



REPORT

Natural Environment Level 1/2 Report

Proposed Thomas Street Quarry Expansion

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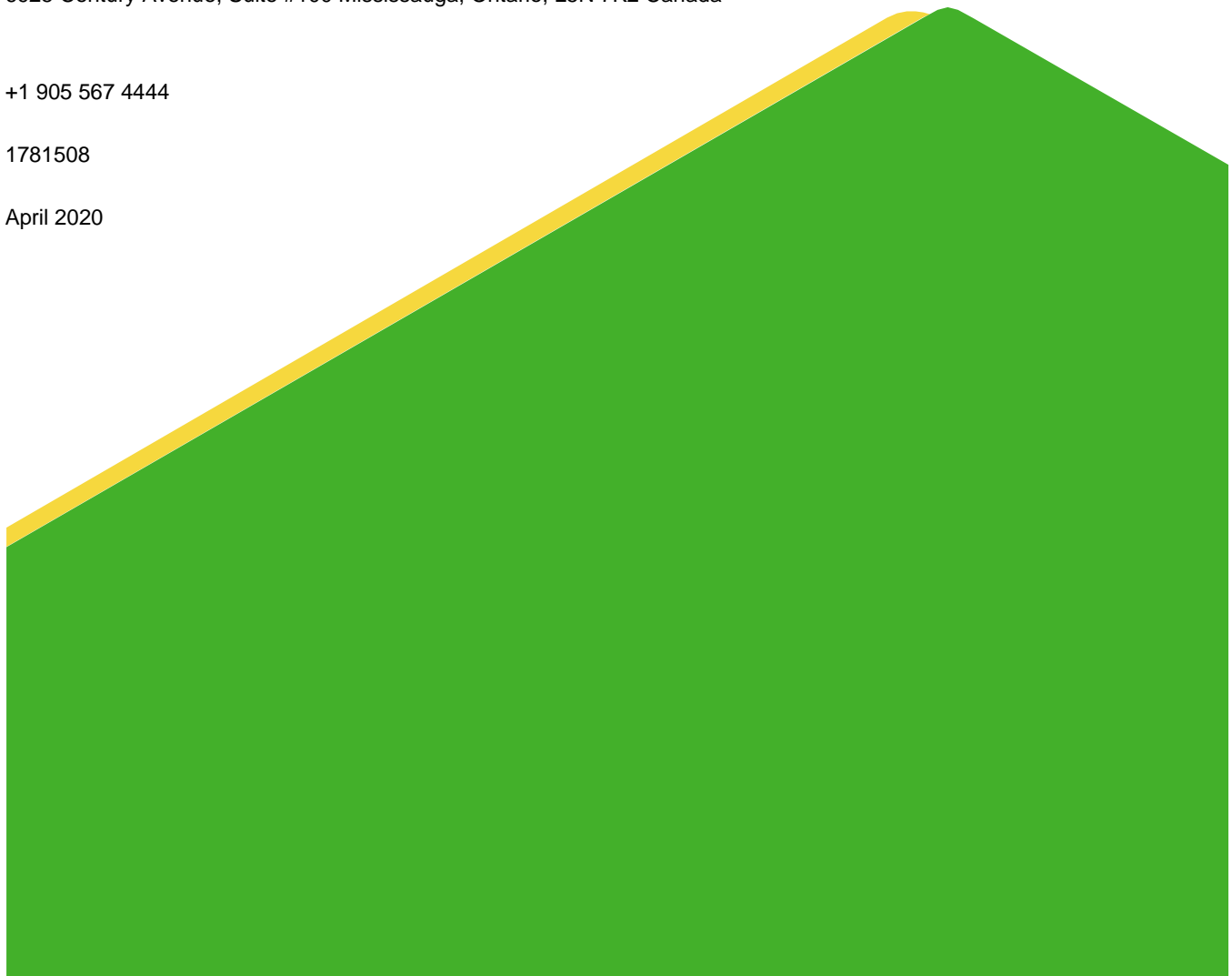
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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been retained by St. Marys Cement Inc. (Canada) (SMC), to complete natural environment technical studies to accompany the application for a new Category 2, Class “A” licence (Quarry Below Water) (the Project) under the *Aggregate Resources Act* (ARA) on Lot 29, North Thames River Concession (municipally known as 4608 Perth Road Line 5), Perth South, Ontario (Figure 1). The Project is an expansion of the existing Thomas Street Quarry.

1.1 Purpose

This report specifically addresses the requirements of a Natural Environment Level 1 and Level 2 (NEL 1/2) Technical Report (Aggregate Resources of Ontario Provincial Standards, Section 2.2) that will accompany the applications for a Category 2, Class “A” Quarry Below Water. This report also meets the requirements of an Environmental Impact Statement (EIS) as required by the County of Perth’s (the County) Official Plan (OP) to assess impacts of development on natural heritage features.

For the purpose of this report, the following definitions are used:

Site (Figure 1) - The site is the total land area within the property owned by SMC that is proposed for licensing under the ARA. The site is approximately 46 ha and rectangular in shape.

Extraction Limit (Figure 1) – The total area in which aggregate is proposed for extraction. The total area of the extraction limit is approximately 43 ha. The extraction limit will be set back 30 m along roads and 15 m along property boundaries, except for the eastern boundary adjacent to the existing Thomas Street Quarry where no setback is proposed in order to integrate the operations.

Study Area (Figure 2) - The study area for the NEL 1/2 assessment is defined in the Aggregate Resources of Ontario Provincial Standards, Sections 2.2.3 and 2.2.4 as the site and surrounding 120 m. Because the predicted groundwater drawdown is expected to reach approximately 1 km west of the site (Golder 2020), but not further than the boundary of the site to the east, where it meets the existing Thomas Street Quarry, the study area was amended to match the simulated extent of groundwater drawdown as shown on Figure 2.

The purpose of this report is to assess potential environmental impacts of the proposed aggregate extraction on the site with respect to the following:

- The environmental features and functions in the study area
- The influence of extraction on the surrounding natural environment
- The rehabilitation potential of the site after extraction

1.2 Site and Adjacent Lands

1.2.1 Site Description

The site is a single agricultural parcel located on the north side of Perth Road Line 5 in a rural setting approximately 2 km southwest of the Town of St. Marys in Perth County, Ontario. The majority of the site consists of an agricultural field planted in soya bean that is bordered by a sparsely vegetated hedgerow. There is a thicket in the east-central portion of the field, and farm buildings and a residence in the southern portion of the site. There is a small meadow marsh at the north end of the agricultural field (Figure 1).

1.2.2 Adjacent Lands

The site and the study area are shown on Figure 2. The existing Thomas Street Quarry (Category 1 Class A – Below Water Licence No. 4494) is located to the east of the site, with a licensed extraction area of 424.97 ha. There is a second licensed aggregate pit located to the west of the site with an extraction area of 35.6 ha. There are agricultural fields with scattered woodlands to the north, northeast, and west, and Perth Road Line 5 to the south, with the Thames River with forested riparian areas further to the south. There are two small cultural meadows to the northwest and southeast of the site, and a cultural woodland to the east (Figure 1).

2.0 ENVIRONMENTAL POLICY CONTEXT

The site and study area are within the Township of Perth South, and the County of Perth. Documents reviewed to gain an understanding of the natural heritage features and regulations that are relevant to the proposed site and study area consisted of the following:

- The ARA (Ontario 1990) and the Provincial Standards of Ontario – Category 2 – Class A Quarry Below Water (MNR 1997)
- The Provincial Policy Statement (MMAH 2014)
- The *Fisheries Act* (Canada 1985)
- The *Migratory Birds Convention Act* (Canada 1994)
- The *Species at Risk Act* (Canada 2002)
- The *Endangered Species Act* (Ontario 2007)
- Township of Perth South Zoning By-Law No. 4-1999 (2016)
- The County of Perth Official Plan (2017)
- O. Reg. 157/06 – Upper Thames River Conservation Authority: Regulation of Development, Interference with Wetlands, and Alterations to Shorelines and Watercourses

An overview of the above noted legislation and policy documents are discussed in Sections 2.1 to 2.8.

2.1 Aggregate Resources Act

Applicants are required under the ARA Provincial Standards to prepare a Level 1 Natural Environment Technical Report and, where significant natural environment features occur on, or in proximity (i.e., within 120 m, or the estimated area of groundwater drawdown) to the proposed operation, a Level 2 Natural Environment Report is required. Significant natural heritage features are defined in the PPS (MMAH 2014) with guidance from supporting technical manuals prepared by the Ministry of Natural Resources (MNR 2000; MNR 2010; MNR 2015a). A Level 2 Natural Environment Technical Report, identifying the particular features and functions of the designated natural environment feature(s), the nature of the potential negative impacts of the extractive operation, the proposed mitigation of those effects and the nature and magnitude of any residual effects is also required to satisfy the ARA Provincial Standards (MNR 1997). As well, the proposed rehabilitation of the extraction area, and any prescriptions for that rehabilitation, are identified and discussed in the Level 1 and, if necessary, the Level 2 Natural Environment Technical Reports.

2.2 Provincial Policy Statement

The Provincial Policy Statement (PPS) was issued under Section 3 of *The Planning Act*. The natural heritage policies of the PPS (MMAH 2014) indicate that:

- 2.1.1 Natural features and areas shall be protected for the long-term.
- 2.1.2 The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features.
- 2.1.3 Natural heritage systems shall be identified in Ecoregions 6E and 7E, recognizing that natural heritage systems will vary in size and form in settlement areas, rural areas, and prime agricultural areas.
- 2.1.4 Development and site alteration shall not be permitted in:
 - a) significant wetlands in Ecoregions 5E, 6E, and 7E
 - b) significant coastal wetlands
- 2.1.5 Unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions, development and site alteration shall not be permitted in:
 - a) significant wetlands in the Canadian Shield north of Ecoregions 5E, 6E, and 7E
 - b) significant woodlands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River)
 - c) significant valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Marys River)
 - d) significant wildlife habitat
 - e) significant areas of natural and scientific interest
 - f) coastal wetlands in Ecoregions 5E, 6E, and 7E that are not subject to policy 2.1.4(b)
- 2.1.6 Development and site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements.
- 2.1.7 Development and site alteration shall not be permitted in habitat of endangered species and threatened species, except in accordance with provincial and federal requirements.
- 2.1.8 Development and site alteration shall not be permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.3, 2.1.4 and 2.1.5 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.

2.3 Fisheries Act

The purpose of the *Fisheries Act* (Canada 1985) is to maintain healthy, sustainable and productive Canadian fisheries through the prevention of pollution and the protection of fish and their habitat. All projects undertaking work in or near-water must comply with the provisions of the *Fisheries Act*.

Measures to protect fish habitat include avoiding in-water work (i.e., below the high-water mark) and work on the banks or shoreline of a watercourse/waterbody, as well maintaining riparian vegetation. Any project that is unable to avoid impacts to fish or fish habitat will require a project review (DFO 2019). If it is determined through the Fisheries and Oceans Canada (DFO) review process that the project will result in death of fish or the harmful alteration, disruption or destruction of fish habitat (HADD), an authorization under the *Fisheries Act* is required. This includes projects that have the potential to obstruct fish passage or impacts flows.

Proponents of projects requiring a *Fisheries Act* Authorization are required to also submit a Habitat Offsetting Plan, which provides details of how the death of fish and/or HADD to fish habitat will be offset, as well as outlining associated costs and monitoring commitments. Proponents also have a duty to notify DFO of any unforeseen activities that cause harm to fish and outline the steps taken to address them.

2.4 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (MBCA) (Canada 1994) prohibits the killing or capturing of migratory birds, as well as any damage, destruction, removal or disturbance of active nests. It also allows the Canadian government to pass and enforce regulations to protect various species of migratory birds, as well as their habitats. While Environment and Climate Change Canada (ECCC) can issue permits allowing the destruction of nests for scientific or agricultural purposes, or to prevent damage being caused by birds, it does not typically allow for permits in the case of industrial or construction activities.

2.5 Species at Risk

2.5.1 Species at Risk Act

At a federal level, species at risk (SAR) designations for species occurring in Canada are initially determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). If approved by the federal Minister of the Environment and Climate Change, species are added to the federal List of Wildlife Species at Risk (Canada 2002). Species that are included on Schedule 1 as endangered or threatened are afforded protection of critical habitat on federal lands under the *Species at Risk Act* (SARA). On private or provincially-owned lands, only aquatic species listed as endangered, threatened or extirpated and migratory birds are protected under SARA, unless ordered by the Governor in Council.

2.5.2 Endangered Species Act

SAR designations for species in Ontario are initially determined by the Committee on the Status of Species at Risk in Ontario (COSSARO), and if approved by the provincial Minister of Environment, Conservation and Parks, species are added to the provincial *Endangered Species Act* (ESA) which came into effect June 30, 2008 (Ontario 2007). The legislation prohibits the killing or harming of species identified as endangered or threatened in the various schedules to the Act. The ESA also provides habitat protection to all species listed as threatened or endangered. As of June 30, 2008, the Species at Risk in Ontario (SARO) List is contained in Ontario Regulation (O. Reg.) 230/08.

Subsection 9(1) of the ESA prohibits the killing, harming or harassing of species identified as ‘endangered’ or ‘threatened’ in the various schedules to the Act. Subsection 10(1) (a) of the ESA states that “*No person shall damage or destroy the habitat of a species that is listed on the SARO list as an endangered or threatened species*”.

General habitat protection is provided, by the ESA, to all threatened and endangered species. Species-specific habitat protection is only afforded to those species for which a habitat regulation has been prepared and passed into law as a regulation of the ESA. The ESA has a permitting and registration process where alterations to the habitat of protected species may be considered.

2.6 County of Perth

According to Schedule A (Land Use Plan) of the County’s OP (Perth 2017), the southern half of the site is designated as Potential Limestone Resource, while the northern half is designated as Agriculture. Proposed enlargements of existing extraction areas are permitted within designated Mineral Aggregate Resource areas (including Potential Limestone Resource). An OP amendment is required to re-designate the northern half of the site from agricultural use to mineral extraction (Perth 2017).

The thicket complex on the site (CUT1-7) (Figure 1) is designated as Natural Resources / Environment (Schedule A: Perth 2017). This land use designation covers several natural features, including wetlands, wildlife and fish habitat, woodlands and environmentally sensitive areas. Policies related to each applicable natural feature within the site and study area are discussed in Section 6.0.

2.7 Township of Perth South

The Township of Perth South (the Township) has adopted the policies of the County’s OP, which are discussed in Section 2.6. The Township provides municipal-level land use policies in the Zoning By-Law No. 4-1999 (2016).

The site is zoned Agricultural. Uses permitted within the Agricultural Zone are generally limited to agricultural, residential or recreational, as well as some existing uses. A Zoning By-law amendment is required for aggregate extraction on the site.

2.8 Upper Thames River Conservation Authority

The study area is within the jurisdiction of the UTRCA. According to Schedule C (Land Use Constraints) of the County’s OP (Perth 2017), a portion of the southern end of the site and study area is overlapped by the Flood Plain and the Flood and Fill Constraints area that corresponds to the UTRCA regulated limits regulated by Ontario Regulation 157/06 (Ontario 2006) under the *Conservation Authorities Act* (Ontario 2011). Because this project is under the purview of the ARA, permits from the UTRCA are not required.

3.0 DESCRIPTION OF PROPOSED DEVELOPMENT

The site is an expansion of the adjacent Thomas Street Quarry. The tonnage limit for the combined site and Thomas St. Quarry operations will remain at 3.25 million tonnes per year. The proposed extraction area of the site is approximately 43 ha. The eastern to northeastern side will be contiguous with the Thomas Street Quarry, the northwest and western sides will have 15 m setbacks, and the southern side will have a 30 m setback from Perth Road Line 5. Access to the proposed quarry expansion will be through the common boundary with the Thomas Street Quarry.

Quarrying will begin within the southern half of the extraction area and proceed northwards. Above and below-water extraction will be concurrent in each phase, and extraction of the previous phase will be completed before extraction begins in the next phase, unless there is an operational requirement to complete extraction in both phases simultaneously (i.e., for blending purposes). Although there will be some portable processing equipment on the site during operations, the majority of processing will continue at the existing Thomas Street Quarry.

The total depth of extraction on the site will be continuous with the existing Thomas Street Quarry floor, which is anticipated to vary between elevations of approximately 271 and 279 metres above sea level (masl).

Dewatering will be accomplished in a similar manner as the existing Thomas Street Quarry with surface water and groundwater inputs passively drained over the quarry floor to a sump(s) and eventually pumped off-site to the Thames River.

4.0 METHODS

4.1 Background Review

The investigation of existing conditions in the study area included a background information search and literature review to gather data about the local area and provide context for the evaluation of the natural features.

The following sources were used for the background review:

- Natural Heritage Information Centre (NHIC) database, maintained by the MNRF (NHIC 2017)
- Land Information Ontario (LIO) geospatial data (MNRF 2019a)
- Species at Risk Public Registry (ECCC 2020)
- Species at Risk in Ontario (SARO) List (MNRF 2020)
- Breeding Bird Atlas of Ontario (OBBA) (Cadman et al. 2007)
- Atlas of the Mammals of Ontario (Dobbyn 1994)
- Ontario Reptile and Amphibian Atlas (Ontario Nature 2019)
- Bat Conservation International (BCI) range maps (BCI 2017)
- Ontario Butterfly Atlas (Jones et al. 2017)
- eBird species maps (eBird 2017)
- MNRF LIO Aquatic Resources Area Layer (MNRF 2019b)
- MNRF Fish On-Line (MNRF 2019c)
- DFO Aquatic SAR Mapping (DFO 2017)
- Upper Thames River Watershed Report Card (UTRCA 2012a)
- Plover Mills Subwatershed – 2012 Watershed Report Card (UTRCA 2012b)
- Perth Natural Heritage Systems Study (Perth 2018)

- County of Perth Official Plan (2017)
- Township of Perth South Zoning By-Low (2016)
- Aerial imagery

To develop an understanding of the drainage patterns, ecological communities and potential natural heritage features that may be affected by the proposed aggregate development, MNRF LIO data were used to create base layer mapping for the study area. A geographic query of the NHIC database was conducted to identify element occurrences of any natural heritage features, including wetlands, ANSIs, life science sites, rare vegetation communities, rare species (i.e., species ranked S1-S3 by NHIC), species designated under the ESA or SARA, and other natural heritage features within 1 km of the study area.

4.2 Species at Risk Screening

SAR considered for this report include those species listed in the ESA and SARA. An assessment was conducted to determine which SAR had potential habitat in the study area. A screening of all SAR which have the potential to be found in the vicinity of the study area was conducted first as a desktop exercise using the sources listed in Section 4.1. Species with ranges overlapping the study area, or recent occurrence records in the vicinity, were screened by comparing their habitat requirements to habitat conditions in the study area.

The potential for the species to occur was determined through a probability of occurrence. A ranking of low indicates no suitable habitat availability for that species in the study area and no specimens identified. Moderate probability indicates more potential for the species to occur, as suitable habitat appeared to be present in the study area, but no occurrence of the species has been recorded. Alternatively, a moderate probability could indicate an observation of a species, but there is no suitable habitat in the study area. High potential indicates a known species record in the study area (including during the field surveys or background review) and good quality habitat is present.

Searches were conducted during all field surveys for suitable habitats and signs of all SAR identified through the desktop screening. Any habitat identified during the field surveys with potential to provide suitable conditions for additional SAR not already identified through the desktop screening was also assessed and recorded. All probability ratings were updated based on the results of the field surveys.

4.3 Field Surveys

The habitats and communities on the site were characterized through field surveys. The following sections outline the methods used for each of the field surveys. During all surveys, area searches were conducted and additional incidental wildlife, plant, and habitat observations were recorded. Searches were also conducted to document the presence or absence of suitable habitat, based on habitat preferences, for those species identified in the desktop SAR screening described above. The dates when all surveys were conducted are included in Table 1.

Table 1: Summary of Field Surveys Conducted on the Proposed Thomas Street Quarry Expansion Site in 2017 and 2018

Date	Type of Survey
May 2, 2018	Bat Habitat Assessment, General Wildlife Survey, Anuran Call-Count Survey (ACC) #1, Aquatic Habitat Survey

Date	Type of Survey
May 22, 2018	ACC #2, General Wildlife Survey
June 12, 2018	ACC #3, General Wildlife Survey
June 14, 2018	Breeding Bird Survey (BBS) #1, General Wildlife Survey
June 14-28, 2018	Bat Acoustic Survey (Stationary Detectors)
June 28, 2018	BBS#2, Ecological Land Classification (ELC), Botanical Inventory, General Wildlife Survey
February 14, 2019	Woodland/thicket characterization and ELC

4.3.1 Plant Community Surveys and Botanical Inventory

Plant communities on and immediately surrounding the site were first delineated at a desktop level using high-resolution aerial imagery. Plant communities on the site were then ground-truthed in the field (where accessible) using the Ecological Land Classification (ELC) system for southern Ontario (Lee et al. 1998). These inventories were carried out by systematically traversing the site for a thorough survey of species and communities. Information on dominant plant species and plant community structure and composition was recorded in order to better define and refine the plant community polygons.

The botanical inventory included area searches in all naturally-occurring habitats on the site. The searches were conducted by systematically walking through all habitats in a meandering fashion, generally paralleling the principal (long) axis of a natural area, where feasible, and examining the full width of the area. Lists of all plant species identified during all the field surveys were compiled.

4.3.2 Anuran Call Count Survey

Anuran (frog and toad) call count surveys were conducted at two stations on the site (Figure 1). Surveys followed protocols from the Marsh Monitoring Program method for vocalizing frog surveys (BSC 2008). This method involves collection of call data from fixed stations over three survey periods during the spring and early summer (April to early June), with an interval of at least 15 days between surveys. Surveys began one half-hour after sunset and ended by midnight during evenings with appropriate weather conditions (i.e., little wind and a minimum air temperature of 5°C, 10°C, and 17°C for each respective survey period).

Each station consisted of a semi-circle with a 100 m radius from the centre point (where the observer stands), and each survey was three minutes in duration. All frogs and toads seen or heard were noted on pre-printed datasheets. Frogs and toads heard or seen outside of the 100 m radius were also noted, including estimated distance (where possible).

4.3.3 Breeding Bird Survey

Breeding bird point count surveys for songbirds and other diurnal birds were conducted at three stations on the site (Figure 2). Surveys followed protocols from the Canadian Breeding Bird Survey (Downes and Collins 2003), and the OBBA (Cadman et al. 2007). Point count stations were established in representative habitats on the site

and were spaced a minimum of 250 m apart. Surveys were conducted between 30 minutes before sunrise and 10:00 am to encompass the period of maximum bird song.

Each station consisted of a circle with a 100 m radius from the centre point (where the observer stands), and each point count was 10 minutes in duration, and was separated into survey windows of 0-3, 3-5, and 5-10 minutes. All birds seen or heard were noted on pre-printed datasheets and observations were made regarding sex, age and notable behaviour, when possible. Birds heard or seen outside of the 100 m radius were also noted using methods from the OBBA, including estimated distance (where possible).

4.3.4 Bat Survey

Field survey methods for bat surveys were based on the MNRF guidance document *Survey Protocol for Species at Risk Bats within Treed Habitats* (MNRF 2017a). Bat surveys consisted of two components: 1) a habitat assessment to identify maternity roost potential on the site, and 2) an acoustic survey to confirm and characterize the bat community (i.e., species) on the site. Specific methods for each survey type are described below.

4.3.4.1 Habitat Assessment

An assessment of potential suitable maternity roost habitat (including high-level plant community classification, snag density estimates, and average tree diameter at breast height) was conducted on the site for bats including the four species listed as endangered under the ESA: little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), eastern small-footed myotis (*Myotis leibii*) and tri-colored bat (*Perimyotis subflavus*). In addition to the overall habitat assessment, potential individual maternity roosts were identified and assessed. Data collected for individual roosts included tree species, height, diameter-at-breast height (DBH), snag class and description of habitat features (e.g., cavity, peeling bark). The farm buildings in the south portion of the site (RES) (Figure 1) were also assessed for potential to provide anthropogenic maternity roost habitat. Buildings were assessed from the exterior and interior (where possible and safe to access) for suitable roosting features such as presence of chimneys, loose boards, condition of soffits, and potential entrance/egress points.

