape Responses of Bats to Habitat Fragmentation in Atlantic Forest of Paraguay. Journal of Mammalogy 85:688-697.

Grantz, D.A., J.H.B. Gamer, and D.W. Johnson. 2003. Ecological Effects of Particulate Matter. Environment International 213-239.

Grosman, P.D., J.A.G. Jaeger, P.M. Biron, C. Dussault, and J.P. Ouellet. 2011. Trade-Off Between Road Avoidance and Attraction by Roadside Salt Pools in Moose: An Agent-Based Model to Assess Measures for Reducing Moose-Vehicle Collisions. Ecological Modelling 222: 1423-1435.

Gunderson, L.H. 2000. Ecological Resilience – In Theory and Application. Annual Review of Ecology and Systematics 31: 425-439.

Gurarie, E., J. Suutarinen, I. Kojola, and O. Ovaskainen. 2011. Summer Movements, Predation, and Habitat Use of Wolves in Human Modified Boreal Forests. Oecologia 165: 891-903.

Habib, L., E.M. Bayne, and S. Boutin. 2007. Chronic Industrial Noise Affects Pairing Success and Age Structure of Ovenbirds *Seiurus aurocapilla*. Journal of Applied Ecology 44: 176-184.

Hagan, J.M., W.M. Vander Haegen, and P.S. McKinley. 1996. The Early Development of Forest Fragmentation Effects on Birds. Conservation Biology 10: 188-202.

Hammond, F.M. 2002. The Stratton Mountain Black Bear Study. Effects of Resort and Residential Development on Black Bears in Vermont: Final Report. Vermont Agency of Natural Resources, Department of Fish and Wildlife.

Hanski, I. 1996. Metapopulation Ecology. Pages 13-43 in O.E. Rhodes, R.K. Chesser, and M.H. Smith (ed.). Population dynamics in Ecological Space and Time. University of Chicago Press, Chicago, IL.

Hanski, I, and M. Gilpin. 1991. Metapopulation Dynamics: Brief History and Conceptual Domain. Biological Journal of the Linnean Society 42:3-16.

Hargis, C.D., J.A. Bissonette, and D.L. Turner. 1999. The Influence of Forest Fragmentation and Landscape Pattern on American Martens. Journal of Applied Ecology 36: 157-172.

Hebblewhite, M., and E. Merrill. 2008. Modelling Wildlife—Human Relationships for Social Species with Mixed-Effects Resource Selection Models. Journal of Applied Ecology. 45: 834-844.

Helldin, J-O. 2000. Population Trends and Harvest Management of Pine Marten *Martes martes* in Scandanavia. Wildlife Biology 6: 111-120.

Hockin, D., M. Ounsted, M. Gorman, D. Hill, V. Keller, and M.A. Barker. 1992. Examination of the Effects of Disturbance on Birds with Reference to its Importance in Ecological Assessments. Journal of Environmental Management 36: 253–286.

Holling, C. S. 1973. Resilience and Stability of Ecological Systems. Annual Review of Ecology and Systematics 4:1-23.

Horejsi, B.L. 1979. Seismic Operations and Their Impact on Large Mammals: Results of a Monitoring Program. Western Wildlife Environments. Mobil Oil Canada Ltd. Calgary, AB.

Houle, M., D. Fortin, C. Dussault, R. Courtois, and J.P. Ouellet. 2010. Cumulative Effects of Forestry on Habitat Use by Gray Wolf (*Canis lupus*) in the Boreal Forest. Landscape Ecology 25:419-433.

Howe, E.J., M. Obbard and J.A. Schaefer. 2001. Population Viability of Black Bears on the Bruce Peninsula, Ontario. Watershed Ecosystems Graduate Program, Trent University, Wildlife Research and Development Section, Ontario Ministry of Natural Resources, Biology Department, Trent University.

Hussain, A., J.B. Armstrong, D.B. Brown, and J. Hogland. 2007. Land-Use Pattern, Urbanization, and Deer-Vehicle Collisions in Alabama. Human-Wildlife Conflicts 1:89-96.

Jaarsma, C.F., F. van Langevelde, and H. Botma. 2006. Flattened Fauna and Mitigation: Traffic Victims Related to Road, Traffic, Vehicle, and Species Characteristics. Transportation Research Part D. 11: 264-276.

Jaster, L.A., W.E. Jensen, and W.E. Lanyon. 2012. Eastern Meadowlark (*Sturnella magna*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/160. Accessed: October 6, 2013.

Jędrzejewski, W., K. Schmidt, J. Theuerkauf, B. Jędrzejewski, and H. Okarma. 2001. Daily Movements and Territory Use by Radio-Collared Wolves (*Canis lupus*) in Bialowieza Primeval Forest in Poland. Canadian Journal of Zoology 79: 1993-2004.

Jensen, W.F., T.K. Fuller, and W.L. Robinson. 1986. Wolf, *Canis lupus*, Distribution on the Ontario-Michigan Border Near Sault Ste. Marie. Canadian Field-Naturalist 100: 363-366.

Jensen, P.G., C.L. Demers, S.A. McNulty, W.J. Jakubas, and M.M. Humphries. 2012. Marten and Fisher Responses to Fluctuations in Prey Populations and Mast Crops in the Northern Hardwood Forest. Journal of Wildlife Management 76: 489-502.

Johnson, G.D. and M.D. Strickland. 2004. An Assessment of Potential Mortality of Migrating Indiana Bats (*Myotis sodalis*) and Virginia Big-eared Bats (*Corynorhinus townsendii virginianus*) Traversing Between Caves Supplement to: Biological Assessment for the Federally Endangered Indiana Bat *(Myotis sodalis*) and Virginia Big-eared Bat (*Corynorhinus townsendii virginianus*). Prepared for NedPower Mount Storm LLC, Chantilly, VA. 24 pp.

Jones, G. 2008. Sensory Ecology: Noise Annoys Foraging Bats. Current Biology 18: 1098-1100.

Kirk, D. A. 2003. Overview of Raptor Status and Conservation in Canada. Bird Trends 9:1-9.

Klingbeil, B.T. and M.R. Willig. 2009. Guild-Specific Responses of Bats to Landscape Composition and Configuration in Fragmented Amazonian Rainforest. Journal of Applied Ecology 46: 203-213.

Korschgren, C.E., L.S.George, and W.L. Green. 1985. Disturbance of Diving Ducks on a Migrational Staging Area. Wildlife Society Bulletin 13: 290–296.

Kristan, W.B. III., and W.I. Boarman. 2007. Effects of Anthropogenic Development on Common Raven Nesting Biology in the West Mojave Desert. Ecological Applications 17:1703-1713.

Kuhn, N. and R. Bryan. 2004. Incorporating Rainfall and Drying Sequences into Erodibility Assessment. ISCO 2004 – 13th International Soil Conservation Organisation Conference – Brisbane, July 2004: Conserving Soil and Water for Society: Sharing Solutions. Paper No. 672: 1-4.

Kuzyk, G.W., J. Kneteman, and F.K.A. Schmiegelow. 2004. Winter Habitat Use by Wolves, Canis lupus, in Relation to Forest Harvesting in West-Central Alberta. Canadian Field-Naturalist 118: 368-375.

Latham, A.D.M., M.C. Latham, and M.S. Boyce. 2011a. Habitation Selection and Spatial Relationshiops of Black Bears (*Ursus americanus*) with Woodland Caribou (*Rangifer tarandus caribou*) in Northeastern Alberta. Canadian Journal of Zoology. 89: 267-277.

Latham, A.D.M., M.C. Latham, M.S. Boyce, and S. Boutin. 2011b. Movement Responses by Wolves to Industrial Linear Features and Their Effect on Woodland Caribou in Northeastern Alberta. Ecological Applications 21: 2854-2865.

Laurian, C., C. Dussault, J.P. Ouellet, R. Courtois, M. Poulin, and L. Breton. 2008a. Behavioural Adaptations of Moose to Roadside Salt Pools. Journal of Wildlife Management 72: 1094-1100.

Laurian, C., C. Dussault, J-P. Ouellet, R. Courtois, M. Poulin, and L.Breton. 2008b. Behaviour of Moose Relative to a Road Network. Journal of Wildlife Management 72:1550-1557.

Leblond, M., C. Dussault, J-P. Ouellet, M. Poulin, R. Courtois, and J. Fortin. 2007. Management of Roadside Salt Pools to Reduce Moose-Vehicle Collisions. Journal of Wildlife Management 71: 2304-2310.

Levins, R. 1969. Some Demographic and Genetic Consequences of Environmental Heterogeneity for Biological Control. Bulletin of the Entomological Society of America 15:237-240.

Li, H., L. Wang, and J. Qiu. 2007. Quantifying CO2 and N2O emissions from agricultural soils in the Huang Huai-hai Plain in Hebei Province. Chinese Journal of Applied Ecology 18: 1994–2000.

Liebezeit, J.R., S.J. Kendall, S. Brown, C.B. Johnson, P. Martin, T.L. McDonald, D.C. Payer, C.L. Rea, B. Streever, A. M. Wildman, and S. Zack. 2009. Influence of Human Development and Predators on Nest Survival of Tundra Birds, Arctic Coastal Plain, Alaska. Ecological Applications 19:1628-1644.

Linnell, J.D.C., J.E. Swenson, R. Andersen, and B. Barnes. 2000. How Vulnerable are Denning Bears to Disturbance? Wildlife Society Bulletin 28: 400-413.

Machtans, C.S. 1996. Songbird Response to Seismic Lines in the Western Boreal Forest: A Manipulative Experiment. Canadian Journal of Zoology 84: 1421-1430.

Madsen, J. 1985. Impact of Disturbance on Field Utilization of Pink-Footed Geese in West Jutland, Denmark. Biological Conservation 33: 53-63.

Maier J.A.K., J.M. Ver Hoef, A.D McGuire, R.T. Bowyer, L. Saperstein, and H.A. Maier. 2005. Distribution and Density of Moose in Relation to Landscape Characteristics: Effects of Scale. Canadian Journal of Forest Research 35:2233–2243.

Male, S.K., and E. Nol. 2005. Impacts of Roads Associated with the Ekati Diamond Mine™, Northwest Territories, Canada, on Reproductive Success and Breeding Habitat of Lapland Longspurs. Canadian Journal of Zoology 83: 1285-1296.

Martin, S.G. and T.A. Gavin. 1995. Bobolink (*Dolichonyx oryizvorus*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/176. Accessed: October 24, 2013.

Marzluff, J.M., and E. Neatherlin. 2006. Corvid Response to Human Settlements and Campgrounds: Causes, Consequences, and Challenges for Conservation. Biological Conservation 30:301-314.

McCutchen, H.E. 1990. Cryptic Behaviour of Black Bears (*Ursus americanus*) in Rocky Mountain National Park, Colorado. International Conference of Bear Research and Management 8: 65-72.

McGarigal, K., S.A. Cushman, M.C. Neel, and E. Ene. 2002. FRAGSTATS: Spatial Pattern Analysis Program for Categorical Maps. Computer software program produced by the authors at the University of Massachusetts, Amherst. Available at: http://www.umass.edu/landeco/research/fragstats/fragstats.html

McGarigal, K., SA Cushman, and E Ene. 2012. FRAGSTATS v4: Spatial Pattern Analysis Program for Categorical and Continuous Maps. Fragstats Documentation . University of Massachusetts, Amherst. Available at: http://www.umass.edu/landeco/research/fragstats/fragstats.html. Accessed: May 6, 2013.

McNay, R.S., G.D. Sutherland, R.K, McCann, and V. Brumovsky. 2013. Evaluation of Moose Population Trends in the Cariboo Region 1985-2012. Report No. 449. Wildlife Infometrics Inc., Mackenzie, BC. 86 pp.

McNew, L.B. Jr. and A. Woolf. 2005. Dispersal and Survival of Juvenile Beavers (*Castor canadensis*) in Southern Illinois. Amerian Midland Naturalist 154: 217-228.

Mech, D.L. 1995. The Challenge and Opportunity of Recovering Wolf Populations. Conservation Biology. 9: 1-9.

Mech, L.D., S.H. Fritts, G.L. Radde, and W.J. Paul. 1988. Wolf Distribution and Road Density in Minnesota. Wildlife Society Bulletin. 16: 85-87.

Meininger, C.A., and P.D. Spatt. 1988. Variations of Tardigrade Assemblages in Dust-Impacted Arctic Mosses. Arctic and Alpine Research 20: 24-30.

Mergey, M., R. Helder, and J.J. Roeder. 2011. Effect of Forest Fragmentation on Space-Use Patters in the European Pine Marten. Journal of Mammalogy 92: 328-335.

Meyer, C.F.J. and E.K.V. Kalko. 2008. Assemblage-Level Responses of Phyllostomid Bats to Tropical Forest Fragmentation: Land-Bridge Islands as a Model System. Journal of Biogeography 35: 1711-1726.

Milakovic, B., K.L. Parker, D.D. Gustine, R.J. Lay, A.B.D. Walker, and M.P. Gillingham. 2011. Habitat Selection by a Focal Predator (*Canis lupus*) in a Multiprey Ecosystem of the Northern Rockies. 92: 568-582.

MCBA (*Migratory Birds Convention Act*). 1994. S.C. 1994, c. 22. Government of Canada.

MNR (Ontario Ministry of Natural Resources). 2000. Significant Wildlife Habitat Technical Guide. 151 pp.

MNR. 2005. Backgrounder on Wolf Conservation in Ontario. June 2005. 55 pp.

MNR. 2009. Backgrounder on Black Bears in Ontario. June 2009. Available at: http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@fw/documents/document/274503.pdf. Accessed: May 22, 2013.

MNR. 2010. Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales. Toronto, ON. 211 pp.

MNR. 2012a. Species at Risk Information Package to Support the Assessment of Impacts of the Proposed Central Corridor Energy Group/Goldcorp Transmission Corridor Routes on Species at Risk. Ontario Ministry of Natural Resources, Sioux Lookout District. September 19, 2012. 66 pp.

MNR. 2012b. Status of White Nose Syndrome in Ontario. Available at: http://www.mnr.gov.on.ca/en/Business/FW/2ColumnSubPage/289678.html. Accessed: October 24, 2013.

Mladenoff, D.J., T.A. Sickley, R.G. Haight, and A.P. Wydeven. 1995. A Regional Landscape Analysis and Prediction of Favorable Gray Wolf Habitat in the Northern Great Lakes Region. Conservation Biology. 9: 279-294.

Monda, M.J., J.T. Ratti, and T.R. McCabe. 1994. Reproductive Ecology of Tundra Swans on the Arctic National Wildlife Refuge, Alaska. Journal of Wildlife Management 58:757-773.

Mooij, J.H. 1982. Inquiry into the Effects of Open Field Roads on Wild Geese in the North Rhine. Charadrius 18:73-92.

Moriarty, K.M., W.J. Zielinski, and E.D. Forsman. 2011. Decline in American Marten Occupancy Rates at Sagehen Experimental Forest, California. Journal of Wildlife Management 75: 1774-1787.

Moses, R., S. Boutin and E. Bayne. 2002. Monitoring Mid-Sized Carnivores in the Mixed Wood Boreal Forest Across a Range of Human Disturbance. Available at: http://www.biology.ualberta.ca/faculty/stan_boutin/ilm/uploads/public/publications/reports/pdf/Winter_Mammal_Tracking_Synopsis_Report_2001-2002.pdf

Mosnier, A., and J.P. Ouellet. 2008. Black Bear Adaptation to Low Productivity in the Boreal Forest. Ecoscience. 15: 485-497.

Natural Heritage Information Centre (NHIC). 2013. Available at: http://nhic.mnr.gov.on.ca/MNR/nhic/data.cfm. Accessed: October 5, 2013

Naylor, B., D. Kaminski, S. Bridge, P. Elkie, D. Ferguson, G. Lucking, and B. Watt. 1999. User's Guide for OWHAM99 and OWHAMTool (Ver. 4.0). Ontario Ministry of Natural Resources, Southcentral Sciences Section Technical Report. No. 54.

Nielsen, S.E., J. Cranston, and G.B. Stenhouse. 2009. Identification of Priority Areas for Grizzly Bear Conservation and Recovery in Alberta, Canada. Journal of Conservation Planning 5: 38-60.

Novak, M., M. E. Obbard, J. G. Jones, R. Newman, A. Booth, A. J. Satterthwaite, and G. Linscombe. 1987. Furbearer Harvests in North America, 1600-1984. Ontario Trappers Association, Ontario, Canada. Cited In Fryxell, J.M. I. Thompson, and J. Baker. 2008. Population Ecology of Marten (*Martes americana*) in the Boreal Forests of Northern Ontario. Final Report for NSERC, Forest Ecosystem Research Cooperative Inc., Canadian Forest Service, and Ontario Ministry of Natural Resources. 21 pp.

Ontario Fur Managers Federation. 2012. Beaver. Available at: http://www.furmanagers.com/#!beaver/c1pvp. Accessed: October 24, 2013.

Ontario Ministry of the Environment. 2012. Ontario's Ambient Air Quality Criteria. Standards Development Branch, Ontario Ministry of the Environment. PIBS#6570e01.

