

City of London

W12A Landfill Expansion Environmental Assessment - Biology

Existing Conditions and Impact Assessment Report

Prepared by:

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Date: November 2020

Project #: 60556244

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Revision History

Rev #	Date	Revised By:	Revision Description

November 16, 2020

City of London
300 Dufferin Avenue
London, ON
N6B 1Z2

Project #
60556244

Dear Mr. Wesley Abbott:

**Subject: W12A Landfill Expansion
Environmental Assessment - Biology
Existing Conditions and Impact Assessment Report**

We are pleased to provide the W12A Landfill Expansion Environmental Assessment - Biology Existing Conditions and Impact Assessment Report as supporting documentation to the W12A Landfill Expansion Environmental Assessment.

This Biology Assessment Report has been prepared as a requirement of the Individual Environmental Assessment in accordance with the requirements of The London Plan and London's Environmental Management Guidelines (2007). This report is consistent with the Provincial Policy Statement (2020), the Natural Heritage Reference Manual (2010), and other relevant Provincial and Federal legislation, policies and regulations.

Sincerely,
AECOM Canada Ltd.



Gary A. Epp, M.Sc., Ph.D.
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Senior Ecologist, Environment

JW:jw
Encl.
cc:

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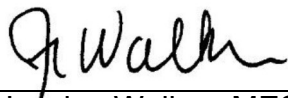
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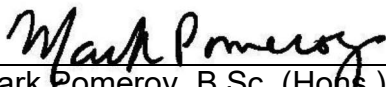


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List of Abbreviations

Abbreviation	Definition
ANSI	Areas of Natural and Scientific Interest
CC	Coefficient of Conservatism
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CWS	Canadian Wildlife Services
DBH	Diameter at Breast Height
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
EASR	Environmental Assessment Study Report
EC-CWS	Environment Canada-Canadian Wildlife Service
EIS	Environmental Impact Study
ELC	Ecological Land Classification
END	Endangered
ESA	Endangered Species Act
FAC	Facultative
FACU	Facultative Upland
FACW	Facultative Wetland
FQI	Floristic Quality Index
HADD	Harmful Alteration, Disruption, or Destruction
HBI	Hilsenhoff Biotic Index
KCCA	Kettle Creek Conservation Authority
LCS	Leachate Collection System
LFG	Landfill Gas
LIO	Land Information Ontario
LSW	Locally Significant Wetland
MBCA	Migratory Bird Convention Act
MECP	Ministry of Environment, Conservation and Parks
MNHSS	Middlesex Natural Heritage Systems Study
MNRF	Ontario Ministry of Natural Resources
MRF	Materials Recovery Facility
NHIC	Natural Heritage Information Centre
NHRM	Natural Heritage Reference Manual
OBBA	Ontario Breeding Bird Atlas
OBL	Obligate Wetland
OMAFRA	Ontario Ministry of Agriculture, Food, and Rural Affairs
O. Reg	Ontario Regulation
PPS	Provincial Policy Statement
PSW	Provincially Significant Wetland
PTE	Permission to Enter
PWQO	Provincial Water Quality Objectives
SAR	Species at Risk
SARA	Species at Risk Act
SWHTG	Significant Wildlife Habitat Technical Guide
SC	Special Concern

SOCC	Species of Conservation Concern
SWH	Significant Wildlife Habitat
SWM	Stormwater Management
TDS	Total Dissolved Solids
THR	Threatened
ToR	Terms of Reference
TSS	Total Suspended Solids
UPL	Upland
UTRCA	Upper Thames Region Conservation Authority
VES	Visual Encounter Survey
WQI	Water Quality Index
WWTP	Wastewater Treatment Plant

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1. Introduction

The City of London is proposing an expansion of the existing W12A Landfill site (the Project) located 3502 Manning Drive, part of Lots 18, 19, and 20 of Concession 6 in the former Township of Westminster, in the south end of the City of London, Ontario.

The environment is considered in broad terms to include the natural, social, cultural, and economic aspects of the environment. This document presents the *Biology* component existing conditions and impact assessment for the Environmental Assessment (EA) of the proposed W12A Landfill expansion. This work has been conducted in accordance with the requirements set out in the approved amended Terms of Reference (ToR), dated February 2019 and the work plan dated October 2019 prepared following commencement of the EA and circulated to the Ministry of Environment, Conservation, and Parks (MECP)/Ministry of Natural Resources and Forestry (MNR)/Conservation Authority.

This report is a supporting document to the Environmental Assessment Study Report (EASR).

1.1 Background

AECOM was retained by the City of London (hereafter referred to as the City) to complete a Biology Study in support of an Individual EA for the proposed expansion of the W12A Landfill within the City of London, Ontario.

All residential residual waste (i.e., waste remaining after reduction, reuse, recycling, composting and resource recovery program) and some business residual waste from the City, is disposed of at the W12A Landfill site. At the current disposal rate, the W12A Landfill's existing approved capacity is expected to be depleted at the end of 2023. As such, the City is developing a Residual Waste Disposal Strategy to provide for the disposal of residual wastes generated from the City for the 25 year period 2024 through 2048.

A previous study (*W12A Landfill Area Plan*) looked at a number of alternatives for managing residual waste and concluded the preferred alternative was the expansion of the W12A Landfill.

The Existing Conditions and Impact Assessment Report for the W12A Landfill site has been prepared to document the existing conditions within and within the vicinity of the W12A landfill, as well as provide an impact assessment for the preferred expansion alternative from a biological perspective. The biology assessment will work to support the decision of the preferred alternative from an environmental perspective for the expansion of the W12A landfill site. This report has been prepared as a requirement of the Individual Environmental Assessment in accordance with the requirements of The London Plan and London's Environmental Management Guidelines (2007). This report is consistent with the Provincial Policy Statement (PPS; 2020), the Natural Heritage Reference Manual (NHRM; 2010), and other relevant Provincial and Federal legislation, policies and regulations.

1.2 Study Area and Surrounding Land Use

The subject lands consist of 234 ha of land which are bounded by Scotland Drive to the north, Manning Drive to the south, White Oak Road to the west, existing agricultural land to the east and includes the existing W12A Landfill located at 3502 Manning Drive, London, Ontario. For the purpose of this report, the Study Area includes a 500 meter area of investigation surrounding the subject property in order to capture natural heritage features and adjacent lands which may be affected by the proposed expansion.

The Study Area is located within the MNRF Aylmer District and in both the Upper Thames Region Conservation Authority (UTRCA) and Kettle Creek Conservation Authority (KCCA) watersheds.

Land Use within the Study Area is comprised predominantly of the existing landfill as well as agricultural lands to the east, west and south, with an aggregate facility and natural heritage features present north of the subject lands.

A review of Map 1 of the London Plan (2017) identifies land use within the Study Area as Waste Management Resource Recovery Area, Farmland, Green Space and Environmental Review. Map 5 of the London Plan (2017) further identifies the following Natural Heritage Features within the Study Area:

- Unevaluated Vegetated Patches
- Unevaluated Wetlands
- Wetlands (i.e., Locally Significant Wetlands)
- Potential Environmentally Significant Area
- Significant Woodlands

Figure 1 illustrates the Study Area in addition to land uses including natural heritage features identified in the London Plan (2017) and MNRF's Land Information Ontario (LIO) mapping.

Maps 1 and 5 of The London Plan are provided in **Appendix A**.

1.3 Background Information Review

A review of background information was completed to identify natural heritage features, as well as flora and fauna known within or in proximity to the Study Area. The following online databases and faunal atlases were reviewed for the W12A Landfill Study Area:

- MNRF's Make-a-Map: Natural Heritage Areas application (NHIC);
- MNRF Land Information Ontario geospatial database information;
- Fisheries and Oceans Canada (DFO) Aquatic Species at Risk mapping;
- Ontario Ministry of Agriculture, Food and Rural Affairs' (OMAFRA) AgMaps online mapping tool;
- Ontario Breeding Bird Atlas (2006); and,
- Ontario Reptile and Amphibian Atlas (Ontario Nature 2015).

Additional studies and reports reviewed for relevant information include the following:

W12A Landfill Area Plan Study – Ecological Background Study and Natural Heritage Study (Earth Tech, 2005);
 Natural Environment Assessment Report (BioLogic Incorporated, 2013);
 Middlesex Natural Heritage Systems Study (MNHSS; Middlesex County, 2014);
 The London Plan (2017);
 City of London Inventory and Evaluation of Woodlands (North-South Environmental Inc., 2009);
 Dingman Creek Watershed Report Card (2017); and,
 Kettle Creek Watershed Report Card (2013).

1.4 Relevant Legislation, Policies and Guidelines

Table 1 below provides a summary of the relevant legislation, policies and guidelines that may apply to the proposed expansion of the W12A Landfill site.

Table 1: Applicable Legislation, Regulations and Guidelines

Level of Governance	Legislation	Policies/Regulations	Guidelines	Applicability to W12A Landfill Project
Federal	<i>Fisheries Act (1985)</i>	Fish Protection Policy Statement	N/A	On June 21, 2019, Bill C-68 (An Act to amend the Fisheries Act and other Acts in consequence) was passed into law. This included several changes to the habitat provisions and associated sections. On August 28, 2019, the habitat provisions came into force. Any proposed work with the potential to

Level of Governance	Legislation	Policies/Regulations	Guidelines	Applicability to W12A Landfill Project
				cause Harmful Alteration, Disruption or Destruction (HADD) of fish habitat or the death of fish needs to be assessed under the Fisheries Act and determination of the need for DFO review as per the Self-Assessment process currently in place.
	<i>Migratory Bird Convention Act (MBCA)(1994)</i>	Regulations Respecting the Protection of Migratory Birds (1994)	N/A	<p>The MBCA affords protection to Birds listed under Article 1 of the <i>Migratory Birds Convention Act</i>.</p> <p>“No person shall disturb, destroy or take a nest, egg [...] of a migratory bird.” (MBCA 1994). Bird nests that are destroyed during construction and/or related activities is referred to as incidental take and is illegal except under the authority of a permit obtained by Canadian Wildlife Services (CWS).</p>
	Species at Risk Act (SARA) (2002)	N/A	N/A	The SARA lists Species at Risk in Canada and affords protection to species listed as Threatened or Endangered, as well as their habitat, on federal land, which includes the internal waters of Canada.
Provincial	Planning Act (1990)	Provincial Policy Statement (2020)	<p>Natural Heritage Reference Manual (2010)</p> <p>Ecoregion Criterion</p>	The PPS, NHRM and Ecoregion Criterion Schedule outline the protection of Natural Heritage Features within Ontario including Significant Wetlands,

Level of Governance	Legislation	Policies/Regulations	Guidelines	Applicability to W12A Landfill Project
			Schedule 7E (2015)	Woodlands and Wildlife Habitat.
	<i>Conservation Authorities Act (1990)</i>	Ontario Regulation 157/06 (Upper Thames River Conservation Authority) Ontario Regulation 97/04 Ontario Regulation 181/06 (Kettle Creek)	Environmental Planning Policy Manual for the Upper Thames River Conservation Authority (June 28, 2006).	The Study Area falls within lands that are regulated by the Kettle Creek Conservation Authority and the Upper Thames River Conservation Authority.
	<i>Fish and Wildlife Conservation Act (1997)</i>	N/A	N/A	The <i>Fish and Wildlife Act</i> affords protection to some species of birds, amphibians, reptiles and mammals in Ontario. Some bird species which are not afforded protection under the federal MBCA are afforded protection through this act (i.e., raptors).
	<i>Endangered Species Act (ESA)(2007)</i>	Ontario Regulation 242/08 Ontario Regulation 230/08	N/A	The <i>ESA</i> and its associated regulations list Species at Risk within Ontario and afford protection to species listed as Threatened or Endangered, as well as their habitats.
Municipal	City of London Official Plan (2006) The London Plan (2016) – currently under appeal	Environmental Policies (Section 15)	Environmental Management Guidelines (2007)	These documents outline the City's objectives and policies to guide the physical development of all lands found within the boundaries of the municipality.
	City of London Tree Protection By-law (2016)	N/A	Tree Planting and Protection Guidelines (2015)	The City of London's Tree Protection by-law outlines the requirements for a tree removal permit within the City of London.

Level of Governance	Legislation	Policies/Regulations	Guidelines	Applicability to W12A Landfill Project
				Note: The City of London is exempt from this by-law.

1.5 Study Scope

A work plan and description of existing conditions were prepared for this study on October 17, 2017 for inclusion in the ToR. The work plan was expanded upon in May 2019 for review by the MNRF. The work plan outlined the surveys to be completed during field investigations in order to characterize existing aquatic and terrestrial ecosystems within the Study Area.

The ToR was submitted to the MECP in October 2018, with an amended version submitted in February 2019 for MECP review and approval.

Appendix B provides a copy of the Terms of Reference for the Biology Assessment component of the Environmental Assessment.

1.6 Agency Consultation

On October 16th and 17th, 2017, information requests were sent to Kathleen Buck at the Aylmer District of the MNRF and Christine Creighton at the UTRCA, respectively. On October 30th, 2018, an information request was also sent to Joe Gordon at the KCCA requesting the following information:

- Presence of Natural Areas (Environmentally Significant Areas, Provincially Significant Wetlands, Areas of Natural and Scientific Interest, Provincial Parks, Conservation Reserves and Wildlife Management Areas);
- Natural Area Reports;
- Species at Risk Occurrences and potential to occur;
- Identification of Restricted species;
- Rare Species Occurrences (locally and provincially rare);
- In-water Timing Restrictions;
- Important Commercial or Recreation Fisheries;
- Water Quantity/Quality Data;
- Groundwater Discharge Areas;
- Watercourse Names, Thermal and Flow Regimes;
- Fish Habitat Sensitivity;
- Habitat Information and Location;
- Fisheries Management Objectives/plans;
- Fish Community Records;
- Benthic Invertebrate data;
- Known fish spawning;
- Aboriginal Fisheries; and,
- Significant Wildlife Habitat or Wildlife use of the area.

On December 15th, 2017 an email response was received from Kathleen Buck. A response was also received from Cari Ramsey of the UTRCA on October 30th, 2018 and on November 19th, 2018 a response was received from Jennifer Dow of the KCCA. Agency Correspondence can be found in **Appendix C**.

Additional information regarding natural heritage features for the Study Area is provided in the Middlesex Natural Heritage System Study prepared by the UTRCA. Relevant mapping of natural heritage features is provided in **Appendix D**.

2. Existing Conditions

The following sections provide a description of the existing physical and natural heritage features within the Study Area.

2.1 Physical Features and Functions

2.1.1 Terrain and Drainage

The northern portion of the W12A Landfill Study Area is located within the Dingman Creek subwatershed and the southern portion within the Dodd Creek subwatershed. The northern portion of the Study Area slopes gently towards the northwest where the Silver Swamp Locally Significant Wetland (LSW) is located adjacent to the subject lands (see **Figure 2**). The southern portion of the Study Area slopes gently to the south. The highest elevation occurs within the subject lands on the landfill itself and slopes to the north and south to low points where tributaries of Dingman Creek and Dodd Creek drain to the northwest and south, respectively. The northwest flow passes through the Silver Swamp LSW and continues to Dingman Creek. Cultivated agricultural lands occupy the majority of the Study Area, with the active W12A landfill, natural features, cemetery, material recovery facility, aggregate pits and rural residences occupying the remainder.

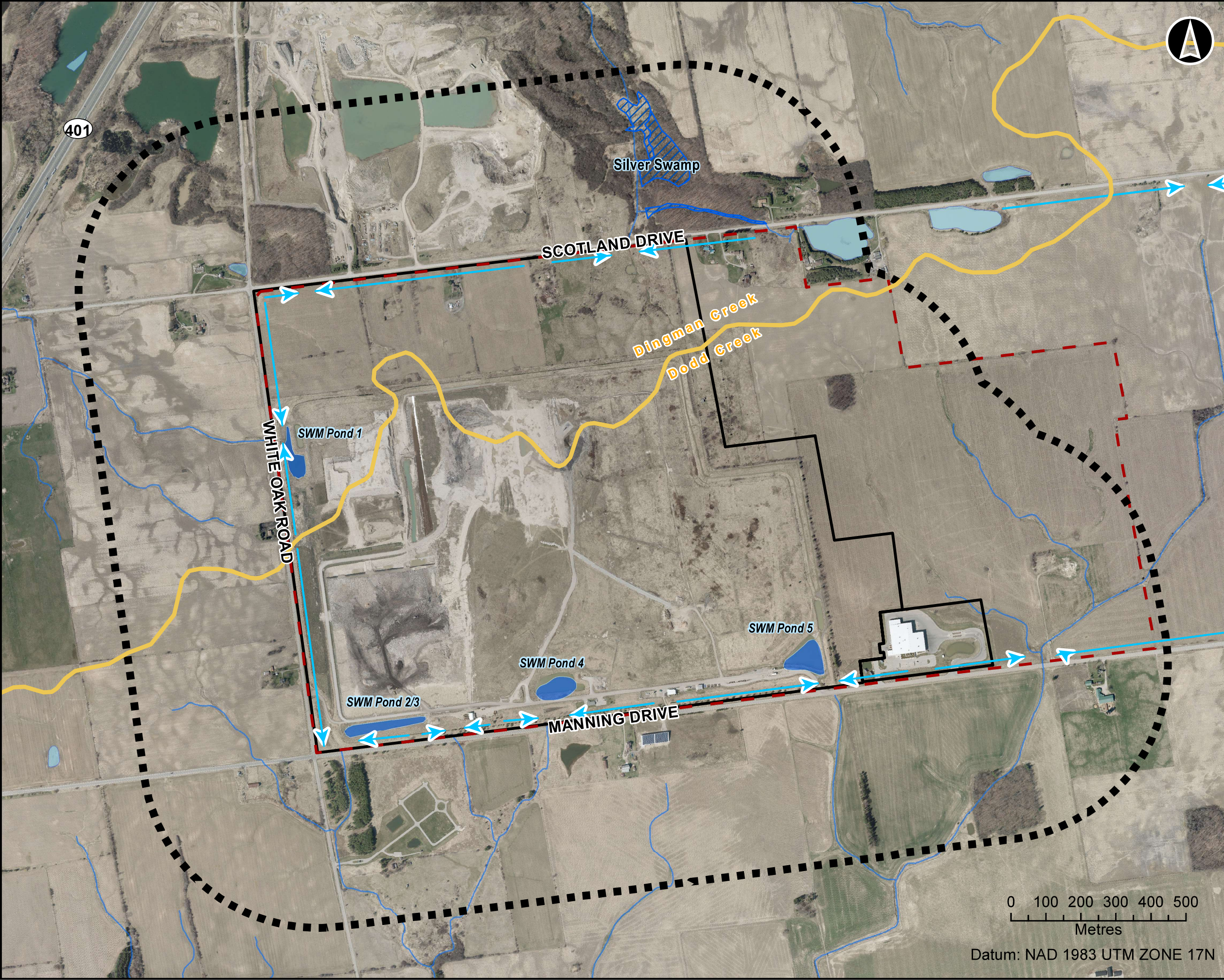
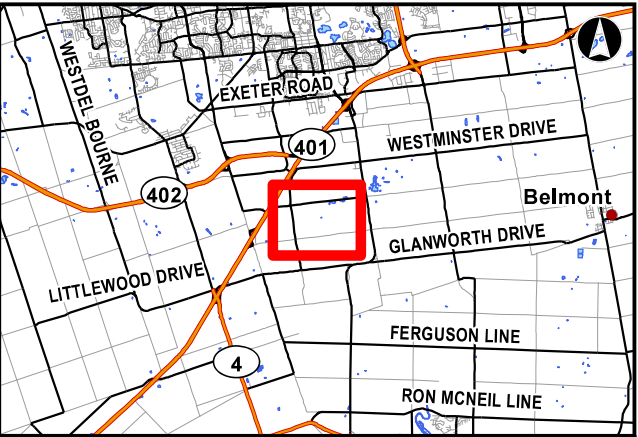
2.1.2 Soils

According to Middlesex County soils data (Hagerty and Kingston 1992), the following soil associations are noted for the site and surrounding area:

- The Muriel Association – Drainage is moderately well to imperfect. Textures range between silt loam, loam and silty clay loam. Parent material is clayey glacial till.
- The Burford Association – Drainage is rapid to imperfect. Textures range from loam to fine sandy loam. Parent material is glaciofluvial outwash.

Most slopes are mapped as simple and less than 5% with some complex slopes greater than 5%. These conditions were also observed during site investigations. In general, soils for this region are predominantly grey-brown podzols (Chapman and Putnam 1984).

The W12A landfill has a 15-20 m underlay of low permeability clay till below which is a 2-8 m sandy layer and then a 20 m thick clayey till. The presence of these low permeable soils mean that the landfill footprint does not affect the groundwater flows or contributions to adjacent natural heritage features.



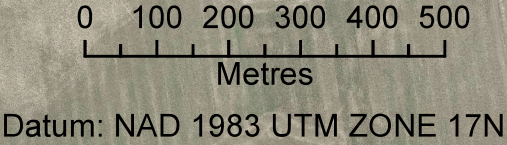
- Legend**
- Drainage Direction
 - Watercourse
 - Waterbody
 - Ponds and Stormwater Management Facilities
 - Site Study Area
 - Site-vicinity Study Area
 - Waste Management Resource Recovery Area Boundary
 - Locally Significant Wetlands
 - Subwatershed Boundary

W12A Landfill Expansion
Biology Assessment

Terrain and Drainage within the Study

November 2020	1:10,500 <small>* when printed 11"x17"</small>	Source: LIO, City of London
P#: 60556244 AECOM		Figure 2

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2.2 Natural Heritage Features

2.2.1 Field Investigations Summary

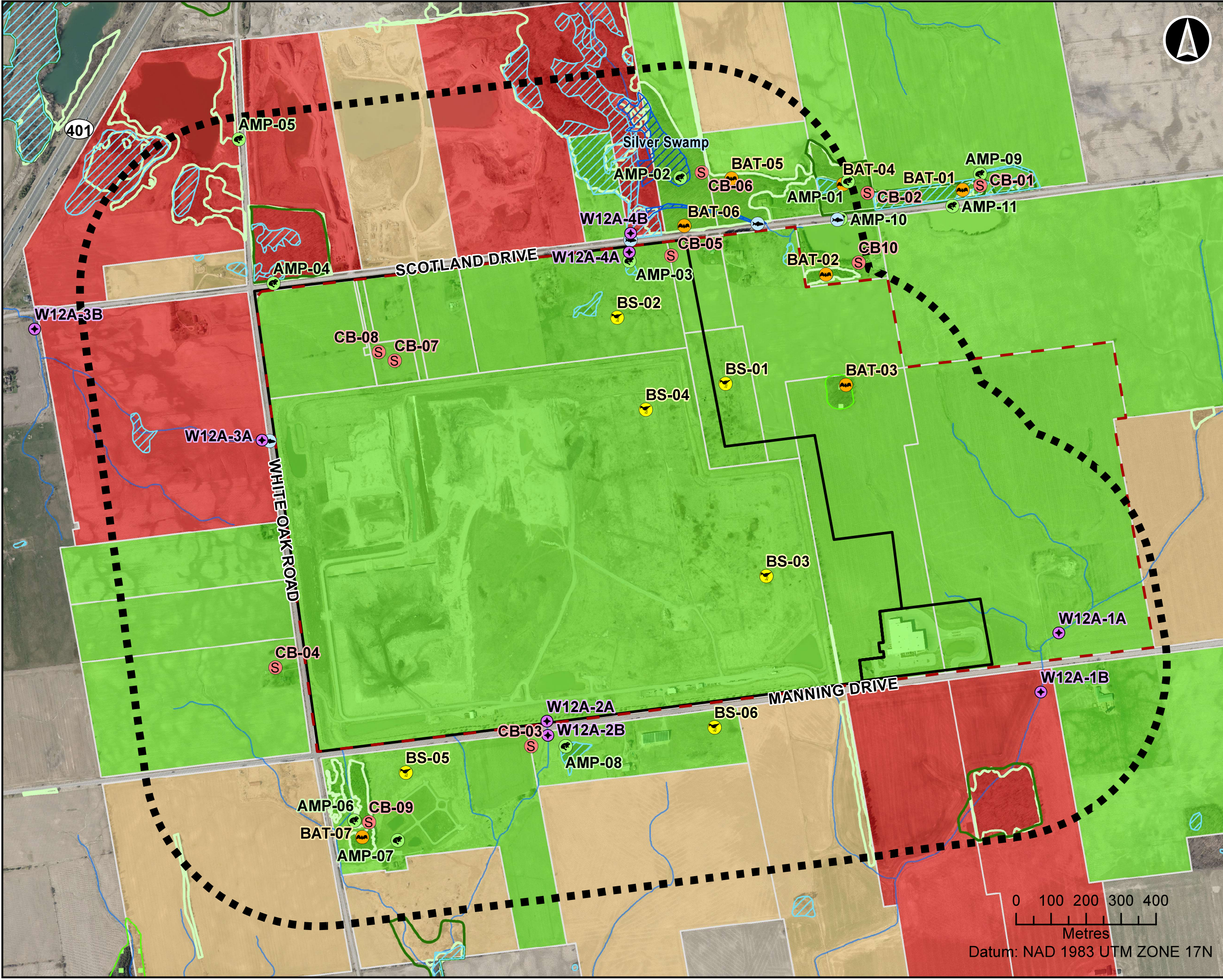
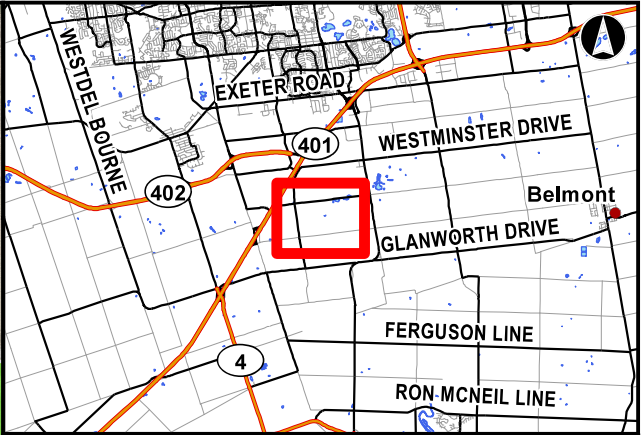
Field investigations for the Study Area were intended to provide a comprehensive inventory of ecological features, and local flora and fauna. Field investigations completed by AECOM included: aquatic habitat assessments, vegetation community (Ecological Land Classification) delineation, snake cover board surveys, floral species inventories, anuran call surveys, breeding bird surveys, bat habitat assessments, lepidoptera/odonata surveys, a vernal pools assessment as well as a Significant Wildlife Habitat (SWH) assessment.

Benthic Invertebrate Surveys were completed by StraightUp Environmental in April 2018.

Prior to commencing field investigations, properties requiring Permission to Enter (PTE) were identified using aerial photography and property parcel mapping. AECOM prepared notification letters to individual landowners, which described the nature of the studies (i.e., ecological field investigations), the anticipated timing of each investigation and request to enter their property. A total of thirty-one (31) PTE letters were issued by the City of London for properties within the study area.

Twenty-five (25) signed PTE letters granting property access were received from landowners. Where site access was not granted, field investigations were completed roadside or within an adjacent property with granted access. **Figure 3** displays the PTE status for the Study Area.

The location of the anuran call, aquatic habitat assessment, benthic invertebrate surveys, snake coverboard and breeding bird field investigation surveys completed within the Study Area can also be found on **Figure 4**.



- Legend**
- Watercourse
 - Wooded Area (MNRF, 2018)
 - Parcel Fabric
 - Site Study Area
 - Site-vicinity Study Area
 - Waste Management Resource Recovery Area Boundary
- Natural Heritage Features (2017)**
- Locally Significant Wetlands
 - Unevaluated Wetland
 - Significant Woodland
 - Unevaluated Vegetation Patch
- Field Survey Location**
- Snake Coverboard Location
 - Anuran Call Survey Location
 - Aquatic Survey Location
 - Benthic Survey Location
 - Breeding Bird Survey Location
- Permission To Enter (PTE)**
- Aquired
 - PTE Not Gained
 - No Access Needed

W12A Landfill Expansion
Biology Assessment

Field Investigation Locations

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The remaining surveys were not confined to a specific location and are therefore not displayed on this figure. **Table 2** summarizes all field investigations completed for the Study Area.

Table 2: Field Investigations Summary

Field Investigation/Survey	Date	Investigators
Anuran Call Surveys	April 23 rd 2018 May 9 th 2018 May 31 st 2018 July 3 rd 2018	Emily McNaughton and Alex McKinstry Emily McNaughton and Jack Brand Nataliya Simonova and Andrew Minielly Emily McNaughton and Jack Brand
Aquatic Habitat Assessments	June 14 th 2018	Olivia Butty and Andrew Aberdein
Benthic Invertebrate Surveys	June 5, 2018	StraightUp Environmental
Vernal Pool Surveys	April 24 th 2018	Nataliya Simonova and Emily McNaughton
Bat Habitat Assessment	April 23 rd 2018 April 24 th 2018 May 7 th 2018 May 31 st 2018	Emily McNaughton and Nataliya Simonova Emily McNaughton and Nataliya Simonova Emily McNaughton and Nataliya Simonova Andrew Minielly and Nataliya Simonova
Snake Cover Board & Area Searches	April 24 th , 2018 May 31 st 2018 July 20 th 2018 July 27 th 2018 August 9 th 2018	Emily McNaughton and Nataliya Simonova Andrew Minielly and Nataliya Simonova Matthew Ross and Emily McNaughton Matthew Ross and Kasey McKenzie Kasey McKenzie and Nataliya Simonova
Breeding Bird Surveys	June 7 th 2018 June 18 th 2018 June 28 th 2018	Matthew Ross and Nataliya Simonova Matthew Ross and Edyta Ratajczyk Matthew Ross and Emily McNaughton
Lepidoptera and Odonata Surveys	July 20 th 2018 July 27 th 2018 August 9 th 2018	Matthew Ross and Emily McNaughton Matthew Ross and Kasey McKenzie Kasey McKenzie and Nataliya Simonova
Ecological Land Classification	April 23 rd 2018 May 7 th 2018 May 31 st 2018 June 7 th 2018 July 20 th 2018 July 27 th 2018 August 9 th 2018 October 23 rd 2018	Nataliya Simonova and Emily McNaughton Nataliya Simonova and Emily McNaughton Nataliya Simonova and Andrew Minielly Nataliya Simonova and Matthew Ross Matthew Ross and Emily McNaughton Matthew Ross and Kasey McKenzie Kasey McKenzie and Nataliya Simonova Nataliya Simonova and Matthew Ross
Floral Inventory	April 23 rd 2018 May 7 th 2018 May 31 st 2018 June 7 th 2018 July 20 th 2018 July 27 th 2018 August 9 th 2018 October 23 rd 2018	Nataliya Simonova and Emily McNaughton Nataliya Simonova and Emily McNaughton Nataliya Simonova and Andrew Minielly Nataliya Simonova and Matthew Ross Matthew Ross and Emily McNaughton Matthew Ross and Kasey McKenzie Kasey McKenzie and Nataliya Simonova Nataliya Simonova and Matthew Ross
Significant Wildlife Habitat Survey	April 23 rd 2018 May 7 th 2018 May 31 st 2018	Nataliya Simonova and Emily McNaughton Nataliya Simonova and Emily McNaughton Nataliya Simonova and Andrew Minielly

Field Investigation/Survey	Date	Investigators
	June 7 th 2018	Nataliya Simonova and Matthew Ross
	July 20 th 2018	Matthew Ross and Emily McNaughton
	July 27 th 2018	Matthew Ross and Kasey McKenzie
	August 9 th 2018	Kasey McKenzie and Nataliya Simonova
	October 23 rd 2018	Nataliya Simonova and Matthew Ross

Methods for the investigations noted above are described in **Section 2.2.2** and **Section 2.2.3**.

2.2.2 Aquatic Ecosystems

The following section documents the existing aquatic conditions within the Study Area. Aquatic ecosystems are those associated with bodies of water such as, but not limited to, pools, ponds, lakes, rivers, streams and wetlands. Aquatic ecosystems provide habitat for a variety of wildlife species, some of which are rare or sensitive. Aquatic systems and the species which are known in the area were identified through background review of secondary sources and the completion of site investigations.

Background

A review of the background information as outlined in **Section 1.2** identified the following six (6) Municipal Drains within the Study Area (OMAFRA, 2019): Shore Drain, Sterling Drain, W12A Municipal Drain (all within the Dodd Creek subwatershed), Gouge Drain, Bannister-Johnson Drain, and C.B. Smith Drain (all within the Dingman Creek subwatershed). These watercourses have been altered (e.g., channelized) to facilitate drainage for surrounding land use.

The northern portion of the Study Area is located in the Dingman Creek subwatershed and within the jurisdiction of the Upper Thames River Conservation Authority (UTRCA). The Dingman Creek subwatershed is situated in the agricultural heartland of southwestern Ontario in close proximity to Lakes Huron, St. Clair and Erie. The subwatershed drains 176 square kilometres of land, and ultimately flows into the Thames River.

According to the Dingman Creek Watershed Report Card (2017), the watershed is comprised of 56% agricultural, 24% urban, 18% natural cover, 1% aggregates and 1% water. There are 46 fish species and 13 freshwater mussels recorded within the watershed, with specific gamefish including Smallmouth Bass (*Micropterus dolomieu*), Largemouth Bass (*Micropterus salmoides*), Black Crappie (*Pomoxis nigromaculatus*), Northern Pike (*Esox lucius*), and Brown Trout (*Salmo trutta*). The Report Card identifies one fish SAR, Silver Shiner (*Notropis photogenis*), under the *Endangered Species Act* (ESA) and one species at risk (SAR) mussel species, Rainbow (*Villosa iris*), under the *Species at Risk Act* (SARA) recorded within the watershed. A review of Fisheries and Oceans Canada (DFO) SAR Habitat Mapping indicates that no aquatic SAR have been identified within the Study Area. The Ontario Ministry of Natural Resources and Forestry (MNR) and the UTRCA did not have any fish, benthic or mussel data pertaining to the Study Area beyond those data reported in the Watershed Report Card. The Natural Environment Assessment Report completed by BioLogic Incorporated (2013) for Aaroc Aggregates Limited indicates that the Bannister-Johnson Drain provides warm water habitat for small-bodied fish species.

The southern portion of the Study Area is located within the Dodd Creek subwatershed, which is part of Kettle Creek watershed under the jurisdiction of the Kettle Creek Conservation Authority (KCCA). According to the Kettle Creek Watershed Report Card (2013), the Dodd Creek subwatershed is the largest tributary of the main branch of Kettle Creek. It is located within an area of extensive agricultural land use with few natural areas and little wetland cover, disturbed riparian zones and altered stream reaches. These characteristics result in warm water temperatures, rapid water level fluctuation, and poor surface water quality. Thirty species of fish are found in the Dodd Creek subwatershed.

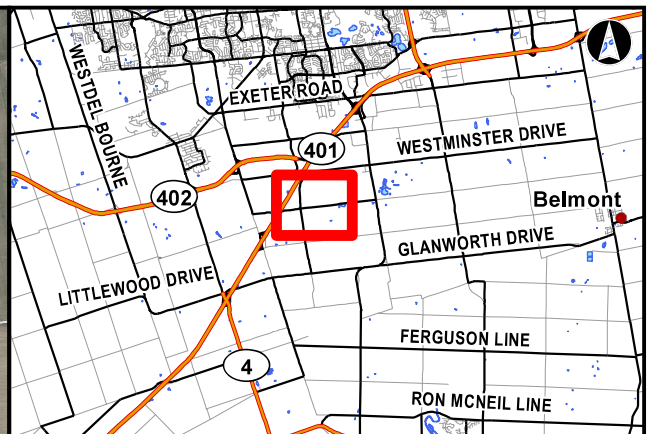
Fish community data collected on August 17, 2018 from Shore Creek Drain at Manning Drive provided by the KCCA (**Appendix C**) indicated the following small-bodied fish species were present: Johnny Darter (*Etheostoma nigrum*), Creek Chub (*Semotilus atromaculatus*), Brook Stickleback (*Culaea inconstans*), and Bluntnose Minnow (*Pimephales notatus*). Sampling at another site within Shore Creek Drain at Glanworth Drive south of the Study Area on August 30th, 2018 found the above species as well as White Sucker (*Catostomus commersonii*) and Blacknose Dace (*Rhinichthys atratulus*). Other sampling sites, including benthic and water quality sites, were located well outside of the Study Area. A review of DFO SAR Habitat Mapping indicates that no aquatic SAR have been identified within the Study Area.

Field Investigation Methods

Aquatic Habitat Assessment

Potential aquatic natural heritage features were identified within the Study Area from aerial photography and agency mapping. Detailed aquatic habitat assessments were undertaken on July 14, 2018 to confirm aquatic natural heritage features and document aquatic existing conditions. The location of aquatic surveys is shown on Figure 3 and a photographic log of aquatic features is provided on **Figure 4**. Criteria recorded during the aquatic habitat assessment were:

- Documentation of surrounding natural features and land uses (e.g., wetland, agriculture, etc.);
- Channel dimensions, substrate composition, bank stability, and channel morphology including:
 - Runs - typically deep, fast moving water with little to no turbulence of water;
 - Riffles - shallow, fast moving water typically running over rocks; riffles providing areas of high oxygenation;
 - Flats - low flowing water with a smooth un-agitated surface;
 - Pools - are described as deep pockets of slow moving water that provide ideal habitat for fish;
- Substrate composition (i.e., clay, silt, sand, gravel, cobble, rock, boulder, muck and detritus);



- Legend**
- Photo Location and Direction
 - Watercourse
 - Waterbody
 - Parcel Fabric
 - Site Study Area
 - Site-vicinity Study Area
 - Waste Management Resource Recovery Area Boundary

W12A Landfill Expansion Biology Assessment		
Aquatic Existing Conditions		
August 2020	1:9,000 <small>* when printed 11"x17"</small>	Source: LIO, City of London
P#: 60556244		Figure 4
AECOM		
<small>This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or relied upon by third parties, except as agreed by AECOM and its client, as required by law or for use by governmental reviewing agencies. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without AECOM's express written consent.</small>		

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- Indicators of water quality; water clarity, water colour, presence and type of macrophytes and algal growth, evidence of runoff;
- Basic field parameters such as pollution sources (i.e. tile drain discharges, other piped discharges and road runoff); and,
- Suitable fish habitat parameters.

Results and Discussion

Aquatic Habitat Assessment

Bannister-Johnson Drain

The Bannister-Johnson Drain crossing at 3713 Scotland Drive was assessed upstream (south) of the roadway crossing. The watercourse consisted of an intermittent channel with sloping valley topography surrounding the watercourse. The surrounding land use upstream was meadow and an agricultural drainage pond adjacent to the watercourse with agricultural land use beyond. Evidence of overland flow (bent grasses) providing inputs from additional drainage features was present. Channel dimensions were assessed to have a mean wetted width of 0.30 m and mean wetted depth of 0.05 m. The pond dimensions were approximately 21 m wide by 21 m long. Channel banks were well vegetated and stable. Substrate was composed predominantly of muck, with lesser amounts of detritus. Dense (90%) in-stream cover was provided by aquatic vegetation, both emergent and submergent. The channel morphology consisted of pools of standing water. Low flow barriers to fish passage were present in the form of intermittently dry sections of watercourse. The watercourse may provide marginal fish habitat and potential warm water refuge habitat within the agricultural drainage pond during high flow conditions, but connectivity downstream to fish bearing watercourses could not be assessed due to PTE restrictions. However, based on watercourse characteristics and aerial photo interpretation, the Bannister-Johnson Drain and the adjacent pond have the potential to support fish and fish habitat that are regulated under the *Fisheries Act*. No important or exceptional fish habitat was observed.

Unnamed Pond (3405 Scotland Drive)

The waterbody was a permanent offline pond with rolling hill topography surrounding the waterbody. The surrounding land use was residential southeast of the pond and a plantation tree-row along the southern bank and forest beyond. The pond dimensions were approximately 90 m wide and 170 m long. Water depth at the northern bank was approximately 0.4 m, but high turbidity prevented an estimation of water depth deeper in the pond. Inputs into the pond from roadside and residential drainage were present, as was a dry overflow drain crossing under Scotland Drive at the northeast portion of the pond. Waterbody banks were stable and sparsely vegetated with low (0-30%) cover provided predominantly (90%) by willow trees and small patches (10%) by herbaceous common reed (*Phragmites australis*). High turbidity prevented assessment of substrate composition. The pond has the capacity to support fish species, but none were observed. Furthermore, the pond is offline. Since the pond is offline, it does not have the potential to support fish and fish habitat that is regulated under the *Fisheries Act*.

Unnamed Drain (3502 Scotland Drive)

The watercourse upstream (south) of Scotland Drive was channelized for 10 m leading from a buried plastic culvert and dry at the time of assessment, while downstream (north) the channel was intermittent and increasingly defined with more standing water further downstream away from the Study Area. The topography was rolling hills with surrounding land use of forest with residential and agricultural land beyond. The watercourse received roadside drainage inputs from ditches along Scotland Drive. The bankfull depth where the watercourse became more defined downstream was approximately 0.3 m. The banks at this location were stable and had high (90-

100%) canopy cover provided by trees and grasses. Substrate was composed entirely of muck within the channel. Low flow barriers to fish passage were present in the form of intermittently dry sections of watercourse. The watercourse may provide marginal fish habitat during high flow conditions, but connectivity downstream to fish bearing watercourses could not be assessed due to limited PTE. However, based on watercourse characteristics, the unnamed drain has the potential to support fish and fish habitat that is regulated under the *Fisheries Act*. No important or exceptional fish habitat was observed.

C.B. Smith Drain

The C.B. Smith Drain crossing under White Oaks Road from the W12A Landfill site downstream onto 4067 Scotland Drive was assessed from the road right-of-way. The watercourse was intermittent and dry at the time of assessment where it crosses White Oak Road, but flow was present further downstream where the watercourse crosses Scotland Drive outside the 500 m area of investigation. Existing conditions within the watercourse on the property at 4067 Scotland Drive could not be assessed due to limited PTE. The topography was sloping toward the watercourse and surrounding land use was agricultural downstream at 4067 Scotland Drive and landfill upstream at the W12A Landfill site. Channel dimensions at the Scotland Drive crossing were a wetted width of 0.5 m and wetted depth of 0.1 m. In-stream cover was provided by algae and aquatic vegetation. Substrate was composed of 60% muck, 30% silt, and 10% cobble. The channel morphology was 90% standing pool and 10% run. The watercourse may provide marginal fish habitat at the Scotland Drive crossing, but no fish were observed and this watercourse crossing was outside the 120 m Study Area buffer; however, incidental observations of fish within the C.B. Smith Drain at the White Oak Road crossing were recorded during benthic sampling when a precipitation event provided flow in the channel (see the StraightUp Environmental Consulting W12A Landfill Benthic Water Quality Report in **Appendix E**). Since C.B. Smith Drain is connected to other fish bearing watercourses downstream and supports fish and fish habitat, it is regulated under the *Fisheries Act*. However, no important or exceptional fish habitat was observed.

Benthic Invertebrates

Water chemistry parameters measured during benthic invertebrate sampling documented high conductivity, total dissolved solids (TDS), and salinity in at least one sampling reach within each site (**Table 3**). The Provincial Water Quality Objectives (PWQO) do not provide specific guidance for these parameters. Additionally, the water quality measurements were taken during a precipitation event, which may have contributed to an increase in these parameters due to increased flow from surrounding roadways and agricultural runoff.

Table 3: Water Chemistry Parameter Results

Reach	Temperature (°C)	Conductivity (µS/cm)	Total Dissolved Solids (mg/l)	Salinity (Practical Salinity Units)	Dissolved Oxygen (mg/l)	pH	Turbidity	Algae
W12A-1A	15.85	649	0.422	0.32	5.82	7.44	Turbid	Sparse
W12A-1B	14.67	2013	1.311	1.04	7.21	7.48	Turbid	Sparse
W12A-2A	19.14	5791	3.81	3.23	5.94	6.80	Turbid	Sparse
W12A-2B	16.47	1701	1.106	0.87	5.89	7.27	Turbid	Sparse
W12A-3A	15.33	2156	1.403	1.11	3.78	6.97	Turbid	Sparse
W12A-3B	15.59	469	0.304	0.23	8.73	7.51	Turbid	Sparse
W12A-4A	14.56	651	0.423	0.32	6.39	7.06	Turbid	Sparse
W12A-4B	13.57	2048	1.329	1.05	7.12	7.30	Turbid	Sparse

All sites sampled had a BioMAP Water Quality Index (WQI) rating less than 14, which indicated the water quality was impaired under the protocol (**Table 4**). Similarly, the Hilsenhoff Biotic Index (HBI) rating was above 7.26 for all sites indicating very poor water quality and severe organic pollution was likely. The predominantly agricultural surrounding land use may have contributed to these indices scores and acted as a source of organic pollution. Complete benthic invertebrate sampling results are provided in the StraightUp Environmental Consulting W12A Landfill Benthic Water Quality Report in **Appendix E**.

Table 4: Benthic Water Quality Indices Results

Standard	Reach							
	W12A-1A	W12A-1B	W12A-2A	W12A-2B	W12A-3A	W12A-3B	W12A-4A	W12A-4B
Average BioMap WQI	1.36	2.46	1.29	1.11	1.722	3.449	2.69	3.09
Hilsenhoff Biotic Index	9.34	8.81	9.65	9.95	8.5	7.281	8.85	8.66

2.2.3 Terrestrial Ecosystems

The following sections document the existing terrestrial conditions within the Study Area. Terrestrial ecosystems are those associated with land including, but not limited to, forests, meadows, thickets and wetlands. Ecosystems and species identified within the Study Area during the background review and site investigations are described in detail below.

Vegetation Communities

Background

A review of the background information as outlined in **Section 1.3** identified the following natural heritage features within the Study Area:

- Potential Environmentally Significant Area on the north side of Scotland Drive (Vegetation Patch #10121);
- Unevaluated vegetation patches north of Scotland Drive (vegetation patches #10120 and #10122);
- Unevaluated vegetation patches south of Manning Drive (vegetation patch #11068);
- Unevaluated wetlands north of Scotland Drive;
- Locally Significant Wetland north of Scotland Drive (Silver Swamp); and,
- Significant Woodlands (vegetation patches #10120, #10122, and #11068) and an Unevaluated Vegetation Patch at the north end of the property at 3438 Manning Drive.

Field Investigation & Analysis Methods

The following section outlines the methods used to assess the vegetation communities within the Study Area.

Vegetation Community Classification & Delineation – Each vegetation community within the Study Area was assessed and classified into Ecological Land Classification (ELC) units as per the MNRF guidelines (Lee et al, 1998). This system provides a standard for comparing similar communities across Ontario and classifies vegetation communities through the completion of a multilayer (canopy, sub-canopy, ground cover) vegetation inventory. A summary of disturbance factors, community conditions, plant species list and representative photographs were also recorded for each vegetation patch. The plant list was established through the completion of a three season floral species inventory completed in the spring, summer and fall of 2018. Where wetland communities were encountered, the wetland boundary delineation was refined using the 50/50 rule (i.e., 50% of plants were comprised of wetland plant species and 50% were comprised of upland plant species) as per the MNRF Wetland Evaluation Guidelines for Southern Ontario (OMNRF 3rd Edition, 2013).

Where property access was not granted, communities were identified and delineated through a combination of roadside and aerial imagery interpretation or through the review of previously completed reports. Species lists for these communities are truncated due to limited visibility and in some instances were limited to genus.

Variables captured in the field were used to determine numerous indices which provide insight into the vegetation community quality and sensitivity. The variables included species richness (i.e., the number of species within a community), Coefficient of Conservatism (CC), Floristic Quality Index (FQI), Weediness Index and Wetness Index.

Vegetation community sensitivity was based on the Floristic Quality Assessments System for Southern Ontario (Oldham *et al.*, 1995) which included the calculation of the *Mean Coefficient of Conservatism*, the *Floristic Quality Index* and the *Weediness Index* for all wetland communities and quadrats located within the Study Area. These three parameters are intended to be used together in order to assign an ecological community sensitivity ranking based on plant species composition. The ranking is not intended to provide a measure of the overall value of a community, but rather reflects the sensitivity of the community to disturbance based on the grouping of plants present within the community. The following provides a summary of the parameters used to assess community sensitivity:

Coefficient of Conservatism

These values range from 0 (low) to 10 (high) and are based on species tolerance to disturbance and fidelity to a specific habitat. Vegetation species and community sensitivity were assessed through the application of CC values, assigned to each native species in southern Ontario (Oldham *et al.*, 1995). The occurrence of species with a CC of 9 or 10 can be indicators of undisturbed habitats such as mature forests, fens or bogs. General habitat values associated with CC values are:

- 0 – 3** Species found in a wide variety of communities including disturbed sites.
- 4 – 6** Species associated with a specific community; tolerate to moderate disturbance.
- 7 – 8** Species associated with a community in an advanced successional stage, tolerant of minor disturbances.
- 9 – 10** Species with a high degree of fidelity to a narrow range of ecological parameters.

Floristic Quality Index

The floristic quality of an area is reflected in the mean value of CC. The FQI is an indication of native vegetation quality for a vegetation community area. The following summarizes the FQI rankings:

- 1-19** Indicates low vegetative quality
- 20-35** Indicates high vegetative quality and high-quality aquatic resources
- > 35** Indicate "Natural Area" quality.

$$\text{FQI} = \text{mean CC} \times \sqrt{N}$$

Where $\sqrt{N}$ is the square root of the number of native species observed.

Weediness Index

The sensitivity of natural areas can be assessed through application of the Weediness Index. The Weediness Index quantifies the potential invasiveness of non-native plants. In combination with the percentage of non-native plants, this value can be used as an indicator of disturbance. Values ranging from -1 (low) to -3 (high) have been assigned to most non-native species based on the potential impact each species can have in natural areas:

- (-1)** Little or no impact on natural areas (most non-native plants fall into this category)
- (-2)** Occasional impacts on natural areas; generally infrequent or localized
- (-3)** Major potential impacts on natural areas; very invasive

Wetness Index

All plants in southern Ontario have been assigned a wetland category, based on the designations developed for use by the United States Fish and Wildlife Service. Plants are designated into the following categories:

- OBL (Obligate Wetland)** occurs almost always in wetlands under natural conditions (estimated >99% probability)
- FACW (Facultative Wetland)** usually occurs in wetlands, but occasionally found in non-wetlands (estimated 67-99% probability)
- FAC (Facultative)** equally likely to occur in wetlands or non-wetlands (estimated 34-66% probability)
- FACU (Facultative Upland)** occasionally occurs in wetlands, but usually occurs in non-wetlands (estimated 1-33% probability)
- UPL (Upland)** occurs almost never in wetlands under natural conditions (estimated <1% probability)

Further refinement of the Facultative categories is denoted by a "+" or "-" to express exaggerated tendencies for those species. The "+" denotes a greater estimated probability occurring in wetlands than species in the general indicator category, but a lesser probability than species occurring in the next higher category. The "-" denotes a lesser estimated probability of occurring in wetlands than species in the general indicator category, but a greater probability than species occurring in the next lower general category. Each wetland

category has been assigned a numerical value to facilitate the quantification of the wetness index.

Natural Heritage Features Mapping - A mapping exercise was completed to identify and delineate natural heritage features within the Study Area. This exercise included a compilation of digital vegetation layers obtained through the background information review as well as ELC community identification and delineation through the completion of field investigations and aerial photo interpretation as described above. Mapping of natural heritage features within the Study Area was completed following the guidelines outlined in the Middlesex Natural Heritage System Study (MNHSS; 2014). To maintain a consistent approach with that undertaken during field investigations, ELC community terminologies were used in place of the MNHSS defined Vegetation Communities. Following the MNHSS (2014), Vegetation Groups were established by grouping vegetation communities of similar structure within 20 m of each other. This assessment resulted in the identification of five (5) Vegetation Groups within the Study Area consisting of woodlands, wetlands, thickets, meadows, connected vegetation features and water features. Vegetation patches were then delineated by combining one or more abutting (< 20 m apart) vegetation groups. Using criteria outlined in Table 9 of the MNHSS (2014), an assessment was completed to identify significant natural features. **Table 5** below summarizes the criteria used to assess the natural heritage features identified within the W12A Landfill Study Area.

Table 5: Summary of Criteria for Significant Natural Heritage Features as outlined in Table 9 of the Middlesex Natural Heritage Systems Study (2014).

Criterion #	Feature Type	Description	Meets Criteria for Provincial Significance
Applied to Vegetation Groups			
1	Significant Valleylands	Any Vegetation Group within or touching a Significant Valleyland	Yes
2	Areas of Natural and Scientific Interest (ANSI)	Any vegetation Group located within or touching a provincial or regional Life Science ANSI	Yes
3	Open Watercourse	Any Vegetation Group located within 30 m of an Open Watercourse	Yes
4	Wetlands	All evaluated wetlands and all unevaluated Wetland Vegetation Groups > 0.5 ha	No; unless identified by MNRF
5	Woodland Size	Any Woodland Vegetation Group ≥ 4 ha	Yes
6	Woodland Proximity	Any Woodland Vegetation Group within 100 m of a ≥ 4 ha Woodland Vegetation Group	Yes
7	Thicket Size	Any Thicket Vegetation Group ≥ 2 ha	No
8	Meadow Size	Any Meadow Vegetation Group $10 \geq$ ha	No
9	Meadow Proximity	Any Meadow Vegetation Group within 100 m of a ≥ 4 ha Woodland or ≥ 2 ha Thicket Vegetation Group	No
Applied to Vegetation Patches			
10	Patches with Vegetation Group that meet a Group Criteria	Any Vegetation Patch that contains a Vegetation Group that meets a group of Criteria (i.e., Meets Criteria 1-9 above)	No

Criterion #	Feature Type	Description	Meets Criteria for Provincial Significance
11	Diversity	Any Vegetation Patch that contains a diversity of Vegetation Communities, Groups or Ecosystems	No
12	Proximity	Any Vegetation Patch within 100 m of a significant Vegetation Patch (i.e., meets Criteria 10 or 11 above)	No
13	Significant Wildlife Habitat	Any Vegetation Group that contains Significant Wildlife Habitat	Yes
14	Groundwater Dependent Wetland	Any Vegetation Group that contains Groundwater Dependent Wetland	Yes
15	Bluff or Depositional Area	All Watercourse Bluff or Depositional Areas	No

Results and Discussion

Vegetation communities identified within the Study Area included meadows, forests, woodlands, thickets and wetlands. The majority of the Study Area includes agricultural lands and cultural meadow communities associated with the active W12A Landfill. Two more contiguous natural heritage features are present north of Scotland Drive and contain a mosaic of vegetation communities. Five (5) Vegetation Patches were identified within the Study Area. **Table 6** below provides a summary of the Vegetation Community Series identified within each Vegetation Patch, as well as a brief description of the natural heritage features identified within the Study Area. Vegetation communities and patches are delineated on **Figure 5**.

A list of plant species observed during field investigations can be found in **Appendix F**.

Table 6: Vegetation Communities Summary for W12A Landfill Study Area

Vegetation Patch ID	Total Area	ELC Community Series Present	ELC Delineation Method	Patch Description	Natural Heritage Features Present
P01	16.00 ha	FOD OAO CUW CUW-1 CUM SWT2 FOD5-5	Aerial photo interpretation and roadside assessment	Patch P01 is located northwest of the subject lands and includes a mosaic of natural and cultural communities identified through field investigations.	<p>Natural heritage features identified through review of MNHSS criteria (2014) and the London Plan (2017) include the following:</p> <ul style="list-style-type: none"> • Significant Woodlands • Unevaluated Wetland <p>The Significant Woodlands have the potential to provide</p>

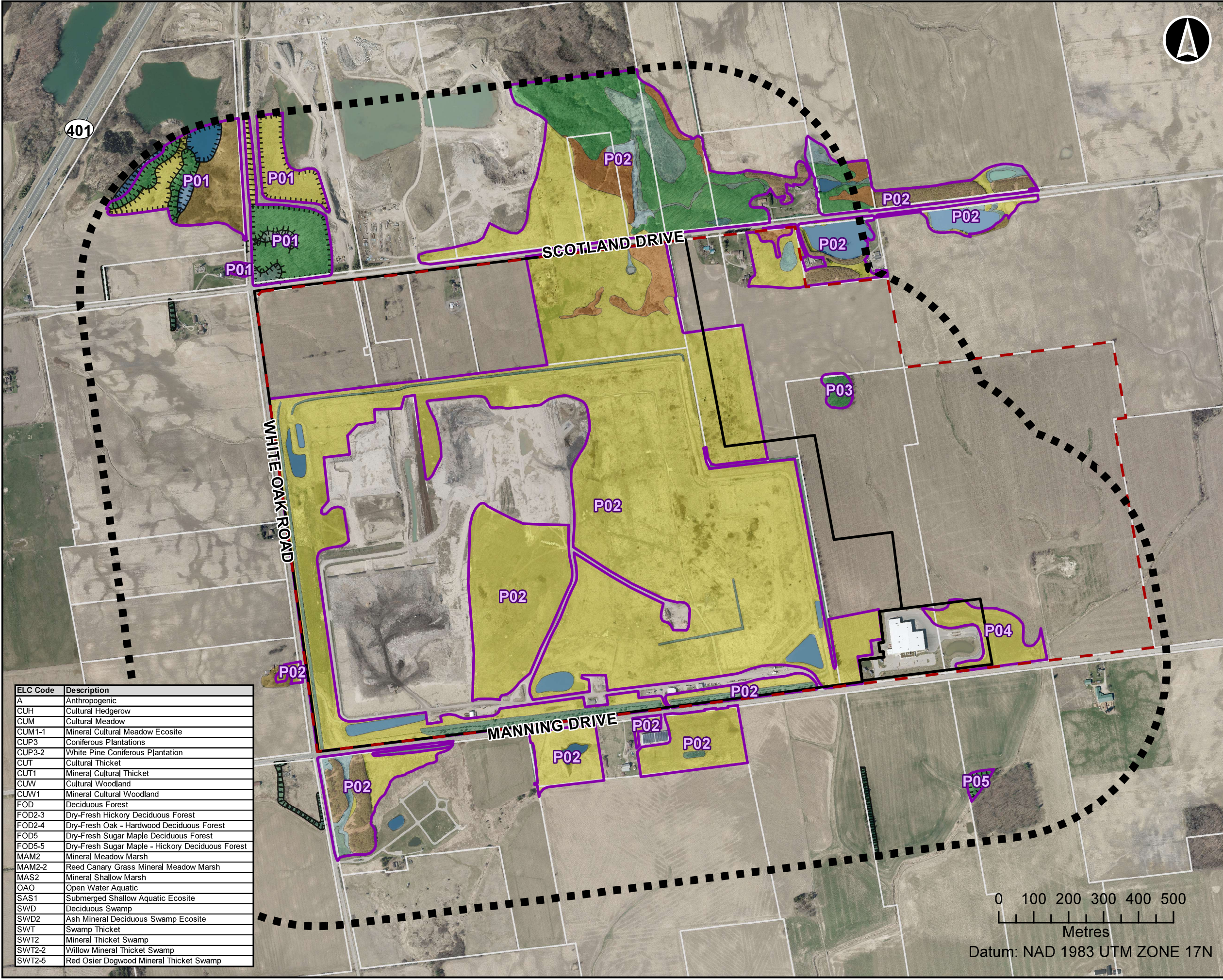
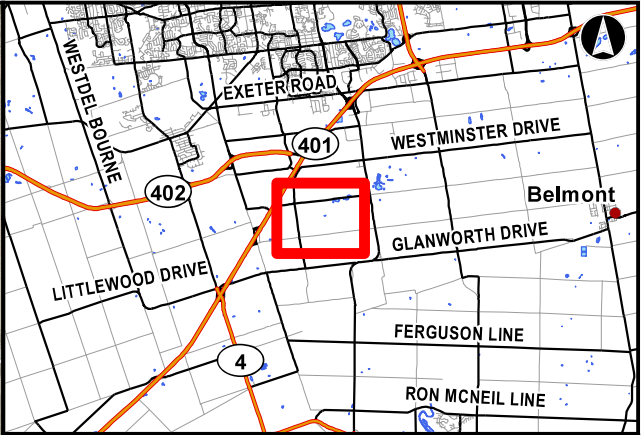
Vegetation Patch ID	Total Area	ELC Community Series Present	ELC Delineation Method	Patch Description	Natural Heritage Features Present
					suitable conditions for SWH and/or SAR habitat such as Bat Maternity Roosting Habitat and/or SAR bat habitat.
P02	166.1 ha	A CUH CUM1-1 CUP3 CUP3-2 CUT CUT1 FOD2-4 FOD5 FOD5-5 MAM2 MAM2-2 MAS OAO SAS SWD SWD2 SWT SWT2 SWT2-2 SWT2-5	Field investigations completed for W12A Landfill Expansion Environmental Assessment: Biology Assessment	Patch P02 is located south-southwest of the subject lands, within the subject lands, and north-northeast of the subject lands. The communities south and within the subject lands are primarily cultural communities, while the communities to the north of the subject lands are a mosaic of natural and cultural communities.	<p>Natural heritage features identified through review of MNHSS criteria (2014) and the London Plan (2017) include the following:</p> <ul style="list-style-type: none"> • Significant Woodlands • Locally Significant Wetlands (Silver Swamp) • Unevaluated Wetland • Valleyland • Potential Environmentally Significant Areas <p>Additionally, SAR habitat has been confirmed within the vegetation patch for the following species:</p> <ul style="list-style-type: none"> • Bobolink • Eastern Meadowlark <p>Vegetation groups within this patch have been confirmed as SWH for the following:</p> <ul style="list-style-type: none"> • Eastern Wood-pewee • Monarch • Terrestrial Crayfish

Vegetation Patch ID	Total Area	ELC Community Series Present	ELC Delineation Method	Patch Description	Natural Heritage Features Present
					<ul style="list-style-type: none"> Amphibian Breeding (Woodland) <p>Vegetation groups within this patch have also been identified as Candidate SWH for the following:</p> <ul style="list-style-type: none"> Bat Maternity Colonies (Little Brown Myotis/Northern Myotis) Turtle Overwintering <p>Treed communities within this patch also have the potential to provide suitable bat SAR habitat.</p>
P03	0.694 ha	FOD2-3	Field investigations completed for W12A Landfill Expansion Environmental Assessment: Biology Assessment	Patch P03 is located in the eastern portion of the subject lands and consists entirely of a single natural deciduous forest community.	<p>Vegetation groups within this patch have been identified as Candidate SWH for the following:</p> <ul style="list-style-type: none"> Bat Maternity Colonies (Little Brown Myotis/Northern Myotis) <p>This community may also provide suitable bat SAR habitat.</p>
P04	3.263 ha	CUM1-1	Field investigations completed for W12 Landfill Expansion Environmental Assessment: Biology Assessment	Patch P04 is located immediately southeast of the subject lands and consists entirely of a single cultural meadow community.	<p>Natural heritage features identified through review of MNHSS criteria (2014) and the London Plan (2017) include the following:</p> <ul style="list-style-type: none"> Valleyland

Vegetation Patch ID	Total Area	ELC Community Series Present	ELC Delineation Method	Patch Description	Natural Heritage Features Present
P05	0.365 ha	FOD	Field investigations completed for W12A Landfill Expansion Environmental Assessment: Biology Assessment	Patch P05 is located southeast of subject lands and south of P04. This patch consists entirely of a single natural deciduous forest community.	<p>Natural heritage features identified through review of MNHSS criteria (2014) and the London Plan (2017) include the following:</p> <ul style="list-style-type: none"> • Significant Woodlands • Valleyland <p>The Significant Woodlands have the potential to provide suitable conditions for SWH and/or SAR habitat such as Bat Maternity Roosting Habitat and/or SAR bat habitat.</p>

Legend:**A – Anthropogenic****CUH – Cultural Hedgerow****CUM – Cultural Meadow****CUM1-1 – Mineral Cultural Meadow Ecosite****CUP3 – Coniferous Plantation****CUP3-2 – White Pine Coniferous Plantation****CUT – Cultural Thicket****CUT1 – Mineral Cultural Thicket Ecosite****CUW – Cultural Woodland****CUW1 – Mineral Cultural Woodland Ecosite****OAO – Open Aquatic****FOD – Deciduous Forest****FOD2-3 – Dry-Fresh Hickory Deciduous Forest****FOD2-4 – Dry-Fresh Oak – Hardwood Deciduous Forest****FOD5 – Dry-Fresh Sugar Maple Deciduous Forest****FOD5-5 – Dry-Fresh Sugar Maple – Hickory Deciduous Forest****MAM2 – Mineral Meadow Marsh Ecosite****MAM2-2 – Reed Canary Grass Mineral Meadow Marsh****MAS2 – Mineral Shallow Marsh****OAO – Open Water Aquatic****SAS1 – Submerged Shallow Aquatic Ecosite****SWD – Deciduous Swamp****SWD2 – Ash Mineral Marsh Deciduous Swamp Ecosite****SWT – Thicket Swamp****SWT2 – Mineral Thicket Swamp****SWT2-2 – Willow Mineral Thicket Swamp Type****SWT2-5 – Red Osier Dogwood Mineral Thicket Swamp**

A full description of ELC communities identified within the Study Area can be found in **Appendix G**.