4.3.4.2 Acoustic Survey

Based on the findings of the habitat assessment, two passive full-spectrum bat detectors were deployed in potentially suitable maternity roost habitat on the site. Detector 1 was deployed along the edge of the cultural thicket (CUT1-7) in the central portion of the site (Figure 1), within 5 m of rock piles. Trees within the thicket and rock piles immediately south of the thicket were assessed to have potential to provide maternity roost habitat for SAR bats. Detector 2 was deployed in the southern portion of the site within 50 m of the farm buildings on the site, which were assessed to have potential to provide anthropogenic maternity roost habitat for SAR bats. The Thames River was approximately 70 m from the farm buildings, which could represent a drinking source for bats in the local landscape (Figure 1).

The detectors were programmed to start recording one half hour before sunset and recorded for a total duration of one hour each night. The detectors recorded for a total of 14 nights.

4.3.4.3 Data Analysis and Assessment

Acoustic data from both the active monitoring and acoustic survey was filtered in Sonobat Data Wizard to remove noise files, and the high-grade noise scrubber setting was used. The data was analyzed and auto-classified using SonoBat 4.2.1 nnE. The Sonobat program is specifically intended for discrimination of bats to the species level wherever possible, and validation of the species-level classification was conducted by Golder's bat acoustic specialist. The results of the species classification were tallied on a per-night basis for each station for each

species or species group. Once automated classification was complete, a subset of the files were reviewed (QA/QC'd) by an experienced and qualified bat acoustic specialist using the SonoVet tool. All recordings identified as high frequency calls were reviewed and a subset of the low frequency calls were also reviewed (see the percentage manually reviewed table for Qa/Qc percentages). For calls that were auto-classified to species by SonoBat but not reviewed, the SonoBat classification was accepted.

Bat passes cannot always be identified to species level. This can be due to either poor quality of the recording (i.e., high signal to noise ratio), or ambiguity of the call type. Some bat species have very similar calls and all bats have variability in their call repertoires. Some bat calls are quite diagnostic and can be confidently identified to species while other bat passes can only be identified to a Genus or to a group of species.

4.3.5 General Wildlife Survey

General wildlife surveys included track and sign surveys, area searches, and incidental observations, concurrent with other field surveys. The full range of habitats across the site were searched, with special attention paid to edge habitats and other areas where mammals might be active. Areas of exposed substrate such as sand or mud were located and examined for any visible tracks. Any wildlife (including mammals, birds, butterflies, and dragonflies) seen and identified were recorded. When encountered, tracks and other signs (e.g., tracks, scats, hair, tree scrapes, etc.) were identified to a species, if possible, and recorded. Observations of wildlife species or signs during all field surveys were recorded.

Visual encounter surveys for reptiles and amphibians, as well as reptile and amphibian habitat (with a focus on SAR) were also conducted on the site. All suitable habitats for reptiles and amphibians were searched (e.g., flipping logs and other types of cover objects, observations in piles of rocks) and all reptiles and amphibians observed were identified and recorded.

4.3.6 Aquatic Habitat Survey

The site was surveyed to verify the location and extent of any aquatic features (e.g., tributaries), and to conduct a qualitative assessment of aquatic habitat. Parameters recorded as part of the qualitative assessment included wetted and bankfull width, water depth, substrate type, cover features, and instream and riparian vegetation.

4.4 Analysis of Significance and Sensitivity and Impact Assessment

An assessment was conducted to determine if any significant environmental features or SAR exist, or have moderate or high potential to exist, on the site or in the study area and assess whether the proposed extraction would negatively impact surrounding significant natural heritage features or SAR. Preventative, mitigative and remedial measures were considered in assessing the net effects of the proposed extraction operation on the surrounding ecosystem.

5.0 EXISTING CONDITIONS

5.1 Ecosystem Setting and Regional Context

The study area is located in Ecoregion 6E (Lake Simcoe – Rideau), which covers just over 6% of southern Ontario (Crins et al. 2009). Ecoregion 6E is underlain by bedrock of dolomite and limestone, and is characterized by gently rolling surface terrain interspersed by drumlin fields and moraines. Soils are primarily mineral-based and dominated by Gray Brown Luvisols and Melanic Brunisols. The majority of the region is covered by cropland or pasture (57%), with 16% covered by forest and 4% covered by water (Crins et al. 2009).

The study area is located in the Stratford Till Plain physiographic region. The till is a product of the Huron ice lobe and is described as fairly uniform silty clay. A network of glacial spillway overlies the till plain, converging in the area of the site along the Thames River and Trout Creek drainage corridors (Chapman and Putnam 1984)..

5.2 Hydrogeology

Based on borehole drilling conducted on the site, the ground surface slopes in a southerly direction, ranging from approximately 330 masl in the northwest of the site to 295 masl at the Thames River to the south of the site.

Based on MECP water well records and site water level data, groundwater is inferred to flow from a high of 330 masl in the eastern portion of the site to a low of 260 masl in the western portion of the site. In addition, bedrock water levels are typically much lower (10 m+) than nearby river levels, suggesting that the bedrock aquifers on the site appear to have a poor hydraulic connection to the Thames River to the south of the site.

The maximum amount of groundwater drawdown on the site as a result of the Project is expected to be 4 m and occurs along the west-central flank of the site (Figure 2). Off-site, in the study area, the extent of drawdown extends approximately 1 km west of the site (the Thomas Street Quarry and the Thomas Street Quarry Expansion) (Figure 2).

A more detailed discussion of hydrogeological conditions is provided in a separate report, entitled Hydrogeology and Hydrology Level 1 and 2 Assessment for the Proposed Thomas Street Quarry Expansion (Golder 2020).

5.3 Surface Water Resources

The study area is located in the Upper Thames River watershed, and the Plover Mills subwatershed (UTRCA 2012a,b).

The County's OP has not mapped any watercourses on the site (Perth 2017). According to LIO mapping (MNRF 2019a), there are three branches of an unnamed tributary that originate at the north and west ends of the site and flows southwest across the site to enter the Thames River approximately 560 m west of the site (Figure 1). Based on field surveys, the agricultural field on the site (OAGM) (Figure 1) was planted with crops, and no channels or flowing water were observed in this community.

An isolated meadow marsh (MAM2) (Figure 1) with shallow standing water in the spring and early summer was observed at the northern edge of the site. This feature is discussed further in Section 6.3.

Within the thicket (CUT1-7) on the site (Figure 1), a tributary characterized by a narrow channel and high riparian cover was observed. The water within the thicket was flowing from north to south, however there was no standing or flowing water upstream or downstream of the thicket. The water appeared to report from subsurface pathways and then returned back to subsurface after flowing across the surface (Golder 2020). The tributary within the thicket was intermittent and observed to be dry in several locations during all field surveys, suggesting that this feature likely only flows during or shortly after precipitation or melt events. In sections where the tributary contained water, wetted width was approximately 0.3 m, and wetted depth was 0.05 m. Substrates were composed of cobble, sand and silt.

Off-site, within the study area, the Thames River flows parallel to the southern boundary of the site, approximately 20 m or more south of the site on the south side of Perth Road Line 5 (Figure 2). The Thames River is a large river with low slope and a warmwater thermal regime (MNRF 2019b; URTCA 2017).

5.4 Vegetation

5.4.1 Regional Setting

The study area is located in the Great Lakes – St. Lawrence Forest Region and the Huron-Ontario subregion (Rowe 1972). The natural upland forest cover in this region is dominated by sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), basswood (*Tilia americana*), white ash (*Fraxinus americana*), white oak (*Quercus alba*), bur oak (*Quercus macrocarpa*), eastern hemlock (*Tsuga canadensis*) and eastern white pine (*Pinus strobus*). The lowland areas are characterized by forests of silver maple (*Acer saccharinum*), white elm (*Ulmus americana*), red elm (*Ulmus rubra*), black ash (*Fraxinus nigra*) and eastern white cedar (*Thuja occidentalis*) (Rowe 1972).

5.4.2 Plant Communities

Based on the field surveys conducted on the site, two natural ELC community types were identified on the site, in addition to two anthropogenic communities. The ELC communities are shown on Figure 1 and are briefly described in Table 2.

Table 2: Plant Communities within the Proposed Thomas Street Quarry Expansion Site

ELC Community	Field Description	SRANK ^a
CUT1-7 European Buckthorn Cultural Thicket	A small cultural thicket in the east-central portion of the site dominated by common buckthorn (<i>Rhamnus cathartica</i>). Ground cover was sparse through the shaded middle of the thicket and moderate to dense along the thicket edges and in openings. Ground cover was composed of colonizing species, such as goldenrods (<i>Solidago</i> spp.), teasel (<i>Dipsacus fullonum</i>), garlic mustard (<i>Alliaria petiolata</i>), and common burdock (<i>Arctium minus</i>). In the north portion of the thicket there was a small sugar-maple-black maple deciduous forest inclusion. Trees were generally immature and small (<25 cm DBH), with the occasional larger tree (25-50 cm DBH). Snags and deadfall were few in number in this community. Occasional trees, such as poplar (<i>Populus</i> spp.), and willow (<i>Salix</i> spp.), were observed scattered through the south portion of the thicket.	N/A
MAM2 Mineral Meadow Marsh	A meadow marsh dominated by grasses, which was flooded in the spring and early summer.	N/A
OAGM Open Agriculture	Open agricultural field planted in soya bean covering the majority of the site.	N/A
RES Residential	Areas of residential property containing anthropogenic structures (e.g., house, garage and barns) within the south portion of the site.	N/A

^a An SRank is a provincial –level rank indicating the conservation status of a species or plant community and is assigned by the NHIC in Ontario (NHIC 2017). SRanks are not legal designations but are used to prioritize protection efforts in the Province. SRanks for plant communities in Ontario are defined in the Significant Wildlife Habitat Technical Guide (MNR 2000). Ranks 1-3 are considered extremely rare to uncommon in Ontario; Ranks 4 and 5 are considered to be common and widespread. N/A indicates a community that has not been ranked, which often applies to anthropogenic, culturally-influenced or high-level ELC communities (i.e., FOD).

5.4.3 Vascular Plants

A total of 85 vascular plant species were identified during the botanical, or other, surveys completed on the site (Appendix A). Of these, 42% are native species and 49% are exotic species. The remaining 9% were unable to be identified to the species level due to plant condition, seasonal timing (i.e., not flowering), or origin (i.e., planted landscaped species). The high proportion of exotic species is typical of an agricultural environment where there is a high level of disturbance and limited natural habitat.

Significant and Sensitive Species

All of the plant species identified through the botanical, or other surveys, are secure and common, widespread and abundant in Ontario and globally (S4 or S5; G5) or are unranked alien species (SNA; GNR). None of the plant species identified in the desktop SAR screening as having ranges which overlap the study area (Appendix B) were found during the botanical, or other, field surveys.

5.5 Wildlife

5.5.1 Amphibians

Two amphibian species were observed during anuran call count, or other, field surveys conducted on the site (Appendix C). Both species were observed in the meadow marsh (MAM2) (Figure 1) in the north portion of the site.

Significant and Sensitive Species

Both of the amphibian species observed during field surveys are secure and common in Ontario and globally (S5; G5) (Appendix C). None of the amphibian species identified in the desktop SAR screening as having ranges which overlap the study area (Appendix B) were found during the field surveys.

5.5.2 Breeding Birds

A total of 31 bird species were observed during breeding bird, or other, surveys conducted on the site (Appendix C). American robin (*Turdus migratorius*), barn swallow (*Hirundo rustica*), red-winged blackbird (*Agelaius phoeniceus*), and song sparrow (*Melospiza melodia*) were the most common bird species observed during the surveys. American robin breeds in open woodlands and are common in residential yards, and barn swallow is common in agricultural settings, particularly where there are suitable barns for nesting. Red-winged blackbirds are common in wetlands, open fields and meadows, including crop fields, and song sparrow breeds in a range of forest, shrub and riparian habitats, often near water (Cornell 2015).

Significant and Sensitive Species

All of the bird species observed during field surveys are secure and common in Ontario and globally (S4 or S5; G5) (Appendix C). Two of the bird species observed on the site are designated as threatened under the ESA: bank swallow (*Riparia riparia*) and barn swallow.

Bank swallow breeds in a variety of natural and anthropogenic habitats (e.g., lake bluffs, stream banks, stockpiles, sand and gravel pits) located near open foraging sites such as waterbodies, fields, wetlands and riparian woods. Forested areas are generally avoided (Garrison 1999). Bank swallow was observed flying over the site during breeding bird surveys, but no suitable nesting habitat was identified on the site. Off-site, aggregate stockpiles in the eastern portion of the study area may provide suitable nesting habitat for bank swallow. The agricultural fields on the site and throughout the study area may provide suitable foraging habitat for bank swallow.

Barn swallow breeds in areas that contain a suitable nesting structure, open areas for foraging, and a body of water. This species nests in human made structures including barns, buildings, sheds, bridges, and culverts. Preferred foraging habitat includes grassy fields, pastures, agricultural cropland, lake and river shorelines, cleared right-of-ways, and wetlands (COSEWIC 2011a). Mud nests are fastened to vertical walls or built on a ledge underneath an overhang, and suitable nests from previous years are reused (Brown and Brown 2019). Two structures on the site were assessed to provide nesting habitat for barn swallow: a large, two-storied barn, and a house (RES) (Figure 1). Barn swallow were observed entering these structures during breeding bird surveys, and foraging throughout the site. The structures were deemed unsafe to enter, so observations of potential nests in the structures were not possible.

Barn swallow and bank swallow are discussed further in Section 6.1.

5.5.3 Bats

5.5.3.1 Habitat Assessment

Based on the habitat assessment, three areas on the site were assessed to have moderate-high potential to provide suitable maternity roost habitat for bats. These areas included:

- Cultural thicket (CUT1-7) in the central portion of the site
- Rock piles at the south end of the cultural thicket (CUT1-7) in the central portion of the site
- Farm buildings and residence (RES) in the south portion of the site (Figure 1)

The cultural thicket contained a low density of large diameter (i.e., >30 cm DBH) trees or snags with cavities, peeling bark, or leaf clumps / squirrel nests that may provide maternity roosting habitat for tree-roosting SAR bats, including little brown myotis, northern myotis, and tri-colored bat (*Perimyotis subflavus*).

In addition to the treed areas, there were two cobble rock piles identified at the south end of the cultural thicket (CUT1-7) on the site with potential to provide maternity roosting habitat for eastern small-footed myotis, which is not known to roost in trees and prefers rock piles, bedrock crevices and talus slopes (Humphrey 2017).

These features were targeted for detailed acoustic monitoring in the second stage of bat surveys.

5.5.3.2 Acoustic Survey

In total, six bat species were identified during the acoustic survey, including an unknown myotis species. The mean bat passes per night with standard deviation for all bat species at the stationary detectors is included in Table 3. The total and maximum number of passes of myotis species is provided in Table 4.

Table 3: Mean (Standard Deviation) Bat Passes per Night at Acoustic Monitoring Stations from June 14 – 28, 2018

Station	# of Nights Surveyed	Total Passes per Night (all bats)	Bat Species or Call Frequency Type										
			HiF total ²	LoF total ²	LoF Unknown Species ³	HiF Unknown Species ⁴	Hoary Bat	Silver-haired Bat	Big Brown Bat	Red Bat	Big Brown or Silver-haired Bat	Unknown Myotis	Little Brown Myotis
1	14	69(56.34)	1.07(1.07)	67.93(56.29)	2.79(3.09)	0.15(0.38)	3.07(2.46)	0.79(0.89)	42.14(38.66)	0.36(0.5)	19.14(17.25)	0.07(0.27)	0.5(0.76)
2	14	149.93(83.86)	4.14(3.72)	145.79(83.58)	22.5(15.81)	0.5(0.97)	4.14(2.18)	2.71(2.72)	68.36(39.23)	0.43(0.78)	48.07(35.08)	0.43(0.51)	2.79(2.47)

Table 4: Total Passes and Maximum Passes within One Night for SAR Bats at Acoustic Monitoring Stations from June 14 - 28, 2018

Station	Bat Species or Call Frequency Type					
	Total Unknown HiF ¹	Max Unknown HiF ¹	Total Myotis Species	Max Myotis Species	Total Little Brown Myotis	Max Little Brown Myotis
1	2	1	1	1	7	2
2	7	3	6	1	39	8

¹ - HiF = High Frequency; LoF = Low Frequency

Overall, Detector 1 at the cultural thicket (CUT1-7) had a moderate level of activity for a site in southern Ontario, while Detector 2 at the farm buildings and residence (RES) (Figure 1) had a high level of bat activity. The most frequently recorded bat species at both stations was big brown bat (*Eptesicus fuscus*). A low number of passes at both stations were identified as silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), little brown myotis, and red bat (*Lasiurus borealis*). A low number of unknown *Myotis* species and high-frequency bat species passes (potentially indicative of *Myotis* species) were also recorded at both stations.

The number of bat passes recorded by a detector may include multiple passes by the same bat individual and therefore are only indicative of presence/absence, rather than the number of bats that are potentially using the site. The results of the acoustic survey, combined with the habitat assessment, indicate that there is moderate to high potential for the farm buildings and residence on site to provide maternity roost habitat, and a moderate potential for bat maternity roost habitat in the vicinity of the site. The cultural thicket (CUT1-7) on site is dominated by common buckthorn and trees were generally immature and small (<25 cm DBH) which does not represent high quality maternity roost habitat. The Thames River located south of the site likely functions as a primary drinking source for bats in the local landscape and the presence of this nearby drinking source may be a contributing factor to the level of general bat activity recorded on the site as bats may be travelling across the site to reach the river. General bat maternity roost habitat for non-SAR bats is discussed further in Section 6.7.

Significant and Sensitive Species

The majority of bat species observed during the field surveys are secure and common in Ontario (S4). Eastern small-footed myotis is considered imperiled to vulnerable (S2S3) in the province. Two bat species (big brown bat and eastern small-footed myotis) are considered apparently secure or secure globally (G4; G5), while the remaining species are considered vulnerable to apparently secure globally (G3G4) (Appendix C).

One bat species observed during the acoustic surveys is designated endangered under the ESA: little brown myotis. Little brown myotis will roost in both natural and man-made structures. Within forest communities, roosting colonies require a number of large dead trees, in specific stages of decay and that project above the canopy in relatively open areas. They may also form nursery colonies in buildings within 1 km of water (ECCC 2018).

Although this SAR species were recorded at the farm buildings and cultural thicket on the site, there was a low number of SAR and potential SAR bat passes evenly distributed throughout the night, with only a single detection within one hour of sunset when bats are known to emerge from roosts. In addition, the acoustic detector at the farm buildings recorded no SAR or potential SAR bat passes within the first hour after sunset, and the peak of activity occurred between 01:00 and 03:00. This data suggests there is a low potential for little brown myotis maternity roost habitat on the site, and these detections likely instead represent commuting or foraging bats (e.g., commuting to the nearby drinking source to the south, as discussed above). Because there is low potential for SAR bat maternity roost habitat on the site, this species is not carried to the impact analysis, and further analysis is not warranted.

5.5.4 Fish and Fish Habitat

No fish were observed within the isolated tributary on site, and there was no connection to surface water features downstream (i.e., the Thames River). Off-site, the Thames River flows throughout the study area and within 20 m of the site to the south (Figure 1). The Thames River is considered fish habitat under the *Fisheries Act*. The majority of watercourses in the Plover Mills subwatershed where the study area is located are characterized as having warmwater or unconfirmed thermal regimes, and are known to provide habitat for the fish species shown in Table 5 (UTRCA 2012a).

Table 5: Fish species known to occur in the Plover Mills subwatershed (UTRCA 2012a)

Common Name	Scientific Name	Common Name	Scientific Name
black bullhead	<i>Ameiurus melas</i>	largemouth bass	<i>Micropterus salmoides</i>
black redhorse	<i>Moxostoma duquesni</i>	least darter	<i>Etheostoma microperca</i>
blacknose dace	<i>Rhinichthys atratulus</i>	longear sunfish	<i>Lepomis megalotis</i>
blackside darter	<i>Percina maculata</i>	mimic shiner	<i>Notropis volucellus</i>
bluegill	<i>Lepomis macrochirus</i>	northern hog sucker	<i>Hypentelium nigricans</i>
bluntnose minnow	<i>Pimephales notatus</i>	northern pike	<i>Esox lucius</i>
brook stickleback	<i>Culaea inconstan</i>	northern redbelly dace	<i>Chrosomus eos</i>
brook trout	<i>Salvelinus fontinalis</i>	pearl dace	<i>Margariscus nachtriebi</i>
brown bullhead	<i>Ameiurus nebulosus</i>	pumpkinseed	<i>Lepomis gibbosus</i>
central mudminnow	<i>Umbra limi</i>	quillback	<i>Carpiodes cyprinus</i>
central stoneroller	<i>Campostoma anomalum</i>	rainbow darter	<i>Etheostoma caeruleum</i>
common carp	<i>Cyprinus carpio</i>	river chub	<i>Nocomis micropogon</i>
common shiner	<i>Luxilus cornutus</i>	rock bass	<i>Ambloplites rupestris</i>
creek chub	<i>Semotilus atromaculatus</i>	rosyface shiner	<i>Notropis rubellus</i>
fantail darter	<i>Etheostoma flabellare</i>	silver shiner	<i>Notropis photogenis</i>
fathead minnow	<i>Pimephales promelas</i>	smallmouth bass	<i>Micropterus dolomieu</i>
golden redhorse	<i>Moxostoma erythrurum</i>	spotfin shiner	<i>Cyprinella spiloptera</i>
golden shiner	<i>Notemigonus crysoleucas</i>	stonecat	<i>Noturus flavus</i>
greater redhorse	<i>Moxostoma valenciennesi</i>	striped shiner	<i>Luxilus chrysocephalus</i>
green sunfish	<i>Lepomis cyanellus</i>	walleye	<i>Sander vitreus</i>
greenside darter	<i>Etheostoma blennioides</i>	white sucker	<i>Catostomus commersonii</i>
hornyhead chub	<i>Nocomis biguttatus</i>	yellow bullhead	<i>Ameiurus natalis</i>
iowa darter	<i>Etheostoma exile</i>	yellow perch	<i>Perca flavescens</i>
johnny darter	<i>Etheostoma nigrum</i>		

5.5.5 Other Wildlife

Four mammals were observed on the site during field surveys (Appendix C): coyote (*Canis latrans*), raccoon (*Procyon lotor*), red squirrel (*Tamiasciurus hudsonicus*), and white-tailed deer (*Odocoileus virginianus*). Four arthropods were also observed during field surveys: ebony jewelwing (*Calopteryx maculata*), monarch (*Danaus plexippus*), twelve-spotted skimmer (*Libellula pulchella*), and viceroy (*Limenitis archippus*).

Significant and Sensitive Species

Monarch is designated as special concern under the ESA, and assigned a provincial rarity rank of S2 (imperiled) for non-breeding populations. Monarch is discussed further in Section 6.7.5. All other wildlife species observed during the field surveys are secure and common in Ontario and globally (S5; G5) (Appendix C). None of the other wildlife species identified in the desktop SAR screening as having ranges which overlap the study area (Appendix B) were found during the field surveys.

6.0 ASSESSMENT OF SIGNIFICANT NATURAL HERITAGE FEATURES

This section assesses the natural heritage features and functions (as outlined in Section 2.0) located within the study area. The following sources were used during the assessment of features:

- Natural Heritage Reference Manual (NHRM; MNR 2010);
- Significant Wildlife Habitat Technical Guide (SWHTG; MNR 2000);
- Significant Wildlife Habitat Mitigation Support Tool (SWHMiST; MNRF 2014); and
- Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E (MNRF 2015a).

6.1 Habitat of Endangered or Threatened Species

General habitat protection is provided by the ESA to all threatened and endangered species. General habitat is defined as the area on which a species depends directly or indirectly to carry out life processes, including reproduction, rearing, hibernation, migration or feeding. Species-specific habitat protection is only afforded to those species for which a habitat regulation has been prepared and passed into law as a regulation of the ESA. A habitat regulation outlines specific habitat features and associated buffers that are protected, and also specifies the geographic area(s) of the province where the habitat regulation applies. In some cases, a General Habitat Description (GHD) may also be prepared to help define and refine the area of protected habitat in advance of a habitat regulation.