Ontario Ministry of Transportation (MTO). 2007. Environmental Guide for Erosion and Sediment Control During Construction of Highway Projects. pp.78. Available at: http://www.raqsb.mto.gov.on.ca/techpubs/eps.nsf/8cec129ccb70929b852572950068f16b/7ff7c9fa7def430f852572b300578dec/$FILE/MTO%20Env%20Guide%20for%20ESC%20Final%20Feb%202007.pdf

Paquet, P. and C. Callaghan. 1996. Effects of Linear Developments on Winter Movements of Gray Wolves in the Bow River Valley of Banff National Park, Alberta. National Technical Information Service. pp. 21.

Patterson, B.R., J.F. Benson, K.R. Middel, K.J. Mills, A. Silver, and M.E. Obbard. 2013. Moose Calf Mortality in Central Ontario, Canada. Journal of Wildlife Management 77:832-841.

Peek, J.M. 1974. Initial response of moose to a forest fire in northeastern Minnesota. American Midland Naturalis 91: 435-438.Peek, J.M., M.D. Scott, L.J. Nelson, D.J. Pierce, and L.L. Irwin. 1982. Role of Cover in Habitat Management for Big Game in Northwestern United States. Transactions of the 47th North American Wildlife and Natural Resources Conference. Cited in T. Romito, K. Smith, B. Beck, J. Beck, M. Todd, R. Bonar, and R. Quilan. 1999. Moose Winter Habitat: Habitat Suitability Index Model Version 5. Foothills Research Institute.

Pelchat, B.O., and R.L. Ruff. 1986. Habitat and Spatial Relationships of Black Bears in Boreal Mixedwood Forest of Alberta. International Conference on Bear Research and Management 6:81-92.

Pereboom, V., M. Mergey, N. Villerette, R. Helder, J-F. Gerard, and T. Lode. 2008. Movement Patterns, Habitat Selection, and Corridor Use of a Typical Woodland-Dweller Species, the European Pine Marten (*Martes martes*), in Fragmented Landscape. Canadian Journal of Zoology 86: 983-991.

Peirce, K.N., and L.J. Van Daele. 2006. Use of a Garbage Dump by Brown Bears in Dillingham, Alaska. Ursus 17:165-177.

Poole, K.G., A.D. Porter, A. de Vries, C. Maundrell, S.D. Grindal, and C.C. St. Clair. 2004. Suitability of a Young Deciduous-Dominated Forest for American Marten and the Effects of Forest Removal. Canadian Journal of Zoology 82: 423-435.

Potvin, F., L. Belanger, and K. Lowell. 2000. Marten Habitat Selection in a Clearcut Boreal Landscape. Conservation Biology 14: 844-857.

Potvin, M.J., T.D. Drummer, J.A. Vucetich, D.E. Beyer, R.O. Peterson, and J.H. Hammill. 2005. Monitoring and Habitat Analysis for Wolves in Upper Michigan. Journal of Wildlife Management 69: 1660-1669.

Proctor, M. 2003. Genetic Analysis of Movement, Dispersal, and Population Fragmentation of Grizzly Bears in Southwestern Canada. Ecotoxicology Lead Campus Program Publications.

Reitsma, L., M. Goodnow, M.T. Hallworth, and C.J. Conway. 2010. Canada Warbler (*Wilsonia canadensis*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/421 Accessed: August 30, 2012.

Renecker, L.A., and R.J. Hudson. 1986. Seasonal Energy Expenditures and Thermoregulatory Responses of Moose. Canadian Journal of Zoology 64: 322-327.

Restani, M., J.M. Marzluff, and R.E. Yates. 2001. Effects of Anthropogenic Food Sources on Movements, Survivorship, and Sociality of Common Ravens in the Arctic. Condor 103:399-404.

Reynolds-Hogland, M.J., and M.S. Mitchell. 2007. Effects of Road on Habitat Quality for Bears in the Southern Appalachians: a Long-term Study. Journal of Mammalogy. 88: 1050-1061.

Rioux, S., J-P.L. Savard, and A.A. Gerick. 2013. Avian Mortalities due to Transmission Line Collisions: a Review of Current Estimates and Field Methods with an Emphasis on Applications to the Canadian Electric Network. Avian Conservation and Ecology 8:7.

Rodgers, A.R. 2007. Moose Population Trends in Ontario. Centre for Northern Forest Ecosystem Research, Ontario Ministry of Natural Resources. Available at: http://files.dnr.state.mn.us/fish_wildlife/wildlife/moose/mac/summit-rodgers1.pdf. Accessed: October 24, 2013.

Rogers, L.L., and A.W. Allen. 1987. Habitat Suitability Index Models: Black Bear, Upper Great Lakes Region. U.S. Fish and Wildlife Service Biological Report 82(10.144). 54 pp.

Romin, L.A., and J.A. Bissonette. 1996. Deer: Vehicle Collisions: Status of State Monitoring Activities and Mitigation Efforts. Wildlife Society Bulletin 24:276-283.

Ronconi, R.A., C.C. St. Clair, P.D O'Hara, and A.E. Burger. 2004. Waterbird Deterrence at Oil Spills and Other Hazardous Sites: Potential Application of a Radar-Activated On-Demand Deterrence System. Marine Ornithology 32: 25-33.

Rusek, A. and V.G. Marshall. 2000. Impacts of Airborne Pollutants on Soil Fauna. Annual Review of Ecology and Systematics 31:395-423.

Schmiegelow, F.K., C.S. Machtans, and S.J. Hannon. 1997. Are Boreal Birds Resilient to Forest Fragmentation? An Experimental Study of Short-Term Community Responses. Ecology 78:1914-1932.

Shafroth, P.B., J.M Friedman, G.T. Auble, M.L. Scott, and J.H. Braatne. 2002. Potential Responses of Riparian Vegetation to Dam Removal. Bioscience 52:703-712.

Schaub, A., J. Ostwald, and B.M. Siemers. 2008. Foraging Bats Avoid Noise. Journal of Experimental Biology 211: 3174-3180.

Sheoran, V., Sheoran, A.S. and P. Poonia. 2010. Soil Reclamation of Abandoned Mine Land by Revegetation: A Review. International Journal of Soil, Sediment and Water 3: 1-20.

Siemers, B.M. and A. Schaub. 2010. Hunting at the Highway: Traffic Noise Reduces Foraging Efficiency in Acoustic Predators. Proceedings of the Royal Society: B Biological Sciences 278: 1646-1652.

Smith-Patten, B.D., and M.A. Patten .2008. Diversity, Seasonality, and Context of Mammalian Roadkills in the Southern Great Plains. Environmental Management 41: 844-852.

Species at Risk Act (SARA). 2012. Public Registry, A to Z Species Index. Available at: http://www.sararegistry.gc.ca/sar/index/default_e.cfm. Accessed: September 19, 2013.

Spectranalysis Inc. 2004. Introduction to the Ontario Land Cover Data Base, Second Edition (2000): Outline of Production Methodology and Description of 27 Land Cover Classes. Report to Ontario Ministry of Natural Resources. Unpublished.

Spellerberg, I.F. and T. Morrison. 1998. The Ecological Effects of New Roads – A Literature Review. Science for Conservation 84: 1-56.

Stark, J.M., and E.F. Redente. 1987. Production potential of stockpiled topsoil. Soil Science 144:72-76.

St.Clair, C.C. 2003. Comparative Permeability of Roads, Rivers, and Meadows to Songbirds in Banff National Park. Conservation Biology 17: 1151-1160.

St. Clair, C.C., M. Bélisle, A. Desrochers, and S. Hannon. 1998. Winter Responses of Forest Birds to Habitat Corridors and Gaps. Conservation Ecology [online] 2: 13. Available at: http://www.consecol.org/vol2/iss2/art13/. Accessed: May 23, 2013.

Stewart, A. and P.E. Komers. 2012. Testing the Ideal Free Distribution Hypothesis: Moose Response to Changes in Habitat Amount. International Scholarly Research Network - Ecology: 8 pp.

Struebig, M.J., T. Kingston, A. Zubaid, A. Mohd-Adnan, and S.J. Rossiter. 2008. Conservation Value of Forest Fragments to Palaeotropical Bats. Biological Conservation 141: 2112-2126.

Swift, T.L., and S.J. Hannon. 2010. Critical Thresholds Associated with Habitat Loss: A Review of the Concepts, Evidence, and Applications. Biological Reviews 85: 35-53.

TAC (Transportation Association of Canada). 2005. National guide to erosion and sediment control on roadway projects. Transportation Association of Canada, Ottawa, ON.

Tahera Diamond Corporation (Tahera). 2008. Jericho Diamond Project 2007 Wildlife Monitoring Program Data Summary. Prepared by Golder Associates Ltd. For Tahera Diamond Corporation.

Tayor, K.C., R.W. Arnup, B.G. Merchant, W.J. Parton, and J. Nieppola. 2000. A Field Guide to Forest Ecosystems of Northeastern Ontario: 2nd Edition. Queens Printer for Ontario, Ontario.

Telesco, D.J., and F.T. VanManen. 2006. Do Black Bears Respond to Military Weapons Training? Journal of Wildlife Management 70:222-230.

Theberge, J. B. and M. T. Theberge. 2004. The Wolves of Algonquin Park, a 12 Year Ecological Study. Department of Geography, Publication Series Number 56, University of Waterloo, Waterloo, Ontario.

Theuerkauf, J., S. Rouys, and W. Jedrzejewski. 2003. Selection of Den, Rendezvous, and Resting Sites by Wolves in the Bialowieza Forest, Poland. Canadian Journal of Zoology. 81: 163-167.

Thiel, R.P. 1985. Relationship Between Road Densities and Wolf Habitat Suitability in Wisconsin. American Midland Naturalist 113: 404-407.

Thiel, R.P., S. Merrill, and L.D. Mech. 1998. Tolerance by Denning Wolves, Canis lupus, to Human Disturbance. Canadian Field-Naturalist 122: 340-342.

Thurber, J.M., R.O. Peterson, T.D. Drummer, and S.A. Thomasma. 1994. Gray Wolf Response to Refuge Boundaries and Roads in Alaska. Wildlife Society Bulletin 22: 61-68.

Tietje W.M., and R.L. Ruff. 1980. Denning Behaviour of Black Bears in the Boreal Forest of Alberta. Journal of Wildlife Management 44:858–870.

Trombulak, S.C., and C.A. Frissell. 2000. A Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. Conservation Biology 14: 18-30.

Underhill J. E. and P. Angold. 2000. Effects of Roads on Wildlife in an Intensively Modified Landscape. Environmental Review 8: 21–39.

Vander Heyden, V. and E.C. Meslow. 1999. Habitat Selection by Female Black Bears in the Central Cascades of Oregon. Northwest Science. 73: 283-293.

Walker D.A., and K.R. Everett. 1987. Road Dust and Its Environmental-Impact on Alaskan Taiga and Tundra. Arctic and Alpine Research 19: 479-489.

Ward, D.H., and R.S. Stein. 1989. Response of Brant and Other Geese to Aircraft Disturbance at Izembek Lagoon, Alaska. U.S. Fish and Wildlife Service, Alaska Fish and Wildlife Research Center. Final Report to the Minerals Management Service, Anchorage, AK. 193 pp.

Watson, R.T., M.C. Zinyowera, and R.H. Moss (eds.): 1996, Climate Change 1995: Impacts, Adaptation, and Mitigation of Climate Change – Scientific-Technical Analysis – Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.

Weaver, J.L., P.C. Paquet, and L.F. Ruggiero. 1996. Resilience and Conservation of Large Carnivores in the Rocky Mountains. Conservation Biology 10: 964-976.

Wiggins, D.A., D.W. Holt, and S.M. Leasure. 2006. Short-Eared Owl (*Asio flammeus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/062. Accessed: January 10, 2013.

With, K.A., and T.O. Crist. 1995. Critical Thresholds in Species' Responses to Landscape Structure. Ecology 76: 2446-2459.

Zalewski, A. W. Jędrzejewski, and B. Jędrzejewski. 1995. Pine Marten Home Ranges, Numbers, and Predaton on Vertebrates in a Deciduous Forest (Białowiża National Park, Poland). Annales Zoologici Fennici 32: 131-144.

Zielinksi, W.J., K.M. Slauson, and A.E. Bowles. 2008. Effects of Off-Highway Vehicle Use on the American Marten. Journal of Wildlife Management 72: 1558-1571.

Zimpfer, N.L., W.E. Rhodes, E.D. Silverman, G.S. Zimmerman, and K.D. Richkus. 2013. Trends in Duck Breeding Populations, 1955-2013. U.S. Fish and Wildlife Service, Administrative Report – July 12, 2013. 25 pp.

Report Signature Page

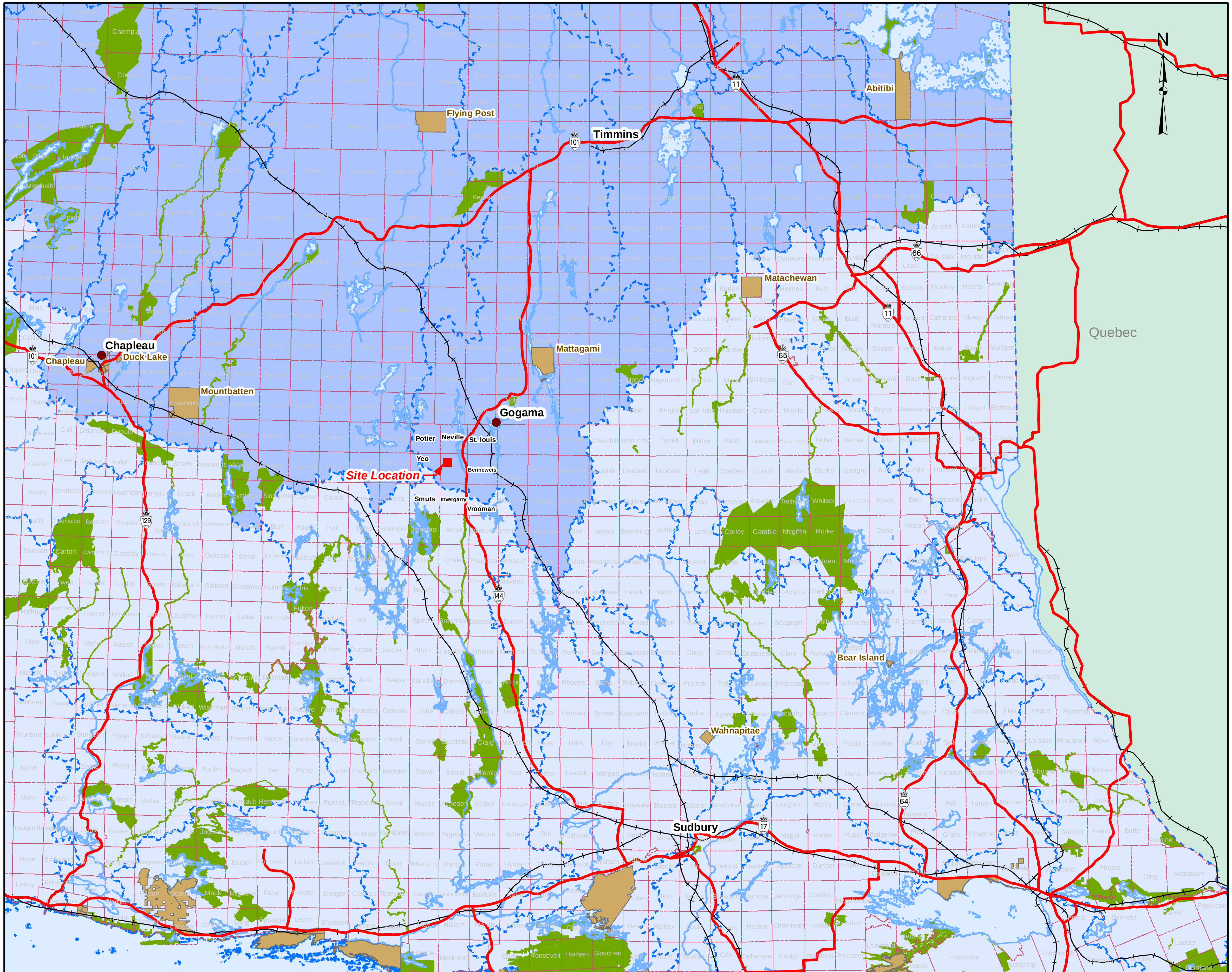
GOLDER ASSOCIATES LTD.