- Legend**
- Parcel Fabric
 - Site Study Area
 - Site- vicinity Study Area
 - Waste Management Resource Recovery Area Boundary
 - Vegetation Patch

- Vegetation Community**
- | | |
|-----|-----|
| CUH | FOD |
| CUM | MAM |
| CUP | MAS |
| CUT | OAO |
| CUW | SAS |
| | SWD |
| | SWT |

Aerial Photo Interpretation / Roadside Assessment

ELC Code	Description
A	Anthropogenic
CUH	Cultural Hedgerow
CUM	Cultural Meadow
CUM1-1	Mineral Cultural Meadow Ecosite
CUP3	Coniferous Plantations
CUP3-2	White Pine Coniferous Plantation
CUT	Cultural Thicket
CUT1	Mineral Cultural Thicket
CUW	Cultural Woodland
CUW1	Mineral Cultural Woodland
FOD	Deciduous Forest
FOD2-3	Dry-Fresh Hickory Deciduous Forest
FOD2-4	Dry-Fresh Oak - Hardwood Deciduous Forest
FOD5	Dry-Fresh Sugar Maple Deciduous Forest
FOD5-5	Dry-Fresh Sugar Maple - Hickory Deciduous Forest
MAM2	Mineral Meadow Marsh
MAM2-2	Reed Canary Grass Mineral Meadow Marsh
MAS2	Mineral Shallow Marsh
OAO	Open Water Aquatic
SAS1	Submerged Shallow Aquatic Ecosite
SWD	Deciduous Swamp
SWD2	Ash Mineral Deciduous Swamp Ecosite
SWT	Swamp Thicket
SWT2	Mineral Thicket Swamp
SWT2-2	Willow Mineral Thicket Swamp
SWT2-5	Red Osier Dogwood Mineral Thicket Swamp

0 100 200 300 400 500
Metres
Datum: NAD 1983 UTM ZONE 17N

W12A Landfill Expansion
Biology Assessment

ELC Vegetation Communities
and Vegetation Patches

August
2020

1:300,000
* when printed 11"x17"

Source: LIO,
City of London

P#: 60556244
AECOM

Figure 5

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Bat Habitat Assessment

Background

During the background review and agency consultation as outlined in **Section 1.3** and **Section 1.6**, correspondence with the MNRF identified the potential for four (4) species of SAR bats to occur within the Study Area: Eastern Small-footed (*Myotis leibii*), Little Brown Myotis (*Myotis lucifugus*), Tri-coloured Bat (*Perimyotis subflavus*) and Northern Myotis (*Myotis septentrionalis*) (see **Appendix C**). These species are listed as Endangered provincially and are therefore afforded protection under the ESA. As the Study Area contains treed forest and swamp communities, a bat habitat assessment was completed to determine the presence of maternity roosting habitat for SAR and for SWH (Bat Maternity Roosting Habitat).

Field Investigation Methods

Trees within the Study Area were assessed for candidate bat habitat according to the MNRF guidelines outlined in the Survey Protocol for Species at Risk Bats within Treed Habitats (OMNRF, 2017). Surveys included area searches within suitable ecosites <10 ha in size (properties at 3298 Scotland Drive, 3405 Scotland Drive, 6100 White Oak Road) and plot surveys in those ecosites >10 ha (properties at 3502 Scotland Drive and 3483 and 3583 Westminster Drive). The surveys were conducted during the leaf-off period to assess trees with a diameter at breast height (DBH) >10 cm for cavities, cracks, loose bark, or knot holes in addition to leaf clusters that provide maternity roosting habitat for SAR bats. Dates of the bat habitat assessments are provided in **Section 2.2.1**. The location of the surveys is presented on **Figure 3**.

Results and Discussion

Eighty-nine (89) trees were observed that showed suitable characteristics for Little Brown Myotis/Northern Myotis bats. Twenty-seven (27) trees were identified within the FOD2-3 at 3438 Manning Drive, twelve (12) within the FOD5-5 at 3502 Scotland Drive, twenty-eight (28) within the FOD5-5 at 3483 Westminster Drive, eight (8) within the FOD5-5 at 3583 Westminster Drive, three (3) within the CUP3 at 3298 Scotland Drive, and eleven (11) within the CUP3 at 6100 White Oak Road. No suitable leaf clusters were observed. **Appendix H** provides the results of the bat habitat assessment.

According to the Survey Protocol for Species at Risk Bats within Treed Habitats (OMNRF, 2017), there is no minimum threshold for snags/ha to be considered suitable maternity roost habitat, although ELC ecosites with 10 or more snags/ha may be considered high quality habitat. Based upon the results of the bat habitat assessment, candidate habitat for SAR bats and corresponding SWH may be present within the Study Area. Further acoustic monitoring would be required to confirm the presence of SAR bats and/or SWH for Bat Maternity Roosting Habitat in the identified candidate habitat within the Study Area. If SAR bats are recorded during acoustic monitoring and impacts to these features were anticipated, this data can be used to calculate snag densities to determine the quality of bat habitat present, which would then be used in consultation with MECP to determine requirements under the ESA.

Since the identified bat cavity trees are outside of the Subject Lands, there will be no loss of bat cavity trees from landfill expansion within the subject lands.

Additional details on SAR bats and SWH for bats can be found in **Section 2.3.4** and **Section 2.3.5**, respectively.

Breeding Birds

Background

A review of background information outlined in **Section 1.3** identified ninety-one (91) species of birds with various levels of breeding evidence within the 10 by 10 km square (17MH84) that encompasses the Study Area (BSC *et al.*, 2016). Of these species, four (4) were listed as provincially Threatened and four (4) were listed as Special Concern under the Species at Risk in Ontario List (O.Reg. 230/08) (see **Table 7**). **Appendix I** presents a list of Breeding Birds within the Study Area. Breeding bird surveys were completed to determine the presence of SAR and Species of Conservation Concern (SOCC) birds within the Study Area.

Table 7: Ontario Breeding Bird Atlas (OBBA) Significant Species Records Within or in the Vicinity of the Study Area

Common Name	Scientific Name	S-Rank	Endangered Species Act Status	Breeding Evidence
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	S4B	SC	Confirmed
Bank Swallow	<i>Riparia riparia</i>	S4B	THR	Confirmed
Barn Swallow	<i>Hirundo rustica</i>	S4B	THR	Confirmed
Bobolink	<i>Dolichonyx oryzivorus</i>	S4B	THR	Confirmed
Eastern Meadowlark	<i>Sturnella magna</i>	S4B	THR	Confirmed
Eastern Wood-pewee	<i>Contopus virens</i>	S4B	SC	Probable
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	S4B	SC	Possible
Wood Thrush	<i>Hylocichla mustelina</i>	S4B	SC	Confirmed

Legend:

END – Endangered

THR – Threatened

SC – Special Concern

S4B – Apparently Secure Breeding Population

Field Investigation Methods

Due to the size and diversity of habitats within southern Ontario, several bird monitoring protocols have been developed that focus on targeting groups of birds including the Forest Bird Monitoring Program developed by the Environment Canada - Canadian Wildlife Service (EC-CWS 2009) and the Marsh Monitoring Program (Bird Studies Canada *et al.* 2009). Similarly, the Ontario Breeding Bird Atlas (OBBA) *Guide for Participants* (2001) provides additional methods for conducting breeding bird surveys throughout Ontario. These protocols outline the methods to be conducted in order to obtain representative and unbiased data. The methods listed below outline proper site selection, timing including time of day and time of year to conduct the surveys and suitable weather conditions (EC-CWS 2009, OBBA, 2001).

Under the Canadian Wildlife Service Forest Bird Monitoring Program, survey stations should typically occur within an individual community that is characterized by uniform community structure. Within these communities, stations should be located at least 250 m apart and 100 m from the edge (EC-CWS, 2009). Survey stations were situated in natural areas that occur within the Study Area boundary. These natural areas were comprised predominantly of cultural meadow communities. Each station was located at least 200 m apart to maintain a degree of separation and reduce the chances of double counting individual birds. Six (6) stations were established within natural features located in the subject lands. Locations of breeding bird survey stations are shown on **Figure 3**.

Due to the presence of Bobolink and Eastern Meadowlark, as determined during the first visit conducted on June 7th, 2018, three point-count surveys were completed at each station during the breeding bird period between May 24 and July 10 in order to confirm breeding evidence for these species (OBBA 2001, OMNRF 2012). The separate surveys are recommended as they typically provide data that more accurately reflects the number of species and birds utilizing the habitat at each station (EC-CWS 2009). Surveys were completed between 5:00 am and 10:00 am under appropriate weather conditions (i.e., no precipitation, calm to light wind) (EC-CWS 2009). Each point-count consisted of a ten (10) minute survey during which time, species, breeding evidence and individual bird movement within a 100 m radius was recorded. Species heard outside of the 100 m radius or that were observed outside of their breeding habitat within the 100 m radius (i.e., flyovers) were recorded separately.

Results and Discussion

Forty-three (43) bird species, included in **Table 8**, were identified within the subject lands during field investigations. Of these species, four (4) were recorded as 'confirmed', eleven (11) as 'probable' and eighteen (18) as 'possible' breeders within the subject lands. Ten (10) species were observed but were not exhibiting breeding evidence. Additionally, five (5) provincially listed species under the ESA were observed within the subject lands, including four (4) Threatened species - Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*), Bobolink (*Dolichonyx oryzivorus*), and Eastern Meadowlark (*Sturnella magna*), and one (1) Special Concern species - Eastern Wood-pewee (*Contopus virens*).

Table 8: Summary of Breeding Bird Evidence recorded within the W12A Landfill Study Area

Common Name	Scientific Name	AECOM Observations (see Figure 3 locations)						
		BS-01	BS-02	BS-03	BS-04	BS-05	BS-06	Incidental
Green Heron	<i>Butorides virescens</i>							X
Canada Goose	<i>Branta canadensis</i>							X
Mallard	<i>Anas platyrhynchos</i>							H
Turkey Vulture	<i>Cathartes aura</i>							X
Sharp-shinned Hawk	<i>Accipiter striatus</i>							X
Red-tailed Hawk	<i>Buteo jamaicensis</i>							X

Common Name	Scientific Name	AECOM Observations (see Figure 3 locations)						
		BS-01	BS-02	BS-03	BS-04	BS-05	BS-06	Incidental
Wild Turkey	<i>Meleagris gallopavo</i>							S
Killdeer	<i>Charadrius vociferus</i>			A			S	FY
Spotted Sandpiper	<i>Actitis macularia</i>							FY
Mourning Dove	<i>Zenaida macroura</i>						S	S
Eastern Wood-Pewee	<i>Contopus virens</i>							S
Alder Flycatcher	<i>Empidonax alnorum</i>		T					S
Willow Flycatcher	<i>Empidonax traillii</i>	T	T					S
Eastern Kingbird	<i>Tyrannus tyrannus</i>		S			P	X	S
Horned Lark	<i>Eremophila alpestris</i>							S
Tree Swallow	<i>Tachycineta bicolor</i>	X		X			X	
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>				X		X	
Bank Swallow	<i>Riparia riparia</i>	X	X					
Barn Swallow	<i>Hirundo rustica</i>	X		X		X	X	X
American Crow	<i>Corvus brachyrhynchos</i>			S			S	
Black-capped Chickadee	<i>Poecile atricapillus</i>			S				S
House Wren	<i>Troglodytes aedon</i>					S		S
American Robin	<i>Turdus migratorius</i>		S	S			A	S
Gray Catbird	<i>Dumetella carolinensis</i>					S		
Cedar Waxwing	<i>Bombycilla cedrorum</i>							S
Red-eyed Vireo	<i>Vireo olivaceus</i>							S
Yellow Warbler	<i>Dendroica petechia</i>		T				S	S
Common Yellowthroat	<i>Geothlypis trichas</i>	T		T		T		S
Northern Cardinal	<i>Cardinalis cardinalis</i>	T	T	A		T		S

Common Name	Scientific Name	AECOM Observations (see Figure 3 locations)						
		BS-01	BS-02	BS-03	BS-04	BS-05	BS-06	Incidental
Indigo Bunting	<i>Passerina cyanea</i>					S		
Chipping Sparrow	<i>Spizella passerina</i>						S	S
Clay-coloured Sparrow	<i>Spizella pallida</i>	S						
Field Sparrow	<i>Spizella pusilla</i>	T	T				T	S
Savannah Sparrow	<i>Passerculus sandwichensis</i>	T	A	T	T	A		S
Song Sparrow	<i>Melospiza melodia</i>	T	T	T	S	T	A	A
Bobolink	<i>Dolichonyx oryzivorus</i>		CF	A	P	P		CF
Red-winged Blackbird	<i>Agelaius phoeniceus</i>		T	CF	S	A	A	S
Eastern Meadowlark	<i>Sturnella magna</i>	T	P	T	T		S	S
Common Grackle	<i>Quiscalus quiscula</i>							X
Brown-headed Cowbird	<i>Molothrus ater</i>	S					H	
Orchard Oriole	<i>Icterus spurius</i>							S
Baltimore Oriole	<i>Icterus galbula</i>						S	
American Goldfinch	<i>Carduelis tristis</i>		S			S	S	S

Legend: Breeding Bird Evidence (OBBA 2001)

Observed X - Species observed in its breeding season (no evidence of breeding).

Possible H - Species observed in its breeding season in suitable habitat

S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat

Probable P - Pair observed in their breeding season in suitable nesting habitat.

T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place

A - Agitated behaviour or anxiety calls of an adult

Confirmed FY - Recently fledged young or downy young, including young incapable of sustained flight

CF - Adult carrying food for young.

Bank Swallows (*Riparia riparia*) were observed foraging over cultural meadow at BS-01 and BS-02 during breeding bird surveys completed in 2018. This species builds their nests within burrows dug into natural (e.g., banks of rivers or lakes) and human-made vertical surfaces (i.e., active

sand and gravel pits where banks remain stable) made of silt and sand deposits (OMNRF 2018). Bank swallows are considered colonially nesters which can range in size from several to a few thousand pairs (OMNRF 2018). This species is designated as Threatened provincially and will be discussed in more detail in **Section 2.2.4** and **Section 2.2.8** below. Although no nesting habitat for Bank Swallow was observed during field investigations, it is anticipated that the species is utilizing potential habitat provided by the aggregate facility located north of Scotland Drive. Access to this property was not granted at the time of investigations and, therefore, habitat for the species could not be confirmed.

Similar to Bank Swallow, Barn Swallows (*Hirundo rustica*) were observed foraging over agricultural fields and cultural meadow at BS-01, BS-03, BS-05 and BS-06 during breeding bird surveys completed in 2018. Barn Swallow habitat consists almost exclusively of human-made structures including barns, bridges and culverts which provide ledges on which they can build their cup-shaped nests out of mud (MECP 2019). Barn Swallows are aerial-insectivores which are frequently observed foraging over open areas including pastures, meadows, wetlands, agricultural fields and parks. No nesting was observed during site investigations; however, it is anticipated that the species is nesting in structures present within the Study Area. Barn Swallow is listed as Threatened in Ontario –protection for this species, along with its habitat is afforded protection under the ESA. This species will be discussed in more detail in **Section 2.2.4** and **Section 2.2.8** below.

Bobolink (*Dolichonyx oryzivorus*) was observed within cultural meadow communities in the Study Area during breeding bird surveys (BS-02, BS-03, BS-04, BS-05). This species breeds in a variety of natural and anthropogenic grasslands such as meadows, pastures and hayfields where small trees, shrubs and fence posts are used as elevated song perches (OMNRF 2018). This species was confirmed breeding within the Study Area. Bobolink is designated as Threatened provincially and is afforded protection under the ESA. This species will be discussed further in **Section 2.2.4** and **Section 2.2.8** below.

Eastern Meadowlark (*Sturnella magna*) was also observed within cultural meadow communities (BS-01, BS-02, BS-03, BS-04 and BS-06) throughout the Study Area during breeding bird surveys. Similar to Bobolink, Eastern Meadowlark primarily breeds in tall grasslands including pastures and hayfields, but they can also be observed in alfalfa fields, weedy borders or croplands, roadsides, orchards, airports, overgrown fields and other open areas (OMNRF 2018). This species is designated as Threatened under the Species at Risk in Ontario List (O. Reg 230/08); this species and its habitat is therefore afforded protection under the ESA.

Eastern Wood-pewee (*Contopus virens*) was observed within the Dry-Fresh Sugar Maple – Hickory Deciduous Forest (FOD5-5) located at the northeast portion of the Study Area. This species commonly nests in the mid-canopy of forest clearings and edges of deciduous and mixed forests, commonly with little understory vegetation (OMNRF 2018). A singing male was observed during field investigations completed during the breeding bird season. Eastern Wood-pewee is designated as Special Concern provincially. Although this species is not afforded protection under the ESA, the species is considered a SOCC – habitat for this species is considered SWH as defined by the SWH Ecoregion 7E Criterion Schedule (OMNRF 2015). This species and its habitat are discussed further in **Section 2.2.5** below.

In addition to Bobolink and Eastern Meadowlark, two (2) area-sensitive bird species were also observed during the breeding bird surveys or incidentally:

- Sharp-shinned Hawk (*Accipiter striatus*)

- Savannah Sparrow (*Passerculus sandwichensis*)

These species require larger areas of suitable habitat for successful breeding and, in turn, sustain populations. As such, these species can provide an indicator of habitat quality and availability within the Study Area.

All other bird species observed are fairly common to abundant and widespread in southern Ontario. The majority of native bird species and their active nests are protected under the federal *Migratory Birds Convention Act, 1994* (MBCA). Some bird species which are not under federal jurisdiction, such as raptors, are protected under Ontario's *Fish and Wildlife Conservation Act, 1997*. Nests of these species can only be removed if a permit is obtained from the Ministry of Natural Resources

Amphibians

Background

A review of the background information as outlined in **Section 1.3** identified no significant amphibian species within the Study Area (Ontario Nature, 2017). The potential presence of other species such as gray treefrog (*Hyla versicolor*), spring peeper (*Pseudacris crucifer*), western chorus frog (*Pseudacris triseriata*), and wood frog (*Rana (Lithobates) sylvatica*) indicate the potential for Significant Wildlife Habitat. Therefore, surveys were conducted to determine the presence and populations of anuran species within the Study Area and determine the presence of SWH including Amphibian Breeding Habitat.

Field Investigation Methods

Anuran call surveys were conducted at eleven (11) wetland communities within the Study Area. The location of each anuran call survey can be found on **Figure 3**. These surveys were conducted following the Ontario Marsh Monitoring Program (Bird Studies Canada 2008).

In order to detect both early and late anuran breeders, three (3) site visits were conducted during the breeding season (April to July). In accordance with the protocol, surveys did not begin until at least one-half hour after sunset and were completed before midnight. In addition, surveys were only conducted during suitable weather conditions which included winds less than 19 km/hr (0-4 on the Beaufort wind scale) and minimum night-time air temperatures of at least 5 °C for the first survey, 10 °C for the second survey and 17 °C for the third survey. It should be noted that surveys can be conducted at lower temperatures if there is strong calling activity observed. Species observed and call frequency were recorded by biologists during each three-minute point count. The frequency categories of anuran calls are as follows:

0 - None heard.

1 - Individuals can be counted, calls not overlapping. Abundance is recorded with this call code (e.g., SPPE1-1; Call Code -1, Count 1)

2 - Numbers of some individuals can be estimated or counted, others overlapping. Abundance is recorded with this call code (e.g., SPPE2-5; Call Code - 2, Count - 5)

3 - Full chorus, calls continuous and overlapping, and individuals not distinguishable. Abundance is not recorded with this call as it cannot be reliably estimated (e.g., SPPE3).

Table 9: Anuran Call Survey Results

Station Name	Date	Start Time	End Time	Temperature (C)	Beaufort Scale	Precipitation	Background Noise	Species observed within 100m station (code/count)	Species observed outside 100m station
Round 1									
AMP-01	23-Apr-18	21:43	21:46	14	3	None	0	None	None
AMP-02	23-Apr-18	20:33	20:36	20	1	None	0	SPPE3 WOFR3	None
AMP-03	23-Apr-18	20:50	20:53	20	1	None	0	SPPE3	WOFR1-1 SPPE3
AMP-04	23-Apr-18	20:59	21:02	20	1	None	0	SPPE3 WOFR1-1	None
AMP-05	23-Apr-18	21:12	21:15	15	3	None	1	None	None
AMP-06	9-May-18	21:22	21:25	14	2	None	2	None	None
AMP-07	9-May-18	21:32	21:36	14	2	None	2	AMTO1-1 SPPE2-4	None
AMP-08	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AMP-09	23-Apr-18	21:28	21:31	14	2	None	1	SPPE3 NLFR1-1	None
AMP-10	23-Apr-18	21:55	21:58	12	2	None	0	SPPE3	SPPE3

Station Name	Date	Start Time	End Time	Temperature (C)	Beaufort Scale	Precipitation	Background Noise	Species observed within 100m station (code/count)	Species observed outside 100m station
AMP-11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Round 2									
AMP-01	31-May-18	21:29	21:32	23	1	None	2	GRTR1-3 GRFR1-1	SPPE1-2
AMP-02	31-May-18	21:07	21:10	24	3	None	1	None	None
AMP-03	31-May-18	22:53	22:56	23	3	None	1	GRTR2-6	None
AMP-04	31-May-18	22:10	22:13	23	3	None	2	GRTR2-3	None
AMP-05	31-May-18	22:22	22:25	23	3	None	3	GRTR2-3	None
AMP-06	31-May-18	22:38	22:41	23	2	None	2	None	None
AMP-07	31-May-18	22:31	22:35	23	2	None	2	GRFR1-1	None
AMP-08	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
AMP-09	31-May-18	21:45	21:48	23	2	None	1	GRFR1-1 GRTR2-7	None
AMP-10	31-May-18	22:02	22:05	24	2	None	2	GRTR1-1 GRFR1-1	None

Station Name	Date	Start Time	End Time	Temperature (C)	Beaufort Scale	Precipitation	Background Noise	Species observed within 100m station (code/count)	Species observed outside 100m station
AMP-11	31-May-18	21:54	21:58	23	3	None	1	None	None
Round 3									
AMP-01	3-Jul-18	21:50	21:53	29	1	None	1	GRFR1-1 GRTR1-1	None
AMP-02	3-Jul-18	22:06	22:09	23	1	None	2	None	None
AMP-03	3-Jul-18	22:24	22:27	23	1	None	1	GRFR1-1	GRTR2-3
AMP-04	3-Jul-18	22:35	22:38	22	0	None	2	GRFR1-1	GRTR1-1
AMP-05	3-Jul-18	22:45	22:48	20	2	None	3	GRTR3	None
AMP-06	3-Jul-18	22:59	22:02	20	0	None	1	None	GRFR1-1
AMP-07	3-Jul-18	23:08	23:11	19	2	None	2	GRFR1-1	GRFR1-2 GRTR1-1
AMP-08	3-Jul-18	23:18	23:21	19	1	None	2	GRFR1-5	GRTR2-3
AMP-09	3-Jul-18	23:31	23:34	19	2	None	2	NLFR1-1 GRFR1-3 GRTR1-1	None
AMP-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Station Name	Date	Start Time	End Time	Temperature (C)	Beaufort Scale	Precipitation	Background Noise	Species observed within 100m station (code/count)	Species observed outside 100m station
AMP-11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Legend:*AMTO – American Toad**GRFR – Green Frog**GRTR – Gray Tree Frog**NLFR – Northern Leopard Frog**SPPE – Spring Peeper**WOFR – Wood Frog*

Results and Discussion

The results of anuran call surveys are summarized in Table 9. Species observed within the Study Area during field investigations include spring peeper, wood frog, American toad (*Anaxyrus americanus*), northern leopard frog (*Lithobates pipiens*), gray tree frog and green frog (*Rana clamitans*).

No amphibian Species at Risk (SAR) were recorded during field investigations conducted by AECOM staff in 2018. However, calling activity documented at AMP-02 met criteria for Amphibian Breeding (Woodland) Significant Wildlife Habitat. Therefore, the Mineral Thicket Swamp (SWT2) which is part of the Silver Swamp Locally Significant wetland, is considered Significant Wildlife Habitat. This habitat will be discussed in more detail in **Section 2.2.5** below.

Reptiles

Background

A review of the background information, as outlined in **Section 1.3**, identified two (2) reptile species within the 10 by 10 km square (17MH84) that overlaps the Study Area (Ontario Nature, 2017). These species included two (2) provincially listed Special Concern species. These species are presented in **Table 10**.

**Table 10: Ontario Reptile and Amphibian Atlas Significant Reptile Records
Within or in the Vicinity of the Study Area**

Common Name	Scientific Name	SARA Status	COSEWIC Status	ESA Status	S-rank
Eastern Ribbonsake	<i>Thamnophis sauritus</i>	SC Schedule 1	SC	SC	S3
Snapping Turtle	<i>Chelydra serpentina</i>	SC Schedule 1	SC	SC	S3

Legend:

SC – Special Concern

S3 – Vulnerable

Field Investigation Methods

During initial site investigations, AECOM staff recorded potential snake habitat/hibernacula within the Study Area. Dimensions of any rock or debris piles observed were recorded as well as a description of surrounding habitat conditions, slope and likelihood of the observed piles extending below frost line. The type of material and approximate size of the hibernacula was also recorded. These observations were used to inform the placement of cover boards for Artificial Cover Surveys within the Study Area.

Snake surveys included both Visual Encounter Surveys (VES) and Artificial Cover (e.g., cover board) surveys following the Survey Protocol for Ontario's Species at Risk Snakes (OMNRF 2016). Five (5) VESs and four (4) cover board surveys were conducted under ideal weather conditions including, calm, clear or partly cloudy days and with a temperature range of 10 to 25°C

(on very warm days, surveys were conducted in the morning). Where large stones or other cover objects were observed, they were slowly and carefully overturned and checked for the presence of snakes. Cover boards were also overturned and gently replaced to check for the presence of snakes. Any snake species observed was visually identified; the estimated length and any other visible distinguishing characteristics were recorded. Locations of snake cover boards are shown on **Figure 3**. A description of cover board locations can also be found in **Table 11** below.

Table 11: Snake Cover Board Locations

Cover Board Name	GPS Location	Description
CB-01	E. 482550 N. 4748521	At edge of coniferous plantation within cultural meadow
CB-02	E. 482228 N. 4748500	In clearing within a cultural thicket
CB-03	E. 481265 N. 4746917	Within cultural meadow adjacent to tree row
CB-04	E. 480533 N. 4747141	Within cultural meadow adjacent to old house foundation
CB-05	E. 481666 N. 4748321	Within cultural meadow adjacent to tree row
CB-06	E. 481753 N. 4748559	In clearing within cultural thicket near edge of deciduous forest
CB-07	E. 480874 N. 4748019	In cultural meadow adjacent to old house foundation
CB-08	E. 480829 N. 4748044	In cultural meadow adjacent to old house foundation
CB-09	E. 480801 N. 4746699	At edge of coniferous plantation within cultural meadow
CB-10	E. 482203 N. 4748301	At edge of coniferous plantation within cultural meadow

Results and Discussion

Three (3) potential hibernacula sites were observed during field investigations. **Table 12** summarizes the potential hibernacula location and brief description of each feature.

Table 12: Potential Snake Hibernacula Locations

Hibernacula	GPS Location	Description
Hibernacula 1	E. 482223 N. 4748312	Concrete debris pile adjacent to coniferous plantation
Hibernacula 2	E. 480872 N. 4748017	Residential building debris in cultural meadow

Hibernacula 3	E. 480527 N. 4747150	Rock pile and old residence debris/foundation adjacent to small woodland and agricultural field
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Table 13 below presents the results of cover board surveys and

Table 14 presents the results of the area searches.

Table 13: Summary of Snake Cover Board Surveys within the Study Area

Visit	Cover Board	Temperature (°C)	Species Observed
Visit 1 – May 31st	CB-01	28	None
	CB-02	28	None
	CB-03	28	None
	CB-04	28	None
	CB-05	28	None
	CB-06	28	None
	CB-07	28	None
	CB-08	28	None
	CB-09	28	None
	CB-10	28	None
Visit 2 – July 20th	CB-01	24	None
	CB-02	24	None
	CB-03	24	None
	CB-04	24	None
	CB-05	24	None
	CB-06	24	None
	CB-07	24	Boards Buried
	CB-08	24	Boards Buried
	CB-09	24	None
	CB-10	24	None
Visit 3 – July 27th	CB-01	17	None
	CB-02	17	None
	CB-03	17	None
	CB-04	17	None
	CB-05	17	None
	CB-06	17	None
	CB-07	17	Boards Buried
	CB-08	17	Boards Buried
	CB-09	17	None
	CB-10	17	None
Visit 4 – August 9th	CB-01	19-31	None
	CB-02	19-31	None
	CB-03	19-31	None
	CB-04	19-31	None
	CB-05	19-31	None
	CB-06	19-31	None
	CB-07	19-31	Boards Buried
	CB-08	19-31	Boards Buried
	CB-09	19-31	None
	CB-10	19-31	None

Table 14: Summary of Visual Encounter Surveys within the Study Area

Visit	Temperature (°C)	Species	GPS Location
Visit 1	19	Eastern Gartersnake	E. 482571 N. 4748516
Visit 2	N/A	None	N/A
Visit 3	N/A	None	N/A
Visit 4	N/A	None	N/A

No significant snake species were observed during area searches or cover board surveys. One species, Eastern Gartersnake (*Thamnophis sirtalis*) was observed during VESs. This species is common and widespread throughout Ontario.

Lepidoptera and Odonata

Background

A review of the background information as outlined in **Section 1.3** identified thirteen (13) butterfly species as potentially present within the square (17MH84) that encompasses the Study Area (**Table 15**). All species identified during the background review as potentially occurring within the Study Area are common and widespread species within Ontario. No SAR butterflies, dragonflies or damselflies were identified during background review.

Table 15. Butterfly Atlas Records Within or in the Vicinity of the Study Area

Common Name	Scientific Name	S-rank
Fiery Skipper	<i>Hylephila phyleus</i>	SNA
Tawny-edged Skipper	<i>Polites themistocles</i>	S5
Northern Broken-Dash	<i>Wallengrenia egeremet</i>	S5
Mulberry Wing	<i>Poanes massasoit</i>	S4
Hobomok Skipper	<i>Poanes hobomok</i>	S5
Black Dash	<i>Euphyes conspicua</i>	S3
Banded Hairstreak	<i>Satyrium calanus</i>	S4
Striped Hairstreak	<i>Satyrium liparops</i>	S5
Great Spangled Fritillary	<i>Speyeria cybele</i>	S5
Meadow Fritillary	<i>Boloria bellona</i>	S5
Baltimore Checkerspot	<i>Euphydryas phaeton</i>	S4
Viceroy	<i>Limenitis archippus</i>	S5
Eyed Brown	<i>Lethe eurydice</i>	S5

Legend:

SNA – Not Applicable
S3 – Vulnerable
S4 – Apparently Secure
S5 – Secure

Field Investigation Methods

All observations of butterflies, damselflies and dragonflies were recorded during the completion of other field surveys.

Results and Discussion

Eight (8) odonatan species and six (6) lepidopteran species were observed within the Study Area during field investigations. **Table 16** below presents the results of Lepidoptera and Odonata observations.

Table 16: Summary of Lepidoptera & Odonata Results

Common Name	Scientific Name	S-Rank
White-faced Meadowhawk	<i>Sympetrum obtrusum</i>	S5
Eastern Forktail	<i>Ishnura verticalis</i>	S5
Black Saddlebags	<i>Tramea lacerate</i>	S4
Calico Pennant	<i>Celithemis elisa</i>	S5
Widow Skimmer	<i>Libellula luctuosa</i>	S5
Common Whitetail	<i>Plathemis Lydia</i>	S5
Cabbage White	<i>Pieris rapae</i>	SNA
Giant Swallowtail	<i>Papilio cresphontes</i>	S4
Common Wood-nymph	<i>Cercyonis pegala</i>	S5
Ebony Jewelwing	<i>Calopteryx maculata</i>	S5
Viceroy	<i>Limenitis archippus</i>	S5
Slender Spreadwing	<i>Lestes rectangularis</i>	S5
Monarch	<i>Danaus plexippus</i>	S2N, S4B
Eastern Tailed Blue	<i>Cupido comyntas</i>	S5

Legend:

SNA – Not Applicable
S2N – Imperiled Nonbreeding Population
S4 – Apparently Secure
S4B – Apparently Secure Breeding Population
S5 – Secure

Monarch (*Danaus plexippus*) was observed within cultural meadow communities throughout the Study Area. This species is listed as Special Concern provincially and is therefore considered a Species of Conservation Concern. Habitat for this species is considered Significant Wildlife Habitat and will be discussed in more detail in **Section 2.2.5**.

All other species observed during field investigations are considered common and widespread within Ontario.

2.2.4 Species at Risk Assessment

Background

The status of species within Ontario is determined by the Committee on the Status of Species at Risk in Ontario (COSSARO) and Schedule 1 of the SARA (as recommended by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)). The four categories of species classification within SARA and the ESA include (terms in brackets apply solely to the province):

- Extirpated: no longer lives within a certain region (of Ontario), although still lives somewhere in the world;
- Endangered: lives in the wild (in Ontario) but is facing imminent extinction or extirpation;
- Threatened: lives in the wild (in Ontario), is not endangered, but is likely to become endangered if steps are not taken to address factors threatening it; and
- Special concern: lives in the wild (in Ontario), is not endangered or threatened, but may become threatened or endangered due to a combination of biological characteristics and identified threats.” (OMNRF 2014d, SARA 2002).

For the purpose of this report, SAR are defined as species that are listed as either Threatened or Endangered provincially or federally (in the case of aquatic organisms). These species, as well as their habitat, are afforded protection under the ESA (2007) and SARA. Species listed as Special Concern are not subject to the prohibitions under the ESA or SARA, but have been included in the SAR screening to avoid future implications should the status of these species change under the ESA (2007) or SARA, and to recognize that in some cases (i.e., aquatic species at risk) they are protected under other legislation. Furthermore, species listed as Special Concern are considered SOCC in the Natural Heritage Reference Manual (NHRM). As such, habitat for these species is considered SWH. These species and their habitats are discussed in detail in **Section 2.2.5**.

A preliminary SAR screening exercise was completed to determine the number of SAR within potentially suitable habitat within the W12A Landfill Study Area.

Methods

A list of SAR which have the potential to occur within the Study Area was compiled based on a review of background information as described in **Section 1.3** as well as input provided by agency correspondence as outlined in **Section 1.6**. Habitat preferences of the listed terrestrial SAR were then compared to onsite habitat characteristics to determine if the Study Area contained potential habitat for SAR. The potential for species to occur was then determined through a probability of occurrence whereby the following rankings were applied:

- **Low Probability:** suitable habitat for the species is not likely present within the study area;
- **Moderate Probability:** potentially suitable SAR habitat may be present within the study area; and,
- **High Probability:** preferred habitat conditions for SAR are likely present within the study area.
- **Confirmed:** species were observed within the Study Area during field investigations.

The SAR screening was refined, where feasible, using the results of the ELC community delineation and taxa specific surveys completed during field investigations as described in **Section 2.2.1**.

Results and Discussion

A review of background information and input from agency correspondence identified seventy-six (76) SAR have the potential to occur within the Study Area. Of these species, thirty-seven (37) species are listed as Endangered, nineteen (19) species are listed as Threatened, and twenty (20) species are listed as Special Concern.

Based on the results of the SAR Screening, two (2) SAR have a low probability of occurrence within the Study Area, as suitable habitat conditions are not likely present. Twelve (12) were determined to have at least a moderate probability of occurrence within the Study Area as potentially suitable habitat was identified during the review of existing conditions. Of these twelve, four (4) SAR have a high potential for occurrence within the Study Area as preferred habitat conditions were identified during the review of existing conditions. Candidate and confirmed SAR within the Study Area are summarized in **Table 17** below.

Table 17: Potential & Confirmed Species at Risk Within the Study Area

Common Name	Scientific Name	ESA Status	Candidate	Confirmed
Bank Swallow	<i>Riparia riparia</i>	THR	X	
Barn Swallow	<i>Hirundo rustica</i>	THR	X	
Bobolink	<i>Dolichonyx oryzivorus</i>	THR		X
Eastern Meadowlark	<i>Sturnella magna</i>	THR		X
Eastern Wood-pewee	<i>Contopus virens</i>	SC		X
Little Brown Myotis	<i>Myotis lucifugus</i>	END	X	
Eastern Small-footed Myotis	<i>Myotis leibii</i>	END	X	
Northern Myotis	<i>Myotis septentrionalis</i>	END	X	
Tri-colored Bat	<i>Perimyotis subflavus</i>	END	X	
Eastern Ribbonsnake	<i>Thamnophis sauritus</i>	SC	X	
Snapping Turtle	<i>Chelydra serpentina</i>	SC	X	
Monarch	<i>Danaus plexippus</i>	SC		X

Legend:

END – Endangered

THR – Threatened

SC – Special Concern

Six (6) of these species were observed during field investigations. As summarized in **Section 2.2.3**, Bobolink and Eastern Meadowlark were confirmed breeding within cultural meadow habitats within the Study Area including the current Landfill property. These species are both listed as Threatened provincially and are afforded protection under the ESA. Therefore, any impacts to this species or its habitat will require further considerations under the ESA. Habitat for these species is delineated on **Figure 7**.

Although nesting was not observed for Barn Swallow and Bank Swallow, these species were observed foraging within the Study Area during field investigations. Potential suitable habitat for Barn Swallow and Bank Swallow is present within the Study Area; however, as no nests were found in the landfill footprint, direct habitat under the General Habitat Description for each species is considered absent (MNRF 2015a; MNRF 2015b). These species are listed as Threatened provincially. These species, as well as their habitat are afforded protection under the ESA.

Eastern Wood-Pewee and Monarch were also observed within the Study Area during field investigations. These species are listed as Special Concern provincially and are therefore considered SOCC. These species do not receive habitat protection the ESA; however, their habitat is considered SWH which is should be protected in accordance with the *Provincial Policy Statement, 2020* (PPS). These species are further addressed in **Section 2.2.5**.

The full SAR Screening is provided in **Appendix J**.

2.2.5 Significant Wildlife Habitat Assessment

Background

SWH is defined by the NHRM (2010) as “areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations”. This includes areas where species concentrate at a vulnerable point in their life cycle or areas important for migratory species. The Significant Wildlife Habitat Technical Guide (SWHTG) (2000) which supports the NHRM provides detailed information on the identification, description and prioritization of SWH. The SWHTG (2000) divides wildlife habitat into four categories including Seasonal Concentration Areas, Rare Vegetation Communities or Specialized Habitats for Wildlife, Habitat of Species of Conservation Concern and Animal Movement Corridors. Additionally, due to Ontario’s vast size and biodiversity, the OMNRF created draft Ecoregion Criterion Schedules that support the SWHTG and provide significance criteria that are reflective of geographic differences. The Ecoregion criteria schedules provide guidance for SWH designation for the four categories of SWH outlined in the SWHTG and its appendices. The schedules provide information including descriptions of wildlife habitat, wildlife species, and the criteria required to determine SWH.

The following section outlines the methods completed to determine the presence of candidate and/or confirmed SWH within the Study Area.

Methods

An SWH screening exercise was completed using the Wildlife Habitat Ecoregion Criteria Schedule (OMNRF 2012) to determine the presence of candidate SWH within the Study Area.

The probability of occurrence of candidate SWH for all four categories was determined by comparing existing conditions determined through aerial photo-interpretation and field

investigations, to criterion listed in the schedules. A background review, as described in **Section 1.3**, was conducted to determine the presence of SOCC within the Study Area. The potential for SWH to occur was determined through a probability of occurrence whereby the following rankings were applied:

- **No Probability:** Conditions for Candidate SWH are not present within the Study Area.
- **Low Probability:** suitable conditions to meet criteria for Confirmed SWH is not likely present within the study area;
- **Moderate Probability:** Candidate SWH habitat may be present within the study area;
- **High Probability:** Candidate SWH is likely present within the study area; and,
- **Confirmed:** Defining Criteria for Confirmed SWH were observed/met within the Study Area during field investigations.

Where feasible, the results of field investigations were used to confirm the presence of SWH within the Study Area.

Results and Discussion

Based on the SWH screening completed for the Study Area, conditions for candidate habitat were not met for seventeen (17) habitats. Thirteen (13) habitats had low to moderate probability of occurrence as suitable conditions are not likely present or may be present within the Study Area. Six (6) habitats had a high probability of occurrence within the Study Area including:

- Bat Maternity Colonies;
- Turtle Wintering Areas;
- Colonially-Nesting Bird Breeding Habitat (Trees/Shrubs);
- Amphibian Breeding Habitat (Wetlands);
- Marsh Breeding Bird Habitat; and,
- Special Concern and Rare Wildlife Species.

During field investigations completed in 2018, three (3) SWH were confirmed within the Study Area:

1. **Amphibian Breeding Habitat** (Woodland) was identified within the Silver Swamp LSW;
2. **Terrestrial Crayfish SWH** was identified within the Silver Swamp LSW; and, Terrestrial Crayfish was confirmed within the cultural thicket habitat in the north of the subject lands;
3. **Special Concern and Rare Wildlife Species Habitat** for Monarch was identified within cultural meadow throughout the Study Area, while habitat for Eastern Wood-pewee was identified within FOD5-5 Dry-Fresh Sugar Maple – Hickory Deciduous Forest Type in P02 north of the subject lands within the potential ESA shown on **Figure 1**.

The PPS states that development and site alteration is not permitted in SWH unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.

Two (2) candidate SWHs were also identified within the Study Area during field investigation in 2018. **Candidate habitat for Bat Maternity Colonies** was identified within deciduous forest (FOD5-5) and cultural thicket (CUT) communities north of the subject lands, the cultural plantation communities northeast (CUP3-2) and southwest (CUP3) of the subject lands, and the deciduous forest (FOD2-3) community within the subject lands. Full bat habitat assessments would be

required to confirm the presence of Bat Maternity Colonies. **Candidate habitat for Turtle Wintering Areas** was identified in the open aquatic (OAO) community within the deciduous forest community (FOD2-4) northeast of the subject lands.

The full SWH Screening for the Study Area is provided in **Appendix K**. Locations of confirmed and candidate SWH are identified on **Figure 6**.

2.2.6 Significant Natural Heritage Features & Species

The following section provides a summary of significant features present within the Study Area as identified by federal, provincial and municipal evaluation and ranking systems including the Fisheries Act, the COSEWIC, the MNRF, COSSARO, UTRCA, KCCA and the London Plan (2017) and the MNHSS (2014).

2.2.7 Federally Recognized Features & Species

There are no federally owned lands present within the Study Area. As such, there are no federal implications related to terrestrial SAR. Although several species discussed within this report have been designated Threatened or Endangered on Schedule 1 of the SARA, protection of these species is afforded at the provincial level and therefore will be discussed in **Section 2.2.8**.

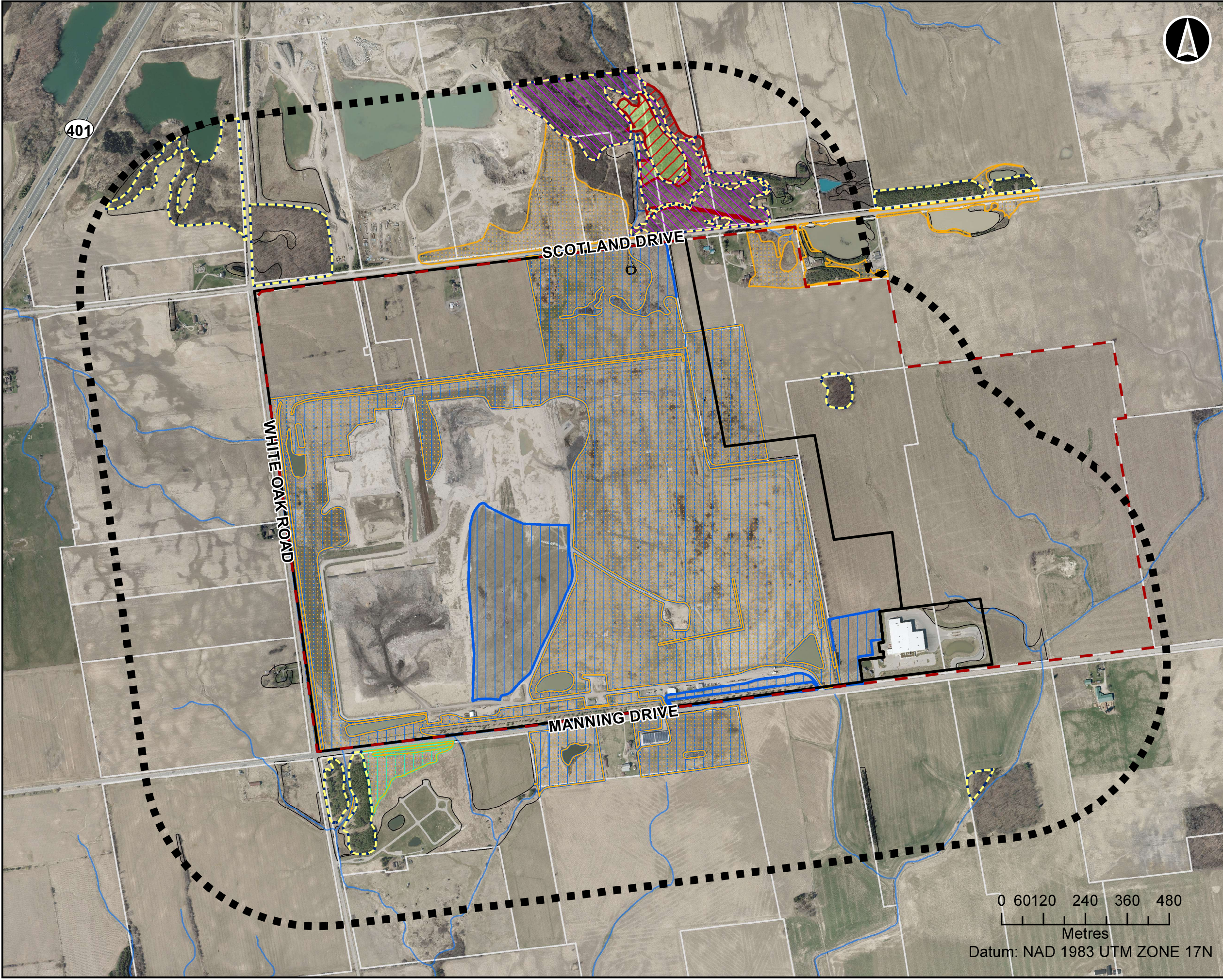
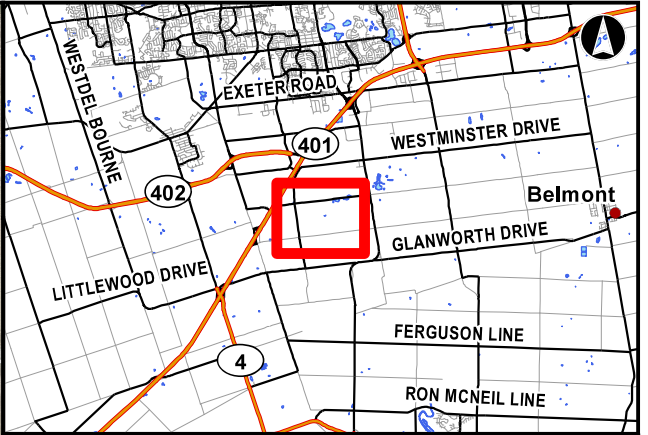
Background data indicate that several water features (e.g., watercourses and waterbodies) support, or are likely to support fish and fish habitat that is regulated under the *Fisheries Act*. Therefore, future work proposed in or near these features must be assessed for the potential to result in Harmful Alteration, Disruption, or Destruction (HADD) as defined by the federal *Fisheries Act*. If proposed work has the potential to cause serious harm, a Request for Review form must be submitted to DFO to determine permitting requirements under the *Fisheries Act*.

It should be noted that although there are no federally owned lands present within the Study Area, the *MBCA* still applies.

2.2.8 Provincially Recognized Features & Species

As outlined in **Section 2.2.3**, methods employed in the MNHSS (2014) were utilized to identify and delineate natural heritage features within the W12A Landfill Study Area. Using Criteria outlined in Table 9 of the MNHSS (Middlesex County 2014) and criteria outlined in the NHRM (OMNRF 2010), an assessment was completed to identify natural heritage features including Significant Woodlands and SWH. Additionally, field investigations further identified habitat for species listed as Threatened under the ESA. The following summarizes the provincially recognized features and species that are present or have the potential to occur within the Study Area:

Significant Woodlands – Where woodland cover is between 5% and 15% in the county, all woodlands > 4ha in area should be considered significant (OMNRF 2010). Similarly, where land cover is less than 15%, woodlands with any interior habitat (i.e., 100 m from the edge of the feature) should be considered Significant. Therefore, all woodlands which meet Criteria 5 were designated as Significant Woodlands within the W12A Landfill Study Area. These features include Significant Woodlands as delineated on Map 5 of the London Plan are identified on **Figure 7**.



Legend

- Watercourse
- Parcel Fabric
- Site Study Area
- Site-vicinity Study Area
- Waste Management Resource Recovery Area Boundary
- Ecological Land Classification (ELC)

Candidate Significant Wildlife Habitat (SWH)

- Bat Maternity Colonies
- Turtle Overwintering

Confirmed Significant Wildlife Habitat (SWH)

- Terrestrial Crayfish
- Amphibian Breeding

Confirmed Significant Wildlife Habitat for Special Concern and Rare Species

- Monarch
- Eastern Wood-pewee

Species At Risk (SAR) Habitat

- Bobolink
- Bobolink & Eastern Meadowlark
- Bats

W12A Landfill Expansion Biology Assessment		
Species at Risk and Significant Wildlife Habitat within the Study Area		
August 2020	1:10,500 <small>* when printed 11"x17"</small>	Source: LIO, City of London
P#: 60556244		Figure 6
AECOM		
<small>This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or relied upon by third parties, except as agreed by AECOM and its client, as required by law or for use by governmental reviewing agencies. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without AECOM's express written consent.</small>		

0 60 120 240 360 480
Metres
Datum: NAD 1983 UTM ZONE 17N

Significant Wildlife Habitat – As identified in **Section 2.2.5**, three (3) SWH were confirmed within the W12A Landfill Study Area – Terrestrial Crayfish Habitat, Amphibian Breeding Habitat (Woodlands) and Special Concern and Rare Species Habitat. Two (2) species of Special Concern were observed within the Study Area during field investigations: Eastern Wood-pewee within the FOD5-5 community in Patch P02, as well as Monarch which was observed in the multiple cultural meadow communities throughout Patch P02. Terrestrial Crayfish were observed within Silver Swamp and adjacent cultural thicket within Patch P02. Additionally, Patches P01, P03, P04 and P05 have the potential to support SWH such as Bat Maternity Roosting Habitat, Turtle Overwintering Habitat or Habitat for Special Concern and Rare Species. Confirmed and Candidate Significant Wildlife Habitat can be seen on **Figure 7**.

Species at Risk Habitat – Bobolink and Eastern Meadowlark were confirmed breeding within the cultural meadows in Patch P02. These species are listed as Threatened under the Species at Risk in Ontario list. These species and their habitat are therefore afforded protection under the ESA. Although nesting was not observed for Barn Swallow and Bank Swallow, these species were observed foraging within the Study Area during field investigations. Potential suitable habitat for Barn Swallow and Bank Swallow is present within the Study Area; however, as no nests were found in the landfill footprint, direct habitat under the General Habitat Description for each species is considered absent (MNRF 2015a)(MNRF 2015b). All wooded habitats provide potential suitable habitat for SAR bat species. Confirmed and Candidate SAR habitat can be seen on **Figure 7**.

2.2.9 Municipally Recognized Features & Species

Provincially recognized features outlined in **Section 2.2.8** above, are designated as Green Space Place Type within the London Plan and as shown on Map 1. In addition to these features, the following section summarizes the municipally recognized features identified through a review of Map 5 of the City of London's Plan and field investigations.

Potential Environmentally Significant Area – The larger, contiguous natural feature located north of Scotland Drive and associated with Silver Swamp has been identified as a potential Environmentally Significant Area.

Significant Woodlands - in addition to Significant Woodlands identified through desktop analysis in **Section 2.3.3**, Vegetation Patches #10120, #10122 and #11068 have also been identified as Significant Woodlands as shown on Map 5 of the London Plan.

Locally Significant Wetland - Silver Swamp LSW is present north of Scotland Drive.

Unevaluated Wetlands – unevaluated wetlands identified on Map 5 of the London Plan as well as wetland communities identified during field investigations require an evaluation in accordance with the Ontario Wetland Evaluation System (OMNRF 2013).

These features are designated as Environmental Review Place Type on Map 1 of the London Plan and may require further study to determine their level of significance, should additional studies be required in consultation with the City of London. These features are delineated on **Figure 7**.

2.2.10 Natural Heritage Features & Constraints

Natural Heritage features identified within the Study Area, as shown on **Figure 7**, were based on the review of applicable background information, field investigations and desktop analysis based on technical criteria outlined in the MNR's NHRM (OMNR 2010) and are consistent with policies set out in the PPS Natural Heritage policies (OMMAH 2020), as well as through the London Plan Natural Heritage policies. Natural Heritage features included in the Green Space Place Type and identified within the Study Area include:

- Locally Significant Wetlands – Silver Swamp,
- Significant Woodlands,
- Significant Wildlife Habitat,
- Species at Risk Habitat,

These natural heritage components pose various degrees of environmental constraint to development, including landfill expansion. Environmental constraints generally refer to areas where development is precluded or limited, based on the significance or sensitivity of the natural heritage features(s) and/or their functions. In some cases, the constraint to development is absolute (no development or site alteration is permitted); in other cases, development may be permitted if it can be demonstrated that the proposed development will not have a significant negative impact on the feature, and or, its functions. In the latter case, permitting with associated mitigation or compensation may be required.

The following section outlines the degree of constraint for development for each natural heritage feature identified within the W12A Landfill Study Area.

2.2.11 Development Constraints for Natural Heritage Features & Adjacent Lands

Development within and adjacent to natural heritage features identified within the W12A Landfill Study Area should be consistent with the policies outlined in the London Plan (2017) which adhere to the PPS (2020). **Table 18** below summarizes the level of protection required for natural heritage features identified within the Study Area, including preliminary buffer requirements and the development distance from a natural feature that would trigger an Environmental Impact Study (EIS) as outlined in the London Plan and its associate Environmental Management Guidelines. As it is not common practice for a municipality to complete an EIS for a landfill or landfill expansion, the City of London will determine whether an EIS will be required further to the completion of the Environmental Assessment (EA).

Table 18: Summary of Development Constraints for Natural Heritage Features identified within the W12A Landfill Study Area

Natural Heritage Feature	Adjacent Lands	Development Constraints as per the PPS (2020) and London Plan (2017)	Recommended Preliminary Buffers
Provincially Significant Wetlands, Wetlands and Unevaluated wetlands.	120m	Development and site alteration shall not be permitted within a Provincially Significant Wetland (PSW) or LSW (evaluated as not Provincially Significant). Development and site alteration shall not be permitted within and/or adjacent to an unevaluated wetland identified on Map 5 and/or if an Ecological Land Classification identifies a community as a wetland.	30 metres from the outer boundary of the wetland or individual units in the case of complexes.
Significant Woodlands	120m	Development and site alteration shall not be permitted in Significant Woodlands unless it has been demonstrated that there will be no negative impacts on the natural heritage features or their ecological functions.	15 metres from the woodland dripline.
Significant Wildlife Habitat	120m	Development and site alteration shall not be permitted in and adjacent to SWH unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological function.	5-30 metres depending on the type of SWH identified: <ul style="list-style-type: none"> ▪ 5 metres for habitats associated with early successional habitats ▪ 15 metres for habitats associated with woodlands ▪ 30 metres for habitats associated with wetlands.
Significant Valleylands	120m	Development and site alteration shall not be permitted in or adjacent to Significant Valleylands unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological function.	To be determined through correspondence with the relevant Conservation Authorities at the site development stage.
Habitat for Threatened or Endangered Species	120m	Development and site alteration shall not be permitted in the habitat of Endangered Species and Threatened species, except in accordance	Buffers will depend on the type of habitat and species identified within the study area. Habitat for Threatened or Endangered Species was not identified within the Study

Natural Heritage Feature	Adjacent Lands	Development Constraints as per the PPS (2020) and London Plan (2017)	Recommended Preliminary Buffers
(SAR habitat)		<p>with provincial and federal requirements.</p> <p>Development and site alteration shall not be permitted on adjacent lands unless it has been demonstrated that there will be no negative impacts on natural heritage features or their ecological functions.</p>	Area. Therefore, no preliminary buffers are recommended at this time.
Fish Habitat	120m	<p>Development and site alteration shall not be permitted in Fish Habitat except in accordance with relevant provincial and federal requirements.</p> <p>Development and site alteration shall not be permitted on adjacent lands unless it has been demonstrated that there will be no negative impacts on the natural heritage feature or their ecological function.</p>	30 m from watercourses and waterbodies

Natural heritage features identified as part of the Green Space Place Type, through background review and field investigations are delineated on **Figure 7**. Recommended preliminary buffers are based on standard practices for each natural heritage feature.

Natural heritage features which are included in the Environmental Review Place Type designation and that are found within the Study Area include:

Unevaluated wetlands,
Valleylands, and
Potential Environmental Significant Areas.