Two species designated threatened under the ESA (barn swallow, bank swallow) and one species designated endangered under the ESA (little brown myotis) were observed on the site during field surveys. Off-site, 12 species designated threatened or endangered under the ESA were assessed to have moderate potential to occur in the study area based on the availability of potential suitable habitat: bobolink (*Dolichonyx oryzivorus*), chimney swift (*Chaetura pelagica*), eastern meadowlark (*Sturnella magna*), eastern small-footed myotis, little brown myotis, northern myotis, tri-colored bat, black redhorse (*Moxostoma duquesnei*), silver shiner (*Notropis photogenis*), wavy-rayed lampmussel (*Lampsilis fasciola*), spiny softshell (*Apalone spinifera*), and butternut (*Juglans cinerea*).

6.1.1 Birds

Bank Swallow

The draft bank swallow GHD (MNR 2015b) defines habitat by three categories:

- Category 1 - the breeding colony, including burrows and substrate around them
- Category 2 - the area within 50 m of the colony bank face (to allow entry/exit)
- Category 3 - the area of suitable foraging habitat within 500 m of the outer edge of the colony

Bank swallow was observed flying over the site during field surveys. Off-site, aggregate stockpiles in the eastern portion of the study area (DIST) (Figure 1) may provide suitable nesting habitat for bank swallow. The agricultural fields on the site and in the study area may provide suitable foraging habitat for bank swallow. Because there is potential suitable nesting habitat off-site within the study area, and suitable foraging habitat on the site, bank swallow is carried forward to the impact analysis (Section 7.1).

Barn Swallow

The barn swallow GHD (MNR 2013a) defines habitat by three categories:

- Category 1 - nest
- Category 2 - the area within 5 m of the nest (representing area by the male)
- Category 3 - the area between 5 m and 200 m of the nest (i.e., foraging habitat)

Barn swallow was observed flying over the site during field surveys. Two structures on the site were assessed to provide nesting habitat for barn swallow: a large, two-storied barn, and a house (RES) (Figure 1). Because there is suitable nesting habitat on the site, barn swallow is carried forward to the impact analysis (Section 7.1).

Bobolink

Bobolink, designated threatened under the ESA, breeds in grasslands or graminoid dominated hayfields with tall vegetation (Gabhauer 2007). Bobolink prefers grassland habitat with a forb component and a moderate litter layer. They have low tolerance for presence of woody vegetation and are sensitive to frequent mowing within the breeding season.

The GHD (MNR 2013b) for bobolink defines habitat by three categories:

- Category 1 - nest and the area within 10 m of the nest
- Category 2 - the area between 10 m and 60 m of the nest, or centre of approximate defended territory
- Category 3 - the area of continuous suitable habitat between 60 m and 300 m of the nest, or centre of approximate defended territory

The agricultural field on the site is planted in soy and is unsuitable for grassland birds. In addition, this species was not observed during field surveys. Off-site, agricultural fields and meadows throughout the study area may provide suitable nesting habitat. Because there is potential suitable nesting habitat off-site within the study area, bobolink is carried forward to the impact analysis (Section 7.1).

Chimney Swift

Chimney swift, designated threatened under the ESA, was assessed to have a moderate potential to occur off-site, within the study area. Chimney swift breeding habitat is varied and includes urban, suburban, rural and wooded sites. Preferred nesting sites are dark, sheltered spots with a vertical surface to which the bird can grip. Unused chimneys are the primary nesting and roosting structure, but other anthropogenic structures and large diameter cavity trees are also used (COSEWIC 2007).

The GHD (MNR 2013c) for chimney swift defines habitat by one category:

- Category 1 – human-made nest/roost, or a natural nest/roost cavity and the area within 90 m of the natural cavity

No natural or human-made roosts were identified on the site. Off-site, there is potential that chimneys or large diameter cavity trees occur within the study area that could provide suitable nesting or roosting habitat. Because there is potential suitable habitat off-site within the study area, chimney swift is carried forward to the impact analysis (Section 7.1).

Eastern Meadowlark

Eastern meadowlark, designated threatened under the ESA, breeds in pastures, hayfields, meadows and old fields. Eastern meadowlark prefers moderately tall grasslands with abundant litter cover, high grass proportion, and a forb component (Hull 2003).

The GHD (MNR 2013d) for eastern meadowlark defines habitat by three categories:

- Category 1 - nest and the area within 10 m of the nest
- Category 2 - the area between 10 m and 100 m of the nest, or centre of approximate defended territory
- Category 3 - the area of continuous suitable habitat between 100 m and 300 m of the nest, or centre of approximate defended territory

The agricultural field on site is planted in soy and is unsuitable for grassland birds. In addition, this species was not observed during field surveys. Off-site, agricultural fields and meadows throughout the study area may provide suitable nesting habitat. Because there is potential suitable nesting habitat off-site within the study area, eastern meadowlark is carried forward to the impact analysis (Section 7.1).

6.1.2 Bats

Little Brown Myotis, Northern Myotis, Tri-Colored Bat, and Eastern Small-Footed Myotis

Little brown myotis, northern myotis, tri-colored bat and eastern small-footed myotis are all designated endangered under the ESA and were assessed to have moderate potential to occur off-site, within the study area. Little brown myotis will roost in both natural and man-made structures including buildings. Natural roosting colonies require a number of large dead trees, in specific stages of decay and that project above the canopy in relatively open areas (ECCC 2018). Northern myotis usually roosts in hollows, crevices, and under loose bark of mature trees. Roosts may be established in the main trunk or a large branch of either living or dead trees as well as on anthropogenic structures (ECCC 2018). Tri-colored bat may roost in foliage, in clumps of old leaves, hanging moss or squirrel nests. They are occasionally found in buildings although there are no records of this in Canada (ECCC 2018). Eastern small-footed myotis is not known to roost within trees, but there is very little known

about its roosting habits. The species generally roosts on the ground under rocks, in rock crevices, talus slopes and rock piles and occasionally inhabits buildings (Humphrey 2017).

As discussed in Section 5.5.3, there is a low potential for SAR bat maternity roost habitat on the site. Off-site, woodlands and any rock piles throughout the study area may provide suitable roosting habitat for these SAR bat species. Because there is potential suitable maternity roost habitat off-site within the study area, little brown myotis, northern myotis, tri-colored bat and eastern small-footed myotis are carried forward to the impact analysis (Section 7.1).

6.1.3 Fish and Mussels

Black Redhorse

Black redhorse, designated threatened under the ESA, was assessed to have a moderate potential to occur off-site, within the study area. This species is known to occur in the Thames River watershed. Habitats are typically found in moderately sized to large rivers and streams with moderate flows. It is rarely found associated with aquatic vegetation. (COSEWIC 2015).

There is no habitat regulation or GHD for black redhorse and this species receive general habitat protection under the ESA. Because there is potential suitable aquatic habitat off-site in the south portion of the study area, within the Thames River, black redhorse is carried forward to the impact analysis (Section 7.1).

Silver Shiner

Silver shiner, designated threatened under the ESA, is found in the Thames and Grand Rivers, and it has been recently reported in Bronte Creek and Sixteen Mile Creek which flow into Lake Ontario. They prefer moderately-flowing sections of larger streams with clear water and moderate currents. Usual substrates include gravel, rubble, boulder, and sand. Aquatic vegetation may be present or absent (COSEWIC 2011b).

The silver shiner GHD (MNR 2017b) defines habitat by three categories:

- Category 1 - Flowing pools, runs and riffles in occupied reaches
- Category 2 - Shallow, nearshore habitats, and areas with aquatic vegetation in occupied reaches
- Category 3 - Floodplains and riparian edges adjacent to occupied reaches

Because there is potential suitable aquatic habitat off-site in the south portion of the study area, within the Thames River, silver shiner is carried forward to the impact analysis (Section 7.1).

Wavy-rayed Lampmussel

Wavy-rayed lampmussel, designated threatened under the ESA, inhabits clear, medium-sized rivers and streams, with steady flow and stable substrate. It is typically found in clean sand or gravel substrates, often stabilized with cobble or boulders, in and around riffle areas up to 1 m in depth. It may also be found in large creeks and rivers (Morris 2011).

There is no habitat regulation or GHD for wavy-rayed lampmussel and this species receives general habitat protection under the ESA. There is no suitable aquatic habitat on the site. Wavy-rayed lampmussel is known to occur in the Thames River (UTRCA 2012a) and may occur in the river and its tributaries throughout the study area. Because there is potential suitable habitat off-site within the study area, wavy-rayed lampmussel is carried forward to the impact analysis (Section 7.1).

6.1.4 Reptiles

Spiny Softshell

Spiny softshell, designated threatened under the ESA, will typically inhabit rivers with soft bottoms but occasionally lakes, impoundments, bays, marshy lagoons, as well as ditches and ponds near rivers. Soft sandy or muddy substrates with aquatic vegetation are essential habitat features. Hibernation takes place in deep pools with soft substrates. Nesting areas consist of sandy or gravelly areas, relatively free of vegetation and close to water (COSEWIC 2016).

There is no habitat regulation or GHD for spiny softshell and this species receive general habitat protection under the ESA. There is no suitable aquatic habitat on the site. Spiny softshell is frequently observed in the Plover Mills subwatershed (UTRCA 2012b) and may occur in the Thames River and its tributaries off-site throughout the study area. Because there is potential suitable habitat off-site within the study area, spiny softshell is carried forward to the impact analysis (Section 7.1).

6.1.5 Vascular Plants

Butternut

Butternut, designated endangered under the ESA, is found along stream banks, on wooded valley slopes, and in deciduous and mixed forests. It is commonly associated with beech, maple, oak and hickory (Voss and Reznicek 2012). Butternut prefers moist, fertile, well-drained soils, but can also be found in rocky limestone soils. This species is shade intolerant (Farrar 1995).

Habitat of butternut is regulated in Ontario such that healthy trees receive a 25 m habitat protection zone around the base of the stem within which disturbance is prohibited and an additional 25 m restricted activity zone (MNRF 2018).

No butternut was observed on the site. Off-site, this species may occur along stream banks and woodlands throughout the study area. Because there is potential suitable habitat off-site within the study area, butternut is carried forward to the impact analysis (Section 7.1).

6.2 Fish Habitat

As discussed in Sections 5.3 and 5.5.4, there is an unnamed tributary that originates, and is isolated within, the cultural thicket (CUT1-7) (Figure 1) in the east-central portion of the site. Due to the intermittent nature of the tributary, lack of connection to any off-site water features, and lack of fish observations, the tributary does not support fish directly, nor does it contribute indirectly to fish habitat downstream. It does not meet the definition of fish habitat in the *Fisheries Act*.

The Thames River provides fish habitat. According to the County's OP (2017), development is not permitted within 15 m of a watercourse. Development is permitted within 30 m, where it is demonstrated there will be no adverse impacts on fish habitat. Because the Thames River is located within 20 m of the site, fish habitat is carried forward to the impact analysis (Section 7.2).

6.3 Significant Wetlands

Significant wetlands are areas identified as provincially significant by the MNRF using evaluation procedures established by the Province, as amended from time to time (MMAH 2014). Wetlands are assessed based on a range of criteria, including biology, hydrology, societal value and special features (MNRF 2019d).

Based on LIO mapping (MNRF 2019a), there are no PSWs on the site or within the study area, nor are there any other mapped unevaluated wetlands on the site or in the study area. A small (0.3 ha) meadow marsh (MAM2) (Figure 1) was identified in the north portion of the site during field surveys. However, this marsh is not designated Natural Resources/Environment on Schedule A of the County's OP (2017), which maps the natural heritage system for the County, including Provincially and Locally Significant Wetlands. Other areas mapped as Natural Resources/Environment within the study area appear to be associated with woodlands and/or riparian forest. There are no policies contained within the County's OP (2017) relating to unevaluated wetlands not identified as Locally Significant.

Although the meadow marsh was not formally evaluated according to the Ontario Wetland Evaluation System (OWES) (Ontario 2013), data gathered during the background review and field surveys indicates it does not meet criteria to be considered significant due to the small size (less than 0.5 ha), limited habitat forms and functions, lack of hydrologic connections or proximity to other wetlands and waterbodies, low biodiversity, and lack of social and economic importance. Furthermore, there are no PSWs within 0.75 km of the site (i.e., the maximum distance allowed between wetlands to complex wetlands), to warrant a complexing assessment with existing off-site PSWs. Further analysis is not warranted.

6.4 Significant Woodlands

Woodlands can vary in their level of significance at the local, regional and provincial levels. Significant woodlands are areas which are ecologically important in terms of features such as species composition, age of trees and stand history; functionally important due to their contribution to the broader landscape because of their location, size or due to the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history (MMAH 2014). These are to be identified using criteria established by the MNRF and are included in the Natural Heritage Reference Manual (NHRM) for Policy 2.3 of the PPS (MNR 2010).

Woodlands in Perth County have been recently evaluated for significance based on PPS criteria and mapped in Appendix L-1 of the Perth Natural Heritage System Study (PNHSS) (Perth 2018). According to the County's OP (Perth 2017), significant woodlands are defined as woodlands 1 ha in size or larger. In addition, the Natural Resources/Environment system, which includes mapping of significant woodlands where woodlands are located, is mapped on Schedule A of the County's OP (Perth 2017).

The cultural thicket (CUT1-7) (Figure 1) in the east-central portion of the site is mapped as a significant woodland in the PNHSS, and as part of the Natural Resources/Environment system in the County's OP (Perth 2017, 2018). However, the mapping of natural heritage features, including significant woodlands, in both documents was based on interpretation of aerial imagery without ground-truthing, and can be prone to misinterpretation for some features. Field surveys conducted in 2018 by Golder confirmed that this feature was a cultural thicket and not a woodland. According to the PPS (MMAH 2014), woodlands may be delineated by the *Forestry Act* definition (i.e., meeting a minimum density of trees per hectare), or by the ELC system definition for forest (tree cover greater than 60%). Because the cultural thicket does not meet either definition of a woodland, it does not qualify to be evaluated for significance as such.

Off-site, within the study area, the cultural woodland (CUW1) approximately 40 m to the east of the site is mapped as a significant woodland in the PNHSS (Perth 2018). In addition, although the woodland is not mapped as Natural Resources/Environment on Schedule A of the County's OP (Perth 2017), it is approximately 2 ha in size and therefore meets the size criteria to be considered significant by the County (Perth 2017).

Off-site, within the study area, there is a narrow strip of deciduous forest along the southern bank of the Thames River (FOD6), approximately 60 m south of the site (Figure 1), that is mapped as a significant woodland in the PNHSS (Perth 2018). This woodland is not mapped as Natural Resources/Environment on Schedule A of the County's OP (Perth 2017). However, based on aerial imagery the deciduous woodland (FOD6) is contiguous with an extensive forest system extending to the west of the study area, with a combined area greater than 1 ha. The overall forest unit meets the size criteria to be considered significant by the County (Perth 2017).

Beyond 120 m of the site, there are multiple woodlands in the study area (Figure 2) that are mapped as significant woodlands in the PNHSS (Perth 2018). In addition, these woodlands are mapped as Natural Resources/Environment on Schedule A of the County's OP (Perth 2017) and/or are 1 ha in size or larger, and therefore also meet the criteria to be considered significant by the County.

Based on this assessment, there are no significant woodlands on the site, two significant woodlands within 120 m of the site, and multiple significant woodlands beyond 120 m of the site, in the study area.

According to the County's OP (Perth 2017), development and site alteration is generally prohibited within significant woodlands and a 30 m buffer area. Where a licence for extraction has been obtained, a minimum amount of the woodland may be permitted to be removed to facilitate extraction provided that the remaining woodland area is protected and the extraction area is rehabilitated back to woodland as soon as possible during progressive rehabilitation. Development may be permitted within the 30 m buffer where it is demonstrated that no negative impact to the feature or its function will occur (Perth 2017).

Because there are multiple significant woodlands off-site within the study area, significant woodlands are carried forward to the impact analysis (Section 7.3).

6.5 Significant Valleylands

Significant valleylands should be defined and designated by the planning authority. General guidelines for determining significance of these features are provided in the Natural Heritage Reference Manual (NHRM) for Policy 2.3 of the PPS (MNR 2010). Recommended criteria for designating significant valleylands under the PPS include prominence as a distinctive landform, degree of naturalness, importance of its ecological functions, restoration potential, and historical and cultural values.

Valleylands in Perth County were recently evaluated for significance based on PPS criteria and mapped in Appendix H-1 of the PNHSS (Perth 2018). Based on the mapping, there are no significant valleylands on the site. Off-site, immediately to the south, the Thames River valleyland is mapped as significant valleyland (Perth 2018).

According to the County's OP (Perth 2017), specific policies pertaining to development within and adjacent to significant valleylands will be developed through the OP Amendment process.

Because there is a significant valleyland off-site within the study area, significant valleylands are carried forward to the impact analysis (Section 7.4).

6.6 Significant Areas of Natural and Scientific Interest

Significant ANSIs are areas identified as provincially significant by the MNRF using evaluation procedures established by the Province, as amended from time to time.

There are no ANSIs on the site or off-site within the study area. Further analysis is not warranted.

6.7 Significant Wildlife Habitat

Significant wildlife habitat (SWH) is one of the more complicated natural heritage features to identify and evaluate. The NHRM includes criteria and guidelines for designating SWH. There are two other documents, the Significant Wildlife Habitat Technical Guide (SWHTG) and the Significant Wildlife Habitat Mitigation Support Tool (SWHMiST) (MNR 2000 and MNRF 2014), that can be used to help decide what areas and features should be considered significant wildlife habitat. These documents were used as reference material for this study.

There are four general types of significant wildlife habitat: seasonal concentration areas, migration corridors, rare or specialized habitats, and species of conservation concern. The specific habitats considered in this report are evaluated based on the criteria outlined in the Ecoregion 6E Criterion Schedule (MNRF 2015a). All types of SWH are discussed below in relation to the site and study area and the proposed extraction.

6.7.1 Seasonal Concentration Areas

Seasonal concentration areas are those areas where large numbers of a species congregate at one particular time of the year. Examples include deer yards, amphibian breeding habitat, bird nesting colonies, bat hibernacula, raptor roosts, and passerine migration concentrations. If a SAR, or if a large proportion of the population may be lost if significant portions of the habitat are altered, all examples of certain seasonal concentration areas may be designated.

The SWHTG (MNR 2000) and Ecoregion 6E Criterion Schedule (MNRF 2015a) identifies the following 12 types of seasonal concentrations of animals that may be considered significant wildlife habitat:

- winter deer yards and congregation areas
- colonial bird nesting sites
- waterfowl stopover and staging areas
- shorebird migratory stopover areas
- landbird migratory stopover areas
- raptor winter feeding and roosting areas
- reptile hibernacula
- turtle wintering areas
- bat hibernacula
- bat maternity colonies
- bat migratory stopover areas
- migratory butterfly stopover areas

There are no designated deer winter yards or winter congregation areas on the site or in the study area. No colonial bird nesting sites, shorebird migratory, or aquatic waterfowl stopover areas were identified during field surveys, and none were identified in the study area through aerial interpretation. There does not appear to be large, non-agricultural open fields to provide terrestrial waterfowl stopover or staging areas, and no large areas of forest with adjacent meadow habitat to support raptor wintering areas. No exposed bedrock or rock piles that

extend below the frost line that would support bat or reptile hibernacula were identified during field surveys or during aerial interpretation. Because the study area is further than 5 km from Lake Ontario, migratory butterfly stopover areas and landbird migratory stopover areas are not applicable.

The meadow marsh (MAM1) and tributary within the cultural thicket (CUT1-7) (Figure 1) on the site was assessed to have low potential to provide aquatic or overwintering habitat for turtles due to the small size and ephemeral nature of these features. No basking objects such as logs or rocks were observed, and no turtles were observed during field surveys. There are no wetlands mapped within the study area according to LIO mapping (MNRF 2019a) and County mapping (Perth 2017).

Although the buildings (RES) and the cultural thicket (CUT1-7) (Figure 1) on the site were assessed to have moderate to high potential to provide maternity roost habitat for non-SAR bats (Section 5.5.3), buildings and thickets are not considered to be SWH according to the Ecoregion 6E Criterion Schedule (MNRF 2015a). However, best management practices are recommended in Section 8.2 to minimize adverse impacts to bat individuals that may be roosting in these features. Off-site, woodlands throughout the study area (Figure 2) may provide suitable SWH for bat maternity colonies. Because there is potential for seasonal concentration areas off-site within the study area, seasonal concentration areas are carried forward to the impact analysis (Section 7.5).

6.7.2 Migration Corridors

The SWHTG (MNR 2000) defines animal movement corridors as elongated, naturally vegetated parts of the landscape used by animals to move from one habitat to another. This is generally in response to different seasonal habitat requirements. For example, trails used by deer to move to wintering areas or areas used by amphibians between breeding and summer habitat. To qualify as significant wildlife habitat, these corridors would be a critical link between habitats that are regularly used by wildlife.

The site does not provide any critical linkage function, or general movement function, in the north-south or east-west directions. Off-site, a thin strip of deciduous forest (FOD6, FOD) (Figure 1) associated with the Thames River valleyland in the southern portion of the study area represents the primary connection for wildlife movement in the study area. Because there is a potential migration corridor off-site within the study area, migration corridors are carried forward to the impact analysis (Section 7.5).

6.7.3 Specialized Habitats

Specialized habitats are microhabitats that provide a critical resource to some groups of wildlife. Examples include salt licks for ungulates and groundwater seeps for wild turkeys.

The SWHTG (MNR 2000) and Ecoregion 6E Criterion Schedule (MNRF 2015a) defines seven specialized habitats that may be considered SWH. They are:

- habitat for area-sensitive species
- amphibian breeding habitat (woodlands and wetlands)
- turtle nesting habitat
- specialized raptor nesting habitat
- waterfowl nesting areas

- bald eagle and osprey habitat
- seeps and springs

A meadow marsh (MAM1) in the north portion of the site (Figure 1) was assessed to provide suitable breeding habitat for two amphibian species: spring peeper and American toad. However, based on field surveys the marsh did not meet the species presence and abundance criteria to be confirmed as SWH. There are no wetlands mapped within the study area according to LIO mapping (MNR 2019a) and County mapping (Perth 2017).

No habitat for area-sensitive species or nesting turtles was identified during field surveys. No seeps or springs were identified on the site or in the study area during field surveys. No suitable wetland habitat was identified on the site or in the study area to support waterfowl and no consideration of waterfowl nesting habitat is required. No bald eagle or osprey individuals, and no nests, were observed during field surveys. However, the forested riparian area of the Thames River throughout the study area (FOD6, FOD) (Figure 1) may provide suitable bald eagle and osprey habitat. Because there is potential for specialized habitats off-site within the study area, specialized habitats are carried forward to the impact analysis (Section 7.5).

6.7.4 Rare Habitat

This category includes vegetation communities that are considered rare in the province. Generally, communities assigned an SRANK of S1 to S3 (extremely rare to rare-uncommon) by the NHIC could qualify. It is assumed that these habitats are at risk and that they are also more likely to support rare species and other features that are considered significant.

No rare vegetation communities were identified on the site during the field surveys, and are unlikely to occur in the study area. Further analysis is not warranted.

6.7.5 Habitat for Species of Conservation Concern

Habitat for species of conservation concern (SOCC) includes habitat for three groups of species:

- Species that are rare, those whose populations are significantly declining, or have a high percentage of their global population in Ontario;
- Species listed as special concern under the ESA
- Species listed as threatened or endangered under SARA

Rare species are considered at five levels: globally rare, nationally rare, provincially rare, regionally rare, and locally rare (i.e., in the municipality). This is also the order of priority that should be attached to the importance of maintaining species. Some species have been identified as being susceptible to certain practices, and their presence may result in an area being designated significant wildlife habitat. Examples include species vulnerable to forest fragmentation and species such as woodland raptors that may be vulnerable to forest management or human disturbance. The final group of species of conservation concern includes species that have a high proportion of their global population in Ontario. Although they may be common in Ontario, they are found in low numbers in other jurisdictions.

The SWHTG (MNR 2000) and Ecoregion 6E Criterion Schedule (MNR 2015a) defines five specialized habitats that may be considered SWH. They are:

- marsh bird breeding habitat

- open country bird breeding habitat
- shrub/early successional bird breeding habitat
- terrestrial crayfish
- special concern and rare wildlife species

The meadow marsh (MAM1) (Figure 1) in the north portion of the site was not assessed to provide habitat for any marsh bird species during breeding bird surveys or other field surveys. No open country bird breeding habitat was identified on the site or in the study area during field surveys or aerial interpretation. The cultural thicket (CUT1-7) (Figure 1) in the east-central portion of the site is too small (i.e., <10 ha) to qualify as shrub/early successional bird breeding habitat. No habitat for terrestrial crayfish was identified on the site or in the study area during field surveys or aerial interpretation.