Lynnette Dagenais, MSc.
Ecologist

John Virgil, Ph.D.
Associate/Senior Ecologist

JB/LS/BW/JV/ls

n:\active\2013\1190 sudbury\1197\13-1197-0003 iamgold terrestrial cote gold timmins\reporting\tsds\wildlife\report revised 14may8\13-1197-0003r2 rpt 14may8 revised iamgold wildlife tsd v2.0.docx



LEGEND

- Populated Places
- Major Roads
- Railway
- First Nations Communities
- Townships
- Provincial Park

Primary Watersheds

- Hudson Bay
- Great Lakes

REFERENCE

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

30,000 0 30,000

SCALE 1:1,250,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

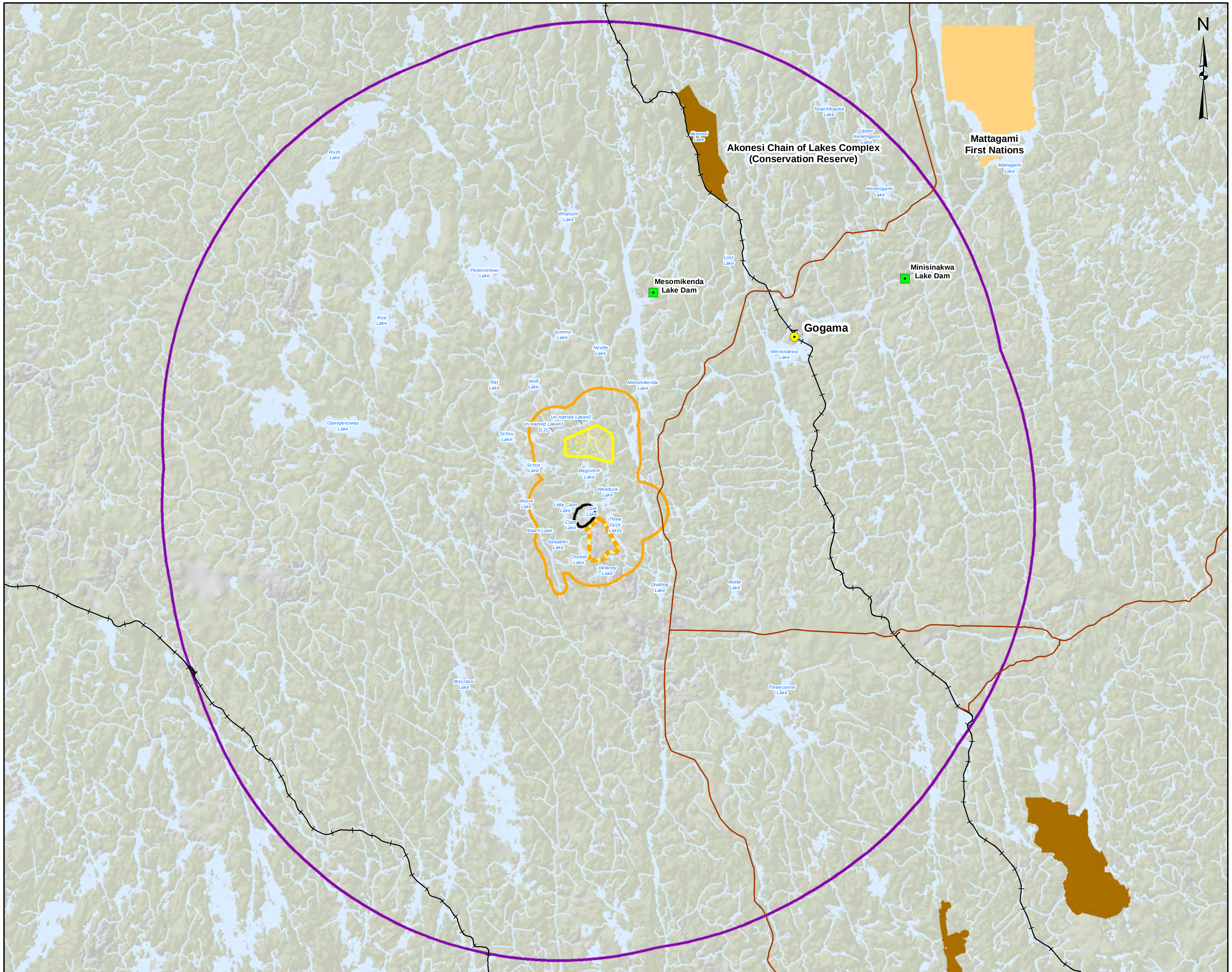
TITLE

Project Location

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012	FIGURE: 1-1	
GIS	RRD	Oct. 2013		
CHECK	BW	Jan. 2014		
REVIEW	DJ	Jan. 2014		

Path: Z:\Projects\2013\13-1192-0021\GIS\MXDs\Reporting\Terrestrial\Figure1-1_Project_Location.mxd



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

Local and Regional Study Areas

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012	FIGURE: 2-1	
GIS	AL	Oct. 2013		
CHECK	JB	Jan. 2014		
REVIEW	DJ	Jan. 2014		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Figure3_StudyAreas.mxd

ATTACHMENT I

Terrestrial Baseline Report, Côté Gold Project

December 10, 2013

2013 TERRESTRIAL BASELINE STUDY CÔTÉ GOLD PROJECT

Submitted to:
IAMGOLD Corporation
401 Bay Street, Suite 3200
PO Box 153
Toronto, Ontario
M5H 2Y4

Report Number: 13-1197-0003

Distribution:

1 e-copy - IAMGOLD Corporation
1 copy - Golder Associates Ltd.

REPORT

Table of Contents

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

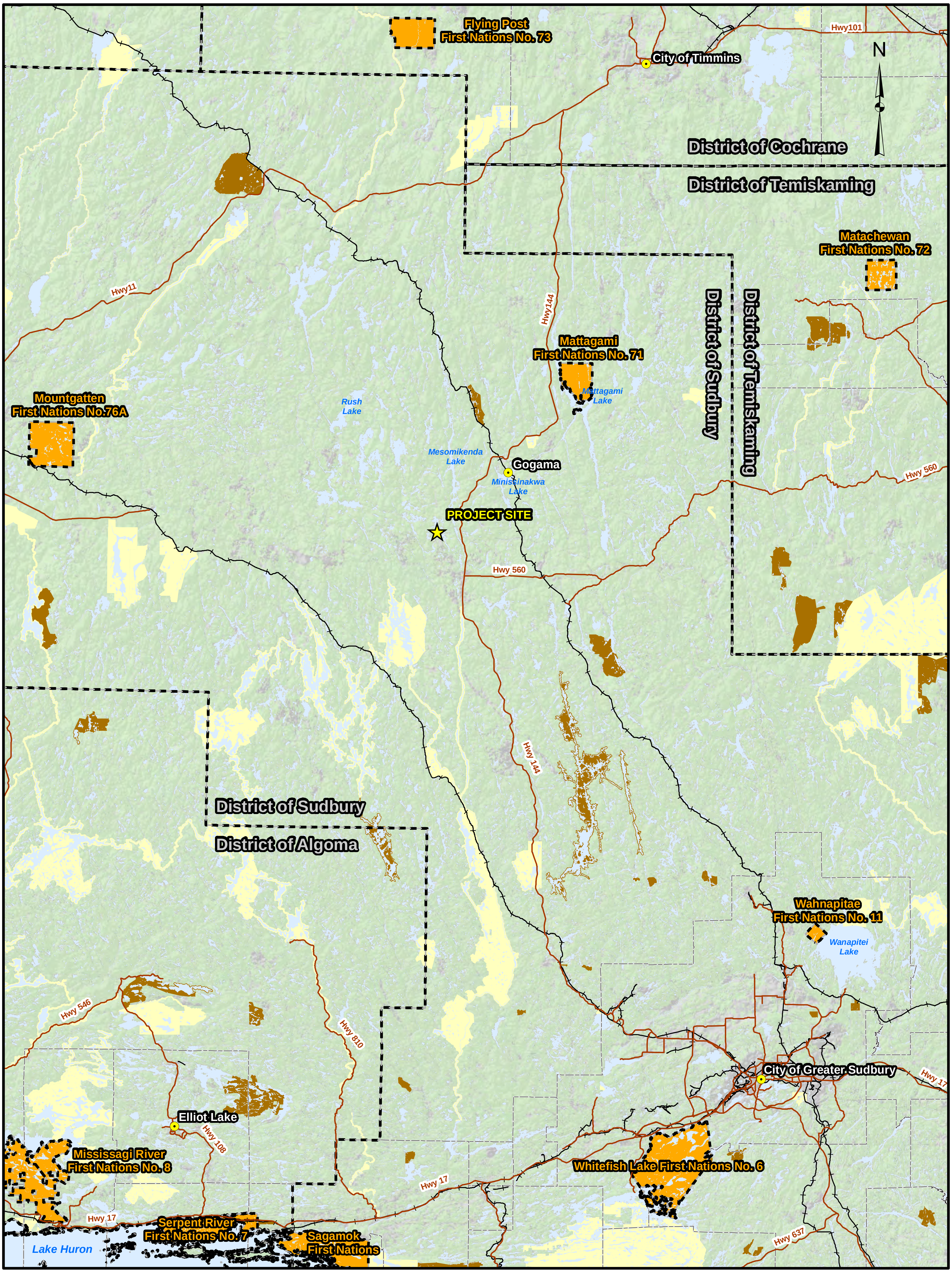
IAMGOLD Corporation (IAMGOLD) is planning to develop the Côté Gold Project (the Project) located approximately 20 kilometres (km) south-west of Gogama, 130 km south-west of Timmins and 200 km north-west of Sudbury (see Figure 1).

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.



LEGEND

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

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	Dec. 2013	

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Baseline\Figure1_KeyPlan.mxd

1.1 Overview of the Côté Gold Project

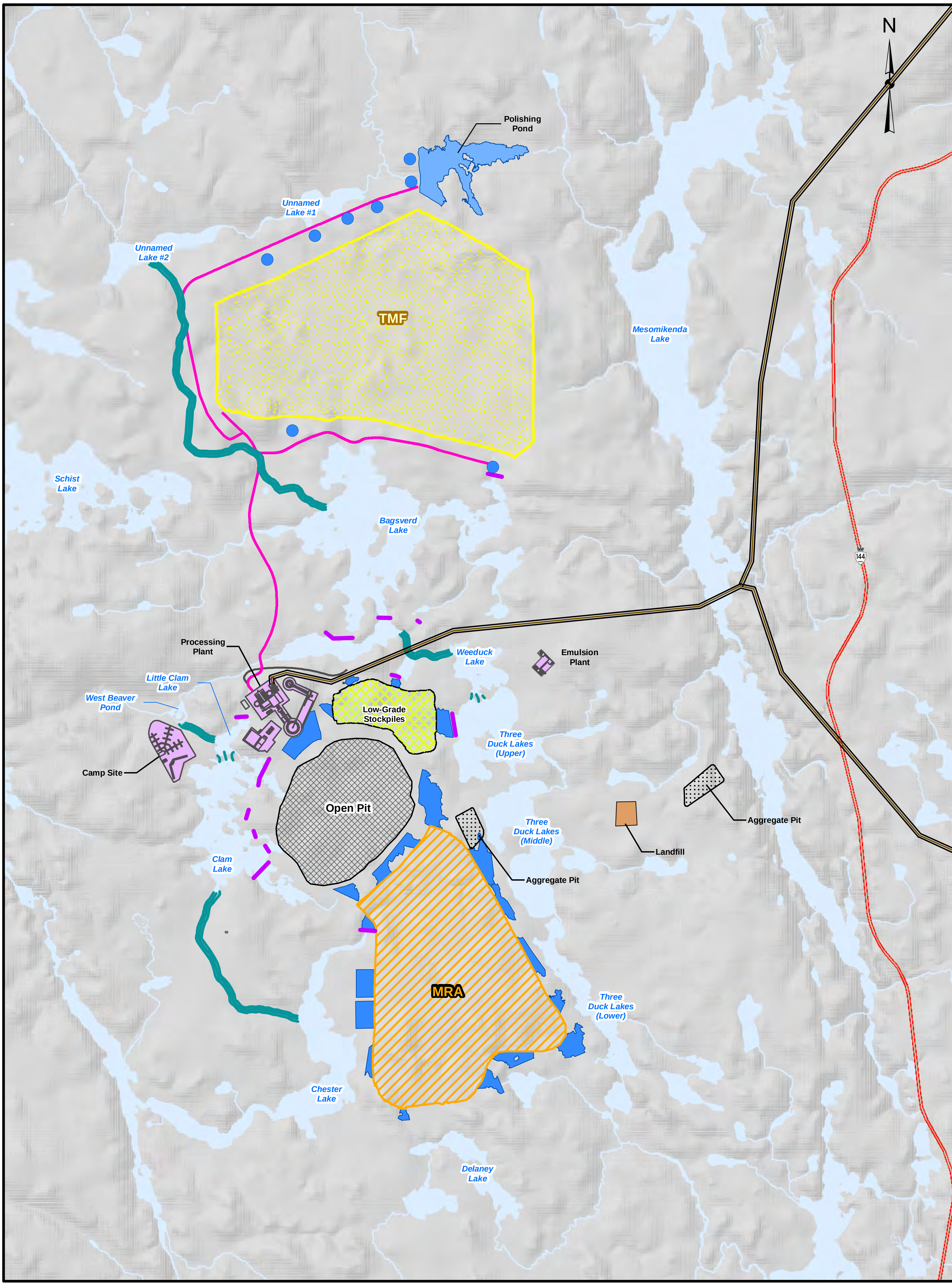
IAMGOLD is planning to construct, operate and eventually reclaim a new open pit gold mine at the Côté Gold Project site.

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,
© Queens Printer 2013
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		

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 (*Caprimulgus 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).