These features designations are considered to be interim in nature until the significance of these patches can be confirmed through further investigations and the application of evaluation criteria. Some of these unevaluated features could not be evaluated due to lack of property access. Nevertheless, these features are well outside of the proposed expansion area and will not be affected by the proposed expansion. Evaluation of these patches is, therefore, not required.

3. Project Description

The landfill expansion consists of a vertical expansion over the existing landfill footprint to provide 13.8 million m³ of airspace for waste and daily cover. To accommodate ancillary features and provide additional on-Site buffer width compared to the existing landfill, the northern boundary of the landfill property will be adjacent to Scotland Drive and a 100 m buffer width will be provided on the east side of the landfill footprint and some additional area in the southeast corner to tie into the adjacent Materials Recovery Facility (MRF) property line. This results in a 106.3 ha landfill footprint within a 192.4 ha landfill property, with a highest ridge elevation of waste of 318.43 masl.

The W12A Landfill Expansion Environmental Assessment report (Golder, 2020a) provides the plans for landfill expansion phasing, drainage areas, stormwater management and ancillary facilities in relation to the descriptions in the following sections.

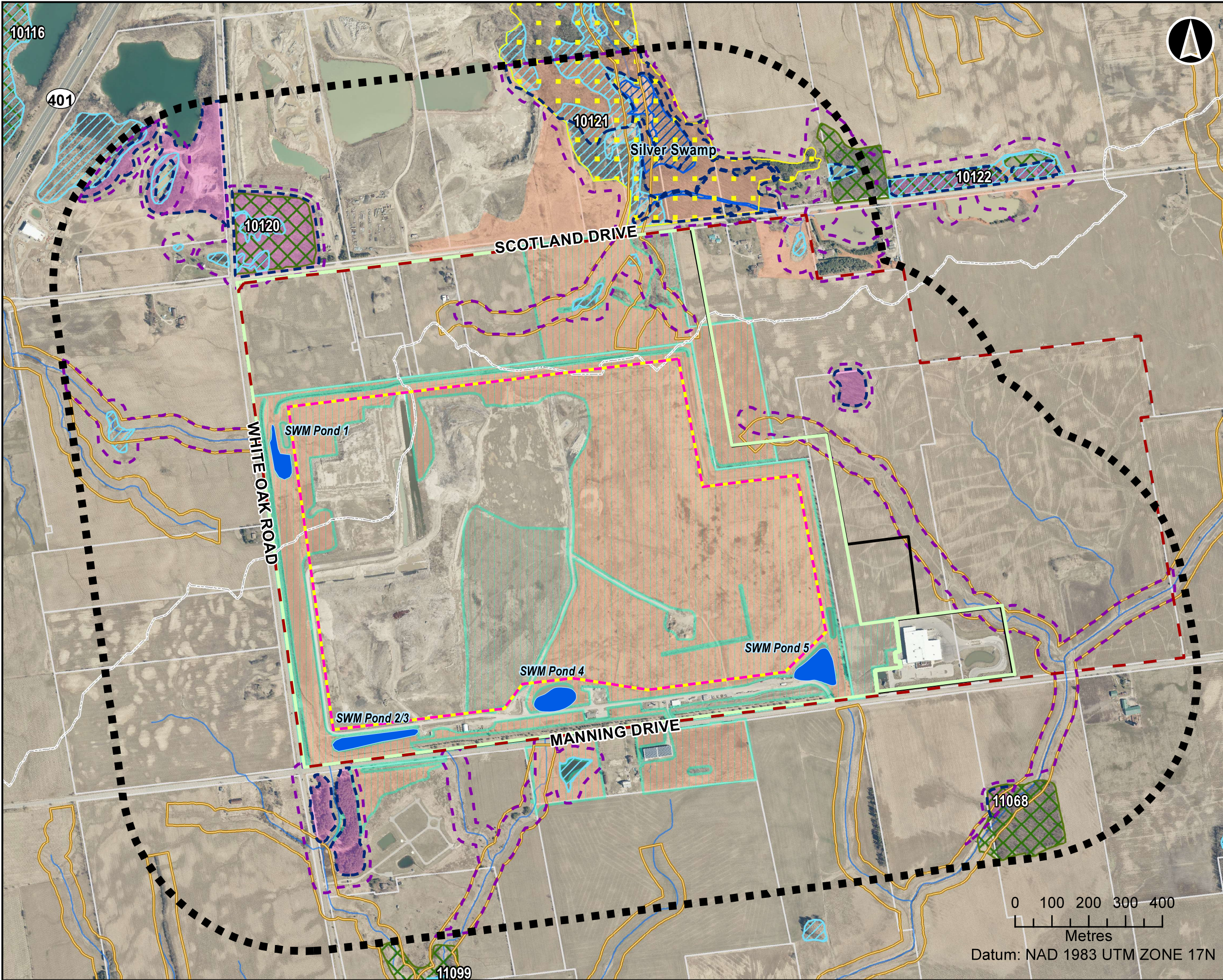
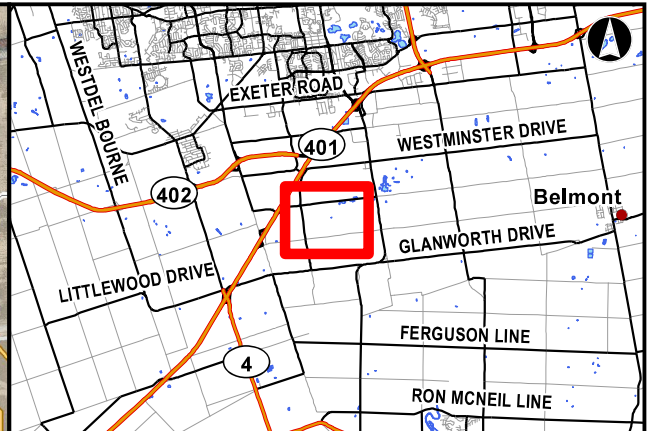
Figure 8 shows the landfill expansion area in relation to natural heritage features and existing infrastructure.

3.1 Landfill Phasing and Development

The landfill expansion will be developed sequentially in eight Phases, 1E through 8E, progressing from the west side of the landfill towards the east. Landfilling in each Phase will be approximately 2.5 to 3.5 years based on an expected typical annual air space consumption of 500,000 m³ per year, which corresponds to an average annual waste receipt of 370,000 tonnes per year over the 25-year planning period. A separate cell dedicated for disposal of the non-decomposable portion of the waste stream will be provided in the southeastern area of the landfill expansion. Filling in this non-decomposable waste cell will take place in lifts over the 25-year expansion period and will be blended in to meet the temporary side slopes in the adjacent Phases 7E and 8E as they are developed. Because this waste is non-decomposable, it would not receive daily cover; however, if it is observed that specific materials are generating odours or are otherwise of concern if left uncovered, daily cover material would be placed. This fill area would receive final cover consistent with that on the remainder of the landfill, but it is not proposed to install a landfill gas collection system in this area as part of the final cover construction.

To commence filling in each Phase, the existing cover material would be progressively stripped from an area large enough to accommodate the year's disposal, which is estimated to average approximately 4 ha. The area of exposed waste would be limited to that needed to spread, compact and cover the waste received on a daily basis, and will range from about 40 m by 25 m typically (1,000 m²) to 50 m by 30 m (1,500 m²). The waste will be spread and compacted in lifts of about 0.6 m to a height of approximately 3 m. All waste will be covered daily.

For the southern Phases 1E, 3E, 5E and 7E the waste would be placed initially to build a berm along the south side of the Phase and will be covered with final cover soil and seeded to establish vegetation; the berm will screen the view of subsequent filling operations north of the berm from off-Site vantage points to the south. The south side perimeter waste berm would be raised sequentially and filled in behind until the peak elevation is reached. The Phase boundaries have been designed (offset) such that the completed southern Phases (1E, 3E,



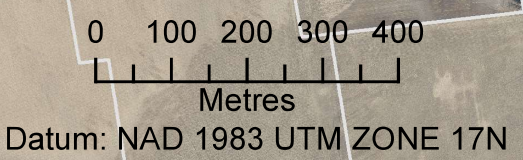
- Legend**
- Watercourse
 - Parcel Fabric
 - Site Study Area
 - Site-vicinity Study Area
 - Waste Management Resource Recovery Area Boundary
 - Proposed Property Boundary
 - Existing and Proposed Limits of Waste
- Natural Heritage Features**
- 11033 Vegetation Patch ID
- Conservation Authority Boundary
 - Valleyland
 - Potential ESA
 - Locally Significant Wetland
 - Unevaluated Wetland
 - Significant Woodland
 - Species At Risk (SAR) Habitat
 - Candidate Species at Risk (SAR) Habitat
 - Confirmed Significant Wildlife Habitat (SWH)
 - Candidate Significant Wildlife Habitat (SWH)
 - Preliminary Buffer
 - Ponds and Stormwater Management Facilities

W12A Landfill Expansion
Environmental Assessment

Proposed Landfill Expansion

November 2020	1:10,000 <small>* when printed 11"x17"</small>	Source: LIO, City of London
P#: 60556244 AECOM		Figure 8

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5E, 7E) will effectively screen the view of landfilling operations in the northern Phases (2E, 4E, 6E, 8E) from off-Site vantage points to the south.

Temporary soil berms, and if necessary shallow swales, would be provided to direct surface water runoff from existing covered upslope areas around the active fill areas / Phases to the stormwater management system since this runoff has not been in contact with waste.

On an annual or biannual basis, final cover would then be constructed over areas reaching final grade and permanent vertical landfill gas (LFG) wells will be installed and connected to the LFG gas collection system.

For the portion of the proposed vertical expansion that will involve placement of additional waste above the Phase 2 area, the existing leachate collection system (LCS) will continue to be used to collect and remove leachate from the area.

3.2 Leachate Control and Management

Phase 2 utilizes the clay till as a natural low permeability liner and has a continuous granular drainage blanket and piping system over a shaped subgrade to collect leachate and direct it by gravity to the north end of the Phase 2 area where the collected leachate is removed for subsequent off-site treatment. The waste in the Phase 1 area rests directly on the underlying low permeability clay till and has a perimeter LCS around the north, east and south sides to intercept leachate seepage at the base of the waste. Collected leachate either drains into the Phase 2 collection system or into a separate storage from where it is removed for subsequent off-site treatment.

For the portion of the proposed vertical expansion that will involve placement of additional waste above the Phase 2 area, the existing LCS will continue to be used to collect and remove leachate from the area. For the vertical expansion above the Phase 1 area, it is proposed to replace the existing perimeter LCS with a new perimeter LCS that will more effectively serve the same functions as the existing system. To control the potential for leachate seeps along the perimeter side slopes that could occur as a result of leachate mounding and/or perched leachate in Phase 1, it is proposed to construct granular finger drains around the north, east and south sides of the exterior perimeter of the Phase 1 area and connect them into the replacement Phase 1 perimeter LCS.

The leachate collected from the Phase 1 and Phase 2 LCS will continue to be routed through on-Site piping to the main leachate pumping station located at the southeast corner of the Site. From here, the leachate will be pumped off-Site through a leachate forcemain to the Dingman Road pump station, where combined with municipal sewage it will enter the municipal sanitary sewer system to treatment at the Greenway Wastewater Treatment Plant (WWTP).

3.3 Landfill Gas Generation and Control

It is estimated that the total expanded landfill will theoretically generate a maximum of 4,395 standard cubic feet per minute (scfm) of LFG in 2049 (the year following completion of filling of the expansion), of which typically 50% is methane. LFG is collected from completed areas of the landfill using a vertical well system that is connected to an enclosed flare; the existing flare is sized to combust a maximum of approximately 1,700 scfm of LFG. Considering the actual extent of the LFG well extraction system and its collection efficiency, analysis indicates that the capacity

of the existing flare may be exceeded around year 2027. The timing for installation of additional flare capacity will depend on the actual operation of the existing flare and its ability to handle the collected gas flow rate. It is proposed to utilize vertical LFG extraction wells to be progressively installed with the construction of final cover following placement of waste to final contours in each Phase. To reduce air emissions (for odour control purposes during landfilling operations and to increase the overall collection of landfill gases), it is proposed that a number of horizontal landfill gas collection pipes will also be installed progressively as waste is placed.

3.4 Stormwater Management

The on-site drainage network is currently divided into four general areas with a system of berms, slopes and perimeter drainage ditches directing runoff generated within the W12A Landfill property envelope to four separate stormwater management ponds. Under the proposed vertical expansion, the peak of the landfill mound will shift to the south and side slopes of the mound will be longer and somewhat steeper in places, resulting in changes of the drainage boundaries to each of the ponds and, in general, reduced times to peak runoff. To address these changes in surface water runoff, some modifications to the existing stormwater management (SWM) ponds will be required.

Under current conditions, Ponds 2/3, 4 and 5 collect an area of 130 hectares of surface water runoff and provide treatment and attenuation prior to discharge off-Site to the south, to the Dodd Creek Watershed. The proposed landfill expansion and mound configuration will result in a reduction of the drainage area being collected and treated by these ponds and discharged to Dodd Creek subwatershed to 95.3 hectares. Under current conditions Pond 1 collects a drainage area of 14.4 hectares of surface water runoff and discharges off-Site to the north, to the Dingman Creek subwatershed. The proposed landfill expansion would result in an increased drainage area of 34.4 hectares to Pond 1. The outlet structure for Pond 1 will be designed such that discharge will match or be below pre-expansion peak flows for the 1:2 year through 1:100-year design storm events.

Stormwater runoff from the proposed expansion will continue to be managed in terms of both quality (80% Total Suspended Solids removal) and quantity (to match post-expansion flows to pre-expansion conditions for the 1:2 year through the 1:100-year return period design storm). The 1:250-year return period design storm was also assessed to predict conditions during such an event to accommodate climate change.

The proposed pond modifications are as follows:

- Pond 1 – to accommodate an increased contributing drainage area and reduction in time to peak, the pond will be expanded to the north, increasing the size of the main pond and forebay. The outlet structure will be modified with an appropriately sized orifice to meet discharge requirements.
- Pond 2/3 – the landfill expansion will result in a decreased drainage area to this pond; however, to meet the Enhanced Level Protection (80% TSS removal) the permanent pool depth will be increased, and some modifications will be made to the existing outlet structure.
- Pond 4 – this pond will receive stormwater runoff from a smaller total drainage area. The existing permanent pool and active storage is sufficiently sized to meet the 80% TSS removal requirements. The existing outlet structure will be modified to control discharge;

an overflow weir will be added and the existing double inlet catchbasin maintained for larger storm events.

- Pond 5 – this pond will receive stormwater runoff from a larger total drainage area. The pond will be expanded to the east and north to increase both the permanent pool and active storage capacities. The existing outlet structure will be modified with an appropriately sized orifice and a weir.

3.5 Site Operations and Ancillary Components

The expanded landfill will operate, at the maximum, from 7 a.m. to 5 p.m., Monday through Saturday plus one hour before, i.e., 6 a.m. to 7 a.m., for site preparations and one hour after, i.e., 5 p.m. to 6 p.m. to complete placement of daily cover. The Site will be closed on Sundays; on statutory holidays site operations will be as required to accommodate hauling contracts.

It is proposed that the maximum annual receipt of waste for the expanded landfill will be 500,000 tonnes per year, reduced from the 650,000 tonnes/year allowed for the existing landfill.

The expanded landfill will also need to continue to occasionally operate 24 hours per day, 7 days per week when lime stabilized dewatered biosolids (dewatered sewage sludge) from the Greenway WWTP are being received and disposed at the landfill. This is typically required for three weeks per year; however, some years this period could be extended. In addition, re-builds or major equipment repairs typically occur approximately every five years or longer and can take up to two to three months to complete. The landfill may receive a load of biosolids (approximately 15 tonnes) every 75 to 90 minutes. Disposal of the biosolids involves excavating a hole in the existing waste in the active area (when practical) prior to the load arriving and covering the biosolids with daily cover soil as soon as the load has been dumped.

The main site access for the expansion will be at the same location as for the existing site, off Manning Drive at the southeast corner of the Site. The main ancillary facilities are located along the perimeter road across the south side of the Site. It is proposed that many of the existing ancillary facilities at the site will be progressively upgraded or replaced during the expansion at or close to their existing location, except for a new site office / administration building to be located close to the site entrance. These facilities consist of the contractor's office and garage; administration building; flare and control system; weigh scales and scale house and leachate pump station; and small vehicle waste drop-off. A new enclosed night waste storage facility for receipt and temporary storage of three to five loads of waste may also be constructed; access to the landfill at night will be done using card key access and automatic gates. In addition, in the vacant southeast corner area between the landfill and the MRF there will be a new scale and scale house, a grade-separated small vehicle drop-off for waste, a grade-separated small vehicle drop-off for recyclable materials, an area for drop-off of brush, tires and large items, and a new Household Special Waste depot.

The source of heating for all site buildings will be natural gas.

The existing paved roads on the south and west sides of the landfill are paved and will remain paved for the expansion. It is proposed that the perimeter access road around the north and east sides of the landfill will also be asphalt surfaced, as will the vehicle access roads for the proposed recycling drop-off facilities in the southeast corner between the landfill facilities and the MRF will also be paved. Access for collection vehicles to the expansion Phases will be mainly from the south side perimeter road, and for Phases 1E and 2E from the west

side perimeter road. From the south side it is anticipated that the two existing granular surfaced haul roads will continue to be utilized.

A secondary site access off Scotland Drive will be used as a secondary site access and service road for operations and maintenance vehicles to the north part of the landfill property and as an emergency access/exit. The secondary access will have a locked gate to prevent unauthorized usage and will be gravel surfaced.

3.6 Closure and Post-closure

The landfill Phases will be progressively closed after the final waste contours have been reached in each Phase and landfill operations have proceeded into the next Phase(s). The final cover on the landfill will consist of a permeable cover design, comprised of 600 mm of soil topped with 150 mm of topsoil or similar and vegetated. The vertical LFG extraction wells will be installed to collect gas from within the expanded waste mass as part of the progressive construction of the final cover system.

Post-closure activities will involve continued operation and maintenance of the leachate collection and removal system, the LFG control system and the stormwater management system. In addition to general inspection of the site, there will be inspection of the landfill cover for evidence of erosion, leachate seeps or instability, and maintenance / repair as required.

3.7 Description of Activities

The time frames over which there will be activities on the Site associated with the proposed vertical expansion can be divided into three: initial construction, operations and post-closure. Following is a general description of the activities that are expected to take place during each of these periods.

Initial Construction: It is anticipated that the initial construction activities associated with the expansion will take place in the 2023 to 2025 period. Because the expansion will be a vertical expansion above the existing footprint, there will be no large-scale excavation required to construct a new cell. Construction of the replacement perimeter leachate collection system immediately adjacent to the existing toe of the landfill around the north, east and south perimeter of Phase 1 will involve conventional trenching and pipe installation; trenches into the waste will also be extended up the existing landfill side slopes to install finger drains. The modifications / enlargements to the existing stormwater management system ponds and their outlet controls will also be completed, involving relatively shallow excavation and soil berm construction in the immediate area of the existing ponds; no construction or alterations are proposed for the existing structures that convey the pond discharge below the adjacent roadways to the downstream watercourses or in the downstream watercourses themselves. Site roads will be constructed/upgraded adjacent to the north and east sides of the existing landfill. Construction of other infrastructure upgrades, i.e., main pump station, some of the buildings and some of the ancillary facilities, will take place along the south side of the Site that is already occupied by Site infrastructure. Construction of the new diversion and drop-off facilities in the southeast corner of the expanded site adjacent to the MRF will involve stripping of existing vegetation and then conventional construction for these types of facilities. Surplus soil resulting from this initial construction will either be temporarily stockpiled on the landfill for re-use in ongoing operations or stockpiled for future use in the on-Site buffer area to the north of the landfill footprint where soil stockpiles already exist.

Operations: Operation of the expanded landfill is expected to be ongoing between 2024 and 2048. The expansion will commence in Phase 1E in the southwest and in the non-decomposable cell in the southeast, which will involve progressive stripping of the existing cover material from the active area and the placement and compaction of waste and spreading of daily cover soil, compaction and daily covering of the waste. The daily cover will be mostly suitable types of materials incoming to the site on an ongoing basis, supplemented as needed by material from on-Site soil stockpiles. After completion of a cell and moving to the next disposal area (as per the phasing plan), final cover soil will be placed over the waste and revegetated and the landfill gas collection system progressively installed with the final cover. During operations, vehicles will travel on the on-Site perimeter roads and on the haul roads located on the landfill, as well as to and from the soil stockpiles in the north buffer area. There will be ongoing maintenance and monitoring activities. The operations activities during the expansion will basically be a continuation of current site activities both on and adjacent to the existing landfill footprint, with raising of the landfill to reach the design configuration.

Post-Closure: When the approved capacity of the expanded landfill is reached at the end of the 25 year planning period at the end of 2048, the final cover will be placed on the last landfill Phase. After disposal operations cease, it is expected that the diversion activities may continue at the site using the established infrastructure. The activities associated with operation and maintenance of the leachate collection and pumping systems, the conveyance of collected leachate off-Site for treatment, the stormwater management ponds and the operation and maintenance of the landfill gas collection and flaring system will continue. Post-closure groundwater and surface water monitoring programs will continue. The leachate and landfill gas management system operations will extend for many decades post-closure.

4. Impact Assessment

The following impact assessment considers the potential direct and indirect impacts of the W12A Landfill expansion preferred alternative on the aquatic and terrestrial ecosystems within the Study Area for the construction, operations and closure stages of the project as outlined in **Section 3**.

Potential direct impacts to natural heritage features and functions are those that result in an immediate loss of the feature or function as a consequence of the project works. This may include the removal of a vegetation community or habitat within the area of expansion or ancillary facilities and related works or work areas. Potential indirect impacts are those whereby the project works cause impacts to an adjacent or downstream feature or function through the alteration of the project site.

When considering and assessing the potential environmental impacts of a project on natural heritage features and functions, the first approach is to avoid potential impacts through layout and design of the project. Where impacts cannot be avoided, then mitigation of those impacts should be implemented to reduce the severity of those impacts. If mitigation measures are not possible or sufficient to mitigate potential impacts, then compensation for the loss of features and/or functions is required.

The proposed expansion of the W12A Landfill avoids many potential impacts by situating the future expansion on the existing landfill fill area.

Figure 8 shows the limits of the proposed landfill expansion overlaid with the natural heritage features.

4.1 Construction Stage

4.1.1 Aquatic Ecosystems

Direct Impacts

Since all aquatic habitat for both Dingman Creek and Dodd Creek are outside of the proposed expansion area, no direct impacts to aquatic species or habitat are anticipated.

The proposed modification to stormwater management facilities' (SWMF) weirs and outlets will all occur within the landfill area. As there are no physical alterations to the downstream SWMF infrastructure including the ditches, culverts, or other downstream watercourses, no direct impacts to aquatic species or habitat are anticipated from the proposed modifications to SWMF system.

Indirect Impacts

As described above, construction and alterations associated with the proposed modification to the SWMF weirs and outlets are not proposed for existing structures that convey pond discharge to downstream watercourses. As such, no indirect impacts to aquatic species or habitat are anticipated during the Construction Stage.

4.1.2 Terrestrial Ecosystems

Direct Impacts

While the preferred alternative avoids areas of natural heritage features and functions by restricting the landfill expansion to the existing landfill footprint, direct impacts are anticipated. These impacts are based on the occurrence of Confirmed Significant Wildlife Habitat for Monarch and Species at Risk Habitat for grassland birds that overlaps with the existing landfill. The habitat for Eastern Meadowlark and Bobolink within the Study Area includes the existing landfill due to the grassland habitat characteristics of the vegetation cover over the existing landfill area and adjacent lands. The direct impacts to these areas during the Construction Stage are not considered to be significant and may be avoided based on the specific location of trenching activities.

Other potential direct impacts may include incidental injury or mortality of common wildlife species that may occupy areas of the existing landfill site; these may include groundhogs, Killdeer, common snake species, etc.

Should stripping of existing vegetation for the new diversion and drop-off facilities in the southeastern corner occur during the breeding bird window (April 1st to August 31st), there is potential for impacts to nesting birds and may contravene the *Migratory Birds Convention Act*. Often during the construction phase of projects involving the excavation/stripping and stockpiling of soil there are unintended impacts related to the creation of environments suitable for the nesting of breeding birds or other species (nesting turtles). Should stockpiling of stripped soil or fill be conducted during the breeding bird window, there is a potential for birds such as Banks Swallows or Cliff Swallows to establish nests in newly exposed slopes that are greater than 3:1 in inclination. Once established, the nests cannot be disturbed until the young have fledged from the nests.

Other potential direct impacts may include common wildlife species that may occupy areas of the existing landfill site; these may include groundhogs, Killdeer, common snake species, etc.

Indirect Impacts

Potential indirect impacts of the construction phase include typical construction-related impacts including:

- Dust deposition on vegetation in adjacent vegetation communities;
- Noise related impacts to wildlife in adjacent habitat;
- Introduction of invasive plant species via construction equipment; and,
- Accidental injury or mortality of wildlife or vegetation (i.e., adjacent trees) from construction equipment and vehicles.

These indirect impacts are not considered significant and are mitigatable with standard measures.

4.2 Operations Stage

4.2.1 Aquatic Ecosystems

Direct Impacts

During the Operations Stage of the expansion of the W12A Landfill direct impacts to aquatic ecosystems are not anticipated.

Indirect Impacts

While the proposed works associated with the Operations Stage for the preferred alternative are not expected to result in direct impacts to aquatic ecosystems, there will be changes to drainage areas and the resulting water balance. These changes are outlined in the *Stormwater Management Report – London Ontario W12 Landfill* (Golder, 2020b) and include the following:

1. The reduction of surface water drainage to Dodd Creek from SWM Ponds 2/3, 4 and 5. The reduction in drainage area from pre-expansion to post-expansion is estimated to be 20.1 hectares, from 127.6 ha to 106.5 ha.
2. The increase in surface water drainage to Dingman Creek from Pond 1. The increase in drainage area from pre-expansion to post-expansion is estimated to be 20 hectares, from 14.5 ha to 34.5 ha.

The alteration to drainage areas for Dingman and Dodd Creek occur in the upper reaches of the subwatershed and represent a 0.12% decrease and 0.20% increase in overall subwatershed area, respectively. Additionally, discharge from the Site to the Dingman Creek subwatershed will be attenuated by Pond 1 to below pre-development flows up to and including the 1:100-year return period design storm under the proposed design (Golder, 2020b). As such, these changes in drainage area are expected to have a negligible effect on runoff and drainage downstream of the Site in both the Dingman and Dodd Creek subwatersheds. Further, modifications to the existing SWM infrastructure, along with mitigation measures (i.e., erosion and sediment control), are expected to result in surface water quality conditions that are comparable to existing conditions and meet the MECP PWQOs (Golder, 2020b).

As described in the *Groundwater Impact Assessment – W12A Landfill Expansion EA* (Golder, 2020c). The existing landfill is located overlying a surficial aquitard of low permeability clayey till (15-20 m thick) and will not affect recharge of the groundwater system or groundwater levels/quantity. Therefore, the proposed vertical expansion is not anticipated to have any direct impacts downgradient groundwater levels or quantity off-site.

The above indirect impacts are not considered significant and are mitigatable with standard measures.

4.2.2 Terrestrial Ecosystems

Direct Impacts

During the Operations Stage of the Landfill Expansion, potential direct impacts to terrestrial features and functions are anticipated from the progressive removal of grassland cover to facilitate the vertical expansion. These impacts are based on the Confirmed SWH for Monarch and SAR Habitat for grassland birds as described in **Section 4.1.2**. Although the aforementioned habitat will be removed for the proposed landfill expansion, these impacts will be temporary in nature as they will be revegetated when vertical capacity is reached to mimic habitat conditions currently present (e.g., grassland species, common milkweed). In addition to temporary habitat removal, accidental destruction of nests, stockpiling of stripped material creating nesting opportunities for birds, or wildlife mortality may occur as part of the Operations Stage (as outlined for the Construction Stage in **Section 4.1.2**). These occurrences can be avoided through the implementation of standard operational measures, the continuation of measures implemented during the Construction Stage, and potential compensation for SAR Habitat (as described in **Section 5.1**).

Indirect Impacts

During the Operations Stage of the expansion of the W12A Landfill, potential indirect impacts to terrestrial ecosystems are likely to be limited to the following types of impacts:

- Dust and airborne waste deposition in natural habitat;
- Noise related impacts to wildlife in adjacent habitat;
- Introduction of invasive plant species via construction equipment; and,
- Accidental injury or mortality of wildlife or vegetation (i.e., adjacent trees) from construction equipment and/or vehicles.

4.3 Closure and Post-Closure

4.3.1 Aquatic Ecosystems

Direct Impacts

Potential direct impacts to aquatic systems are not anticipated during closure and post-closure activities.

Indirect Impacts

Potential indirect impacts associated with closure and post-closure activities are limited to the management of leachate and stormwater management within the landfill. With the implementation of the LFG control system and the proposed stormwater management system, indirect impacts as a result of landfill closure are not anticipated.

4.3.2 Terrestrial Ecosystems

Direct Impacts

Activities associated with landfill closure include the addition of topsoil and plantings of native vegetation; as such, the project closure will result in an overall compensation for natural communities lost during construction and operations.

Indirect Impacts

Potential indirect impacts associated with closure and post-closure activities are limited to the management of leachate and stormwater management within the landfill. With the implementation of the LFG control system and the proposed stormwater management system, indirect impacts as a result of landfill closure are not anticipated.

5. Mitigation and Compensation

5.1 Construction Stage

Mitigation of Direct Impacts to Species at Risk and Wildlife

Natural heritage features and habitat are most susceptible during the construction stage of any project as site conditions are most substantially altered during this stage. Therefore, construction activities need to be mitigated and controlled to avoid significant adverse effects.

To avoid or minimize impacts related to the construction stage (as outlined in **Section 4.1**), a detailed Environmental Mitigation and Monitoring Plan (EMMP) will be developed. It is recommended that the EMMP be developed prior to the issuance of engineering drawings to allow for mitigation measures to be incorporated into contract drawings for future planning. The contents of the EMMP will be determined at Detailed Design, but may include typical construction mitigation measures such as erosion and sediment control, work area delineation, construction timing windows, etc.

Based on the proposed expansion, vegetation removal associated with the construction stage will be required. In order to avoid direct impacts to the SAR Birds, including Bobolink and Eastern Meadowlark, all habitat removal should occur outside of the bird nesting season (April 1 to August 31). This also avoids potential incidental take and therefore contravention of the *Migratory Bird Convention Act (MBCA)*. Should vegetation clearing be required during the nesting period, a nest search may be completed by a quality ecologist. Once the ecologist has confirmed no active nests are present, clearing may take place up to 24 hours after completion of the inspection. Nest searches should only be completed within simple habitats or where nests are conspicuous.

Based on the preferred alternative and its proximity to natural heritage features and significant species, the preparation and implementation of a Species at Risk and Wildlife Observation Protocol will be required. This protocol will outline the steps to take in the event of an encounter with wildlife, including Species at Risk (SAR), during the construction stage. Detailed information and specific requirements related to wildlife and SAR encounters will be incorporated in the protocol including proper species identification, taxa- or species-specific handling methods, and reporting of wildlife and SAR as required by provincial legislation.

Along with the Species at Risk and Wildlife Observation Protocol, further mitigation related to potential wildlife and SAR encounters during the construction stage will include the following items:

- Species Fact Sheets for SAR that may be encountered on-site during the construction stage will be posted on-site in the site office or trailer where it is visible to workers for review. These fact sheets will outline SAR identification and species-specific protocols in the event they are encountered.
- To ensure compliance with policy and the Species at Risk and Wildlife Observation Protocol, all persons entering the site will receive staff training outlining the proper identification, handling methods, any associated reporting of wildlife and/or SAR

encounters, and steps to take to ensure compliance with the in the event of wildlife and SAR encounters.

Wildlife exclusionary fencing around the landfill, or portions of the landfill should be considered at Detailed Design to mitigation wildlife encounters on site during construction and operations.

Compensation Mitigation of Potential Impacts to SAR & Wildlife

As habitat for SAR grassland birds cannot be avoided within the proposed expansion alternative, compensation for habitat loss will be required as regulated under the ESA (O.Reg. 242/08). Consultation with the MECP will be required to determine appropriate compensation measures for Bobolink and Eastern Meadowlark. These measures may include enhancing existing grasslands in adjacent habitats or creating additional grassland habitats within the same eco-region. Further details on permitting requirements for SAR birds can be found in **Section 7.2**.

Compensation for Significant Wildlife Habitat for Monarch will be achieved at project closure with the implementation of native plantings which are recommended to include common milkweed (*Asclepias syriaca*), a host plant for the species.

5.2 Operations Stage

During the Operations Stage, standard mitigation measures for erosion and sediment control, dust suppression, timing of operations (e.g., 7am to 7pm), maintenance of the stormwater management system and facilities, and maintenance of the leachate treatment system will be required.

Based on the proposed expansion, vegetation removal associated with the operations stage will be required. To avoid direct impacts to the SAR Birds, including Bobolink and Eastern Meadowlark, all habitat removal should occur outside of the bird nesting season (April 1 to August 31). Further, mitigation measures outlined in **Section 5.1** should be implemented related to vegetation removal and nest searches. Although the vegetation removal during this stage will be progressive, with revegetation upon vertical landfill capacity for a given area, compensation (as described in **Section 5.1**) for the removal of SAR Habitat and SWH may be required as determined through consultation with MECP and other applicable regulatory agencies.

As heavy machinery activity will continue throughout the operations phase, considerations for wildlife exclusionary fencing and implementation of The Species at Risk and Wildlife Observation Protocol developed for the Construction Stage (as outlined in **Section 5.1**) should occur.

5.3 Closure and Post-Closure Stage

The Closure and Post-Closure stage of the project is self mitigating, as the site will be progressively top soiled and vegetated as landfilling is completed in the expansion phases. It is recommended that all plantings include native species that are known to occur within the region and may include compensation plantings as determined through consultation with the MECP for Bobolink and Eastern Meadowlark habitat compensation.

6. Monitoring

6.1 Construction Stage

As mentioned in **Section 5.1**, an EMMP will be developed and will include a Construction Monitoring Plan that will outline monitoring activities to be completed during construction. These activities will include, but are not limited to, the following:

- Pre-construction inspection to confirm proper installation of ESC and any recommended wildlife exclusionary measures;
- Regular Erosion and Sediment Control (ESC) fencing monitoring and any exclusionary fencing measures; and,
- Training session for on-site personnel which summarizes mitigation measures.

6.2 Operations Stage

Monitoring during operations may include monitoring of any compensation measures necessary to meet MECP permitting or approval requirements for Bobolink and Eastern Meadowlark as well as standard water quality and quantity monitoring necessary to meet relevant provincial permitting and approvals. Monitoring requirements for Operations will be determined at the Detailed Design stage.

6.3 Closure and Post-Closure Stage

Monitoring of compensation plantings and SAR habitat will likely be required to meet requirements under the ESA (O.Reg 242/08). The closure and post-closure monitoring efforts will be determined at the Detailed Design Stage.

7. Other Approvals

The proposed expansion for the W12A Landfill will require approvals other than the acceptance and approval of the Environmental Assessment (EA). Based on the layout, design and operation of the proposed expansion, approvals may be required under the following legislation:

1. Provincial: *Endangered Species Act*
2. Provincial: *Planning Act*
3. Provincial: *Conservation Authorities Act*
4. Municipal: *The London Plan*

The triggers for these legislation and general permit requirements are outlined in the following sections.

Note that the approvals outlined below all require specific information that can only be determined at the detailed design stage of planning and engineering.

7.1 Provincial

Endangered Species Act

The confirmed presence and breeding of two Species at Risk birds, Bobolink and Eastern Meadowlark, in the cultural meadow habitats (Patch P02) within the proposed expansion area of the W12A Landfill will require review and determination of permitting requirements under the *Endangered Species Act (ESA)*. Direct loss and/or damage of Bobolink and Eastern Meadowlark habitat is likely to occur during site preparation (e.g., vegetation stripping and site grading), construction of temporary stockpile areas, transportation of equipment and materials, and excavation. These activities may negatively affect Bobolink and Eastern Meadowlark habitat through direct removal of habitat, increased erosion and sedimentation; soil removal / disturbance and compaction; and accidental soil or water contamination by oils, gasoline, grease and other materials from construction equipment and materials storage or handling. It is possible that mitigation can be put into place to avoid or minimize the effects to the species. The proposed annual removal of habitat for these species is approximately 4ha per year with a totally removal of 63.19 ha. Consultation with the MECP will be required to determine whether the proposed works require a Notice of Activity or Overall Benefit Permit.

Planning Act – Provincial Policy Statement

The presence of Significant Wildlife Habitat (SWH) within and adjacent to the W12A Landfill expansion area triggers the requirement for an Environmental Impact Study (EIS) under the *Planning Act vis a vis the Provincial Policy Statement (PPS)*. These policies include the exclusion of development within PSWs, habitat of END or THR species, fish habitat, as well as within Significant Wildlife Habitat (SWH), significant woodlands, significant valley lands, ANSIs or adjacent lands "...unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions" (MAH 2020).

The requirement for an EIS as it relates to SWH may be met by the similar requirement under municipal policies, as noted in the next section (**Section 7.3**). This report is considered to meet the requirements for an EIS under the PPS.

Conservation Authorities Act

While the proposed expansion area for the preferred alternative does not directly overlap with the Regulation Limits for the Upper Thames River Conservation Authority (UTRCA) and the Kettle Creek Conservation Authority (KCCA), it does immediately abut limits for both authorities. It will, therefore, be prudent to engage both the UTRCA and KCCA in discussions to determine the potential requirements for a Section 28 Permit under the *Ontario Regulation 157/06* (UTRCA) and *Ontario Regulation 181/06* (KCCA) under the *Conservation Authorities Act*.

7.2 Municipal

The London Plan

The London Plan (2016) requires an EIS for any proposed works involving development and site alteration within or adjacent to the Natural Heritage System such that they will only be permitted after ecological functions have been evaluated and it is demonstrated that there will be no negative impacts to the Natural Heritage System. While not identified on The London Plan Natural Heritage Features mapping (Map 5), the presence of SAR Habitat and SWH within and adjacent to the proposed landfill expansion area triggers the requirement for an EIS.

As noted above, the preparation of an EIS can meet the requirements under the Provincial Policy Statement (2020) and The London Plan. The requirement for any additional work to meet the requirements for an EIS will be determined in consultation with the City of London (as outlined in **Section 2.2.11** and **7.1**).

8. Conclusion

The Biology Existing Conditions and Impact Assessment Report for the W12A Landfill Expansion provides documentation of aquatic and terrestrial ecology field investigations, assessment of natural heritage features, an impact assessment for the proposed expansion, recommended mitigation measures, monitoring requirements, and other approval requirements.

Existing Conditions

The following existing natural heritage features and functions were identified for the Site Study Area and Site-vicinity Study Area:

Aquatic Habitat & Fisheries

- The Site Study Area and Site-vicinity Study Area contain three (3) watercourses (Bannister-Johnston Drain, Unnamed Drain, and C.B. Smith Drain) that have the potential to support fish and fish habitat that are regulated under the *Fisheries Act*. However, no important or exceptional fish habitat was observed during field investigations.
- All sites sampled for benthic invertebrates had impaired to very poor water quality based on a BioMAP Water Quality Index (WQI) rating less than 14, and a Hilsenhoff Biotic Index (HBI) rating was above 7.26.

Terrestrial Ecosystems and Species

- Identified Natural Heritage Features in the Site Study Area and Site-vicinity Study Area included Significant Woodlands, Unevaluated Wetlands, Locally Significant Wetland (Silver Swamp), Valleylands, and a Potential ESA based on the review of MNHSS criteria (2014) and the London Plan (2017).
- Candidate habitat for Species at Risk (SAR) bats and Bat Maternity Colonies Significant Wildlife Habitat (SWH) was identified within the Site Study Area and Site-vicinity Study Area.
- Bobolink and Eastern Meadowlark were confirmed breeding within the Site Study Area and Site-vicinity Study Area during field investigations. Further, Bank Swallow and Barn Swallow were observed foraging within the Study Area; however, no nests were observed, and direct habitat was considered absent.
- Special Concern and Rare Wildlife Species Habitat (SWH) for Eastern Wood-Pewee and Monarch was confirmed within the Site Study Area and Site-vicinity Study Area .
- Additionally, Terrestrial Crayfish SWH was confirmed and Candidate habitat for Turtle Wintering Areas was identified within the Site Study Area and Site-vicinity Study Area .

Within the area of the proposed expansion only the following were confirmed:

- Bobolink and Eastern Meadowlark breeding (SAR) habitat was confirmed within the proposed expansion area.
- Special Concern and Rare Species Habitat (SWH) for Monarch was identified within the proposed expansion area.

Impacts of the Preferred Alternative

With the selection of the Preferred Expansion Alternative involving a vertical lift on the existing landfill area, many potential impacts to adjacent natural heritage features are avoided. However,

with the presence of SAR habitat for Bobolink and Eastern Meadowlark and SWH for Monarch on the existing landfill, certain impacts are unavoidable.

During the Construction Phase, the following potential impacts can be anticipated:

Potential Impacts to Aquatic Habitat & Fish:

- No direct impacts to fish or fish habitat are anticipated as all aquatic habitat is outside of the area of the proposed expansion;

Potential Impacts to Terrestrial Habitat & Species

- Loss of SAR Habitat for Eastern Meadowlark and Bobolink related to the clearing of existing vegetation cover to excavate trenches, construct the MRF, and add finger drains;
- Loss of SWH for Monarch;
- Dust deposition on vegetation in adjacent vegetation communities;
- Noise related impacts to wildlife in adjacent habitat;
- Introduction of invasive plant species via construction equipment;
- Disturbance, accidental injury or mortality of wildlife or vegetation (i.e. adjacent trees) from construction equipment and vehicles

Mitigation & Compensation

The following mitigation and compensation measures will be required for the Construction and Operations Stages;

- Preparation and implementation of an Environmental Mitigation and Monitoring Plan (EMMP);
- Preparation and implementation of a Species at Risk and Wildlife Handling Protocol;
- Restriction of vegetation clearing to periods outside of the breeding bird timing window (April 1st to August 31st); clearing may only take place from September 1st to March 31st;
- To avoid birds such as Banks Swallows from nesting in topsoil or excavated material piles, the slopes of piles should be less than 70 degrees;
- Compensation for the loss of Eastern Meadowlark and Bobolink habitat will be required as part of the conditions of a permit under the *Endangered Species Act*. While the details of compensation are subject to a submission and proposal for compensation at the Detailed Design stage, it can be expected that some measures may include enhancement of existing habitats on adjacent lands, or creation of new habitat within the same EcoRegion;
- Compensation for loss of SWH for Monarch will also be required. Compensation measures may include the enhancement of habitats (planting of common milkweed, butterfly weed, etc) within or adjacent to the site, or the creation of new meadow habitat with native plant species including common milkweed.

Each of the above noted mitigation or compensation measures will need to be developed at the Detailed Design stage of planning and engineering, and hence are provided herein as general requirements.

Other Approvals

The preferred expansion alternative for the W12A Landfill will require approvals other than the acceptance and approval of the Environmental Assessment (EA). Based on the layout, design and operation alternative approvals may be required under the following legislation:

- Provincial: Endangered Species Act
- Provincial: Planning Act
- Provincial: Conservation Authorities Act
- Municipal: The London Plan

The triggers for these legislation and general permit requirements are outlined in Section 7.0. Specific permitting requirements will require specifications that will be determined at the Detailed Design stage of planning and engineering. At that stage, and with further consideration of specific mitigation measures, it is possible that not all of the above approvals are required.

Conclusion

The proposed expansion of the W12A Landfill is expected to result in several impacts to natural heritage features and functions. Overall, the impacts are considered to be low and can be mitigated with the implementation of the mitigation measures identified in this report. With enhanced mitigation and compensation measures there is potential for a net benefit. The details of the mitigation measures and confirmation of net benefit will require additional development at the Detailed Design stage.

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Contact

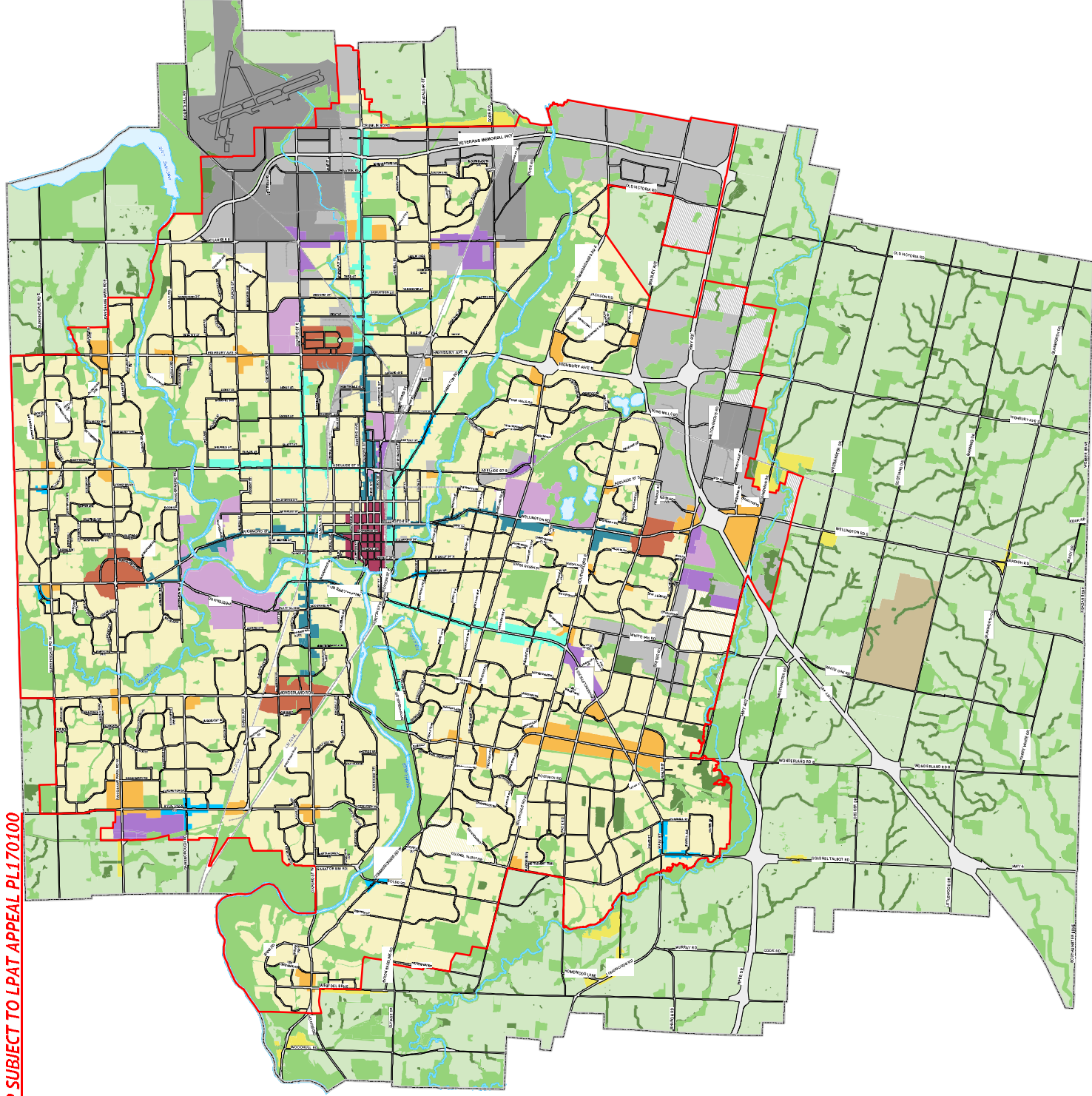
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Appendix **A**

The London Plan, Map 1 and Map 5

MAP 1 - PLACE TYPES

MAP SUBJECT TO LPAT APPEAL PL170100



LEGEND

PLACE TYPES

- Green Space
- Environment's Review
- Downtown
- Transit Village
- Rapid Transit Corridor
- Urban Corridor
- Shopping Area
- Main Street
- Neighbourhoods
- Institutional
- Heavy Industrial
- Light Industrial
- Commercial Industrial
- Rural Community Growth
- Future Industrial Growth
- Farmland
- Rural Neighbourhoods
- Waste Management Resource Recovery Area
- Urban Growth Boundary

BASE MAP FEATURES

- Street (See Map 3)
- Railways
- Water Courses/Ponds



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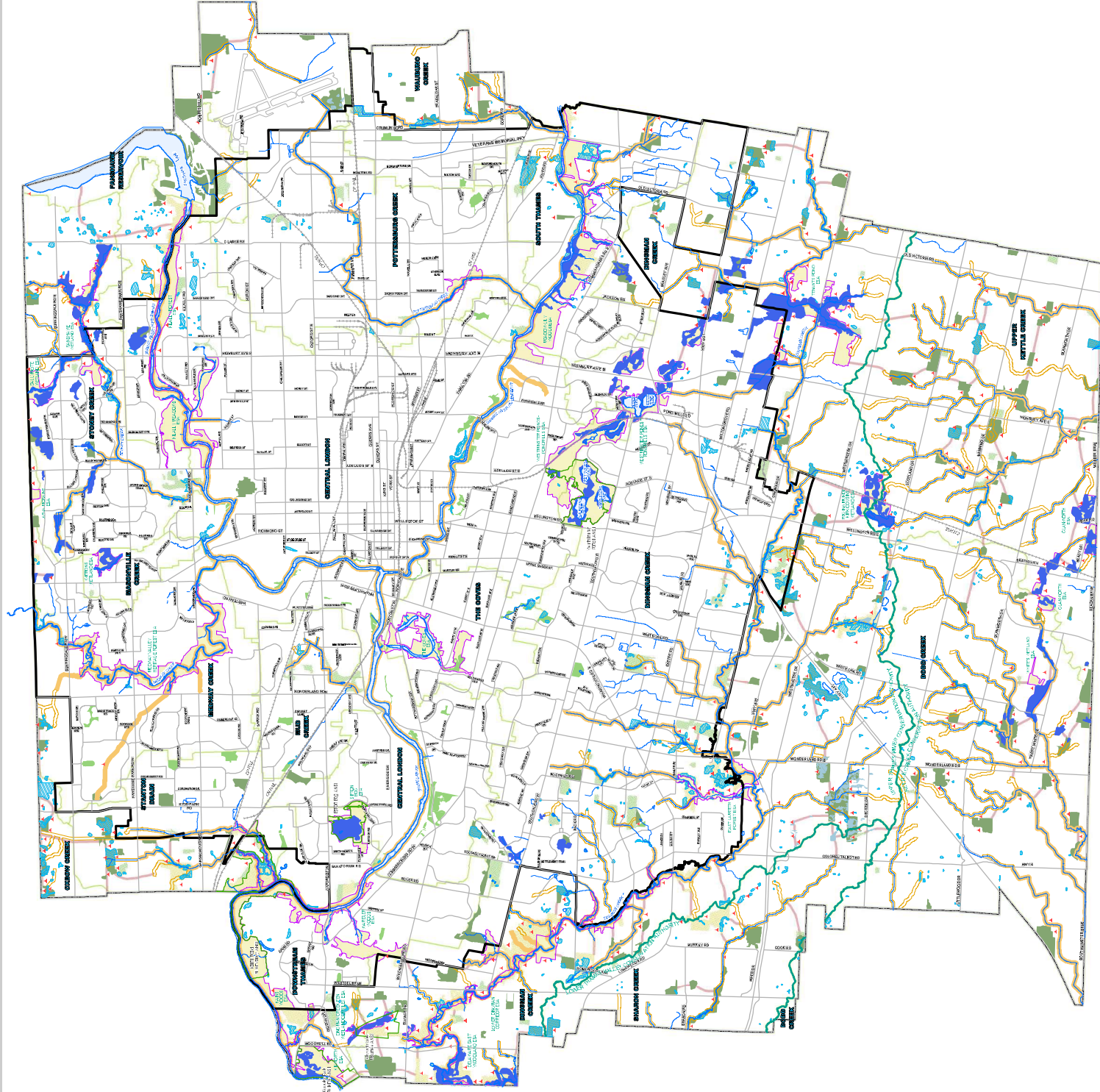
ADOPTED BY COUNCIL ON JUNE 23, 2016
APPROVED BY THE PROVINCE ON DECEMBER 28, 2016

THIS MAP MUST BE READ IN CONJUNCTION
WITH THE TEXT OF THE LONDON PLAN

NOTE: At the time of the printing of this map, the Rapid Transit EA is in progress. It is expected that a rapid transit alignment will be known before The London Plan is approved. This map shows the Rapid Transit Corridors and Urban Corridors to recognize potential alignments. These Place Types will be modified to align with the results of the EA process for the final version of The London Plan.

While every effort has been made to ensure that the mapping is accurate, a reader should verify any information shown on this map with the City of London Planning Department's Office, Suite 308, 300 Dufferin Avenue, London, Ontario, N6B 1Z6 or by calling (519) 661-2500 extension 4939.

MAP 5 - NATURAL HERITAGE



LEGEND

NATURAL HERITAGE SYSTEM

- Areas of Natural and Scientific Interest
- Environmentally Significant Areas (ESA)
- Potential ESAs
- Upland Corridors
- Potential Naturalization Areas
- Unrated Vegetation Patches

BASE MAP FEATURES

- Water Bodies
- Conservation Authority Boundary
- Subwatershed Boundary
- Subwatershed Name
- Water Course
- Water Course Name
- Water Course Point
- Water Course Line
- Water Course Area
- Water Course Point
- Water Course Line
- Water Course Area



0 500 1,000 2,000 3,000 4,000
Metres
1:30,000

ADOPTED BY COUNCIL ON JUNE 23, 2016

UNDER REVIEW BY THE PROVINCE

THIS MAP MUST BE READ IN CONJUNCTION
WITH THE TEXT OF THE LONDON PLAN

While every effort has been made to ensure that this mapping is accurate, a reader should verify all information contained in this map before using it by contacting the City Clerk's Office, Suite 308, 300 Dufferin Avenue, London, Ontario, N6B 1Z2 or by calling (519) 461-2300 ext. 4436

Appendix **B**

Biology Work Plan – Environmental Assessment of the Proposed W12A Landfill Expansion, City of London

August 2019

BIOLOGY WORK PLAN

Environmental Assessment of the Proposed W12A Landfill Expansion
City of London

Submitted to:
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Manager of Solid Waste Engineering
City of London
300 Dufferin Avenue
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Appendix A - References

1.0 Introduction

This document presents the proposed detailed work plan for the Biology Component of the Environmental Assessment (EA) for the proposed W12A Landfill expansion (project) in London, Ontario. The work plan is being submitted for approval to the Minister of Natural Resources and Forestry (MNRF).

This work plan has been developed with consideration of the commitments made for the project within the development of the Terms of Reference (ToR). The relevant commitments are provided below in Table 1.0-1.

Table 1.0-1: Project Commitments from ToR Relevant to Work Plan Development

ID	Commitment
5	Where described in the ToR for the environmental Components, detailed work plans for the technical studies will be prepared and provided to the appropriate GRT* agency for review and concurrence.
6	The City will share work plans with Indigenous Communities and post work plans on the project website.
10	During the EA, the preliminary criteria and indicators for each of the environmental Components will be refined and described in the EA study report.
11	The preliminary Study Areas will be reviewed and confirmed during the EA and described in the EA study report.
12	A more detailed description of the environmental conditions will be prepared during the EA to reflect the confirmed Study Areas using a combination of sources of existing information and site-specific investigations and studies and provided in the EA study report.

* Government Review Team (GRT)

2.0 Assessment Framework

2.1 Overall Approach

It is proposed that the EA work will be undertaken in a series of nine steps (further details are provided in Section 4.0) as follows:

- Step 1 – Characterize existing environmental conditions;

- Step 2 – Identify the ‘Alternative Methods’ of landfill expansion;
- Step 3 – Qualitative evaluation of ‘Alternative Methods’;
- Step 4 – Compare the ‘Alternative Methods’ for landfill expansion and identify the preferred alternative;
- Step 5 – Refine the mitigation measures and determine the net effects of the preferred alternative;
- Step 6 – Describe the preferred ‘Alternative Method’;
- Step 7 – Consideration of climate change;
- Step 8 – Cumulative impact assessment; and
- Step 9 – Preparation of the EA Study Report.

Consultation with the public, Indigenous Communities, GRT members, City of London Advisory Committees, and other stakeholders will be ongoing throughout the EA process.

2.2 Project Team Organization

The project tasks will be organized to be completed by the following teams:

- The EA Management Team consists of the project director, project manager and project coordinator for the EA;
- The Design and Operations (D&O) Team consists of landfill design technical staff and AutoCAD technicians; and
- The EA Team consists of technical discipline leads for each of the specified environmental Components.

2.3 Study Areas

Data for the EA will be collected and analyzed for preliminary generic study areas presented in the ToR. These will be confirmed and may be refined during the EA. These preliminary generic study areas are as follows:

Biology Work Plan

Environmental Assessment of the Proposed W12A Landfill Expansion, City of London

Site Study Area – The existing W12A Landfill Site, located at 3502 Manning Drive and adjacent lands where landfill expansion may occur.

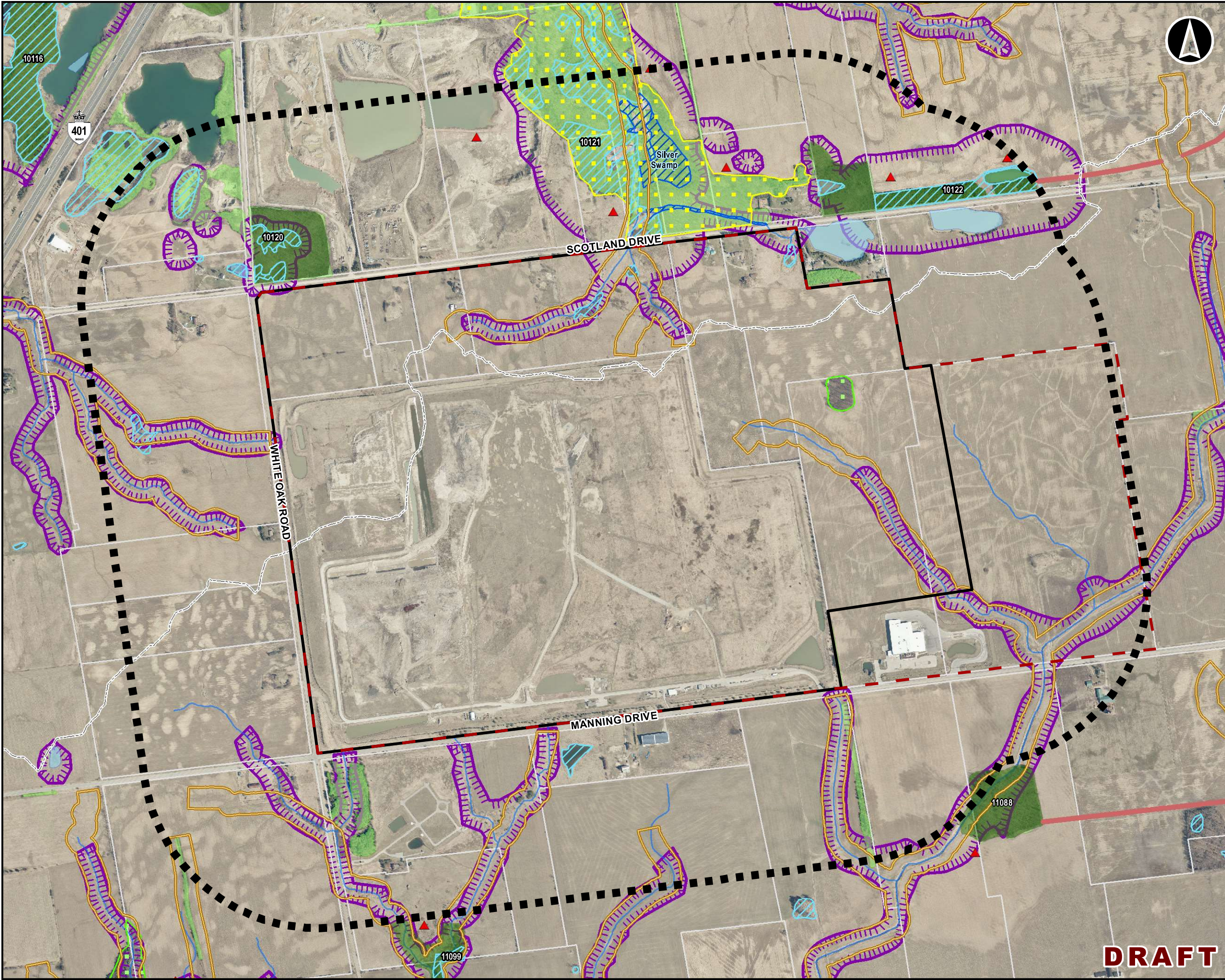
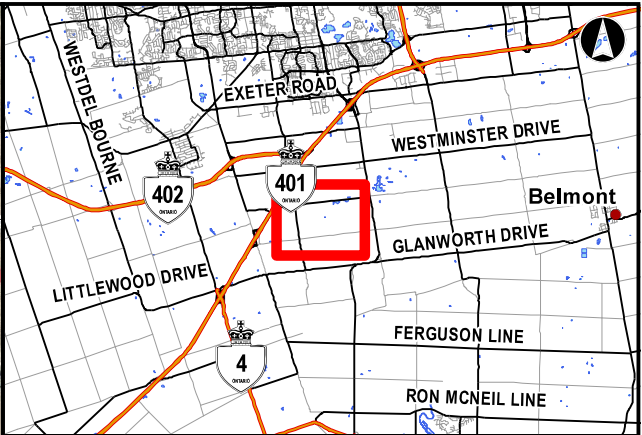
Site-vicinity Study Area – The lands in the area immediately adjacent to the Site Study Area that have the potential to be directly affected by the landfill expansion and activities with the Site Study Area. The extent of the Site-vicinity Study Area will be determined for each of the environmental Components. For most environmental Components, a Site-vicinity Study Area of 500 metres from the Site Study Area is appropriate.