Monarch, designated special concern under the ESA, was observed on the site during field surveys. Monarch is found throughout the northern and southern regions of the province. This butterfly is found wherever there are milkweed (*Asclepius* spp.) plants for its caterpillars and wildflowers that supply a nectar source for adults. It is often found on abandoned farmland, meadows, open wetlands, prairies and roadsides, but also in city gardens and parks (COSEWIC 2010). Open meadow areas around the farm buildings (RES) (Figure 1) and thicket edges and openings (CUT1-7) (Figure 1) on site may provide suitable foraging habitat for this species. In addition, milkweed was observed in these areas on the site during field surveys which may support reproduction.

One additional species designated special concern under the ESA, yellow-banded bumblebee (*Bombus terricola*) was assessed to have moderate potential to occur on the site. The thicket in the center of the site (CUT1-7) (Figure 1) may provide suitable foraging habitat, where suitable nectaring plants were observed.

Seven additional species designated special concern under the ESA were assessed to have moderate potential to occur off-site within the study area based on the availability of suitable habitat (Appendix B): bald eagle (*Haliaeetus leucocephalus*), common nighthawk (*Chordeiles minor*), eastern wood-pewee (*Contopus virens*), grasshopper sparrow (*Ammodramus savannarum*), wood thrush (*Hylocichla mustelina*), northern map turtle (*Graptemys geographica*), and snapping turtle (*Chelydra serpentina*).

Because there is candidate habitat for nine species of conservation concern as SWH on the site or in the study area, habitat for species of conservation concern is carried forward to the impact analysis (Section 7.5).

7.0 IMPACT ANALYSIS

7.1 Threatened and Endangered Species

Bank Swallow

Although existing foraging habitat on the site will be removed, birds may still forage over the open extraction area. In addition, there is abundant similar foraging habitat in the local area. Because there is no nesting habitat on the site or in the study area and the availability of suitable foraging habitat in the local landscape will not be altered, bank swallow or its habitat is not expected to be impacted as a result of the proposed extraction. Further analysis is not warranted.

Barn Swallow

Barn swallow was determined to be nesting in the farm buildings in the south portion of the site (RES) (Figure 1), which are proposed to be removed as part of the Project. The ESA requires that the removal of barn swallow habitat be registered with the MECP and the associated rules and conditions outlined in Section 23.5 of Ontario Regulation 242/08 be followed (e.g., preparation of a mitigation and restoration plan). A Notice of Activity (NOA) was submitted and successfully registered on November 7, 2018 (confirmation ID M-102-2269622060). A mitigation and restoration record was also prepared, and includes , habitat compensation, monitoring and reporting. Further analysis is not warranted.

Bobolink, Chimney Swift, Eastern Meadowlark

Agricultural fields and graminoid-dominated meadows off-site, within the study area, may provide suitable habitat for bobolink and eastern meadowlark. Potential habitat is located outside of the proposed limit of extraction and is not expected to be directly impacted as a result of the proposed Project. Grassland habitats do not depend on the groundwater supply for growth and are therefore not expected to be impacted by potential groundwater drawdown within the zone of influence (Figure 2).

Groundwater drawdown within the zone of influence (Figure 2) as a result of the Project is not expected to impact vegetation in the study area as the background information suggests that the groundwater in the vicinity of the site is contained within bedrock and is unavailable for plant uptake (see Section 7.3 for more detailed discussion). Therefore potential cavity trees that may support chimney swift nesting/roosting are not expected to be impacted. Further, any chimney structures within the study area that may be used by chimney swift will not be impacted by groundwater drawdown.

Therefore, it is not anticipated that the Project will have a negative effect on these species or their habitats. Further analysis is not warranted.

Little Brown Myotis, Northern Myotis, Tri-Colored Bat, and Eastern Small-Footed Myotis

Habitat for little brown myotis, northern myotis, and tri-colored bat may be located in woodlands off-site, in the study area. Groundwater drawdown within the zone of influence (Figure 2) as a result of the Project is not expected to impact vegetation in the study area as the background information suggests that the groundwater in the vicinity of the site is contained within bedrock and is unavailable for plant uptake (see Section 7.3 for more detailed discussion). Potential rock piles within the study area that may provide roosting habitat for eastern small-footed myotis are not expected to be impacted by groundwater drawdown. Therefore, it is anticipated that the Project will not have a negative effect on these species or their habitats. Further analysis is not warranted.

Black Redhorse, Silver Shiner, Wavy-rayed Lampmussel, and Spiny Softshell

All habitat for black redhorse, silver shiner, wavy-rayed lampmussel, and spiny softshell is located outside of the proposed limit of extraction. No adverse impacts to the Thames River flow regime or channel stability are expected as a result of the proposed Project (see Section 7.2 for more detailed discussion). In addition, the implementation of appropriate best management practices (Section 8.2.1) will minimize potential adverse indirect effects (i.e., sedimentation) on the habitat. Further analysis is not warranted.

Butternut

Habitat for butternut may be located off-site in the study area. Groundwater drawdown within the zone of influence (Figure 2) as a result of the Project is not expected to impact vegetation in the study area as the background information suggests that the groundwater in the vicinity of the site is contained within bedrock and is unavailable

for plant uptake (see Section 7.3 for more detailed discussion). Therefore, it is anticipated that the Project will not have any negative effect on this species or its habitat. Further analysis is not warranted.

7.2 Fish Habitat

Based on the Hydrogeology and Hydrology Level 1 and 2 Assessment for the Proposed Thomas Street Quarry Expansion (Golder 2020), there will be an increase in annual runoff from the site by approximately 0.02% to the Thames River average annual flow. However, this increase in discharge is not expected to have a significant impact on the Thames River flow regime or channel stability. The majority of the site discharge will be controlled by the quarry dewatering and will be discharged at a controlled rate. This will effectively mitigate natural peak flows since rainfall or melt events will be stored in the quarry sump(s) until it can be pumped out. Discharge management and monitoring will be managed and documented under the current or future amended Environmental Compliance Approval. It is likely that water quality management will be consistent with discharge management for the existing Thomas Street Quarry, which undergoes weekly testing for total suspended solids (TSS) and pH levels, quarterly testing for acute lethality to rainbow trout (*Oncorhynchus mykiss*) and *Daphnia magna*, and semi-annual testing for chronic lethality to fathead minnow and *Ceriodaphnia dubia*. Discharge water will be pumped from the quarry into the Thames River during operations, and will cease during rehabilitation. The expected maximum daily discharge volume to the Thames River is unlikely to result in any changes to the existing warmwater thermal regime of the river. In addition, the river supports many coolwater fish species (e.g., smallmouth bass, common shiner, blacknose dace) that are tolerant of a wider range of water temperatures.

Although the Thames River is within the potential groundwater zone of influence (Figure 2), it is considered to be hydraulically disconnected from the underlying bedrock aquifer in the vicinity of the site and is not expected to be adversely impacted by groundwater drawdown (Golder 2020). In addition, the implementation of appropriate best management practices (Section 8.2.1) will minimize potential adverse indirect effects (i.e., sedimentation) on the river. Further analysis is not warranted.

7.3 Significant Woodlands

All of the off-site woodlands are located greater than 30 m from the site and are outside of the proposed limit of extraction. The maximum rooting depth for the majority of tree species in Ontario is generally within 5 m of the ground surface (Canadell et al. 1996). It is inferred that the saturated water table in the vicinity of the site lies below the overburden and within the bedrock and would therefore be unavailable for uptake by tree roots. Therefore, any drawdown in the bedrock aquifer would not result in any adverse impacts to significant woodlands in the vicinity of the site. Furthermore, the majority of the bedrock within the groundwater zone of influence (Figure 2) is mapped as low permeability till which would tend to limit off-site drawdown should the water table exist within the overburden (Golder 2020). Based on the Tier 3 Water Budget and Local Area Risk Assessment for the Town of St. Marys (Matrix 2014), overburden water levels appear to be deep and are located just above the top of bedrock, suggesting groundwater levels within the zone of influence are generally greater than 10 m below the ground surface and unavailable for root uptake. Further analysis is not warranted.

7.4 Significant Valleylands

The Thames River valleyland is located off-site within the study area and is not expected to be directly impacted through ground disturbance or vegetation clearing. As discussed in Section 7.2, the 0.02% increase in annual runoff to the Thames River is not expected to have a significant impact on the Thames River flow regime or channel stability. As discussed in Section 7.3, riparian vegetation / woodlands are not expected to be adversely

impacted by potential groundwater drawdown and no impacts to functions provided by this vegetation, such as erosion stability, shading, or wildlife habitat, are expected. In addition, the implementation of appropriate best management practices (Section 8.2.1) will minimize potential adverse indirect effects (i.e., erosion) on the valleyland. Further analysis is not warranted.

7.5 Significant Wildlife Habitat

Candidate SWH for two special concern or rare species (monarch and yellow-banded bumblebee) were identified on the site. Areas of suitable habitat for monarch and yellow-banded bumblebee on the site are small and isolated, and unlikely to support a large concentration of individuals. There is abundant similar habitat in and adjacent to the study area, and loss of this habitat due to the proposed extraction is not expected to impact the regional population of monarch or yellow-banded bumblebee. Further analysis is not warranted.

Candidate SWH for seven special concern or rare species (bald eagle, common nighthawk, eastern wood-pewee, grasshopper sparrow, wood thrush, northern map turtle, and snapping turtle) were identified off-site within the study area. All candidate SWH for these species are located outside of the proposed limit of extraction and no direct impacts to the features are anticipated. There will be no loss of aquatic habitat as a result of the Project for northern map turtle or snapping turtle in the Thames River, to the south of the site within the study area. No impacts to the flow of the Thames River are anticipated due to the proposed extraction (Section 7.2), and no impacts are expected to the regional population of these turtle species. As discussed in Section 7.3, no adverse impacts to woodlands within the study area as a result of potential groundwater drawdown are expected, and no adverse impacts to eastern wood-pewee, bald eagle or wood thrush are anticipated. Agricultural fields and graminoid-dominated meadows within the study area that may provide suitable habitat for grasshopper sparrow do not depend on the groundwater supply for growth and are therefore not expected to be impacted by potential groundwater drawdown. Further analysis is not warranted.

All other candidate SWH (i.e., bat maternity colonies, migration corridors and bald eagle nesting habitat) are located outside of the proposed limit of extraction and no direct impacts are expected. As discussed in Section 7.3, no adverse impacts to woodlands within the study area as a result of potential groundwater drawdown are expected, and no adverse impacts to bat maternity colonies or bald eagle nesting habitat are anticipated. As discussed in section 7.4, no adverse impacts to the form or function of the Thames River valleyland are expected and therefore no impacts to migration corridors are anticipated. Further analysis is not warranted.

8.0 REHABILITATION / MITIGATION / MONITORING

8.1 Rehabilitation Concept

The rehabilitation policies of the County (Perth 2017) require rehabilitation to a use which is both consistent and compatible with adjacent land uses. The post-extraction rehabilitation plan has been designed to fit into the overall regional context and complement the existing topography and terrestrial and aquatic features in the area. Approximately 50% of the combined existing Thomas Street Quarry and proposed Thomas Street Quarry Expansion will be a lake with side slopes of varying grades from near vertical to $\pm 5:1$. The lake will ultimately reach a size of ± 129 ha with water level approximately ± 294 masl.

Any plantings included in the rehabilitation plan will be of locally native, non-invasive species. Aquatic plants may include shrubs such as red-osier dogwood (*Cornus sericea*) and slender willow (*Salix petiolaris*), and herbaceous plants such as water plantain (*Alisma plantago-aquatica*), lake sedge (*Carex lacustris*), swamp milkweed

(*Asclepias incarnata*), softstem bulrush (*Schoenoplectus tabernaemontani*), and cattail (*Typha* spp.). Terrestrial plants may include a mixture of deciduous and coniferous species common to the local landscape, such as sugar maple, white pine, trembling aspen, American basswood, American beech, white cedar, white elm, and black cherry.

8.2 Mitigation and Monitoring

8.2.1 General Best Management Practices

Standard Best Management Practices to mitigate damage to the adjacent natural features include the following:

- To be in compliance with the MBCA, avoid removal of vegetation during the active season for breeding birds (April 15 – August 15) unless construction disturbance is preceded by a nesting survey conducted by a qualified biologist. If any active nests are found during the nesting survey, a buffer will be installed around the nest to protect against disturbance. Vegetation within the protection buffer cannot be removed until the young have fledged the nest.
- Remove the barn and the cultural thicket on the site outside of the bat maternity roosting period (May 1 to July 31) to minimize adverse impacts on non-SAR roosting bats that may be roosting in the structure/feature.
- Ensure all equipment is cleaned prior to transportation and use on the site to avoid the spread or introduction of invasive species seed on the site.
- Implement standard best management practices, including, but not limited to sediment and erosion controls, and spill prevention.

8.2.2 Barn Swallow

As discussed in Section 7.1, a NOA for barn swallow was successfully submitted (confirmation ID M-102-2269622060), and a mitigation and restoration record were prepared in accordance with the requirements outlined in O. Reg. 242/08, s. 23.5. The mitigation and monitoring requirements as outlined in the record will be followed.

9.0 SUMMARY AND RECOMMENDATIONS

The proposed Thomas Street Quarry Expansion has been assessed for potential ecological impacts under the ARA Provincial Standards (Section 2.1), the Provincial Policy Statement (Section 2.2), policies of the County of Perth (Section 2.6) and the Township of Perth South (Section 2.7), as well as other relevant legislation, including the *Fisheries Act* (Section 2.3), the MBCA (Section 2.4) and the ESA (Section 2.5).

Based on these analyses, it is expected that there will be no negative impacts to the significant natural features and functions on the site in the study area. In addition, an ecologically based rehabilitation plan and preventive mitigation measures that will enhance the natural heritage system have been developed. The following notes are recommended for inclusion on the Site Plan:

- To be in compliance with the MBCA, avoid removal of vegetation during the active season for breeding birds (April 15 – August 15) unless construction disturbance is preceded by a nesting survey conducted by a qualified biologist. If any active nests are found during the nesting survey, a buffer will be installed around the nest to protect against disturbance. Vegetation within the protection buffer cannot be removed until the young have fledged the nest.

- Remove the barn and the cultural thicket on the site outside of the bat maternity roosting period (May 1 to July 31) to minimize adverse impacts on non-SAR roosting bats that may be roosting in the structure/feature.
- All mitigation and monitoring requirements under O. Reg. 242/08, s. 23.5 for removal of barn swallow habitat will be followed.
- The site will be rehabilitated in accordance with the requirements of the rehabilitation plan developed with ecological concepts from this report.

10.0 CLOSURE

We trust this report meets your current needs. If you have any further questions regarding this report, please contact the undersigned.

Signature Page

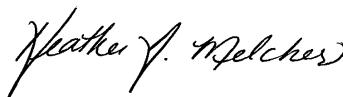
Golder Associates Ltd.



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Ecologist



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Principal, Senior Ecologist

DR/AVS/HM/mp

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FIGURES



LEGEND

WATERCOURSE

SURVEY STATIONS

AMPHIBIAN CALL-COUNT SURVEY STATION

BAT ACOUSTIC SURVEY STATION

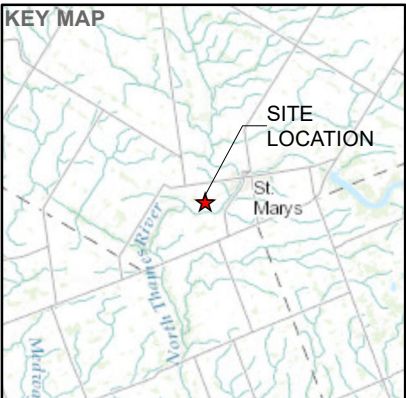
BREEDING BIRD SURVEY STATION

ECOLOGICAL LAND CLASSIFICATION (ELC)

PROPOSED LIMIT OF EXTRACTION

PROPOSED LICENCE BOUNDARY (SITE BOUNDARY)

FOD6-2	Fresh-Moist Sugar Maple-Black Maple Deciduous Forest
FOD6	Fresh-Moist Sugar Maple Deciduous Forest
FOD	Deciduous Forest
MAM2	Mineral Meadow Marsh
CUT1-7	European Buckthorn Cultural Thicket
CUW1	Mineral Cultural Woodland
CUM	Cultural Meadow
CUP	Cultural Plantation
RES	Residential
DIST	Disturbed
IND	Industrial
OAGM	Open Agriculture



REFERENCE(S)
1. BASEDATA - MNRF LIO, OBTAINED 2017
2. IMAGERY - SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
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3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N

CLIENT
ST. MARYS CEMENT INC. (CANADA)

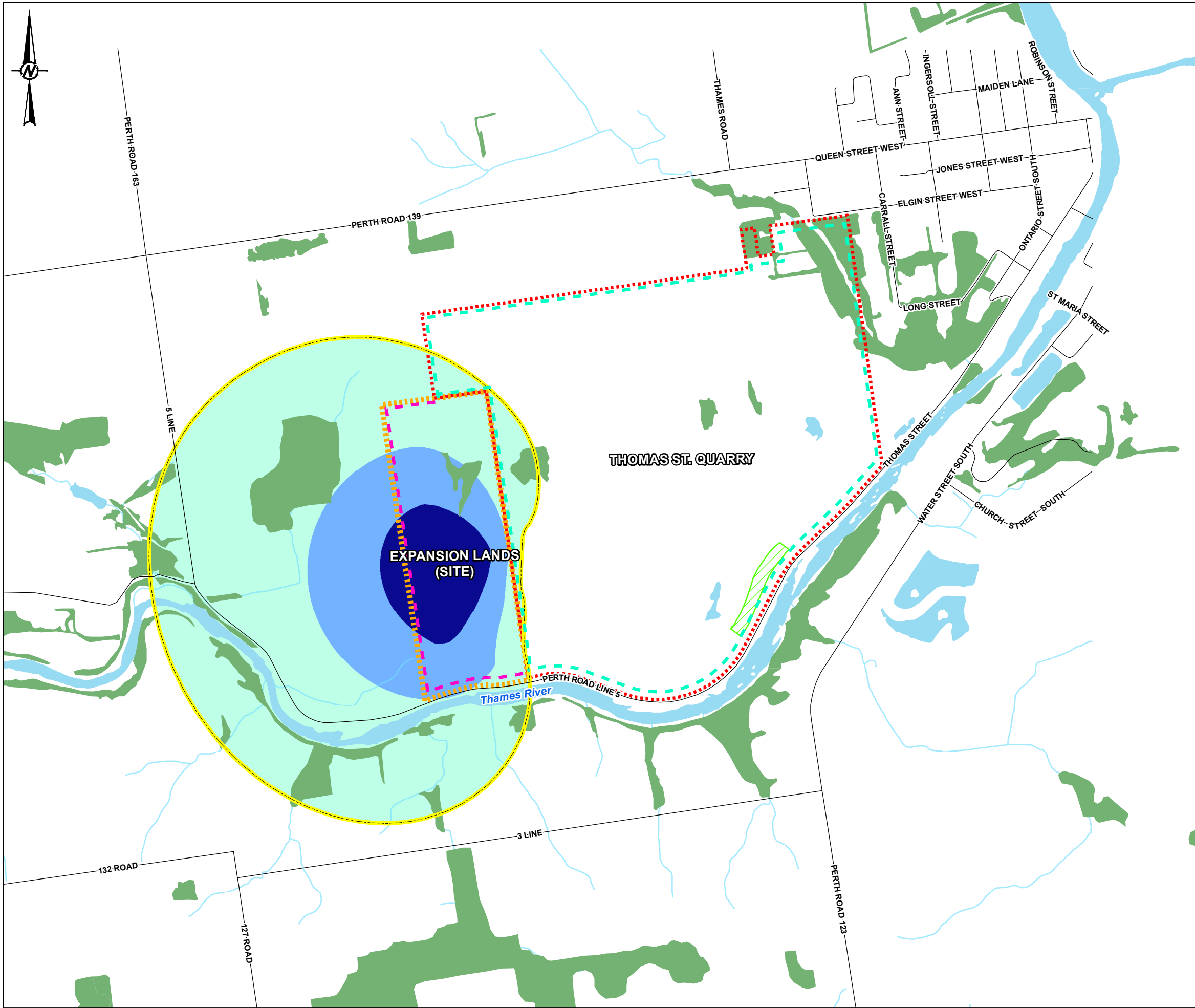
PROJECT
THOMAS STREET QUARRY EXPANSION

TITLE
ECOLOGICAL LAND CLASSIFICATION AND SURVEY STATIONS

CONSULTANT	YYYY-MM-DD	2020-04-28
	DESIGNED	RA
	PREPARED	ST/SO
	REVIEWED	DR
	APPROVED	HM

PROJECT NO. 1781508 (2000)	CONTROL 0006	REV. ####	FIGURE 1
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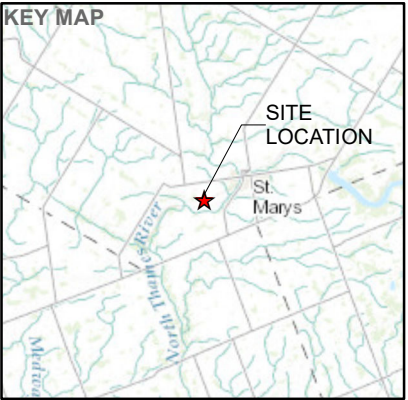


LEGEND

- WATERCOURSE
- WATERBODY
- ANSI, EARTH SCIENCE
- WOODLANDS
- EXISTING LIMIT OF EXTRACTION (THOMAS ST. QUARRY)
- EXISTING LICENCE BOUNDARY (THOMAS ST. QUARRY)
- PROPOSED LIMIT OF EXTRACTION
- PROPOSED LICENCE BOUNDARY (SITE BOUNDARY)
- STUDY AREA

GROUNDWATER DRAWDOWN (M)

- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10



REFERENCE(S)

1. BASEDATA - MNRF LIO, OBTAINED 2017

2. IMAGERY - SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), SWISSTOPO, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

3. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N
PROJECTION: TRANSVERSE MERCATOR
DATUM: NORTH AMERICAN 1983

CLIENT
ST. MARYS CEMENT INC. (CANADA)

PROJECT
THOMAS STREET QUARRY EXPANSION

TITLE
STUDY AREA WITH SIMULATED GROUNDWATER DRAWDOWN

	CONSULTANT	YYYY-MM-DD	2020-04-28
	DESIGNED	RA	
	PREPARED	ST/SO	
	REVIEWED	DR	
	APPROVED	HM	

PROJECT NO. 1781508 (2000)	CONTROL 0006	REV. ####	FIGURE 2
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 28mm