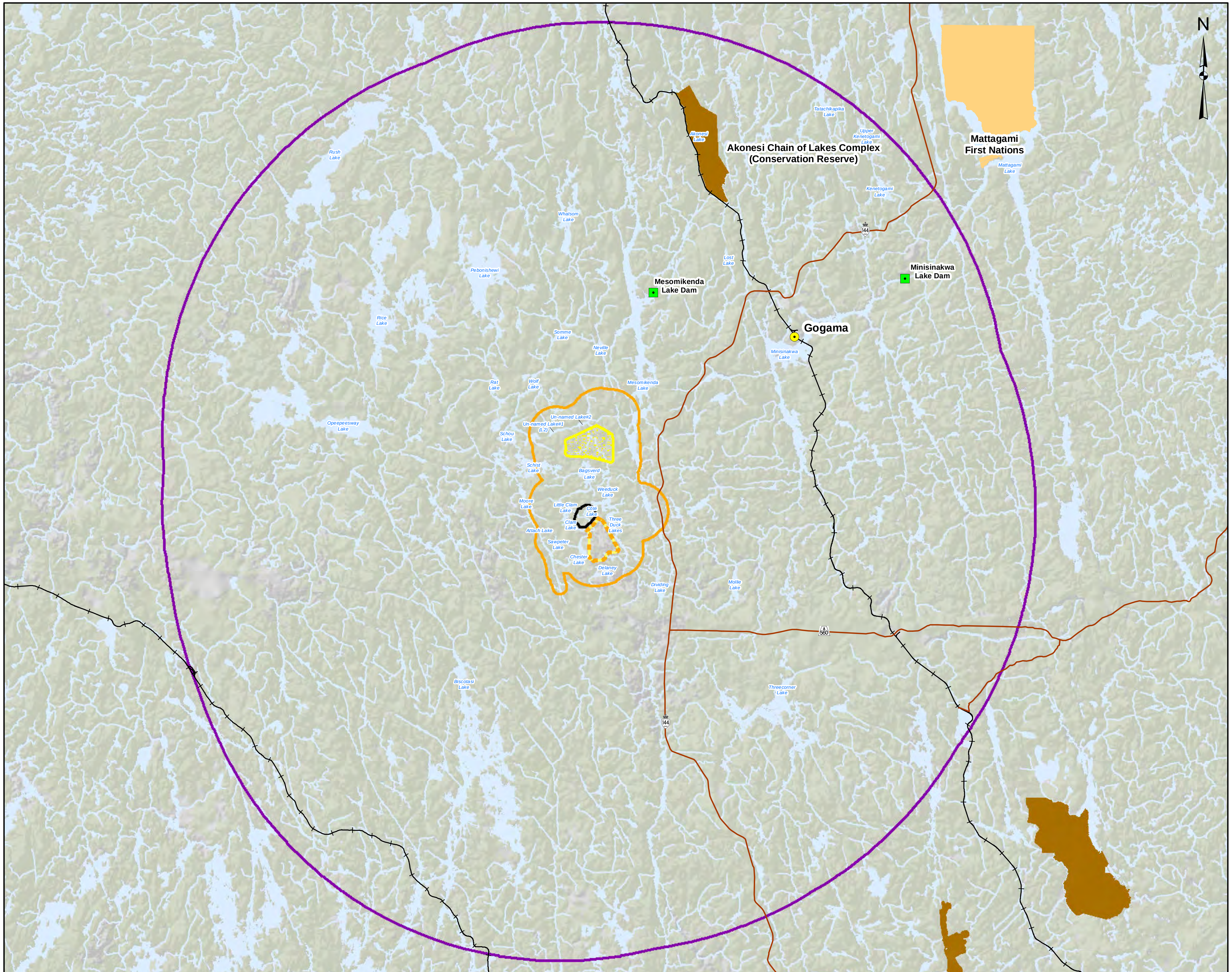
Local Study Area

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

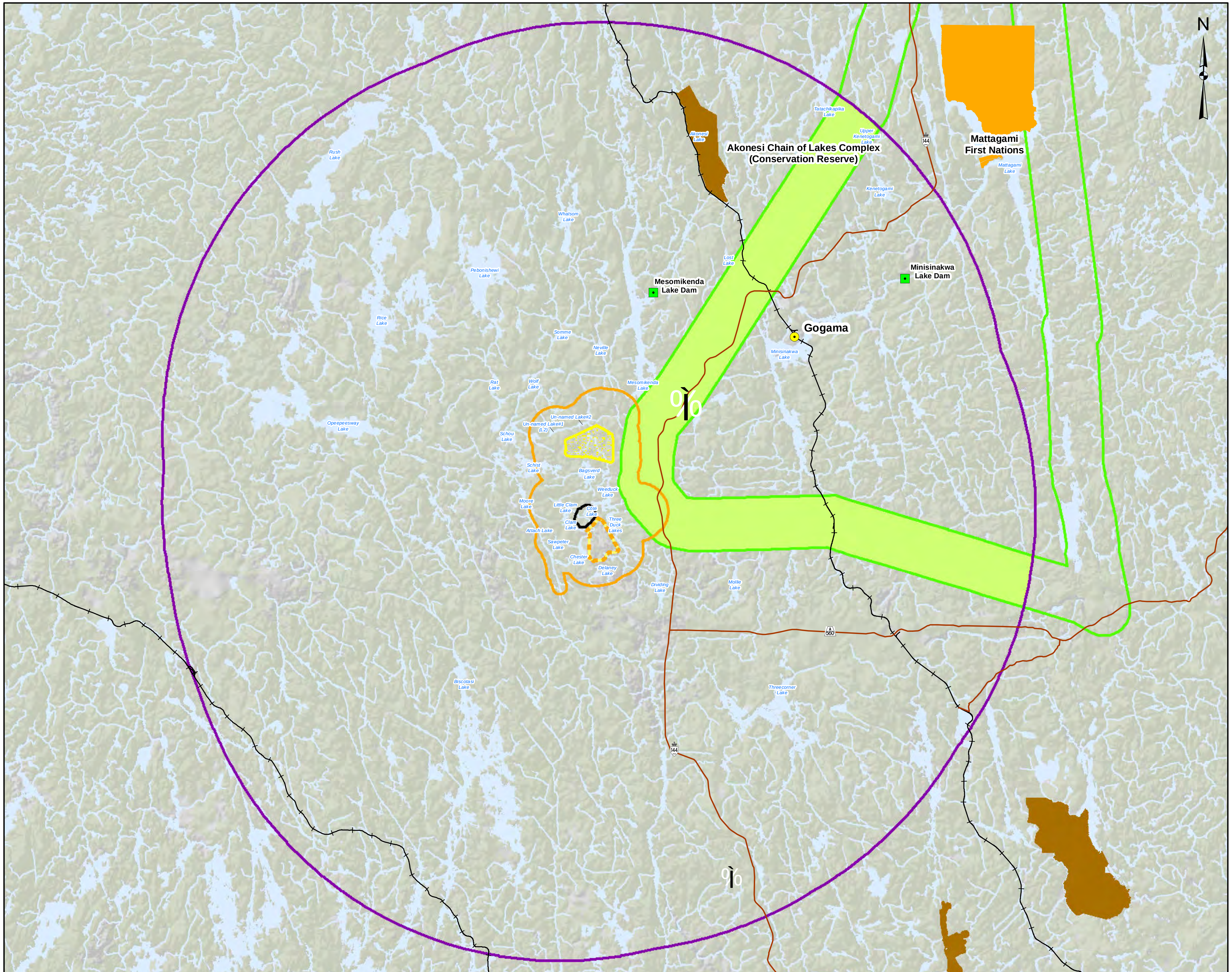
TITLE

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		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Baseline\Figure3_StudyAreas.mxd



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

6,700 0 6,700

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	FIGURE: 4	
GIS	JMC/RRD	July 2013		
CHECK	JB	July 2013		
REVIEW	DJ	Dec 2013		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Baseline\Figure4_Overlap between the Site RSA.mxd

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)

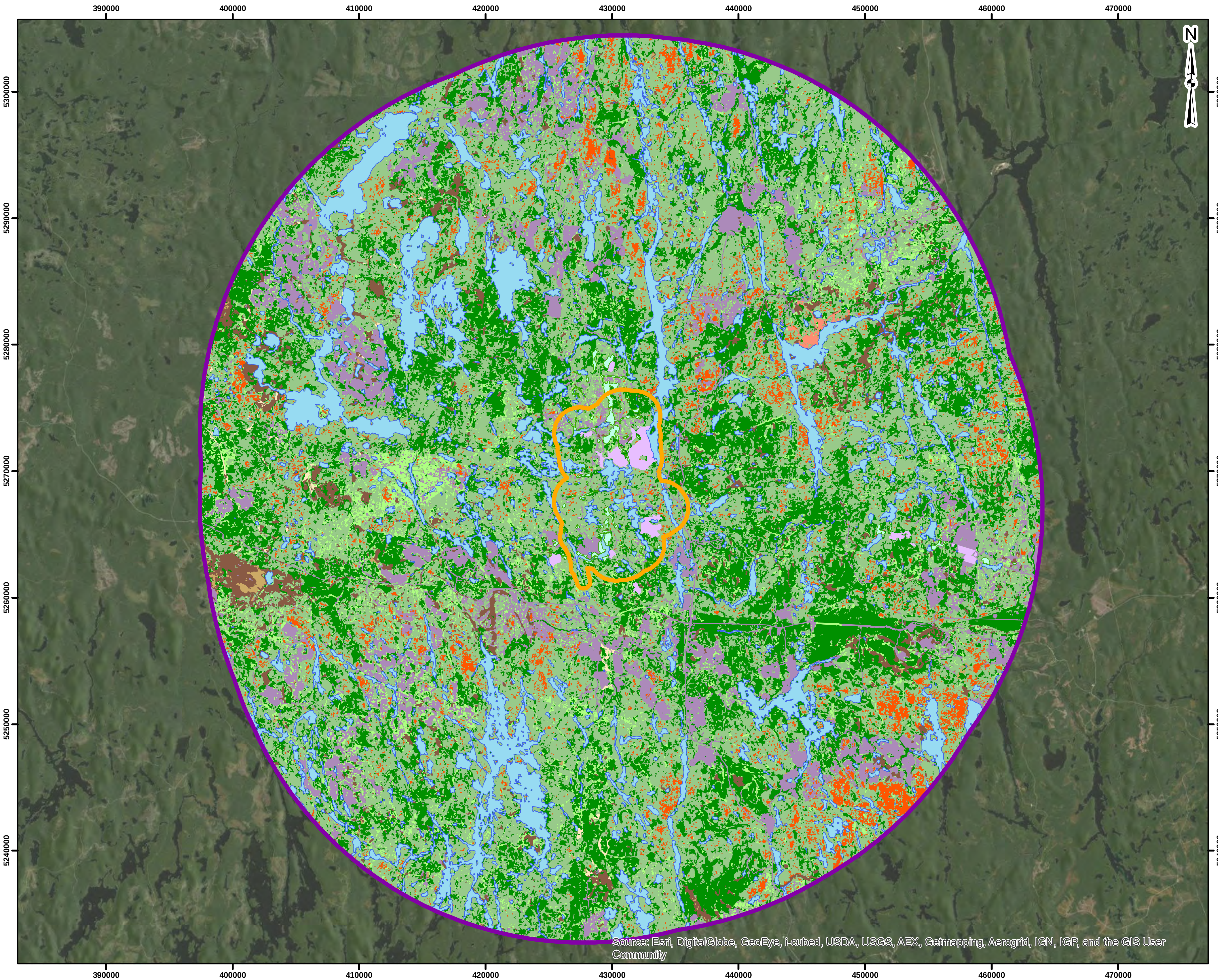
Plant community mapping was initially completed as a desktop exercise using information acquired during the desktop review. Figure 5 shows the distribution of available land cover throughout the RSA. Existing information was used to identify habitats with potential to support plant species at risk. Preliminary 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).

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

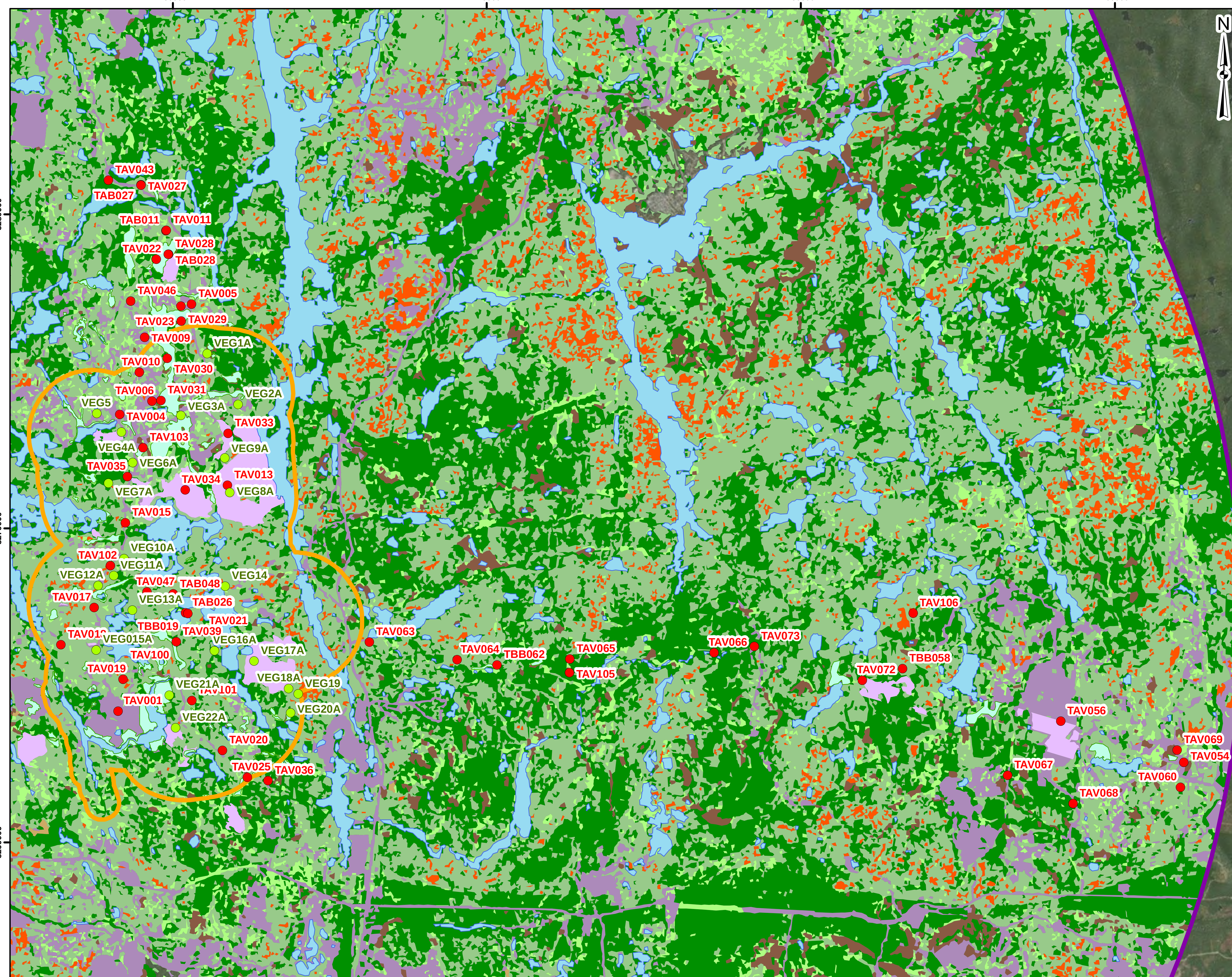
TITLE

Land Cover Distribution
in the Regional Study Area

Golder Associates
Sudbury, Ontario

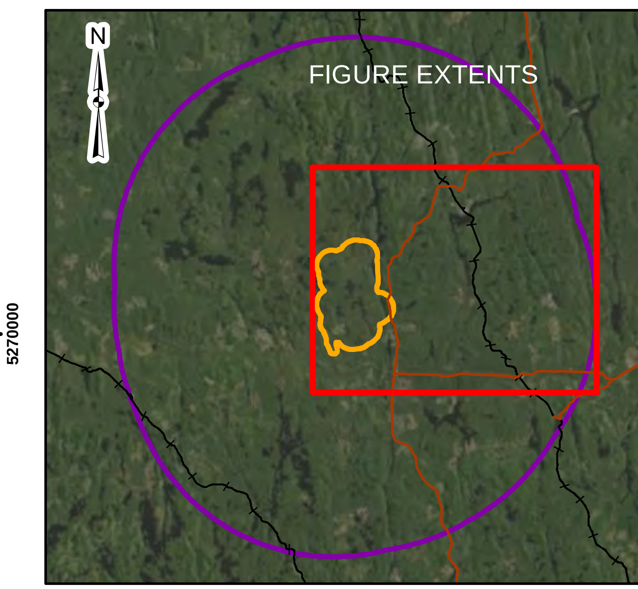
PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012	FIGURE: 5	
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	Dec. 2013		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Baseline\Figure5_Landcover_LSA_RSA.mxd



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	FIGURE: 6	
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	JB	Dec. 2013		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\Terrestrial\Baseline\Figure6_PlantCommunitySurveyLocations_LSA.mxd

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:

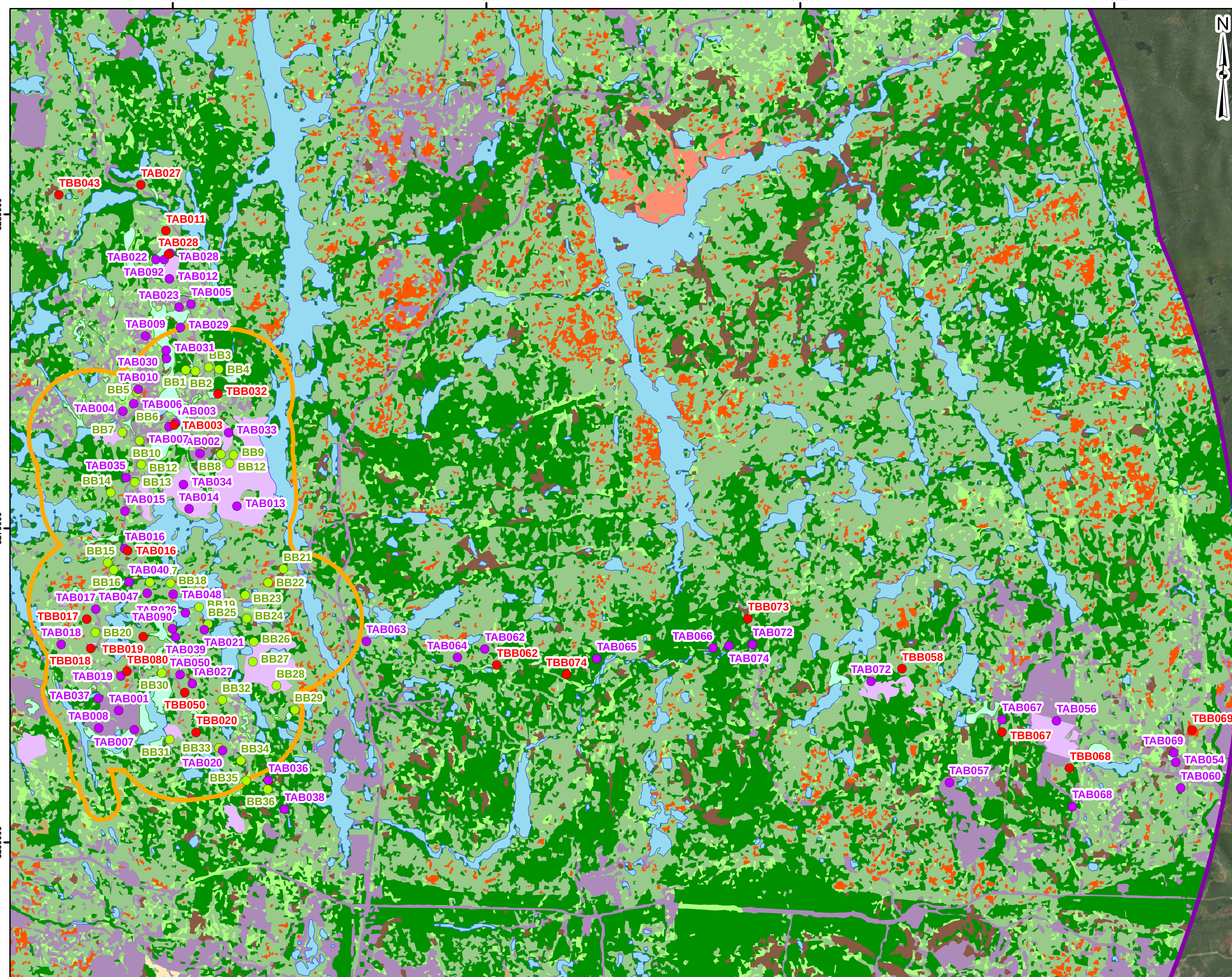
- to document upland bird species' relative abundance and richness within the RSA; and
- to assess the use of upland bird nesting habitats within the RSA.

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.