Wider Study Area – An area that takes on the broader community generally beyond the immediate site vicinity and for specific environmental Components may include the entire Municipality.

The proposed preliminary study area for the Biology Component is presented in Table 2.3-1 and shown on Figure 2.3-1.

Table 2.3-1: Proposed Preliminary Study Areas for the Biology Component

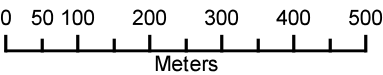
Environmental Component	Preliminary Area(s) to be Studied	Rationale
Biology	Site and Site-vicinity	Potential effects on biological resources are expected to be limited to 500 m from the Site Study Area.



- Legend**
- Watercourse
 - Waterbody
 - Wooded Area (MNR, 2018)
 - Conservation Authority Regulation Limit
 - Parcel Fabric
 - Site Study Area
 - Site-vicinity Study Area
 - Waste Management Resource Recovery Area Boundary

City of London - Natural Heritage Features (2017)

- Woodlot Patch ID
- Potential Naturalization
- Conservation Authority
- Upland Corridor
- Unevaluated Valleyland
- Locally Significant Wetlands
- Unevaluated Wetland
- Significant Woodland
- Unevaluated Vegetation Patch
- Potential ESA



**W12A Landfill Expansion
Biology Assessment**

Study Area

Aug, 2019	1:10,500 * when printed 11"x17"	Datum: NAD 1983 UTM Zone 17N Source: LIO, City of London
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Figure 2.3-1

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3.0 Assessment Criteria and Indicators

The Biology Component will be assessed for the potential effects of the undertaking based on two criteria as follows.

The rationale, indicators and data sources for the proposed assessment sub-Components are provided in the ToR and are presented in Table 3.0-1 below.

Table 3.0-1 Component Rationale and Indicators for the EA

Sub-Component	Rationale	Indicator(s)	Data Sources
Aquatic ecosystems	Landfill expansion could remove or disturb the functioning of natural aquatic habitats and species, including rare, threatened or endangered species.	<ul style="list-style-type: none"> • Expected change in surface water quality on-site and within the site-vicinity. • Expected impact on aquatic habitat and biota, including rare, threatened or endangered species within on-site and within the site-vicinity. 	<ul style="list-style-type: none"> • <i>W12A Landfill Area Plan Study – Ecological Background Study and Natural Heritage Study</i> (Earth Tech, 2005). • <i>Middlesex Natural Heritage Systems Study</i> (Middlesex County, 2014). • <i>The London Plan</i> (2016) • <i>City of London Inventory and Evaluation of Woodlands</i> (North-South Environmental Inc. (2009). • <i>Dingman Creek Subwatershed Study</i> (Aquafor Beech et.al., 1995) and <i>Dingman Creek Subwatershed Study Update</i> (Delcan, 2005). • <i>Dingman Creek Watershed Report Card</i> (2012). • <i>Dodd Creek Subwatershed Strategy</i> (Wilcox Betsy, 2005). • <i>Department of Fisheries and Oceans (DFO) Drain Classification and Fish Habitat Data</i> from the Upper Thames River Conservation Authority (UTRCA) and Kettle Creek Conservation Authority (KCCA). • Land Information Ontario (LIO). • Ministry of Natural Resources and Forestry (MNRF) SAR List. • Natural Heritage Information Centre.

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Sub-Component	Rationale	Indicator(s)	Data Sources
			<ul style="list-style-type: none"> • DFO <i>Drain Classification and Fish Habitat Data</i> from the UTRCA and KCCA. • Aquatic habitat and Benthic Water Quality • Species at Risk screening & habitat assessment
Terrestrial ecosystems	Landfill expansion could remove or disturb the functioning of natural terrestrial habitats and vegetation, including rare, threatened or endangered species.	Expected impact on terrestrial vegetation communities, wildlife habitat, and wildlife, including rare, threatened or endangered species on-site and within the site-vicinity.	<ul style="list-style-type: none"> • <i>W12A Landfill Area Plan Study – Ecological Background Study and Natural Heritage Study</i> (Earth Tech, 2005). • <i>Middlesex Natural Heritage Systems Study</i> (Middlesex County, 2014). • <i>The London Plan</i> (2016). • <i>City of London Inventory and Evaluation of Woodlands</i> (North-South Environmental Inc., 2009). • <i>Dingman Creek Subwatershed Study</i> (Aquafor Beech et. al., 1995) and <i>Dingman Creek Subwatershed Study Update</i> (Delcan, 2005). • <i>Dingman Creek Watershed Report Card</i> (2012). • <i>Dodd Creek Subwatershed Strategy</i> (Wilcox Betsy, 2005). • <i>DFO Drain Classification and Fish Habitat Data</i> from the UTRCA and KCCA. • Land Information Ontario (LIO). • <i>MNRF Ontario SAR List</i>. • <i>Natural Heritage Ontario Reptile and Amphibian Atlas</i>. • <i>Ontario Breeding Bird Atlas</i>. • <i>Ontario Butterfly Atlas</i>. • Terrestrial and wetland vegetation community investigations, breeding

Sub-Component	Rationale	Indicator(s)	Data Sources
			birds surveys, herpetofauna (amphibians and salamanders) surveys, bat habitat surveys, snake cover board and area searches, lepidoptera and odonata (butterfly, dragonfly and damselfly) surveys and wildlife habitat surveys <ul style="list-style-type: none">• Complete Species at Risk screening & habitat assessment

The criteria and indicators will be refined during the EA as necessary.

4.0 Detailed Workplan

4.1 Step 1: Characterize Existing Environmental Conditions

This section presents an overview of existing environmental conditions for the Biology Component on and in the area of the W12A Landfill based on existing documentation. As described in the Ministry of the Environment, Conservation and Parks (*MECP Code of Practice* (MOECC, 2014a), the City of London will complete additional studies/investigations to present a more detailed description of the environmental conditions in the EA Report.

4.1.1 Overview of Existing Conditions (Existing Documentation)

The Biology Component of this study is comprised of terrestrial, wetland and aquatic ecosystems.

Natural vegetation in the Middlesex region consists primarily of deciduous forest communities (Middlesex County, 2014) including Dry-fresh Deciduous Forest, Fresh-moist Sugar Maple Deciduous Forest and Fresh-moist Poplar-sassafras Deciduous Forest (North-South Environmental Inc., 2009).

Clay to silt textured soils are the predominant type in the Dingman Creek Subwatershed (Delcan, 2005) and areas of imperfect to poor drainage may contribute to the presence of wetlands in the general area. Several man-made or managed drains are also present. Unevaluated woodlands, unevaluated wetlands and a potential Environmentally Significant Area (ESA) are located in the Site-vicinity Study Area, as well as some successional meadows and thickets.

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Previous investigations identified several vegetation community types within the general area of the landfill site, including cultural, forest, marsh, open aquatic and swamp communities.

The primary terrestrial features found within the general area of the W12A Landfill as shown on Figure 2.3-1 include:

- A potential ESA on the north side of Scotland Drive (vegetation patch #10121)
- Significant Woodlands north of Scotland Drive (vegetation patches #10120 and #10122)
- Significant woodland south of Manning Drive (vegetation patch #11068)
- Unevaluated wetlands north of Scotland Drive
- Locally Significant Wetland north of Scotland Drive (Silver Swamp)

The primary aquatic features identified in the area include the Shore Drain, Sterling Drain, Bannister Johnson Drain and C.B. Smith Drain. Most of these watercourses have been altered (e.g., channelized) to facilitate drainage for surrounding land use.

Fish habitat has been identified as either Type 2 (generally important but not critical) or Type 3 (marginal/severely degraded). Fish species previously observed were ranked globally as G5 and provincially as S5 (in each case meaning very common and abundant). The benthic macroinvertebrate community is considered of poor quality and is indicative of shallow, eutrophic aquatic habitat.

Previous studies have identified several species of mammals, birds, amphibians and reptiles in the region. The background review has identified known records of several plant, bird, snake, and mammal Species at Risk (SAR) and Species of Conservation Concern (SOCC), and potential Significant Wildlife Habitat (SWH) including features supporting bat maternity colonies, amphibian breeding, and habitat for SOCC. To determine the presence/absence of any significant species or features within the study areas, site-specific field investigations will be required.

A Biology Assessment (*W12A Landfill Area Plan Study – Ecological Background Study and Natural Heritage Study*) was undertaken in 2005 to fully describe the conditions that existed within the Site and Site-vicinity Study Area. Although a significant amount of fieldwork was completed within the Site and Site-vicinity Study Area, the information is considered dated and requires updating. In addition, previous studies did not include habitat assessments and surveys for Species at Risk.

4.1.2 Additional Studies/Investigations

This work consists of a three (3) season inventory of the natural heritage features within the Site and Site-vicinity Study Area and will follow City of London data collection guidelines as per the City of London Environmental Management Guidelines (2007).

Species at Risk Screening

To determine the potential for Species at Risk (SAR) within the study area, a habitat screening will first be conducted whereby an Ecologist will review available background documents such as MNRF's online database, Amphibian and Reptiles Atlas, the Ontario Breeding Bird Atlas, Agency correspondence, etc. to create a complete list of potential SAR within the area. The listed species habitat preferences will then be compared to habitat characteristics to determine if the Site and Site-vicinity study areas may potentially contain preferred habitat for the potential SAR.

Aquatic Ecosystems Studies/Investigations

Aquatic habitat and benthic (macro) invertebrate studies will be required to further the understanding of existing conditions of the aquatic ecosystems. All of the studies described below were completed in 2018.

Aquatic Habitat Assessments

Aquatic biologists will conduct aquatic habitat assessments of the four (4) watercourses within the Site-vicinity Study Area where property is access allowed. Investigations include the determination of drainage patterns and determination of the status of watercourses. Data collection includes:

- Channel type (natural or channelized)
- Channel morphology (width, depth)
- Flow characteristics
- Substrates
- Instream cover
- Specialized habitat present
- Bank and riparian community characteristics
- Valley form characteristics

Benthic (macro) Invertebrate Surveys

Surveys are to be completed at four primary sites within the Site and Site-vicinity Study Areas. Benthic monitoring will be conducted following protocols established by Dr. Bob Bailly (University of Western University, 2001) and involve transverse sweeps or 'kicks' across suitable habitats (i.e., riffles). Sampling will be done during the period between early June to late September avoiding spring and fall spawning activity.

Terrestrial Ecosystem Studies/Investigations

Terrestrial and wetland vegetation community investigations, breeding birds surveys, herpetofauna (amphibians and salamanders) surveys, bat habitat surveys, snake cover board and area searches, lepidoptera and odonata (butterfly, dragonfly and damselfly) surveys and wildlife habitat surveys will be completed to further the understanding of existing conditions of the terrestrial ecosystems.

Ecological Land Classification Confirmation & Floral Inventory

Vegetation communities will be delineated and assessed according to the protocols outlined in the Ecological Land Classification (ELC) system for Southern Ontario (Lee et al., 1998) to Vegetation Community Type where possible. A three-season plant inventory will be completed to ensure that spring ephemerals and seasonally significant species are documented. Vegetation communities will be mapped and used to further refine the results of the SAR and SWH screening exercises.

Wetland Community Boundary Delineation

Where wetland communities are observed, wetland community boundaries and descriptions will be documented following protocols outlined in the Ontario Ministry of Natural Resources Ontario Wetland Evaluation System (OWES) for Southern Ontario (MNR 2014).

Breeding Bird Surveys

Breeding bird surveys should typically be conducted over a minimum of two (2) site visits during peak calling season and peak calling hours. However, given the identification of grassland bird SAR species during the preliminary SAR Screening, and the presence of candidate habitat, three rounds of surveys are required to satisfy survey requirements for SAR grassland birds (i.e., Bobolink and Eastern Meadowlark). For the majority of Ontario's breeding birds this occurs between a half-hour before sunrise to approximately 10:00 a.m. from May 24th to July 10th. Birds observed exhibiting various breeding behaviors in suitable habitat on or adjacent to the Site-vicinity Study Area will be recorded. Incidental observations of other wildlife, including amphibians and mammals, will also be recorded on each field visit.

Herpetofauna Surveys

To survey for the presence of breeding amphibians and salamanders, daytime site visits will be conducted to examine the suitability of vegetation communities present within the Site and Site-vicinity Study Area for the presence of vernal pools. The following parameters will be used to identify potential viable vernal pools:

- Small, isolated pools (lacking the presence of fish populations);
- The potential to hold water at least until July;

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- Have water depths of at least 30 cm in early spring to be considered suitable amphibian breeding habitat. The 30 cm depth criterion is consistent with the recommendations of Calhoun and deMaynadier (2004);
- Good surrounding upland forested habitat;
- Each viable vernal pool would be mapped and marked using GPS, as the identified pools will serve as the amphibian/salamander survey stations; and
- Water depth, classification of surrounding vegetation, in-water characteristics (i.e., %vegetation vs % open water), and evidence of breeding amphibians (egg masses) would be recorded.

Following the identification of viable vernal pools, the following additional amphibian and salamander surveys will be conducted:

- Auditory Amphibian Surveys following the protocols as outlined in the Marsh Monitoring Protocol, the standardized field methodology for audio-surveying breeding frogs and toads. Amphibian surveys will be completed at each of the pre-determined survey stations established during the amphibian/salamander habitat surveys.
- Visual Amphibian/Salamander surveys will be conducted within suitable habitat identified during the vernal pool surveys. Area searches were conducted in conjunction with other surveys completed for the Site and Site-vicinity Study Area.

Bat Habitat Suitability Assessment

To survey for the presence of bat habitat, a bat habitat suitability assessment will be completed within the Site and Site-vicinity Study Area during the leaf-off and leaf-on period. This assessment will be conducted within identified ELC areas of candidate habitat (i.e., CUW, FOD, FOM, FOC, SWD, SWM and SWC) following the MNRF Survey Protocol for Species at Risk within Treed Habitats – Little Brown, Northern Myotis, and Tri-Colored Bat (April 2017).

Snake Cover Board and Area Searches

To survey for the presence of snakes and identify candidate habitat within the Site Area, a combination of cover board surveys and area searches will be completed. These surveys will be completed during daytime bat habitat assessments, ELC investigations, as well as breeding bird surveys. Five (5) daytime searches will be conducted, to survey potential habitat including hibernacula (rock or debris piles) and installed cover boards.

Lepidoptera and Odonata Surveys

Butterfly, dragonfly and damselfly surveys will be conducted in conjunction with ELC and SWH surveys within the study area. These will be conducted by walking the entire Site and Site-vicinity Study Areas capturing and identifying species as they are seen. Once identified, the species will be released.

Significant Wildlife Habitat Surveys

A Significant Wildlife Habitat screening exercise will be conducted using the Wildlife Habitat Ecoregion Criteria Schedule 7E (OMNR 2015) to determine the presence of Candidate SWH within the Site and Site-vicinity Study Areas. The presence of candidate habitat for all five SWH categories will be determined by comparing existing conditions, based on ELC site investigations, to criterion listed within the 7E schedule.

4.2 Step 2: Identify ‘Alternative Methods’ of Landfill Expansion

During the initial stage of the EA, a reasonable range of expansion alternatives will be identified and described at a sufficient level of detail (i.e., conceptual designs) so that potential effects of the expanded landfill on each environmental Component can be assessed and compared.

This task will involve developing the conceptual site design for the proposed expansion of the W12A Landfill, to gain an additional 25 years of disposal capacity. This task will be completed by the Design and Operations Team.

4.3 Step 3: Qualitative Evaluation of ‘Alternative Methods’

Based on the conceptual site design, and considering mitigation measures, potential impacts of the proposed W12A Landfill expansion on the Biology Component will be assessed. The Biology Component technical discipline lead will evaluate each ‘Alternative Method’ qualitatively and quantitatively including:

- Identify differences in potential impacts to watercourses.
 - temperature,
 - sedimentation,
 - fish habitat: quality of fish habitat lost or affected; and area of fish habitat lost or affected
- Identify differences in the ‘Alternative Methods’ that will impact terrestrial features (removal of habitat, harm or harassment of species, sedimentation, dust, spills and potential contamination).
 - Woodlands: area of woodland lost or affected,
 - Significant Wildlife Habitat (SWH): area of habitat lost or affected ,
 - Species at Risk (SAR) and their habitat: area of habitat lost or affected,

- unevaluated wetlands: area of wetland lost or affected,
- potential ESA north of Scotland Drive,
- locally significant wetland (Silver Swamp).

In this step, each 'Alternative Method' of the W12A Landfill expansion will be examined by the EA Team to determine if it would ultimately be approvable under the Environmental Protection Act (EPA).

This screening step is included to eliminate any alternative that would likely not be approvable. Should an alternative be found to not be approvable due to unacceptable net effects (i.e., no further refinement of mitigation is possible) or technical reasons, then the alternative would be eliminated from further consideration. At this point, the EA Management Team may consider additional 'Alternatives Methods' for the project that may have been identified by the public or other parties during the EA process.

4.4 Step 4: Compare the 'Alternative Methods' for Landfill Expansion and Identify the Preferred Alternative

A comparative evaluation of the 'Alternative Methods' will be completed and would consist of evaluating the relative importance or ranking of the assessment criteria (i.e., although all criteria are relevant, certain criteria may be considered more important than others¹).

The Biology Component technical discipline lead will complete the following tasks:

- Rank each 'Alternative Method' based on aquatic ecosystem differences.
- Rank each 'Alternative Method' based on terrestrial ecosystem differences.
- Describe advantages and disadvantages of each 'Alternative Method'

The EA Management Team will take each discipline's comparison and compile the overall comparison of 'Alternative Methods'.

¹ The public has been asked during the consultation on the Terms of Reference and will be asked during consultation on the EA to provide input into the ranking of the relative importance of the Components.

4.5 Step 5: Refine Mitigation Measures and Determine Net Effects of the Preferred Alternative

In this task, the EA Team will identify linkages between the environmental Components (i.e., direct or indirect effects of the proposed expansion on the Biology Component via another Component) and prepare diagrams. The purpose of linkage diagrams, prepared by the technical discipline leads, is to facilitate an integrated assessment of effects.

The prediction of future environmental effects associated with the preferred 'Alternative Method' (with conceptual design mitigation measures in place) will be determined by the Biology Component technical discipline lead. Assessment of potential effects will be done using appropriate objectives, standards, policies and regulations. The remaining net effects, if any, will be documented.

Also, a qualitative comparison will be made between the predicted effects of the preferred alternative and the Do-Nothing alternative considering the indicators for the Biology Component.

4.6 Step 6: Describe the Preferred 'Alternative Method' for Landfill Expansion

A description of the preferred landfill expansion alternative will be detailed following the identification of appropriate mitigation measures. In addition, a leachate management assessment will be completed that will include;

- the quantity of leachate generated from the preferred landfill expansion alternative will be predicted,
- the quality of the leachate associated with the expansion and requiring treatment will be assessed,
- a high level assessment of the capability of the existing forcemain to continue to convey the collected leachate to the municipal sewer system will be completed; and,
- a high level assessment of the capability of the Greenway Wastewater Treatment Plant to continue to treat the leachate will be carried out.

The results will be provided in the EA study report (Task 9).

4.7 Step 7: Consideration of Climate Change

The potential effects of climate change on infrastructure associated with the site, as well as ways that the project could reduce greenhouse gas (GHG) emissions or remove GHG from the atmosphere will be considered by the air quality, surface water and geology and hydrogeology Component technical discipline leads.

4.8 Step 8: Cumulative Impact Assessment

The EA Team will work to identify the predicted effects of other existing or known proposed projects in the area of the site. The Biology Component technical discipline lead will consider any identified effects together with those predicted during the comparative evaluation of 'Alternative Methods' to determine if there are any unacceptable predicted cumulative effects.

4.9 Step 9: Preparation of EA Study Report

In support of the completion of this task, the Biology Component technical discipline lead will carry out the following tasks:

- document the assessment results in a Biology Supporting Document that will form an appendix to the EA submission,
- participate in meetings with the GRT including upfront consultations with the MNRF during the EA to obtain pre-approval of tasks in the work plan, as required,
- support consultation events as required in development of presentation material and/or being at the event; and,
- provide technical support during the review of the draft EA by the regulatory agencies and public.

Appendix A

References

Biology Work Plan

Environmental Assessment of the Proposed W12A Landfill Expansion, City of London

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Wilcox, B., 2005: Dodd Creek Watershed Strategy.

Appendix **C**

Agency Correspondence

Ross, Matthew

From: Jennifer Dow <jennifer@kettlecreekconservation.on.ca>
Sent: Monday, November 19, 2018 4:21 PM
To: Ross, Matthew
Cc: Joe Gordon
Subject: RE: Natural Heritage data request for W12 landfill EA
Attachments: In-Water Work Timing Window Guidelines.pdf; 20181119_141513.jpg; Shore Creek Drain_Manning_95375.JPG; Shore Creek Drain_Glanworth_95373.JPG; Water Quality Site_Site#6_CL.JPG; Benthic Site_Harry White_B2.JPG; WM White Drain_Harry White_95348_95349.JPG; 2004 Middlesex-Elgin Groundwater Study_Dillon.pdf

Hello Ross,

Thank you for allowing KCCA to provide natural heritage information for the proposed W12A Landfill Expansion EA. While KCCA does not have any long term monitoring sites within the study area or 500m buffer, KCCA does have some information near the study area that might be helpful for your review. For your reference, I have attached a copy of the in-water work timing window guidelines.

Additional Study Report:

Northeast of the study area is located the Kirk-Cousins Management Area (KCMA) (located on Scotland Drive, just east of Wellington Road S.) Attached is a photo of the front cover of an October 2000 report of a three-year study completed at the KCMA on flora and fauna. This report can be made available if you think it would be useful for natural heritage review. There are several hard copies here at the main KCCA office if you would like to borrow one, or alternatively, I can make a PDF copy.

Fish Community:

As part of KCCA's environmental monitoring program, staff have been collecting fish data as part of a drain classification program for Fisheries and Oceans Canada. In 2018, one site (95375) was sampled that is located within the buffer of the study site and one site (95373) was sampled downstream of the study area. Number in brackets is the total number of that species collected during the sampling events.

Site 1: Shore Creek Drain @Manning Drive (see map—I also circled the location of the KCMA in blue)

Drain Segment ID: 95375

Sample Date: August 17, 2018

Species collected: Johnny Darter (17), Creek Chub (2), Brook Stickleback (12), Bluntnose Minnow (14)

Site 2: Shore Creek Drain @Glanworth Drive (see map)

Drain Segment ID: 95373

Sample Date: August 30, 2018

Species collected: Bluntnose Minnow (5), Creek Chub (16), White Sucker (18), Blacknose Dace (2), Johnny Darter (4), Brook Stickleback (3)

2016 Sites on W.M White Drain @Harry White Drive (see map, these sites are near the study site)

Drain Segment ID: 95348

Sample Date: October 11, 2016

Species collected: Blacknose Dace (11), Bluntnose Minnow (15), Common Shiner (25), Creek Chub (90), Johnny Darter (5), Least Darter (8), Brook Stickleback (14), White Sucker (58)

Drain Segment ID: 95349

Sample Date: October 11, 2016

Species collected: Blacknose Dace (2), Common Shiner (3), Creek Chub (9), Johnny Darter (6), Least Darter (16), Brook Stickleback (19), White Sucker (7)

Water Quality:

There is a long-term surface water quality monitoring site on Clinton Line (see attached map) which is downstream of your study site. Surface water samples are collected at this site during the ice-free months, generally March to November for a suite of parameters (general chemistry, bacteria, nutrients and metals). This site has water quality data from 2006 to present. This data can be made available if you think it would be useful for natural heritage review, however it is well outside of your study area.

Benthic Invertebrate data:

There is one long-term benthic invertebrate monitoring station located downstream of the study site on Harry White Drive just west of White Oak (Site B2), (see attached map). Benthic samples have been collected at this site every year in the fall since 2006. Data was collected using the BioMap protocol from 2006 to 2009 and OBBN from 2010 to present. This data can be made available if you think it would be useful for natural heritage review, however it is well outside of your study area.

Groundwater:

While KCCA does not have any groundwater monitoring wells located in or near the study site, there is a 2004 Dillon Consulting/Golder Associates report on Middlesex-Elgin Groundwater that might be useful (Project No. 02-0394). I have attached a copy of the report.

Should you have any questions, or require any additional information, please feel free to contact me.

Thank you,
Jennifer Dow

Water Conservation Supervisor
Kettle Creek Conservation Authority
Tel: (519) 631-1270 ext.228
Fax: (519) 631-5026
www.kettlecreekconservation.on.ca



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From: Ross, Matthew [<mailto:Matthew.Ross@aecom.com>]
Sent: October-30-18 1:40 PM
To: Joe Gordon <joe@kettlecreekconservation.on.ca>
Subject: Natural Heritage data request for W12 landfill

Hello Joe,

Please see the attached natural heritage data information request and location map for a project site at the W12 landfill in London, Ontario.

Regards,

Matthew Ross, B.Sc.

Terrestrial Ecologist, Water & Natural Resources, Environment

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From: Cari Ramsey <ramseyc@thamesriver.on.ca>
Sent: Tuesday, October 30, 2018 1:24 PM
To: Ross, Matthew
Subject: W12 Landfill Site
Attachments: Scotland.pdf

Hi Matthew;

My apologies on this one. I thought I sent the info, but apparently it was a different site and this one got lost in the shuffle. I have attached the mapping for this area and you will notice that only half the subject area is within the UTRCA watershed. The additional area will be within the Kettle Creek CA jurisdiction so you should contact them for any additional information. For the rest of the info I have the following:

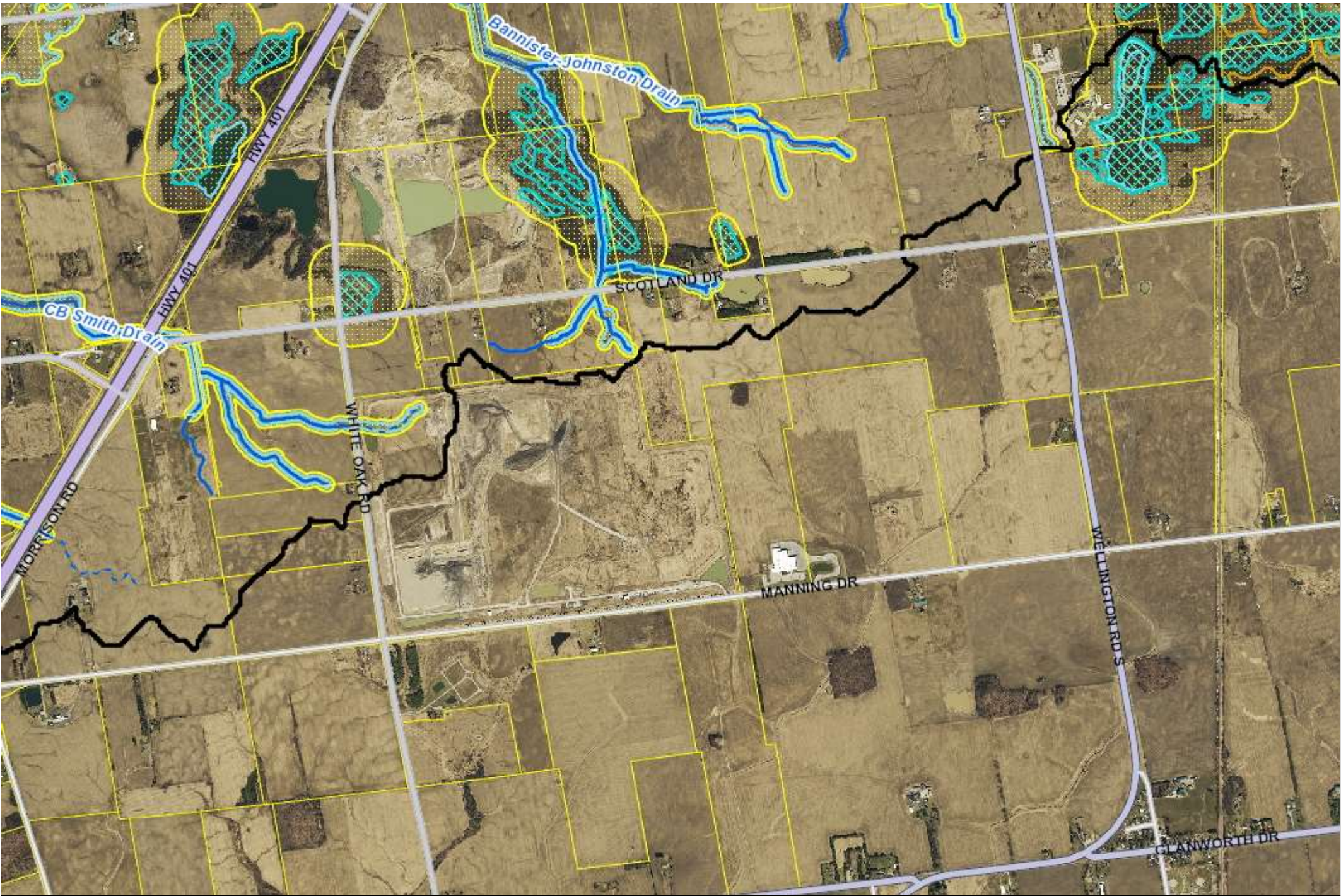
- *No SARA species within the area
- *Warm water watercourses therefore the timing windows would be No In-Water Work from March 15th to July 15th
- *Water quality and quantity information would come from Ministry of the Environment, Conservation and Parks (MECP)
- * We do not have any fish, benthic or mussel information for that area

Sorry it took that long to not have that much info, but if you have any questions please feel free to contact me.

Thanks!
Cari

Cari Ramsey
Environmental Regulations Technician/ Health and Safety Specialist
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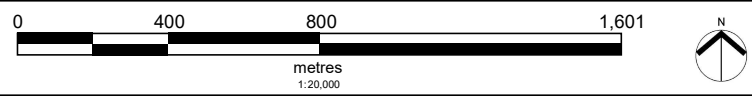
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Notes:
Scotland/White Oak

Created By: cr October 30, 2018

* Please note: Any reference to scale on this map is only appropriate when it is printed landscape on legal-sized (8.5" x 14") paper.



Regulation Limit

Regulation under s.28 of the *Conservation Authorities Act*
Development, interference with wetlands, and alterations
to shorelines and watercourses. O.Reg 157/06, 97/04.

Legend

- UTRCA Watershed (1:10K)
- Assessment Parcel (MPAC)
- Watercourse
 - Open
 - Tiled
- Wetland Hazard
- Flooding Hazard
- Erosion Hazard
- Regulation Limit 2015

The Regulation Limit depicted on this map schedule is a representation of O.Reg 157/06 under O.Reg 97/04.

The Regulation Limit is a conservative estimation of the hazard lands within the UTRCA watershed. In the case of discrepancies between the mapping and the actual features on a property, the text of Ontario Regulation 157/06 prevails and the jurisdiction of the UTRCA may extend beyond areas shown on the maps.

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This document is not a Plan of Survey.

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UPPER THAMES RIVER
CONSERVATION AUTHORITY
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From: ESA-Aylmer (MNRF) <ESA.Aylmer@ontario.ca>
Sent: Friday, December 15, 2017 10:30 AM
To: Ross, Matthew
Subject: RE: Natural heritage information request for W12 landfill EA
Attachments: 2017-04_SAR Screening Process_Technical Bulletin.pdf

Good morning Matthew,

The Ministry of Natural Resources and Forestry (MNRF) understands that AECOM is conducting an Information Request for the City of London's W12A Landfill Expansion EA proposed at Lots 18-20, Concession 6 in the City of London, as identified in the information provide.

MNRF provides the following natural heritage information in response to your request.

Species at Risk (SAR)

The Species at Risk in Ontario (SARO) List (<https://www.ontario.ca/laws/regulation/080230>) is Ontario Regulation 230/08 issued under the *Endangered Species Act, 2007* (ESA). The ESA came into force on June 30, 2008, and provides both species protection (under section 9) and habitat protection (under section 10) to species listed as endangered or threatened on the SARO List.

An initial SAR (Endangered and Threatened species) screening has been completed for the above-noted property.

There are known occurrences of SAR on the property, including:

- Barn Swallow (threatened) – receives species and general habitat protection;
- Bobolink (threatened) – receives species and general habitat protection; and
- Eastern Meadowlark (threatened) – receives species and general habitat protection.

There are also known occurrences of SAR in the general project area that may occur on-site, including

- Butternut (endangered) – receives species and general habitat protection;
- Eastern Flowering Dogwood (endangered) – receives species and regulated habitat protection; and
- SAR Bats (endangered) – receives species and general habitat protection.

Please note that this is an initial screening for SAR and the absence of an element occurrence does not indicate the absence of species. The province has not been surveyed comprehensively for the presence or absence of SAR and MNRF data relies on observers to report sightings of SAR. Field assessments by a qualified professional may be necessary if there is a high likelihood for SAR species and/or habitat to occur within the project footprint and potentially be impacted.

MNRF recommends that field assessments are undertaken by a qualified biologist to determine whether the proposed project may contravene the ESA. If the project has the potential to contravene the ESA, an Information Gathering Form (IGF) should be submitted to ESA.Aylmer@Ontario.ca and no on-site activity (i.e. site alteration, vegetation/debris removal, etc.) should occur until a Stage 2 Screening is complete to ensure compliance with the Act. Please see our attached Technical Bulletin regarding the Aylmer District Species at Risk Screening Process for more information.

It is important to note the following:

- The Committee on the Status of Species at Risk in Ontario (COSSARO) meets regularly to evaluate new species for listing and/or re-evaluate species already on the SARO List.
- As a result, species designations may change and changes may occur in both species and habitat protection which could affect the level of protection they receive under the ESA 2007 and whether proposed projects may have adverse effects on SAR.
- Habitat protection provisions for a species may change if a species-specific habitat regulation comes into effect.

If an activity or project will result in adverse effects to endangered or threatened species and/or the habitat, additional action would need to be taken in order to remain in compliance with the ESA. Additional action could be applying for an authorization under section 17(2)(c) of the ESA, or completing an online registry for an ESA regulation and following the rules in regulation if the project is eligible (<http://www.ontario.ca/environment-and-energy/natural-resources-approvals>).

Questions about the registry process should be directed to MNRF's Registry and Approval Services Centre at 1-855-613-4256 or at mnr.rasc@ontario.ca. Please be advised that applying for an authorization does not guarantee approval and the process can take several months.

Significant Wildlife Habitat (SWH)

Significant wildlife habitat (SWH) may be present on or adjacent to the above-noted subject lands (within 120 m). Please consult the Significant Wildlife Habitat Technical Guide (SWHTG, OMNR 2000), the Natural Heritage Reference Manual (NHRM) and the Ecoregion Criteria Schedules for criteria on identifying and determining significance of wildlife habitat. SWH is identified by planning authorities using the criteria and processes recommended in the SWHTG and Ecoregion Criteria Schedules.

Link to the SWHTG: <https://www.ontario.ca/environment-and-energy/guide-significant-wildlife-habitat>

Link to Ecoregion 7E criteria schedule: http://publicdocs.mnr.gov.on.ca/View.asp?Document_ID=21843&Attachment_ID=45645

Habitat of species of special concern (not legally protected under the ESA) and those ranked S 1 to 3 receives consideration for SWH of Special Concern and Rare Wildlife Species. The following species are known to occur in the area for your information:

- Eastern Wood-pewee (Special Concern), last observed date: 2002
- Snapping Turtle (Special Concern), last observed date: 2013
- Yellow Bartonian (S2), last observed date: 1932
- Slender Bluet (S2) last observed date: 2000
- Double-striped Bluet (S3) last observed date: 2000

Areas of Natural and Scientific Interest (ANSIs)

There are no Provincially or Regionally Significant Earth or Life Science ANSI's within or adjacent to the proposed subject lands.

Significant Wetlands

There are no Provincially Significant Wetlands (PSWs) present within or adjacent to the above-noted subject lands. However, there is an evaluated wetland (Non PSW), Silver Swamp, located immediately adjacent to the project area, north of Scotland Dr. Wetland shapefiles can be downloaded from Land Information Ontario (LIO) or viewed on our Make a Natural Heritage Map tool (<https://www.ontario.ca/page/make-natural-heritage-area-map>).

Significant Valleylands

MNRF does not possess significant valleylands mapping. The NHRM provides guidance and evaluation criteria for determining significant valleylands. Conservation authorities should be contacted to inquire about information pertaining to significant valleylands if they have not been identified in the applicable Official Plan.

Fish and Fish Habitat

There appear to be watercourses within and adjacent to the project area; however, no information on fish and fish habitat or mussel and mussel habitat is available.

MNRF recommends you contact the appropriate conservation authority and DFO for up-to-date fisheries, mussel, and drain information.

- Conservation Authorities and Official Plans may provide additional natural heritage information for this study.

Please be advised that it is your responsibility to be aware of and comply with all relevant federal or provincial legislation, municipal by-laws or other agency approvals.

If you have any questions or require additional information, please feel free to contact me.

Kind regards,

Kathleen Buck
Management Biologist
MNRF Aylmer District
615 John St. N.
Aylmer, ON N5H2S8
P (519)773-4785
F (519)773-9014
Kathleen.Buck@ontario.ca

As part of providing [accessible customer service](#), please let me know if you have any accommodation needs or require communication supports or alternate formats.

From: Ross, Matthew [<mailto:Matthew.Ross@aecom.com>]
Sent: October-17-17 3:02 PM
To: ESA-Aylmer (MNRF)
Subject: Natural heritage information request for W12 landfill EA

To whom it may concern,

Please see the attached information request and project location map for the W12 landfill Environmental Assessment in London, Ontario.

Regards,

Matthew Ross, B.Sc.
Terrestrial Ecologist, Water & Natural Resources, Environment
D +1-519-650-8628
matthew.ross@aecom.com

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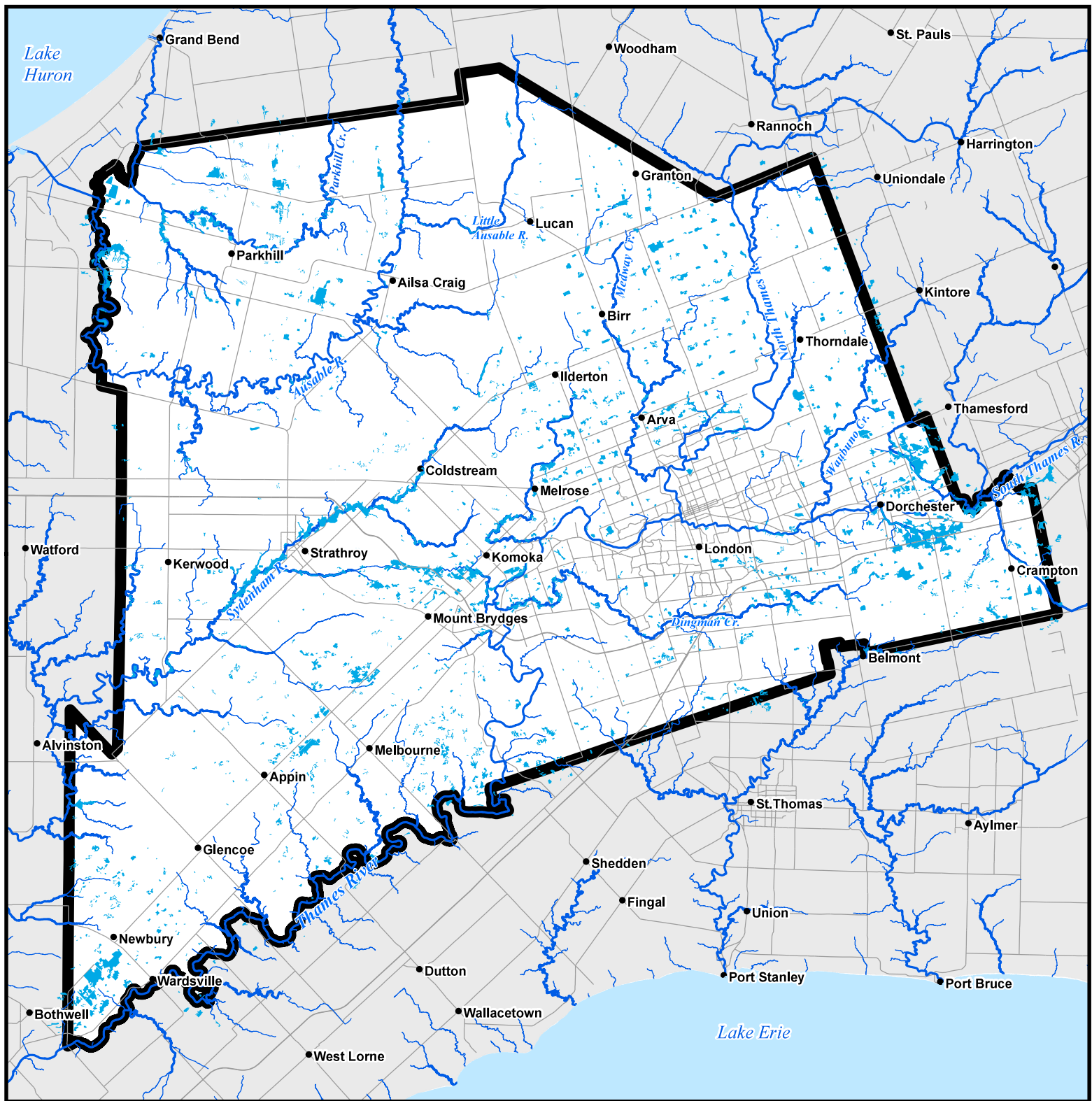
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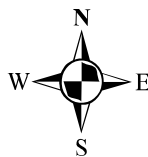
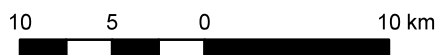
Appendix **D**

Middlesex Natural Heritage System Study Mapping



Middlesex Natural Heritage Systems Study 2014

Wetland Group

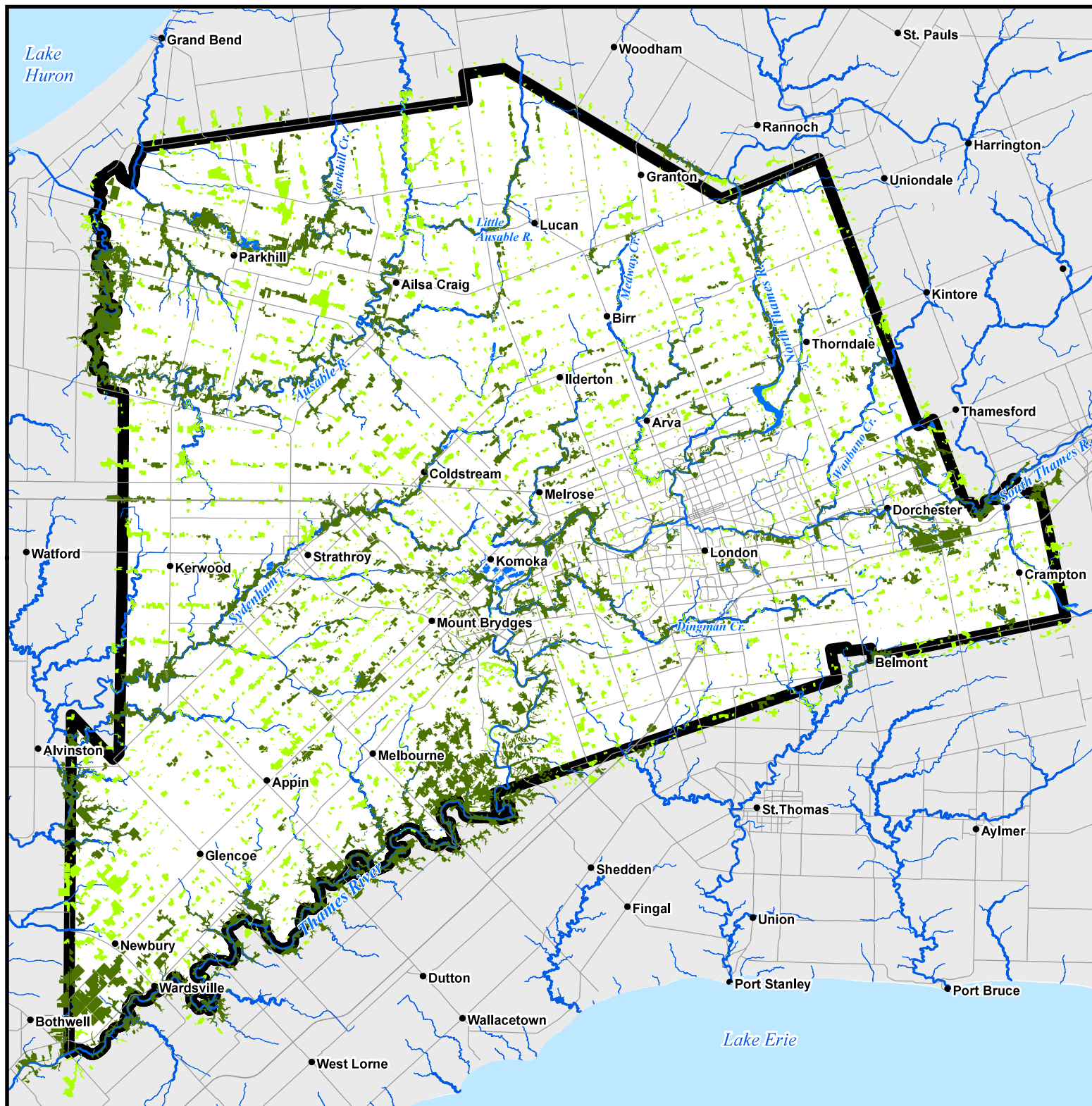


Legend

- Wetland Group
- Study Boundary

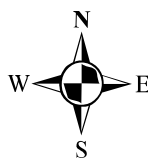
Produce by Upper Thames River Conservation Authority, July 2014,
Basemapping :Land Information Ontario, Copyright © Queens Printer, 2014.

Wetland Boundaries: Ontario Ministry of Natural Resources, Copyright ©
Queens Printer, 2014 and Conservation Authorities: Ausable Bayfield, St.
Clair Region, Upper Thames River, based on 2010 imagery.



Middlesex Natural Heritage Systems Study 2014

Woodland Group



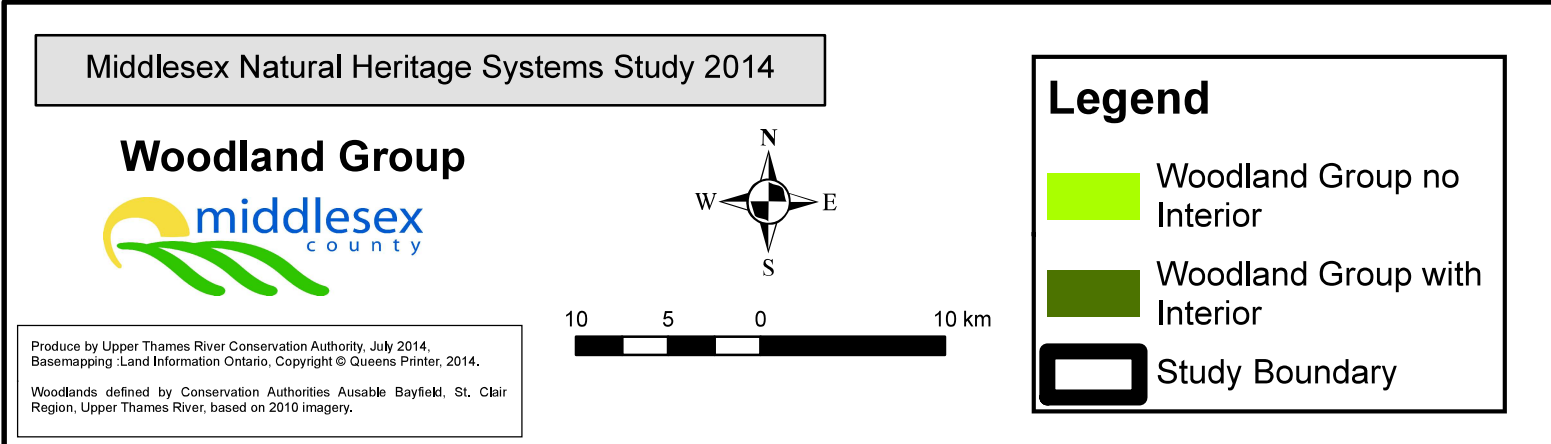
A horizontal scale bar with tick marks at 10, 5, 0, and 10 km. The bar is black with white text and tick marks.

Legend

-  Not Witbin 100m of Another Woodland >4ha
 Witbin 100m of Another Woodland >4ha
 Study Boundary

Produce by Upper Thames River Conservation Authority, July 2014,
Basemapping :Land Information Ontario, Copyright © Queens Printer, 2014.

Woodlands defined by Conservation Authorities Ausable Bayfield, St. Clair Region, Upper Thames River, based on 2010 imagery.



Woodlands defined by Conservation Authorities Ausable Bayfield, St. Clair Region, Upper Thames River, based on 2010 imagery.

Appendix **E**

W12A Landfill Benthic Water Quality Report



W12A LANDFILL BENTHIC WATER QUALITY REPORT JUNE 5, 2018

Submitted on July 04, 2018

Prepared for: Aecom and the City of London Ontario

Prepared by: Dave Johnson, Principal, StraightUp Environmental Consulting

EXECUTIVE SUMMARY

On June 5, 2018, StraightUp Environmental collected Benthic samples from eight sites around the W12A landfill site as part of the environmental study for the proposed landfill expansion (Table 2). Along with the Benthic samples, water chemistry with a Sonde and substrate characteristics were also recorded (Table 3).

Aquatic invertebrates have the longest history of use in biomonitoring programs. In typical unpolluted temperate streams of North America, certain insect taxa predominate. Mayflies (Ephemeroptera), caddisflies (Trichoptera), and stoneflies (Plecoptera) are the most common insects in these undisturbed streams. In rivers disturbed by urbanization, agriculture, forestry, and other perturbations, flies (Diptera), and especially midges (family Chironomidae) predominate.

Traditionally, water quality monitoring actions have focused on physical and chemical measurements. It is widely recognized that the use of other indicators, in addition and complimentary to traditional chemical and physical water quality monitoring techniques, can greatly enhance the assessment and management of aquatic ecosystems.

Consequently, biological monitoring, or biomonitoring, is an important tool in assessing the condition of aquatic ecosystems. Information on and understanding of environmental change is necessary to allow for the protection and remediation of ecosystems. The best way to identify measurement parameters that can serve as vital signs of ecosystems, and define the limits of their variation, is through long term biomonitoring. The resulting data sets are analyzed to provide the basis for defining normal limits of variation or diagnosing ecosystem impairment.

The City of London requested that StraightUp Environmental follow the BioMAP protocol to assess the current water quality. This protocol uses a biotic Water Quality Index ($WQI_{(d)}$) as well as a set of summary metrics to determine the condition of the health of the watercourse (Table 1.0).

All of the sites sampled are classified as Creeks; less than 4m bank full width. All sites on these Creeks seem to be rain dependant with the exception of site W12A-3B. The Creek was dry in-between Site W12A-3A and W12A-3B. Site W12A-3B has other feeder Creeks and appears to have year round flow.

If the WQI rating falls below 14, then the Creek is considered impaired. (Table 1) **All of the sites sampled scored way below 14 and are considered impaired.** The highest score recorded was at site **W12A-3B** and only had a **WQI rating of 3.45**, the lowest score recorded was at site **W12A-2B**, it had a **WQI rating of 1.11**.

StraightUp Environmental chose to use the Hilsenhoff Biotic Index (Genus-Species level) instead of the Family Biotic Index (FBI) as it is obviously more accurate and taxon are already taken to the lowest level. This index was developed by Hilsenhoff (1988). This index is based on the taxon's tolerance to organic pollution. Each of the taxon are assigned a number from 0-10 for its tolerance to organic pollution, 0 being intolerant to organic pollution and 10 being very tolerant to organic pollution. **All of the sites sampled indicate "severe organic pollution likely"** with the best rating at site **W12A-3B**, it had an **HBI rating of 7.28** and the worst rating was at site **W12A-2B**, its rating was **9.95**.

Conductivity, TDS and Salinity levels were extremely high at sites W12A-1B, W12A-2A, W12A-2B, W12A-3A and W12A-4B with **conductivity reaching 5791uS/cm, TDS 3.81 and Salinity of 3.23 at site W12A-2A.** (Table 3) These sites are impacted by the existing Landfill site through drainage or tile coming from within the existing landfill.

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1.0. Introduction

On June 5, 2018, StraightUp Environmental collected benthic macroinvertebrate samples from the area around the current W12A Landfill site. Four Creeks/Drains were chosen for this study and samples were taken from two sites per watercourse.

In addition to the biological monitoring; water temperature, conductivity, TDS, salinity, dissolved oxygen, pH levels along with the substrate characteristics were recorded.

The City of London requested that StraightUp Environmental follow the BioMAP protocol to assess the current water quality. This protocol uses a biotic Water Quality Index ($WQI_{(d)}$) as well as a set of summary metrics to determine the condition of the health of the watercourse (Table 1.0).

TABLE 1.0: CLASSIFICATION OF WATER QUALITY BASED ON THE BioMAP

BioMAP WQI_d		
	Unimpaired	Impaired
Creeks	>16	<14
Streams	>12	<10
Rivers	>9	<7

(Griffiths, 1999)

2.0: Methods

2.1: Sample Collection

In June of 2018, benthic invertebrate samples were collected from 8 sites on the W12A Landfill site location as part of the Environmental Studies for the proposed Expansion of W12A Landfill (Table 2.0). All samples from sites were collected on June 05, 2018.

Two quantitative samples were collected at each site using a Surber Sampler with an enclosed area of 0.05 m². One qualitative sample was also collected at each site using a 500µm D-Net and the “kick and sweep” method, sampling through the different habitat and substrate at each site location.

For each sample, the sediment, debris and organisms were immediately placed into one litre mason jars, preserved with 10% formalyn solution, and labelled with the site code, stream name and date.

Along with the benthic sampling, the following information was provided from each site:

- substrate characteristics
- water depth
- velocity
- temperature
- conductivity
- pH
- DO
- TDS
- algae

TABLE 2.0: LOCATION OF BENTHIC SAMPLING SITES ON W12A

SITE CODE	UTM east	UTM north	DESCRIPTION
W12A-1A	467681	4744858	Approx. 100 meters upstream of Manning Drive at 2 nd culvert
W12A-1B	482712	4746915	Downstream of the culvert on Manning Drive
W12A-2A	481291	4746760	Upstream of Culvert on Manning Drive
W12A-2B	481295	4746746	Downstream of Culvert on Manning Drive
W12A-3A	480500	4747572	Downstream of Culvert on White Oak Rd.
W12A-3B	479820	4747952	Upstream of Culvert on Scotland Drive, West of White Oak Road
W12A-4A	481525	4748129	South of the Culvert on Scotland Drive
W12A-4B	479820	4747952	North of the Culvert on Scotland Drive

2.2. SAMPLE PROCESSING

Benthic macroinvertebrate samples were processed by StraightUp Environmental. Our lab received the samples and examined the submission sheet to match the number of jars for each sample and confirmed the samples received. Our taxonomists ensured that the correct number of jars and labels matched the submission sheets. The samples were washed free of the ethanol through a 500µm sieve prior to sorting and identification.

2.3. Subsampling

Subsampling is accomplished by stacking 3 sieves; 4mm, 2mm and a 500mic. on top of each other and flushing thoroughly with running water. Both the 4mm and the 2mm sieve have all bugs counted and the 500mic sieve was 25% sampled and multiplied by four.

2.4. Detailed Identification

All of the benthic macroinvertebrates were identified to the lowest practical level (Table 2.1). Taxonomic resolution was dependent upon the condition and maturity of the specimen. A list of the taxonomic keys used is identified in Appendix A.

2.5. Quality Assurance and Quality Control Measures

StraightUp Environmental incorporates a list of QA/QC procedures for all of its benthic projects to ensure the accuracy of all data:

- Samples were inspected, enumerated and logged upon arrival
- Taxonomic identifications are based on the most updated taxonomic keys
- Sorted specimens are preserved in 70% ethanol, labelled and stored at StraightUp's laboratory indefinitely
- Sediments and debris are preserved with 70% ethanol, labelled and stored for up to 3 months
- To ensure the accuracy of the data entry, the spreadsheets are compared to the field and bench sheets by a second person

2.6. Data Interpretation and Reporting

The identification and enumeration of the benthic macroinvertebrates was performed by StraightUp Environmental. The detailed list summarizing the density and taxa for each of the samples using an Excel spreadsheet was reported per 0.05m² as shown in Appendix B and a list of taxonomic keys used is in Appendix A.

2.7. BioMAP Water Quality Index (WQI_d)

The BioMAP WQI_d is an abundance-weighted mean sensitivity value of the benthic organisms occurring at a site. The required taxonomic resolution from (Table 2.1) is used to determine the quality of the water. Each of the taxa is given sensitivity values from 0-4 with 4 being the most sensitive to anthropological changes.

The WQI_d was calculated as follows:

$$\left[\sum_{i=1}^n e^{sv_i} * \ln(x_i + 1) \right] \div \left[\sum_{i=1}^n \ln(x_i + 1) \right]$$

Where, sv_i is the sensitivity value of the i^{th} taxon

x_i is the density of the i^{th} taxon

n is the total number of taxa in the sample

For streams, bank full widths of less than 4 meters such as the monitoring sites on Trib C, a $WQI_{(d)} > 16$ would indicate unimpaired and < 14 would indicate impaired water quality (Griffiths, 1999)

If the index falls between 14 and 16, the water quality cannot be classified solely by using this index and therefore a weight of evidence approach is used including Simpson's Indices (family level) and Hilsenhoff's modified biotic index.

TABLE 2.1: BIOMAP'S REQUIRED TAXONOMIC RESOLUTION FOR THE IDENTIFICATION OF BENTHIC MACROINVERTEBRATES (GRIFFITHS, 1993)

Taxon	Required taxonomic resolution
Insects	Genus
Beetles	Genus
Elmidae	Species (adults)
Caddisflies	Genus
Dragonflies	Species
Mayflies	Genus
Baetis	Species
Stenonema	Species
Stoneflies	Genus/Species
Capniidae	Genus
True Flies	Genus
Chironomidae	Genus
Simuliidae	Family
Mites	Family
Crustaceans	Genus
Amphipods	Genus
Gammarus	Species
Crayfish	Genus
Molluscs	Genus
Annelids	Species
Flatworms	Genus

2.8. Hilsenhoff's Modified Family Level Biotic Index (Bode et al., 1991, 1996; Mandaville 2002)

This index was developed by Hilsenhoff (1988). Each taxa has a tolerance to organic pollution value ranging from 0 (intolerant) to 10 (tolerant), (Table 2.2). Its intent is for rapid field assessment of organic pollution. Tolerance values used are from

<http://lakes.chebucto.org/ZOOBENTH.BENTHOS/tolerance.html>

The Modified Family Biotic Index was calculated as follows:

$$(\sum x_i t_i) \div n$$

where, x_i is the number of individuals within a taxon

t_i is the tolerance value of the taxon

n is the total number of organisms in the sample

TABLE 2.2: HILSENHOFF'S FAMILY LEVEL BIOTIC INDEX

Family Biotic Index	Water Quality	Degree of Organic Pollution
0.00-3.50	Excellent	No apparent organic pollution
3.51-4.25	Very good	Possible slight organic pollution
4.26-5.00	Good	Some organic pollution probable
5.01-5.75	Fair	Fairly substantial pollution likely
5.76-6.50	Fairly poor	Substantial pollution likely
6.51-7.25	Poor	Very substantial pollution likely
7.26-10.00	Very poor	Severe organic pollution likely

(Hilsenhoff, 1988)

3.0 RESULTS

3.1. Watercourse Characteristics

Canopy coverage was close to 50% for sites W12A-3B and W12A-4B. All other sites had zero canopy coverage. All of the sites sampled had no riffle or run and consisted mainly of still water pools

The forecast in the morning was sunny with highs of 22°C and clouded over in the afternoon with a few showers.