APPENDIX A

Vascular Plant List

Scientific Name	Common Name	Origin ^a	S Rank ^b	G Rank ^b	ESA ^c	Location ^d
Trees (12 taxa)						
<i>Acer negundo</i>	Manitoba Maple	N	S5	G5	—	A; B
<i>Acer nigrum</i>	Black Maple	N	S4	G5	—	A; B
<i>Acer saccharinum</i>	Silver Maple	N	S5	G5	—	A; B
<i>Acer saccharum</i>	Sugar Maple	N	S5	G5	—	A
<i>Juglans nigra</i>	Black Walnut	N	S4	G5	—	A
<i>Malus pumila</i>	Apple	I	SNA	G5	—	A; B
<i>Picea abies</i>	Norway Spruce	N	SNA	G5	—	A
<i>Picea glauca</i>	White Spruce	N	S5	G5	—	A
<i>Robinia pseudo-acacia</i>	Black Locust	N	SNA	G5	—	A
<i>Salix fragilis</i>	Crack Willow	I	SNA	GNR	—	A
<i>Thuja occidentalis</i>	Eastern White Cedar	N	S5	G5	—	A
<i>Tilia americana</i>	American Basswood	N	S5	G5	—	B
Small trees, shrubs and woody vines (8 taxa)						
<i>Cornus alternifolia</i>	Alternate-leaved Dogwood	N	S5	G5	—	A
<i>Cornus amomum</i>	Pale Dogwood	N	S5	G5	—	B
<i>Crataegus monogyna</i>	English Hawthorn	I	SNA	G5TNR	—	B
<i>Rhamnus cathartica</i>	Common Buckthorn	I	SNA	GNR	—	B
<i>Rosa acicularis</i>	Prickly Rose	N	S5	G5T5	—	B
<i>Rubus idaeus</i>	Common Red Raspberry	I	SNA	G5T5	—	A
<i>Syringa vulgaris</i>	Common Lilac	I	SNA	GNR	—	A
<i>Vitis riparia</i>	Riverbank Grape	N	S5	G5	—	A; B
Graminoids (11 taxa)						
<i>Bromus inermis</i>	Smooth Brome	I	SNA	GNR	—	A; B
<i>Carex hirta</i>	Hammer Sedge	I	SNA	GNR	—	B
<i>Carex rosea</i>	Rosy Sedge	N	S5	G5	—	B
<i>Carex</i> sp.	Sedge sp.	—	—	—	—	B
<i>Carex stipata</i>	Awl-fruited Sedge	N	S5	G5	—	A; B
<i>Dactylis glomerata</i>	Orchard Grass	I	SNA	GNR	—	A; B
<i>Elymus repens</i>	Quack Grass	I	SNA	GNR	—	A; B
<i>Phalaris arundinacea</i>	Reed Canary Grass	N	S5	G5TNR	—	B
<i>Phleum pratense</i>	Common Timothy	I	SNA	GNR	—	A
<i>Poa pratensis</i>	Kentucky Blue Grass	N	S4	G5	—	A; B
<i>Zea mays</i>	Corn	I	GNR	SNA	—	A
Forbs (54 taxa)						
<i>Achillea millefolium</i>	Yarrow	N	SNA	G5	—	B
<i>Actium lappa</i>	Great Burdock	I	SNA	GNR	—	A; B
<i>Alliaria petiolata</i>	Garlic Mustard	I	SNA	GNR	—	A; B
<i>Ambrosia artemisiifolia</i>	Common Ragweed	N	S5	G5	—	A
<i>Ambrosia trifida</i>	Great Ragweed	N	S5	G5	—	A
<i>Arctium minus</i>	Common Burdock	I	SNA	GNR	—	A; B
<i>Asclepias incarnata</i>	Swamp Milkweed	N	S5	G5	—	A
<i>Asclepias syriaca</i>	Common Milkweed	N	S5	G5	—	A; B
<i>Capsella bursa-pastoris</i>	Shepherd's Purse	I	SNA	GNR	—	A
<i>Chenopodium album</i>	Lamb's Quarters	I	SNA	GNR	—	A; B
<i>Cichorium intybus</i>	Chicory	I	SNA	GNR	—	A; B
<i>Cirsium arvense</i>	Canada Thistle	I	SNA	GNR	—	A; B
<i>Cirsium vulgare</i>	Bull Thistle	I	SNA	GNR	—	A

Scientific Name	Common Name	Origin ^a	S Rank ^b	G Rank ^b	ESA ^c	Location ^d
<i>Convolvulus arvensis</i>	Field Bindweed	I	SNA	GNR	—	A
<i>Daucus carota</i>	Wild Carrot	I	SNA	GNR	—	A; B
<i>Dipsacus fullonum</i>	Common Teasel	I	SNA	GNR	—	A; B
<i>Echinocystis lobata</i>	Wild Cucumber	N	S5	G5	—	A
<i>Erigeron annuus</i>	Daisy Fleabane	N	S5	G5	—	A
<i>Fragaria virginiana</i>	Wild Strawberry	N	S5	G5	—	B
<i>Galium aparine</i>	Cleavers	N	S5	G5	—	A
<i>Galium sp</i>	Bedstraw sp.	—	—	—	—	B
<i>Geum aleppicum</i>	Yellow Avens	N	S5	G5	—	A; B
<i>Geum canadense</i>	White Avens	N	S5	G5	—	A; B
<i>Impatiens capensis</i>	Spotted Jewelweed	N	S5	G5	—	B
<i>Leonurus cardiaca</i>	Common Motherwort	I	SNA	GNR	—	A
<i>Leucanthemum vulgare</i>	Oxeye Daisy	I	SNA	G5	—	B
<i>Lotus corniculatus</i>	Bird's-foot Trefoil	I	SNA	GNR	—	A
<i>Malva moschata</i>	Musk Mallow	I	SNA	GNR	—	A
<i>Malva neglecta</i>	Dwarf Cheeseweed	I	SNA	GNR	—	A
<i>Matricaria discoidea</i>	Pineapple Weed	I	SNA	G5	—	A
<i>Medicago sativa</i>	Alfalfa	I	SNA	GNR	—	A
<i>Melilotus alba</i>	White Sweet-clover	I	SNA	G5	—	A
<i>Nepeta cataria</i>	Catnip	I	SNA	GNR	—	A
<i>Oxalis sp</i>	Wood-sorrel sp.	—	—	—	—	B
<i>Plantago lanceolata</i>	Lance Leaved Plantain	I	S5	G5	—	A
<i>Plantago major</i>	Common Plantain	I	SNA	GNR	—	A
<i>Podophyllum peltatum</i>	May-apple	N	S5	G5	—	B
<i>Potentilla sp</i>	Cinquefoil sp.	—	—	—	—	A
<i>Prunella vulgaris</i>	Selfheal	N	S5	G5	—	A
<i>Ranunculus acris</i>	Tall Buttercup	I	SNA	G5	—	B
<i>Rumex crispus</i>	Curly Dock	I	SNA	GNR	—	A
<i>Solanum dulcamara</i>	Bittersweet Nightshade	I	SNA	GNR	—	B
<i>Solidago sp</i>	Goldenrod sp.	—	—	—	—	B
<i>Taraxacum officinale</i>	Common Dandelion	I	SNA	G5	—	A; B
<i>Tragopogon pratensis</i>	Meadow Goat's Beard	N	SNA	GNR	—	A
<i>Tragopogon sp.</i>	Goat's-beard sp.	—	—	—	—	B
<i>Trifolium pratense</i>	Red Clover	I	SNA	GNR	—	A
<i>Trifolium repens</i>	White Clover	N	SNA	GNR	—	A
<i>Tussilago farfara</i>	Colt's-foot	I	SNA	GNR	—	A; B
<i>Urtica dioica</i>	Stinging Nettle	N	S5	G5	—	A
<i>Verbena hastata</i>	Blue Vervain	N	S5	G5	—	B
<i>Vicia cracca</i>	Bird Vetch	I	SNA	GNR	—	A; B
<i>Vincetoxicum rossicum</i>	Dog Strangling Vine	I	SNA	GNR	—	A; B
<i>Viola sp</i>	Violet sp.	—	—	—	—	B

^a Origin: N = Native; (N) = Native but not in study area region; I = Introduced.

^b Ranks based upon determinations made by the Natural Heritage Information Centre (2017).

G = Global; S = Provincial; Ranks 1-3 are considered imperiled or rare; Ranks 4 and 5 are considered secure.

NA = Not applicable [used mainly for abundance of non-natives; NR = Not ranked [used mainly for non-natives];

Q = Taxonomic questions not fully resolved; T = sub-specific taxon (taxa) present in the province; U = Uncertain.

^c *Endangered Species Act* (ESA), 2007 (O.Reg 242/08 last amended 27 March 2018 as O.Reg 219/18). Species at Risk in Ontario List, 2007 (O.Reg 230/08 last amended 1 Aug 2018 as O. Reg 404/18, s. 1.)

END= Endangered; SC = Special Concern; THR = Threatened.

^d Locations:

A = Farm buildings and surrounding area (RES)

B = Cultural thicket (CUT)

APPENDIX B

Species at Risk Screening

Common Name	Scientific Name	Endangered Species Act ¹	Species at Risk Act (Sch 1) ²	COSEWIC ³	Provincial (SRank) ⁴	Habitat Requirements ⁵	Potential to Occur on the site and/or in the study area	Rationale for Potential to Occur on the site and/or in the study area
Yellow-banded bumble bee	<i>Bombus terricola</i>	SC	SC	SC	S2	This species is a forage and habitat generalist. Mixed woodlands are commonly used for nesting and overwintering, but it also occupies various open habitats including native grasslands, farmlands and urban areas. It is an early emerging species, making it likely an important pollinator of early blooming wild flowering plants (e.g. wild blueberry) and agricultural crops (e.g., apple). Nest sites are mostly abandoned rodent burrows (COSEWIC 2015).	Moderate	The thicket in the center of the site may provide suitable foraging habitat, where suitable nectaring plants were observed. Off-site, woodlands throughout the study area may provide suitable nesting and overwintering habitat.
Monarch	<i>Danaus plexippus</i>	SC	SC	END	S2N, S4B	In Ontario, monarch is found throughout the northern and southern regions of the province. This butterfly is found wherever there are milkweed (<i>Asclepius</i> spp.) plants for its caterpillars and wildflowers that supply a nectar source for adults. It is often found on abandoned farmland, meadows, open wetlands, prairies and roadsides, but also in city gardens and parks. Important staging areas during migration occur along the north shores of the Great Lakes (COSEWIC 2010).	Moderate	The thicket in the center of the site and open meadows surrounding the farm buildings in the south portion of the site may provide suitable foraging and reproduction habitat, where suitable nectaring plants and milkweed were observed. Off-site, meadows and roadsides throughout the study area may provide suitable habitat.
Bald eagle	<i>Haliaeetus leucocephalus</i>	SC	—	NAR	S2N,S4B	In Ontario, bald eagle nests are typically found near the shorelines of lakes or large rivers, often on forested islands. The large, conspicuous nests are typically found in large super-canopy trees along water bodies (Buehler 2000).	Moderate	No suitable shoreline habitat was observed on the site, and this species was not observed during field surveys. Off-site, any large super-canopy trees along the Thames River in the study area may provide suitable nesting habitat. In addition, there are occurrence records throughout the study area (eBird 2019).
Bank swallow	<i>Riparia riparia</i>	THR	THR	THR	S4B	In Ontario, bank swallow breeds in a variety of natural and anthropogenic habitats, including lake bluffs, stream and river banks, sand and gravel pits, and roadcuts. Nests are generally built in a vertical or near-vertical bank. Breeding sites are typically located near open foraging sites such as rivers, lakes, grasslands, agricultural fields, wetlands and riparian woods. Forested areas are generally avoided (Garrison 1999).	High	There are no suitable steep valley slopes or banks on site to provide nesting habitat. Off-site, aggregate stockpiles in the central and eastern portions of the study area may provide nesting habitat. Individuals were observed flying over the site during field surveys. In addition, there are occurrence records throughout the study area (eBird 2019).
Barn swallow	<i>Hirundo rustica</i>	THR	THR	THR	S4B	In Ontario, barn swallow breeds in areas that contain a suitable nesting structure, open areas for foraging, and a body of water. This species nests in human made structures including barns, buildings, sheds, bridges, and culverts. Preferred foraging habitat includes grassy fields, pastures, agricultural cropland, lake and river shorelines, cleared right-of-ways, and wetlands (COSEWIC 2011a). Mud nests are fastened to vertical walls or built on a ledge underneath an overhang. Suitable nests from previous years are reused (Brown and Brown 1999).	High	Barn swallow were observed flying around the buildings in the south portion of the site, where they are likely nesting. In addition, there are occurrence records throughout the study area (eBird 2019).

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Black tern	<i>Chlidonias niger</i>	SC	—	NAR	S3B	In Ontario, black tern breeds in freshwater marshlands where it forms small colonies. It prefers marshes or marsh complexes greater than 20 ha in area and which are not surrounded by wooded area. Black terns are sensitive to the presence of agricultural activities. The black tern nests in wetlands with an even combination of open water and emergent vegetation, and still waters of 0.5-1.2 m deep. Preferred nest sites have short dense vegetation or tall sparse vegetation often consisting of cattails, bulrushes and occasionally burreed or other marshland plants. Black terns also require posts or snags for perching (Weseloh 2007).	Low	There is no suitable large marsh habitat on the site or in the study area. In addition, there are no occurrence records in the vicinity of the study area.
Bobolink	<i>Dolichonyx oryzivorus</i>	THR	THR	THR	S4B	In Ontario, bobolink breeds in grasslands or graminoid dominated hayfields with tall vegetation (Gabhauer 2007). Bobolink prefers grassland habitat with a forb component and a moderate litter layer. They have low tolerance for presence of woody vegetation and are sensitive to frequent mowing within the breeding season. They are most abundant in established, but regularly maintained, hayfields, but also breed in lightly grazed pastures, old or fallow fields, cultural meadows and newly planted hayfields. Their nest is woven from grasses and forbs. It is built on the ground, in dense vegetation, usually under the cover of one or more forbs (Renfrew et al. 2015).	Moderate	The site is planted in soy and is unsuitable for grassland birds. In addition, this species was not observed during field surveys. Off-site, agricultural fields and grasslands throughout the study area may provide suitable nesting habitat. In addition, there are occurrence records throughout the study area (eBird 2019).
Chimney swift	<i>Chaetura pelagica</i>	THR	THR	THR	S4B, S4N	In Ontario, chimney swift breeding habitat is varied and includes urban, suburban, rural and wooded sites. They are most commonly associated with towns and cities with large concentrations of chimneys. Preferred nesting sites are dark, sheltered spots with a vertical surface to which the bird can grip. Unused chimneys are the primary nesting and roosting structure, but other anthropogenic structures and large diameter cavity trees are also used (COSEWIC 2007a).	Moderate	No natural or human-made roosts were identified on the site. There is potential that chimneys or large diameter cavity trees may occur within the study area that could provide suitable nesting or roosting habitat.
Common nighthawk	<i>Chordeiles minor</i>	SC	THR	SC	S4B	In Ontario, these aerial foragers require areas with large open habitat. This includes farmland, open woodlands, clearcuts, burns, rock outcrops, alvars, bogs, fens, prairies, gravel pits and gravel rooftops in cities (Sandilands 2007).	Moderate	The site and study area is primarily active agriculture, and is unlikely to provide suitable nesting habitat. In addition, this species was not observed during field surveys. Off-site, open meadows throughout the study area.
Eastern meadowlark	<i>Sturnella magna</i>	THR	THR	THR	S4B	In Ontario, eastern meadowlark breeds in pastures, hayfields, meadows and old fields. Eastern meadowlark prefers moderately tall grasslands with abundant litter cover, high grass proportion, and a forb component (Hull 2003). They prefer well drained sites or slopes, and sites with different cover layers (Roseberry and Klimstra 1970).	Moderate	The site is planted in soy and is unsuitable for grassland birds. In addition, this species was not observed during field surveys. Off-site, agricultural fields and grasslands throughout the study area may provide suitable nesting habitat. In addition, there are occurrence records throughout the study area (eBird 2019).

Common Name	Scientific Name	Endangered Species Act ¹	Species at Risk Act (Sch 1) ²	COSEWIC ³	Provincial (SRank) ⁴	Habitat Requirements ⁵	Potential to Occur on the site and/or in the study area	Rationale for Potential to Occur on the site and/or in the study area
Eastern wood-pewee	<i>Contopus virens</i>	SC	SC	SC	S4B	In Ontario, eastern wood-pewee inhabits a wide variety of wooded upland and lowland habitats, including deciduous, coniferous, or mixed forests. It occurs most frequently in forests with some degree of openness. Intermediate-aged forests with a relatively sparse midstory are preferred. In younger forests with a relatively dense midstory, it tends to inhabit the edges. Also occurs in anthropogenic habitats providing an open forested aspect such as parks and suburban neighborhoods. Nest is constructed atop a horizontal branch, 1-2 m above the ground, in a wide variety of deciduous and coniferous trees (COSEWIC 2012a).	Moderate	This species was not observed during field surveys, and is unlikely to occur on the site. Off-site, woodlands throughout the study area may provide suitable nesting habitat. In addition, there are occurrence records throughout the study area (eBird 2019).
Grasshopper sparrow <i>pratensis</i> subspecies	<i>Ammodramus savannarum (pratensis subspecies)</i>	SC	SC	SC	S4B	In Ontario, grasshopper sparrow is found in medium to large grasslands with low herbaceous cover and few shrubs. It also uses a wide variety of agricultural fields, including cereal crops and pastures. Close-grazed pastures and limestone plains (e.g. Carden and Napanee Plains) support highest density of this bird in the province (COSEWIC 2013).	Moderate	The site is planted in soy and is unsuitable for grassland birds. In addition, this species was not observed during field surveys. Off-site, agricultural fields and grasslands throughout the study area may provide suitable nesting habitat.
Wood thrush	<i>Hylocichla mustelina</i>	SC	THR	THR	S4B	In Ontario, wood thrush breeds in moist, deciduous hardwood or mixed stands that are often previously disturbed, with a dense deciduous undergrowth and with tall trees for singing perches. This species selects nesting sites with the following characteristics: lower elevations with trees less than 16 m in height, a closed canopy cover (>70 %), a high variety of deciduous tree species, moderate subcanopy and shrub density, shade, fairly open forest floor, moist soil, and decaying leaf litter (COSEWIC 2012b).	Moderate	There is no suitable forest habitat on the site to provide suitable habitat for nesting. In addition, this species was not observed during field surveys. Off-site, woodlands throughout the study area may provide suitable nesting habitat.
Yellow-breasted chat	<i>Icteria virens virens</i>	END	END	END	S2B	In Ontario, yellow-breasted chat breeds in early successional, shrub-thicket habitats including woodland edges, regenerating old fields, railway and hydro right-of-ways, young coniferous reforestations, and wet thickets bordering wetlands. Tangles of grape (<i>Vitis</i> spp.) and raspberry (<i>Rubus</i> spp.) vines are features of most breeding sites. There is some evidence that the yellow-breasted chat is an area sensitive species. Nests are located in dense shrubbery near to the ground (COSEWIC 2011b).	Low	The cultural thicket on the site is likely too small to provide suitable habitat for nesting. In addition, this species was not observed during field surveys and there are no occurrence records in the vicinity of the study area.

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Black Redhorse	<i>Moxostoma duquesnei</i>	THR	THR	THR	S2	In Ontario, black redhorse is limited to only six watersheds. In the Lake Huron drainage, it is found in the Bayfield River, Maitland River and Ausable River watersheds. In the Lake Erie drainage, it is known from the Catfish Creek and Grand River watersheds. It is also present in the Thames River watershed in the Lake St. Clair drainage. The Catfish Creek population is considered extirpated. The black redhorse is a species of freshwater fish endemic to Ontario. Habitats are typically found in moderately sized to large rivers and streams with moderate flows. It is rarely found associated with aquatic vegetation. Preferred substrates include rubble, gravel, sand, boulders and silt. In summer, this fish species generally prefers pools, and they overwinter in deeper pools. Spring spawning has been observed in riffle habitats, over substrates ranging from fine gravel to large cobble, and at water temperatures between 15°C and 21°C (COSEWIC 2015).	Moderate	There is no suitable aquatic habitat on the site. Black redhorse is known to occur in the Thames River (UTRCA 2012) and may occur in the portion of the Thames River to the south of the site.
Greater Redhorse	<i>Moxostoma valenciennesi</i>	—	—	—	S3	In Ontario, greater redhorse is found in moderate to swift currents with riffles, runs and pools in medium to large rivers with clear water. Substrates of gravel, cobble or boulders is preferred. May also be found in lakes (NatureServe Explorer 2018). This species has some sensitivity to siltation and pollution.	Low	There is no suitable aquatic habitat on the site, and the Thames River south of the site is not likely to provide preferred habitat. Greater redhorse is not known to occur in the Thames River.
Northern Brook Lamprey – Great Lakes/ Upper St. Lawrence population	<i>Ichthyomyzon fossor</i>	SC	SC	SC	S3	In Ontario, northern brook lamprey occurs in rivers draining into Lakes Superior, Huron and Erie, as well as in the Ottawa and St. Lawrence Rivers. It is found in clear streams of varying sizes. Adults prefer riffle and run areas of coldwater streams and rivers with gravel and sand substrates. Spawning habitat usually includes a swift current and coarse gravel or rocky substrate, with which males construct inconspicuous nests (COSEWIC 2007b).	Low	There is no suitable aquatic habitat on the site, and the Thames River south of the site is not likely to provide preferred coldwater habitat.
Redside Dace	<i>Clinostomus elongatus</i>	END	END	END	S2	In Ontario, reddsides are a small coolwater species common in the USA but less so in Canada, is found in tributaries of western Lake Ontario, Lake Erie, Lake Huron and Lake Simcoe. They are found in pools and slow-moving areas of small headwater streams with clear to turbid water. Overhanging grasses, shrubs, and undercut banks, are an important part of their habitat, as are instream boulders and large woody debris. Preferred substrates are variable and include silt, sand, gravel and boulders. Spawning occurs in shallow riffle areas (Redside Dace Recovery Team 2010).	Low	There is no suitable aquatic habitat on the site, and the Thames River south of the site is not likely to provide preferred coldwater habitat. Redside dace is not known to occur in the Thames River.

Common Name	Scientific Name	Endangered Species Act ¹	Species at Risk Act (Sch 1) ²	COSEWIC ³	Provincial (SRank) ⁴	Habitat Requirements ⁵	Potential to Occur on the site and/or in the study area	Rationale for Potential to Occur on the site and/or in the study area
Silver Shiner	<i>Notropis photogenis</i>	THR	THR	THR	S2S3	In Ontario, silver shiner is found in the Thames and Grand Rivers, and it has been recently reported in Bronte Creek and Sixteen Mile Creek which flow into Lake Ontario. They prefer moderately-flowing sections of larger streams with clear water and moderate currents. Usual substrates include gravel, rubble, boulder, and sand. Aquatic vegetation may be present or absent. The silver shiner most frequently occurs in deep, swift riffles and faster currents of pools below riffles. Spawning habitat is suggested to occur in relatively deep riffles (COSEWIC 2011c).	Moderate	There is no suitable aquatic habitat on the site. Silver shiner is known to occur in the Thames River (UTRCA 2012) and may occur in the portion of the Thames River to the south of the site.
Wavy-Rayed Lampmussel	<i>Lampsilis fasciola</i>	THR	END	SC	S1	In Ontario, wavy-rayed lampmussel inhabits clear, medium-sized rivers and streams, with steady flow and stable substrate. It is typically found in clean sand or gravel substrates, often stabilized with cobble or boulders, in and around riffle areas up to 1 m in depth. It may also be found in large creeks and rivers (Morris 2011).	Moderate	There is no suitable aquatic habitat on the site. Wavy-rayed lampmussel is known to occur in the Thames River (UTRCA 2012) and may occur in the river and its tributaries throughout the study area.
Eastern small-footed myotis	<i>Myotis leibii</i>	END	—	—	S2S3	This species is not known to roost within trees, but there is very little known about its roosting habits. The species generally roosts on the ground under rocks, in rock crevices, talus slopes and rock piles. It occasionally inhabits buildings. Areas near the entrances of caves or abandoned mines may be used for hibernaculum, where the conditions are drafty with low humidity, and may be subfreezing (Humphrey 2017).	Moderate	Although there are rock piles on the site that may provide suitable maternity roost habitat, this species was not observed during bat acoustic surveys. Off-site, rock features in the study area may provide suitable roosting habitat. No potential hibernacula were identified in the study area.
Little brown myotis	<i>Myotis lucifugus</i>	END	END	END	S3	In Ontario, this specie's range is extensive and covers much of the province. It will roost in both natural and man-made structures. Roosting colonies require a number of large dead trees, in specific stages of decay and that project above the canopy in relatively open areas. May form nursery colonies in the attics of buildings within 1 km of water. Caves or abandoned mines may be used as hibernacula, but high humidity and stable above freezing temperatures are required (ECCC 2018).	Moderate	Although cavity trees were observed in the thicket on the site, and this species was detected during bat acoustic surveys, the data suggests that the bats were more likely to be using the site for feeding or commuting rather than roosting. Off-site, woodlands and buildings throughout the study area may provide suitable roosting habitat. No potential hibernacula were identified in the study area.
Northern myotis	<i>Myotis septentrionalis</i>	END	END	END	S3	In Ontario, this species' range is extensive and covers much of the province. It will usually roost in hollows, crevices, and under loose bark of mature trees. Roosts may be established in the main trunk or a large branch of either living or dead trees. Caves or abandoned mines may be used as hibernacula, but high humidity and stable above freezing temperatures are required (ECCC 2018).	Moderate	Although cavity trees were observed in the thicket on the site, this species was not detected during bat acoustic surveys. Off-site, woodlands throughout the study area may provide suitable roosting habitat. No potential hibernacula were identified in the study area.