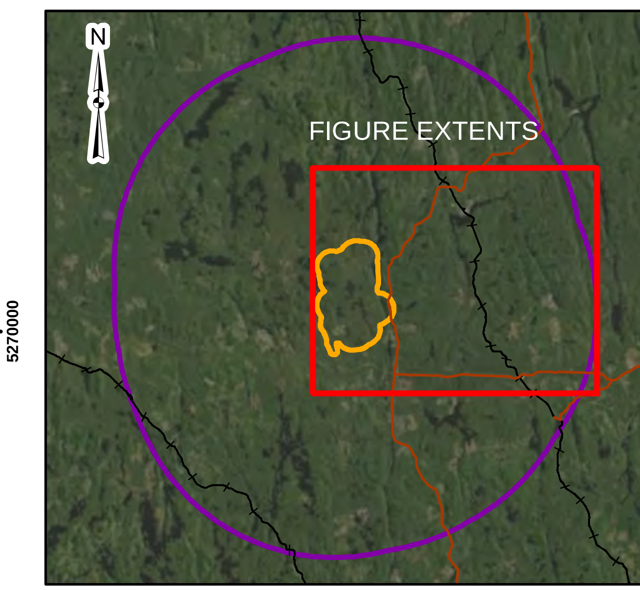
Each survey location consisted of a 50 m radius circular-plot; with an additional 50 m radius buffer (i.e., a total of 100 m radius was surveyed). Survey locations were selected in contiguous land cover types (Figure 7). A GPS unit was used to navigate to each pre-selected survey location and if the 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.

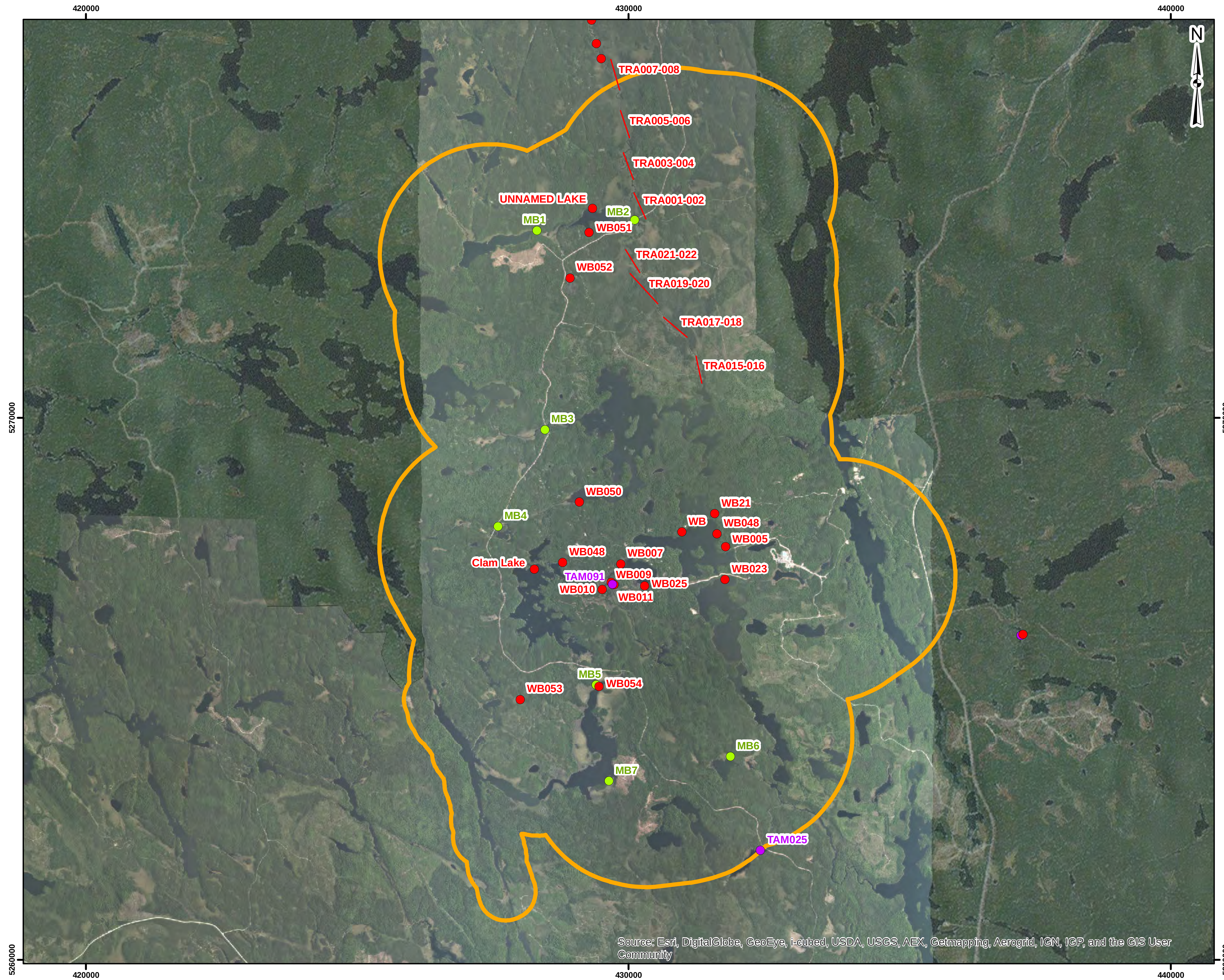
In total, nine marsh bird surveys were completed in the LSA between 2012 and 2013. Marsh bird surveys began approximately 30 minutes before sunrise and ended no later than 10 a.m. (Ralph 1993). Marsh bird surveys are weather dependant and were only completed during suitable weather conditions (i.e.,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

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

1,700 0 1,700

SCALE 1:70,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Marsh Bird and Waterbird Survey Locations in the 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: 8

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\TerrestrialBaseline\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 eight, 500 m transects and 17 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 17 point count locations were distributed along shorelines throughout the LSA. These 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.

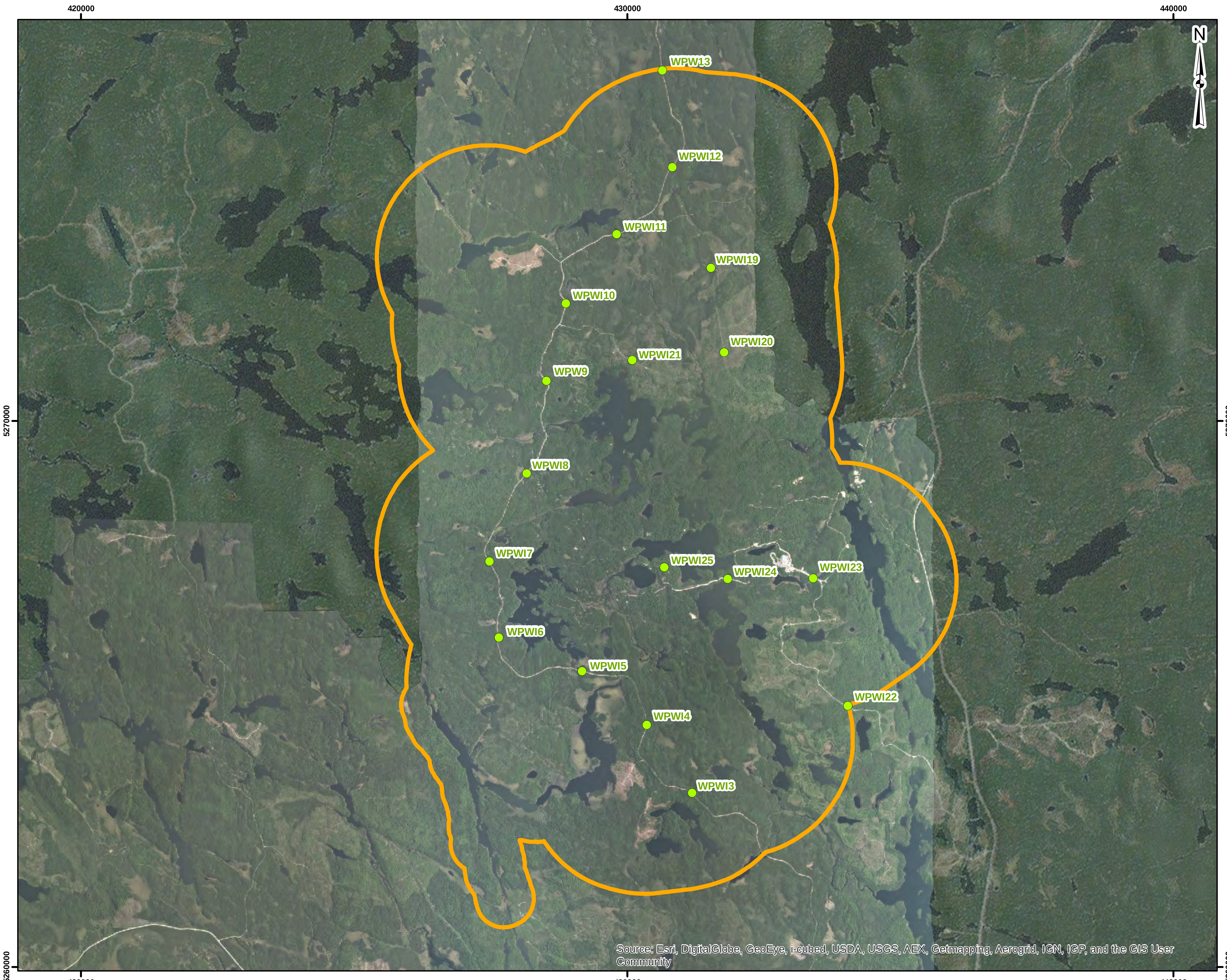
4.7 Whip-poor-will and Common Nighthawk Surveys

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. A first round of whip-poor-will surveys was completed from June 5 to 8, 2012 and a second round was completed from July 6 to 7, 2012. Whip-poor-will surveys were completed at 13 locations during the first round of surveys and 17 locations during the second round along existing roads and trails within the LSA to determine the occurrence and relative abundance of whip-poor-will in suitable habitat types (Figure 9). 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

- Whip-poor-will and Common Nighthawk Survey Locations 2012
- 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

PROJECT
IAMGOLD CÔTÉ GOLD PROJECT

TITLE
Whip-poor-will and Owl Survey Locations in the Local Study Area

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012	FIGURE: 9	
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	Dec. 2013		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\TerrestrialBaseline\Figure9_WhippoorwillCommonNighthawkSurveyLocations_LSA.mxd

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.

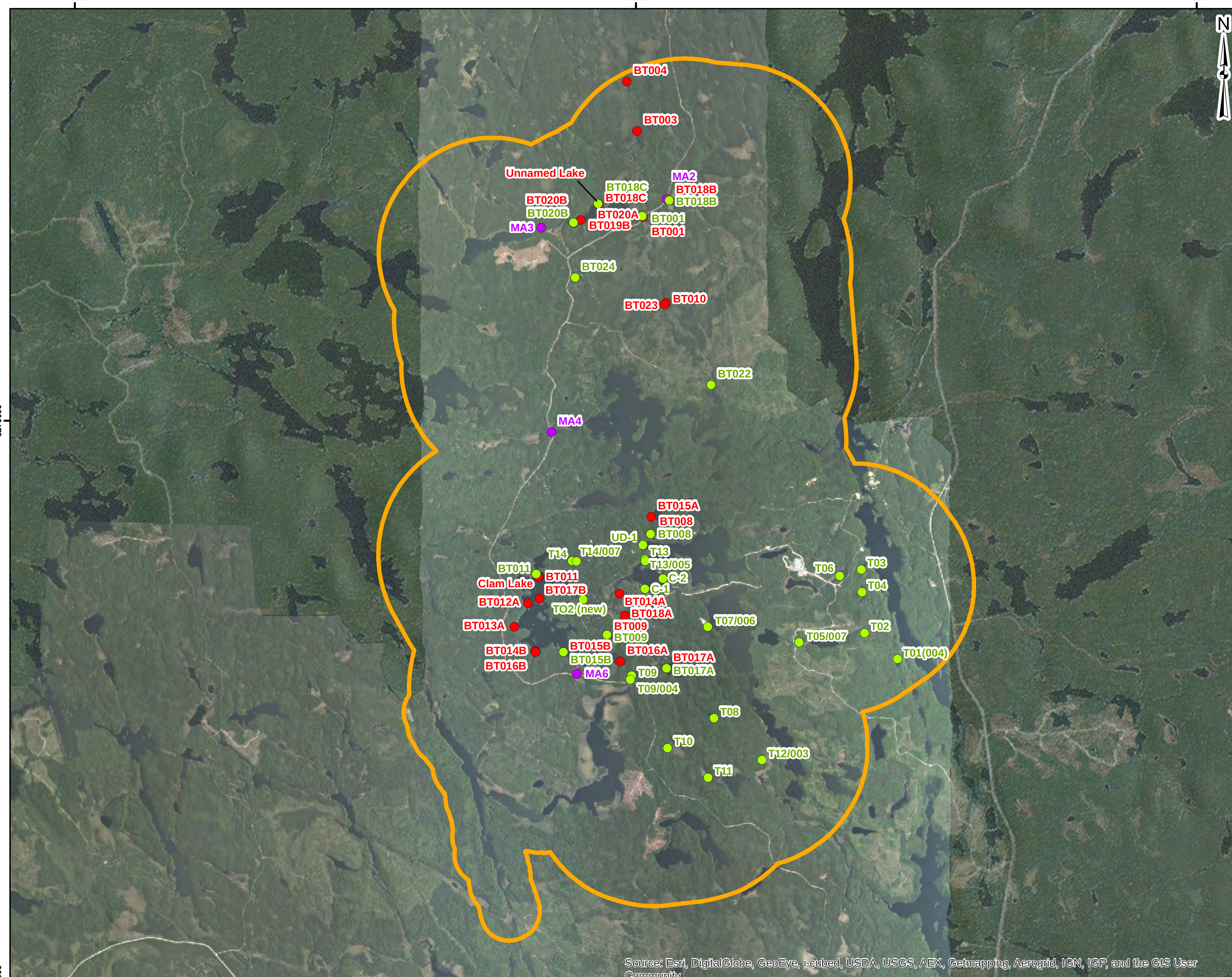
4.8 Basking Turtle Surveys

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 (Figure 10) in the LSA in 2012 and 2013. A canoe was used to survey the length of Bagsverd Creek and the entire shoreline of Clam Lake and the Unnamed Lake (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

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

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

TITLE

Basking Turtle and Amphibian Survey Locations in the 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: 10

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

Where possible, surveys were combined with waterbird surveys and breeding bird surveys during favourable weather conditions to gain efficiencies, and were completed between 10 a.m. and 5 p.m., depending on air temperature. 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 four survey locations in the LSA (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-two call locations were sampled during round one and 30 call locations were sampled during round two. Owl survey locations located in the LSA 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).

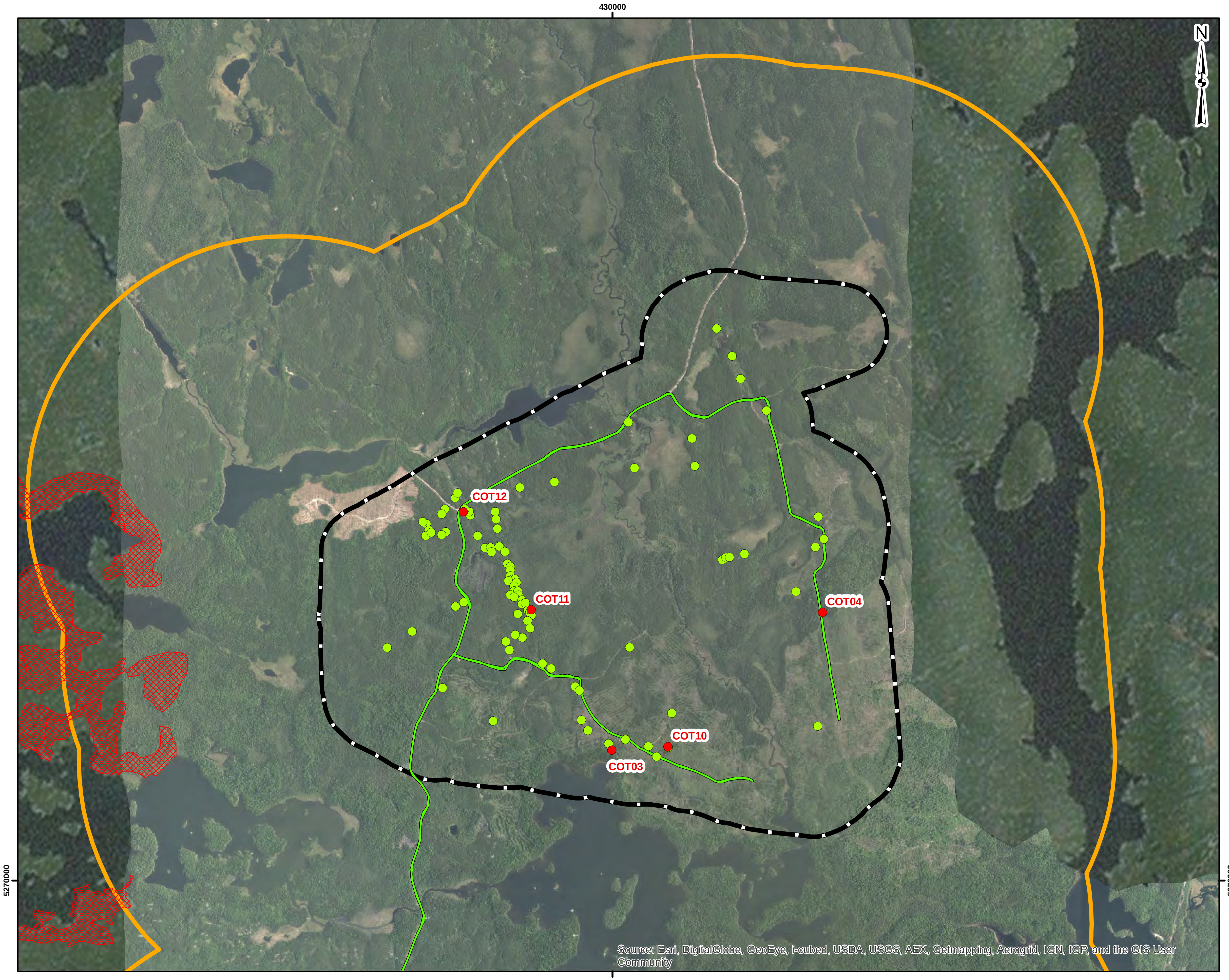
Acoustic Survey of Candidate Bat Maternity Roost Habitat