Conductivity at site W12A-2A was 5791us/cm, which is extremely high, the TDS was 3.81 and salinity was 3.23, these are also very high and would obviously contribute to the high continuity. TDS refers to the total dissolved solids and the salinity refers to the amount of salt in the water. Five out of the eight sites had extremely high levels of TDS and salinity. (Table 3.0)

Table 3.0: SUMMARY OF THE PHYSICAL DATA AND CHEMISTRY FROM TRIB C

Reach	Boulder %	Cobble %	Gravel %	Sand %	Silt %	Clay %
W12A-1A	0	0	10	10	75	5
W12A-1B	0	10	25	10	55	0
W12A-2A	0	20	20	20	20	20
W12A-2B	10	30	30	10	10	10
W12A-3A	0	5	10	30	50	5
W12A-3B	25	25	20	10	15	5
W12A-4A	0	0	20	25	50	5
W12A-4B	0	20	40	10	30	0
Reach	Riffle (%)		Run (%)		Pool (%)	
W12A-1A	0		0		100	
W12A-1B	0		0		100	
W12A-2A	0		0		100	
W12A-2B	0		0		100	
W12A-3A	0		0		100	
W12A-3B	0		0		100	
W12A-4A	0		0		100	
W12A-4B	10		10		80	

Reach		Bank Full Width (m)			Depth (cm)		Velocity (cm/s)	
W12A-1A								
• Centre point		1.9			10		0	
• Downstream		1.7			10		0	
• Upstream		1.9			10		0	
W12A-1B								
• Centre point		1.9			11		0	
• Downstream		1.9			9		0	
• Upstream		1.9			8		0	
W12A-2A								
• Centre point		3.1			25		0	
• Downstream		3.1			20		0	
• Upstream		2.7			18		0	
W12A-2B								
• Centre point		3.1			20		0	
• Downstream		2.9			18		0	
• Upstream		2.9			16		0	
W12A-3A								
• Centre point		3.3			13		0	
• Downstream		2.4			15		0	
• Upstream		2.7			12		0	
W12A-3B								
• Centre point		2.1			10		0	
• Downstream		2.2			8		0	
• Upstream		2.0			9		0	
W12A-4A								
• Centre point		0.8			10		0	
• Downstream		0.9			11		0	
• Upstream		0.7			12		0	
W12A-4B								
• Centre point		3.3			120		0	
• Downstream		3.0			110		0	
• Upstream		3.4			100		0	
Reach	Temperature (°C)	Conductivity (µS/cm)	TDS	Salinity	Dissolved Oxygen	pH	Turbidity	Algae
W12A-1A	15.85	649	0.422	0.32	5.82	7.44	Turbid	Sparse
W12A-1B	14.67	2013	1.311	1.04	7.21	7.48	Turbid	Sparse
W12A-2A	19.14	5791	3.81	3.23	5.94	6.80	Turbid	Sparse
W12A-2B	16.47	1701	1.106	0.87	5.89	7.27	Turbid	Sparse
W12A-3A	15.33	2156	1.403	1.11	3.78	6.97	Turbid	Sparse
W12A-3B	15.59	469	0.304	0.23	8.73	7.51	Turbid	Sparse
W12A-4A	14.56	651	0.423	0.32	6.39	7.06	Turbid	Sparse
W12A-4B	13.57	2048	1.329	1.05	7.12	7.30	Turbid	Sparse

3.2: Benthic Water Quality Results

All of the watercourses sampled are dependant on rainfall and all contained dry spots except for site 3B. **All of the sites** sampled have a **WQI** rating of **IMPAIRED** and all have a **Hilsenhoff Biotic Index** rating of **VERY POOR QUALITY (SEVERE ORGANIC POLLUTION LIKELY)**. The watercourses are all classified as Creeks according to Griffith and WQI readings of less then 14 would indicate impaired.(Table 4.0)

Site 2B had the worst ratings with the **WQI being 1.11** and the **BIOTIC INDEX of 9.95**. This site was dry downstream and contained many Bluntnose minnows, Fathead minnows, Common shiners and Brook Sticklebacks which contributed to the lack of insects in the three samples taken.

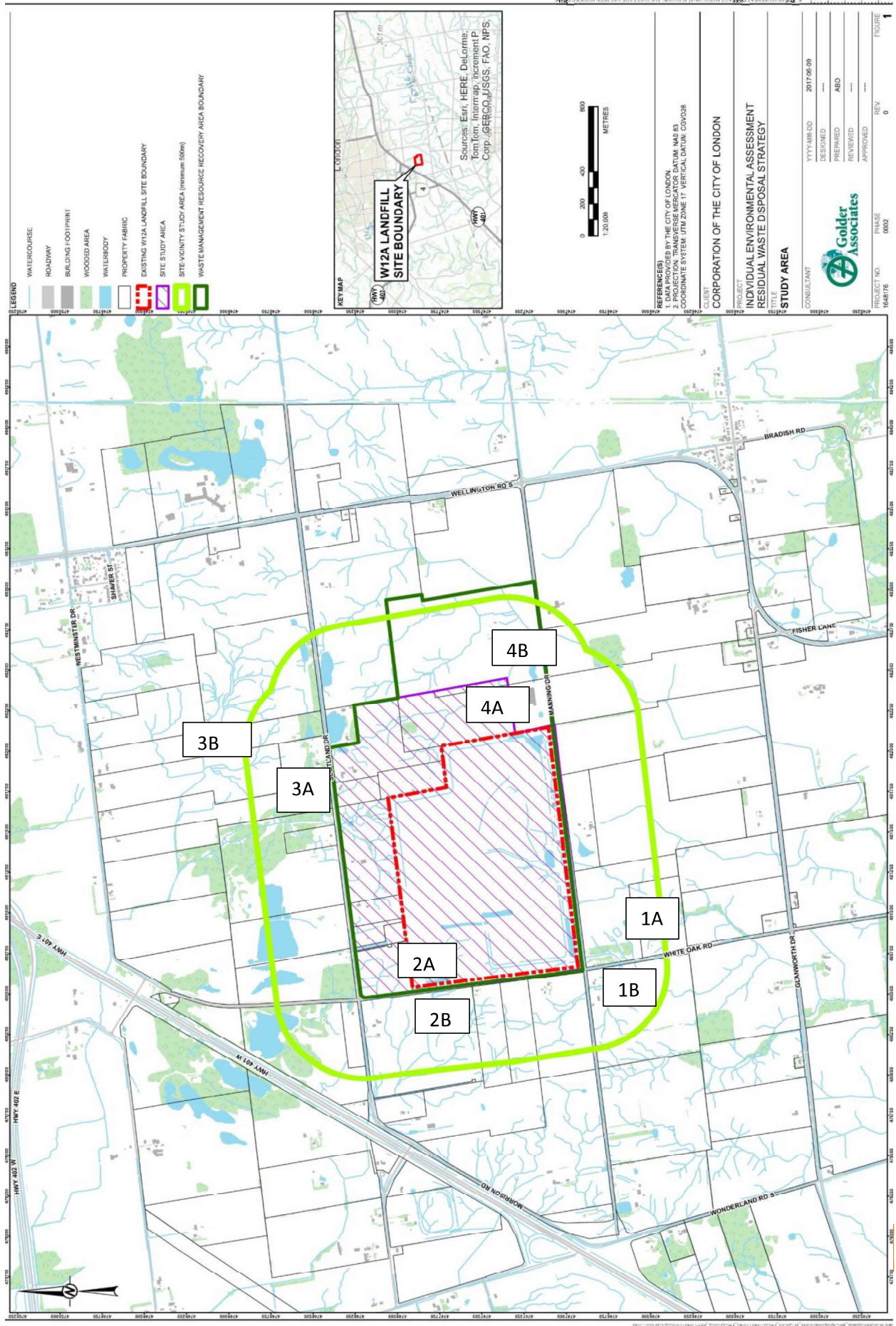
Hilsenhoff's Biotic Index was used instead of the Family Biotic Index as the bugs are already taken to the Genus-Species Level and is obviously more accurate.

Table 4.0: Results

Site:	W12A-1A	W12A-1B	W12A-2A	W12A-2B	W12A-3A	W12A-3B	W12A-4A	W12A-4B
Total Taxa	10	27	8	7	11	11	19	18
Average BioMap WQI	1.36	2.46	1.29	1.11	1.722	3.449	2.69	3.09
Hilsenhoff Biotic Index	9.34	8.81	9.65	9.95	8.5	7.281	8.85	8.66
EPT Richness (%)	0.126	0.195	0.265	0	0.5	0.151	0	0
Percentage Oligochaetes	4.79	35.28	22.22	18.64	65.5	6.184	55.93	33.17
Percentage Chironomidae	86.76	41.33	75.40	81.36	0	20.06	27.12	45.19
Percentage Insects	94.70	59.84	69.84	81.36	1.5	23.53	28.47	73.08
Simpsons diversity	0.760	0.309	0.336	0.083	0.071	0.431	0.13	0.217
Simpsons index of diversity	0.240	0.690	0.664	0.917	0.929	0.569	0.87	0.783
Simpsons reciprocal	1.32	3.230	2.98	12.058	14.169	2.320	7.66	4.611

4.0. Site Map

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5.0. Site Photo

Site W12A-4B-downstream



Site: W12A-4B-upstream



Site: W12A-4A-upstream



Site: W12A-4A-downstream



Site: W12A-3A-downstream



Site: W12A-3A-upstream



Site: W12A-2B-downstream



Site: W12A-2A-upstream



Site: W12A-1A-downstream



Site: W12A-2B-downstream



Site: W12A-1B-upstream



Site W12A-1A: Upstream



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7.0. Benthic Data

W12A-1A

Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP sensitivity value
Insects:				
ALDERFLIES:				
CORYDALIDAE:				
chauliodes				1
corydalis				2
nigronia				3
SIALIDAE				
sialis				2
AQUATIC MOTHS:				
PYRALIDAE:				
petrophila				2
other				0
BEETLES:				
DYROPIDAE:				
helichus				2
DYTISCIDAE:				
acilius				0
agabates				0
agabus				2
bidessonotus				1
celina				0
colymbetes				1
copelatus				3
coptotomus lenticus				1
coptotomus longulus				1
coptotomus loticus				2
cybister				0
desmopachria				0
dytiscus				1
graphoderus				0
heterosternuta				3
hydrocolus				1
hydroporus				1
hydrovatus				0
hygrotus				0
ilybius				2
laccophilus				0
laccornis				1
liodessus				2
lioporeus				3
matus2				2
nebrionporus				2
neoporus				2
neoscutopterus				0
oreodytes				2
rhantus				0
sanfilippodytes				3
stictotarsus				2
uvarus				2
ELMIDAE:				
Optioservus larvae				
Stenelmis larvae				
dubiraphia larvae				
ancyrionxy variegata				2
dubiraphia bivittata				0
dubiraphia minima				1
dubiraphia quadrinotata				1
dubiraphia vittata				2
macronychus galbratus				2
microcylloepus pusillus				3
optioservus fastiditus				2
optioservus ovalis				2
optioservus trivittatus				3
promoresia elegans				3
promoresia tardella				4

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stenelmis bicarinata				2
stenelmis crenata				2
stenelmis musgravei				1
stenelmis quadramaculata				0
stenelmis sandersoni				2
stenelmis vittipennis				2
GYRINIDAE:				
dineutes				2
gyrinus				1
HALIPLIDAE:				
halipus				1
peltodytes				2
HYDROPHILIDAE:				
anacaena				2
berosus				0
crenitis				2
cymbiodyta				1
enochrus				0
helochares				
helocombus				0
helophorus				1
hydrobius				1
Hydrochara				0
Hydrochus				1
Hydrophilus				3
Laccobius				1
Paracymus				2
Sperchopsis				3
Tropisternus				0
Lampyridae				1
Limnichidae:				
Lutrochus				3
Psephenidae:				
Ectopria				3
Psephenus				3
Ptilodactylidae:				
Anchytarsus				3
Scirtidae				
Micrasema				4
BUGS:				
Belostomatidae:				
Belostoma				0
Lethocerus				0
Corixidae:				
Callicorixa				2
Corisella				0
Hesperocorixa	x	4	2	1
Palmacorixa				2
Sigara grossolineata				2
Sigara lineata				2
Sigara mathesoni				3
Sigara trilineata				2
Sigara others				0
Trichocorixa calva				3
Trichocorixa others				1
Gerridae:				
Aquarius				3
Gerris				1
Limnoporus				1
Metrobates				2
Neogerris				0
Rheumatobates				1
Trepobates				1
Mesoveliidae:				
Mesovelia				1
Nepidae:				
Nepa				1
ranatra				0
Notonectidae:				
Buenoa				0
Notonecta				0
Pleidae:				
Neoplea				0
Veliidae:				
Microvelia				0
Rhagovelia				2
CADDISFLIES:				
Apataniidae:				
Apatania				4
Beraeidae:				
Beraea				4

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Brachycentridae:				
Brachycentrus				3
micrasema				4
Calamoceratidae:				
Heteroplectron				3
Dipseudopsidae:				
Phylocentropus				2
Glossosomatidae:				
Agapetus				4
Glossosoma				4
Protoptila				2
Goeridae:				
Goera				3
Helicopsychidae:				
Helicopsyche				2
Hydropsychidae:				
Arctopsyche				4
Cheumatopsyche				1
Diplectrona				4
Homoplectra				4
Hydropsyche alhedra				3
Hydropsyche alvata				1
Hydropsyche betteni				2
Hydropsyche bronta				3
Hydropsyche cuanis				2
Hydropsyche dicantha				2
Hydropsyche hageni				2
Hydropsyche morosa				2
Hydropsyche immature				
Hydropsyche placoda				2
Hydropsyche scalaris				2
hydropsyche slossonae				3
Hydropsyche sparna				3
Hydropsyche ventura				4
Hydropsyche welkeri				3
Macrostemum				2
Parapsyche				4
Potamyia				1
Hydroptilidae:				
Agraylea				1
Hydroptila				2
Ithytrichia				4
Leucotrichia				3
Mayatrichia				2
Neotrichia				2
Ochrotrichia				2
Orthotrichia				
Oxyethira				1
Stactobiella				4
Lepidostomatidae:				
Lepidostoma				4
Theliopsyche				4
Leptoceridae:				
Ceraclea				1
Leptocerus				0
Mystacides				1
Nectopsyche				1
Oecetis				2
Setodes				2
Triaenodes				1
Limnephilidae:				
Anabolia				1
Asynarchus				1
Chyranda				4
Frenesia				4
Glyphopsyche				1
Hesperophylax				4
Hydatophylax				4
Ironoquia				2
Lenarchus				1
Limnephilus moestus				3
Limnephilus				1
Nemotaulius				1
Onocosmoecus				4
Platycentropus				2
Pseudostenophylax				4
Psychoglypha				4
Pycnopsyche				3
Molannidae:				
Molanna				2
Odontoceridae:				
Marilia				3

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Psilotreta				4
Philopotamidae:				
Chimarra				3
Dolophilodes				4
Wormaldia				4
Phryganeidae:				
Agrypnia				1
Banksiola				0
Fabria				1
Oligostomis				3
Phryganea				1
Ptilostomis				2
Polycentropodidae:				
Cyrnellus				1
Neureclipsis				2
Nyctiophylax				2
Polycentropus				
Psychomyiidae:				
Lype				3
Psychomyia				3
Rhyacophilidae:				
Rhyacophila fenestra				3
rhyacophila lobifera				3
Rhyacophila				4
Sericostomatidae:				
Agarodes				3
Uenoidae:				
Neophylax				4
DAMSELFLIES:				
Calopterygidae:				
Calopteryx aequabilis				2
Calopteryx maculata				3
Hetaerina				2
Coenagrionidae:				
Amphiagrion				1
Argia apicalis				1
Argia fumipennis				3
Argia moesta				2
Argia sedula				2
Argia tibialis				3
Argia translata				1
Chromagrion				2
Coenagrion				0
Enallagma antennatum				1
Enallagma aspersum				0
Enallagma basidens				0
Enallagma boreale				1
Enallagma carunculatum				1
Enallagma civile				1
Enallagma clausum				0
Enallagma cyathigerum				1
Enallagma ebrium				1
Enallagma exsulans				3
Enallagma geminatum				2
Enallagma hageni				0
Enallagma signatum				1
Enallagma vesperum				1
Ischnura				1
Nehalennia				1
Lestidae:				
Archilestes				2
Lestes				1
DRAGONFLIES:				
Aeshnidae:				
Aeshna				2
Anax				0
Basiaeschna				1
Boyeria				2
Nasiaeschna				1
Cordulegastridae:				
Cordulegaster				3
Corduliidae:				
Cordulia				1
Epitheca				1
Helocordulia				2
Neurocordulia				2
Somatochlora				3
Gomphidae:				
Arigomphus				1

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Dromogomphus				2
Gomphurus				2
Gomphus				3
Hagenius				2
Ophiogomphus				3
Phanogomphus				1
Stylogomphus				3
Stylurus				3
Libellulidae:				
Erythemis				1
Ladona				0
Leucorrhinia				0
Libellula				1
Perithemis				1
Plathemis				0
Sympetrum				1
Tramea				1
Macromiidae:				
Didymops				2
Macromia				2
MAYFLIES:				
Ameletidae:				
Ameletus				4
Arthropleidae:				
Arthroplea				3
Baetidae:				
Acentrella				3
acerpenna macdunnoughi				3
Acerpenna pygmaea				2
Baetis brunneicolor				3
Baetis flavistriga				1
Baetis intercalaris				2
Baetis				2
baetis rusticans				
Baetis tricaudatus				4
Callibaetis				0
Centroptilum				3
Dipheter				3
Heterocloeon				2
Plauditus armillatus				2
Plauditus cestus				3
Plauditus cingulatus				2
Plauditus dubius				1
Plauditus punctiventris				3
Plauditus virilis				1
Procloeon				2
Pseudocentroptiloides				3
Pseudocloeon frondalis				2
Pseudocloeon longipalpus				1
Pseudocloeon propinquus				2
Baetiscidae:				
Baetisca				2
Caenidae:				
Brachycercus				2
Caenis anceps				2
Caenis				1
Ephemerellidae:				
Attenella				2
Dannella				3
Dentatella bartoni				1
Drunella				4
Ephemerella aurivillii				4
Ephemerella				3
Eurylophella aestiva				1
Eurylophella bicolor				3
Eurylophella coxalis				3
Eurylophella funeralis				4
Eurylophella lutulenta				1
Eurylophella temporalis				1
Serratella serratoides				4
Serratella				3
Ephemeridae:				
Ephemerella guttulata				3
Ephemerella simulans				2
Ephemerella varia				3
Hexagenia atrocauda				3
Hexagenia				1
Litobrantha				3
Pentagenia				3

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Heptageniidae:			
Anepeorus			1
Epeorus			4
Heptagenia			3
Leucrocota			3
Nixe			3
Rhithrogena			4
Stenacron			2
Stenonema exiguum			1
Stenonema femoratum			1
Stenonema ithaca			2
Stenonema luteum			2
Stenonema mediopunctatum			3
Stenonema modestum			2
Stenonema pulchellum			1
Stenonema terminatum			2
Stenonema vicarium			3
Isonychiidae:			
Isonychia			2
Leptohyphidae:			
Tricorythodes			2
Leptophlebiidae:			
Choroterpes			3
Habrophlebia			
Habrophlebiodes			2
Leptophlebia			1
Paraleptophlebia			3
Metretopodidae:			
Siphloplecton			2
Oligoneuriidae:			
Homoeoneuria			2
Polymitarcyidae:			
Ephoron			3
Potamanthidae:			
Anthropotamus			2
Pseudironidae:			
Pseudiron			2
Siphonuridae:			
Parameletus			3
Siphonurus			2
STONEFLIES:			
Capniidae:	1		
Allocapnia granulata			2
allocapnia minima			2
Allocapnia pygmaea			3
Allocapnia recta			4
Allocapnia rickeri			3
Allocapnia vivipara			2
Capnia			4
Paracapnia			3
Chloroperlidae:			
Alloperla			4
Haploperla			3
Suwallia			4
Sweltsa			4
Leuctridae:			
Leuctra			4
Paraleuctra			4
Nemouridae:			
Amphinemura			4
Nemoura			3
Ostrocerca			4
Paranemoura			4
Podmosta			4
Prostoia			3
Shipsa			3
Soyedina			4
Peltoperlidae:			
Peltoperla			3
Tallaperla			3
Perlidae:			
Acroeuria abnormis			2
Acroeuria carolinensis			3
Acroeuria evoluta			2
Acroeuria lycorias			2
Agnetina			3
Attaneuria			2
Neoperla			3
Paragnetina			3
Perlesta			2
Perlinella			3

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Perlodidae:				
Arcynopteryx				4
Clioperla				3
Cultus				4
Helopicus				
Isogenoides				4
Isoperla bilineata				2
Isoperla nana				2
Isoperla				4
Malirekus				4
Pteronarcyidae:				
Pteronarcys				3
Taeniopterygidae:				
Oemopteryx				4
Strophopteryx				4
Taeniopteryx burksi				2
Taeniopteryx				3
TRUE FLIES:				
Athericidae:				
Atherix				3
Ceratopogonidae	x	22	34	0
Chaoboridae:				
Chaoborus				0
Chironomidae:				
Ablabesmyia				2
Acricotopus				1
Apsectrotanytus				4
Brillia parva				4
Brillia				2
Brundiniella				4
Cardiocladius				2
Chaetocladius				1
Chernovskia				1
Chironomus	x	134	242	0
Cladopelma				1
Cladotanytarsus				2
Clinotanytus				1
Coelotanytus				1
Conchapelopia				2
Corynoneura				2
Cricotopus (C.) tremulus-gp				3
Cricotopus (C.) trifascia				3
Cricotopus (C.) others				2
Cricotopus(Isocladius)				0
Cryptochironomus				1
Cryptotendipes				2
Demicryptochironomus				1
Diamesa				3
Dicrotendipes	x	42	56	0
Diplocladius				3
Donericotopus				3
Einfeldia				0
Endochironomus				0
Epoicocladius				2
Eukiefferiella claripennis-gp				1
Eukiefferiella				3
Glyptotendipes	x	74	82	0
Harnischia				1
Heleniella				4
Helopelopia				3
Heterotanytarsus				0
Heterotrissocladius hirtapex				2
Heterotrissocladius				1
Hydrobaenus				1
Labrundinia				1
Larsia				1
Lauterbouriella				0
Limnophyes				1
Lipiniella				1
Macropelopia				3
Meropelopia				3
Metriocnemus				3
Microchironomus				1
Microcricotopus				1
Microsectra				3
Microtendipes				2
Monodiamesa				1
Nanocladius				3
Natarsia				3
Nilotanytus				2
Nilothauma				1
Odontomesa				2

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Orthocladius				
Pagastia				3
Pagastiella				0
Parachaetocladus				3
Parachironomus				1
Paracladopelma doris				3
Paracladopelma doris-gp				2
Paracladopelma galaptera				0
Paracladopelma nais				2
Paracladopelma nereis				3
Paracladopelma undine				2
Paracladopelma winnelli				2
Parakiefferiella				2
Paralauterborniella				0
Paramerina				
Parametrioctenemus				3
Paratanytarsus				1
Paratendipes				2
Pentaneura				2
Phaenopsectra				1
Polypedilum albicorne				3
Polypedilum angulum				
Polypedilum aviceps				3
Polypedilum fallax				1
Polypedilum flavum (convictum)				2
Polypedilum halterale				0
Polypedilum illinoense				1
Polypedilum laetum				2
Polypedilum nubeculosum				2
Polypedilum scalaenum				1
Polypedilum trigonus				0
Polypedilum tritum				0
Potthastia				1
Procladius	x	34	24	0
Prodiamesa				3
Protanypus				0
Psectrocladius				1
Psectrotanypus				0
Pseudochironomus				1
Rheocricotopus				2
Rheopelopia				3
Rheotanytarsus				3
Robackia				2
Saetheria				2
Stempellina				2
Stempellinella				3
Stenochironomus				2
Stictochironomus				2
Stilocladus				3
Sublettea				2
Sympotthastia				3
Syndiamesa				3
Synorthocladus				3
Tanypus	x			1
Tanytarsus				2
Thienemanniella				2
Thienemannimyia				2
Tribelos				1
Trissopelopia				2
Tvetenia				2
Unniella				
Xenochironomus				2
Xylotopus				2
Zalutschia				0
Zavreliomyia				2
Culicidae				0
Dixidae				1
Dolichopodidae				2
Empididae				2
Ephydriidae				1
Muscidae				1
Psychodidae				0
Ptychopteridae				1
Simuliidae				2
Stratiomyidae				0
Syrphidae				0
Tabanidae:				
Chrysops				2
Tabanus				0
Tipulidae:				
Antocha				3
Cryptolabis				4

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Dactylobois				3
Dicranota				3
Erioptera				1
Helius				1
Hexatoma				2
Limnophila				2
Limonia				2
Ormosia				3
Pedicia				3
Pilaria				1
Pseudolimnophila				3
Tipula				
Crustaceans:				
AMPHIPODS:				
Crangonyctidae:				
Crangonyx gracilis-cmpx				3
Crangonyx rivularis				3
Crangonyx				2
Gammaridae:				
Gammarus fasciatus				2
Gammarus lacustris				3
Gammarus pseudolimnae				3
Hyalidae:				
Hyalala	x	2	2	2
CRAYFISHES:				
Cambaridae:				
Cambarus				1
Orconectes				2
Palaemonetidae:				
Palaemonetes				3
ISOPODS:				
Asellidae:				
Caecidotea				1
Lirceus				2
Molluscs:				
BIVALVES:				
Dreissenidae:				
Dreissena				1
Sphaeriidae:				
musculium lacustre				1
Musculium partumeium				1
Musculium securis				1
musculium transversum				2
Pisidium				1
Sphaerium fabale				3
Sphaerium occidentale				0
Sphaerium rhomboideum				1
Sphaerium simile				1
Sphaerium striatinum				2
Unionidae:				
Actinonaias carinata				2
Actinonaias ligamentina				3
Alasmidonta marginata				3
Alasmidonta viridis				3
Amblema plicata				2
Anodontoides ferussacianus				3
Carunculina parva				1
Cyclonaias tuberculata				2
Elliptio dilatata				1
Epioblasma(=Dysnomia)				2
Fusconaia flava				1
Lampsilis cardium				3
Lampsilis fasciola				3
Lampsilis radiata siliquoidea				1
Lampsilis ventricosa				1
Lasmigona complanata				1
Lasmigona compressa				3
Lasmigona costata				2
Leptodea fragilis				1
Ligumia nasuta				0
Ligumia recta				2
Obliquaria reflexa				1
Obovaria subrotunda				2
Pleurobema coccineum				1
Proptera alata				0
Ptychobranthus fasciolaris				3
Pyganodon (=Anodonta,in part)				1
Quadrula pustulosa				1
Quadrula quadrula				2
Simpsoniconcha ambigua				2
Strophitus undulatus				3
Truncilla				2

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Villosa fabalis				2
Villosa iris				2
SNAILS:				
Ancylidae:				
Ferrissia fragilis				0
Ferrissia parallela				1
Ferrissia rivularis				2
Bithyniidae:				
Bithynia				1
Hydrobiidae:				
Amnicola				2
Birgella (=Somatogyrus)				2
Cincinnati				1
Fontigens				3
Potamopyrgus				1
Probythinella				2
Lymnaeidae:				
Bulinnea				1
Fossaria				1
Lymnaea				1
Pseudosuccinea				0
Radix				1
Stagnicola				0
Physidae:				
Physella				0
Planorbidae:				
Gyraulus				1
Helisoma				1
Planorbella				0
Planorbula				1
Promenetus				2
Pleuroceridae:				
Elimia (=Goniobasis)				2
Pleurocera				1
Valvatidae:				
Valvata				2
Viviparidae:				
Campeloma				1
Cipangopaludina				1
Viviparus				1
Annelids:				
LEECHES:				
Erpobdellidae:				
Dina dubia				1
Dina parva				0
Erpobdella				1
Mooreobdella				2
Nepheleopsis				2
Hirudinidae:				
Haemopsis				1
Macrobdella				0
Glossiphoniidae:				
Alboglossiphonia				2
Batrachobdella				2
Glossiphonia				2
Helobdella elongata				1
Helobdella fusca				2
Helobdella papillata				1
Helobdella stagnalis				2
Helobdella triserialis				2
Placobdella				1
Theromyzon				
WORMS:				
Lumbriculidae				0
Tubificidae:				
Aulodrilus				2
Bothrioneurum				2
Branchiura				0
Ilyodrilus				0
Isochaetides curvisetosus				3
Isochaetides freyi				1
Limnodrilus	x	22	16	0
Potamotheix bavaricus				2
Potamotheix moldaviensis				2
Potamotheix vejovskyi				2
Quistadrilus				0
Rhyacodrilus				3
Spirosperma				1
Tasserkidrilus				2
Tubifex				0
Oligochaete				
no cheate				0

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Platyhelminthes:				0
FLATWORMS:				
Alloecoela				1
Tricladida				3
Total sum/0.05m2		331	456	
Total Taxa	10			
BioMap WQI		1.373292815	1.345766854	
Avareage	1.359529834			
Hilsenhoff Biotic Index	9.340479193			
EPT Richness (%)	0.126103405			
Percentage Oligocheates	4.791929382			
Percentage Chironomidae	86.7591425			
Percentage Insects	94.703657			
Simpsons diversity	0.760082309			
Simpsons index of diversity	0.239917691			
Simpsons reciprocal	1.315646987			

W12A-1B

Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP sensitivity value
Insects:				
ALDERFLIES:				
CORYDALIDAE:				
Chauliodes				1
Corydalis				2
Nigronia				3
SIALIDAE				
Sialis				2
AQUATIC MOTHS:				
PYRALIDAE:				
Petrophila				2
Other				0
BEETLES:				
DYROPIDAE:				
Helichus				2
DYTISCIDAE:				
Acilius				0
agabetes				0
agabus				2
bidessonotus				1
celina				0
colymbetes				1
copelatus				3
coptotomus lenticus				1
coptotomus longulus				1
coptotomus loticus				2
cybister				0
desmopachria				0
dytiscus				1
graphoderus				0
heterosternuta				3
hydrocolus				1
hydroporus				1
hydrovatus				0
hygrotus				0
illybius				2
laccophilus				0
laccornis				1
liodessus				2
lioporeus				3
matus2	X		4	2
nebraporus				2
neoporus				2
neoscutopterus				0
oreodytes				2
rhantus				0
sanfilippodytes				3
stictotarsus				2
uvarus				2
ELMIDAE:				
Optioservus larvae				
Stenelmis larvae		1		
dubiraphia larvae	X	29	16	
ancyrionxy variegata				2
dubiraphia bivittata		3		0
dubiraphia minima				1
dubiraphia quadrinotata				1
dubiraphia vittata				2
macronychus galbratus				2
microcyloepus pusillus				3
optioservus fastiditus				2

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optioservus ovalis				2
optioservus trivittatus				3
promoresia elegans				3
promoresia tardella				4
stenelmis bicarinata				2
stenelmis crenata				2
stenelmis musgravei				1
stenelmis quadramaculata				0
stenelmis sandersoni				2
stenelmis vittipennis				2
GYRINIDAE:				
dineutes				2
gyrinus				1
HALIPLIDAE:				
haliplus	X			1
peltodytes		3		2
HYDROPHILIDAE:				
anacaena				2
berosus				0
crenitis				2
cymbiodyta				1
enochrus				0
helochares				
helocombus				0
helophorus				1
hydrobius				1
Hydrochara				0
Hydrochus				1
Hydrophilus				3
Laccobius				1
Paracymus				2
Sperchopsis				3
Tropisternus				0
Lampyridae				1
Limnichidae:				
Lutrochus				3
Psephenidae:				
Ectopria				3
Psephenus				3
Ptilodactylidae:				
Anchytarsus				3
Scirtidae				
Micrasema				4
BUGS:				
Belostomatidae:				
Belostoma				0
Lethocerus				0
Corixidae:				
Callicorixa				2
Corisella				0
Hesperocorixa	X	15	18	1
Palmarcorixa				2
Sigara grossolineata				2
Sigara lineata				2
Sigara mathesoni				3
Sigara trilineata				2
Sigara others				0
Trichocorixa calva				3
Trichocorixa others				1
Gerridae:				
Aquarius				3
Gerris				1
Limnoporus				1
Metrobates				2
Neogerris				0
Rheumatobates				1
Trepobates				1
Mesoveliidae:				
Mesovelia				1
Nepidae:				
Nepa				1
ranatra				0
Notonectidae:				
Buenoa				0
Notonecta				0
Pleidae:				
Neoplea				0
Veliidae:				
Microvelia				0
Rhagovelia				2
CADDISFLIES:				

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Apataniidae:				
Apatania				4
Beraeidae:				
Beraea				4
Brachycentridae:				
Brachycentrus				3
micrasema				4
Calamoceratidae:				
Heteroplectron				3
Dipseudopsidae:				
Phylocentropus				2
Glossosomatidae:				
Agapetus				4
Glossosoma				4
Protoptila				2
Goeridae:				
Goera				3
Helicopsychidae:				
Helicopsyche				2
Hydropsychidae:				
Arctopsyche				4
Cheumatopsyche				1
Diplectrona				4
Homoplectra				4
Hydropsyche alhedra				3
Hydropsyche alvata				1
Hydropsyche betteni				2
Hydropsyche bronta				3
Hydropsyche cuanis				2
Hydropsyche dicantha				2
Hydropsyche hageni				2
Hydropsyche morosa				2
Hydropsyche immature				
Hydropsyche placoda				2
Hydropsyche scalaris				2
hydropsyche slossonae				3
Hydropsyche sparna				3
Hydropsyche ventura				4
Hydropsyche welkeri				3
Macrostemum				2
Parapsyche				4
Potamyia				1
Hydroptilidae:				
Agraylea				1
Hydroptila				2
Ithytrichia				4
Leucotrichia				3
Mayatrichia				2
Neotrichia				2
Ochrotrichia				2
Orthotrichia				
Oxyethira				1
Stactobiella				4
Lepidostomatidae:				
Lepidostoma				4
Theliopsyche				4
Leptoceridae:				
Ceraclea				1
Leptocerus				0
Mystacides				1
Nectopsyche				1
Oecetis				2
Setodes				2
Trienodes				1
Limnephilidae:				
Anabolia				1
Asynarchus				1
Chyranda				4
Frenesia				4
Glyphopsyche				1
Hesperophylax				4
Hydatophylax				4
Ironoquia				2
Lenarchus				1
Limnephilus moestus				3
Limnephilus				1
Nemotaulius				1
Onocosmoecus				4
Platycentropus				2
Pseudostenophylax				4
Psychoglypha				4
Pycnopsyche				3

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Molannidae:				
Molanna				2
Odontoceridae:				
Marilia				3
Psilotreta				4
Philopotamidae:				
Chimarra				3
Dolophilodes				4
Wormaldia				4
Phryganeidae:				
Agrypnia				1
Banksiola				0
Fabria				1
Oligostomis				3
Phryganea				1
Ptilostomis				2
Polycentropodidae:				
Cyrnellus				1
Neureclipsis				2
Nyctiophylax				2
Polycentropus				
Psychomyiidae:				
Lype				3
Psychomyia				3
Rhyacophilidae:				
Rhyacophila fenestra				3
rhyacophila lobifera				3
Rhyacophila				4
Sericostomatidae:				
Agarodes				3
Uenoidae:				
Neophylax				4
DAMSELFLIES:				
Calopterygidae:				
Calopteryx aequabilis				2
Calopteryx maculata				3
Hetaerina				2
Coenagrionidae:				
Amphiagrion				1
Argia apicalis				1
Argia fumipennis				3
Argia moesta				2
Argia sedula				2
Argia tibialis				3
Argia translata				1
Chromagrion				2
Coenagrion				0
Enallagma antennatum				1
Enallagma aspersum				0
Enallagma basidens				0
Enallagma boreale				1
Enallagma carunculatum				1
Enallagma civile				1
Enallagma clausum				0
Enallagma cyathigerum				1
Enallagma ebrium				1
Enallagma exsulans				3
Enallagma geminatum				2
Enallagma hageni				0
Enallagma signatum				1
Enallagma vesperum				1
Ischnura				1
Nehalennia				1
Lestidae:				
Archilestes				2
Lestes				1
DRAGONFLIES:				
Aeshnidae:				
Aeshna				2
Anax				0
Basiaeschna				1
Boyeria		1		2
Nasiaeschna				1
Cordulegastridae:				
Cordulegaster				3
Corduliidae:				
Cordulia				1
Epitheca				1
Helocordulia				2

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Neurocordulia				2
Somatochlora				3
Gomphidae:				
Arligomphus				1
Dromogomphus				2
Gomphurus				2
Gomphus				3
Hagenius				2
Ophiogomphus				3
Phanogomphus				1
Stylogomphus				3
Stylurus				3
Libellulidae:				
Erythemis				1
Ladona				0
Leucorrhinia				0
Libellula				1
Perithemis				1
Platthemis				0
Sympetrum				1
Tramea				1
Macromiidae:				
Didymops				2
Macromia				2
MAYFLIES:				
Ameletidae:				
Ameletus				4
Arthropleidae:				
Arthroplea				3
Baetidae:				
Acentrella				3
acerpenna macdunnoughi				3
Acerpenna pygmaea				2
Baetis brunneicolor				3
Baetis flavistriga				1
Baetis intercalaris				2
Baetis				2
baetis rusticans				
Baetis tricaudatus				4
Callibaetis				0
Centroptilum				3
Diphetor				3
Heterocloeon				2
Plauditus armillatus				2
Plauditus cestus				3
Plauditus cingulatus				2
Plauditus dubius				1
Plauditus punctiventris				3
Plauditus virilis				1
Procloeon				2
Pseudocentroptiloides				3
Pseudocloeon frondalis				2
Pseudocloeon longipalpus				1
Pseudocloeon propinquus				2
Baetiscidae:				
Baetisca				2
Caenidae:				
Brachycercus				2
Caenis anceps				2
Caenis				1
Ephemerellidae:				
Attenella				2
Dannella				3
Dentatella bartoni				1
Drunella				4
Ephemerella aurivillii				4
Ephemerella				3
Euryophella aestiva				1
Euryophella bicolor				3
Euryophella coxalis				3
Euryophella funeralis				4
Euryophella lutulenta				1
Euryophella temporalis				1
Serratella serratoides				4
Serratella				3
Ephemeridae:				
Ephemera guttulata				3
Ephemera simulans				2
Ephemera varia				3

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Hexagenia atrocauda				3
Hexagenia				1
Litobranca				3
Pentagenia				3
Heptageniidae:				
Anepeorus				1
Epeorus				4
Heptagenia				3
Leucrocuta				3
Nixe				3
Rhithrogena				4
Stenacron				2
Stenonema exiguum				1
Stenonema femoratum				1
Stenonema ithaca				2
Stenonema luteum				2
Stenonema mediopunctatum				3
Stenonema modestum				2
Stenonema pulchellum				1
Stenonema terminatum				2
Stenonema vicarium				3
Isonychiidae:				
Isonychia				2
Leptohyphidae:				
Tricorythodes				2
Leptophlebiidae:				
Choroterpes				3
Habrophlebia				
Habrophlebiodes				2
Leptophlebia				1
Paraleptophlebia				3
Metretopodidae:				
Siphloplecton				2
Oligoneuriidae:				
Homoeoneuria				2
Polymitarcyidae:				
Ephoron				3
Potamanthidae:				
Anthropotamus				2
Pseudironidae:				
Pseudiron				2
Siphonuridae:				
Parameletus				3
Siphonurus				2
STONEFLIES:				
Capniidae:			1	
Allocaupnia granulata				2
allogaupnia minima				2
Allocaupnia pygmaea				3
Allocaupnia recta				4
Allocaupnia rickeri				3
Allocaupnia vivipara				2
Capnia				4
Paracupnia				3
Chloroperlidae:				
Alloperla				4
Haploperla				3
Suwallia				4
Sweltsa				4
Leuctridae:				
Leuctra				4
Paraleuctra				4
Nemouridae:				
Amphinemura				4
Nemoura				3
Ostrocerca				4
Paranemoura				4
Podmosta				4
Prostoia				3
Shipsa				3
Soyedina				4
Peltoperlidae:				
Peltoperla				3
Tallaperla				3
Perlidae:				
Acroeneuria abnormis				2
Acroeneuria carolinensis				3
Acroeneuria evoluta				2
Acroeneuria lycorias				2
Agnetina				3
Attaneuria				2

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Neoperla				3
Paragnetina				3
Perlesta				2
Perlinella				3
Perlodidae:				
Arcynopteryx				4
Clioperla				3
Cultus				4
Helopicus				
Isogenoides				4
Isoperla bilineata				2
Isoperla nana				2
Isoperla				4
Malirekus				4
Pteronarcyidae:				
Pteronarcys				3
Taeniopterygidae:				
Oemopteryx				4
Strophopteryx				4
Taeniopteryx burksi				2
Taeniopteryx				3
TRUE FLIES:				
Athericidae:				
Atherix				3
Ceratopogonidae				0
Chaoboridae:				
Chaoborus				0
Chironomidae:				
Ablabesmyia				2
Aricotopus				1
Apsectrotanytus				4
Brillia parva				4
Brillia				2
Brundiniella				4
Cardiocladius				2
Chaetocladius				1
Chernovskia				1
Chironomus	X	54	62	0
Cladopelma				1
Cladotanytarsus				2
Clinotanytus				1
Coelotanytus				1
Conchapelopia				2
Corynoneura				2
Cricotopus (C.) tremulus-gp				3
Cricotopus (C.) trifascia				3
Cricotopus (C.) others				2
Cricotopus(Isocladius)				0
Cryptochironomus				1
Cryptotendipes				2
Demicryptochironomus				1
Diamesa				3
Dicortendipes		2		0
Diplocladius				3
Doncricotopus				3
Einfeldia				0
Endochironomus				0
Epoicocladius				2
Eukiefferiella claripennis-gp				1
Eukiefferiella				3
Glyptotendipes	X	38	38	0
Harnischia				1
Heleniella				4
Helopelopia				3
Heterotanytarsus				0
Heterotrissocladius hirtapex				2
Heterotrissocladius				1
Hydrobaenus				1
Labrundinia				1
Larsia				1
Lauterbouriella				0
Limnophyes				1
Lipiniella				1
Macropelopia				3
Meropelopia				3
Metricnemus				3
Microchironomus				1
Microcricotopus				1
Micropsectra				3
Microtendipes				2
Monodiamesa				1
Nanocladius				3

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Natarsia				3
Nilotanypus				2
Nilothauma				1
Odontomesa				2
Orthocladus	X	3		
Pagastia				3
Pagastiella				0
Parachaetocladus				3
Parachironomus				1
Paracladopelma doris				3
Paracladopelma doris-gp				2
Paracladopelma galaptera				0
Paracladopelma nais				2
Paracladopelma nereis				3
Paracladopelma undine				2
Paracladopelma winnelli				2
Parakiefferiella				2
Paralauterborniella				0
Paramerina				
Parametrioctenus				3
Paratanytarsus				1
Paratendipes	X			2
Pentaneura				2
Phaenopsectra				1
Polypedilum albicorne				3
Polypedilum angulum				
Polypedilum aviceps				3
Polypedilum fallax				1
Polypedilum flavum (convictum)				2
Polypedilum halterale				0
Polypedilum illinoense				1
Polypedilum laetum				2
Polypedilum nubeculosum				2
Polypedilum scalaenum				1
Polypedilum trigonus				0
Polypedilum tritum				0
Potthastia				1
Procladius				0
Prodiamesa				3
Protanypus				0
Psectrocladius				1
Psectrotanypus	X			0
Pseudochironomus	X	12	3	1
Rheocricotopus				2
Rheopelopia				3
Rheotanytarsus				3
Robackia				2
Saetheria				2
Stempellina				2
Stempellinella				3
Stenochironomus				2
Stictochironomus				2
Stilocladus				3
Sublettea				2
Sympotthastia				3
Syndiamesa				3
Synorthocladus				3
Tanypus	X			1
Tanytarsus				2
Thienemanniella				2
Thienemannimyia				2
Tribelos				1
Trissopelopia				2
Tvetenia				2
Unniella				
Xenochironomus				2
Xylotopus				2
Zalutschia				0
Zavrelimyia				2
Culicidae		1		0
Dixidae				1
Dolichopodidae				2
Empididae				2
Ephydriidae	X	1	1	1
Muscidae				1
Psychodidae				0
Ptychopteridae				1
Simuliidae				2
Stratiomyidae	X			0
Syrphidae				0
Tabanidae:				
Chrysops				2

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Tabanus	X		1	0
Tipulidae:				
Antocha				3
Cryptolabis				4
Dactylobis				3
Dicranota				3
Erioptera				1
Helius				1
Hexatoma				2
Limnophila				2
Limonia				2
Ormosia				3
Pedicia				3
Pilaria				1
Pseudolimnophila				3
Tipula				
Crustaceans:				
AMPHIPODS:				
Crangonyctidae:				
Crangonyx gracilis-cmpx				3
Crangonyx rivularis				3
Crangonyx				2
Gammaridae:				
Gammarus fasciatus				2
Gammarus lacustris				3
Gammarus pseudolimnae				3
Hyalidae:				
Hyalala	X	8	6	2
CRAYFISHES:				
Cambaridae:				
Cambarus				1
Orconectes	X		7	2
Palaemonetidae:				
Palaemonetes				3
ISOPODS:				
Asellidae:				
Caecidotea				1
Lirceus				2
Molluscs:				
BIVALVES:				
Dreissenidae:				
Dreissena				1
Sphaeriidae:				
musculium lacustre				1
Musculium partumeium				1
Musculium securis				1
musculium transversum				2
Pisidium				1
Sphaerium fabale				3
Sphaerium occidentale				0
Sphaerium rhomboideum				1
Sphaerium simile				1
Sphaerium striatinum				2
Unionidae:				
Actinonaias carinata				2
Actinonaias ligamentina				3
Alasmidonta marginata				3
Alasmidonta viridis				3
Amblema plicata				2
Anodontoides ferussacianus				3
Carunculina parva				1
Cyclonaias tuberculata				2
Elliptio dilatata				1
Epioblasma(=Dysnomia)				2
Fusconaia flava				1
Lampsilis cardium				3
Lampsilis fasciola				3
Lampsilis radiata siliquoidea				1
Lampsilis ventricosa				1
Lasmigona complanata				1
Lasmigona compressa				3
Lasmigona costata				2
Leptodea fragilis				1
Ligumia nasuta				0
Ligumia recta				2
Obliquaria reflexa				1
Obovaria subrotunda				2
Pleurobema coccineum				1
Proptera alata				0
Ptychobranthus fasciolaris				3
Pyganodon (=Anodonta,in part)				1
Quadrula pustulosa				1

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Quadrula quadrula				2
Simpsoniconcha ambigua				2
Strophitus undulatus				3
Truncilla				2
Villosa fabalis				2
Villosa iris				2
SNAILS:				
Ancylidae:				
Ferrissia fragilis				0
Ferrissia parallela				1
Ferrissia rivularis				2
Bithyniidae:				
Bithynia				1
Hydrobiidae:				
Amnicola				2
Birgella (=Somatogyrrus)				2
Cincinnatia				1
Fontigens				3
Potamopyrgus				1
Probythinella				2
Lymnaeidae:				
Bulinnea				1
Fossaria	X	1		1
Lymnaea				1
Pseudosuccinea				0
Radix				1
Stagnicola				0
Physidae:				
Physella			2	0
Planorbidae:				
Gyraulus				1
Helisoma				1
Planorbella				0
Planorbula				1
Promenetus				2
Pleuroceridae:				
Elimia (=Goniobasis)				2
Pleurocera				1
Valvatidae:				
Valvata				2
Viviparidae:				
Campeloma				1
Cipangopaludina				1
Viviparus				1
Annelids:				
LEECHES:				
Erpobdellidae:				
Dina dubia				1
Dina parva				0
Erpobdella				1
Mooreobdella				2
Nepheleopsis				2
Hirudinidae:				
Haemopsis				1
Macrobdella				0
Glossiphoniidae:				
Alboglossiphonia				2
Batrachobdella				2
Glossiphonia				2
Helobdella elongata				1
Helobdella fusca				2
Helobdella papillata				1
Helobdella stagnalis			1	2
Helobdella triserialis				2
Placobdella				1
Theromyzon				
WORMS:				
Lumbriculidae				0
Tubificidae:				
Aulodrilus				2
Bothrioneurum				2
Branchiura				0
Ilyodrilus				0
Isochaetides curvisetosus				3
Isochaetides freyi				1
Limnodrilus	X	78	103	0
Potamothrix bavaricus				2
Potamothrix moldaviensis				2
Potamothrix vejvodskyi				2
Quistadrilus				0
Rhyacodrilus				3
Spirosperma				1

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Tasserkidrilus				2
Tubifex				0
Oligochaete				
no cheate				0
Platyhelminthes:				0
FLATWORMS:				
Alloeochoela				1
Tricladida				3
Total sum/0.05m2		235	245	
Total Taxa	27			
BioMap WQI		2.226431242	2.68476166	
avareage	2.455596451			
HBI rate	8.812865497			
EPT Richness (%)	0.194931774			
Percentage Oligochaetes	35.28265107			
Percentage Chironomidae	41.32553606			
Percentage Insects	59.84405458			
Simpsons diversity	0.309588135			
Simpsons index of diversity	0.690411865			
Simpsons reciprocal	3.230097945			

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Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP sensitivity value
Insects:				
ALDERFLIES:				
CORYDALIDAE:				
chauliodes				1
corydalis				2
nigronia				3
SIALIDAE				
sialis				2
AQUATIC MOTHS:				
PYRALIDAE:				
petrophila				2
other				0
BETTERLES:				
DYROPIDAE:				
helichus				2
DYTISCIDAE:				
acilius				0
agabates				0
agabus				2
bidessonotus				1
celina				0
colymbetes				1
copelatus				3
coptotomus lenticus				1
coptotomus longulus				1
coptotomus loticus				2
cybister				0
desmopachria				0
dytiscus				1
graphoderus				0
heterosternuta				3
hydrocolus				1
hydroporus				1
hydrovatus				0
hygrotus				0
ilybius				2
laccophilus				0
laccornis				1
liodessus				2
lioporeus				3
matus2				2
nebrionporus				2
neoporus				2
neoscutopterous				0
oreodytes				2
rhantus				0
sanfilippodytes				3
stictotarsus				2
uvarus				2
ELMIDAE:				
Optioservus larvae				
Stenelmis larvae				
dubiraphia larvae				
ancyrionxy variegata				2
dubiraphia bivittata				0
dubiraphia minima				1
dubiraphia quadrinotata				1

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dubiraphia vittata				2
macrorychus galbratus				2
microcylloepus pusillus				3
optioservus fastiditus				2
optioservus ovalis				2
optioservus trivittatus				3
promoresia elegans				3
promoresia tardella				4
stenelmis bicarinata				2
stenelmis crenata				2
stenelmis musgravei				1
stenelmis quadramaculata				0
stenelmis sandersoni				2
stenelmis vittipennis				2
GYRINIDAE:				
dineutes				2
gyrinus				1
HALIPLIDAE:				
haliphus				1
peltodytes				2
HYDROPHILIDAE:				
anacaena				2
berosus				0
crenitis				2
cymbiodyta				1
enochrus				0
helochares				
helocombus				0
helophorus				1
hydrobius				1
Hydrochara				0
Hydrochus				1
Hydrophilus				3
Laccobius				1
Paracymus				2
Sperchopsis				3
Tropisternus				0
Lampyridae				1
Limnichidae:				
Lutrochus				3
Psephenidae:				
Ectopria				3
Psephenus				3
Ptilodactylidae:				
Anchytarsus				3
Scirtidae				
Micrasema				4
BUGS:				
Belostomatidae:				
Belostoma				0
Lethocerus				0
Corixidae:				
Callicorixa				2
Corisella				0
Hesperocorixa				1
Palmarcorixa				2
Sigara grossolineata				2
Sigara lineata				2
Sigara mathesoni				3
Sigara trilineata				2
Sigara others				0
Trichocorixa calva				3
Trichocorixa others				1
Gerridae:				
Aquarius				3
Gerris				1
Limnoporus				1
Metrobates				2
Neogerris				0
Rheumatobates				1
Trepobates				1
Mesoveliidae:				
Mesovelia				1
Nepidae:				
Nepa				1
ranatra				0
Notonectidae:				
Buenoa				0
Notonecta				0
Pleidae:				
Neoplea				0
Veliidae:				

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Microvelia				0
Rhagovelia				2
CADDISFLIES:				
Apataniidae:				
Apatania				4
Beraeidae:				
Beraea				4
Brachycentridae:				
Brachycentrus				3
micrasema				4
Calamoceratidae:				
Heteroplectron				3
Dipseudopsidae:				
Phylocentropus				2
Glossosomatidae:				
Agapetus				4
Glossosoma				4
Protoptila				2
Goeridae:				
Goera				3
Helicopsychidae:				
Helicopsyche				2
Hydropsychidae:				
Arctopsyche				4
Cheumatopsyche				1
Diplectrona				4
Homoplectra				4
Hydropsyche alhedra				3
Hydropsyche alvata				1
Hydropsyche betteni				2
Hydropsyche bronta				3
Hydropsyche cuanis				2
Hydropsyche dicantha				2
Hydropsyche hageni				2
Hydropsyche morosa				2
Hydropsyche immature				
Hydropsyche placoda				2
Hydropsyche scalaris				2
hydropsyche slossonae				3
Hydropsyche sparna				3
Hydropsyche ventura				4
Hydropsyche welkeri				3
Macrostemum				2
Parapsyche				4
Potamyia				1
Hydroptilidae:				
Agraylea				1
Hydroptila				2
Ithytrichia				4
Leucotrichia				3
Mayatrichia				2
Neotrichia				2
Ochrotrichia				2
Orthotrichia				
Oxyethira				1
Stactobiella				4
Lepidostomatidae:				
Lepidostoma				4
Theliopsyche				4
Leptoceridae:				
Ceraclea				1
Leptocerus				0
Mystacides				1
Nectopsyche				1
Oecetis				2
Setodes				2
Trienodes				1
Limnephilidae:				
Anabolia				1
Asynarchus				1
Chyranda				4
Frenesia				4
Glyphopsyche				1
Hesperophylax				4
Hydatophylax				4
Ironoquia				2
Lenarchus				1
Limnephilus moestus				3
Limnephilus				1
Nemotaulius				1
Onocosmoecus				4

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Platycentropus				2
Pseudostenophylax				4
Psychoglypha				4
Pycnopsyche				3
Molannidae:				
Molanna				2
Odontoceridae:				
Marilia				3
Psilotreta				4
Philopotamidae:				
Chimarra				3
Dolophilodes				4
Wormaldia				4
Phryganeidae:				
Agrypnia				1
Banksiola				0
Fabria				1
Oligostomis				3
Phryganea				1
Ptilostomis				2
Polycentropodidae:				
Cynellus				1
Neureclipsis				2
Nyctiophylax				2
Polycentropus				
Psychomyiidae:				
Lype				3
Psychomyia				3
Rhyacophilidae:				
Rhyacophila fenestra				3
rhyacophila lobifera				3
Rhyacophila				4
Sericostomatidae:				
Agarodes				3
Uenoidae:				
Neophylax				4
DAMSELFLIES:				
Calopterygidae:				
Calopteryx aequabilis				2
Calopteryx maculata				3
Hetaerina				2
Coenagrionidae:				
Amphiagron				1
Argia apicalis				1
Argia fumipennis				3
Argia moesta				2
Argia sedula				2
Argia tibialis				3
Argia translata				1
Chromagrion				2
Coenagrion				0
Enallagma antennatum				1
Enallagma aspersum				0
Enallagma basidens				0
Enallagma boreale				1
Enallagma carunculatum				1
Enallagma civile				1
Enallagma clausum				0
Enallagma cyathigerum				1
Enallagma ebrium				1
Enallagma exsulans				3
Enallagma geminatum				2
Enallagma hageni				0
Enallagma signatum				1
Enallagma vesperum				1
Ischnura				1
Nehalennia				1
Lestidae:				
Archilestes				2
Lestes				1
DRAGONFLIES:				
Aeshnidae:				
Aeshna				2
Anax				0
Basiaeschna				1
Boyeria				2
Nasiaeschna				1
Cordulegastridae:				
Cordulegaster				3

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Corduliidae:				
Cordulia				1
Epitheca				1
Helocordulia				2
Neurocordulia				2
Somatochlora				3
Gomphidae:				
Arigomphus				1
Dromogomphus				2
Gomphurus				2
Gomphus				3
Hagenius				2
Ophiogomphus				3
Phanogomphus				1
Stylogomphus				3
Stylurus				3
Libellulidae:				
Erythemis				1
Ladona				0
Leucorrhinia				0
Libellula				1
Perithemis				1
Plathemis				0
Sympetrum				1
Tramea				1
Macromiidae:				
Didymops				2
Macromia				2
MAYFLIES:				
Ameletidae:				
Ameletus				4
Arthropleidae:				
Arthroplea				3
Baetidae:				
Acentrella				3
acerpenna macdunnoughi				3
Acerpenna pygmaea				2
Baetis brunneicolor				3
Baetis flavistriga				1
Baetis intercalaris				2
Baetis				2
baetis rusticans				
Baetis tricaudatus				4
Callibaetis				0
Centroptilum				3
Diphetor				3
Heterocloeon				2
Plauditus armillatus				2
Plauditus cestus				3
Plauditus cingulatus				2
Plauditus dubius				1
Plauditus punctiventris				3
Plauditus virilis				1
Procloeon				2
Pseudocentroptiloides				3
Pseudocloeon frondalis				2
Pseudocloeon longipalpus				1
Pseudocloeon propinquus				2
Baetiscidae:				
Baetisca				2
Caenidae:				
Brachycercus				2
Caenis anceps				2
Caenis		1		1
Ephemerellidae:				
Attenella				2
Dannella				3
Dentatella bartoni				1
Drunella				4
Ephemerella aurivillii				4
Ephemerella				3
Eurylophella aestiva				1
Eurylophella bicolor				3
Eurylophella coxalis				3
Eurylophella funeralis				4
Eurylophella lutulenta				1
Eurylophella temporalis				1
Serratella serratoides				4
Serratella				3

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Ephemeraidae:				
Ephemera guttulata				3
Ephemera simulans				2
Ephemera varia				3
Hexagenia atrocauda				3
Hexagenia				1
Litobrantha				3
Pentagenia				3
Heptageniidae:				
Anepeorus				1
Epeorus				4
Heptagenia				3
Leucrocuta				3
Nixe				3
Rhithrogena				4
Stenacron				2
Stenonema exiguum				1
Stenonema femoratum				1
Stenonema lthaca				2
Stenonema luteum				2
Stenonema mediopunctatum				3
Stenonema modestum				2
Stenonema pulchellum				1
Stenonema terminatum				2
Stenonema vicarium				3
Isonychiidae:				
Isonychia				2
Leptohyphidae:				
Tricorythodes				2
Leptophlebiidae:				
Choroterpes				3
Habrophlebia				
Habrophlebiodes				2
Leptophlebia				1
Paraleptophlebia				3
Metretopodidae:				
Siphloplecton				2
Oligoneuriidae:				
Homoeoneuria				2
Polymitarcyidae:				
Ephoron				3
Potamanthidae:				
Anthropotamus				2
Pseudironidae:				
Pseudiron				2
Siphonuridae:				
Parameletus				3
Siphonurus				2
STONEFLIES:				
Capniidae:				
Allocaupnia granulata				2
allogaupnia minima				2
Allocaupnia pygmaea				3
Allocaupnia recta				4
Allocaupnia rickeri				3
Allocaupnia vivipara				2
Capnia				4
Paracupnia				3
Chloroperlidae:				
Alloperla				4
Haploperla				3
Suwallia				4
Sweltsa				4
Leuctridae:				
Leuctra				4
Paraleuctra				4
Nemouridae:				
Amphinemura				4
Nemoura				3
Ostrocerca				4
Paranemoura				4
Podmosta				4
Prostoia				3
Shipsa				3
Soyedina				4
Peltoperlidae:				
Peltoperla				3
Tallaperla				3
Perlidae:				
Acroneuria abnormis				2
Acroneuria carolinensis				3

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Acroneuria evoluta				2
Acroneuria lycorias				2
Agnetina				3
Attaneuria				2
Neoperla				3
Paragnetina				3
Perlesta				2
Perlinella				3
Perlidae:				
Arcynopteryx				4
Cloperla				3
Cultus				4
Helopius				
Isogenoides				4
Isoperla bilineata				2
Isoperla nana				2
Isoperla				4
Malirekus				4
Pteronarcyidae:				
Pteronarcys				3
Taeniopterygidae:				
Oemopteryx				4
Strophopteryx				4
Taeniopteryx burksi				2
Taeniopteryx				3
TRUE FLIES:				
Athericidae:				
Atherix				3
Ceratopogonidae	x	2	3	0
Chaoboridae:				
Chaoborus				0
Chironomidae:				
Ablabesmyia				2
Acricotopus				1
Apsectrotanytus				4
Brillia parva				4
Brillia				2
Brundiniella				4
Cardiocladius				2
Chaetocladius				1
Chernovskiiia				1
Chironomus	x	84	82	0
Cladopelma				1
Cladotanytarsus				2
Clinotanytus				1
Coelotanytus				1
Conchapelopia				2
Corynoneura				2
Cricotopus (C.) tremulus-gp				3
Cricotopus (C.) trifascia				3
Cricotopus (C.) others				2
Cricotopus(Isocladius)				0
Cryptochironomus				1
Cryptotendipes				2
Demicryptochironomus				1
Diamesa				3
Dicortendipes				0
Diplocladius				3
Doncricotopus				3
Einfeldia				0
Endochironomus				0
Epoicocladius				2
Eukiefferiella claripennis-gp				1
Eukiefferiella				3
Glyptotendipes	x	28	22	0
Harnischia				1
Heleniella				4
Helopelopia				3
Heterotanytarsus				0
Heterotrissocladius hirtapex				2
Heterotrissocladius				1
Hydrobaenus				1
Labrundinia				1
Larsia				1
Lauterborniella				0
Limnophyes				1
Lipiniella				1
Macropelopia				3
Meropelopia				3
Metriocnemus				3
Microchironomus				1
Microcricotopus				1