Common Name	Scientific Name	Endangered Species Act ¹	Species at Risk Act (Sch 1) ²	COSEWIC ³	Provincial (SRank) ⁴	Habitat Requirements ⁵	Potential to Occur on the site and/or in the study area	Rationale for Potential to Occur on the site and/or in the study area
Tri-colored bat	<i>Perimyotis subflavus</i>	END	END	END	S3?	In Ontario, tri-colored bat may roost in foliage, in clumps of old leaves, hanging moss or squirrel nests. They are occasionally found in buildings although there are no records of this in Canada. They typically feed over aquatic areas with an affinity to large-bodied water and will likely roost in close proximity to these. Hibernation sites are found deep within caves or mines in areas of relatively warm temperatures. These bats have strong roost fidelity to their winter hibernation sites and may choose the exact same spot in a cave or mine from year to year (ECCC 2018).	Moderate	The thicket on the site does not contain suitable leaf clumps or squirrel nests to support maternity roost habitat. In addition, this species was not observed during bat acoustic surveys. Off-site, woodlands throughout the study area may provide suitable roosting habitat. No potential hibernacula were identified in the study area.
Northern map turtle	<i>Graptemys geographica</i>	SC	SC	SC	S3	In Ontario, the northern map turtle prefers large waterbodies with slow-moving currents, soft substrates, and abundant aquatic vegetation. Ideal stretches of shoreline contain suitable basking sites, such as rocks and logs. Along Lakes Erie and Ontario, this species occurs in marsh habitat and undeveloped shorelines. It is also found in small to large rivers with slow to moderate flow. Hibernation takes place in soft substrates under deep water (COSEWIC 2012c).	Moderate	There is no suitable aquatic habitat on the site. Northern map turtle is frequent in the Plover Mills subwatershed (UTRCA 2012) and may occur in the Thames River south of the site. There is no nesting habitat on the site.
Snapping turtle	<i>Chelydra serpentina</i>	SC	SC	SC	S3	In Ontario, snapping turtle uses a wide range of waterbodies, but shows preference for areas with shallow, slow-moving water, soft substrates and dense aquatic vegetation. Hibernation takes place in soft substrates under water. Nesting sites consist of sand or gravel banks along waterways or roadways (COSEWIC 2008).	Moderate	There is no suitable aquatic habitat on the site. Snapping turtle is known to occur in the Plover Mills subwatershed (UTRCA 2012) and may occur in the Thames River and its tributaries throughout the study area. There is no nesting habitat on the site.
Spiny softshell	<i>Apalone spinifera</i>	END	END	THR	S2	In Ontario, spiny softshell will typically inhabit rivers with soft bottoms but occasionally lakes, impoundments, bays, marshy lagoons, as well as ditches and ponds near rivers. Soft sandy or muddy substrates with aquatic vegetation are essential habitat features. Hibernation takes place in deep pools with soft substrates. Nesting areas consist of sandy or gravelly areas, relatively free of vegetation and close to water (COSEWIC 2016).	Moderate	There is no suitable aquatic habitat on the site. Spiny softshell is frequent in the Plover Mills subwatershed (UTRCA 2012) and may occur in the Thames River and its tributaries throughout the study area. There is no nesting habitat on the site.
Blue ash	<i>Fraxinus quadrangulata</i>	THR	SC	THR	S2?	In Ontario, blue ash occurs in the Carolinian forest. Blue ash occurs in three types of habitat: rich floodplain forests, shallow soil over dry limestone and well-drained sand (Environment Canada 2015). Only the last two types of habitat are used on the islands and spits of southern Lake Erie.	Low	There is no suitable forest on the site or in the study area to support suitable growing conditions for blue ash. In addition, this species was not observed during field surveys is not known to occur in the study area (Bickerton 2017).
Butternut	<i>Juglans cinerea</i>	END	END	END	S2?	In Ontario, butternut is found along stream banks, on wooded valley slopes, and in deciduous and mixed forests. It is commonly associated with beech, maple, oak and hickory (Voss and Reznicek 2012). Butternut prefers moist, fertile, well-drained soils, but can also be found in rocky limestone soils. This species is shade intolerant (Farrar 1995).	Moderate	Although the thicket on the site may provide suitable habitat, this species was not observed during field surveys. Off-site, this species may occur along stream banks and woodlands throughout the study area.

Common Name	Scientific Name	Endangered Species Act ¹	Species at Risk Act (Sch 1) ²	COSEWIC ³	Provincial (SRank) ⁴	Habitat Requirements ⁵	Potential to Occur on the site and/or in the study area	Rationale for Potential to Occur on the site and/or in the study area
Willowleaf aster	<i>Symphyotrichum praealtum</i>	THR	THR	THR	S2	In Ontario, willowleaf aster occurs only in the southwest portion of the province, where it grows in tallgrass prairies, oak savannahs, meadows, and thickets. Occasionally it also occurs in woodland openings, abandoned fields, along railways and roadsides, and on the banks of streams, drains, and ditches. This species prefers moist soil and requires some form of disturbance to sustain populations (Jones 2013).	Low	Although the thicket on site may provide suitable habitat, this species was not observed during field surveys. In addition, this species is not known to occur in the study area (Jones 2013).
Wood-poppy	<i>Stylophorum diphyllum</i>	END	END	END	S1	In Ontario, wood poppy occurs in rich-moist deciduous woods, forested ravines and slopes, and along wooded streams. Associated dominant tree species include sugar maple, white ash, American beech, black cherry, and hackberry (Bowles 2007).	Low	There is no suitable forest on the site to support suitable growing conditions for wood poppy. In addition, this species was not observed during field surveys, and is not known to occur in the study area (Bowles 2007).

¹ *Endangered Species Act* (ESA), 2007 (O.Reg 242/08 last amended 27 March 2018 as O.Reg 219/18). Species at Risk in Ontario List, 2007 (O.Reg 230/08 last amended 1 Aug 2018 as O. Reg 404/18, s. 1.); Schedule 1 (Extirpated - EXP), Schedule 2 (Endangered - END), Schedule 3 (Threatened - THR), Schedule 4 (Special Concern - SC)

² *Species at Risk Act* (SARA), 2002. Schedule 1 (Last amended 18 December 2019); Part 1 (Extirpated), Part 2 (Endangered), Part 3 (Threatened), Part 4 (Special Concern)

³ Committee on the Status of Endangered Wildlife in Canada (COSEWIC) <http://www.cosewic.gc.ca/>

⁴ Provincial Ranks (SRANK) are Rarity Ranks assigned to a species or ecological communities, by the Natural Heritage Information Centre (NHIC). These ranks are not legal designations. SRANKS are evaluated by NHIC on a continual basis and updated lists produced annually. SX (Presumed Extirpated), SH (Possibly Extirpated - Historical), S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), S4 (Apparently Secure), S5 (Secure), SNA (Not Applicable), S#S# (Range Rank), S? (Not ranked yet), SAB (Breeding Accident), SAN (Non-breeding Accident), SX (Apparently Extirpated). Last assessed November 2019.

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APPENDIX C

Wildlife List

Common Name	Scientific Name	SRANK ^a	GRANK ^a	ESA ^b
Birds				
American Crow	<i>Corvus brachyrhynchos</i>	S5B	G5	—
American Goldfinch	<i>Carduelis tristis</i>	S5B	G5	—
American Robin	<i>Turdus migratorius</i>	S5B	G5	—
Baltimore Oriole	<i>Icterus galbula</i>	S4B	G5	—
Bank Swallow	<i>Riparia riparia</i>	S4B	G5	Threatened
Barn Swallow	<i>Hirundo rustica</i>	S4B	G5	Threatened
Blue Jay	<i>Cyanocitta cristata</i>	S5	G5	—
Brown Thrasher	<i>Toxostoma rufum</i>	S4B	G5	—
Brown-headed Cowbird	<i>Molothrus ater</i>	S4B	G5	—
Cedar Waxwing	<i>Bombycilla cedrorum</i>	S5B	G5	—
Chipping Sparrow	<i>Spizella passerina</i>	S5B	G5	—
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	S4B	G5	—
Common Grackle	<i>Quiscalus quiscula</i>	S5B	G5	—
Common Yellowthroat	<i>Geothlypis trichas</i>	S5B	G5	—
Eastern Phoebe	<i>Sayornis phoebe</i>	S5B	G5	—
European Starling	<i>Sturnus vulgaris</i>	SNA	G5	—
Field Sparrow	<i>Spizella pusilla</i>	S4B	G5	—
Gray Catbird	<i>Dumetella carolinensis</i>	S4B	G5	—
Great Blue Heron	<i>Ardea herodias</i>	S4	G5	—
Horned Lark	<i>Eremophila alpestris</i>	S5B	G5	—
House Sparrow	<i>Passer domesticus</i>	SNA	G5	—
House Wren	<i>Troglodytes aedon</i>	S5B	G5	—
Indigo Bunting	<i>Passerina cyanea</i>	S4B	G5	—
Killdeer	<i>Charadrius vociferus</i>	S5B, S5N	G5	—
Mourning Dove	<i>Zenaida macroura</i>	S5	G5	—
Northern Cardinal	<i>Cardinalis cardinalis</i>	S5	G5	—
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	S4B	G5	—
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	S4	G5	—
Song Sparrow	<i>Melospiza melodia</i>	S5B	G5	—
Turkey Vulture	<i>Cathartes aura</i>	S5B	G5	—
Warbling Vireo	<i>Vireo gilvus</i>	S5B	G5	—
Mammals				
Big Brown Bat	<i>Eptesicus fuscus</i>	S4	G5	—
Coyote	<i>Canis latrans</i>	S5	G5	—
Eastern Red Bat	<i>Lasiurus borealis</i>	S4	G3G4	—
Hoary Bat	<i>Lasiurus cinereus</i>	S4	G3G4	—
Little Brown Myotis	<i>Myotis lucifugus</i>	S3	G3	Endangered
Raccoon	<i>Procyon lotor</i>	S5	G5	—
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	S5	G5	—
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	S4	G3G4	—
White-tailed Deer	<i>Odocoileus virginianus</i>	S5	G5	—
Amphibians				
American Toad	<i>Anaxyrus [Bufo] americanus</i>	S5	G5	—
Spring Peeper	<i>Pseudacris crucifer</i>	S5	G5	—

Common Name	Scientific Name	SRANK ^a	GRANK ^a	ESA ^b
Invertebrates				
Ebony Jewelwing	<i>Calopteryx maculata</i>	—	—	—
Monarch	<i>Danaus plexippus</i>	S2N, S4B	G5	Special Concern
Twelve-spotted Skimmer	<i>Libellula pulchella</i>	—	—	—
Viceroy	<i>Limenitis archippus</i>	S5	G5	—

^a Ranks based upon determinations made by the Ontario Natural Heritage Information Centre

G = Global; S = Provincial; Ranks 1-3 are considered imperiled or rare; Ranks 4 and 5 are considered secure.

SNA = Not applicable for Ontario Ranking (e.g. Exotic species)

^b *Endangered Species Act* (ESA), 2007 (O.Reg 242/08 last amended 27 March 2018 as O.Reg 219/18). Species at Risk in Ontario List, 2007 (O.Reg 230/08 last amended 1 Aug 2018 as O. Reg 404/18, s. 1.); Schedule 1 (Extirpated - EXP), Schedule 2 (Endangered - END), Schedule 3 (Threatened - THR), Schedule 4 (Special Concern - SC)

Bolded species are designated under the ESA

APPENDIX D

Curricula Vitae

Education

*M.Sc. Applied Marine
Science, University of
Plymouth, Devon, UK, 1998*

*B.Sc. (Honours) Biology,
Laurentian University,
Sudbury, Ontario, 1996*

Certifications

*PADI Master Scuba Diver
Trainer,
2000*

*Small Craft Boat Operator,
2003*

*Small Non-pleasure Vessel
Basic Safety - MED A3,
2011*

*Canadian Red Cross First
Aid and CPR,
2012*

*WHMIS Training,
1990, 2001, 2004*

Languages

English – Fluent

Golder Associates Ltd. – Mississauga**Employment History*****Golder Associates Ltd. – Mississauga, Ontario***

Principal, Senior Ecologist (2004 to Present)

Heather Melcher is a Principal, Senior Ecologist and Project Manager/Director with Golder Associates. Heather has over 18 years of experience working in a number of sectors including transportation, oil and gas, transmission, land development, power, aggregates and mining. Her experience lies in designing, managing and carrying out environmental impact assessments within provincial and federal frameworks and environmental land use policies for projects of various size and complexity. She leads a team of ecologists and multi-disciplinary project teams to holistically assess potential project impacts through integration of components. Heather works closely with provincial and federal agencies to help her clients navigate changing planning and species at risk (SAR) legislation. Heather has experience developing rehabilitation plans for disturbed sites and biodiversity plans that integrate the ecology of a smaller site into the regional system as well as developing compensation habitat plans and mitigation plans for SAR. Heather is also a recognized expert witness for Local Planning Appeal Tribunal (LPAT) hearings in Ontario.

ESG International – Guelph, Ontario

Ecologist/Environmental Planner (2002 to 2003)

Specialized in resource management and land use planning. Worked with clients, residential and commercial land developers, land planners and regulatory agencies to obtain permits and approvals, specifically within the framework of Niagara Escarpment and Oak Ridges Moraine legislation. Compiled, assessed and reported on marine data collected for international projects.

CBCL Ltd – Halifax, Nova Scotia

Ecologist/Environmental Planner (2001 to 2002)

Intermediate project manager responsible for designing and implementing environmental effects monitoring, environmental impact assessment, and natural heritage projects. Developed and implemented marine and freshwater fisheries and benthic investigations, aquatic habitat assessments, and water quality and sediment assessments. Liaised with clients and regulatory agencies (federal and provincial), to obtain development permits and approvals.

Southeast Environmental Association – Montague, Prince Edward Island

Bacterial Water Quality Project Coordinator (2000 to 2002)

Responsible for collection of freshwater samples and laboratory analysis of faecal coliform bacteria to determine the effects of livestock farming runoff on the shellfish industry. Liaised with landowners and the agricultural engineer to establish effective remediation efforts, and developed education initiatives involving the general public, farmers and shell fishers. Reported to a multi-stakeholder board.

PROJECT EXPERIENCE – CONSTRUCTION MATERIALS**Scotian Materials
Limited**Halifax, Nova Scotia,
Canada

Senior Technical Lead (biophysical) for the provincial environmental assessment to support the expansion of an existing quarry. Studies completed to support the project included fish and fish habitat, species at risk, flora and fauna and wetland surveys. The technical lead for the impact assessment for the natural environment and the completion of supporting permit/approval applications. Scope included the completion of wetland and wildlife management plans.

**EWL Ltd., Gordon Lake
Quarry and Borrow
Area**

Kenora, Ontario, Canada

Natural environment component lead for permit applications under the Aggregate Resources Act (ARA). The aggregate areas are in support of rehabilitation activities associated with the decommissioning of the former Gordon-Werner Lake Mine. Coordinated aquatic and terrestrial field data collection and analysis, interpreted and integrated data with hydrogeological and surface water components, and developed a Natural Environment Level 1/2 (NEL 1/2) technical report. Responsible for negotiations with the Ministry of Natural Resources and Forestry (MNRF) and Ministry of Environment, Conservation and Parks (MECP) regarding woodland caribou and SAR bats. Prepared and submitted permitting applications under the Endangered Species Act (ESA), developed mitigation plans and coordinated with construction team.

**Lafarge Canada Inc.,
McGill Pit**Kemptville, Ontario,
Canada

Natural environment component lead for a below water pit licence application under the ARA. Coordinated aquatic and terrestrial field data collection and analysis, interpreted and integrated data with hydrogeological and surface water components and completed a comprehensive, integrated impact assessment. Developed progressive and final rehabilitation plans, participated in agency and public consultation and produced an NEL 1/2 report and municipal Environmental Impact Study (EIS) report. Led negotiations with the MNRF regarding SAR issues and developed mitigation and habitat compensation plans for butternut. Participated in an Ontario Municipal Board (OMB) hearing as an expert witness.

Colacem CementL'Original, Ontario,
Canada

Natural environment component lead for the Colacem Cement Plant assessment. Designed and coordinated aquatic and terrestrial field data collection and analysis, interpreted and integrated data with physical resource components. Developed an EIS for the municipal approval process. Worked with MNRF and South Nation Conservation on significant natural heritage feature and SAR issues and with Fisheries and Oceans Canada (DFO) on a Fisheries Act authorization for removal of fish habitat. Currently preparing for participation in a LPAT (formerly the OMB) hearing as an expert witness.

**CBM Ltd. (a division of
Votorantim Cimentos),
Dance Pit Extension**
North Dumfries, Ontario,
Canada

Project manager and natural environment technical advisor for an above water pit licence application under the ARA. Worked with the natural environment component lead to collect, analyse, interpret and integrate terrestrial and aquatic data with hydrogeological and surface water components. Developed a rehabilitation plan, consulted with the Grand River Conservation Authority, the MNRF and MECP, the Region of Waterloo, the Municipality of North Dumfries and the City of Cambridge, and participated in agency and public consultation. Coordinated and managed the activities of a multi-disciplinary team including hydrogeologists, surface water engineers, noise, air quality, visual assessment and vibration specialists, public consultation and Indigenous community engagement specialists, and archaeologists. Managed and tracked overall project budget and schedule.

**CBM Ltd. (a division of
Votorantim Cimentos),
Lanci Pit Expansion**
Aberfoyle, Ontario,
Canada

Project manager and natural environment technical advisor for an above water pit licence application under the ARA. Worked with the natural environment component lead to analyse, interpret and integrate terrestrial and aquatic data with hydrogeological and surface water components. Developed a rehabilitation plan, consulted with the Grand River Conservation Authority, the MNRF, the municipality, and participated in agency and public consultation. Coordinated and managed the activities of a multi-disciplinary team including hydrogeologists, surface water engineers, noise scientists, archaeologists, and an Indigenous Community engagement team. Managed and tracked overall project budget and schedule.

**Cavanagh
Construction Ltd.,
Henderson II Quarry**
Ottawa, Ontario, Canada

Natural environment component lead for a below water quarry licence application under the ARA. Coordinated aquatic and terrestrial field data collection and analysis, interpreted and integrated data with hydrogeological and surface water components and completed a comprehensive integrated impact assessment. Developed a rehabilitation plan, participated in agency and public consultation and developed an NEL 1/2 report and municipal EIS report. Led negotiations with the MNRF regarding SAR issues and developed compensation plans.

**Tackaberry Sand and
Gravel Ltd., Perth
Quarry**
Perth, Ontario, Canada

Natural environment component lead for a below water quarry licence application under the ARA. Coordinated aquatic and terrestrial field data collection and analysis, interpreting and integrated data with hydrogeological and surface water components. Developed a rehabilitation plan, participated in agency and public consultation and developed an NEL 1/2 report and municipal EIS. Led negotiations with the MNRF regarding SAR issues and developed compensation plans for the removal of habitat. Worked with Rideau Valley Conservation Authority and Mississippi Valley Conservation Authority on headwater drainage feature assessment and mitigation plans.

**Greenfield Aggregates
Sherk Pit**
Waterloo, Ontario,
Canada

Natural environment component lead for a below water pit licence application under the ARA. Analysed and integrated terrestrial and aquatic data with hydrogeological and surface water components, completed a comprehensive and integrated impact assessment. Developed a rehabilitation plan and an NEL 1/2 report and municipal EIS report. Participated in consultation with the Region and the Ecological and Environmental Advisory Committee (EEAC).

**Lafarge Canada Inc.,
French Settlement Pit**
Ottawa, Ontario, Canada

Natural environment component lead for a below water pit licence application under the ARA. Coordinated aquatic and terrestrial field data collection and analysis. Interpreting and integrated data with hydrogeological and surface water components. Developed a progressive and final rehabilitation plan and an NEL 1/2 report and municipal EIS report. Consulted with regulatory agencies and participated in public consultation process.

**Lafarge Canada Inc.,
Sunningdale Pit**
London, Ontario,
Canada

Natural environment component lead for a below water pit licence application under the ARA. Coordinated aquatic and terrestrial field data collection and analysis. Interpreting and integrated data with hydrogeological and surface water components. Completed a comprehensive and integrated impact assessment. Developed a progressive and final rehabilitation plan and an NEL 1/2 report and EIS. Consulted with regulatory agencies and participated in public consultation process. Developed mitigation and habitat compensation plans under the ESA for barn swallow.

**Lafarge Canada Inc.,
Limebeer Pit**
Caledon, Ontario,
Canada

Project manager and natural environment component lead for a below water pit licence application under the ARA. Coordinated aquatic and terrestrial field data collection and analysis. Interpreting and integrated data with hydrogeological and surface water components. Completed a comprehensive and integrated impact assessment. Developed a progressive and final rehabilitation plan and an NEL 1/2 report and EIS. Consulted with regulatory agencies, participated in public consultation process. Coordinated and managed the activities, schedule and budget of a multi-disciplinary team including hydrogeologists, groundwater modelling experts, surface water engineers, and noise and air quality specialists.

**Lafarge Canada Inc.,
Avening Pit Extension**
Creemore, Ontario,
Canada

Project manager and natural environment component lead for an above water pit licence application under the ARA. Coordinated aquatic and terrestrial field data collection and analysis. Interpreting and integrated data with hydrogeological and surface water components. Completed a comprehensive and integrated impact assessment. Developed a progressive and final rehabilitation plan and an NEL 1/2 report and EIS. Coordinated and managed the activities, schedule and budget of a multi-disciplinary team including hydrogeologists, surface water engineers, and noise and air quality specialists.

Floyd Preston Ltd.
Eastern Ontario, Canada

Natural environment component lead for a quarry licence application under the ARA. Liaised with client, coordinated field data collection, mentored intermediate staff in data analysis and interpretation and prepared an NEL 1 report.

PROJECT EXPERIENCE – SPECIES AT RISK

**EWL Management Ltd
Madawaska Mine
Decommissioning**
Faraday, Ontario,
Canada

Natural environment component lead for SAR permitting for bats, including little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*) and tricolor bat (*Perimyotis subflavus*). Prepared and submitted permitting documents under the ESA, led consultation with the MNRF and MECP, developed a mitigation plan and provided direction to the construction team.

**TransCanada - Various
Sites in Ontario**
Ontario, Canada

Natural environment component lead for multi-year annual SAR and migratory bird monitoring at numerous sites across Ontario since 2012. In support of TransCanada's right-of-way maintenance brushing program. Provide SAR advice and liaise with MNRF to develop construction monitoring protocols for SAR and migratory birds. Lead crews to complete monitoring on an annual basis.

Lafarge Canada Ltd.
Various Locations,
Ontario, Canada

Natural environment component lead for multi-year annual SAR monitoring and reporting at aggregate sites across Ontario following registration. Species surveys include Blanding's turtle, loggerhead shrike, least bittern and gray ratsnake. Developed survey protocols with several MNRF district offices and lead crews to complete monitoring.

**Leader Resources
Services Ltd.**
Various Locations,
Ontario, Canada

Project manager for a number of wind power projects under the Ontario Renewable Energy Approvals Act (REA). Worked with the client and the MNRF to develop protocols and coordinate field surveys. Completed and submitted ESA permitting applications and compensation plans.

Lafarge Canada Ltd.
Various Locations,
Ontario, Canada

Project manager and natural environment component lead for a number of licence applications for proposed new and expanded aggregate extraction operations (pits and quarries) in Ontario under the ARA. Developed survey protocols, consulted with the MNRF, registered for activities under the ESA (Notice of Activity), completed Information Gathering Forms (IGF), prepared and submitted permit applications and developed compensation plans.

PROJECT EXPERIENCE – TRANSMISSION

**Hydro One Circuit
B5C/B6C Line
Refurbishment EA**
Westover to Burlington,
Ontario, Canada

Natural environment component lead for a provincial Class Environmental Assessment for a 40 km line refurbishment. Designed the field program (terrestrial and aquatic), analysed and integrated data with other physical resource disciplines. Completed a comprehensive and integrated impact assessment. Led consultation with regulatory agencies including two district MNRF offices, Hamilton Conservation Authority, Conservation Halton, Grand River Conservation Authority, Niagara Escarpment Commission, and participating in the public consultation process. Provided input into alternatives assessment for temporary hydro line bypass and developed reports.

**Wataynikaneyap Power
Phase 2 Transmission
Line**
Northwestern Ontario,
Canada

Senior advisor and technical reviewer for the wildlife component of permitting. Worked with the permitting lead and the wildlife component lead to design field programs, consult and negotiate with the MNRF and Environment and Climate Change Canada/Canadian Wildlife Service (ECCC/CWS), and prepare technical supporting documents for permitting and permit applications under the ESA, the Public Lands Act, and the federal Species at Risk Act (SARA). Provided senior leadership and technical guidance and review for all deliverables.