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

800 0 800

SCALE 1:30,000 METRES

PROJECT

IAMGOLD CÔTÉ GOLD PROJECT

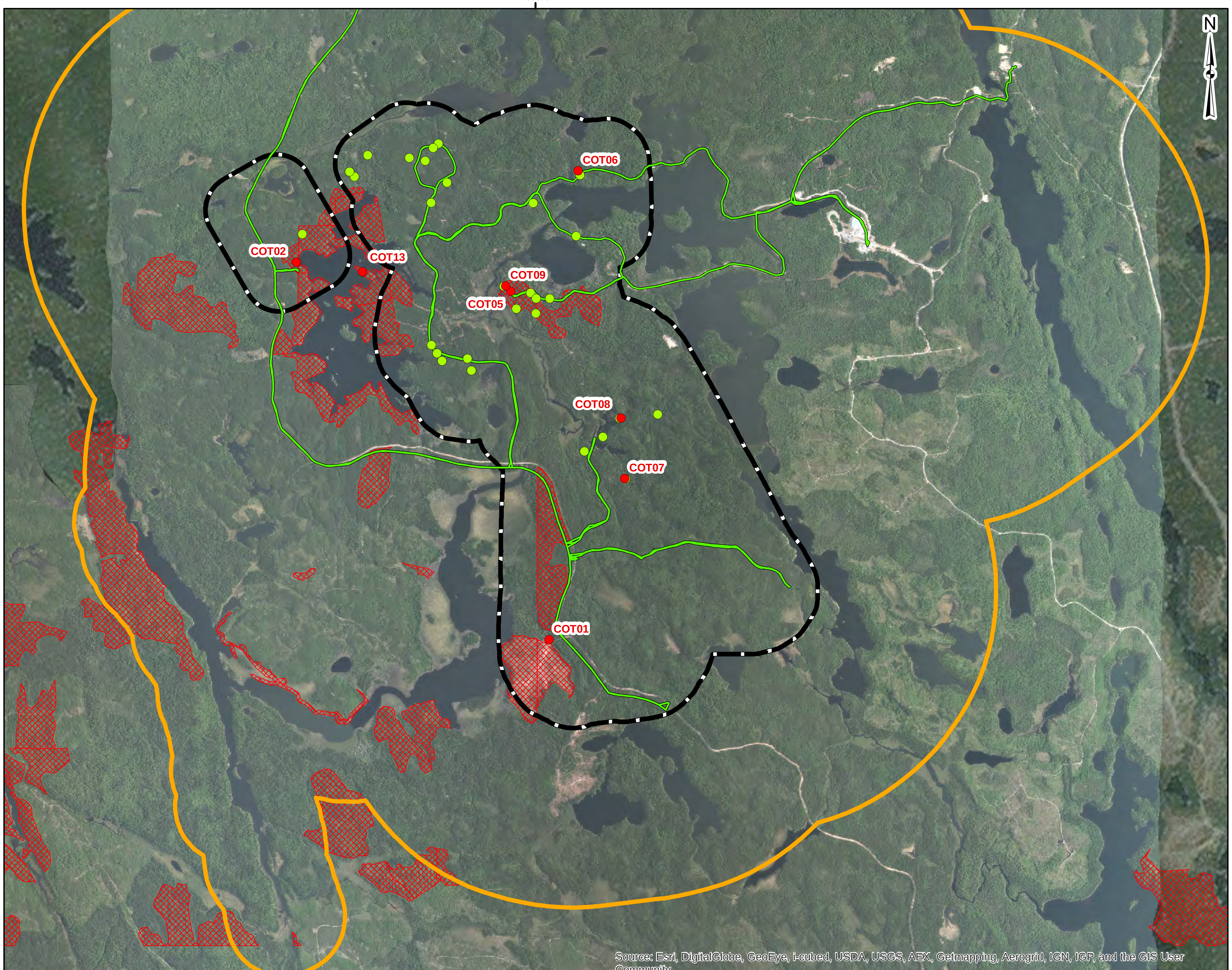
TITLE

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. 0
DESIGN	RRD	Dec. 2012	FIGURE: 11	
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	Dec. 2013		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\TerrestrialBaseline\Figure11_BatDetectorPotentialHibernaculaNorth.mxd



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

SCALE 1:35,000 METRES

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. 0
DESIGN	RRD	Dec. 2012	FIGURE: 12	
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	Dec. 2013		

Path: Z:\Projects\2013\13-1197-0003\GIS\MXDs\Reporting\TerrestrialBaseline\Figure12_BatDetectorPotentialHibernaculaSouth.mxd

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

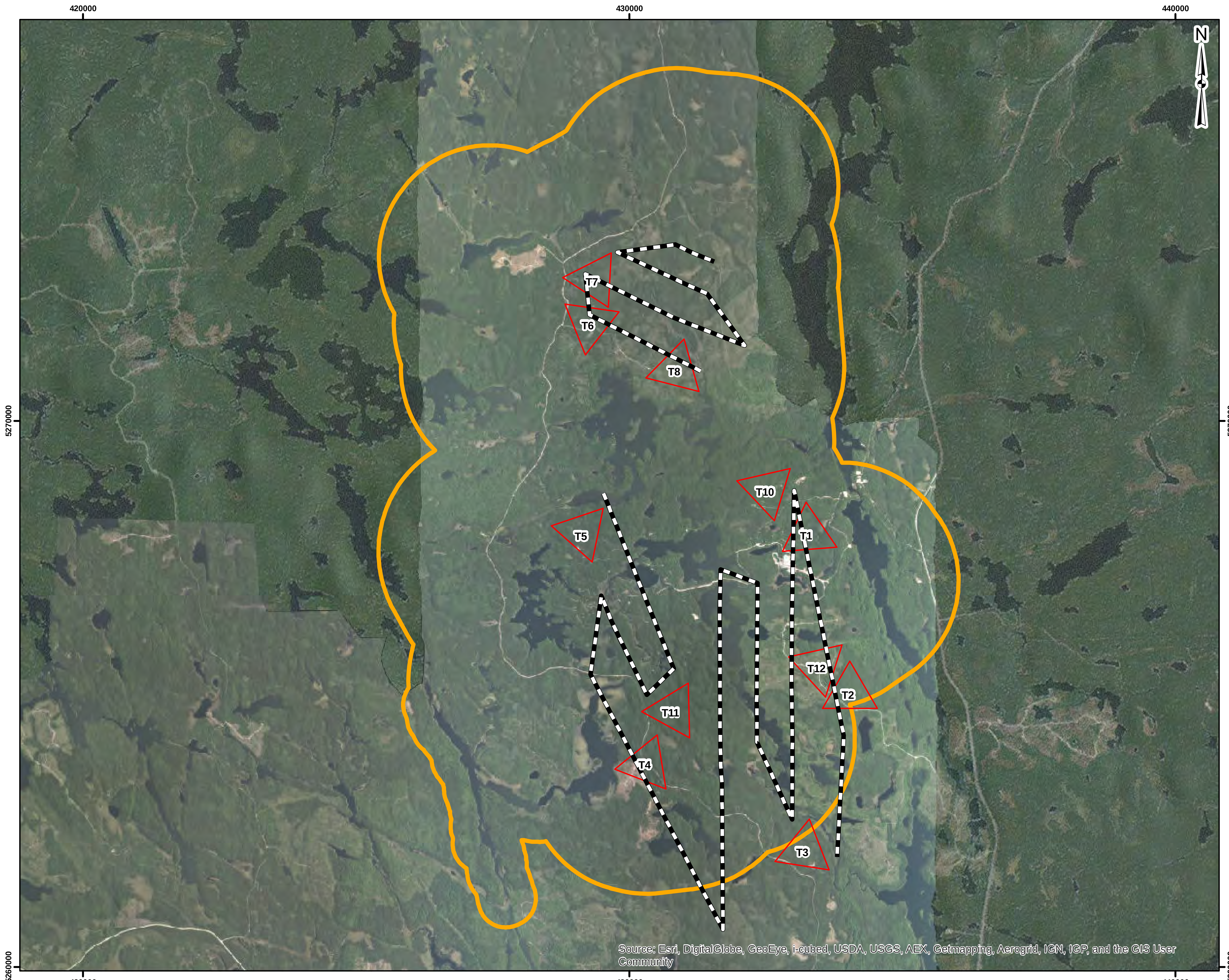
Automated analysis of full-spectrum acoustic data was completed using a multi-step process of extracting, filtering and classifying the digital recordings. The Sonobat© 3.2.0 automated classifier software package was used for final species classification, with manual QA/QC conducted on a subset of files 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		
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	July. 2013		

FIGURE: 13

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).

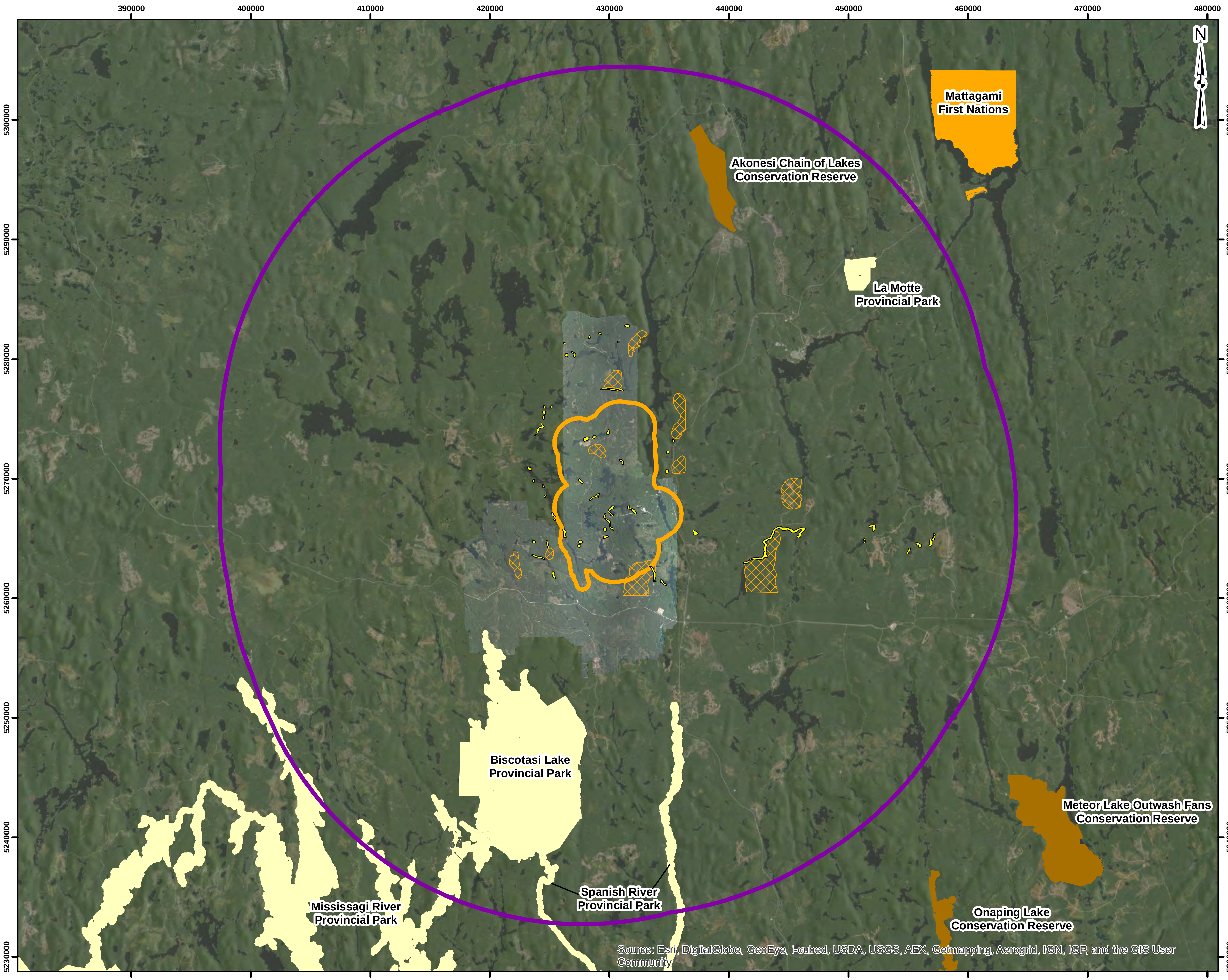
Based on the 1971 to 2000 climate normals for regional climate monitoring stations (Environment Canada 2012), total annual precipitation normals are 797 mm in Chapleau, 831 mm in Timmins and 899 mm in Sudbury. Of this total precipitation, the proportion that falls as snow is reported as 38% at Timmins, 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	FIGURE: 14	
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	DJ	Dec. 2013		

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. 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	
	B136Tl	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/Tl, B016Tt/Tl, B098Tt/Tl, B099Tt/Tl, 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 B120TI 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, B034TI, B088Tt, B108TI, 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
B012TI (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
B016TI (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
B034TI (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
B049TI (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
B053TI (n = 2)	LSA	7.45 ± 1.85	7.88 ± 0.28	20.00 ± 4.00
B098TI (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
B099TI (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
B108TI (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
B114TI (n = 2)	LSA	17.65 ± 1.35	7.79 ± 0.22	19.00 ± 0.00
B120TI (n = 2)	LSA	15.35 ± 5.45	10.00 ± 0.00	54.5 ± 18.50
B126TI (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.

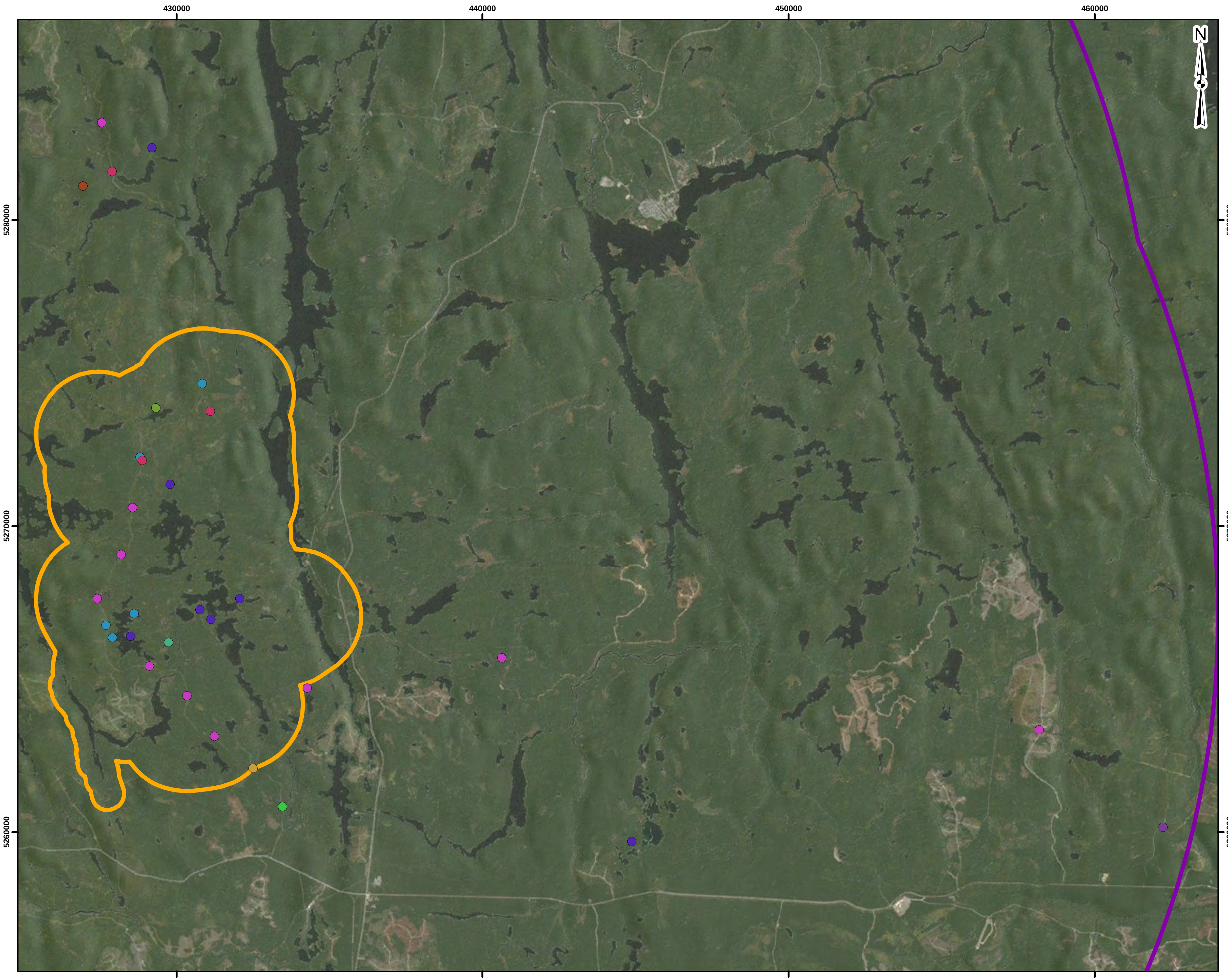
Table 9: Raptor Observations in the Local Regional Study Areas, 2012 and 2013

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).