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Micropsectra				3
Microtendipes				2
Monodiamesa				1
Nanocladius				3
Natarsia				3
Nilotanypus				2
Nilothauma				1
Odontomesa				2
Orthocladius				
Pagastia				3
Pagastiella				0
Parachaetocladius				3
Parachironomus				1
Paracladopelma doris				3
Paracladopelma doris-gp				2
Paracladopelma galaptera				0
Paracladopelma nais				2
Paracladopelma nereis				3
Paracladopelma undine				2
Paracladopelma winnelli				2
Parakiefferiella				2
Paralauterborniella				0
Paramerina				
Parametriocnemus				3
Paratanytarsus				1
Paratendipes				2
Pentaneura				2
Phaenopsectra				1
Polypedilum albicorne				3
Polypedilum angulum				
Polypedilum aviceps				3
Polypedilum fallax				1
Polypedilum flavum (convictum)				2
Polypedilum halterale				0
Polypedilum illinoense				1
Polypedilum laetum				2
Polypedilum nubeculosum				2
Polypedilum scalaenum				1
Polypedilum trigonus				0
Polypedilum tritum				0
Potthastia				1
Procladius				0
Prodiamesa				3
Protanypus				0
Psectrocladius	x	27	13	1
Psectrotanypus	x	12	17	0
Pseudochironomus				1
Rheocricotopus				2
Rheopelopia				3
Rheotanytarsus				3
Robackia				2
Saetheria				2
Stempellina				2
Stempellinella				3
Stenochironomus				2
Stictochironomus				2
Stilocladius				3
Sublettea				2
Sympotthastia				3
Syndiamesa				3
Synorthocladius				3
Tanypus				1
Tanytarsus				2
Thienemanniella				2
Thienemannimyia				2
Tribelos				1
Trissopelopia				2
Tveteria				2
Unniella				
Xenochironomus				2
Xylotopus				2
Zalutschia				0
Zavrelimyia				2
Culicidae				0
Dixidae				1
Dolichopodidae				2
Empididae				2
Ephyridae				1
Muscidae				1
Psychodidae				0
Ptychopteridae				1
Simuliidae				2

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Stratiomyidae				0
Syrphidae				0
Tabanidae:				
Chrysops				2
Tabanus	x	2	1	0
Tipulidae:				
Antocha				3
Cryptolabis				4
Dactyolobis				3
Dicranota				3
Erioptera				1
Helius				1
Hexatoma				2
Limnophila				2
Limonia				2
Ormosia				3
Pedicia				3
Pilaria				1
Pseudolimnophila				3
Tipula				
Crustaceans:				
AMPHIPODS:				
Crangonyctidae:				
Crangonyx gracilis-cmpx				3
Crangonyx rivularis				3
Crangonyx				2
Gammaridae:				
Gammarus fasciatus				2
Gammarus lacustris				3
Gammarus pseudolimnae				3
Hyalidae:				
Hyalala				2
CRAYFISHES:				
Cambaridae:				
Cambarus				1
Orconectes				2
Palaemonetidae:				
Palaemonetes				3
ISOPODS:				
Asellidae:				
Caecidotea				1
Lirceus				2
Molluscs:				
BIVALVES:				
Dreissenidae:				
Dreissena				1
Sphaeriidae:				
musculium lacustre				1
Musculium partumeium				1
Musculium securis				1
musculium transversum				2
Pisidium				1
Sphaerium fabale				3
Sphaerium occidentale				0
Sphaerium rhomboideum				1
Sphaerium simile				1
Sphaerium striatinum				2
Unionidae:				
Actinonaias carinata				2
Actinonaias ligamentina				3
Alasmidonta marginata				3
Alasmidonta viridis				3
Amblema plicata				2
Anodontoides ferussacianus				3
Carunculina parva				1
Cyclonaias tuberculata				2
Elliptio dilatata				1
Epioblasma(=Dysnomia)				2
Fusconaia flava				1
Lampsilis cardium				3
Lampsilis fasciola				3
Lampsilis radiata siliquioidea				1
Lampsilis ventricosa				1
Lasmigona complanata				1
Lasmigona compressa				3
Lasmigona costata				2
Leptodea fragilis				1
Ligumia nasuta				0
Ligumia recta				2
Obliquaria reflexa				1
Obovaria subrotunda				2
Pleurobema coccineum				1

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Proptera alata				0
Ptychobranthus fasciolaris				3
Pyganodon (=Anodonta,in part)				1
Quadrula pustulosa				1
Quadrula quadrula				2
Simpsoniconcha ambigua				2
Strophitus undulatus				3
Truncilla				2
Villosa fabalis				2
Villosa iris				2
SNAILS:				
Ancylidae:				
Ferrissia fragilis				0
Ferrissia parallela				1
Ferrissia rivularis				2
Bithyniidae:				
Bithynia				1
Hydrobiidae:				
Amnicola				2
Birgella (=Somatogyrus)				2
Cincinnatia				1
Fontigens				3
Potamopyrgus				1
Probythinella				2
Lymnaeidae:				
Bulinnea				1
Fossaria				1
Lymnaea				1
Pseudosuccinea				0
Radix				1
Stagnicola				0
Physidae:				
Physella				0
Planorbidae:				
Gyraulus				1
Helisoma				1
Planorbella				0
Planorbula				1
Promenetus				2
Pleuroceridae:				
Elimia (=Goniobasis)				2
Pleurocera				1
Valvatidae:				
Valvata				2
Viviparidae:				
Campeloma				1
Cipangopaludina				1
Viviparus				1
Annelids:				
LEECHES:				
Erpobdellidae:				
Dina dubia				1
Dina parva				0
Erpobdella				1
Mooreobdella				2
Nephelopsis				2
Hirudinidae:				
Haemopsis				1
Macrobdella				0
Glossiphoniidae:				
Alboglossiphonia				2
Batrachobdella				2
Glossiphonia				2
Helobdella elongata				1
Helobdella fusca				2
Helobdella papillata				1
Helobdella stagnalis				2
Helobdella triserialis				2
Placobdella				1
Theromyzon				
WORMS:				
Lumbriculidae				0
Tubificidae:				
Aulodrilus				2
Bothrioneurum				2
Branchiura				0
Ilyodrilus				0
Ischaetides curvisetosus				3
Ischaetides freyi				1
Limnodrilus	x	36	48	0
Potamotheix bavaricus				2
Potamotheix moldaviensis				2

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Potamothenrix vejvodskyi				2
Quistadrilus				0
Rhyacodrilus				3
Spirosperma				1
Tasserkidrilus				2
Tubifex				0
Oligochaete				
no cheate				0
Platyhelminthes:				0
FLATWORMS:				
Alloeocoela				1
Tricladida				3
Total sum/0.05m2		192	186	
Total Taa	8			
BioMap WQI		1.342268159	1.237976286	
avareage	1.290122223			
HBI rate	9.645502646			
EPT Richness (%)	0.264550265			
Percentage Oligochaetes	22.22222222			
Percentage Chironomidae	75.3968254			
Percentage Insects	69.84126984			
Simpsons diversity	0.335586638			
Simpsons index of diversity	0.664413362			
Simpsons reciprocal	2.979856425			

W12A LANDFILL BENTHIC WATER QUALITY REPORT JUNE 5, 2018				
Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP sensitivity value
Insects:				
ALDERFLIES:				
CORYDALIDAE:				
chauliodes				1
corydalis				2
nigronia				3
SIALIDAE				
sialis				2
AQUATIC MOTHS:				
PYRALIDAE:				
petrophila				2
other				0
BEETLES:				
DYROPIDAE:				
helichus				2
DYTISCIDAE:				
acilius				0
agabates				0
agabus				2
bidessonotus				1
celina				0
colymbetes				1
copelatus				3
coptotomus lenticus				1
coptotomus longulus				1
coptotomus loticus				2
cybister				0
desmopachria				0
dytiscus				1
graphoderus				0
heterosternuta				3
hydrocolus				1
hydroporus				1
hydrovatus				0
hygrotus				0
illybius				2
laccophilus				0
laccornis				1
liodessus				2
lioporeus				3
matus2				2
nebrioporus				2
neoporus				2
neoscutopterosus				0
oreodytes				2
rhantus				0
sanfilippodytes				3
stictotarsus				2
uvarus				2
ELMIDAE:				
Optioservus larvae				
Stenelmis larvae				
dubiraphia larvae				
ancyrionxy variegata				2
dubiraphia bivittata				0
dubiraphia minima				1
dubiraphia quadrinotata				1
dubiraphia vittata				2
macronychus galbratus				2
microcylloepus pusillus				3
optioservus fastiditus				2
optioservus ovalis				2
optioservus trivittatus				3
promoresia elegans				3
promoresia tardella				4
stenelmis bicarinata				2
stenelmis crenata				2
stenelmis musgravei				1
stenelmis quadramaculata				0
stenelmis sandersoni				2
stenelmis vittipennis				2
GYRINIDAE:				
dineutes				2
gyrinus				1
HALIPLIDAE:				
halipus				1
peltodytes				2
HYDROPHILIDAE:				
anacaena				2
berosus				0
crenitis				2
cymbiodyta				1
enochrus				0
helochares				

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helocombus				0
helophorus				1
hydrobius				1
Hydrochara				0
Hydrochus				1
Hydrophilus				3
Laccobius				1
Paracymus				2
Sperchopsis				3
Tropisternus				0
Lampyridae				1
Limnichidae:				
Lutrochus				3
Psephenidae:				
Ectopria				3
Psephenus				3
Ptilodactylidae:				
Anchytarsus				3
Scirtidae				
Micrasema				4
BUGS:				
Belostomatidae:				
Belostoma				0
Lethocerus				0
Corixidae:				
Callicorixa				2
Corisella				0
Hesperocorixa				1
Palmarcorixa				2
Sigara grossolineata				2
Sigara lineata				2
Sigara mathesoni				3
Sigara trilineata				2
Sigara others				0
Trichocorixa calva				3
Trichocorixa others				1
Gerridae:				
Aquarius				3
Gerris				1
Limnoporus				1
Metrobates				2
Neogerris				0
Rheumatobates				1
Trepobates				1
Mesoveliidae:				
Mesovelia				1
Nepidae:				
Nepa				1
ranatra				0
Notonectidae:				
Buenoa				0
Notonecta				0
Pleidae:				
Neoplea				0
Veliidae:				
Microvelia				0
Rhagovelia				2
CADDISFLIES:				
Apataniidae:				
Apatania				4
Beraeidae:				
Beraea				4
Brachycentridae:				
Brachycentrus				3
micrasema				4
Calamoceratidae:				
Heteroplectron				3
Dipseudopsidae:				
Phyllocentropus				2
Glossosomatidae:				
Agapetus				4
Glossosoma				4
Protoptila				2
Goeridae:				
Goera				3
Helicopsychidae:				
Helicopsyche				2
Hydropsychidae:				
Arctopsyche				4
Cheumatopsyche				1
Dipletrona				4

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Homoplectra				4
Hydropsyche alhedra				3
Hydropsyche alvata				1
Hydropsyche betteni				2
Hydropsyche bronta				3
Hydropsyche cuanis				2
Hydropsyche dicantha				2
Hydropsyche hageni				2
Hydropsyche morosa				2
Hydropsyche immature				
Hydropsyche placoda				2
Hydropsyche scalaris				2
Hydropsyche slossonae				3
Hydropsyche sparna				3
Hydropsyche ventura				4
Hydropsyche welkeri				3
Macrostemum				2
Parapsyche				4
Potamyia				1
Hydroptilidae:				
Agraylea				1
Hydroptila				2
Ithytrichia				4
Leucotrichia				3
Mayatrichia				2
Neotrichia				2
Ochrotrichia				2
Orthotrichia				
Oxyethira				1
Stactobiella				4
Lepidostomatidae:				
Lepidostoma				4
Theliopsyche				4
Leptoceridae:				
Ceraclea				1
Leptocerus				0
Mystacides				1
Nectopsyche				1
Oecetis				2
Setodes				2
Trienodes				1
Limnephilidae:				
Anabolia				1
Asynarchus				1
Chyranda				4
Frenesia				4
Glyphopsyche				1
Hesperophylax				4
Hydatophylax				4
Ironoquia				2
Lenarchus				1
Limnephilus moestus				3
Limnephilus				1
Nemotaulius				1
Onocosmoecus				4
Platycentropus				2
Pseudostenophylax				4
Psychoglypha				4
Pycnopsyche				3
Molannidae:				
Molanna				2
Odontoceridae:				
Marilia				3
Psilotreta				4
Philopotamidae:				
Chimarra				3
Dolophilodes				4
Wormaldia				4
Phryganeidae:				
Agrypnia				1
Banksiola				0
Fabria				1
Oligostomis				3
Phryganea				1
Ptilostomis				2
Polycentropodidae:				
Cyrnellus				1
Neureclipsis				2
Nyctiophylax				2
Polycentropus				
Psychomyiidae:				
Lype				3

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Psychomyia				3
Rhyacophilidae:				
Rhyacophila fenestra				3
rhyacophila lobifera				3
Rhyacophila				4
Sericostomatidae:				
Agarodes				3
Uenoidae:				
Neophylax				4
DAMSELFIES:				
Calopterygidae:				
Calopteryx aequabilis				2
Calopteryx maculata				3
Hetaerina				2
Coenagrionidae:				
Amphiagrion				1
Argia apicalis				1
Argia fumipennis				3
Argia moesta				2
Argia sedula				2
Argia tibialis				3
Argia translata				1
Chromagrion				2
Coenagrion				0
Enallagma antennatum				1
Enallagma aspersum				0
Enallagma basidens				0
Enallagma boreale				1
Enallagma carunculatum				1
Enallagma civile				1
Enallagma clausum				0
Enallagma cyathigerum				1
Enallagma ebrium				1
Enallagma exulans				3
Enallagma geminatum				2
Enallagma hageni				0
Enallagma signatum				1
Enallagma vesperum				1
Ischnura				1
Nehalennia				1
Lestidae:				
Archilestes				2
Lestes				1
DRAGONFLIES:				
Aeshnidae:				
Aeshna				2
Anax				0
Basiaeschna				1
Boyeria				2
Nasiaeschna				1
Cordulegastridae:				
Cordulegaster				3
Corduliidae:				
Cordulia				1
Epithea				1
Helocordulia				2
Neurocordulia				2
Somatochlora				3
Gomphidae:				
Arigomphus				1
Dromogomphus				2
Gomphurus				2
Gomphus				3
Hagenius				2
Ophiogomphus				3
Phanogomphus				1
Stylogomphus				3
Stylurus				3
Libellulidae:				
Erythemis				1
Ladona				0
Leucorrhinia				0
Libellula				1
Perithemis				1
Platthemis				0
Sympetrum				1
Tramea				1

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Macromiidae:				
Didymops				2
Macromia				2
MAYFLIES:				
Ameletidae:				
Ameletus				4
Arthropleidae:				
Arthroplea				3
Baetidae:				
Acentrella				3
acerpenna macdunnoughi				3
Acerpenna pygmaea				2
Baetis brunneicolor				3
Baetis flavistriga				1
Baetis intercalaris				2
Baetis	x			2
baetis rusticans				
Baetis tricaudatus				4
Callibaetis				0
Centroptilum				3
Dipheter				3
Heterocloeon				2
Plauditus armillatus				2
Plauditus cestus				3
Plauditus cingulatus				2
Plauditus dubius				1
Plauditus punctiventris				3
Plauditus virilis				1
Procloeon				2
Pseudocentroptiloides				3
Pseudocloeon frondalis				2
Pseudocloeon longipalpus				1
Pseudocloeon propinquus				2
Baetiscidae:				
Baetisca				2
Caenidae:				
Brachycercus				2
Caenis anceps				2
Caenis				1
Ephemerellidae:				
Attenella				2
Dannella				3
Dentatella bartoni				1
Drunella				4
Ephemerella aurivillii				4
Ephemerella				3
Euryophella aestiva				1
Euryophella bicolor				3
Euryophella coxalis				3
Euryophella funeralis				4
Euryophella lutulenta				1
Euryophella temporalis				1
Serratella serratoides				4
Serratella				3
Ephemeridae:				
Ephemerella guttulata				3
Ephemerella simulans				2
Ephemerella varia				3
Hexagenia atrocauda				3
Hexagenia				1
Litobrantha				3
Pentagenia				3
Heptageniidae:				
Anepeorus				1
Epeorus				4
Heptagenia				3
Leucrocota				3
Nixe				3
Rhithrogena				4
Stenacron				2
Stenonema exiguum				1
Stenonema femoratum				1
Stenonema ithaca				2
Stenonema luteum				2
Stenonema mediopunctatum				3
Stenonema modestum				2
Stenonema pulchellum				1
Stenonema terminatum				2
Stenonema vicarium				3
Isonychiidae:				
Isonychia				2

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Leptohyphidae:				
Tricorythodes				2
Leptophlebiidae:				
Choroterpes				3
Habrophlebia				
Habrophlebiodes				2
Leptophlebia				1
Paraleptophlebia				3
Metretopodidae:				
Siphloplecton				2
Oligoneuriidae:				
Homoeoneuria				2
Polymitarcyidae:				
Ephoron				3
Potamanthidae:				
Anthropotamus				2
Pseudironidae:				
Pseudiron				2
Siphonuridae:				
Parameletus				3
Siphonurus				2
STONEFLIES:				
Capniidae:				
Allocapnia granulata				2
allocapnia minima				2
Allocapnia pygmaea				3
Allocapnia recta				4
Allocapnia rickeri				3
Allocapnia vivpara				2
Capnia				4
Paracapnia				3
Chloroperlidae:				
Alloperla				4
Haploperla				3
Suwallia				4
Sweltsa				4
Leuctridae:				
Leuctra				4
Paraleuctra				4
Nemouridae:				
Amphinemura				4
Nemoura				3
Ostrocerca				4
Paranemoura				4
Podmosta				4
Prostoia				3
Shipsa				3
Soyedina				4
Peltoperlidae:				
Peltoperla				3
Tallaperla				3
Perlidae:				
Acroneuria abnormis				2
Acroneuria carolinensis				3
Acroneuria evoluta				2
Acroneuria lycorias				2
Agnetina				3
Attaneuria				2
Neoperla				3
Paragnetina				3
Perlesta				2
Perlinella				3
Perlodidae:				
Arcynopteryx				4
Clioperla				3
Cultus				4
Helopicus				
Isogenoides				4
Isoperla bilineata				2
Isoperla nana				2
Isoperla				4
Malirekus				4
Pteronarcyidae:				
Pteronarcys				3
Taeniopterygidae:				
Oemopteryx				4
Strophopteryx				4
Taeniopteryx burksi				2
Taeniopteryx				3
TRUE FLIES:				
Athericidae:				

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Atherix				3
Ceratopogonidae				0
Chaoboridae:				
Chaoborus				0
Chironomidae:				
Ablabesmyia				2
Acricotopus				1
Apsectrotanypus				4
Brillia parva				4
Brillia				2
Brundiniella				4
Cardiocladius				2
Chaetocladius				1
Chernovskia				1
Chironomus	x	29	48	0
Cladopelma				1
Cladotanytarsus				2
Clinotanypus				1
Coelotanypus				1
Conchapelopia				2
Corynoneura				2
Cricotopus (C.) tremulus-gp				3
Cricotopus (C.) trifascia				3
Cricotopus (C.) others				2
Cricotopus(Isocladius)				0
Cryptochironomus				1
Cryptotendipes				2
Demicryptochironomus				1
Diamesa				3
Dicrotendipes				0
Diplocladius				3
Doncricotopus				3
Einfeldia				0
Endochironomus				0
Epoicocladius				2
Eukiefferiella claripennis-gp				1
Eukiefferiella				3
Glyptotendipes	x	12	51	0
Harnischia				1
Heleniella				4
Helopelopia				3
Heterotanytarsus				0
Heterotrissocladius hirtapex				2
Heterotrissocladius				1
Hydrobaenus				1
Labrundinia				1
Larsia				1
Lauterborniella				0
Limnophyes				1
Lipiniella				1
Macropelopia				3
Meropelopia				3
Metriocnemus				3
Microchironomus				1
Microcricotopus				1
Micropsectra				3
Microtendipes				2
Monodiamesa				1
Nanocladius				3
Natarsia				3
Nilotanypus				2
Nilothauma				1
Odontomesa				2
Orthocladius				
Pagastia				3
Pagastiella				0
Parachaetocladius				3
Parachironomus				1
Paracladopelma doris				3
Paracladopelma doris-gp				2
Paracladopelma galaptera				0
Paracladopelma nais				2
Paracladopelma nereis				3
Paracladopelma undine				2
Paracladopelma winnelli				2
Parakiefferiella				2
Paralauterborniella				0
Paramerina				
Parametriocnemus				3
Paratanytarsus				1
Paratendipes				2
Pentaneura				2

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Phaenopsectra				1
Polypedilum albicorne				3
Polypedilum angulum				
Polypedilum aviceps				3
Polypedilum fallax				1
Polypedilum flavum (convictum)				2
Polypedilum halterale				0
Polypedilum illinoense				1
Polypedilum laetum				2
Polypedilum nubeculosum				2
Polypedilum scalaenum				1
Polypedilum trigonus				0
Polypedilum tritum				0
Potthastia				1
Procladius				0
Prodiamesa				3
Protanypus				0
Psectrocladius	x		4	1
Psectrotanypus	x			0
Pseudochironomus				1
Rheocricotopus				2
Rheopelopia				3
Rheotanytarsus				3
Robackia				2
Saetheria				2
Stempellina				2
Stempellinella				3
Stenochironomus				2
Stictochironomus				2
Stilocladius				3
Sublettea				2
Sympotthastia				3
Syndiamesa				3
Synorthocladius				3
Tanypus				1
Tanytarsus				2
Thienemanniella				2
Thienemannimyia				2
Tribelos				1
Trissopelopia				2
Tvetenia				2
Unniella				
Xenochironomus				2
Xylotopus				2
Zalutschia				0
Zavrelimyia				2
Culicidae				0
Dixidae				1
Dolichopodidae				2
Empididae				2
Ephydriidae				1
Muscidae				1
Psychodidae				0
Ptychopteridae				1
Simuliidae				2
Stratiomyidae				0
Syrphidae				0
Tabanidae:				
Chrysops				2
Tabanus				0
Tipulidae:				
Antocha				3
Cryptolabis				4
Dactylobis				3
Dicranota				3
Erioptera				1
Helius				1
Hexatoma				2
Limnophila				2
Limonia				2
Ormosia				3
Pedicia				3
Pilaria				1
Pseudolimnophila				3
Tipula				
Crustaceans:				
AMPHIPODS:				
Crangonyctidae:				
Crangonyx gracilis-cmpx				3
Crangonyx rivularis				3
Crangonyx				2
Gammaridae:				

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Gammarus fasciatus				2
Gammarus lacustris				3
Gammarus pseudolimnae				3
Hyalidae:				
Hyalidae				2
CRAYFISHES:				
Cambaridae:				
Cambarus				1
Orconectes				2
Palaemonetidae:				
Palaemonetes				3
ISOPODS:				
Asellidae:				
Caecidotea				1
Lirceus				2
Molluscs:				
BIVALVES:				
Dreissenidae:				
Dreissena				1
Sphaeriidae:				
musculium lacustre				1
Musculium partumeium				1
Musculium securis				1
musculium transversum				2
Pisidium				1
Sphaerium fabale				3
Sphaerium occidentale				0
Sphaerium rhomboideum				1
Sphaerium simile				1
Sphaerium striatinum				2
Unionidae:				
Actinonaias carinata				2
Actinonaias ligamentina				3
Alasmidonta marginata				3
Alasmidonta viridis				3
Amblema plicata				2
Anodontoides ferussacianus				3
Carunculina parva				1
Cyclonaias tuberculata				2
Elliptio dilatata				1
Epioblasma(=Dysnomia)				2
Fusconaia flava				1
Lampsilis cardium				3
Lampsilis fasciola				3
Lampsilis radiata silicoidea				1
Lampsilis ventricosa				1
Lasmigona complanata				1
Lasmigona compressa				3
Lasmigona costata				2
Leptodea fragilis				1
Ligumia nasuta				0
Ligumia recta				2
Obliquaria reflexa				1
Obovaria subrotunda				2
Pleurobema coccineum				1
Proptera alata				0
Ptychobranthus fasciolaris				3
Pyganodon (=Anodonta,in part)				1
Quadrula pustulosa				1
Quadrula quadrula				2
Simpsoniconcha ambigua				2
Strophitus undulatus				3
Truncilla				2
Villosa fabalis				2
Villosa iris				2
SNAILS:				
Ancylidae:				
Ferrissia fragilis				0
Ferrissia parallela				1
Ferrissia rivularis				2
Bithyniidae:				
Bithynia				1
Hydrobiidae:				
Amnicola				2
Birgella (=Somatogyrus)				2
Cincinnatia				1
Fontigens				3
Potamopyrgus				1
Probythinella				2
Lymnaeidae:				
Bulinnea				1
Fossaria				1

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Lymnaea				1
Pseudosuccinea				0
Radix				1
Stagnicola				0
Physidae:				
Physella				0
Planorbidae:				
Gyraulus				1
Helisoma				1
Planorbella				0
Planorbula				1
Promenetus				2
Pleuroceridae:				
Elimia (=Goniobasis)				2
Pleurocera				1
Valvatidae:				
Valvata				2
Viviparidae:				
Campeloma				1
Cipangopaludina				1
Viviparus				1
Annelids:				
LEECHES:				
Erpobdellidae:				
Dina dubia				1
Dina parva				0
Erpobdella				1
Mooreobdella				2
Nepheleopsis				2
Hirudinidae:				
Haemopsis				1
Macrobdella				0
Glossiphoniidae:				
Alboglossiphonia				2
Batrachobdella				2
Glossiphonia				2
Helobdella elongata				1
Helobdella fusca				2
Helobdella papillata				1
Helobdella stagnalis	x			2
Helobdella triserialis				2
Placobdella				1
Theromyzon				
WORMS:				
Lumbriculidae				0
Tubificidae:				
Aulodrilus				2
Bothrioneurum				2
Branchiura				0
Ilyodrilus				0
Isochaetides curvisetosus				3
Isochaetides freyi				1
Limnodrilus	x	10	23	0
Potamothenix bavaricus				2
Potamothenix moldaviensis				2
Potamothenix vejovskyi				2
Quistadrilus				0
Rhyacodrilus				3
Spirosperma				1
Tasserkidrilus				2
Tubifex				0
Oligochaete				
no cheate				0
Platyhelminthes:				0
FLATWORMS:				
Alloeochoa				1
Tricladida				3
Total sum/0.05m2		51	126	
Total Taxa	7			
BioMap WQI		1	1.218950612	
avareage	1.109475306			
HBI rate	9.95480226			
EPT Richness (%)	0			
Percentage Oligochaetes	18.6440678			
Percentage Chironomidae	81.3559322			
Percentage Insects	81.3559322			
Simpsons diversity	0.0829315			
Simpsons index of diversity	0.9170685			
Simpsons reciprocal	12.05814433			

W12A-3A-2018				
Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP sensitivity value
Insects:				
ALDERFLIES:				
CORYDAULIDAE:				
chauliodes	W12A LANDFILL BENTHIC WATER QUALITY REPORT JUNE 5,2018			1
corydalis				2
nigronia				3
SIALIDAE				
sialis				2
AQUATIC MOTHS:				
PYRALIDAE:				
petrophila				2
other				0
BETTERLES:				
DYROPIDAE:				
helichus				2
DYTISCIDAE:				
acilius				0
agabates				0
agabus				2
bidessonotus				1
celina				0
colymbetes				1
copelatus				3
coptotomus lenticus				1
coptotomus longulus				1
coptotomus loticus				2
cybister				0
desmopachria				0
dytiscus				1
graphoderus				0
heterosternuta				3
hydrocolus				1
hydroporus				1
hydrovatus				0
hygrotus				0
illybius				2
laccophilus				0
laccornis				1
liodessus				2
lioporeus				3
matus2				2
nebrionporus				2
neoporus				2
neoscutopterus				0
oreodytes				2
rhantus				0
sanfilippodytes				3
stictotarsus				2
uvarus				2
ELMIDAE:				
Optioservus larvae				
Stenelmis larvae				
dubiraphia larvae				
ancronxy variegata				2
dubiraphia bivittata				0
dubiraphia minima				1
dubiraphia quadrinotata				1
dubiraphia vittata				2
macronychus galbratus				2
microcylloepus pusillus				3
optioservus fastiditus				2
optioservus ovalis				2
optioservus trivittatus				3
promoresia elegans				3
promoresia tardella				4
stenelmis bicarinata				2
stenelmis crenata				2
stenelmis musgravei				1
stenelmis quadramaculata				0
stenelmis sandersoni				2
stenelmis vittipennis				2
GYRINIDAE:				
dineutes				2
gyrinus				1
HALIPLIDAE:				
halipus				1
peltodytes				2
HYDROPHILIDAE:				
anacaena				2
berosus				0
crenitis				2
cymbiodyta				1
enochrus				0
helochares				
helocombus				0
helophorus				1
hydrobius				1
Hydrochara				0

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Hydrochus				1
Hydrophilus				3
Laccobius				1
Paracymus				2
Sperchopsis				3
Tropisternus				0
Lampyridae				1
Limnichidae:				
Lutrochus				3
Psephenidae:				
Ectopria				3
Psephenus				3
Ptilodactylidae:				
Anchytarsus				3
Scirtidae				
Micrasema				4
BUGS:				
Belostomatidae:				
Belostoma				0
Lethocerus				0
Corixidae:				
Callicorixa				2
Corisella				0
Hesperocorixa				1
Palmacorixa				2
Sigara grossolineata				2
Sigara lineata				2
Sigara mathesoni				3
Sigara trilineata				2
Sigara others				0
Trichocorixa calva				3
Trichocorixa others				1
Gerridae:				
Aquarius				3
Gerris				1
Limnoporus				1
Metrobates				2
Neogerris				0
Rheumatobates				1
Trepobates				1
Mesoveliidae:				
Mesovelia				1
Nepidae:				
Nepa				1
ranatra				0
Notonectidae:				
Buenoa				0
Notonecta				0
Pleidae:				
Neoplea				0
Veliidae:				
Microvelia				0
Rhagovelia				2
CADDISFLIES:				
Apataniidae:				
Apatania				4
Beraeidae:				
Beraea				4
Brachycentridae:				
Brachycentrus				3
micrasema				4
Calamoceratidae:				
Heteroplectron				3
Dipseudopsidae:				
Phylocentropus				2
Glossosomatidae:				
Agapetus				4
Glossosoma				4
Protophila				2
Goeridae:				
Goera				3
Helicopsychidae:				
Helicopsyche				2
Hydropsychidae:				
Arctopsyche				4
Cheumatopsyche				1
Diplectrona				4
Homoplectra				4
Hydropsyche alhedra				3
Hydropsyche alvata				1
Hydropsyche betteni				2

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Hydropsyche bronta				3
Hydropsyche cuanis				2
Hydropsyche dicantha				2
Hydropsyche hageni				2
Hydropsyche morosa				2
Hydropsyche immature				
Hydropsyche placoda				2
Hydropsyche scalaris				2
hydropsyche slossonae				3
Hydropsyche sparna				3
Hydropsyche ventura				4
Hydropsyche welkeri				3
Macrostemum				2
Parapsyche				4
Potamyia				1
Hydroptilidae:				
Agraylea				1
Hydroptila				2
Ithytrichia				4
Leucotrichia				3
Mayatrichia				2
Neotrichia				2
Ochrotrichia				2
Orthotrichia				
Oxyethira				1
Stactobiella				4
Lepidostomatidae:				
Lepidostoma				4
Theliopsyche				4
Leptoceridae:				
Ceraclea				1
Leptocerus				0
Mystacides				1
Nectopsyche				1
Oecetis				2
Setodes				2
Triaenodes				1
Limnephilidae:				
Anabolia				1
Asynarchus				1
Chyranda				4
Frenesia				4
Glyphopsyche				1
Hesperophylax				4
Hydatophylax				4
Ironoquia				2
Lenarchus				1
Limnephilus moestus				3
Limnephilus				1
Nemotaulius				1
Onocosmoecus				4
Platycentropus				2
Pseudostenophylax				4
Psychoglypha				4
Pycnopsyche				3
Molannidae:				
Molanna				2
Odontoceridae:				
Marilia				3
Psilotreta				4
Philopotamidae:				
Chimarra				3
Dolophilodes				4
Wormaldia				4
Phryganeidae:				
Agrypnia				1
Banksiola				0
Fabria				1
Oligostomis				3
Phryganea				1
Ptilostomis				2
Polycentropodidae:				
Cynellus				1
Neureclipsis				2
Nyctiophylax				2
Polycentropus				
Psychomyiidae:				
Lype				3
Psychomyia				3
Rhyacophilidae:				
Rhyacophila fenestra				3
rhyacophila lobifera				3

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Rhyacophila				4
Sericostomatidae:				
Agarodes				3
Uenoidae:				
Neophylax				4
DAMSELFLIES:				
Calopterygidae:				
Calopteryx aequabilis				2
Calopteryx maculata				3
Hetaerina				2
Coenagrionidae:				
Amphiagrion				1
Argia apicalis				1
Argia fumipennis				3
Argia moesta				2
Argia sedula				2
Argia tibialis				3
Argia translata				1
Chromagrion				2
Coenagrion				0
Enallagma antennatum				1
Enallagma aspersum				0
Enallagma basidens				0
Enallagma boreale				1
Enallagma carunculatum				1
Enallagma civile	x			1
Enallagma clausum				0
Enallagma cyathigerum				1
Enallagma ebrium				1
Enallagma exsulans				3
Enallagma geminatum				2
Enallagma hageni				0
Enallagma signatum				1
Enallagma vesperum				1
Ischnura				1
Nehalennia				1
Lestidae:				
Archilestes				2
Lestes				1
DRAGONFLIES:				
Aeshnidae:				
Aeshna				2
Anax				0
Basiaeschna				1
Boyeria				2
Nasiaeschna				1
Cordulegastridae:				
Cordulegaster				3
Corduliidae:				
Cordulia				1
Epithea				1
Helocordulia				2
Neurocordulia				2
Somatochlora				3
Gomphidae:				
Arigomphus				1
Dromogomphus				2
Gomphurus				2
Gomphus				3
Hagenius				2
Ophiogomphus				3
Phanogomphus				1
Stylogomphus				3
Stylurus				3
Libellulidae:				
Erythemis				1
Ladona				0
Leucorrhinia				0
Libellula				1
Perithemis				1
Plathemis				0
Sympetrum				1
Tramea				1
Macromiidae:				
Didymops				2
Macromia				2

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MAYFLIES:				
Ameletidae:				
Ameletus				4
Arthropleidae:				
Arthroplea				3
Baetidae:				
Acentrella				3
acerpenna macdunnoughi				3
Acerpenna pygmaea				2
Baetis brunneicolor				3
Baetis flavistriga				1
Baetis intercalaris				2
Baetis				2
baetis rusticans				
Baetis tricaudatus				4
Callibaetis				0
Centroptilum				3
Dipheter				3
Heterocloeon				2
Plauditus armillatus				2
Plauditus cestus				3
Plauditus cingulatus				2
Plauditus dubius				1
Plauditus punctiventris				3
Plauditus virilis				1
Procloeon				2
Pseudocentroptiloides				3
Pseudocloeon frondalis				2
Pseudocloeon longipalpus				1
Pseudocloeon propinquus				2
Baetiscidae:				
Baetisca				2
Caenidae:				
Brachycercus				2
Caenis anceps				2
Caenis		1		1
Ephemerellidae:				
Attenella				2
Dannella				3
Dentatella bartoni				1
Drunella				4
Ephemerella aurivillii				4
Ephemerella				3
Eurylophella aestiva				1
Eurylophella bicolor				3
Eurylophella coxalis				3
Eurylophella funeralis				4
Eurylophella lutulenta				1
Eurylophella temporalis				1
Serratella serratoides				4
Serratella				3
Ephemeridae:				
Ephemerella guttulata				3
Ephemerella simulans				2
Ephemerella varia				3
Hexagenia atrocauda				3
Hexagenia				1
Litobrantha				3
Pentagenia				3
Heptageniidae:				
Anepeorus				1
Epeorus				4
Heptagenia				3
Leucrocota				3
Nixe				3
Rhithrogena				4
Stenacron				2
Stenonema exiguum				1
Stenonema femoratum				1
Stenonema ithaca				2
Stenonema luteum				2
Stenonema mediopunctatum				3
Stenonema modestum				2
Stenonema pulchellum				1
Stenonema terminatum				2
Stenonema vicarium				3
Isonychiidae:				
Isonychia				2
Leptohyphidae:				
Tricorythodes				2
Leptophlebiidae:				
Choroterpes				3

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Habrophlebia				
Habrophlebiodes				2
Leptophlebia				1
Paraleptophlebia				3
Metretopodidae:				
Siphloplecton				2
Oligoneuriidae:				
Homoeoneuria				2
Polymitarcyidae:				
Ephoron				3
Potamanthidae:				
Anthropotamus				2
Pseudironidae:				
Pseudiron				2
Siphonuridae:				
Parameletus				3
Siphonurus				2
STONEFLIES:				
Capniidae:				
Allocapnia granulata				2
allocapnia minima				2
Allocapnia pygmaea				3
Allocapnia recta				4
Allocapnia rickeri				3
Allocapnia vivipara				2
Capnia				4
Paracapnia				3
Chloroperlidae:				
Alloperla				4
Haploperla				3
Suwallia				4
Sweltsa				4
Leuctridae:				
Leuctra				4
Paraleuctra				4
Nemouridae:				
Amphinemura				4
Nemoura				3
Ostrocerca				4
Paranemoura				4
Podmosta				4
Prostoia				3
Shipsa				3
Soyedina				4
Peltoperlidae:				
Peltoperla				3
Tallaperla				3
Perlidae:				
Acroeneuria abnormis				2
Acroeneuria carolinensis				3
Acroeneuria evoluta				2
Acroeneuria lycorias				2
Agnetina				3
Attaneuria				2
Neoperla				3
Paragnetina				3
Perlesta				2
Perlinella				3
Perlodidae:				
Arcynopteryx				4
Clioperla				3
Cultus				4
Helopicus				
Isogenoides				4
Isoperla bilineata				2
Isoperla nana				2
Isoperla				4
Malirekus				4
Pteronarcyidae:				
Pteronarcys				3
Taeniopterygidae:				
Oemopteryx				4
Strophopteryx				4
Taeniopteryx burksi				2
Taeniopteryx				3
TRUE FLIES:				
Athericidae:				
Atherix				3
Ceratopogonidae	x		2	0
Chaoboridae:				
Chaoborus				0

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Chironomidae:				
Ablabesmyia				2
Acricotopus				1
Apsectrotanypus				4
Brillia parva				4
Brillia				2
Brundiniella				4
Cardiocladius				2
Chaetocladius				1
Chernovskia				1
Chironomus				0
Cladopelma				1
Cladotanytarsus				2
Clinotanytus				1
Coelotanytus				1
Conchapelopia				2
Corynoneura				2
Cricotopus (C.) tremulus-gp				3
Cricotopus (C.) trifascia				3
Cricotopus (C.) others				2
Cricotopus(Isocladius)				0
Cryptochironomus				1
Cryptotendipes				2
Demicryptochironomus				1
Diamesa				3
Dicrotendipes				0
Diplocladius				3
Doncricotopus				3
Einfeldia				0
Endochironomus				0
Epoicocladius				2
Eukiefferiella claripennis-gp				1
Eukiefferiella				3
Glyptotendipes				0
Harnischia				1
Heleniella				4
Helopelopia				3
Heterotanytarsus				0
Heterotrissocladius hirtapex				2
Heterotrissocladius				1
Hydrobaenus				1
Labrundinia				1
Larsia				1
Lauterborniella				0
Limnophyes				1
Lipiniella				1
Macropelopia				3
Meropelopia				3
Metriocnemus				3
Microchironomus				1
Microcricotopus				1
Micropsectra				3
Microtendipes				2
Monodiamesa				1
Nanocladius				3
Natarsia				3
Nilotanytus				2
Nilothauma				1
Odontomesa				2
Orthocladius				
Pagastia				3
Pagastiella				0
Parachaetocladius				3
Parachironomus				1
Paracladopelma doris				3
Paracladopelma doris-gp				2
Paracladopelma galapera				0
Paracladopelma nais				2
Paracladopelma nereis				3
Paracladopelma undine				2
Paracladopelma winnelli				2
Parakiefferiella				2
Paralauterborniella				0
Paramerina				
Parametriocnemus				3
Paratanytarsus				1
Paratendipes				2
Pentaneura				2
Phaenopsectra				1
Polypedilum albicorne				3
Polypedilum angulum				
Polypedilum aviceps				3

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Polypedilum fallax				1
Polypedilum flavum (convictum)				2
Polypedilum halterale				0
Polypedilum illinoense				1
Polypedilum laetum				2
Polypedilum nubeculosum				2
Polypedilum scalaenum				1
Polypedilum trigonus				0
Polypedilum tritum				0
Potthastia				1
Procladius				0
Prodiamesa				3
Protanypus				0
Psectrocladius				1
Psectrotanypus				0
Pseudochironomus				1
Rheocricotopus				2
Rheopelopia				3
Rheotanytarsus				3
Robackia				2
Saetheria				2
Stempellina				2
Stempellinella				3
Stenochironomus				2
Stictochironomus				2
Stilocladius				3
Sublettea				2
Sympotthastia				3
Syndiamesa				3
Synorthocladius				3
Tanypus				1
Tanytarsus				2
Thienemanniella				2
Thienemannimyia				2
Tribelos				1
Trissopelopia				2
Tvetenia				2
Unniella				
Xenochironomus				2
Xylotopus				2
Zalutschia				0
Zavrelimyia				2
Culicidae				0
Dixidae				1
Dolichopodidae				2
Empididae				2
Ephydriidae				1
Muscidae				1
Psychodidae				0
Ptychopteridae				1
Simuliidae				2
Stratiomyidae				0
Syrphidae				0
Tabanidae:				
Chrysops				2
Tabanus				0
Tipulidae:				
Antocha				3
Cryptolabis				4
Dactylobis				3
Dicranota				3
Erioptera				1
Helius				1
Hexatoma				2
Limnophila				2
Limonia				2
Ormosia				3
Pedicia				3
Pilaria				1
Pseudolimnophila				3
Tipula				
Crustaceans:				
AMPHIPODS:				
Crangonyctidae:				
Crangonyx gracilis-cmpx				3
Crangonyx rivularis				3
Crangonyx				2
Gammaridae:				
Gammarus fasciatus				2
Gammarus lacustris				3
Gammarus pseudolimnae				3
Hyalalidae:				

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Hyalalela	x			2
CRAYFISHES:				
Cambaridae:				
Cambarus				1
Orconectes			1	2
Palaemonetidae:				
Palaemonetes				3
ISOPODS:				
Asellidae:				
Caecidotea	x	12	9	1
Lirceus				2
Molluscs:				
BIVALVES:				
Dreissenidae:				
Dreissena				1
Sphaeriidae:				
musculium lacustre				1
Musculium partumeium				1
Musculium securis				1
musculium transversum				2
Pisidium			1	1
Sphaerium fabale				3
Sphaerium occidentale				0
Sphaerium rhomboideum				1
Sphaerium simile				1
Sphaerium striatinum				2
Unionidae:				
Actinonaias carinata				2
Actinonaias ligamentina				3
Alasmidonta marginata				3
Alasmidonta viridis				3
Amblema plicata				2
Anodontoides ferussacianus				3
Carunculina parva				1
Cyclonaias tuberculata				2
Elliptio dilatata				1
Epioblasma(=Dysnomia)				2
Fusconaia flava				1
Lampsilis cardium				3
Lampsilis fasciola				3
Lampsilis radiata siliquioidea				1
Lampsilis ventricosa				1
Lasmigona complanata				1
Lasmigona compressa				3
Lasmigona costata				2
Leptodea fragilis				1
Ligumia nasuta				0
Ligumia recta				2
Obliquaria reflexa				1
Obovaria subrotunda				2
Pleurobema coccineum				1
Proptera alata				0
Ptychobranhus fasciolaris				3
Pyganodon (=Anodonta,in part)				1
Quadrula pustulosa				1
Quadrula quadrula				2
Simpsoniconcha ambigua				2
Strophitus undulatus				3
Truncilla				2
Villosa fabalis				2
Villosa iris				2
SNAILS:				
Ancylidae:				
Ferrissia fragilis				0
Ferrissia parallela				1
Ferrissia rivularis				2
Bithyniidae:				
Bithynia				1
Hydrobiidae:				
Amnicola				2
Birgella (=Somatogyrus)				2
Cincinnatia				1
Fontigens				3
Potamopyrgus				1
Probythinella				2
Lymnaeidae:				
Bulinnea				1
Fossaria				1
Lymnaea				1
Pseudosuccinea				0
Radix				1
Stagnicola				0

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Physidae:				
Physella	x		17	0
Planorbidae:				
Gyraulus	x	3	4	1
Helisoma				1
Planorbella	x	6	13	0
Planorbula				1
Promenetus				2
Pleuroceridae:				
Elimia (=Goniobasis)				2
Pleurocera				1
Valvatidae:				
Valvata				2
Viviparidae:				
Campeloma				1
Cipangopaludina				1
Viviparus				1
Annelids:				
LEECHES:				
Erpobdellidae:				
Dina dubia				1
Dina parva				0
Erpobdella				1
Mooreobdella				2
Nepheleopsis				2
Hirudinidae:				
Haemopsis				1
Macrobdella				0
Glossiphoniidae:				
Alboglossiphonia				2
Batrachobdella				2
Glossiphonia				2
Helobdella elongata				1
Helobdella fusca				2
Helobdella papillata				1
Helobdella stagnalis				2
Helobdella triserialis				2
Placobdella				1
Theromyzon				
WORMS:				
Lumbriculidae				0
Tubificidae:				
Aulodrilus				2
Bothrioneurum				2
Branchiura				0
Ilyodrilus				0
Isochaetides curvisetosus				3
Isochaetides freyi				1
Limnodrilus	x	53	78	0
Potamothenix bavaricus				2
Potamothenix moldaviensis				2
Potamothenix vejdvskyi				2
Quistadrilus				0
Rhyacodrilus				3
Spirosperma				1
Tasserkidrilus				2
Tubifex				0
Oligochaete				
no cheate				0
Platyhelminthes:				0
FLATWORMS:				
Alloeocoela				1
Tricladida				3
Total sum/0.05m2		74	126	
Total Taxa	11			
BioMap WQI		1.686754559	1.757344314	
avareage	1.722049436			
HBI rate	8.5			
EPT Richness (%)	0.5			
Percentage Oligochaetes	65.5			
Percentage Chironomidae	0			
Percentage Insects	1.5			
Simpsons diversity	0.070578222			
Simpsons index of diversity	0.929421778			
Simpsons reciprocal	14.16867664			

W12A-3B-2018

Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP sensitivity value
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PREPARED BY: DAVE JOHNSON, PRINCIPAL, STRAIGHTUP ENVIRONMENTAL CONSULTING

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Insects:				
ALDERFLIES:				
CORYDALIDAE:				
chauliodes				1
corydalis				2
nigronia				3
SIALIDAE				
sialis				2
AQUATIC MOTHS:				
PYRALIDAE:				
petrophila				2
other				0
BETLES:				
DYROPIDAE:				
helichus				2
DYTISCIDAE:				
acilius				0
agabates				0
agabus	x	12	8	2
bidessonotus				1
celina				0
colymbetes				1
copelatus				3
coptotomus lenticus				1
coptotomus longulus				1
coptotomus loticus				2
cybister				0
desmopachria				0
dytiscus				1
graphoderus				0
heterosternuta				3
hydrocolus				1
hydroporus				1
hydrovatus				0
hygrotus				0
illybius				2
laccophilus				0
laccornis				1
liodessus				2
lioporeus				3
matus2				2
nebrionporus				2
neoporus				2
neoscutopterus				0
oreodytes				2
rhantus				0
sanfilippodytes				3
stictotarsus				2
uvarus				2
ELMIDAE:				
Optioservus larvae				
Stenelmis larvae				
dubiraphia larvae				
ancyrionxy variegata				2
dubiraphia bivittata				0
dubiraphia minima				1
dubiraphia quadrinotata				1
dubiraphia vittata				2
macronychus galbratus				2
microcylloepus pusillus				3
optioservus fastiditus				2
optioservus ovalis				2
optioservus trivittatus				3
promoresia elegans				3
promoresia tardella				4
stenelmis bicarinata				2
stenelmis crenata				2
stenelmis musgravei				1
stenelmis quadramaculata				0
stenelmis sandersoni				2
stenelmis vittipennis				2
GYRINIDAE:				
dineutes				2
gyrinus				1
HALIPLIDAE:				
haliplus				1
peltodytes				2
HYDROPHILIDAE:				
anacaena				2
berosus				0
crenitis				2

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cymbiodyta				1
enochrus				0
helochares				
helocombus				0
helophorus				1
hydrobius				1
Hydrochara				0
Hydrochus				1
Hydrophilus				3
Laccobius				1
Paracymus				2
Sperchopsis				3
Tropisternus				0
Lampyridae				1
Limnichidae:				
Lutrochus				3
Psephenidae:				
Ectopria				3
Psephenus				3
Ptilodactylidae:				
Anchytarsus				3
Scirtidae				
Micrasema				4
BUGS:				
Belostomatidae:				
Belostoma				0
Lethocerus				0
Corixidae:				
Callicorixa				2
Corisella				0
Hesperocorixa				1
Palmacorixa				2
Sigara grossolineata				2
Sigara lineata				2
Sigara mathesoni				3
Sigara trilineata				2
Sigara others				0
Trichocorixa calva				3
Trichocorixa others				1
Gerridae:				
Aquarius				3
Gerris				1
Limnoporus				1
Metrobates				2
Neogerris				0
Rheumatobates				1
Trepobates				1
Mesoveliidae:				
Mesovelia				1
Nepidae:				
Nepa				1
ranatra				0
Notonectidae:				
Buenoa				0
Notonecta				0
Pleidae:				
Neoplea				0
Veliidae:				
Microvelia				0
Rhagovelia				2
CADDISFLIES:				
Apataniidae:				
Apatania				4
Beraeidae:				
Beraea				4
Brachycentridae:				
Brachycentrus				3
micrasema				4
Calamoceratidae:				
Heteroplectron				3
Dipseudopsidae:				
Phyllocentropus				2
Glossosomatidae:				
Agapetus				4
Glossosoma				4
Protophila				2
Goeridae:				
Goera				3
Helicopsychidae:				
Helicopsyche				2
Hydropsychidae:				

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Arctopsyche				4
Cheumatopsyche				1
Diplectrona				4
Homoplectra				4
Hydropsyche alhedra				3
Hydropsyche alvata				1
Hydropsyche betteni				2
Hydropsyche bronta				3
Hydropsyche cuanis				2
Hydropsyche dicantha				2
Hydropsyche hageni				2
Hydropsyche morosa				2
Hydropsyche immature				
Hydropsyche placoda				2
Hydropsyche scalaris				2
Hydropsyche slossonae				3
Hydropsyche sparna				3
Hydropsyche ventura				4
Hydropsyche welkeri				3
Macrostemum				2
Parapsyche				4
Potamyia				1
Hydroptilidae:				
Agraylea				1
Hydroptila				2
Ithytrichia				4
Leucotrichia				3
Mayatrichia				2
Neotrichia				2
Ochrotrichia				2
Orthotrichia				
Oxyethira				1
Stactobiella				4
Lepidostomatidae:				
Lepidostoma				4
Theliopsyche				4
Leptoceridae:				
Ceraclea				1
Leptocerus				0
Mystacides				1
Nectopsyche				1
Oecetis				2
Setodes				2
Trienodes				1
Limnephilidae:				
Anabolia				1
Asynarchus				1
Chyranda				4
Frenesia				4
Glyphopsyche				1
Hesperophylax				4
Hydatophylax				4
Ironoquia				2
Lenarchus				1
Limnephilus moestus				3
Limnephilus				1
Nemotaulius				1
Onocosmoecus				4
Platycentropus				2
Pseudostenophylax				4
Psychoglypha				4
Pycnopsyche				3
Molannidae:				
Molanna				2
Odontoceridae:				
Marilia				3
Psilotreta				4
Philopotamidae:				
Chimarra				3
Dolophilodes				4
Wormaldia				4
Phryganeidae:				
Agrypnia				1
Banksiola				0
Fabia				1
Oligostomis				3
Phryganea				1
Ptilostomis				2
Polycentropodidae:				
Cynellus				1
Neureclipsis				2
Nyctiophylax				2

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Polycentropus				
Psychomyiidae:				
Lype				3
Psychomyia				3
Rhyacophilidae:				
Rhyacophila fenestra				3
rhyacophila lobifera				3
Rhyacophila				4
Sericostomatidae:				
Agarodes				3
Uenoidae:				
Neophylax				4
DAMSELFIES:				
Calopterygidae:				
Calopteryx aequabilis				2
Calopteryx maculata				3
Hetaerina				2
Coenagrionidae:				
Amphiagron				1
Argia apicalis				1
Argia fumipennis				3
Argia moesta				2
Argia sedula				2
Argia tibialis				3
Argia translata				1
Chromagrion				2
Coenagrion				0
Enallagma antennatum				1
Enallagma aspersum				0
Enallagma basidens				0
Enallagma boreale				1
Enallagma carunculatum				1
Enallagma civile				1
Enallagma clausum				0
Enallagma cyathigerum				1
Enallagma ebrium				1
Enallagma exsulans				3
Enallagma geminatum				2
Enallagma hageni				0
Enallagma signatum				1
Enallagma vesperum				1
Ischnura				1
Nehalennia				1
Lestidae:				
Archilestes				2
Lestes				1
DRAGONFLIES:				
Aeshnidae:				
Aeshna				2
Anax				0
Basiaeschna				1
Boyeria				2
Nasiaeschna				1
Cordulegastridae:				
Cordulegaster				3
Corduliidae:				
Cordulia				1
Epitheca				1
Helocordulia				2
Neurocordulia				2
Somatochlora				3
Gomphidae:				
Arigomphus				1
Dromogomphus				2
Gomphurus				2
Gomphus				3
Hagenius				2
Ophiogomphus				3
Phanogomphus				1
Stylogomphus				3
Stylurus				3
Libellulidae:				
Erythemis				1
Ladona				0
Leucorrhinia				0
Libellula				1
Perithemis				1

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Plathemis				0
Sympetrum				1
Tramea				1
Macromiidae:				
Didymops				2
Macromia				2
MAYFLIES:				
Ameletidae:				
Ameletus				4
Arthropleidae:				
Arthroplea				3
Baetidae:				
Acentrella				3
acerpenna macdunnoughi				3
Acerpenna pygmaea				2
Baetis brunneicolor				3
Baetis flavistriga				1
Baetis intercalaris				2
Baetis				2
baetis rusticans				
Baetis tricaudatus				4
Callibaetis				0
Centroptilum				3
Diphetor				3
Heterocloeon				2
Plauditus armillatus				2
Plauditus cestus				3
Plauditus cingulatus				2
Plauditus dubius				1
Plauditus punctiventris				3
Plauditus virilis				1
Procloeon				2
Pseudocentroptiloides				3
Pseudocloeon frondalis				2
Pseudocloeon longipalpus				1
Pseudocloeon propinquus				2
Baetiscidae:				
Baetisca				2
Caenidae:				
Brachycercus				2
Caenis anceps				2
Caenis		2		1
Ephemerellidae:				
Attenella				2
Dannella				3
Dentatella bartoni				1
Drunella				4
Ephemerella aurivillii				4
Ephemerella				3
Eurylophella aestiva				1
Eurylophella bicolor				3
Eurylophella coxalis				3
Eurylophella funeralis				4
Eurylophella lutulenta				1
Eurylophella temporalis				1
Serratella serratoides				4
Serratella				3
Ephemeridae:				
Ephemerella guttulata				3
Ephemerella simulans				2
Ephemerella varia				3
Hexagenia atrocauda				3
Hexagenia				1
Litobrantha				3
Pentagenia				3
Heptageniidae:				
Anepeorus				1
Epeorus				4
Heptagenia				3
Leucrocota				3
Nixe				3
Rhithrogena				4
Stenacron				2
Stenonema exiguum				1
Stenonema femoratum				1
Stenonema ithaca				2
Stenonema luteum				2
Stenonema mediopunctatum				3
Stenonema modestum				2
Stenonema pulchellum				1
Stenonema terminatum				2

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Stenonema vicarium				3
Isonychiidae:				
Isonychia				2
Leptohyphidae:				
Tricorythodes				2
Leptophlebiidae:				
Choroterpes				3
Habrophlebia				
Habrophlebiodes				2
Leptophlebia				1
Paraleptophlebia				3
Metretopodidae:				
Siphonecton				2
Oligoneuriidae:				
Homoeoneuria				2
Polymitarcyidae:				
Ephoron				3
Potamanthidae:				
Anthropotamus				2
Pseudironidae:				
Pseudiron				2
Siphonuridae:				
Parameletus				3
Siphonurus				2
STONEFLIES:				
Capniidae:				
Allocapnia granulata				2
allocapnia minima				2
Allocapnia pygmaea				3
Allocapnia recta				4
Allocapnia rickeri				3
Allocapnia vivpara				2
Capnia				4
Paracapnia				3
Chloroperlidae:				
Alloperla				4
Haploperla				3
Suwallia				4
Sweltsa				4
Leuctridae:				
Leuctra				4
Paraleuctra				4
Nemouridae:				
Amphinemura				4
Nemoura				3
Ostrocerca				4
Paranemoura				4
Podmosta				4
Prostoia				3
Shipsa				3
Soyedina				4
Peltoperlidae:				
Peltoperla				3
Tallaperla				3
Perlidae:				
Acroneuria abnormis				2
Acroneuria carolinensis				3
Acroneuria evoluta				2
Acroneuria lycorias				2
Agnetina				3
Attaneuria				2
Neoperla				3
Paragnetina				3
Perlesta				2
Perlinella				3
Perlodidae:				
Arcynopteryx				4
Clioperla				3
Cultus				4
Helopicus				
Isogenoides				4
Isoperla bilineata				2
Isoperla nana				2
Isoperla				4
Malirekus				4
Pteronarcyidae:				
Pteronarcys				3
Taeniopterygidae:				
Oemopteryx				4
Strophopteryx				4
Taeniopteryx burksi				2

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Taeniopteryx				3
TRUE FLIES:				
Athericidae:				
Atherix				3
Ceratopogonidae				0
Chaoboridae:				
Chaoborus				0
Chironomidae:				
Ablabesmyia				2
Aricotopus				1
Apsectrotanytus				4
Brillia parva				4
Brillia				2
Brundiniella				4
Cardiocladius				2
Chaetocladius				1
Chernovskia				1
Chironomus	x	18	16	0
Cladopelma				1
Cladotanytarsus				2
Clinotanytus				1
Coelotanytus				1
Conchapelopia				2
Corynoneura				2
Cricotopus (C.) tremulus-gp				3
Cricotopus (C.) trifascia				3
Cricotopus (C.) others				2
Cricotopus(Isocladius)				0
Cryptochironomus				1
Cryptotendipes				2
Demicryptochironomus				1
Diamesa				3
Dicrotendipes				0
Diplocladius				3
Doncricotopus				3
Einfeldia				0
Endochironomus				0
Epoicocladius				2
Eukiefferiella claripennis-gp				1
Eukiefferiella				3
Glyptotendipes	x	37	42	0
Harnischia				1
Heleniella				4
Helopelopia				3
Heterotanytarsus				0
Heterotrissocladius hirtapex				2
Heterotrissocladius				1
Hydrobaenus				1
Labrundinia				1
Larsia				1
Lauterborniella				0
Limnophyes				1
Lipiniella				1
Macropelopia				3
Meropelopia				3
Metriocnemus				3
Microchironomus				1
Microcricotopus				1
Micropsectra				3
Microtendipes				2
Monodiamesa				1
Nanocladius				3
Natarsia				3
Nilotanytus				2
Nilothauma				1
Odontomesa				2
Orthocladius				
Pagastia				3
Pagastiella				0
Parachaetocladius				3
Parachironomus				1
Paracladopelma doris				3
Paracladopelma doris-gp				2
Paracladopelma galaptera				0
Paracladopelma nais				2
Paracladopelma nereis				3
Paracladopelma undine				2
Paracladopelma winnelli				2
Parakiefferiella				2
Paralauterborniella				0
Paramerina				
Parametriocnemus				3