**Nextbridge East-West
Tie Transmission Line**

Wawa to Thunder Bay,
Ontario, Canada

Senior advisor and technical reviewer for wildlife permitting for the construction and operation of a 450 km transmission corridor. Worked with the permitting lead and the wildlife component lead to design field programs, consult and negotiate with the MNRF and ECCC/CWS, and prepare technical supporting documents for permitting and permit applications under the ESA, the Public Lands Act, and the SARA. Provided senior leadership and technical guidance and review for all deliverables.

PROJECT EXPERIENCE – TRANSPORTATION**MTO Calamity Creek
Highway 11 Culvert
Replacement Group 'C'
Class EA**

Temiskaming, Ontario,
Canada

Acting environmental manager for the replacement of the Calamity Creek Culvert (47-273/C) located on Highway 11 in the City of Temiskaming Shores, District of Temiskaming. Regular consultation with the MTO, the contractor and Golder's internal team including ecologists, surface water engineers, archaeologists, cultural heritage specialists, and hydrogeologists. Deliverables included a Consultation Plan, an Environmental Screening Document (ESD), which documented the results of all factor-specific environmental studies and consultation undertaken for the project, and an Environmental Management Plan (EMP), which detailed how the environmental mitigation and monitoring commitments made in the ESD would be implemented during construction.

**Ninth Line Municipal
Class EA**

Halton Region, Ontario,
Canada

Senior natural environment technical lead. Led a team of ecologists, analysed and interpreted terrestrial and aquatic data and completed impact assessment. Liaised with prime engineering firm and agencies including the municipality and the MNRF. Provided senior technical review of natural environment study report and permitting documents.

**Regional Road 57
Municipal Class EA**

Clarington, Ontario,
Canada

Senior natural environment technical lead. Led a team of ecologists, analysed and interpreted terrestrial and aquatic data and completed impact assessment. Liaised with prime engineering firm and agencies. Provided senior technical review of natural environment study report.

**Markham GO Station
Road Realignment
Municipal Class EA**

Markham, Ontario,
Canada

Senior natural environment technical lead. Led a team of ecologists, analysed and interpreted terrestrial and aquatic data and completed impact assessment. Liaised with prime engineering firm and agencies. Provided senior technical review of natural environment study report.

PROJECT EXPERIENCE – WASTE**County of Simcoe
Landfills and Transfer
Stations**

Various Sites in the
County of Simcoe,
Ontario, Canada

Senior natural environment technical lead for a number of landfill sites. Assisted the County with landuse planning, due diligence for new properties, approvals and permits for expansions and changing uses. Coordinated field investigations including wetland boundary delineation. Consulted with Conservation Authorities, Niagara Escarpment Commission and MNRF.

Humberstone Landfill
Niagara, Ontario,
Canada

Senior advisor and technical reviewer for a provincial EA in support of a landfill expansion. Worked with the natural environment component lead to design field programs, consult with provincial agencies and prepare technical reports. Provided senior leadership and technical guidance and review for all deliverables.

**Capital Region
Resource Recovery
Centre (CRRRC)**
Ottawa, Ontario, Canada

Natural environment component lead for a provincial EA for a resource recovery centre on a 175 hectare site), including a landfill, contaminated soil management and recycling components. Designed the field program (terrestrial and aquatic), analysed and integrated data with other disciplines, completed an impact assessment. Consulted with regulatory agencies including the Conservation Authority, MNRF and DFO. Provided input to the project design, obtained permits and participated in the public consultation process.

PROJECT EXPERIENCE – RENEWABLE ENERGY

**Trillium Power Wind
Corporation**
Lake Ontario, Ontario,
Canada

Project manager and natural environment lead for an offshore wind power project in Lake Ontario under O. Reg. 359/09 Renewable Energy Approvals (REA). Coordinated and managed a multi-disciplinary team comprised of noise specialists, biologists, archaeologists, public consultation specialists, aboriginal engagement specialists, visual impact assessment specialists and geophysicists. Designed terrestrial and aquatic field surveys, including avian, bat and fisheries assessments. Led provincial and federal agency consultation and participated in public open houses. Impact assessment and reporting, designed to satisfy both provincial and federal (CEAA) requirements, was underway when the project was curtailed.

**Leader Resources
Services Corporation**
Various Locations,
Ontario, Canada

Project manager and project director/senior technical advisor for four wind farm projects under O. Reg. 359/09 REA in Huron County, Ontario. Coordinated and managed a multi-disciplinary team comprised of noise specialists, natural heritage specialists, archaeologists, cultural heritage specialists, public consultation specialists and aboriginal engagement specialists. Led regulatory agency consultation specifically regarding SAR, avian and bat issues, and participated in public consultation process. Directed and reviewed all baseline natural environment impact assessment, mitigation and monitoring reporting, including species at risk, waterbodies, and wildlife/habitat (with a focus on birds and bats). Completed REA-specific project reports.

**Mann
Engineering/EffiSolar**
Various Locations,
Ontario, Canada

Natural heritage component lead for four 10 MW ground-mounted PV solar farms in southeastern Ontario under O. Reg. 359/09 REA. Designed and coordinated field programs for terrestrial and aquatic ecosystems, including SAR. Completed impact assessment, mitigation and monitoring plans and reports and led provincial agency consultation.

SkyPower Corp.
Various Locations,
Ontario, Canada

Project manager for eight wind power park projects in Renfrew County, Prince Edward County and Parry Island, Ontario. Designed and coordinated natural environment field programs, including terrestrial (avian, bats, SAR, wildlife/habitats) and aquatic. Managed a multi-disciplinary team including hydrogeologists, biologists, surface water engineers, noise and air quality experts, socio-economic and public consultation coordinators. Led provincial agency and public consultation. Completed natural environment impact assessment, mitigation and monitoring plans and reports and REA-specific project reports.

Algonquin Power
Amherst Island, Ontario,
Canada

Project manager and natural environment component lead for wind power project in Prince Edward County. Designed and coordinated field programs for terrestrial (avian, bats, SAR) and aquatic ecosystems. Managed a multi-disciplinary team including hydrogeologists, biologists, surface water engineers, noise and air quality experts, socio-economic and public consultation coordinators. Led provincial and federal agency consultation and participated in public consultation. Completed natural environment impact assessment, mitigation and monitoring plans and reports and REA-specific project reports.

SkyPower Corp.
Various Locations,
Ontario, Canada

Project manager for four solar power projects across Ontario, including Napanee and Norfolk. Designed, coordinated and conducted field programs and data collection. Coordinated and managed the activities of a multi-disciplinary team including noise, archaeology, and surface water. Completed screening reports to provincial and municipal standards.

OptiSolar Inc.
Various Locations,
Ontario, Canada

Project manager for three solar power projects across Ontario, including Sarnia, Tilbury and Petrolia. Designed, coordinated and conducted field programs and data collection, coordinated and managed the activities of a multi-disciplinary team including noise, archaeology, surface water, traffic and natural environment. Completed screening reports to provincial and municipal standards.

PROJECT EXPERIENCE – NUCLEAR

**Canadian Waste
Management Office
(NWMO) Deep
Geologic Repository
(DGR) Project Follow-
up Monitoring**
Kincardine, Ontario,
Canada

Project manager and senior technical lead for multi-year follow-up wildlife and vegetation monitoring at the DGR site. The scope of work included SAR turtle visual encounter surveys (VES; also known as basking surveys), SAR snake emergence and egg-laying surveys, rare plant surveys, data comparisons between years of data collection, and reporting.

**Canadian Nuclear
Laboratories (CNL)
Whiteshell Research
and Development
Complex
Decommissioning EA**
Pinawa, Manitoba,
Canada

Natural environment component lead for a federal EA. Developed Valued Ecosystem Components (VEC) and pathways of effects assessment. Analysed existing conditions terrestrial and aquatic data for the regional, local and site study area including for SAR, provided recommendations for additional permitting and mitigation for potential effects to wildlife and sensitive habitats. Provided input to construction design and developed technical reports.

Natural environment component lead for a federal EA. Developed Valued Ecosystem Components (VEC) and pathways of effects assessment. Analysed existing conditions terrestrial and aquatic data for the regional, local and site study area including for SAR, provided recommendations for additional permitting and mitigation for potential effects to wildlife and sensitive habitats. Provided input to construction design and developed technical reports.

**Canadian Nuclear
Laboratories (CNL)
Port Hope Remediation**
Port Hope, Ontario,
Canada

Natural environment component lead for permitting for remediation of Port Hope Harbour, Ganaraska River and other watercourses in Port Hope. Liased with the Ganaraska River Conservation Authority, MNRF, DFO, and Canadian Nuclear Safety Commission, completed pathways of effects assessment, impact assessment and prepared applications and obtaining permits for dredging, bank stabilization, sediment remediation, SAR, and removal and work on Crown lands.

**Bruce Power Units 3&4
Restart**
Kincardine, Ontario,
Canada

Worked with a team to establish VEC and appropriate study areas. Coordinated field technicians and interpreted data on fish impingement, entrainment, fishing pressure and temperature and velocity effects on aquatic habitat and biota, including bass spawning surveys. Worked with a team of biologists to determine the potential for warm water discharges to affect waterfowl use of nearby areas, and evaluated effects on the white-tailed deer population due to vehicle strikes. Prepared technical reports.

**Pickering Nuclear 'A'
Return to Service
Follow-up and
Monitoring**
Pickering, Ontario,
Canada

Multi-year monitoring program. Coordinated aquatic field technicians and interpreted data on impingement, entrainment, fishing pressure, waterfowl surveys, and temperature and velocity effects on aquatic habitat and biota, including bass spawning surveys. Worked with a team of biologists to evaluate the effects of wildlife-vehicle interactions on nearby roadways on terrestrial biota populations. Prepared annual monitoring reports.

PROJECT EXPERIENCE – MINING

**EWL Management Ltd.
Dyno Mine
Rehabilitation**
Bancroft, Ontario,
Canada

Natural environment component lead for an environmental and health risk assessment of decommissioned uranium mine. Worked with a multi-disciplinary team including surface water engineers, geotechnical engineers, and risk specialists. Designed and coordinated bioscience field technicians to carry out the natural environment workplan. Tasks included fish habitat assessment and characterization of the aquatic environment, and collection of benthic, fish, sediment and aquatic plant tissue samples in affected and reference lakes and watercourses in support of the human health and ecological risk assessment. In addition, collection of small mammal and plant tissue samples and characterization of wildlife habitat was included. Responsible for analysis and interpretation of data, as well as report preparation and liaising with stakeholders and government agencies.

**EWL Management Ltd.
Coldstream \ Mine
Rehabilitation**Thunder Bay, Ontario,
Canada

Natural environment component lead for an environmental and health risk assessment of a decommissioned copper mine. Worked with a multi-disciplinary team including surface water engineers, geotechnical engineers, and risk specialists. Designed and coordinated bioscience field technicians to carry out the natural environment work plan. Tasks included fish habitat assessment and characterization of the aquatic environment, and collection of benthic, fish, sediment and aquatic plant tissue samples in affected and reference lakes and watercourses in support of the human health and ecological risk assessment. In addition, collection of plant tissue samples and characterization of wildlife habitat was included. Responsible for analysis and interpretation of data, as well as report preparation and liaising with stakeholders and government agencies.

PROJECT EXPERIENCE – OIL & GAS**Enbridge Bayview
Avenue Pipeline
Replacement**

Ontario, Canada

Natural environment component lead for pipeline replacement project. Coordinated SAR screening, natural heritage feature mapping, site investigations, impact assessment, tree inventory, DFO self-assessment, consultation with MECP, registration of activities (NoA) under the Endangered Species Act and development of mitigation plan. Worked with team to obtain Toronto and Region Conservation Authority (TRCA) permits.

**Enbridge Pipelines Inc.
Line 9**Southern Ontario,
Canada

Project manager for natural environment component of pipeline maintenance project in southern Ontario. Coordinated SAR screening and natural heritage feature mapping, site investigations, identification of permit requirements and constraint mapping in support of brushing and other maintenance activities.

**TransCanada Bear
Creek Rehabilitation**

Ontario, Canada

Natural environment component lead for Bear Creek rehabilitation following washout and exposure of the pipeline in the creek bed. Completed baseline existing conditions reporting including fish and fish habitat, SAR and riparian habitat to meet Conservation Authority, MNRF and DFO requirements. Worked with Golder's hydrology team to obtain Conservation Authority permits, develop a rehabilitation plan suitable for the existing conditions and fish community, and recommended appropriate mitigation during construction.

**TransCanada Greater
Golden Horseshoe
Facilities Modifications**

Ontario, Canada

Natural environment component lead for an environmental and socio-economic assessment for modifications to a number of facilities under the National Energy Board (NEB). Responsibilities included designing the field program (vegetation, wetlands, wildlife, fish and fish habitat), analysing data, completing the baseline and effects assessment, liaising with agencies and permitting.

**TransCanada Eastern
Mainline Project**

Ontario, Canada

Vegetation and wetland component lead for an environmental and socio-economic assessment for a 392 km new construction pipeline in southern Ontario under the National Energy Board (NEB). Designed the field program, analysed data, completed the baseline and effects assessment and reporting. Consulted and negotiated with the MNRF, Environment and Climate Change Canada (ECCC) and local Conservation Authorities, prepared permit applications, and addressed Information Requests (IRs).

**TransCanada Parkway
West Connection**
Milton, Ontario, Canada

Natural environment component lead for an environmental and socio-economic assessment for a new pipeline connection under the NEB. Designed the field program (vegetation, wetlands, wildlife, fish and fish habitat), analysed data, completed the baseline and effects assessment, led consultation with agencies and obtained permits.

**TransCanada Vaughan
Mainline Extension**
Ontario, Canada

Senior technical reviewer and advisor for the vegetation, wetland and wildlife components for an environmental and socio-economic assessment for a new construction pipeline in southern Ontario under the NEB. Consulted with provincial and federal agencies, designed and coordinated baseline, construction and post-construction monitoring programs and developed environmental protection plans.

**TransCanada Kings
North Connection**
Ontario, Canada

Senior technical reviewer and advisor for the vegetation, wetland and wildlife components for an environmental and socio-economic assessment for a new construction pipeline in southern Ontario under the NEB. Consulted with provincial and federal agencies, designed compensation habitat for SAR, designed and coordinated baseline, construction and post-construction monitoring programs and developed environmental protection plans.

**TransCanada LNG
Facility**
Trois Rivières, Quebec,
Canada

Aquatic technical component lead. Designed and conducted inland fisheries field programs for a liquefied natural gas facility and associated distribution pipelines. The programs included aquatic habitat assessments of all watercourse pipeline crossings, and an assessment of habitat and water quality of inland lakes in the vicinity of the facility. Interpreted data and prepared technical reports.

TRAINING

Microsoft Project Level 1 Training
2008

Royal Ontario Museum (ROM) Fish ID Workshop
2005

Introduction and Intermediate MapInfo Professional Training
2000

PROFESSIONAL AFFILIATIONS

Professional Association of Diving Instructors (PADI)

Director, Ontario Stone Sand and Gravel Association (OSSGA) Board of Directors

PUBLICATIONS

**Conference
Proceedings**

Melcher, Heather. 2015. *Bats and the Aggregate Industry*. Ontario Stone Sand and Gravel Association Annual General Meeting, February. Toronto, Canada.

Melcher, Heather. 2014. *Changes to the Ontario Endangered Species Act and Implications to the Aggregate Industry*. Ontario Stone Sand and Gravel Association Annual General Meeting, February. Ottawa, Canada.

Other

Melcher, Heather. 2001; 2002. Effects of Agricultural Inputs of Faecal Coliforms on the Shellfish Industry in Prince Edward Island. Annual Monitoring Report. Prince Edward Island.

Education

*H.B.Sc (Env) Honours
Environmental Biology
Co-op, University of
Guelph, Guelph, Ontario,
2012*

Certifications

*Pleasure Craft Operator
Card,
2010*

*Ecological Land
Classification for southern
Ontario (Ministry of Natural
Resources and Forestry),
2014*

*Ontario Wetland Evaluation
System (Ministry of Natural
Resources and Forestry),
2017*

*Electrofishing,
2017*

*WHMIS,
2017*

*First Aid and CPR Level C,
2017*

*Federal Reliability
Clearance,
2018*

*Butternut Health Assessor
(Ministry of Natural
Resources and Forestry),
2019*

Golder Associates Ltd. – Mississauga**Ecologist**

Amber is an Ecologist and Project Manager with 9 years of experience in terrestrial ecology. She has skills in Ontario flora and fauna identification, species at risk screenings, terrestrial habitat assessments and environmental impact assessments. Amber's experience lies in the design and management of terrestrial field programs, and project management for natural environment components of projects. Amber has experience working in numerous sectors, with a focus in the power, aggregate, oil and gas, land development and mining sectors. Amber also works extensively with the *Endangered Species Act* (ESA) and *Species at Risk Act* (SARA) and associated regulations, and leads Golder's internal Species at Risk Working Group. She has led numerous field programs to support permitting under the ESA and the compilation of terrestrial baseline reports. Her field experience includes completing assessments for significant wildlife habitat, Ecological Land Classification (ELC), wetland delineation and evaluations, herpetofaunal surveys, butternut health assessments, and bat maternity roost habitat surveys.

Employment History**Golder Associates Ltd. – Mississauga, Ontario****Ecologist (2012 to Present)**

Responsibilities include project management, field data collection and analysis, and preparation of environmental assessment reports, screening reports, and natural environment reports for private and public sectors, including land development, aggregate, and power. Development, implementation and coordination of field programs, coordination and management of project budgets for natural environment teams, and management of an internal Species at Risk Grouping Work.

City of Guelph – Guelph, Ontario**Conservation and Efficiency Program Assist (Co-op) (September 2009 to December 2009)**

Responsible for monitoring an information line related to two City rebate programs, verifying applications, and updating rebate qualifications for the City website. Conducted presentations in the Upper Grand District School Board to educate students on water conservation and protection through interactive learning. Participated in a pilot program monitoring the water quality of grey water systems installed in local residences, including water sampling, analysis, tracking of results, and compilation of a report for the City.

Environment Canada - Canadian Wildlife Service – Burlington, Ontario**Wildlife Toxicology Technician (Co-op) (January 2009 to April 2009)**

Independently managed a study exposing tadpoles of the African clawed frog to treated wastewater effluent from the Hamilton Sewage Treatment Plant in a flow-through facility, including animal care, experimental procedure and endpoint measurements. Performed field collection of European starling eggs for use in environmental toxicology monitoring program.

PROJECT EXPERIENCE – AGGREGATES

**Queenston Quarry
Reclamation Company,
Queenston Quarry
Redevelopment Project**
Niagara-on-the-Lake,
Ontario, Canada

Project Manager for proposed re-development of the former Queenston Quarry. Responsibilities included coordinating field data collection and analysis, interpreting data, and preparing an Environmental Impact Study report for the Niagara Escarpment Commission. Responsible for negotiations and discussions with the MNRF regarding SAR issues and developing appropriate mitigation measures.

**Fowler Construction
Ltd., Fleming Quarry
Expansion**
Washago, Ontario,
Canada

Conducted natural heritage studies for a proposed below water quarry license application under the ARA, including a due diligence assessment. Surveys included turtle visual encounter surveys to target Blanding's turtle and spotted turtle, anuran call count surveys, and fish community sampling and fish habitat assessments.

**EWL Management Ltd.,
Northern Ontario
Quarry and Pit Project**
Northern Ontario,
Canada

Managed, coordinated and led the 2016 field program to conduct eastern whip-poor-will, anuran call count, and acoustic bat monitoring surveys for the proposed borrow area and quarry site. Collected and analysed field data in cooperation with other disciplines to prepare the Level I & II Natural Environment Technical Reports as part of two licence applications under the ARA. Worked with the client and MNRF to develop mitigation and compensation plans for species at risk, including woodland caribou and bats.

**Ontario Ministry of
Transportation -
Northern Ontario
Pit/Quarry Permits**
Northern Ontario,
Canada

Prepared the Level I & II Natural Environment Technical reports to support four permit applications for aggregate extraction under the provincial ARA.

**Scotian Materials -
Goffs Quarry
Expansion
Environmental
Assessment**
Halifax, Nova Scotia,
Canada

Conducted natural heritage studies for a proposed quarry expansion project, including preparation of an Environmental Impact Study report as part of the Environmental Assessment Registration Document. Conducted field surveys, including botanical inventory and plant community classification using the Forest Ecosystem Classification system for Nova Scotia, rapid fish habitat assessments, wildlife and SAR habitat assessments, and wetland surveys in accordance with the Nova Scotia Wetland Evaluation Technique.

Colacem Cement Plant
L'Orignal, Ontario,
Canada

Prepared an Environmental Impact Statement for the municipal approval process for the proposed construction of a cement plant. Responsibilities included coordinating field data collection, analysis and interpretation of data, and preparation of the Environmental Impact Statement report. Also prepared and submitted a Request for Project Review to Fisheries and Oceans Canada for impacts to fish habitat.

Lafarge Canada Inc.
Various Locations,
Ontario, Canada

Prepared and submitted the Notice of Activity forms for seven (7) aggregate operations (pit and quarry) in southern Ontario to support the transition of existing exemption agreements under the Endangered Species Act to the new protocol of Registration of Activities. Also prepared mitigation plans for each site as part of the agreements.

**Lafarge Canada Inc.,
Sunningdale Pit**
London, Ontario,
Canada

Prepared the Level I & II Natural Environment Technical Report to accompany the licence application for aggregate extraction under the provincial ARA. Project Manager for annual monitoring of barn swallow compensation structures installed as part of the Notice of Activity under the ESA for the project. Project management responsibilities involved coordination of field surveys to assess use of the structures, preparation of a mitigation plan, and preparation of annual monitoring reports.

**Lafarge Canada Inc.,
Limebeer Pit**
Caledon, Ontario,
Canada

Performed anuran call count and egg mass surveys, as well as turtle nesting surveys, in support of a proposed aggregate licence under the ARA. Prepared the Level I & II Natural Environment Technical report as part of the successful licence application.

**Lafarge Canada Inc.,
Avening Extension Pit**
Creemore, Ontario,
Canada

Performed anuran call count surveys and egg mass searches as part of a proposed expansion to a currently licenced and operating aggregate pit. Prepared the Level I & II Natural Environment Technical report to support the licence expansion application. Also prepared and submitted permitting documents, including a DFO Request for Project Review under the Fisheries Act, and a Notice of Activity under the ESA.

**Lafarge Canada -
Species at Risk
Monitoring**
Various Locations,
Ontario, Canada

Conducted Blanding's turtle basking and nesting surveys in accordance with the Ministry of Natural Resources and Forestry guidelines at several licenced and operational aggregate pits in southern Ontario as part of required SAR monitoring.

PROJECT EXPERIENCE – ECOLOGY

**CIMA, Consumer's
Drive Extension**
Whitby, Ontario, Canada

Conducted a wetland evaluation using the Ontario Wetland Evaluation System (OWES) to evaluate the potential for a wetland on site to be complexed with an existing Provincially Significant Wetland to the south. Terrestrial communities on the site were also delineated and classified using the ELC system for southern Ontario. Helped prepare the wetland evaluation report for submission to the Ministry of Natural Resources and Forestry.

Wetland Evaluation
Belleville, Ontario,
Canada

Project manager for a wetland evaluation project on a proposed subdivision development site. Conducted a wetland evaluation using OWES to evaluate the potential for four wetland units to be complexed with an adjacent Provincially Significant Wetland, and prepared the wetland evaluation report for submission to the Ministry of Natural Resources and Forestry.

**Emery / Metrus, Levi
Creek Constructed
Wetland Monitoring**
Mississauga, Ontario,
Canada

Conducted post-construction environmental monitoring of a constructed wetland adjacent to residential development. Monitoring was conducted for both terrestrial and wetland components, and included anuran surveys, vegetation plot monitoring following the Credit Valley Conservation's vegetation plot technique guidelines, and qualitative wildlife habitat assessments. Prepared the monitoring report for submission to the Credit Valley Conservation Authority and Fisheries and Oceans Canada.

Scoped Subwatershed Study

Central Elgin, Ontario,
Canada

Conducted a natural heritage assessment as part of a scoped subwatershed study in the Lower Kettle Creek subwatershed with the objective to provide a framework to guide future land use and development. Completed field surveys, including assessments for ELC communities, wildlife and SAR habitat, and rapid watercourse and fish habitat. Helped compile the scoped subwatershed study report, including recommendations on environmental targets and management strategies.