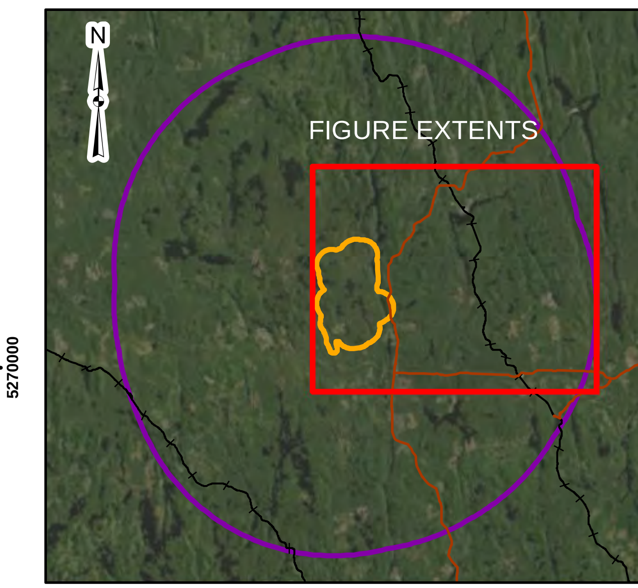
Bald eagle is listed as *Special Concern* under the ESA (Ontario 2007). All other raptor species observed are considered secure provincially (NHIC 2013).



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

Golder Associates
Sudbury, Ontario

PROJECT No. 13-1197-0003			SCALE AS SHOWN	REV. 0
DESIGN	RRD	Dec. 2012	FIGURE: 15	
GIS	JMC/RRD	July. 2013		
CHECK	JB	July. 2013		
REVIEW	JB	Dec. 2013		

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]

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)
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
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*	0	0	0.11 [a]	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)
	fuscescens						
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

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)
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
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]

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)
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.

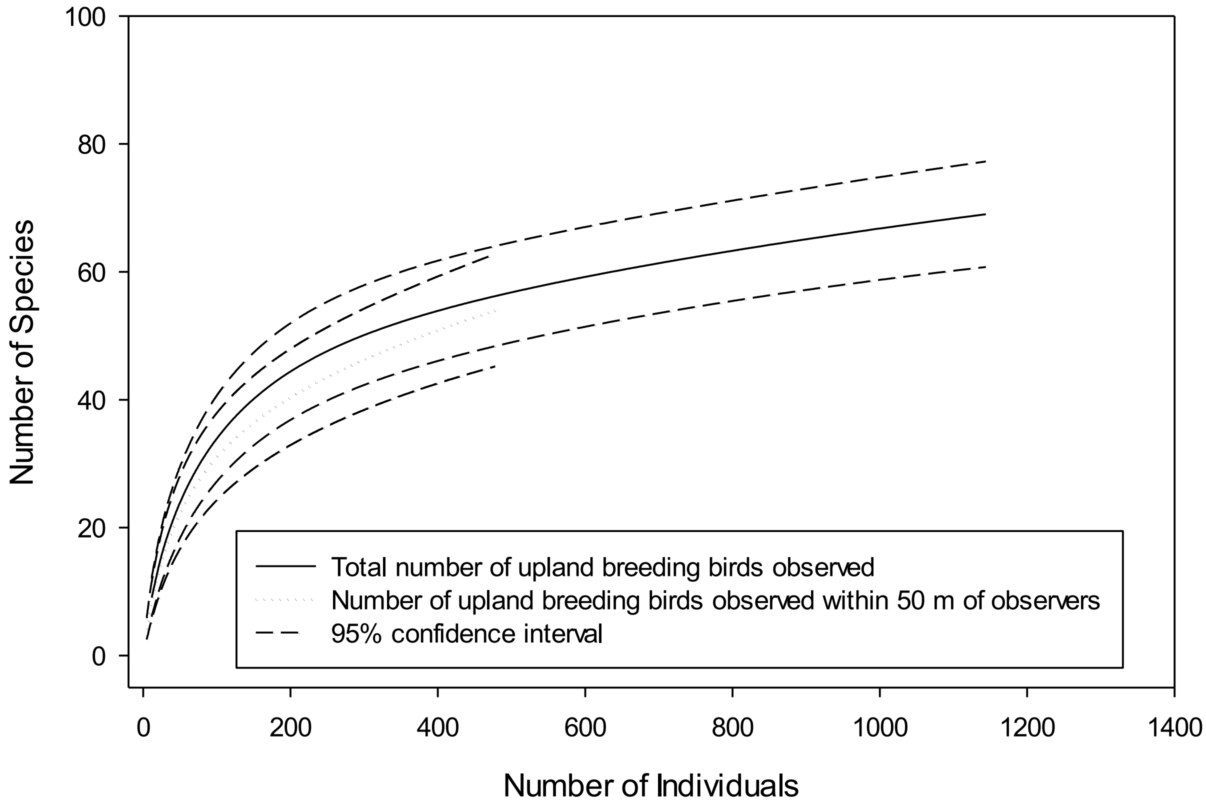


Figure 16: Species Richness Curve (95% Confidence Intervals) for Upland Breeding Birds within the Regional Study Area, 2012 and 2013

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 flycatchers 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 are 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 heard calling at one location (WPWL-15A) within the LSA and two locations (WPWL-a30 and WPWL-a31) within the RSA. The approximate location of the common nighthawks heard calling is shown on Figure 9, and 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.

8.0 REFERENCES

AMEC. 2013. IAMGOLD Corporation Côté Gold Project: Terrestrial Ecology Baseline Study for the Proposed Transmission Line Alignment

Amstislavsky, S. and Y. Ternovskaya. 2000. Reproduction in Mustelids. Animal Reproduction Science, 60-61: 571-581.

Arthur, S.M., T.F. Paragi, and W.B. Krohn. 1993. Dispersal of Juvenile Fisher in Maine. Journal of Wildlife Management. 57:868-874.

Banfield, A.W.F. 1974. The mammals of Canada. University of Toronto Press, Toronto. pp. 438.

Banton, E., J. Johnson, H. Lee, G. Racey, P. Uhlig, and M. Wester. 2009. Ecosites of Ontario: Operational Draft April 20, 2009.

Barbour, R.W. and W.H. Davis. 1969. Bats of America. The University Press of Kentucky,

Bayne, E. 2008. Personal Communication. Associate Professor, Department of Biological Science, University of Alberta. E-mail. August 10, 2008.

Bird Studies Canada. 2012. Bird Surveys Overview. http://www.bsc-eoc.org/volunteer/glmmp/index.jsp?targetpg=glmmpbird&lang=EN

Bird Studies Canada. 2013. Atlas of the Breeding Birds of Ontario. Available at: http://www.birdsontario.org/atlas/index.jsp

Birds of North America Online. 2013. The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna.

Boag, D.A. and M.A. Schroeder. 1992. Spruce Grouse (*Dendragapus canadensis*). In The Birds of North America, No. 5. (A. Poole and F. Gill, eds). The Birds of North America Inc., Philadelphia, PA.

Brand, C.J., L.B. Keith, and C.A. Fischer. 1976. Lynx responses to changing snowshoe hare densities in central Alberta. Journal of Wildlife Management 40:416–428

Brand, C.J. and L.B. Keith. 1979. Lynx demography during a snowshoe hare decline in Alberta. Journal of Wildlife Management 43:827-849.

Britzke, E. and C. Herzog. 2013. Using Acoustic Surveys to Monitor Population Trends in Bats. 4 pp. Available at: http://fw.ky.gov/pdf/acoustictransectguidance.pdf

Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas. 2001. Introduction to distance sampling: estimating abundance of biological populations. Oxford University Press, New York. 432 pp.

Burnett, G.W. 1981. Movements and Habitat Use of the American Marten in Glacier National Park, Montana. Missoula, MT. University of Montana. Master of Science Thesis. 130 pp. Cited in Buskirk, S.W. and L.F. Ruggiero. 1994. American Marten. U.S. Forest Service General Technical Report GM-254. p. 7-37.

Buskirk, S.W. and L.F. Ruggiero. 1994. American Marten. Pages 7-37 General Technical Report GM-254. U.S. Forest Service.

Caceres, M. C. and R. M. Barclay. 2000. *Myotis septentrionalis*. Mammalian Species 634: 1-4.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier, eds. 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto.

Caire, W., R. K. LaVal, M. L. LaVal, and R. Clawson. 1979. Notes on the ecology of *Myotis keenii* (Chiroptera: Vespertilionidae) in eastern Missouri. The American Midland Naturalist 102: 404-407.

Campbell V. and C. Strobeck. 2006. Fine-scale genetic structure and dispersal in Canada lynx (*Lynx canadensis*) within Alberta, Canada. Canadian Journal of Zoology 84:1112–1119.

Chapin, T.G., D.J. Harrison, and D.M. Phillips. 1997. Seasonal Habitat Selection by Marten in an Untrapped Forest Preserve. Journal of Wildlife Management 61:707-717.

Cobb, Eric. 2012. Personal Communication. Ontario Ministry of Natural Recourses, Sudbury District Species at Risk Biologist. April 20, 2012.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2005. Assessment and Update Status Report on the Blanding's Turtle (*Emydoidea blandingii*) in Canada. Ottawa. viii + 40 pp.

Connelly, J.W., M.W. Gratson, and K.P. Reese. 1998. Sharp-Tailed Grouse (*Tympanuchus phasianellus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/354/articles/demography. Accessed: July 22, 2013.

Conway, C.J. 1995. Virginia Rail (*Rallus limicola*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/173

Copeland, Todd. 2012. Personal Communication. Ontario Ministry of Natural Resources, Timmins District Planning Biologist. April 20, 2012.

Copeland, Todd. 2013. Personal Communication. Ontario Ministry of Natural Resources, Timmins District Planning Biologist. April 22, 2013.

Copeland, Todd. 2013. Personal Communication. Ontario Ministry of Natural Resources, Timmins District Planning Biologist. June 7, 2013.

COSEWIC. 2007. COSEWIC assessment and status report on the Olive-sided Flycatcher *Contopus cooperi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 25 pp. available at: http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_olivesided_flycatcher_0808_e.pdf Accessed: 26 July 2013.

COSEWIC. 2008. COSEWIC assessment and status report on the Canada Warbler *Wilsonia canadensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 35 pp. Available at: http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_canada_warbler_0808_e.pdf Accessed: 26 July 2013.

COSEWIC. 2010. COSEWIC assessment and status report on the Jefferson Salamander *Ambystoma jeffersonianum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 38 pp. Available at: http://www.sararegistry.gc.ca/document/default_e.cfm?documentID=2269. Accessed 26 July 2013

COSEWIC. 2013. Canadian Species at Risk, Committee on the Status of Endangered Wildlife in Canada, Ottawa, Canada.

Costello, M.J., G. Pohle, and A. Martin. 2004. Evaluating biodiversity in marine environmental assessments. Canadian Environmental Assessment Agency Research and Development Monograph Series. Available at http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=49503FA1-1&offset=2&toc=show. Accessed February 9, 2012.

Crins, W.J. 2002. Ecozones, Ecoregions, and Ecodistricts of Ontario. ELC Working Group, NRVIS. Queen's Printer for Ontario.

Dobbyn, J.S. 1994. Atlas of the mammals of Ontario. Federation of Ontario Naturalists. 25 pp. Available at: http://ontarionature.org/discover/resources/PDFs/atlases/mammal_atlas_intro.pdf. Accessed: July 20, 2013.

Environment and Natural Resources, Government of the Northwest Territories). 2012. Lynx in the NWT. Available at: http://www.enr.gov.nt.ca/_live/pages/wpPages/Lynx.aspx.

Environment Canada. 2010. The Ecological Framework of Canada. http://ecozones.ca/english/zone/index.html

Environment Canada. 2012. National Climate Data and Information Archive – Canada Climate Normals 1971-2000. http://climate.weatheroffice.gc.ca/climate_normals

Fenton, M. B. 1969. Summer activity of *Myotis lucifugus* (Chiroptera: Vespertilionidae) at hibernacula in Ontario and Quebec. Canadian Journal of Zoology 47: 597-602.

Fenton, M. B. 1970. Popultion studies of *Myotis lucifugus* (Chiroptera: Vespertilionidae) in Ontario. Life Sciences Contribution, Royal Ontario Museum No. 77

Fisher J.T. and L. Wilkinson. 2005. The Response of Mammals to Forest Fire and Timber Harvest in the North American Boreal Forest. Mammal Review 35:51–81.

Fisheries and Environment Canada. 1978. Hydrological Atlas of Canada.

Forsyth, A. 1985. Mammals of the Canadian Wild. Camden House Publishing Ltd., Camden East, Ontario. 351pp.

Gerson, H. 1984. Habitat management guidelines for bats of Ontario. Ontario Ministry Natural Resources Publication #51602. Queen's Printer for Ontario.

Georgian Bay Biosphere Reserve. 2012. Tri-coloured Bat Factsheet. Available at: http://www.gbbr.ca/our-environment/species-at-risk/mammals/tri-coloured-bat/

Government of Ontario. 2007. Endangered Species Act, 2007 Chapter 6. http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_07e06_e.htm

Griffin, D.R. 1940. Notes on the life-histories of New England cave bats. Journal of Mammology 21: 181-187.

Golder Associates Ltd. 2013. Terrestrial Basline Studies, Côté Gold Project. Prepared for IAMGOLD, Toronto, ON.

Hallock, L.A. and K.R. McAllister. 2009. American bullfrog. Washington Herp Atlas. http://www1.dnr.wa.gov/nhp/refdesk/herp/

Hitchcock, H.B. 1949. Hibernation of bats in southeastern Ontario and adjacent Quebec. The Canadian Field-Naturalist 6: 47-59.

Hitchcock, H.B. 1965. Twenty-three years of bat banding in Ontario and Quebec. The Canadian Field-Naturalist 79: 4-14.

Hornung, J.P. 2005. Invertebrate community structure in relation to the foraging ecology of mallard and bufflehead ducklings in western Canada. PhD Dissertation. Department of Renewable Resources, University of Alberta, Edmonton, AB.

International Union for Conservation of Nature and International Council on Mining and Minerals. 2003. Integrating mining and biodiversity conservation: Case studies from around the world. The World Conservation Union (IUCN) and the Internationa Council on Mining and Minerals (ICMM), Gland. 52 p.

Johnson, J.A., P. Uhlig, M. Wester, and S. McMurray. 2010. Field Guide to the Substrates of Ontario: April 22nd, 2010. pp. 78.

Keith, L.B. 2001. Canada Lynx. Hinterland Who's Who. Environment Canada and Canadian Willdife Federation. Available at: http://www.hww.ca/en/species/mammals/canada-lynx-1.html. Accessed: August 1, 2013.

King, C.M. 1983. The relationships between beech (Nothofagus sp.) seedfall and populations of mice (*Mus musculus*), and the demographic and dietary responses of stoats (*Mustela erminea*), in three New Zealand forests. Journal of Animal Ecology 52: 141–166.

King, C.M. and J.E. Moody. 1982. The biology of the stoat (*Mustela erminea*) in the national parks of New Zealand II. Food habits. NZ Journal of Zoology 9: 57-80.

Kirkland, G.L. Jr. and F.J. Jannett Jr. 1982. *Microtus chrotorrhinus*. Mammalian Species 180: 1-5.

Koehler, G.M. 1990. Population and habitat characteristics of lynx and snowshoe hares in north central Washington. Canadian Journal of Zoology 68: 845-851.

Koen, E. L., J. Bowman, C. S. Findlay, and L. Zheng. 2007. Home range and population density of fishers in eastern Ontario. Journal of Wildlife Management. 71(5): 1484-1493.

Krebs, C.J., R. Boonstra, S. Boutin, and A.R.E. Sinclair. 2001. What drives the 10-year cycle of snowshoe hare? Bioscience 51(1): 25-35.

Latour, P.B., N. Maclean, and K.G. Poole. 1994. Movements of Martens, Martes americana, in Burned and Unburned Taiga in the Mackenzie Valley, Northwest Territories. Canadian Field-Naturalist 108:351-354.

Linzey, A.V. 1983. *Synaptomys cooperi*. Mammalian Species 210: 1-5

Lowther, P., A.F. Poole, J.P. Gibbs, S. Melvin and F.A. Reid. 2009. American Bittern (*Botaurus lentiginosus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/018

Macculloch, R.D. 2002. The ROM field guide to amphibians and reptiles of Ontario.