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Paratanytarsus				1
Paratendipes				2
Pentaneura				2
Phaenopsectra				1
Polypedilum albicorne				3
Polypedilum angulum				
Polypedilum aviceps				3
Polypedilum fallax				1
Polypedilum flavum (convictum)				2
Polypedilum halterale				0
Polypedilum illinoense				1
Polypedilum laetum				2
Polypedilum nubeculosum				2
Polypedilum scalaenum				1
Polypedilum trigonus				0
Polypedilum tritum				0
Potthastia				1
Procladius	x	7	13	0
Prodiamesa				3
Protanypus				0
Psectrocladius				1
Psectrotanypus				0
Pseudochironomus				1
Rheocricotopus				2
Rheopelopia				3
Rheotanytarsus				3
Robackia				2
Saetheria				2
Stempellina				2
Stempellinella				3
Stenochironomus				2
Stictochironomus				2
Stilocladius				3
Sublettea				2
Sympotthastia				3
Syndiamesa				3
Synorthocladius				3
Tanypus				1
Tanytarsus				2
Thienemanniella				2
Thienemannimyia				2
Tribelos				1
Trissopelopia				2
Tvetenia				2
Unniella				
Xenochironomus				2
Xylotopus				2
Zalutschia				0
Zavrelimyia				2
Culicidae				0
Dixidae				1
Dolichopodidae				2
Empididae				2
Ephydriidae				1
Muscidae				1
Psychodidae				0
Ptychopteridae				1
Simuliidae		1		2
Stratiomyidae				0
Syrphidae				0
Tabanidae:				
Chrysops				2
Tabanus				0
Tipulidae:				
Antocha				3
Cryptolabis				4
Dactylolabis				3
Dicranota				3
Erioptera				1
Helius				1
Hexatoma				2
Limnophila				2
Limonia				2
Ormosia				3
Pedicia				3
Pilaria				1
Pseudolimnophila				3
Tipula				
Crustaceans:				
AMPHIPODS:				
Crangonyctidae:				
Crangonyx gracilis-cmpx				3

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Crangonyx rivularis				3
Crangonyx	x	123	143	2
Gammaridae:				
Gammarus fasciatus				2
Gammarus lacustris				3
Gammarus pseudolimnae				3
Hyalidae:				
Hyalidae				2
CRAYFISHES:				
Cambaridae:				
Cambarus				1
Orconectes				2
Palaemonetidae:				
Palaemonetes				3
ISOPODS:				
Asellidae:				
Caecidotea				1
Lirceus				2
Molluscs:				
BIVALVES:				
Dreissenidae:				
Dreissena				1
Sphaeriidae:				
musculium lacustre				1
Musculium partumeium				1
Musculium securis				1
musculium transversum				2
Pisidium				1
Sphaerium fabale				3
Sphaerium occidentale				0
Sphaerium rhomboideum				1
Sphaerium simile				1
Sphaerium striatinum				2
Unionidae:				
Actinonaias carinata				2
Actinonaias ligamentina				3
Alasmidonta marginata				3
Alasmidonta viridis				3
Amblema plicata				2
Anodontoides ferussacianus				3
Carunculina parva				1
Cyclonaias tuberculata				2
Elliptio dilatata				1
Epioblasma(=Dysnomia)				2
Fusconaia flava				1
Lampsilis cardium				3
Lampsilis fasciola				3
Lampsilis radiata siliquoides				1
Lampsilis ventricosa				1
Lasmigona complanata				1
Lasmigona compressa				3
Lasmigona costata				2
Leptodea fragilis				1
Ligumia nasuta				0
Ligumia recta				2
Obliquaria reflexa				1
Obovaria subrotunda				2
Pleurobema coccineum				1
Proptera alata				0
Ptychobranhus fasciolaris				3
Pyganodon (=Anodonta,in part)				1
Quadrula pustulosa				1
Quadrula quadrula				2
Simpsoniconcha ambigua				2
Strophitus undulatus				3
Truncilla				2
Villosa fabalis				2
Villosa iris				2
SNAILS:				
Ancylidae:				
Ferrissia fragilis				0
Ferrissia parallela				1
Ferrissia rivularis				2
Bithyniidae:				
Bithynia				1
Hydrobiidae:				
Amnicola				2
Birgella (=Somatogyrus)				2
Cincinnatia				1
Fontigens				3
Potamopyrgus				1
Probythinella				2

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Lymnaeidae:				
Bulinnea				1
Fossaria	x	5	3	1
Lymnaea				1
Pseudosuccinea	x	25	29	0
Radix				1
Stagnicola				0
Physidae:				
Physella	x	75	63	0
Planorbidae:				
Gyraulus				1
Helisoma				1
Planorbella				0
Planorbula				1
Promenetus				2
Pleuroceridae:				
Elimia (=Goniobasis)				2
Pleurocera				1
Valvatidae:				
Valvata				2
Viviparidae:				
Campeloma				1
Cipangopaludina				1
Viviparus				1
Annelids:				
LEECHES:				
Erpobdellidae:				
Dina dubia				1
Dina parva				0
Erpobdella				1
Mooreobdella				2
Nepheleopsis				2
Hirudinidae:				
Haemopsis				1
Macrobdella				0
Glossiphoniidae:				
Alboglossiphonia				2
Batrachobdella				2
Glossiphonia				2
Helobdella elongata				1
Helobdella fusca				2
Helobdella papillata				1
Helobdella stagnalis				2
Helobdella triserialis				2
Placobdella				1
Theromyzon				
WORMS:				
Lumbriculidae				0
Tubificidae:				
Aulodrilus				2
Bothrioneurum				2
Branchiura				0
Ilyodrilus				0
Isochaetides curvisetosus				3
Isochaetides freyi				1
Limnodrilus				0
Potamothenix bavaricus				2
Potamothenix moldaviensis				2
Potamothenix vejovskyi	x	23	18	2
Quistadrilus				0
Rhyacodrilus				3
Spirosperma				1
Tasserkidrilus				2
Tubifex				0
Oligochaete				
no cheate				0
Platyhelminthes:				0
FLATWORMS:				
Alloeocoela				1
Tricladida				3
Total sum		328	335	
Total Taxa	11			
BioMap WQI		3.529334961	3.367681375	
avareage	3.448508168			
HBI rate	7.280542986			
EPT Richness (%)	0.150829563			
Percentage Oligochaetes	6.184012066			
Percentage Chironomidae	20.06033183			
Percentage Insects	23.52941176			
Simpsons diversity	0.430974013			
Simpsons index of diversity	0.569025987			
Simpsons reciprocal	2.320325519			

Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP sensitivity value
W12A LANDFILL BENTHIC WATER QUALITY REPORT JUNE 5,2018				
Insects:				
ALDERFLIES:				
CORYDALIDAE:				
chauliodes				1
corydalis				2
nigronia				3
SIALIDAE				
sialis				2
AQUATIC MOTHS:				
PYRALIDAE:				
petrophila				2
other				0
BEETLES:				
DYROPIDAE:				
helichus				2
DYTISCIDAE:				
acilius				0
agabates				0
agabus			1	2
bidessonotus				1
celina				0
colymbetes				1
copelatus				3
coptotomus lenticus				1
coptotomus longulus	x			1
coptotomus loticus				2
cybister				0
desmopachria				0
dytiscus				1
graphoderus				0
heterosternuta				3
hydrocolus				1
hydroporus				1
hydrovatus				0
hygrotus				0
ilybius				2
laccophilus				0
laccornis				1
liodessus				2
lioporeus				3
matus2				2
nebrionporus				2
neoporus				2
neoscutopterus				0
oreodytes				2
rhantus				0
sanfilippodytes				3
stictotarsus				2
uvarus				2
ELMIDAE:				
Optioservus larvae				
Stenelmis larvae				
dubiraphia larvae			1	
ancyrionxy variegata				2
dubiraphia bivittata				0
dubiraphia minima				1
dubiraphia quadrinotata				1
dubiraphia vittata				2
macronychus galbratus				2
microcylloepus pusillus				3
optioservus fastiditus				2
optioservus ovalis				2
optioservus trivittatus				3
promoresia elegans				3
promoresia tardella				4
stenelmis bicarinata				2
stenelmis crenata				2
stenelmis musgravei				1
stenelmis quadramaculata				0
stenelmis sandersoni				2
stenelmis vittipennis				2
GYRINIDAE:				
dineutes				2
gyrinus				1
HALIPLIDAE:				
halipus				1
peltodytes				2
HYDROPHILIDAE:				
anacaena				2
berosus				0
crenitis				2
cymbiodyta				1
enochrus				0
helochares				

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helocombus			0
helophorus			1
hydrobius			1
Hydrochara			0
Hydrochus			1
Hydrophilus			3
Laccobius			1
Paracymus			2
Sperchopsis			3
Tropisternus			0
Lampyridae			1
Limnichidae:			
Lutrochus			3
Psephenidae:			
Ectopria			3
Psephenus			3
Ptilodactylidae:			
Anchytarsus			3
Scirtidae			
Micrasema			4
BUGS:			
Belostomatidae:			
Belostoma			0
Lethocerus			0
Corixidae:			
Callicorixa			2
Corisella			0
Hesperocorixa			1
Palmarcorixa			2
Sigara grossolineata			2
Sigara lineata			2
Sigara mathesoni			3
Sigara trilineata			2
Sigara others	x		0
Trichocorixa calva			3
Trichocorixa others			1
Gerridae:			
Aquarius			3
Gerris			1
Limnoporus			1
Metrobates			2
Neogerris			0
Rheumatobates			1
Trepobates			1
Mesoveliidae:			
Mesovelia			1
Nepidae:			
Nepa			1
ranatra			0
Notonectidae:			
Buenoa			0
Notonecta			0
Pleidae:			
Neoplea			0
Veliidae:			
Microvelia			0
Rhagovelia			2
CADDISFLIES:			
Apataniidae:			
Apatania			4
Beraeidae:			
Beraea			4
Brachycentridae:			
Brachycentrus			3
micrasema			4
Calamoceratidae:			
Heteroplectron			3
Dipseudopsidae:			
Phylocentropus			2
Glossosomatidae:			
Agapetus			4
Glossosoma			4
Protophila			2
Goeridae:			
Goera			3
Helicopsychidae:			
Helicopsyche			2
Hydropsychidae:			
Arctopsyche			4
Cheumatopsyche			1
Diplectrona			4

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Homoplectra				4
Hydropsyche alhedra				3
Hydropsyche alvata				1
Hydropsyche betteni				2
Hydropsyche bronta				3
Hydropsyche cuanis				2
Hydropsyche dicantha				2
Hydropsyche hageni				2
Hydropsyche morosa				2
Hydropsyche immature				
Hydropsyche placoda				2
Hydropsyche scalaris				2
hydropsyche slossonae				3
Hydropsyche sparna				3
Hydropsyche ventura				4
Hydropsyche welkeri				3
Macrostemum				2
Parapsyche				4
Potamyla				1
Hydroptilidae:				
Agraylea				1
Hydroptila				2
Ithytrichia				4
Leucotrichia				3
Mayatrichia				2
Neotrichia				2
Ochrotrichia				2
Orthotrichia				
Oxyethira				1
Stactobiella				4
Lepidostomatidae:				
Lepidostoma				4
Theliopsyche				4
Leptoceridae:				
Ceraclea				1
Leptocerus				0
Mystacides				1
Nectopsyche				1
Oecetis				2
Setodes				2
Trienodes				1
Limnephilidae:				
Anabolia				1
Asynarchus				1
Chyranda				4
Frenesia				4
Glyphopsyche				1
Hesperophylax				4
Hydatophylax				4
Ironoquia				2
Lenarchus				1
Limnephilus moestus				3
Limnephilus				1
Nemotaulius				1
Onocosmoecus				4
Platycentropus				2
Pseudostenophylax				4
Psychoglypha				4
Pycnopsyche				3
Molannidae:				
Molanna				2
Odontoceridae:				
Marilia				3
Psilotreta				4
Philopotamidae:				
Chimarra				3
Dolophilodes				4
Wormaldia				4
Phryganeidae:				
Agrypnia				1
Banksiola				0
Fabria				1
Oligostomis				3
Phryganea				1
Ptilostomis				2
Polycentropodidae:				
Cyrnellus				1
Neureclipsis				2
Nyctiophylax				2
Polycentropus				
Psychomyiidae:				
Lype				3

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Psychomyia				3
Rhyacophilidae:				
Rhyacophila fenestra				3
rhyacophila lobifera				3
Rhyacophila				4
Sericostomatidae:				
Agarodes				3
Uenoidae:				
Neophylax				4
DAMSELFLIES:				
Calopterygidae:				
Calopteryx aequabilis				2
Calopteryx maculata				3
Hetaerina				2
Coenagrionidae:				
Amphiagrion				1
Argia apicalis				1
Argia fumipennis				3
Argia moesta				2
Argia sedula				2
Argia tibialis				3
Argia translata				1
Chromagrion				2
Coenagrion				0
Enallagma antennatum				1
Enallagma aspersum				0
Enallagma basidens				0
Enallagma boreale				1
Enallagma carunculatum				1
Enallagma civile				1
Enallagma clausum				0
Enallagma cyathigerum				1
Enallagma ebrium				1
Enallagma exsulans				3
Enallagma geminatum				2
Enallagma hageni				0
Enallagma signatum				1
Enallagma vesperum				1
Ischnura				1
Nehalennia				1
Lestidae:				
Archilestes				2
Lestes				1
DRAGONFLIES:				
Aeshnidae:				
Aeshna				2
Anax				0
Basiaeschna				1
Boyeria				2
Nasiaeschna				1
Cordulegastridae:				
Cordulegaster				3
Corduliidae:				
Cordulia				1
Epitheca				1
Helocordulia				2
Neurocordulia				2
Somatochlora				3
Gomphidae:				
Arigomphus				1
Dromogomphus				2
Gomphurus				2
Gomphus				3
Hagenius				2
Ophiogomphus				3
Phanogomphus				1
Stylogomphus				3
Stylurus				3
Libellulidae:				
Erythemis				1
Ladona				0
Leucorrhinia				0
Libellula				1
Perithemis				1
Platthemis				0
Sympetrum				1
Tramea				1

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Macromiidae:				
Didymops				2
Macromia				2
MAYFLIES:				
Ameletidae:				
Ameletus				4
Arthropleidae:				
Arthroplea				3
Baetidae:				
Acentrella				3
acerpenna macdunnoughi				3
Acerpenna pygmaea				2
Baetis brunneicolor				3
Baetis flavistriga				1
Baetis intercalaris				2
Baetis				2
baetis rusticans				
Baetis tricaudatus				4
Callibaetis				0
Centroptilum				3
Diphetor				3
Heterocloeon				2
Plauditus armillatus				2
Plauditus cestus				3
Plauditus cingulatus				2
Plauditus dubius				1
Plauditus punctiventris				3
Plauditus virilis				1
Procloeon				2
Pseudocentroptiloides				3
Pseudocloeon frondalis				2
Pseudocloeon longipalpus				1
Pseudocloeon propinquus				2
Baetiscidae:				
Baetisca				2
Caenidae:				
Brachycercus				2
Caenis anceps				2
Caenis				1
Ephemerellidae:				
Attenella				2
Dannella				3
Dentatella bartoni				1
Drunella				4
Ephemerella aurivillii				4
Ephemerella				3
Eurylophella aestivalis				1
Eurylophella bicolor				3
Eurylophella coxalis				3
Eurylophella funeralis				4
Eurylophella lutulenta				1
Eurylophella temporalis				1
Serratella serratoides				4
Serratella				3
Ephemeridae:				
Ephemera guttulata				3
Ephemera simulans				2
Ephemera varia				3
Hexagenia atrocauda				3
Hexagenia				1
Litobrantha				3
Pentagenia				3
Heptageniidae:				
Anepeorus				1
Epeorus				4
Heptagenia				3
Leucrocota				3
Nixe				3
Rhithrogena				4
Stenacron				2
Stenonema exiguum				1
Stenonema femoratum				1
Stenonema ithaca				2
Stenonema luteum				2
Stenonema mediopunctatum				3
Stenonema modestum				2
Stenonema pulchellum				1
Stenonema terminatum				2
Stenonema vicarium				3
Isonychiidae:				
Isonychia				2

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Leptohyphidae:				
Tricorythodes				2
Leptophlebiidae:				
Choroterpes				3
Habrophlebia				
Habrophlebiodes				2
Leptophlebia				1
Paraleptophlebia				3
Metretopodidae:				
Siphloplecton				2
Oligoneuriidae:				
Homoeoneuria				2
Polymitarcyidae:				
Ephoron				3
Potamanthidae:				
Anthropotamus				2
Pseudironidae:				
Pseudiron				2
Siphonuridae:				
Parameletus				3
Siphonurus				2
STONEFLIES:				
Capniidae:				
Allocaupnia granulata				2
allogaupnia minima				2
Allocaupnia pygmaea				3
Allocaupnia recta				4
Allocaupnia rickeri				3
Allocaupnia vivpara				2
Capnia				4
Paracupnia				3
Chloroperlidae:				
Alloperla				4
Haploperla				3
Suwallia				4
Sweltsa				4
Leuctridae:				
Leuctra				4
Paraleuctra				4
Nemouridae:				
Amphinemura				4
Nemoura				3
Ostrocerca				4
Paranemoura				4
Podmosta				4
Prostoia				3
Shipsa				3
Soyedina				4
Peltoperlidae:				
Peltoperla				3
Tallaperla				3
Perlidae:				
Acroneuria abnormis				2
Acroneuria carolinensis				3
Acroneuria evoluta				2
Acroneuria lycorias				2
Agnetina				3
Attaneuria				2
Neoperla				3
Paragnetina				3
Perlesta				2
Perlinella				3
Perlodidae:				
Arcynopteryx				4
Clioperla				3
Cultus				4
Helopicus				
Isogenoides				4
Isoperla bilineata				2
Isoperla nana				2
Isoperla				4
Malirekus				4
Pteronarcyidae:				
Pteronarcys				3
Taeniopterygidae:				
Oemopteryx				4
Strophopteryx				4
Taeniopteryx burksi				2
Taeniopteryx				3
TRUE FLIES:				
Athericidae:				

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Atherix				3
Ceratopogonidae	x	2		0
Chaoboridae:				
Chaoborus				0
Chironomidae:				
Ablabesmyia				2
Aricotopus				1
Apsectrotanypus				4
Brillia parva				4
Brillia				2
Brundiniella				4
Cardiocladius				2
Chaetocladius				1
Chernovskia				1
Chironomus	x	31	16	0
Cladopelma				1
Cladotanytarsus				2
Clinotanytus				1
Coelotanytus				1
Conchapelopia				2
Corynoneura				2
Cricotopus (C.) tremulus-gp				3
Cricotopus (C.) trifascia				3
Cricotopus (C.) others				2
Cricotopus(Isocladius)				0
Cryptochironomus				1
Cryptotendipes				2
Demicryptochironomus				1
Diamesa				3
Dicrotendipes				0
Diplocladius				3
Doncricotopus				3
Einfeldia				0
Endochironomus				0
Epoicocladius				2
Eukiefferiella claripennis-gp				1
Eukiefferiella				3
Glyptotendipes	x	17	12	0
Harnischia				1
Heleniella				4
Helopelopia				3
Heterotanytarsus				0
Heterotrissocladius hirtapex				2
Heterotrissocladius				1
Hydrobaenus				1
Labrundinia				1
Larsia				1
Lauterborniella				0
Limnophyes				1
Lipiniella				1
Macropelopia				3
Meropelopia				3
Metriocnemus				3
Microchironomus				1
Microcricotopus				1
Micropsectra				3
Microtendipes				2
Monodiamesa				1
Nanocladius				3
Natarsia				3
Nilotanytus				2
Nilothauma				1
Odontomesa				2
Orthocladius				
Pagastia				3
Pagastiella				0
Parachaetocladius				3
Parachironomus				1
Paracladopelma doris				3
Paracladopelma doris-gp				2
Paracladopelma galaptera				0
Paracladopelma nais				2
Paracladopelma nereis				3
Paracladopelma undine				2
Paracladopelma winnelli				2
Parakiefferiella				2
Paralauterborniella				0
Paramerina				
Parametriocnemus				3
Paratanytarsus				1
Paratendipes				2
Pentaneura				2

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Phaenopsectra				1
Polypedilum albicorne				3
Polypedilum angulum				
Polypedilum aviceps				3
Polypedilum fallax				1
Polypedilum flavum (convictum)				2
Polypedilum halterale				0
Polypedilum illinoense				1
Polypedilum laetum				2
Polypedilum nubeculosum				2
Polypedilum scalaenum				1
Polypedilum trigonus				0
Polypedilum tritum				0
Potthastia				1
Procladius				0
Prodiamesa				3
Protanypus				0
Psectrocladius				1
Psectrotanypus				0
Pseudochironomus				1
Rheocricotopus				2
Rheopelopia				3
Rheotanytarsus				3
Robackia				2
Saetheria				2
Stempellina				2
Stempellinella				3
Stenochironomus				2
Stictochironomus				2
Stilocladius				3
Sublettea				2
Sympotthastia				3
Syndiamesa				3
Synorthocladius				3
Tanypus				1
Tanytarsus				2
Thienemanniella				2
Thienemannimyia				2
Tribelos				1
Trissopelopia				2
Tvetenia				2
Unniella				
Xenochironomus	x		4	2
Xylotopus				2
Zalutschia				0
Zavrelimyia				2
Culicidae				0
Dixidae				1
Dolichopodidae				2
Empididae				2
Ephydriidae				1
Muscidae				1
Psychodidae				0
Ptychopteridae				1
Simuliidae				2
Stratiomyidae	x			0
Syrphidae				0
Tabanidae:				
Chrysops				2
Tabanus				0
Tipulidae:				
Antocha				3
Cryptolabis				4
Dactylolobis				3
Dicranota				3
Erioptera				1
Helius				1
Hexatoma				2
Limnophila				2
Limonia				2
Ormosia				3
Pedicia				3
Pilaria				1
Pseudolimnophila				3
Tipula	x			
Crustaceans:				
AMPHIPODS:				
Crangonyctidae:				
Crangonyx gracilis-cmpx				3
Crangonyx rivularis				3
Crangonyx	x	16	8	2
Gammaridae:				

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Gammarus fasciatus				2
Gammarus lacustris				3
Gammarus pseudolimnae				3
Hyalidae:				
Hyalella				2
CRAYFISHES:				
Cambaridae:				
Cambarus				1
Orconectes	x			2
Palaeomonetidae:				
Palaeomonetes				3
ISOPODS:				
Asellidae:				
Caecidotea	x		8	1
Lirceus				2
Molluscs:				
BIVALVES:				
Dreissenidae:				
Dreissena				1
Sphaeriidae:				
musculium lacustre				1
Musculium partumeium				1
Musculium securis				1
musculium transversum				2
Pisidium		2		1
Sphaerium fabale				3
Sphaerium occidentale				0
Sphaerium rhomboideum				1
Sphaerium simile				1
Sphaerium striatinum		4		2
Unionidae:				
Actinonaias carinata				2
Actinonaias ligamentina				3
Alasmidonta marginata				3
Alasmidonta viridis				3
Amblema plicata				2
Anodontoides ferussacianus				3
Carunculina parva				1
Cyclonaias tuberculata				2
Elliptio dilatata				1
Epioblasma(=Dysnomia)				2
Fusconaia flava				1
Lampsilis cardium				3
Lampsilis fasciola				3
Lampsilis radiata silicoidea				1
Lampsilis ventricosa				1
Lasmigona complanata				1
Lasmigona compressa				3
Lasmigona costata				2
Leptodea fragilis				1
Ligumia nasuta				0
Ligumia recta				2
Obliquaria reflexa				1
Obovaria subrotunda				2
Pleurobema coccineum				1
Proptera alata				0
Ptychobranthus fasciolaris				3
Pyganodon (=Anodonta,in part)				1
Quadrula pustulosa				1
Quadrula quadrula				2
Simpsoniconcha ambigua				2
Strophitus undulatus				3
Truncilla				2
Villosa fabalis				2
Villosa iris				2
SNAILS:				
Ancylidae:				
Ferrissia fragilis				0
Ferrissia parallela				1
Ferrissia rivularis				2
Bithyniidae:				
Bithynia				1
Hydrobiidae:				
Amnicola				2
Birgella (=Somatogyrus)				2
Cincinnatia				1
Fontigens				3
Potamopyrgus				1
Probythinella				2
Lymnaeidae:				
Bulinnea				1
Fossaria				1

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Lymnaea				1
Pseudosuccinea				0
Radix				1
Stagnicola				0
Physidae:				
Physella				0
Planorbidae:				
Gyraulus	x		1	1
Helisoma				1
Planorbella	x	4	4	0
Planorbula				1
Promenetus				2
Pleuroceridae:				
Elimia (=Goniobasis)				2
Pleurocera				1
Valvatidae:				
Valvata				2
Viviparidae:				
Campeloma				1
Cipangopaludina				1
Viviparus				1
Annelids:				
LEECHES:				
Erpobdellidae:				
Dina dubia				1
Dina parva				0
Erpobdella				1
Mooreobdella				2
Nepheleopsis				2
Hirudinidae:				
Haemopsis				1
Macrobdella				0
Glossiphoniidae:				
Alboglossiphonia				2
Batrachobdella				2
Glossiphonia				2
Helobdella elongata				1
Helobdella fusca				2
Helobdella papillata				1
Helobdella stagnalis				2
Helobdella triserialis				2
Placobdella				1
Theromyzon				
WORMS:				
enchytraeidae	x	17	24	1
Tubificidae:				
Aulodrilus				2
Bothrioneurum				2
Branchiura				0
Ilyodrilus				0
Isochaetides curvisetus				3
Isochaetides freyi				1
Limnodrilus	x	48	76	0
Potamothenix bavaricus				2
Potamothenix moldaviensis				2
Potamothenix vejovskyi				2
Quistadrilus				0
Rhyacodrilus				3
Spirosperma				1
Tasserkidrilus				2
Tubifex				0
Oligochaete				
no cheate				0
Platyhelminthes:				0
FLATWORMS:				
Alloeocoela				1
Tricladida				3
Total sum		141	155	
Total Taxa	19			
BioMap WQI		2.643788232	2.732480815	
avareage	2.688134524			
HBI rate	8.85084758			
EPT Richness (%)	0			
Percentage Oligochaetes	55.93220339			
Percentage Chironomidae	27.11864407			
Percentage Insects	28.47457627			
Simpsons diversity	0.130604288			
Simpsons index of diversity	0.869395712			
Simpsons reciprocal	7.656716418			

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Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP sensitivity value
Insects:				
ALDERFLIES:				
CORYDALIDAE:				
chauliodes				1
corydalis				2
nigronia				3
SIALIDAE				
sialis				2
AQUATIC MOTHS:				
PYRALIDAE:				
petrophila				2
other				0
BEETLES:				
DYROPIDAE:				
helichus				2
DYTISCIDAE:				
acilius				0
agabates				0
agabus				2
bidessonotus				1
celina				0
colymbetes				1
copelatus				3
coptotomus lenticus				1
coptotomus longulus				1
coptotomus loticus				2
cybister				0
desmopachria				0
dytiscus				1
graphoderus				0
heterosternuta				3
hydrocolus				1
hydroporus	x			1
hydrovatus				0
hygrotus				0
illybius				2
laccophilus				0
laccornis				1
liodessus				2
lioporeus				3
matus2				2
nebraporus				2
neoporus				2
neoscutopterus				0
oreodytes				2
rhantus				0
sanfilippodytes				3
stictotarsus				2
uvarus				2
ELMIDAE:				
Optioservus larvae				
Stenelmis larvae				
dubiraphia larvae				
ancyrionxy variegata				2
dubiraphia bivittata				0
dubiraphia minima				1
dubiraphia quadrinotata				1
dubiraphia vittata				2
macronychus galbratus				2
microcylloepus pusillus				3
optioservus fastiditus				2
optioservus ovalis				2
optioservus trivittatus				3
promoresia elegans				3
promoresia tardella				4
stenelmis bicarinata				2
stenelmis crenata				2
stenelmis musgravei				1
stenelmis quadramaculata				0
stenelmis sandersoni				2
stenelmis vittipennis				2
GYRINIDAE:				
dineutes				2
gyrinus				1
HALIPLIDAE:				
haliplus				1
peltodytes				2
HYDROPHILIDAE:				

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anacaena				2
berosus				0
crenitis				2
cymbiodyta				1
enochrus				0
helochares				
helocombus				0
helophorus				1
hydrobius				1
Hydrochara				0
Hydrochus				1
Hydrophilus				3
Laccobius				1
Paracymus				2
Sperchopsis				3
Tropisternus				0
Lampyridae				1
Limnichidae:				
Lutrochus				3
Psephenidae:				
Ectopria				3
Psephenus				3
Ptilodactylidae:				
Anchytarsus				3
Scirtidae				
Micrasema				4
BUGS:				
Belostomatidae:				
Belostoma				0
Lethocerus				0
Corixidae:				
Callicorixa				2
Corisella				0
Hesperocorixa	2	2		1
Palmacorixa				2
Sigara grossolineata				2
Sigara lineata				2
Sigara matthesoni				3
Sigara trilineata				2
Sigara others				0
Trichocorixa calva				3
Trichocorixa others				1
Gerridae:				
Aquarius				3
Gerris				1
Limnoporus				1
Metrobates				2
Neogerris				0
Rheumatobates				1
Trepobates				1
Mesoveliidae:				
Mesovelia				1
Nepidae:				
Nepa				1
ranatra				0
Notonectidae:				
Buenoa				0
Notonecta				0
Pleidae:				
Neoplea				0
Veliidae:				
Microvelia				0
Rhagovelia				2
CADDISFLIES:				
Apataniidae:				
Apatania				4
Beraeidae:				
Beraea				4
Brachycentridae:				
Brachycentrus				3
micrasema				4
Calamoceratidae:				
Heteroplectron				3
Dipseudopsidae:				
Phyllocentropus				2
Glossosomatidae:				
Agapetus				4
Glossosoma				4
Protoptila				2
Goeridae:				
Goera				3

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Helicopsychidae:				
Helicopsyche				2
Hydropsychidae:				
Arctopsyche				4
Cheumatopsyche				1
Diplectrona				4
Homoplectra				4
Hydropsyche alhedra				3
Hydropsyche alvata				1
Hydropsyche betteni				2
Hydropsyche bronta				3
Hydropsyche cuanis				2
Hydropsyche dicantha				2
Hydropsyche hageni				2
Hydropsyche morosa				2
Hydropsyche immature				
Hydropsyche placoda				2
Hydropsyche scalaris				2
hydropsyche slossonae				3
Hydropsyche sparna				3
Hydropsyche ventura				4
Hydropsyche welkeri				3
Macrostemum				2
Parapsyche				4
Potamyia				1
Hydroptilidae:				
Agraylea				1
Hydroptila				2
Ithytrichia				4
Leucotrichia				3
Mayatrichia				2
Neotrichia				2
Ochrotrichia				2
Orthotrichia				
Oxyethira				1
Stactobiella				4
Lepidostomatidae:				
Lepidostoma				4
Theliopsyche				4
Leptoceridae:				
Ceraclea				1
Leptocerus				0
Mystacides				1
Nectopsyche				1
Oecetis				2
Setodes				2
Trienodes				1
Limnephilidae:				
Anabolia				1
Asynarchus				1
Chyranda				4
Frenesia				4
Glyphopsyche				1
Hesperophylax				4
Hydatophylax				4
Ironoquia				2
Lenarchus				1
Limnephilus moestus				3
Limnephilus				1
Nemotaulius				1
Onocosmoecus				4
Platycentropus				2
Pseudostenophylax				4
Psychoglypha				4
Pycnopsyche				3
Molannidae:				
Molanna				2
Odontoceridae:				
Marilia				3
Psilotreta				4
Philopotamidae:				
Chimarra				3
Dolophilodes				4
Wormaldia				4
Phryganeidae:				
Agrypnia				1
Banksiola				0
Fabria				1
Oligostomis				3
Phryganea				1
Ptilostomis				2
Polycentropodidae:				

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Cynellus				1
Neureclipsis				2
Nyctiophylax				2
Polycentropus				
Psychomyiidae:				
Lype				3
Psychomyia				3
Rhyacophilidae:				
Rhyacophila fenestra				3
rhyacophila lobifera				3
Rhyacophila				4
Sericostomatidae:				
Agarodes				3
Uenoidae:				
Neophylax				4
DAMSELFIES:				
Calopterygidae:				
Calopteryx aequabilis				2
Calopteryx maculata				3
Hetaerina				2
Coenagrionidae:				
Amphiagrion				1
Argia apicalis				1
Argia fumipennis				3
Argia moesta				2
Argia sedula				2
Argia tibialis				3
Argia translata				1
Chromagrion				2
Coenagrion				0
Enallagma antennatum				1
Enallagma aspersum				0
Enallagma basidens				0
Enallagma boreale				1
Enallagma carunculatum				1
Enallagma civile		1		1
Enallagma clausum				0
Enallagma cyathigerum				1
Enallagma ebrium				1
Enallagma exsulans				3
Enallagma geminatum				2
Enallagma hageni				0
Enallagma signatum				1
Enallagma vesperum				1
Ischnura				1
Nehalennia				1
Lestidae:				
Archilestes				2
Lestes				1
DRAGONFLIES:				
Aeshnidae:				
Aeshna				2
Anax				0
Basiaeschna				1
Boyeria				2
Nasiaeschna				1
Cordulegastridae:				
Cordulegaster				3
Corduliidae:				
Cordulia				1
Epitheca				1
Helocordulia				2
Neurocordulia				2
Somatochlora				3
Gomphidae:				
Arigomphus				1
Dromogomphus				2
Gomphurus				2
Gomphus				3
Hagenius				2
Ophiogomphus				3
Phanogomphus				1
Stylogomphus				3
Stylurus				3
Libellulidae:				
Erythemis				1
Ladona				0

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Leucorrhinia				0
Libellula				1
Perithemis				1
Plathemis				0
Sympetrum				1
Tramea				1
Macromiidae:				
Didymops				2
Macromia				2
MAYFLIES:				
Ameletidae:				
Ameletus				4
Arthropleidae:				
Arthroplea				3
Baetidae:				
Acentrella				3
acerpenna macdunnoughi				3
Acerpenna pygmaea				2
Baetis brunneicolor				3
Baetis flavistriga				1
Baetis intercalaris				2
Baetis				2
baetis rusticans				
Baetis tricaudatus				4
Callibaetis				0
Centroptilum				3
Dipheter				3
Heterocloeon				2
Plauditus armillatus				2
Plauditus cestus				3
Plauditus cingulatus				2
Plauditus dubius				1
Plauditus punctiventris				3
Plauditus virilis				1
Procloeon				2
Pseudocentroptiloides				3
Pseudocloeon frondalis				2
Pseudocloeon longipalpus				1
Pseudocloeon propinquus				2
Baetiscidae:				
Baetisca				2
Caenidae:				
Brachycercus				2
Caenis anceps				2
Caenis				1
Ephemerellidae:				
Attenella				2
Dannella				3
Dentatella bartoni				1
Drunella				4
Ephemerella aurivillii				4
Ephemerella				3
Eurylophella aestiva				1
Eurylophella bicolor				3
Eurylophella coxalis				3
Eurylophella funeralis				4
Eurylophella lutulenta				1
Eurylophella temporalis				1
Serratella serratoides				4
Serratella				3
Ephemeridae:				
Ephemera guttulata				3
Ephemera simulans				2
Ephemera varia				3
Hexagenia atrocauda				3
Hexagenia				1
Litobrantha				3
Pentagenia				3
Heptageniidae:				
Anepeorus				1
Epeorus				4
Heptagenia				3
Leucrocuta				3
Nixe				3
Rhithrogena				4
Stenacron				2
Stenonema exiguum				1
Stenonema femoratum				1
Stenonema ithaca				2
Stenonema luteum				2
Stenonema mediopunctatum				3

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Stenonema modestum				2
Stenonema pulchellum				1
Stenonema terminatum				2
Stenonema vicarium				3
Isonychidae:				
Isonychia				2
Leptohyphidae:				
Tricorythodes				2
Leptophlebiidae:				
Choroterpes				3
Habrophlebia				
Habrophlebiodes				2
Leptophlebia				1
Paraleptophlebia				3
Metretopodidae:				
Siphonecton				2
Oligoneuriidae:				
Homoeoneuria				2
Polymitarcyidae:				
Ephoron				3
Potamanthidae:				
Anthropotamus				2
Pseudironidae:				
Pseudiron				2
Siphonuridae:				
Parameletus				3
Siphonurus				2
STONEFLIES:				
Capniidae:				
Allocapnia granulata				2
allocapnia minima				2
Allocapnia pygmaea				3
Allocapnia recta				4
Allocapnia rickeri				3
Allocapnia vivipara				2
Capnia				4
Paracapnia				3
Chloroperlidae:				
Alloperla				4
Haploperla				3
Suwallia				4
Sweltsa				4
Leuctridae:				
Leuctra				4
Paraleuctra				4
Nemouridae:				
Amphinemura				4
Nemoura				3
Ostrocerca				4
Paranemoura				4
Podmosta				4
Prostoia				3
Shipsa				3
Soyedina				4
Peltoperlidae:				
Peltoperla				3
Tallaperla				3
Perlidae:				
Acroneuria abnormis				2
Acroneuria carolinensis				3
Acroneuria evoluta				2
Acroneuria lycorias				2
Agnetina				3
Attaneuria				2
Neoperla				3
Paragnetina				3
Perlesta				2
Perlinella				3
Perlodidae:				
Arcynopteryx				4
Clioperla				3
Cultus				4
Helopicus				
Isogenoides				4
Isoperla bilineata				2
Isoperla nana				2
Isoperla				4
Malirekus				4
Pteronarcyidae:				
Pteronarcys				3
Taeniopterygidae:				

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Oemopteryx				4
Strophopteryx				4
Taeniopteryx burksi				2
Taeniopteryx				3
TRUE FLIES:				
Athericidae:				
Atherix				3
Ceratopogonidae	x			0
Chaoboridae:				
Chaoborus				0
Chironomidae:				
Ablabesmyia				2
Aricotopus				1
Apsectrotanypus				4
Brillia parva				4
Brillia				2
Brundiniella				4
Cardiocladius				2
Chaetocladius				1
Chernovskia				1
Chironomus	x	58	46	0
Cladopelma				1
Cladotanytarsus				2
Clinotanypus				1
Coelotanypus				1
Conchapelopia				2
Corynoneura				2
Cricotopus (C.) tremulus-gp				3
Cricotopus (C.) trifascia				3
Cricotopus (C.) others				2
Cricotopus(Isocladius)				0
Cryptochironomus				1
Cryptotendipes				2
Demicryptochironomus				1
Diamesa				3
Dicrotendipes				0
Diplocladius				3
Doncricotopus				3
Einfeldia				0
Endochironomus				0
Epoicocladius				2
Eukiefferiella claripennis-gp				1
Eukiefferiella				3
Glyptotendipes	x	36	16	0
Harnischia				1
Heleniella				4
Helopelopia				3
Heterotanytarsus				0
Heterotrissocladius hirtapex				2
Heterotrissocladius				1
Hydrobaenus				1
Labrundinia				1
Larsia				1
Lauterbouriella				0
Limnophyes				1
Lipiniella				1
Macropelopia				3
Meropelopia				3
Metriocnemus				3
Microchironomus				1
Microcricotopus				1
Micropectra				3
Microtendipes				2
Monodiamesa				1
Nanocladius				3
Natarsia				3
Nilotanypus				2
Nilothauma				1
Odontomesa				2
Orthocladius				
Pagastia				3
Pagastiella				0
Parachaetocladius				3
Parachironomus				1
Paracladopelma doris				3
Paracladopelma doris-gp				2
Paracladopelma galaptera				0
Paracladopelma nais				2
Paracladopelma nereis				3
Paracladopelma undine				2
Paracladopelma winnelli				2
Parakiefferiella				2

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Paralauterborniella				0
Paramerina				
Parametriocnemus				3
Paratanytarsus				1
Paratendipes				2
Pentaneura				2
Phaenopsectra				1
Polypedilum albicorne				3
Polypedilum angulum				
Polypedilum aviceps				3
Polypedilum fallax				1
Polypedilum flavum (convictum)				2
Polypedilum halterale				0
Polypedilum illinoense				1
Polypedilum laetum				2
Polypedilum nubeculosum				2
Polypedilum scalaenum				1
Polypedilum trigonus				0
Polypedilum tritum				0
Potthastia				1
Procladius				0
Prodiamesa				3
Protanypus				0
Psectrocladius	x			1
Psectrotanypus	x		4	0
Pseudochironomus				1
Rheocricotopus				2
Rheopelopia				3
Rheotanytarsus				3
Robackia				2
Saetheria				2
Stempellina				2
Stempellinella				3
Stenochironomus				2
Stictochironomus				2
Stilocladius				3
Sublettea				2
Sympotthastia				3
Syndiamesa				3
Synorthocladius				3
Tanypus				1
Tanytarsus				2
Thienemanniella				2
Thienemannimyia				2
Tribelos				1
Trissopelopia				2
Tvetenia				2
Unniella				
Xenochironomus	x	24	4	2
Xylotopus				2
Zalutisia				0
Zavrelimyia				2
Culicidae				0
Dixidae				1
Dolichopodidae				2
Empididae				2
Ephydriidae			1	1
Muscidae				1
Psychodidae				0
Ptychopteridae				1
Simuliidae				2
Stratiomyidae				0
Syrphidae				0
Tabanidae:				
Chrysops				2
Tabanus				0
Tipulidae:				
Antocha				3
Cryptolabis				4
Dactylobis				3
Dicranota				3
Erioptera				1
Helius				1
Hexatoma				2
Limnophila				2
Limonia				2
Ormosia				3
Pedicia				3
Pilaria				1
Pseudolimnophila				3
Tipula				
Crustaceans:				

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AMPHIPODS:				
Crangonyctidae:				
Crangonyx gracilis-cmpx				3
Crangonyx rivularis				3
Crangonyx	x	42	6	2
Gammaridae:				
Gammarus fasciatus				2
Gammarus lacustris				3
Gammarus pseudolimnae				3
Hyalidae:				
Hyalidae				2
CRAYFISHES:				
Cambaridae:				
Cambarus				1
Orconectes				2
Palaeomonetidae:				
Palaeomonetes				3
ISOPODS:				
Asellidae:				
Caecidotea	x	12		1
Lirceus				2
Molluscs:				
BIVALVES:				
Dreissenidae:				
Dreissena				1
Sphaeriidae:				
musculium lacustre				1
Musculium partumeium				1
Musculium securis				1
musculium transversum				2
Pisidium				1
Sphaerium fabale				3
Sphaerium occidentale				0
Sphaerium rhomboideum				1
Sphaerium simile				1
Sphaerium striatinum	x	6	6	2
Unionidae:				
Actinonaias carinata				2
Actinonaias ligamentina				3
Alasmidonta marginata				3
Alasmidonta viridis				3
Amblema plicata				2
Anodontoides ferussacianus				3
Carunculina parva				1
Cyclonaias tuberculata				2
Elliptio dilatata				1
Epioblasma(=Dysnomia)				2
Fusconaia flava				1
Lampsilis cardium				3
Lampsilis fasciola				3
Lampsilis radiata siliquioidea				1
Lampsilis ventricosa				1
Lasmigona complanata				1
Lasmigona compressa				3
Lasmigona costata				2
Leptodea fragilis				1
Ligumia nasuta				0
Ligumia recta				2
Obliquaria reflexa				1
Obovaria subrotunda				2
Pleurobema coccineum				1
Proptera alata				0
Ptychobranthus fasciolaris				3
Pyganodon (=Anodonta,in part)				1
Quadrula pustulosa				1
Quadrula quadrula				2
Simpsoniconcha ambigua				2
Strophitus undulatus				3
Truncilla				2
Villosa fabalis				2
Villosa iris				2
SNAILS:				
Ancylidae:				
Ferrissia fragilis				0
Ferrissia parallela				1
Ferrissia rivularis				2
Bithyniidae:				
Bithynia				1
Hydrobiidae:				
Amnicola				2
Birgella (=Somatogyrus)				2
Cincinnati				1

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Fontigens				3
Potamopyrgus				1
Probythinella				2
Lymnaeidae:				
Bulinnea				1
Fossaria				1
Lymnaea				1
Pseudosuccinea				0
Radix				1
Stagnicola				0
Physidae:				
Physella	x		6	0
Planorbidae:				
Gyraulus			2	1
Helisoma				1
Planorbella	x		4	0
Planorbula				1
Promenetus				2
Pleuroceridae:				
Elimia (=Goniobasis)				2
Pleurocera				1
Valvatidae:				
Valvata				2
Viviparidae:				
Campeloma				1
Cipangopaludina				1
Viviparus				1
Annelids:				
LEECHES:				
Erpobdellidae:				
Dina dubia				1
Dina parva				0
Erpobdella				1
Mooreobdella				2
Nepheleopsis				2
Hirudinidae:				
Haemopsis				1
Macrobodella				0
Glossiphoniidae:				
Alboglossiphonia				2
Batrachobdella				2
Glossiphonia				2
Helobdella elongata				1
Helobdella fusca				2
Helobdella papillata				1
Helobdella stagnalis				2
Helobdella triserialis				2
Placobdella				1
Theromyzon				
WORMS:				
enchytraeidae	x	10	8	1
Tubificidae:				
Aulodrilus				2
Bothrioneurum				2
Branchiura				0
Ilyodrilus				0
Isochaetides curvisetosus				3
Isochaetides freyi				1
Limnodrilus	x	60	60	0
Potamothenix bavaricus				2
Potamothenix moldaviensis				2
Potamothenix vejdvskyi				2
Quistadrilus				0
Rhyacodrilus				3
Spirosperma				1
Tasserkidrilus				2
Tubifex				0
Oligochaete				
no cheate				0
Platyhelminthes:				0
FLATWORMS:				
Alloeochoela				1
Tricladida				3
Total sum/0.05m2		248	164	
Total Taxa	18			
BioMap WQI		3.517806795	2.65488626	
avareage	3.086346528			
HBI rate	8.658653846			
EPT Richness (%)	0			
Percentage Oligochaetes	33.17307692			
Percentage Chironomidae	45.19230769			
Percentage Insects	73.07692308			

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Simpsons diversity	0.216856849			
Simpsons index of diversity	0.783143151			
Simpsons reciprocal	4.611336955			

Appendix **F**

Plant Species List

BOTANICAL NAME		COMMON NAME	COEFFICIENT OF CONSERVATISM	WET- NESS INDEX	WEED- INESS INDEX	PROVINCIAL STATUS	OMNR STATUS	COSE- WIC STATU S	GLOBAL STATUS	LOCAL STATUS MIDD
<u>PTERIDOPHYTES</u>		<u>FERNS & ALLIES</u>								
Dryopteridaceae		Wood Fern Family								
<i>Dryopteris</i>	<i>carthusiana</i>	Spinulose Wood Fern	5	-2		S5			G5	X
<i>Dryopteris</i>	<i>cristata</i>	Crested Wood Fern	7	-5		S5			G5	X
<i>Onoclea</i>	<i>sensibilis</i>	Sensitive Fern	4	-3		S5			G5	X
<i>Polystichum</i>	<i>acrostichoides</i>	Christmas Fern	5	5		S5			G5	X
Equisetaceae		Horsetail Family								
<i>Equisetum</i>	<i>arvense</i>	Field Horsetail	0	0		S5			G5	C
<i>Equisetum</i>	<i>hyemale</i> var. <i>affine</i>	Scouring-rush	2	-2		S5			G5T5	C
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Cupressaceae		Cedar Family								
<i>Juniperus</i>	<i>virginiana</i>	Eastern Red Cedar	4	3		S5			G5	X
<i>Thuja</i>	<i>occidentalis</i>	Eastern White Cedar	4	-3		S5			G5	X
Pinaceae		Pine Family								
<i>Picea</i>	<i>abies</i>	Norway Spruce		5	-1	SE3			G?	I
<i>Picea</i>	<i>glauca</i>	White Spruce	6	3		S5			G5	I
<i>Pinus</i>	<i>banksiana</i>	Jack Pine	9	3		S5			G5	I
<i>Pinus</i>	<i>nigra</i>	Austrian Pine		-5	-1	SE2			G?	
<i>Pinus</i>	<i>resinosa</i>	Red Pine	8	3		S5			G5	IR
<i>Pinus</i>	<i>strobus</i>	Eastern White Pine	4	3		S5			G5	X
<i>Pinus</i>	<i>sylvestris</i>	Scotch Pine		5	-3	SE5			G?	IR
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
<i>Acer</i>	<i>negundo</i>	Manitoba Maple	0	-2		S5			G5	C
<i>Acer</i>	<i>platanoides</i>	Norway Maple		5	-3	SE5			G?	IU
<i>Acer</i>	<i>saccharinum</i>	Silver Maple	5	-3		S5			G5	C
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
<i>Acer X</i>	<i>freemanii</i>	Freeman's Maple								

Anacardiaceae		Sumac or Cashew Family								
<i>Toxicodendron</i>	<i>radicans ssp. negundo</i>	Poison-ivy	5	-1		S5			G5T	X
<i>Rhus</i>	<i>hirta</i>	Staghorn Sumac	1	5		S5			G5	C
Apiaceae		Carrot or Parsley Family								
<i>Angelica</i>	<i>atropurpurea</i>	Dark-purple Alexanders	6	-5		S5			G5	C
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
<i>Sium</i>	<i>suave</i>	Hemlock Water-parsnip	4	-5		S5			G5	C
Apocynaceae		Dogbane Family								
<i>Apocynum</i>	<i>cannabinum</i>	Indian Hemp		1		S5			G5T	C
<i>Vinca</i>	<i>minor</i>	Periwinkle		5	-2	SE5			G?	IR
Aquifoliaceae		Holly Family								
<i>Nemopanthus</i>	<i>mucronatus</i>	Mountain-holly	8	-5		S5			G5	X
Aristolochiaceae		Duchman's-pipe Family								
<i>Aristolochia</i>	<i>clematitis</i>	Birthwort		5	-1	SE1			G?	
Asclepiadaceae		Milkweed Family								
<i>Asclepias</i>	<i>incarnata ssp. incarnata</i>	Swamp Milkweed	6	-5		S5			G5T5	C
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
<i>Achillea</i>	<i>millefolium var. millefolium</i>	Common Yarrow		3	-1	SE?			G5T?	
<i>Ambrosia</i>	<i>artemisiifolia</i>	Common Ragweed	0	3		S5			G5	C
<i>Ambrosia</i>	<i>trifida</i>	Giant Ragweed	0	-1		S5			G5	C
<i>Arctium</i>	<i>minus</i>	Common Burdock		5	-2	SE5			G?T?	IC
<i>Artemisia</i>	<i>vulgaris</i>	Common Mugwort		5	-1	SE5			G?	IR
<i>Symphyotrichum</i>	<i>cordifolium</i>	Heart-leaved Aster	5	5		S5			G5	C
<i>Symphyotrichum</i>	<i>ericoides var. pansus</i>	Mayflowered Aster	4	4		S1			G5T?	
<i>Symphyotrichum</i>	<i>lanceolatum</i>	Tall White Aster	3	-3		S5			G5T?	C
<i>Symphyotrichum</i>	<i>lateriflorum</i>	Calico Aster	3	-2		S5			G5T5	C
<i>Eurybia</i>	<i>macrophylla</i>	Large-leaved Aster	5	5		S5			G5	C
<i>Symphyotrichum</i>	<i>puniceum var. puniceum</i>	Purple-stemmed Aster	6	-5		S5			G5T?	X
<i>Bidens</i>	<i>frondosa</i>	Devil's Beggar-ticks	3	-3		S5			G5	X
<i>Carduus</i>	<i>nutans ssp. nutans</i>	Musk Thistle		5	-1	SE?			G?T?	
<i>Centaurea</i>	<i>jacea</i>	Brown Knapweed		5	-1	SE5			G?	I
<i>Centaurea</i>	<i>biebersteinii</i>	Spotted Knapweed		5	-3	SE5			G?	I
<i>Leucanthemum</i>	<i>vulgare</i>	Ox-eye Daisy		5	-1	SE5			G?	
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Cirsium</i>	<i>arvense</i>	Canada Thistle		3	-1	SE5			G?	IC
<i>Cirsium</i>	<i>vulgare</i>	Bull Thistle		4	-1	SE5			G5	I
<i>Erigeron</i>	<i>annus</i>	Eastern Daisy Fleabane	0	1		S5			G5	
<i>Erigeron</i>	<i>philadelphicus ssp. philadelphicus</i>	Philadelphia Fleabane	1	-3		S5			G5T?	C
<i>Inula</i>	<i>helenium</i>	Elecampane		5	-2	SE5			G?	I
<i>Lactuca</i>	<i>serriola</i>	Prickly Lettuce		0	-1	SE5			G?	I
<i>Rudbeckia</i>	<i>hirta</i>	Black-eyed Susan	0	3		S5			G5	C
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				U
<i>Solidago</i>	<i>caesia</i>	Blue-stem Goldenrod	5	3		S5			G5	X

<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>flexicaulis</i>	Zig-zag Goldenrod	6	3		S5			G5	X
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
<i>Solidago</i>	<i>junceae</i>	Early Goldenrod	3	5		S5			G5	X
<i>Solidago</i>	<i>nemoralis ssp. nemoralis</i>	Gray Goldenrod	2	5		S5			G5T?	X
<i>Sonchus</i>	<i>arvensis ssp. arvensis</i>	Field Sow-thistle			-1	SE5			G?T?	I
<i>Tanacetum</i>	<i>vulgare</i>	Common Tansy		5	-1	SE5			G?	I
<i>Taraxacum</i>	<i>officinale</i>	Common Dandelion		3	-2	SE5			G5	IC
<i>Tragopogon</i>	<i>dubius</i>	Doubtful Goat's-beard		5	-1	SE5			G?	I
<i>Tussilago</i>	<i>farfara</i>	Coltsfoot		3	-2	SE5			G?	IC
<i>Xanthium</i>	<i>strumarium</i>	Tumor-curing Cocklebur	2	0		S5			G?	C
Balsaminaceae		Touch-me-not Family								
<i>Impatiens</i>	<i>capensis</i>	Spotted Touch-me-not	4	-3		S5			G5	C
Berberidaceae		Barberry Family								
<i>Caulophyllum</i>	<i>thalictroides</i>	Blue Cohosh	6	5		S5			G	X
<i>Podophyllum</i>	<i>peltatum</i>	May-apple	5	3		S5			G5	X
Betulaceae		Birch Family								
<i>Carpinus</i>	<i>caroliniana ssp. virginiana</i>	Blue Beech	6	0		S5			G5T	C
<i>Corylus</i>	<i>americana</i>	American Hazel	5	4		S5			G5	C
<i>Ostrya</i>	<i>virginiana</i>	Hop Hornbeam - Ironwood	4	4		S5			G5	C
Brassicaceae		Mustard Family								
<i>Alliaria</i>	<i>petiolata</i>	Garlic Mustard		0	-3	SE5			G5	IC
<i>Nasturtium</i>	<i>officinale</i>	Water-cress		-5	-1	SE?			G?	I
Caprifoliaceae		Honeysuckle Family								
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	I
<i>Sambucus</i>	<i>nigra ssp. canadensis</i>	Common Elderberry	5	-2		S5			G5	X
<i>Sambucus</i>	<i>racemosa var. racemosa</i>	Red-berried Elderberry	5	2		S5			G5T4T5	X
<i>Silene</i>	<i>vulgaris</i>	Catchfly		5	-1	SE5			G?	I
<i>Viburnum</i>	<i>acerifolium</i>	Maple-leaved Viburnum	6	5		S5			G5	X
<i>Viburnum</i>	<i>lentago</i>	Nannyberry	4	-1		S5			G5	C
<i>Viburnum</i>	<i>opulus</i>	Guelder Rose		0	-1	SE4			G5	IR
<i>Viburnum</i>	<i>rafinesquianum</i>	Downy Arrow-wood	7	5		S5			G5	X
Caryophyllaceae		Pink Family								
<i>Stellaria</i>	<i>graminea</i>	Grass-leaved Stitchwort		5	-2	SE5			G?	I
Celastraceae		Staff-tree Family								
<i>Euonymus</i>	<i>obovata</i>	Running Strawberry-bush	6	5		S5			G5	C
Chenopodiaceae		Goosefoot Family								
<i>Chenopodium</i>	<i>album var. album</i>	Lamb's Quarters		1	-1	SE5			G5T5	I
Convolvulaceae		Morning-glory Family								
<i>Convolvulus</i>	<i>arvensis</i>	Field Bindweed		5	-1	SE5			G?	I
Cornaceae		Dogwood Family								
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	C
Cucurbitaceae		Gourd Family								

<i>Echinocystis</i>	<i>lobata</i>	Prickly Cucumber	3	-2		S5			G5	X
Dipsacaceae		Teasel Family								
<i>Dipsacus</i>	<i>fullonum ssp. sylvestris</i>	Wild Teasel		5	-1	SE5			G?T?	IC
Elaeagnaceae		Oleaster Family								
<i>Elaeagnus</i>	<i>angustifolia</i>	Russian Olive		4	-1	SE3			G?	
Fabaceae		Pea Family								
<i>Coronilla</i>	<i>varia</i>	Variable Crown-vetch		5	-2	SE5			G?	I
<i>Gleditsia</i>	<i>triacanthos</i>	Honey Locust	3	0		S2			G5	I
<i>Lotus</i>	<i>corniculatus</i>	Bird's-foot Trefoil		1	-2	SE5			G?	I
<i>Medicago</i>	<i>lupulina</i>	Black Medick		1	-1	SE5			G?	IC
<i>Medicago</i>	<i>sativa ssp. sativa</i>	Alfalfa		5	-1	SE5			G?T?	IC
<i>Melilotus</i>	<i>alba</i>	White Sweet-clover		3	-3	SE5			G?	IC
<i>Melilotus</i>	<i>officinalis</i>	Yellow Sweet-clover		3	-1	SE5			G?	IC
<i>Robinia</i>	<i>pseudo-acacia</i>	Black Locust		4	-3	SE5			G5	IC
<i>Trifolium</i>	<i>pratense</i>	Red Clover		2	-2	SE5			G?	I
<i>Trifolium</i>	<i>repens</i>	White Clover		2	-1	SE5			G?	I
<i>Vicia</i>	<i>cracca</i>	Tufted Vetch		5	-1	SE5			G?	I
Fagaceae		Beech Family								
<i>Fagus</i>	<i>grandifolia</i>	American Beech	6	3		S5			G5	C
<i>Quercus</i>	<i>alba</i>	White Oak	6	3		S5			G5	C
<i>Quercus</i>	<i>macrocarpa</i>	Bur Oak	5	1		S5			G5	C
<i>Quercus</i>	<i>rubra</i>	Red Oak	6	3		S5			G5	C
Geraniaceae		Geranium Family								
<i>Geranium</i>	<i>maculatum</i>	Spotted Crane's-bill	6	3		S5			G5	X
<i>Geranium</i>	<i>robertianum</i>	Herb-robert		5	-2	SE5			G5	IC
Grossulariaceae		Currant Family								
<i>Ribes</i>	<i>americanum</i>	Wild Black Currant	4	-3		S5			G5	C
<i>Ribes</i>	<i>rubrum</i>	Red Currant		5	-2	SE5			G4G5	IR
<i>Ribes</i>	<i>triste</i>	Wild Red Currant	6	-5		S5			G5	X
Guttiferae		St. John's-wort Family								
<i>Hypericum</i>	<i>perforatum</i>	Common St. John's-wort		5	-3	SE5			G?	IC
Hamamelidaceae		Witch-hazel Family								
<i>Hamamelis</i>	<i>virginiana</i>	Witch-hazel	6	3		S5			G5	X
Hippocastanaceae		Buckeye Family								
<i>Aesculus</i>	<i>hippocastanum</i>	Horse Chestnut		5	-1	SE2			G?	IR
Hydrophyllaceae		Water-leaf Family								
<i>Hydrophyllum</i>	<i>virginianum</i>	Virginia Water-leaf	6	-2		S5			G5	C
Juglandaceae		Walnut Family								
<i>Carya</i>	<i>cordiformis</i>	Bitternut hickory	6	0		S5			G5	X
<i>Carya</i>	<i>ovata</i>	Shagbark Hickory	6	3		S5			G5	X
<i>Juglans</i>	<i>regia</i>	English Walnut		5	-1	SE1			G?	
Lamiaceae		Mint Family								
<i>Glechoma</i>	<i>hederacea</i>	Creeping Charlie		5	-2	SE5			G?	I
<i>Leonurus</i>	<i>cardiaca ssp. cardiaca</i>	Common Motherwort		5	-2	SE5			G?T?	IC