Ecological Risk Assessment

Nobel, Ontario, Canada

Component Lead for an ecological risk assessment comparing wildlife communities on a former industrial site to a reference site to help analyse potential development options and develop ecological risk-management measures for the site. Responsibilities included designing and coordinating the field study program, analysis of data using the Jaccard Index to evaluate community similarity, and preparation of the ecological assessment report.

Ontario Ministry of Natural Resources and Forestry - Vascular Plants at Risk

Peterborough, Ontario,
Canada

Compiled peer-reviewed literature and information to assist the Ministry of Natural Resources and Forestry with development of policies and practices under the Endangered Species Act for 63 vascular plant species at risk (SAR) in Ontario.

PROJECT EXPERIENCE – SPECIES AT RISK**Canadian Nuclear Laboratories (CNL) Port Hope Remediation**

Port Hope, Ontario,
Canada

Responsible for coordinating species at risk screenings and field work to verify existing habitat conditions in areas proposed for remediation. Provided recommendations on mitigation measures, species-specific surveys to confirm use, and permitting requirements under the ESA.

American Ginseng Monitoring Program

Simcoe County, Ontario,
Canada

Conducted population surveys of American ginseng, designated endangered under the Endangered Species Act, as part of an annual monitoring program between 2015 and 2018.

Municipality of Chatham-Kent, Ontario Certified Site Ready Program

Chatham, Ontario,
Canada

Natural environment component lead for an “Investment Ready” property designation under the Ontario Certified Site Ready Program. As part of the program designation process, a SAR screening and site reconnaissance was completed for two properties to identify potential SAR constraints for future development opportunities.

TC Energy

Various Locations,
Ontario, Canada

Project Manager for the TC Energy Eastern Region (Ontario) pipeline integrity program. Responsibilities include coordinating and managing desktop natural environment and SAR screenings, liaising with the local Conservation Authority to identify and obtain potential permits, and SAR and avian nesting surveys across Ontario as part of pipeline maintenance activities.

CBM Aggregates (a division of St. Marys Cement Canada) – Butternut Health Assessments
Ontario, Canada

Managed and coordinated the completion of Butternut Health Assessments for various sites in southern Ontario, including successful submission of Butternut Health Assessment Reports and Notice of Butternut Impact registrations under the ESA. Also prepared Butternut Planting Plans as part of the registration.

Digram Developments Caledon Inc., Barn Swallow Monitoring
Caledon, Ontario, Canada

Coordinated and managed an annual barn swallow monitoring program of compensation structures at a land development site in Caledon. Prepared the mitigation plan and annual monitoring reports, as required as part of the Notice of Activity registration process under the ESA.

PROJECT EXPERIENCE – ENVIRONMENTAL ASSESSMENT

Clarksburg Master Servicing Plan
Clarksburg, Ontario, Canada

Natural Environment Component Lead for a Class Environmental Assessment of a water and wastewater master servicing plan. Responsibilities included coordination of terrestrial data collection, analysis and interpretation of data, and preparation of the Natural Environment Report.

Town of Blue Mountains Water Supply Master Plan
Blue Mountains, Ontario, Canada

Natural Environment Component Lead for a Schedule B Municipal Class Environmental Assessment. Responsibilities included coordination of terrestrial data collection, analysis and interpretation of data, and preparation of an Environmental Impact Study report.

City of Markham Victoria Square Blvd Improvements
Markham, Ontario, Canada

Natural Environment Component Lead for a Schedule C Class Environmental Assessment related to planned road improvements. Responsibilities included coordination and collection of field data, analysis and interpretation of data, and preparation of the Natural Environment Report.

Tlicho All-Weather Road Project
Northwest Territories, Canada

Completed the baseline description and effects assessment for wildlife Valued Components (VCs) as part of the Adequacy Statement Response for the Environmental Assessment. Also provided responses to agency and stakeholder Information Requests as part of the review of the Environmental Assessment.

City of Cambridge, Zone 1W Project
Cambridge, Ontario, Canada

Project manager for a Class B Environmental Assessment for the Cambridge Pressure Zone 1W project. Responsibilities included coordination of field data collection, data analysis and interpretation, and preparation of a Natural Environment Report.

HydroOne Networks Inc., B5C/B6C Line Refurbishment Project
Burlington, Ontario, Canada

Coordinated and led terrestrial field surveys to support the Environmental Assessment for a 24 km stretch of hydro corridor proposed for refurbishments. Completed ELC assessment and mapping, botanical inventory, SAR surveys and wildlife habitat assessments in cooperation with a First Nations assistant. Also completed a rare plant survey and mapping for a target species (New Jersey Tea).

**Region of Peel – East
to West Wastewater
Diversion Strategy
Project**
Mississauga, Ontario,
Canada

Natural Environment Component Lead for a municipal class Environmental Assessment. Responsibilities included coordination of terrestrial data collection, analysis and interpretation of data, and preparation of the Natural Environment Report.

PROJECT EXPERIENCE – TRANSPORTATION/RAIL

**HDR Inc., Downtown
Rapid Transit
Expansion Study**
Toronto, Ontario,
Canada

Prepared the natural environment component of the Environmental Project Report as part of a Transit Project Assessment Process Environmental Assessment for the Downtown Relief Line project, including evaluation of existing conditions, identification of impacts and recommendation of mitigation and contingency measures. Coordinated and developed responses to agency and stakeholder comments related to natural environment in the Environmental Project Report.

**Markham GO Station
Road Realignment –
Transit Project
Environmental
Assessment**
Markham, Ontario,
Canada

Prepared a Natural Environment Report, including detailed impact assessment, as part of a Transit Project Assessment Process for proposed improvements and road alignment associated with the Markham GO station.

**Canadian National
Railway Company -
Credit River Bridge
Replacement Post-
Construction
Monitoring**
Georgetown, Ontario,
Canada

Completed Year 1 and 2 of the post-construction vegetation monitoring program associated with the restoration of the Credit River Valley following a railway bridge replacement. Prepared the monitoring report for submission to the Credit Valley Conservation Authority and Fisheries and Oceans Canada.

**Canadian National
Railway Company**
Northern Ontario,
Canada

Conducted desktop environmental evaluation reports for siding extensions at six sites in northern Ontario. Each evaluation included a desktop level constraints analysis for species at risk, natural areas, terrestrial features, wildlife and aquatic features and fish habitat. The environmental evaluation report summarized each potential environmental constraint and identified applicable mitigation measures.

PROJECT EXPERIENCE – OIL & GAS

**Syncrude Canada -
Beaver Creek
Monitoring Program**
Fort McMurray, Alberta,
Canada

Prepared the annual water report summarizing the results of surface water quality and toxicity testing conducted in Beaver Creek downstream of the Mildred Lake Settling Basin in 2012, 2013 and 2014. Performed the analysis and interpretation of trends in water quality data collected over two to three sampling periods each year.

**TC Energy - Eastern
Mainline Project**
Ontario, Canada

Coordinated and led the terrestrial field program for baseline data collection in 2014 to accompany the National Energy Board filing for twining of a pipeline between Whitby and Brockville in Ontario. Also coordinated and led the terrestrial SAR field program, targeting amphibians, birds and reptiles, along the proposed route in 2015 in support of SAR permitting.

**Canadian National
Resources Limited,
Cold Lake Oil
Response Project**
Cold Lake, Alberta,
Canada

Conducted wildlife inventory, monitoring and deterrent activities as part of the response to a bitumen release in northern Alberta. Activities included amphibian pit-fall trapping and release, construction monitoring and mitigation, waterfowl trapping, bird surveys, and preparation of daily monitoring reports.

PROJECT EXPERIENCE – MINING

Cliffs Chromite Project
James Bay Lowlands,
Ontario, Canada

Conducted Northeastern Ontario Forest Ecosystem Classification (FEC) surveys in remote locations along proposed transportation corridor alternatives for proposed mining project.

**Osisko Hammond Reef
Gold Project**
Atikokan, Ontario,
Canada

Completed baseline data collection to support the Environmental and Social Impact Assessment for a proposed gold mine. Surveys included avian, turtle and anuran surveys, surveys to identify and delineate potential areas of wild rice colonies, as well as toxicological sampling of local vascular plant species and soil.

PROJECT EXPERIENCE – LAND DEVELOPMENT

**Hopewell
Developments Inc.,
Matheson Boulevard
Commercial
Development**
Mississauga, Ontario,
Canada

Project Manager for a commercial development site adjacent to Little Etobicoke Creek. Conducted a desktop assessment of existing environmental features, assessed potential impacts, and prepared an Environmental Impact Study report. Also identified mitigation measures and provided input into the planting plan for a buffer required by the Toronto and Region Conservation Authority.

**Simcoe County Landfill
Closures**
Simcoe County, Ontario,
Canada

Provided natural environment services for various landfill closure sites across Simcoe County, including preparation and submission of scoped Environmental Impact Studies and restoration plans. Also engaged in consultation with the Nottawasaga Valley Conservation Authority (NVCA) to determine Terms of Reference, permitting requirements and restoration requirements, and attended a site visit with NVCA to delineate wetland boundaries.

**Biddle and Associates
Ltd., Northglen
Residential
Subdivision
Development**
Clarington, Ontario,
Canada

Natural environment component lead on a dewatering monitoring program at a residential subdivision development in compliance with a Permit to Take Water. Responsibilities included designing, coordinating and managing a wetland vegetation monitoring program for a swamp adjacent to the development. Interpreted data and prepared a baseline report and subsequent monitoring reports during the dewatering phase.

**Residential
Development**

Township of
Springwater, Ontario,
Canada

Project Manager and Natural Environment Component Lead for an Environmental Impact Study of a single-residence development. Responsibilities included coordinating aquatic and terrestrial field data collection and analysis, conducting ELC, wildlife habitat and botanical inventory surveys, interpreting data, and producing an Environmental Impact Study report for the township and conservation authority.

**Residential
Development**

Flamborough, Ontario,
Canada

Project Manager for an Environmental Impact Study for proposed residential development. Responsibilities included preparing a Terms of Reference, coordinating and implementing field data collection and analysis, conducting ELC, botanical inventory and amphibian call count surveys, interpreting data, as well as producing an Environmental Impact Study report for the municipality and conservation authority.

**Residential
Development**

Nobleton, Ontario,
Canada

Project Manager and Natural Environment Component Lead for an Environmental Impact Study of single-residence development. Responsibilities included coordinating aquatic and terrestrial field data collection and analysis, interpreting data, attending agency meetings, as well as producing an Environmental Impact Study report for the municipality and conservation authority.

**Elemental Architects -
Tomken Road Natural
Heritage Study**

Mississauga, Ontario,
Canada

Prepared a scoped Environmental Impact Statement to support a commercial development site plan approval with the City of Mississauga

Barrie Landfill

Barrie, Ontario, Canada

Conducted a tree inventory as part of the environmental assessment for construction of a stormwater pond at the Barrie Landfill.

PROJECT EXPERIENCE – POWER**OPG Deep Geologic
Repository Ecological
Surveys**

Tiverton, Ontario,
Canada

Conducted ecological surveys for the proposed Low and Intermediate Level Waste Deep Geologic Repository Project on the Bruce Power site. Conducted field surveys including rare plant survey, turtle visual encounter surveys, and snake visual encounter surveys, and helped compile the annual report outlining survey results.

**NextEra Canada
Development and
Acquisitions Inc.
Battery Energy Storage
Facility**

Elmira, Ontario, Canada

Conducted the Natural Heritage Assessment to support permitting for the proposed Solid Battery Energy Storage Systems project in Elmira, including a SAR screening, site reconnaissance, preparation of a constraints analysis and identification of permit requirements under the ESA and Conservation Authorities Act.

**Disco Road Organics
Processing Facility**

Toronto, Ontario,
Canada

Prepared the Records Review and Site Investigation reports to support the natural heritage portion of a Renewable Energy Approval.

Majestic and Mayer Wind Energy Project Bruce County, Ontario, Canada	Prepared updates to the Records Review, Site Investigation, Evaluation of Significance, and Environmental Effects Monitoring Plan reports to support the natural heritage portion of a Renewable Energy Approval.
Churchill Wind Energy Project Lambton County, Ontario, Canada	Performed site investigations of overall natural heritage, including ELC and habitat mapping, and bat maternity roost surveys, to support Natural Heritage Assessment portion of Renewable Energy Approval for proposed wind project.
Clarington Wind Energy Project Clarington, Ontario, Canada	Performed evening bat acoustic monitoring surveys to identify bat maternity roosts as part of the Natural Heritage Assessment portion of Renewable Energy Approval for proposed wind project.
Arran Wind Farm Project County of Bruce, Ontario, Canada	Performed site investigations of overall natural heritage, including ELC and habitat mapping, and bat maternity roost surveys, to support Natural Heritage Assessment portion of Renewable Energy Approval for proposed wind project.
Twenty-Two Degrees Wind Farm Project County of Huron, Ontario, Canada	Performed site investigations of overall natural heritage, including ELC and habitat mapping, and bat maternity roost surveys, to support Natural Heritage Assessment portion of Renewable Energy Approval for proposed wind project.
Camlachie Wind Farm Project Camlachie, Ontario, Canada	Conducted site investigations of overall natural heritage to support the natural heritage portion of a Renewable Energy Approval, including wildlife habitat identification, vegetation and habitat mapping, and bat maternity roosting and acoustic surveys.
Armow Wind Farm Project Bruce County, Ontario, Canada	Performed site investigations of overall natural heritage to support the natural heritage portion of a Renewable Energy Approval, including wildlife habitat identification, vegetation and habitat mapping, and bat maternity roosting and acoustic surveys.
Summerhaven Wind Farm Project Haldimand County, Ontario, Canada	Performed site investigations as part of natural heritage assessments to support a Renewable Energy Approval for proposed wind project. Site investigations included wildlife habitat identification, vegetation and habitat mapping, and bat maternity roosting and acoustic surveys.

TRAINING

Surface Miner Training
2012

Argo Safe Operation Course
2012

Defensive Driver Training
Canadian Pro Drivers, 2015

Rail Safe
2019

PROFESSIONAL AFFILIATIONS

Ontario Stone Sand and Gravel Association Ecology Committee

Education

*M.Sc. Physical Geography,
University of Toronto,
Mississauga, 2017*

*B.Sc. (Honours; with
distinction) Biology and
Environmental Science,
University of Toronto,
Mississauga, 2013*

Certifications

*Ontario Wetland Evaluation
System (Ministry of Natural
Resources and Forestry),
2018*

*Federal Reliability
Clearance,
2018*

*Class 2 Backpack
Electrofishing Certificate,
2017*

*Defensive driving
certificate,
2017*

*WHMIS,
2016*

*First Aid and CPR Level C,
2017*

*Pleasure Craft Operator,
2017*

Languages

English – Fluent

Golder Associates Ltd. – Mississauga**Ecologist**

Danielle is a junior ecologist at Golder with over 6 years of experience in conducting ecological studies. Her consulting experience spans multiple sectors including land development, aggregates, oil and gas, power, and mining. She is well-versed in a diverse number of field surveys for plants and wildlife including amphibians, reptiles, birds, bats, and mammals, with a focus on species at risk (SAR). She has also been responsible for delineating and evaluating plant communities according to the Ontario Wetland Evaluation System (OWES) and ecological land classification (ELC). Danielle has extensive technical writing experience relating to compliance with SAR legislation including the preparation of natural heritage assessments, environmental impact studies, and mitigation and monitoring plans, and has authored multiple peer-reviewed scientific manuscripts. She is also trained and experienced in the manual analysis of bat echolocation call recordings.

Employment History**Golder Associates Ltd. – Mississauga****Junior Ecologist (2017 to Present)**

Conduct ecological surveys including avian and turtle nesting, breeding birds, snake and bat hibernacula, species at risk habitat; monitor construction activities and direct location and design of exclusion fencing; prepare technical reports for private and public sectors.

University of Toronto – Mississauga**Research Assistant (2013 to 2017)**

Conducted site set-ups, maintenance, and data collection for 7 field research campaigns in multiple ecosystems including urban and natural wetlands, grasslands, and streams. Conducted site vegetation surveys, sampled soil cores, water levels, and greenhouse gas fluxes. Installed and programmed multiple meteorological stations and hydrological and soil sensors. Conducted stream gauging and monitored multiple stream water quality parameters. Used statistical methods and advanced writing skills to analyze and report ecosystem data.

University of Toronto – Mississauga**Teaching Assistant (2013 to 2017)**

Extensive teaching assistant experience in over 10 Environmental Science courses on theory and field methods relating to ecology, hydrology, soil science, geomorphology, and climatology. Instructed and supervised hundreds of students on field site selections, proper instrument functioning, and data collection, analysis, and presentation during practicals and field trips. Led outdoor tutorials on plant identification, wetland delineation and stream gauging.

*Ontario Ministry of the Environment and Climate Change – Toronto, ON
Fish Contaminants Monitoring Intern (2013)*

Analyzed data and prepared reports for the Fish Contaminants Monitoring Program. Conducted electrofishing using a backpack generator in stream ecosystems. Used various advanced statistical methods to find the best approach to estimate non-detected PCB concentrations in the Great Lakes for a scientific paper. Researched which regional sampling blocks within the Great Lakes could be merged through data analysis of various contaminants, contributing to the annual Guide book publication.

PROJECT EXPERIENCE – ECOLOGY

**CIMA, Consumer's
Drive Extension**

Whitby, Ontario, Canada

Conducted a wetland evaluation using the Ontario Wetland Evaluation System (OWES) to evaluate the potential for a wetland on site to be complexed with an existing Provincially Significant Wetland to the south. Terrestrial communities on the site were also delineated and classified using the ELC system for southern Ontario. Helped prepare the wetland evaluation report for submission to the Ministry of Natural Resources and Forestry.

Wetland Evaluation

Belleville, Ontario,
Canada

Field crew member for a wetland evaluation project on a proposed subdivision development site. Conducted a wetland evaluation using OWES to evaluate the potential for four wetland units to be complexed with an adjacent Provincially Significant Wetland, and helped prepare the wetland evaluation report for submission to the Ministry of Natural Resources and Forestry.

PROJECT EXPERIENCE – SPECIES AT RISK

**Digram Developments
Caledon Inc., Barn
Swallow Monitoring**

Caledon, Ontario,
Canada

Completed field surveys for annual barn swallow monitoring program of compensation structures at a land development site in Caledon.

Cameco Corporation

Port Hope, Ontario,
Canada

Field lead for SAR surveys to identify potential SAR habitat and provided recommendations on species-specific surveys and permits/authorizations required to complete the work.

**American Ginseng
Monitoring Program**

Simcoe County, Ontario,
Canada

Conducted population surveys of American ginseng, designated endangered under the ESA, as part of an annual monitoring program between 2017 and 2019.

Barrie Landfill

Prepared a species at risk awareness plan specific to Eastern Hog-nosed Snake for construction crew at the Barrie Landfill.

**Christie Cookie
Factory**

Toronto, Ontario,
Canada

Performed habitat assessments for species at risk likely to occur on site; investigated the site and surrounding areas for Butternut; assisted in preparing technical memorandum for client.

**Canadian Nuclear
Laboratories**Port Hope, Ontario,
Canada

Conducted high level, large scale desktop-level species at risk screenings including reviews of relevant background materials and databases, including the Natural Heritage Information Center (NHIC), Royal Ontario Museum species at risk range mapping, the Atlas of Breeding Birds of Ontario (OBBA), the Mammal Atlas of Ontario, and Amphibians and Reptiles of Ontario Atlas. The screenings also involved air photo interpretation, desktop ELC delineation and GIS mapping in support of the environmental assessment.

PROJECT EXPERIENCE – POWER**Hydro One - B5C/B6C
Line Refurbishment**Burlington, Ontario,
Canada

Conducted breeding bird surveys, ELC and plant surveys, and turtle surveys annually at various locations in support of line refurbishment.

Hydro One - J5D circuitWindsor, Ontario,
Canada

Monitored construction activities for snakes and hibernacula; performed turtle nesting surveys surrounding transmission towers, established exclusion zones around active avian nests; led a Hydro One crew in establishing turtle and snake exclusion fencing surrounding construction areas.

PROJECT EXPERIENCE – ENVIRONMENTAL ASSESSMENT**1250 Markham Road**Toronto, Ontario,
Canada

Performed investigations of the natural areas bordering the property for new plantings and restoration activity.

PROJECT EXPERIENCE – LAND DEVELOPMENT**SCS Sutton - Schell
Lumber**

Sutton, Ontario, Canada

Field crew lead for multiple wildlife surveys and author of an Environmental Impact Study on a commercial development in Sutton, Ontario.

Fieldgate ResidentialShelburne, Ontario,
Canada

Ecological land classification; conducted a bat habitat assessment; assessed tree clearing activities and delineated existing woodland area.

Prudhommes Landing

Lincoln, Ontario, Canada

Participated in a peer review of an Environmental Impact Statement by evaluating a woodland for provincial significance according to the Natural Heritage Reference Manual.

PROJECT EXPERIENCE – HEALTH & SAFETY**Various sites**

Ontario, Canada

Developed Health and Safety Environment Plans (HaSEP) for multiple environmental assessments and surveys for various sites throughout Ontario.

PROJECT EXPERIENCE – AGGREGATES

**Queenston Quarry
Reclamation Company,
Queenston Quarry
Redevelopment Project**
Niagara-on-the-Lake,
Ontario, Canada

Field crew member for proposed re-development of the former Queenston Quarry. Responsibilities included coordinating field data collection and analysis for an Environmental Impact Study report for the Niagara Escarpment Commission.

**CBM Aggregates (a
division of St. Marys
Cement) - Lanci Pit
Expansion**
Puslinch, Ontario,
Canada

Field crew member for a below-water pit licence application under the Aggregate Resources Act. Responsibilities included coordinating field data collection and analysis, interpreting data in cooperation with other disciplines, and preparing the Level I & II Natural Environment Technical Report.

**North York Sand and
Gravel**
North York, Ontario,
Canada

Established survey stations and performed amphibian call count surveys in support of a proposed expansion to a currently licenced and operation aggregate pit.

**Lafarge Avering and
Sunningdale**
Ontario , Canada

Breeding bird surveys and nest surveys targeted at Barn Swallow in compliance with aggregate resources Endangered Species Act agreements at two Lafarge properties where habitat compensation structures have been constructed. Performed bat hibernacula/maternity roost surveys and habitat assessments; established a bat detector; conducted bat exit surveys.

PROJECT EXPERIENCE – OIL & GAS

**Enbridge Pipelines Inc.
Line 3**
Manitoba, Canada

Field lead for breeding bird surveys in support of brushing and other maintenance activities.

**Enbridge Bayview
Avenue Pipeline
Replacement**
Ontario, Canada

Field survey lead for SAR surveys, natural heritage feature mapping, site investigations, registration of activities (NoA) under the Endangered Species Act and development of mitigation plan.

**TCPL KNC Pipeline
Environmental
Monitoring**
Vaughan, Ontario,
Canada

Field Crew lead for SAR amphibian surveys (western chorus frog) and author of annual monitoring reports.

TransCanada Pipelines
Various Locations,
Ontario, Canada

Species at risk and avian nesting surveys for compliance with pipeline maintenance activities at various locations in southern and central Ontario TransCanada pipeline locations; communicated results and recommendations to the client; conducted follow-up survey to monitor nest progress and completion.

TRAINING

Bat Acoustic Survey Techniques Workshop
Bat Survey Solutions, 2019

PUBLICATIONS**Journal Articles**

Radu, D.D. and T.P. Duval. Precipitation frequency alters peatland ecosystem structure and CO₂ exchange: Contrasting effects on moss, sedge, and shrub communities. *Global Change Biology*, 24(D5) (2018), 10.1111/gcb.14057.

Radu, D.D. and T.P. Duval. Response of hydrology and CO₂ flux to experimentally altered rainfall frequency in a temperate poor fen, southern Ontario, Canada. *Biogeosciences*, 15(13) (2018), 3937-3951.

Radu, D.D. and T.P. Duval. Impact of changing rainfall regime on methane flux from a cool temperate fen depends on vegetation cover. *Ecological Engineering*, 114 (2017), 10.1016/j.ecoleng.2017.06.047.

Duval, T.P. and D.D. Radu. Effect of temperature and soil organic matter quality on greenhouse gas production from temperate poor and rich fen soils. *Ecological Engineering*, 114 (2017), 10.1016/j.ecoleng.2017.05.011.



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