Maletzke, B.T., G.M Koehler, R.B. Wielgus, K.B. Aubry, and M.A. Evans. 2008. Habitat conditions associated with lynx hunting behavior during winter in northern Washington. Journal of Wildlife Management 72(7): 1473-1478.

Mech, L.D. and L.L. Rogers. 1977. Status, Distribution, and Movements of Martens in Northeastern Minnesota. Res. Pap. NE-143. Radnor, PA: U.S. Department of Agriculture, Northern Forest Experiment Station. 7 pp. Cited in Buskirk, S.W. and L.F. Ruggiero. 1994. American marten. U.S. Forest Service General Technical Report GM-254. pp. 7-37.

Melvin, S.M. and J.P. Gibbs. 1996. Sora (*Porzana carolina*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. Available at: http://bna.birds.cornell.edu/bna/species/250/articles/demography. Accessed: November, 2012.

Merrit, J.F. 1981. *Clethrionomys gapperi*, Mammalian Species 146: 1-9

Michigan Department of Natural Resources. 2011. Eastern Wolf Factsheet. Available at: http://www.michigan.gov/dnr/0,4570,7-153-10370_12145_12205_63607_63608-292026--,00.html

Migratory Birds Convention Act. 1994. S.C. 1994, c. 22. Government of Canada.

Mills, R. S. 1971. A concentration of *Myotis keenii* at caves in Ohio. Journal of Mammology 52: 625.

Ministry of Natural Resources. 1984. Habitat Management Guidelines for Bats of Ontario. MNR # 51602.Queen’s Printer for Ontario. 42 pp.

Ministry of Natural Resources. 1987. Bald eagle habitat management guidelines, MNR # 51599, June 1987. Queen’s Printer, Ontario.

Ministry of Natural Resources. 2000. Significant Wildlife Habitat Technical Guide. MNR# 51438. Queen’s Printer for Ontario. pp.384.

Ministry of Natural Resources. 2008. Wildlife and Forestry Map: Spanish Forest Management Unit. Term of Plan 2010-2020. Queen’s Printer, Ontario.

Ministry of Natural Resources. 2009a. Canada warbler (*Cardellina canadensis*) Factsheet, MNR # 52577. Queen’s Printer, Ontario.

Ministry of Natural Resources. 2009b. Olive-sided Flycatcher (*Contopus cooperi*) Factsheet, MNR # 52572. Queen’s Printer, Ontario.

Ministry of Natural Resources. 2009c. Whip-poor-will (*Caprimulgus vociferous*). MNR# 52575. Queen’s Printer for Ontario. pp 2.

Ministry of Natural Resources. 2009d. Common Nighthawk (*Chordeiles minor*) Factsheet, MNR # 52579. Queen’s Printer, Ontario.

Ministry of Natural Resources. 2011. Bats and Bat Habitats: Guidelines for Wind Power Projects, 2nd Edition. Queen's Printer for Ontario. pp. 24.

Ministry of Natural Resources. 2012. Amendment of Ontario Regulation 230/08 (Species at Risk in Ontario List) in response to COSSARO report received October 24, 2012. Queens Printer for Ontario.

Moen, R., J.M. Rasmussen, C.L. Burdett, and K.M. Pelican. 2010. Hematology, serum chemistry, and body mass of free-ranging and captive Canada lynx in Minnesota. Journal of Wildlife Diseases 46: 613-622.

Mowat, G. and Slough, B. 2003. Habitat preference of Canada lynx through a cycle in snowshoe hare abundance. Canadian Journal of Zoology 81(10): 1736-1745.

Muller, M.J. and R.W. Storer. 1999. Pied-billed Grebe (*Podilymbus podiceps*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/410

Nagorsen, D. W. and S. V. Nash. 1984. Distributional records of bats from the James Bay region. The Canadian Field-Naturalist 98: 500-502.

Nagorsen, D. W. and R. M. Brigham. 1993. Bats of British Columbia: Royal British Columbian museum handbook. University of British Columbia Press, Vancouver, Canada.

Natural Heritage Information Centre (NHIC). 2013. http://www.mnr.gov.on.ca/MNR/nhic/nhic.cfm

Nellis, C.H., S.P. Wetmore, and L.B. Keith. 1972. Lynx-prey interactions in central Alberta. Journal of Wildlife Management 36(2): 320-328.

Nelson, J.L., E.S. Zavaleta, and F.S. Chapin III. 2008. Boreal Fire Effects on Subsistence Resources in Alaska and Adjacent Canada. Ecosystems 11:156–171.

Newell, T. 1999. *Mustela nivalis*. Animal Diversity Web. Available from http://animaldiversity.ummz.umich.edu/site/accounts/information/Mustela_nivalis.html Accessed: September 1, 2011.

North American Bird Conservation Initiative Canada. 2012. The State of Canada's Birds, 2012. Environment Canada, Ottawa, ON. 36 pp.

O'Donoghue, M., S. Boutin, C.J. Krebs, and E.J. Hofer. 1997. Numerical responses of coyotes and lynx to the snowshoe hare cycle. Oikos 80:150-162.

Oldham, M.J. and W.F. Weller. 2000. Ontario Herpetofaunal Atlas. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. http://nhic.mnr.gov.on.ca/MNR/nhic/herps/ohs.html (updated 15-01-2010).

Ontario Odonata Atlas. 2005. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. http://www.mnr.gov.on.ca/MNR/nhic/odonates/ohs.html (updated 15-02-2005).

Ontario Partners in Flight. 2008. Ontario Landbird Conservation Plan: Boreal Hardwood Transition, North American Bird Conservation Region 12. Ontario Ministry of Natural Resources, Bird Studies Canada, Environment Canada. Draft Version 2.0.

Paragi T.F., W.N. Johnson, D.D. Katnik, and A.J. Magoun. 1996. Marten Selection of Postfire Seres in the Alaskan Taiga. Canadian Journal of Zoology 74: 2226–2237.

Pattie, D. and C. Fisher. 1999. Mammals of Alberta. Lone Pine Publishing, Edmonton, Alberta.

Partners in Flight. 2008. Continental Watch List Species Research and Monitoring Needs. Available at: www.partnersinflight.org/WatchListNeeds/

Poole, K.G. 1994. Characteristics of an unharvested lynx population during a snowshoe hare decline. Journal of Wildlife Management 58: 608-618.

Poole, K.G. 1997. Dispersal patterns of lynx in the Northwest Territories. Journal of Wildlife Management 61:497-505.

Poole, K.G. and R.P. Graf. 1996. Winter Diet of Marten during a Snowshoe Hare Decline. Canadian Journal of Zoology 74: 456-466.

Powell, R.A. and W.J. Zielinski. 1994. Fisher. Pp. 38-72 in L.F. Ruggiero, K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, tech. eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. U.S. Dep. Agric., For. Serv., Rocky Mt. For. and Range Exp. Stn., Fort Collins, CO.

Proulx, G., K. Aubry, J. Birks, S. Buskirk, C. Fortin, H. Frost, W. Krohn, L. Mayo, V. Monakhov, D. Payer, M. Saeki, M. Santos-Reis, R. Weir, and W. Zielinksi. 2004. World Distribution and Status of the Genus Martes in 2000. In D.J. Harrison, A.K. Fuller, and G. Proulx (eds.). Martens and Fishers (Martes) in Human-altered Environments: an International Perspective. Spring Science and Business Media Inc. New York, NY. p. 21-76.

Ralph, C.J. 1993. Designing and implementing a monitoring program and the standards for conducting point counts. In Status and management of neotropical migratory birds (D.M. Finch and P.W. Stangel, eds), pp.204–207. U.S.D.A. Forest Service, General Technical Report RM-229.

Ralph, C.J., G.R. Geupel, P. Pyle, T.E. Martin, and D.F. DeSante. 1993. Handbook of Field Methods for Monitoring Landbirds. General Technical Report PSW-GTR-144. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture, Albany, California.

Reich, L.M. 1981. *Microtus pennsylvanicus*. Mammalian Species 159: 1-8

Reid, F.A. 2006. Mammals of North America. Houghton Mifflin, New York, New York.

Royal Ontario Museum. 2013. Ontario Species at Risk. http://www.rom.on.ca/ontario/risk.php

Ruggiero, L.F., E. Pearson, and S.E. Henry. 1998. Characteristics of American Marten Den Sites in Wyoming. Journal of Wildlife Management 62:663-673.

Rusch, D.H., S. DeStefano, M.C. Reynolds, and D. Lauten. 2000. Ruffed grouse (*Bonasa umbellus*). In: A. Poole and F. Gill, editors. The Birds of North America, No. 515. The Birds of North America, Inc., Philadelphia, PA.

SARA Group. 2009. Sudbury Risk Assessment, Volume III: Ecological Risk Assessment – Final Report (Appendix A). http://www.sudburysoilsstudy.com/EN/indexE.htm

SAS Institute Inc. 2007. JMP 7.0. Cary, North Carolina.

Sauer, J.R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2012. The North American Breeding Bird Survey, Results and Analysis 1966 - 2010. Version 3.23.2012 USGS Patuxent Wildlife Research Center, Laurel, Maryland. Available at: http://www.mbr-pwrc.usgs.gov/bbs/trend/guild09.html. Accessed: July 2013.

Sheffield, S.R. and C.M. King. 1994. *Mustela nivalis*. Mammalian Species. 454: 1 – 10

Simms, D.A. 1979. North American weasels: resource utilization and distribution. Canadian Journal of Zoology 57(3): 504 – 520.

Slough, B. G. and G. Mowat. 1996. Lynx population dynamics in an untrapped refugium. Journal of Wildlife Management 60: 946-961.

Smith, A.C. and J.A. Schaefer. 2002. Home-Range Size and Habitat Selection by American Marten (*Martes americana*) in Labrador. Canadian Journal of Zoology 80:1602-1609.

Soutiere, E.C. 1979. Effects of Timber Harvesting on Marten in Maine. Journal of Wildlife Management 43:850-860.

Species at Risk Act (SARA). 2013. Species at Risk Public Registry: A-Z Species Index. Government of Canada. Available at: http://www.sararegistry.gc.ca/sar/index/default_e.cfm.

Species at Risk in Ontario (SARO). 2013. Species at Risk, Committee on the Status of Species at Risk in Ontario. http://www.on.ec.gc.ca/wildlife/sar/sar-e.html.

Spectranalysis Inc. 2004. Introduction to the Ontario Land Cover Data Base, Second Edition (2000): Outline of Production Methodology and Description of 27 Land Cover Classes. Report to Ontario Ministry of Natural Resources. Unpublished

Steele, M.A. 1998. *Tamiasciurus hudsonicus*. Mammalian Species, No. 586, pp. 1-9.

Strickland, M.A. 1982. Fisher and marten study 1979-80 and 1980-81, Algonquin region. Ontario Ministry Nat. Resources, Owen Sound, ON.

Takats, L.D., C.M. Francis, G.L. Holroyd, J R. Duncan, K.M. Mazur, R.J. Cannings, W. Harris and D. Holt. 2001. Guidelines for Nocturnal Owl Monitoring in North America: March 2001. Beaverhill Bird Observatory and Bird Studies Canada, Edmonton, Alberta. 32 pp.

Thebens, S. 2013. Personal Communication.

Thompson, I.D., and P.W. Colgan. 1987. Numerical Responses of Martens to a Food Shortage in Northcentral Ontario. Journal of Wildlife Management 51:824-835.

Tikhonov, A., P. Cavallini, T. Maran, A. Krantz, J. Herrero, G. Giannatos, M. Stubbe, J. Conroy, B. Kryštufek, A. Abramov, C. Wozencraft. 2008. *Vormela peregusna*. In: IUCN 2008. 2008 IUCN Red List of Threatened Species. Available at: http://www.iucnredlist.org/details/29680. Accessed: July 20, 2013

Turner, R. W. 1974. Mammals of the Black Hills of South Dakota and Wyoming. University of Kansas Museum of Natural History, Miscellaneous Publications 60: 1-178.

Ulev, E. 2007. Lynx canadensis. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available at: http://www.fs.fed.us/database/feis/ Accessed: August 1, 2013.

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

Whitaker, J.O. Jr. 1972. *Zapus hudsonius*. Mammalian Species 11: 1-7

Whitaker, J.O., Jr. and L. J. Rissler. 1992a. Winter activity of bats at a mine entrance in Vermilion County, Indiana. The American Miland Naturalist, 127: 52-59.

Whitaker, J. O., Jr. and L.J. Rissler. 1992b. Seasonal activity of bats at Copperhead Cave. Proceedings from the Indiana Academy of Science 101: 127-135.

Whitaker, J.O. Jr. and R.E. Wrigley. 1972. *Napaeozapus insignis*. Mammalian Species 14:1-6.

Wilson, M. And Watts, B. 2006. The Effect of Moonlight on Detection of Whip-poor-wills: Implications for Long-term Monitoring Strategies. J.Field Ornithol. 77 (2): 207-211.

Zimpfer, N.L., W.E. Rhodes, E.D. Silverman, G.Z. Zimmerman, and K.D. Richkus. 2012. Trends in duck breeding populations, 1955-2012. Division of Migratory Bird Management, U.S. Fish and Wildlife Service. Administrative Report June 29, 2012. 27pp. Available at: http://www.fws.gov/migratorybirds/. Accessed: December 11, 2012.

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

GOLDER ASSOCIATES LTD.

Jennifer Braun, M.Sc.
Terrestrial Biologist

Daryl Johannesen, M.Sc., P.Biol.
Principal

JB/JT/DJ/ls

n:\active\2013\1190 sudbury\1197\13-1197-0003 iamgold terrestrial cote gold timmins\reporting\baseline\13-1197-0003 rpt 13dec10 iamgold terrestrial baseline docx

APPENDIX A

Incidental Wildlife Observations within 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

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														

n:\active\2013\1190 sudbury\1197\13-1197-0003 iamgold terrestrial cote gold timmins\reporting\baseline\appendix\appendix b climate data ls.docx

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
<u>whip-poor-will</u>	<u>*Caprimulgus vociferus*</u>	<u>S4B</u>
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
<u>eastern small-footed bat</u>	<u>*Myotis leibii*</u>	<u>S2S3</u>
<u>eastern wolf</u>	<u>*Canis lupus lycaon*</u>	<u>S4</u>
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

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.
B049Tl (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.
B053Tl (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.

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: B034Tl – Photo faces north from plot centre


Photo 8: B047S – Photo faces north from plot centre


Photo 9: B049Tl – Photo faces north from plot centre


Photo 10: B053Tl – 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

APPENDIX I

Breeding Bird Observation 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	-

n:\active\2013\1190 sudbury\1197\13-1197-0003 iamgold terrestrial cote gold timmins\reporting\baseline\appendix\appendix j basking turtle observations lsa ls.docx

APPENDIX K

Basking Turtle Survey Observation Photographs in the Local Study Area


Photo 1: BT001 - Bagsverd Creek


Photo 3: BT003 - Bagsverd Creek


Photo 5: BT005 - Bagsverd Creek


Photo 2: BT002 - Bragsverd Creek


Photo 4: BT004 - Bagsverd Creek


Photo 6: BT006 - Bagsverd Creek

Photo 7: BT007 - Bagsverd Creek

Photo 9: BT019A - Bagsverd Creek

Photo 11: BT022 - Bagsverd Creek

Photo 8: BT0010 - Bagsverd Creek

Photo 10: BT020A - 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 20: BT015B - Clam Lake


Photo 21: BT016B - Clam Lake


Photo 22: BT017B - Clam Lake


Photo 23: BT008 - 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

n:\active\2013\1190 sudbury\1197\13-1197-0003 iamgold terrestrial cote gold timmins\reporting\baseline\appendix\appendix l basking turtle conditions ls.docx

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	-

n:\active\2013\1190 sudbury\1197\13-1197-0003 iamgold terrestrial cote gold timmins\reporting\baseline\appendix\appendix m basking turtle observations rsa ls.docx

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*
	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*
	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*
	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*
	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*
	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*
	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*
	Bagsverd Creek	July 7-18, 2012	Medium and small hoop nets, minnow traps, backpack electrofisher	None observed	Green Frogs Tadpoles	*Lithobates clamitans*
	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*
	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*
	East Beaver Pond	July 13-14, 2012	Minnow traps	None observed	Green Frogs Wood Frogs	*Lithobates clamitans* *Rana sylvatica*
	North Beaver Pond	July 14-15, 2012	Minnow traps	None observed	Green Frogs Wood Frogs	*Lithobates clamitans* *Rana sylvatica*
	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*
	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 9: Lichen covered rock outcrop at 114lo


Photo 11: Lichen covered rock outcrop at 115lo


Photo 8: Lichen covered rock outcrop at 98med


Photo 10: Crevice observed at 114lo


Photo 12: Crevice observed at 115lo


Photo 13: Crevice observed at 117lo


Photo 14: Crevice observed at 117lo


Photo 15: Crevice observed at 117lo


Photo 16: Lichen covered rock outcrop at 117lo


Photo 17: Crevice observed at 100med


Photo 18: Rock outcrop at 100med


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


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


Photo 21: Crevice observed at 79lo


Photo 22: Lichen covered outcrop at 79lo


Photo 23: Fractured rocks observed at 68med


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

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.

For more information, visit golder.com

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
1010 Lorne Street
Sudbury, Ontario, P3C 4R9
Canada
T: +1 (705) 524 6861

Golder Associates