<i>Lycopus</i>	<i>americanus</i>	Cut-leaved Water-horehound	4	-5		S5			G5	C
<i>Prunella</i>	<i>vulgaris ssp. vulgaris</i>	Common Heal-all		0	-1	SE3			G5T?	
Lythraceae		Loosestrife Family								
<i>Lythrum</i>	<i>salicaria</i>	Purple Loosestrife		-5	-3	SE5			G5	IC
Moraceae		Mulberry Family								
<i>Morus</i>	<i>alba</i>	White Mulberry		0	-3	SE5			G?	I
Oleaceae		Olive Family								
<i>Fraxinus</i>	<i>americana</i>	White Ash	4	3		S5			G5	C
<i>Fraxinus</i>	<i>nigra</i>	Black Ash	7	-4		S5			G5	X
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	C
<i>Ligustrum</i>	<i>vulgare</i>	Common Privet		1	-2	SE5			G?	I
<i>Syringa</i>	<i>vulgaris</i>	Common Lilac		5	-2	SE5			G?	I
Onagraceae		Evening-primrose Family								
<i>Circaea</i>	<i>lutetiana ssp. canadensis</i>	Enchanter's Nightshade	3	3		S5			G5T5	X
<i>Epilobium</i>	<i>ciliatum ssp. ciliatum</i>	Ciliate Willow-herb	3	3		S5			G5T?	X
<i>Epilobium</i>	<i>hirsutum</i>	Great Hairy Willow-herb		-4	-2	SE5			G?	I
<i>Oenothera</i>	<i>biennis</i>	Common Evening-primrose	0	3		S5			G5	R1
Oxalidaceae		Wood Sorrel Family								
<i>Oxalis</i>	<i>stricta</i>	Upright Yellow Wood-sorrel	0	3		S5			G5	X
Papaveraceae		Poppy Family								
<i>Chelidonium</i>	<i>majus</i>	Celandine		5	-3	SE5			G?	I
Plantaginaceae		Plantain Family								
<i>Plantago</i>	<i>lanceolata</i>	Ribgrass		0	-1	SE5			G5	IC
<i>Plantago</i>	<i>major</i>	Common Plantain		-1	-1	SE5			G5	IC
Polygonaceae		Smartweed Family								
<i>Polygonum</i>	<i>persicaria</i>	Lady's-thumb		-3	-1	SE5			G?	I
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	IC
Primulaceae		Primrose Family								
<i>Lysimachia</i>	<i>nummularia</i>	Moneywort		-4	-3	SE5			G?	I
Ranunculaceae		Buttercup Family								
<i>Anemone</i>	<i>canadensis</i>	Canada Anemone	3	-3		S5			G5	C
<i>Ranunculus</i>	<i>acris</i>	Tall Buttercup			-2	SE5			G5	IC
<i>Ranunculus</i>	<i>aquatilis var. diffusus</i>	White Water-crowfoot				S5			G5T	
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC
<i>Frangula</i>	<i>alnus</i>	Glossy Buckthorn		-1	-3	SE5			G?	IU
Rosaceae		Rose Family								
<i>Agrimonia</i>	<i>gryposepala</i>	Tall Hairy Agrimony	2	2		S5			G5	C
<i>Amelanchier</i>	<i>arborea</i>	Downy Juneberry		3		S5			G5	C
<i>Crataegus</i>	<i>species</i>	Hawthorn species								
<i>Crataegus</i>	<i>monogyna</i>	English Hawthorn		5	-1	SE5			G5	I
<i>Fragaria</i>	<i>vesca ssp. americana</i>	Woodland Strawberry	4	4		S5			G5T?	X
<i>Fragaria</i>	<i>virginiana</i>	Virginia Strawberry	2	1		SU			G5T?	C
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1		S5			G5	X

<i>Geum</i>	<i>canadense</i>	White Avens	3	0		S5			G5	X
<i>Malus</i>	<i>pumila</i>	Common Crabapple		5	-1	SE5			G5	I
<i>Potentilla</i>	<i>norvegica ssp. norvegica</i>	Cinquefoil	0			SU			G5T?	X
<i>Potentilla</i>	<i>simplex</i>	Old-field Cinquefoil	3	4		S5			G5	X
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3		S5			G5	C
<i>Prunus</i>	<i>virginiana</i>	Choke Cherry	2	1		S5			G5T?	C
<i>Pyrus</i>	<i>communis</i>	Common Pear		5	-1	SE4			G5	I
<i>Rosa</i>	<i>multiflora</i>	Multiflora Rose		3	-3	SE4			G?	I
<i>Rubus</i>	<i>idaeus</i>	Red Raspberry	0		-2	SE1			G5T5	
<i>Spiraea</i>	<i>alba</i>	Narrow-leaved Meadow-sweet	3	-4		S5			G5	X
Rubiaceae		Madder Family								
<i>Cephalanthus</i>	<i>occidentalis</i>	Eastern Buttonbush	7	-5		S5			G5	X
<i>Galium</i>	<i>mollugo</i>	White Bedstraw		5	-2	SE5			G?	I
<i>Galium</i>	<i>triflorum</i>	Sweet-scented Bedstraw	4	2		S5			G5	X
Rutaceae		Rue Family								
<i>Zanthoxylum</i>	<i>americanum</i>	American Prickly-ash	3	5		S5			G5	C
Salicaceae		Willow Family								
<i>Populus</i>	<i>balsamifera ssp. balsamifera</i>	Balsam Poplar	4	-3		S5			G5T?	X
<i>Populus</i>	<i>deltoides ssp. deltoides</i>	Eastern Cottonwood	4	-1		SU			G5T?	X
<i>Populus</i>	<i>tremuloides</i>	Trembling Aspen	2	0		S5			G5	X
<i>Salix</i>	<i>species</i>	Willow species								
<i>Salix</i>	<i>discolor</i>	Pussy Willow	3	-3		S5			G5	X
<i>Salix</i>	<i>eriocephala</i>	Missouri Willow	4	-3		S5			G5	X
<i>Salix</i>	<i>exigua</i>	Sandbar Willow	3	-5		S5			G5	C
<i>Salix</i>	<i>fragilis</i>	Crack Willow		-1	-3	SE5			G?	I
<i>Salix</i>	<i>nigra</i>	Black Willow	6	-5		S4?			G5	X
<i>Salix</i>	<i>petiolaris</i>	Slender Willow	3	-4		S5			G4	X
<i>Salix X</i>	<i>rubens</i>	Reddish Willow		-4	-3	SE4			HYB	IR
Scrophulariaceae		Figwort Family								
<i>Chelone</i>	<i>glabra</i>	Turtlehead	7	-5		S5			G5	X
<i>Linaria</i>	<i>vulgaris</i>	Butter-and-eggs		5	-1	SE5			G?	IC
<i>Verbascum</i>	<i>thapsus</i>	Common Mullein		5	-2	SE5			G?	IC
<i>Veronica</i>	<i>officinalis</i>	Common Speedwell		5	-2	SE5			G5	I
Solanaceae		Nightshade Family								
<i>Solanum</i>	<i>dulcamara</i>	Bitter Nightshade		0	-2	SE5			G?	IC
Tiliaceae		Linden Family								
<i>Tilia</i>	<i>americana</i>	American Basswood	4	3		S5			G5	C
Ulmaceae		Elm Family								
<i>Celtis</i>	<i>occidentalis</i>	Common Hackberry	8	1		S4			G5	X
<i>Ulmus</i>	<i>americana</i>	White Elm	3	-2		S5			G5?	X
Urticaceae		Nettle Family								
<i>Urtica</i>	<i>dioica ssp. dioica</i>	European Stinging Nettle		-1	-1	SE2			G5T?	IR
Verbenaceae		Vervain Family								
<i>Verbena</i>	<i>hastata</i>	Blue Vervain	4	-4		S5			G5	C

<i>Verbena</i>	<i>urticifolia</i>	White Vervain	4	-1		S5			G5	X
Violaceae		Violet Family								
<i>Viola</i>	<i>pubescens</i>	Downy Yellow Violet	5	4		S5			G5	C
<i>Viola</i>	<i>sororia</i>	Woolly Blue Violet	4	1		S5			G5	X
Vitaceae		Grape Family								
<i>Parthenocissus</i>	<i>inserta</i>	Inserted Virginia-creeper	3	3		S5			G5	X
<i>Vitis</i>	<i>riparia</i>	Riverbank Grape	0	-2		S5			G5	C
<u>MONOCOTYLEDONS</u>		<u>MONOCOTS</u>								
Alismataceae		Water-plantain Family								
<i>Alisma</i>	<i>plantago-aquatica</i>	Common Water-plantain	3	-5		S5			G5	C
<i>Sagittaria</i>	<i>latifolia</i>	Broad-leaved Arrowhead	4	-5		S5			G5	C
Araceae		Arum Family								
<i>Symplocarpus</i>	<i>foetidus</i>	Skunk-cabbage	7	-5		S5			G5	C
Cyperaceae		Sedge Family								
<i>Carex</i>	<i>aquatilis</i>	Aquatic Sedge	7	-5		S5			G5	VU
<i>Carex</i>	<i>communis</i>	Fibrous Rooted Sedge	6	5		S5			G5	C
<i>Carex</i>	<i>crinita</i>	Fringed Sedge	6	-4		S5			G5	C
<i>Carex</i>	<i>gracillima</i>	Graceful Sedge	4	3		S5			G5	C
<i>Carex</i>	<i>intumescens</i>	Bladder Sedge	6	-4		S5			G5	C
<i>Carex</i>	<i>pennsylvanica</i>	Pennsylvania Sedge	5	5		S5			G5	C
<i>Carex</i>	<i>plantaginea</i>	Plantain-leaved Sedge	7	5		S5			G5	C
<i>Carex</i>	<i>platyphylla</i>	Broad-leaved Sedge	7	5		S5			G5	
<i>Carex</i>	<i>rosea</i>	Stellate Sedge	5	5		S5			G5	C
<i>Carex</i>	<i>spicata</i>	Spiked Sedge		5	-1	SE5			G?	IC
<i>Carex</i>	<i>vulpinoidea</i>	Fox Sedge	3	-5		S5			G5	C
<i>Cyperus</i>	<i>odoratus</i>	Fragrant Umbrella Sedge	5	-3		S5			G5	R5
<i>Eleocharis</i>	<i>acicularis</i>	Needle Spike-rush	5	-5		S5			G5	VU
<i>Scirpus</i>	<i>atrovirens</i>	Dark-green Bulrush	3	-5		S5			G5?	C
<i>Scirpus</i>	<i>cyperinus</i>	Wool-grass	4	-5		S5			G5	C
<i>Schoenoplectus</i>	<i>tabernaemontani</i>	American Great Bulrush/softstem bulr	5	-5		S5			G?	C
Iridaceae		Iris Family								
<i>Iris</i>	<i>versicolor</i>	Multi-coloured Blue-flag	5	-5		S5			G5	X
Juncaceae		Rush Family								
<i>Juncus</i>	<i>articulatus</i>	Jointed Rush	5	-5		S5			G5	VU
<i>Juncus</i>	<i>effusus</i> var. <i>solutus</i>	Soft Rush	4	-5		S5			G5T?	X
<i>Juncus</i>	<i>tenuis</i>	Path Rush	0	0		S5			G5	X
Lemnaceae		Duckweed Family								
<i>Lemna</i>	<i>minor</i>	Lesser Duckweed	2	-5		S5			G5	X
<i>Lemna</i>	<i>trisulca</i>	Star Duckweed	4	-5		S5			G5	X
Liliaceae		Lily Family								
<i>Erythronium</i>	<i>americanum</i> ssp. <i>americanum</i>	Yellow Dog's-tooth Violet	5	5		S5			G5T5	X
<i>Maianthemum</i>	<i>racemosum</i> ssp. <i>racemosum</i>	False Solomon's Seal	4	3		S5			G5T	X
<i>Trillium</i>	<i>grandiflorum</i>	White Trillium	5	5		S5			G5	X
Poaceae		Grass Family								

<i>Agrostis</i>	<i>gigantea</i>	Red-top		0	-2	SE5			G4G5	IC
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	C
<i>Bromus</i>	<i>inermis</i> ssp. <i>inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	IC
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	IC
<i>Glyceria</i>	<i>striata</i>	Fowl Meadow Grass	3	-5		S5			G5	X
<i>Hordeum</i>	<i>jubatum</i> ssp. <i>jubatum</i>	Squirrel-tail Grass		-1	-1	SE5			G5T?	I
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	IC
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	X
<i>Poa</i>	<i>palustris</i>	Fowl Meadow Grass	5	-4		S5			G5	X
<i>Poa</i>	<i>pratensis</i> ssp. <i>pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	C
<i>Setaria</i>	<i>pumila</i>	Yellow Foxtail		0	-1	SE5			G?	I
<i>Setaria</i>	<i>viridis</i>	Green Foxtail			-1	SE5			G?	I
Typhaceae		Cattail Family								
<i>Typha</i>	<i>angustifolia</i>	Narrow-leaved Cattail	3	-5		S5			G5	X
<i>Typha</i>	<i>latifolia</i>	Broad-leaved Cattail	3	-5		S5			G5	X
FLORISTIC SUMMARY & ASSESSMENT										
Species Diversity										
Total Species:		232								
Native Species:		144	62.07%							
Exotic Species		88	37.93%							
Total Taxa in Region (List Region, Source)		10000								
% Regional Taxa Recorded		2.32%								
Regionally Significant Species		enter manually								
S1-S3 Species		enter manually								
S4 Species		1								
S5 Species		140								
Co-efficient of Conservatism and Floral Quality Index										
Co-efficient of Conservatism (CC) (average)		3.91								
CC 0 to 3	lowest sensitivity	57	39.58%							
CC 4 to 6	moderate sensitivity	74	51.39%							
CC 7 to 8	high sensitivity	12	8.33%							
CC 9 to 10	highest sensitivity	1	0.69%							
Floral Quality Index (FQI)		46.92								
Presence of Weedy & Invasive Species										
mean weediness		-1.72								
weediness = -1	low potential invasiveness	44	50.00%							
weediness = -2	moderate potential invasiveness	25	28.41%							
weediness = -3	high potential invasiveness	19	21.59%							



Presence of Wetland Species										
<i>average wetness value</i>		0.83								
<i>upland</i>		60	25.86%							
<i>facultative upland</i>		56	24.14%							
<i>facultative</i>		41	17.67%							
<i>facultative wetland</i>		40	17.24%							
<i>obligate wetland</i>		32	13.79%							

Appendix **G**

ELC Community Descriptions

Natural Heritage Feature ID	Property ID	ELC Code	ELC Inclusion/ Complex	Size of Feature (ha)	ELC Description	Significant Feature	Significance
	3298 Scotland Dr	CUP3-2	CUM1-1		This cultural plantation community was located at the southern end of the property along Scotland Drive. Forest canopy cover was dominant at greater than 60% cover and dominant species included white pine (<i>Pinus strobus</i>) and Norway spruce (<i>Picea abies</i>). Sub-canopy cover included White pine, American elm (<i>Ulmus americana</i>), red-osier dogwood (<i>Cornus sericea</i>) and black cherry (<i>Prunus serotina</i>). Ground cover was dominated by garlic mustard (<i>Alliaria petiolata</i>) and Pennsylvania sedge (<i>Carex pensylvanica</i>). A cultural meadow inclusion was present within the community.	Significant Woodland	Municipal
	3298 Scotland Dr	MAM2-2	MAS2		property. Ground cover species were dominant at over 60% cover with the most frequent species being reed canary grass (<i>Phalaris arundinacea</i>) and broad-leaved cattail (<i>Typha latifolia</i>), with vervain species (<i>Verbena sp.</i>). Sub canopy species included willow species (<i>Salix sp</i>). A mineral shallow marsh inclusion was present within the community.		
	3137 Scotland Dr	CUM1-1	CUW1/SWT2-2		This cultural meadow community was located surrounding a pond and along the roadside in the north east end of the property. Ground cover was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), bird's-foot trefoil (<i>Lotus corniculata</i>), tall goldenrod (<i>Solidago altissima</i>) and heath aster (<i>Symphyotrichum ericoides</i>). This community was complexed with a willow mineral thicket swamp and a mineral cultural woodland inclusion was also present.		
	3137 Scotland Dr	CUM1-1	MAM2		This cultural meadow community was located surrounding a pond and along the roadside in the north east end of the property. Ground cover was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), tall goldenrod (<i>Solidago altissima</i>), bird's-foot trefoil (<i>Lotus corniculata</i>), and heath aster (<i>Symphyotrichum ericoides</i>). A mineral shallow marsh inclusion was present within this community.		
	3405 Scotland Dr	CUP3	OAD/CUM1-1		This cultural plantation community was located along the southern side of a pond in the northern portion of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included Scot's pine (<i>Pinus sylvestris</i>), eastern white cedar (<i>Thuja occidentalis</i>) and sugar maple (<i>Acer saccharum</i>). The shrub layer consisted of common buckthorn (<i>Rhamnus cathartica</i>), tartarian honeysuckle (<i>Lonicera tatarica</i>) and red-osier dogwood (<i>Cornus sericea</i>). Ground cover was dominated by smooth brome grass (<i>Bromus inermis</i>), common dandelion (<i>Taraxicum officianale</i>) and wild carrot (<i>Daucus carota</i>). This community was complexed with a cultural meadow and an open aquatic inclusion was also present.		

	3438 Manning Dr	FOD2-3			This dry-fresh hickory deciduous forest community was located at the northern end of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included shagbark hickory (<i>Carya ovata</i>). The sub-canopy consisted of shagbark hickory and black walnut (<i>Juglans nigra</i>). The shrub layer was comprised of common buckthorn (<i>Rhamnus cathartica</i>), and choke cherry (<i>Prunus virginiana</i>), while ground cover was dominated by young shagbark hickory, garlic mustard (<i>Alliaria petiolata</i>), and timothy (<i>Phleum pratense</i>).		
	3465 Scotland Dr	CUM1-1	MAS2/CUT1		Ground cover was dominant at greater than 60% cover with the most frequent species being smooth brome grass (<i>Bromus inermis</i>), canada goldenrod (<i>Solidago canadensis</i>), kentucky bluegrass (<i>Poa pratensis</i>), and spiked sedge (<i>Carex spicata</i>). The shrub layer was comprised of common buckthorn (<i>Rhamnus cathartica</i>), gray dogwood (<i>Cornus racemosa</i>), common apple (<i>Malus pumila</i>) and hawthorn species (<i>Crataegus sp</i>). The tree layer was comprised of sparse white ash (<i>Fraxinus americana</i>), black walnut (<i>Juglans nigra</i>) and eastern cottonwood (<i>Populus deltoides</i>). This community was complexed with a mineral cultural thicket and a mineral shallow marsh inclusion was also present.		
	3483 Westminster Dr	CUT1			This mineral cultural thicket was located in the southeastern portion of the property. Tall shrub layer species were dominant in this community at over 60% cover with the most frequent species being common buckthorn (<i>Rhamnus cathartica</i>) and hawthorn species (<i>Crataegus sp</i>), while the general shrub layer was dominated by common buckthorn, gray dogwood (<i>Cornus racemosa</i>) and tartarian honeysuckle (<i>Lonicera tatarica</i>). Ground cover consisted of Pennsylvania sedge (<i>Carex pensylvanica</i>), yellow trout-lily (<i>Erythronium americanum</i>) and wild strawberry (<i>Fragaria virginiana</i>).		
	3483 Westminster Dr	FOD5			of the natural feature. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), green ash (<i>Fraxinus pennsylvanica</i>), and American beech (<i>Fagus grandifolia</i>). The sub-canopy was dominated by American beech. The shrub layer was comprised of common buckthorn (<i>Rhamnus cathartica</i>), tartarian honeysuckle (<i>Lonicera tatarica</i>) and gray dogwood (<i>Cornus racemosa</i>). Ground cover consisted of Pennsylvania sedge (<i>Carex pensylvanica</i>) yellow trout-lily (<i>Erythronium americanum</i>), and garlic mustard (<i>Alliaria petiolata</i>).		
	3483 Westminster Dr	FOD2-4			This deciduous forest was located in the southern portion of the property adjacent to Scotland Drive. Forest canopy cover was dominant at greater than 60% cover and dominant species included white oak (<i>Quercus alba</i>), ironwood (<i>Ostrya virginiana</i>), and red oak (<i>Quercus rubra</i>). The sub-canopy was comprised of ironwood, sugar maple (<i>Acer saccharum</i>), and white oak. The shrub layer was dominated by common buckthorn (<i>Rhamnus cathartica</i>) and black cherry (<i>Prunus serotina</i>). Ground cover consisted primarily of yellow trout-lily (<i>Erythronium americanum</i>).		

	3483 Westminster Dr	FOD2-4			end of the natural feature. Forest canopy cover was dominant at greater than 60% cover and dominant species included red oak (<i>Quercus rubra</i>), white oak (<i>Quercus alba</i>), and American beech (<i>Fagus grandifolia</i>). The sub-canopy was dominated by sugar maple (<i>Acer saccharum</i>), ironwood (<i>Ostrya virginiana</i>), and common buckthorn (<i>Rhamnus cathartica</i>). The shrub layer was comprised of common buckthorn, black cherry (<i>Prunus serotina</i>), and gray dogwood (<i>Cornus racemosa</i>). Ground cover was comprised of yellow trout-lily (<i>Erythronium americanum</i>) and common speedwell (<i>Veronica officinalis</i>).		
	3483 Westminster Dr	SWD	SWT2-5		centre of the natural feature. The canopy layer was dominated by green ash (<i>Fraxinus pennsylvanica</i>), hybrid white willow (<i>Salix x fragilis</i>) and silver maple (<i>Acer saccharinum</i>), while the sub-canopy consisted of green ash, sugar maple (<i>Acer saccharum</i>) and common buckthorn (<i>Rhamnus cathartica</i>). The shrub layer was dominated by gray dogwood (<i>Cornus racemosa</i>), common red raspberry (<i>Rubus idaeus</i>) and common buckthorn. Ground cover was dominated by reed canary grass (<i>Phalaris arundinacea</i>). A red-osier mineral thicket swamp inclusion was present within the community.		
	3483 Westminster Dr	MAM2	SWT2		This mineral meadow marsh community was located in the north portion of the property. Ground cover species were dominant at over 60% cover with the most frequent species being common reed (<i>Phragmites australis</i>), reed canary grass (<i>Phalaris arundinacea</i>), and sedge species (<i>Carex sp</i>). The shrub layer comprised of gray dogwood (<i>Cornus racemosa</i>), common red raspberry (<i>Rubus idaeus</i>), spiraea species (<i>Spiraea sp</i>), and sandbar willow (<i>Salix exigua</i>). The sparse canopy layer consisted of green ash (<i>Fraxinus pennsylvanica</i>), sugar maple (<i>Acer saccharum</i>), black willow (<i>Salix nigra</i>) and common buckthorn (<i>Rhamnus cathartica</i>). A mineral thicket swamp inclusion was present within the community.		
	3483 Westminster Dr	OAD	MAS2/SWT2-5		This open water community was located in the centre of the natural feature near the western portion of the property. The mineral shallow marsh inclusion and red-osier mineral thicket swamp situated along the north and eastern sides of the open water community. The shrub layer consisted of red-osier dogwood (<i>Cornus sericea</i>), gray dogwood (<i>Cornus racemosa</i>), and common buckthorn (<i>Rhamnus cathartica</i>), while the ground cover was dominated by broad-leaved cattail (<i>Typha latifolia</i>) and reed canary grass (<i>Phalaris arundinacea</i>).		
	3502 Manning Dr	CUM1-1	Treerow		This cultural meadow community was located throughout the property. Ground cover was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), common reed (<i>Phragmites australis</i>), smooth brome grass (<i>Bromus inermis</i>) and reed canary grass (<i>Phalaris arundinacea</i>). A planted treerow consisting of balsam poplar (<i>Populus balsamifera</i>), Norway spruce (<i>Picea abies</i>), white oak (<i>Quercus alba</i>) and sandbar willow (<i>Salix exigua</i>).		

	3502 Scotland Dr	CUP3			This cultural plantation community was located along the central portion of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included white pine (<i>Pinus strobus</i>), Norway spruce (<i>Picea abies</i>) and Scot's pine (<i>Pinus sylvestris</i>). The sub-canopy consisted of sugar maple (<i>Acer saccharum</i>) and green ash (<i>Fraxinus pennsylvanica</i>). The shrub layer was dominated by common buckthorn (<i>Rhamnus cathartica</i>), black cherry (<i>Prunus virginiana</i>) and tartarian honeysuckle (<i>Lonicera tatarica</i>), while the ground layer consisted of garlic mustard (<i>Alliaria petiolata</i>) and wooly blue violet (<i>Viola sororia</i>).		
	3502 Scotland Dr	FOD5-5	SWT2-5/SWD2		This deciduous forest was located in the south west portion of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), shagbark hickory (<i>Carya ovata</i>), American beech (<i>Fagus grandifolia</i>), and red oak (<i>Quercus rubra</i>), while the sub-canopy consisted of sugar maple, shagbark hickory, and green ash (<i>Fraxinus pennsylvanica</i>). The shrub layer consists of sugar maple, American beech, common buckthorn (<i>Rhamnus cathartica</i>), and black cherry (<i>Prunus virginiana</i>). The ground cover was comprised of young sugar maple, yellow trout-lily (<i>Erythronium americanum</i>) and white trillium (<i>Trillium grandiflorum</i>). Inclusions of a red-osier mineral thicket swamp and an ash mineral deciduous swamp ecosite were present within this community.		
	3583 Westminster Dr	FOD5-5	MAM2/CUT		This deciduous forest was located throughout the southern and extends towards the northern portion of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), shagbark hickory (<i>Carya ovata</i>), red oak (<i>Quercus rubra</i>) and American beech (<i>Fagus grandifolia</i>). The sub-canopy consisted of sugar maple, shagbark hickory, red oak and ironwood (<i>Ostrya virginiana</i>). The shrub layer was dominated by sugar maple, American beech, black cherry (<i>Prunus virginiana</i>), and common buckthorn (<i>Rhamnus cathartica</i>). The ground cover was comprised of yellow trout-lily (<i>Erythronium americanum</i>), wooly blue violet (<i>Viola sororia</i>), white trillium (<i>Trillium grandiflorum</i>) and young sugar maple. This community was complexed with a mineral cultural thicket and a mineral meadow marsh inclusion was also present.		
	3583 Westminster Dr	SWT2			layer was dominant at over 60% coverage with the most frequent species being meadow willow (<i>Salix petiolaris</i>), red-osier dogwood (<i>Cornus sericea</i>), wild black currant (<i>Ribes americanum</i>), and common buckthorn (<i>Rhamnus cathartica</i>). Ground cover was comprised of watercress (<i>Nasturtium officinale</i>), sedge species (<i>Carex species</i>), skunk cabbage (<i>Symplocarpus foetidus</i>) and sensitive fern (<i>Onoclea sensibilis</i>).		
	3595 Scotland Dr	CUM1-1			This cultural meadow community was located throughout the property. Ground cover was dominant at greater than 60% cover with the most frequent species being smooth brome grass (<i>Bromus inermis</i>), orchard grass (<i>Dactylis glomerata</i>), and Canada thistle (<i>Cirsium arvense</i>). The sparse shrub layer was comprised of red-osier dogwood (<i>Cornus sericea</i>) and common buckthorn (<i>Rhamnus cathartica</i>).		

	3666 Scotland Dr	CUT1			This mineral cultural thicket was located in the northern portion of the property. Tall shrub layer species were dominant in this community at over 60% cover with the most frequent species being common buckthorn (<i>Rhamnus cathartica</i>) and gray dogwood (<i>Cornus racemosa</i>). The sparse canopy layer consisted of sugar maple (<i>Acer saccharum</i>) and eastern cottonwood (<i>Populus deltoides</i>).		
	3666 Scotland Dr	CUM1-1			This cultural meadow community was located in the southern portion the property. Ground cover was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), brown knapweed (<i>Centaurea jacea</i>), bird's-foot trefoil (<i>Lotus corniculatus</i>) and Canada goldenrod (<i>Solidago canadensis</i>).		
	3666 Scotland Dr	FOD5-5			This deciduous forest was located in the northern end of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), bitternut hickory (<i>Carya cordiformis</i>), and red oak (<i>Quercus rubra</i>). The shrub layer was comprised of common buckthorn (<i>Rhamnus cathartica</i>) and downy arrowwood (<i>Viburnum rafinesquianum</i>). The sparse ground layer consisted of sedge species (<i>Carex sp</i>), may apple (<i>Podophyllum peltatum</i>), moss species, and tall hairy agrimony (<i>Agrimonia gryposepala</i>).		
	3691 Manning Dr	CUM1-1	OAD		was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), tall goldenrod (<i>Solidago altissima</i>), common dandelion (<i>Taraxicum officinale</i>), and Canada thistle (<i>Cirsium arvense</i>). The shrub layer was comprised primarily of young planted Norway spruce (<i>Picea abies</i>) as well as sparse white oak (<i>Quercus alba</i>), Freeman's maple (<i>Acer x freemanii</i>) and balsam poplar (<i>Populus balsamifera</i>). The sparse canopy layer included white cedar (<i>Thuja occidentalis</i>) and Norway spruce. An open aquatic inclusion was present within this community.		
	3696 Scotland Dr	FOD5-5	MAM2/SWT2		This deciduous forest was located throughout the eastern and central portions of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), shagbark hickory (<i>Carya ovata</i>), American beech (<i>Fagus grandifolia</i>), and red oak (<i>Quercus rubra</i>). The sub-canopy consisted of sugar maple, shagbark hickory, American elm (<i>Ulmus americana</i>) and green ash (<i>Fraxinus pennsylvanica</i>). The shrub layer was comprised of young sugar maple, American beech, common buckthorn (<i>Rhamnus cathartica</i>) and gray dogwood (<i>Cornus racemosa</i>). Ground cover was dominated by young sugar maple, yellow trout-lily (<i>Erythronium americanum</i>), creeping bentgrass (<i>Agrostis stolonifera</i>) and reed canary grass (<i>Phalaris arundinacea</i>). This community was complexed with a mineral meadow marsh and a mineral thicket swamp inclusion was also present. Surveys were completed from the roadside.		
	3713 Scotland Dr	CUM1-1	CUT1		This cultural meadow community was located throughout the property. Ground cover was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), orchard grass (<i>Dactylis glomerata</i>) and smooth brome grass (<i>Bromus inermis</i>). This community was complexed with a mineral cultural thicket.		

	3713 Scotland Dr	CUT1	CUM1-1		This mineral cultural thicket was located in the central and northeastern portions of the property. Shrub layer species were dominant in this community at over 60% cover with the most frequent species being common buckthorn (<i>Rhamnus cathartica</i>), gray dogwood (<i>Cornus racemosa</i>) and hawthorn species (<i>Crataegus sp</i>). The sparse canopy layer consisted of freeman's maple (<i>Acer x freemanii</i>), sugar maple (<i>Acer saccharum</i>), choke cherry (<i>Prunus virginiana</i>) and Norway maple (<i>Acer platanoides</i>). A cultural meadow inclusion was present within this community.		
	3713 Scotland Dr	SAS1	MAM2-2/MAS2		This submergent shallow aquatic community was located in the northeast portion of the property. Dominant plant species included white water buttercup (<i>Ranunculus aquatilis</i>), small duckweed (<i>Lemna minor</i>), water plantain (<i>Alisma plantago-aquatica</i>), and pondweed species (<i>Potamogeton sp.</i>). The ground cover surrounding this community consisted of needle spikerush (<i>Eleocharis acicularis</i>), reed canary grass (<i>Phalaris arundinacea</i>), and water sedge (<i>Carex aquatilis</i>). This community was complexed with a mineral shallow marsh and a reed canary grass mineral meadow marsh inclusion was also present.		
	3900 Scotland Dr	FOD5-5	SWT2		This deciduous forest was located in the southern end of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), bitternut hickory (<i>Carya cordiformis</i>), American basswood (<i>Tilia americana</i>), and shagbark hickory (<i>Carya ovata</i>). The sub-canopy was comprised of sugar maple, american basswood, and red oak (<i>Quercus rubra</i>). The shrub layer consisted of common buckthorn (<i>Rhamnus cathartica</i>), gray dogwood (<i>Cornus racemosa</i>), mountain holly (<i>Nemopanthus mucronatus</i>) and riverbank grape (<i>Vitis riparia</i>). Ground cover was dominated by narrow-leaved cattail (<i>Typha angustifolia</i>), broad-leaved cattail (<i>Typha latifolia</i>) and purple loosestrife (<i>Lythrum salicaria</i>). This community was complexed with a mineral thicket swamp.		
	4166 Scotland Dr	CUW1			This cultural woodland community was located in the eastern portion of the property. Dominant tree species present were black locust (<i>Robinia pseudoacacia</i>), black walnut (<i>Juglans nigra</i>), green ash (<i>Fraxinus pennsylvanica</i>) and sugar maple (<i>Acer saccharum</i>). The sub-canopy was comprised of black locust and black walnut. The dominant shrub species present were common buckthorn (<i>Rhamnus cathartica</i>), staghorn sumac (<i>Rhus typhina</i>) and riverbank grape (<i>Vitis riparia</i>). Ground cover was dominated by smooth brome grass (<i>Bromus inermis</i>) and wild carrot (<i>Daucus carota</i>).		
	5861 White Oak Rd	CUM1-1	CUW1		This cultural meadow community was located in the east end of the property. Ground cover was dominant at greater than 60% cover with the most frequent species being early goldenrod (<i>Solidago juncea</i>), devil's beggarticks (<i>Bidens frondosa</i>), smooth brome grass (<i>Bromus inermis</i>), and wild carrot (<i>Daucus carota</i>). The shrub layer was comprised of common buckthorn (<i>Rhamnus cathartica</i>), and tartarian honeysuckle (<i>Lonicera tatarica</i>). The sub-canopy consisted of eastern white cedar (<i>Thuja occidentalis</i>), Manitoba maple (<i>Acer negundo</i>), while the sparse canopy was dominated by freeman's maple (<i>Acer freemanii</i>) and horse chestnut (<i>Aesculus hippocastanum</i>). A cultural woodland inclusion was present within this community.		



	6100 White Oak Rd	CUM1-1	OAO		This cultural meadow community was located in the north end of the property. Ground cover was dominant at greater than 60% cover with the most frequent species being smooth brome grass (<i>Bromus inermis</i>), goldenrod species (<i>Solidago sp.</i>), and common dandelion (<i>Taraxicum officinale</i>). An open aquatic inclusion was present within the community.		
	6100 White Oak Rd	CUP3	CUM1-1		property. Forest canopy cover was dominant at greater than 60% cover and dominant species present was white pine (<i>Pinus strobus</i>). The sub-canopy was comprised of white pine, green ash (<i>Fraxinus pennsylvanica</i>), and Manitoba maple (<i>Acer negundo</i>). The shrub layer consisted of common buckthorn (<i>Rhamnus cathartica</i>), red-osier dogwood (<i>Cornus sericea</i>), and choke cherry (<i>Prunus virginiana</i>). Sparse ground cover consisted of garlic mustard (<i>Alliaria petiolata</i>), woodland strawberry (<i>Fragaria vesca</i>), and ground ivy (<i>Glechoma hederacea</i>). A cultural meadow inclusion was present within the community.		
	6100 White Oak Rd	MAM2-2	SWT2-2		This reed canary grass mineral meadow marsh was located in northwest portion of the property. Ground cover species were dominant at over 60% cover with the most frequent species being reed canary grass (<i>Phalaris arundinacea</i>) and common reed (<i>Phragmites australis</i>). The shrub layer was comprised of pussy willow (<i>Salix discolor</i>), red-osier dogwood (<i>Cornus sericea</i>), and common buckthorn (<i>Rhamnus cathartica</i>). A willow mineral thicket swamp inclusion was present within the community.		

Appendix **H**

Bat Habitat Assessment

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
3438 Manning Drive - FOD 2-3						
1	Shagbark Hickory (<i>Carya ovata</i>)	45	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482161	4747962
2	Shagbark Hickory (<i>Carya ovata</i>)	53	1	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482159	4747972
3	Shagbark Hickory (<i>Carya ovata</i>)	45	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482157	4747967
4	Shagbark Hickory (<i>Carya ovata</i>)	32	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482152	4747965
5	Shagbark Hickory (<i>Carya ovata</i>)	39	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482154	4747962
6	Shagbark Hickory (<i>Carya ovata</i>)	40	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482137	4747960
7	Shagbark Hickory (<i>Carya ovata</i>)	70	1	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482140	4747969
8	Shagbark Hickory (<i>Carya ovata</i>)	35	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482130	4747971
9	Shagbark Hickory (<i>Carya ovata</i>)	50	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482136	4747962
10	Shagbark Hickory (<i>Carya ovata</i>)	35	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482132	4747966
11	Shagbark Hickory (<i>Carya ovata</i>)	29	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482132	4747968
12	Shagbark Hickory (<i>Carya ovata</i>)	30	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482125	4747965
13	Shagbark Hickory (<i>Carya ovata</i>)	45	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482118	4747959
14	Shagbark	45	2	<ul style="list-style-type: none"> • Loose bark 	482113	4747950

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
	Hickory (<i>Carya ovata</i>)			<ul style="list-style-type: none"> Decay Class 1 Other snag within 10m 		
15	Shagbark Hickory (<i>Carya ovata</i>)	35	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	482119	4747947
16	Shagbark Hickory (<i>Carya ovata</i>)	70	1	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	482137	4747924
17	Shagbark Hickory (<i>Carya ovata</i>)	42	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	482138	4747913
18	Shagbark Hickory (<i>Carya ovata</i>)	46	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	482133	4747909
19	Shagbark Hickory (<i>Carya ovata</i>)	85	1	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	482136	4747893
20	Shagbark Hickory (<i>Carya ovata</i>)	45	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	482141	4747887
21	Shagbark Hickory (<i>Carya ovata</i>)	40	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	482149	4747889
22	Shagbark Hickory (<i>Carya ovata</i>)	50	2	<ul style="list-style-type: none"> Cavity Loose bark Decay Class 1 Other snag within 10m 	482159	4747885
23	Shagbark Hickory (<i>Carya ovata</i>)	52	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	482163	4747886
24	Shagbark Hickory (<i>Carya ovata</i>)	70	1	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	482179	4747924
25	Shagbark Hickory (<i>Carya ovata</i>)	30	2	<ul style="list-style-type: none"> Cavity Loose bark Decay Class 1 Other snag within 10m 	482178	4747934
26	Shagbark Hickory (<i>Carya ovata</i>)	35	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	482174	4747939
27	Shagbark Hickory	29	3	<ul style="list-style-type: none"> Cavity Loose bark 	482168	4747941

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
	(<i>Carya ovata</i>)			<ul style="list-style-type: none"> Decay Class 2 Other snag within 10m 		
3502 Scotland Drive – FOD5-5						
13	Shagbark Hickory (<i>Carya ovata</i>)	27	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 	481764	4748282
14	American Elm (<i>Ulmus americana</i>)	32	2	<ul style="list-style-type: none"> Loose bark Decay Class 3 	481763	4748282
15	Shagbark Hickory (<i>Carya ovata</i>)	34	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 	481763	4748284
16	Sugar Maple (<i>Acer saccharum</i>)	25	3	<ul style="list-style-type: none"> Decay Class 2 Cavity at top (chimney style 2m long by 30cm wide) 	481753	4748275
17	Sugar Maple (<i>Acer saccharum</i>)	25	3	<ul style="list-style-type: none"> Loose bark Cavity Decay Class 2 	481743	4748279
18	Shagbark Hickory (<i>Carya ovata</i>)	24	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 Other snag within 10m 	481811	4748260
19	Shagbark Hickory (<i>Carya ovata</i>)	24	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 	481806	4748269
20	Shagbark Hickory (<i>Carya ovata</i>)	28	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 	481881	4748296
21	Shagbark Hickory (<i>Carya ovata</i>)	30	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 	481861	4748228
22	Shagbark Hickory (<i>Carya ovata</i>)	36	2	<ul style="list-style-type: none"> Loose bark Decay Class 1 	481865	4748240
23	Ash species (<i>Fraxinus sp.</i>)	46	2	<ul style="list-style-type: none"> Loose bark Cavities Knot hole Decay Class 3 	481742	4748187
26	American Beech (<i>Fagus grandifolia</i>)	40	2	<ul style="list-style-type: none"> Two Cavities (20cm x 20cm and 30cm x 15cm) 	481766	4748192
3298 Scotland Drive – CUP3						
1	Eastern White Pine (<i>Pinus strobus</i>)	22	2	<ul style="list-style-type: none"> Loose bark Decay Class 2 Other snag within 10m 	482448	4748282
2	Eastern White Pine (<i>Pinus strobus</i>)	19	2	<ul style="list-style-type: none"> Loose bark Decay Class 2 	482442	4748282
3	Eastern White Pine (<i>Pinus</i>)	21	2	<ul style="list-style-type: none"> Loose bark Decay Class 2 	482439	4748282

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
	<i>strobilus</i>)					
3483 Westminster Drive – FOD5-5						
4	White Ash (<i>Fraxinus americana</i>)	18	4	<ul style="list-style-type: none"> • Loose bark • Cavity • Decay Class 3 	482195	4748257
5	White Ash (<i>Fraxinus americana</i>)	21	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	482184	4748299
6	Silver Maple (<i>Acer saccharinum</i>)	55	1	<ul style="list-style-type: none"> • Cavity • Decay Class 1 • Other snag within 10m 	482170	4748303
7	Hybrid White Willow (<i>Salix x fragilis</i>)	42	1	<ul style="list-style-type: none"> • Cavity • Decay Class 2 • Other snag within 10m 	482188	4748305
8	Hybrid White Willow (<i>Salix x fragilis</i>)	22	3	<ul style="list-style-type: none"> • Cavity (open chimney) • Decay Class 2 • Other snag within 10m 	482190	4748317
9	Hybrid White Willow (<i>Salix x fragilis</i>)	43	3	<ul style="list-style-type: none"> • Cavity (open chimney) • Decay Class 2 • Other snag within 10m 	482215	4748306
10	White Ash (<i>Fraxinus americana</i>)	23	1	<ul style="list-style-type: none"> • Cavity • Crack • Loose bark • Decay Class 3 • Other snag within 10m 	482188	4748336
11	White Ash (<i>Fraxinus americana</i>)	20	2	<ul style="list-style-type: none"> • Cavity • Loose bark • Decay Class 3 • Other snag within 10m 	482192	4748332
12	White Ash (<i>Fraxinus americana</i>)	19	1	<ul style="list-style-type: none"> • Crack • Loose bark • Decay Class 3 • Other snag within 10m 	482168	4748334
13	Balsam Poplar (<i>Populus balsamifera</i>)	21	1	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	482160	4748329
14	White Ash (<i>Fraxinus americana</i>)	18	2	<ul style="list-style-type: none"> • Loose bark • Other snag within 10m 	482157	4748320
15	Balsam Poplar (<i>Populus balsamifera</i>)	19	2	<ul style="list-style-type: none"> • Loose bark • Other snag within 10m 	482158	4748313
16	Oak species	34	1	<ul style="list-style-type: none"> • Cavity 	482147	4748313

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
	(<i>Quercus sp.</i>)			<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 		
17	White Ash (<i>Fraxinus americana</i>)	21	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	482149	4748315
18	Balsam Poplar (<i>Populus balsamifera</i>)	19	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 2 • Other snag within 10m 	482144	4748307
19	Balsam Poplar (<i>Populus balsamifera</i>)	29	1	<ul style="list-style-type: none"> • Cavities • Loose bark • Decay Class 3 • Other snag within 10m 	482148	4748309
20	Eastern White Pine (<i>Pinus strobus</i>)	22	2	<ul style="list-style-type: none"> • Loose bark • Knot hole • Decay Class 3 • Other snag within 10m 	482611	4748305
21	Sugar Maple (<i>Acer saccharum</i>)	36	1	<ul style="list-style-type: none"> • Cavities • Knot holes • Decay Class 3 • Other snag within 10m 	482658	4748285
22	White Oak (<i>Quercus alba</i>)	36	1	<ul style="list-style-type: none"> • Cavity • Knot holes • Decay Class 2 • Live tree • Interior • No leaf clusters 	482154	4748240
23	Hawthorn species (<i>Crataegus sp</i>)	18	3	<ul style="list-style-type: none"> • Cavity • Knot holes • Decay Class 2 	482123	4748265
24	Oak species (<i>Quercus sp</i>)	16	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Dead tree • Interior • No leaf clusters 	482140	4748333
25	Ironwood (<i>Ostrya virginiana</i>)	36	1	<ul style="list-style-type: none"> • Knot holes • Decay Class 1 	482082	4748329
26	Sugar Maple (<i>Acer saccharum</i>)	27	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482070	4748345
27	Green Ash (<i>Fraxinus pennsylvanica</i>)	17	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 2 • Other snag within 10m 	482070	4748340
28	Oak species (<i>Quercus sp</i>)	16	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 2 • Declining tree 	482081	4748345

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
				<ul style="list-style-type: none"> • Forest edge • Other snag within 10m • No leaf clusters 		
29	Oak species (<i>Quercus sp</i>)	49	1	<ul style="list-style-type: none"> • Cavity • Decay Class 3 • Dead tree • Forest edge • Other snag within 10m • No leaf clusters 	482105	4748354
30	Ironwood (<i>Ostrya virginiana</i>)	38	3	<ul style="list-style-type: none"> • Cavity • Decay Class 1 • Other snag within 10m 	482138	4748348
31	Trembling Aspen (<i>Populus tremuloides</i>)	19	2	<ul style="list-style-type: none"> • Cavities • Decay Class 3 • Other snag within 10m 	482139	4748356
3583 Westminster Drive – FOD5-5						
1	Shagbark Hickory (<i>Carya ovata</i>)	19	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481656	4748210
2	Sugar Maple (<i>Acer saccharum</i>)	29	2	<ul style="list-style-type: none"> • Cavities • Decay Class 1 	481651	4748186
6	Shagbark Hickory (<i>Carya ovata</i>)	22	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 	481690	4748275
7	Shagbark Hickory (<i>Carya ovata</i>)	18	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481699	4748269
9	Shagbark Hickory (<i>Carya ovata</i>)	34	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481725	4748329
10	Shagbark Hickory (<i>Carya ovata</i>)	31	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481731	4748335
11	Shagbark Hickory (<i>Carya ovata</i>)	36	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481735	4748331
12	Green Ash (<i>Fraxinus pennsylvanica</i>)	25	2	<ul style="list-style-type: none"> • Loose bark • Crack • Decay Class 3 	481703	4748406
6100 White Oak Road – CUP3						
1	Eastern White Pine (<i>Pinus strobus</i>)	17	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 	480772	4746460

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
2	Eastern White Pine (<i>Pinus strobus</i>)	20	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 	480772	4746430
3	Eastern White Pine (<i>Pinus strobus</i>)	20	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480770	4746420
4	Eastern White Pine (<i>Pinus strobus</i>)	18	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480741	4746444
5	Eastern White Pine (<i>Pinus strobus</i>)	19	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480735	4746445
6	Eastern White Pine (<i>Pinus strobus</i>)	22	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 	480748	4746470
7	Eastern White Pine (<i>Pinus strobus</i>)	23	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480743	4746516
8	Eastern White Pine (<i>Pinus strobus</i>)	25	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480753	4746524
9	Eastern White Pine (<i>Pinus strobus</i>)	21	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480734	4746551
10	Eastern White Pine (<i>Pinus strobus</i>)	24	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1-3 • Other snag within 10m 	480732	4746561
11	Eastern White Pine (<i>Pinus strobus</i>)	24	2	<ul style="list-style-type: none"> • Cavities • Loose bark • Knot hole • Decay Class 3 	480732	4746561

Appendix **I**

Breeding Bird List

Common Name	Scientific Name	G-Rank ¹	S-Rank ²	SARA Status ³	COSEWIC Status ⁴	ESA Status ⁵	CASSARO Status ⁶	Area-sensitive Species ⁷	TRCA L-Rank ⁸	Conservation Priority Rank for Grand River Basin ¹⁴	Priority Species in the Lower Great Lakes/St. Lawrence Plain (BCR Region 13) ¹¹	Priority Species in the Boreal Hardwood Transition Region (BCR Region 12) ¹²	OBBA 17MH84	AECOM Observations						
														BS-01	BS-02	BS-03	BS-04	BS-05	BS-06	Incidental
Green Heron	<i>Butorides virescens</i>	G5	S4B						L4	Level 4 Forest	Maintain Current	Increase	FY							X
Canada Goose	<i>Branta canadensis</i>	G5	S5						L5		Decrease	Decrease	FY							X
Mallard	<i>Anas platyrhynchos</i>	G5	S5						L5		Maintain Current	Maintain Current	FY							H
Turkey Vulture	<i>Cathartes aura</i>	G5	S5B						L4	Level 3 Forest			FY							X
Sharp-shinned Hawk	<i>Accipiter striatus</i>	G5	S5				NAR	A	L3	Level 2 Forest			FY							X
Red-tailed Hawk	<i>Buteo jamaicensis</i>	G5	S5				NAR	A	L5				AE							X
Wild Turkey	<i>Meleagris gallopavo</i>	G5	S5						L3				FY							S
Killdeer	<i>Charadrius vociferus</i>	G5	S5B, S5N						L5		Increase	Increase	NE			A			S	FY
Spotted Sandpiper	<i>Actitis macularia</i>	G5	S5						L4	Level 3 Open Country	Increase	Maintain Current	T							FY
Mourning Dove	<i>Zenaidura macroura</i>	G5	S5						L5				NY						S	S
Eastern Wood-Pewee	<i>Contopus virens</i>	G5	S4B		SC	SC	SC		L4		Increase		T							S
Alder Flycatcher	<i>Empidonax aliorum</i>	G5	S5B						L3	Level 3 Forest					T					S
Willow Flycatcher	<i>Empidonax traillii</i>	G5	S5B						L4				FY	T	T					S
Eastern Kingbird	<i>Tyrannus tyrannus</i>	G5	S4B						L4	Level 3 Open Country	Increase		NE		S			P	H	S
Horned Lark	<i>Eremophila alpestris</i>	G5	S5B						L3	Level 3 Open Country			FY							S
Tree Swallow	<i>Tachycineta bicolor</i>	G5	S4B						L4			Increase	AE	X		X			X	
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	G5	S4B						L4	Level 2 Open Country	Increase	Increase	H				X		X	
Bank Swallow	<i>Riparia riparia</i>	G5	S4B			THR			L3	Level 1 Open Country	Increase	Increase	AE	X	X					
Barn Swallow	<i>Hirundo rustica</i>	G5	S4B		THR	THR	THR		L4	Level 3 Open Country	Recovery Objective	Recovery Objective	NY	X		X		X	H	X
American Crow	<i>Corvus brachyrhynchos</i>	G5	S5B						L5				AE			S			S	
Black-capped Chickadee	<i>Poecile atricapillus</i>	G5	S5						L5	Level 4 Forest			CF			S				S
House Wren	<i>Troglodytes aedon</i>	G5	S5B						L5				CF					S		S
American Robin	<i>Turdus migratorius</i>	G5	S5B						L5				NY		S	S			A	S
Gray Catbird	<i>Dumetella carolinensis</i>	G5	S4B						L4	Level 4 Forest		Increase	NY					S		
Cedar Waxwing	<i>Bombycilla cedrorum</i>	G5	S5B						L5				FY							S
Red-eyed Vireo	<i>Vireo olivaceus</i>	G5	S5B						L4				NE							S
Yellow Warbler	<i>Dendroica petechia</i>	G5	S5B						L5				FY		T				S	
Common Yellowthroat	<i>Geothlypis trichas</i>	G5	S5B						L4			Maintain Current	NB	T		T		T		S
Northern Cardinal	<i>Cardinalis cardinalis</i>	G5	S5						L5				FY	T	T	A		T		S
Indigo Bunting	<i>Passerina cyanea</i>	G5	S4B						L4				NY					S		
Chipping Sparrow	<i>Spizella passerina</i>	G5	S5B						L5				NY						S	S
Clay-coloured Sparrow	<i>Spizella pallida</i>	G5	S4B						L3	Level 1 Open Country				S						
Field Sparrow	<i>Spizella pusilla</i>	G5	S4B						L4	Level 3 Open Country	Increase	Assess/Maintain	CF	T	T				T	S
Savannah Sparrow	<i>Passerculus sandwichensis</i>	G5	S4B					A	L4	Level 1 Open Country	Increase		NY	T	A	T	T	A		S
Song Sparrow	<i>Melospiza melodia</i>	G5	S5B						L5			Increase	NY	T	T	T	S	T	A	A
Bobolink	<i>Dolichonyx oryzivorus</i>	G5	S4B		THR	THR	THR	A	L2	Level 2 Open Country	Recovery Objective	Recovery Objective	CF		CF	A	P	P		CF
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	G5	S4						L5				FY		T	CF	S	A	A	S
Eastern Meadowlark	<i>Sturnella magna</i>	G5	S4B		THR	THR	THR	A	L3	Level 2 Open Country	Recovery Objective		NE	T	P	T	T		S	S
Common Grackle	<i>Quiscalus quiscula</i>	G5	S5B						L5				FY							X
Brown-headed Cowbird	<i>Molothrus ater</i>	G5	S4B						L5				FY	S					H	
Orchard Oriole	<i>Icterus spurius</i>	G5	S4B							Level 3 Forest										S
Baltimore Oriole	<i>Icterus galbula</i>	G5	S4B						L5		Maintain Current		CF						S	
American Goldfinch	<i>Carduelis tristis</i>	G5	S5B						L5	Level 3 Open Country			FY		S			S	S	S

Appendix J

Species at Risk Screening

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1, 2}	Known Species Range ^{1, 2}	Source Identifying Species Record	Habitat Identified During Background	Species Observed During Field Investigations	Conclusions/ Recommendations
Birds	Bank Swallow <i>Riparia riparia</i>	THR	No Status	THR	Bank swallows nest in burrows in natural and human-made settings where there are vertical faces in silt and sand deposits. Many nests are on banks of rivers and lakes, but they are also found in active sand and gravel pits or former ones where the banks remain suitable. The birds breed in colonies ranging from several to a few thousand pairs.	The bank swallow is found all across southern Ontario, with sparser populations scattered across northern Ontario. The largest populations are found along the Lake Erie and Lake Ontario shorelines, and the Saugeen River (which flows into Lake Huron).	OBBA	Moderate Probability Suitable habitat may be present within the study area.	Confirmed This species was observed during field investigations. No Suitable habitat was not identified.	Suitable habitat for this species was not identified. No further action is required.
Birds	Barn Swallow <i>Hirundo rustica</i>	THR	No Status	THR	Barn Swallows often live in close association with humans, building their cup-shaped mud nests almost exclusively on human-made structures such as open barns, under bridges and in culverts. The species is attracted to open structures that include ledges where they can build their nests, which are often re-used from year to year. They prefer unpainted, rough-cut wood, since the mud does not adhere as well to smooth surfaces. This species can typically be associated with the following ELC communities: TPO, CUM1, MAM, MAS, OAO, SAS1, SAM1, SAF1 ; containing or adjacent structures that are suitable for nesting.	The Barn Swallow may be found throughout southern Ontario and can range as far north as Hudson Bay, wherever suitable locations for nests exist.	OBBA, MNRF Aylmer District	High Probability Suitable habitat likely present within the study area (structures for nesting and foraging habitat present)	Confirmed This species was observed during field investigations. Candidate Barns and similar structures were identified in the study area, although nesting was not confirmed.	Should development encroach upon potential nesting habitat, additional surveys may be required. It is recommended that any vegetation clearing be completed outside of the breeding bird season (April 1st - August 31st).
Birds	Bobolink <i>Dolichonyx oryzivorus</i>	THR	No Status	THR	Historically, Bobolinks lived in North American tallgrass prairie and other open meadows. With the clearing of native prairies, Bobolinks moved to living in hayfields. Bobolinks often build their small nests on the ground in dense grasses. Both parents usually tend to their young, sometimes with a third Bobolink helping. This species can typically be associated with the following ELC communities: TPO, TPS, CUM1 and MAM2 .	The Bobolink breeds across North America. In Ontario, it is widely distributed throughout most of the province south of the boreal forest, although it may be found in the north where suitable habitat exists.	NHIC, OBBA, SARO online, MNRF Aylmer District	High Probability Suitable habitat likely present within agricultural lands and meadow habitat within the study area.	Confirmed This species was observed during field investigations. Confirmed Cultural meadow communities with extensive grass cover provide suitable habitat.	This species was observed during breeding bird surveys completed in 2018. Should the proposed development encroach upon suitable habitat, a Notice of Activity (NOA) will need to be prepared for the MNRF prior to commencing development in accordance with Section 23.6 of O. Reg. 242/08

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1, 2}	Known Species Range ^{1, 2}	Source Identifying Species Record	Habitat Identified During Background	Species Observed During Field Investigations	Conclusions/ Recommendations
Birds	Eastern Meadowlark <i>Sturnella magna</i>	THR	No Status	THR	<p>Eastern Meadowlarks breed primarily in moderately tall grasslands, such as pastures and hayfields, but are also found in alfalfa fields, weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields, or other open areas. Small trees, shrubs or fence posts are used as elevated song perches.</p> <p>This species can typically be associated with the following ELC communities: TPO, TPS, CUM1, CUS, and MAM2 with elevated song perches.</p>	In Ontario, the Eastern Meadowlark is primarily found south of the Canadian Shield but it also inhabits the Lake Nipissing, Timiskaming and Lake of the Woods areas.	NHIC, OBBA, SARO online, MNRF Aylmer District	<p>High Probability</p> <p>Suitable habitat may be present within agricultural lands and meadow habitat within the study area.</p>	<p>Confirmed</p> <p>This species was observed during field investigations.</p> <p>Confirmed</p> <p>Cultural meadow communities with extensive grass cover provide suitable habitat.</p>	<p>This species was observed during breeding bird surveys completed in 2018.</p> <p>Should the proposed development encroach upon suitable habitat, a Notice of Activity (NOA) will need to be prepared for the MNRF prior to commencing development in accordance with Section 23.6 of O. Reg. 242/08</p>
Birds	Eastern Wood-Pewee <i>Contopus virens</i>	SC	No Status	SC	<p>The Eastern Wood-Pewee can be found in every type of wooded community in eastern North America. The size of the forest does not appear to be an important factor in habitat selection as this species has been found in both small fragmented forests and larger forest tracks. 4</p> <p>This species can typically be associated with the following ELC communities: FOC, FOM, FOD, SWD, SWM and CUW.</p>	The Eastern Wood-Pewee Breed throughout central and eastern North America from Saskatchewan to Nova Scotia south along the Atlantic Coast to North Florida and the Gulf Coast. 4	OBBA	<p>High Probability</p> <p>Suitable habitat may be present within forested ecosystems in the study area.</p>	<p>Confirmed</p> <p>This species was observed during field investigations.</p> <p>Confirmed</p> <p>Forested communities provide suitable habitat.</p>	It is recommended that any vegetation clearing be completed outside of the breeding bird season (April 1st - August 31st).
Birds	Red-headed Woodpecker <i>Melanerpes erythrocephalus</i>	SC	THR Schedule 1	THR	<p>The Red-headed Woodpecker lives in open woodland and woodland edges, and is often found in parks, golf courses and cemeteries. These areas typically have many dead trees, which the bird uses for nesting and perching. This woodpecker regularly winters in the United States, moving to locations where it can find sufficient acorns and beechnuts to eat. A few of these birds will stay the winter in woodlands in southern Ontario if there are adequate supplies of nuts.</p> <p>This species can typically be associated with the following ELC communities: TPS, TPW, CUW, FOD1, FOD2, FOD4-1, FOD6, FOD7, and FOD9 that are open and have an abundance of dead trees.</p>	The Red-headed Woodpecker is found across southern Ontario, where it is widespread but rare. Outside Ontario, it lives in Alberta, Saskatchewan, Manitoba and Quebec, and is relatively common in the United States.	OBBA	<p>Moderate Probability</p> <p>Suitable habitat may be present within wooded ecosystems in the study area.</p>	<p>No</p> <p>This species was not observed during field investigations.</p> <p>No</p> <p>Suitable habitat was not identified.</p>	<p>This species was not observed during field investigations. Suitable habitat for this species was not identified.</p> <p>No further action is required.</p>

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1,2}	Known Species Range ^{1,2}	Source Identifying Species Record	Habitat Identified During Background	Species Observed During Field Investigations	Conclusions/ Recommendations
Birds	Golden-winged Warbler <i>Vermivora chrysoptera</i>	SC	THR Schedule 1	THR	Golden-winged Warblers prefer to nest in areas with young shrubs surrounded by mature forest – locations that have recently been disturbed, such as field edges, hydro or utility right-of-ways, or logged areas.	The Golden-winged Warbler is found in southern Saskatchewan, Manitoba, Ontario, and Quebec, as well as the north-eastern United States. In Ontario, these birds breed in central-eastern Ontario, as far south as Lake Ontario and the St. Lawrence River, and as far north as the northern edge of Georgian Bay. Golden-winged Warblers have also been found in the Lake of the Woods area near the Manitoba border, and around Long Point on Lake Erie. Golden-winged Warblers spend the winter in Central America, some Caribbean islands, and the northern part of South America.	OBBA	Moderate Probability Suitable habitat may be present within wooded ecosites in the study area.	No This species was not observed during field investigations. No Suitable habitat was not identified.	This species was not observed during field investigations. Suitable habitat for this species was not identified. No further action is required.
Birds	Wood Thrush <i>Hylocichla mustelina</i>	SC	No Status	THR	The Wood Thrush can typically be found in the interior and along the edges of well-developed upland deciduous and mixed forests. Key elements of these forests include trees that are greater than 16 m in height, high variety of deciduous tree species, moderate subcanopy and shrub density, shade, fairly open forest floor, moist soils and decaying leaf litter. Wood Thrush is more likely to occur in larger forests but may also nest in 1 ha fragments and semi-wooded residential areas and parks. Smaller habitat fragments have lower fecundity when compared to larger fragments. 3 This species can typically be associated with the following ELC communities: FOD and FOM that are greater than 1 ha in size.	The Wood Thrush ranges across central and southern Ontario, southern Quebec, New Brunswick and southern Nova Scotia and the majority of the eastern United States. It winters in Central America between southern Mexico and Panama. 3	OBBA	Moderate Probability Suitable habitat may be present within forested ecosites in the study area.	No This species was not observed during field investigations. No Although deciduous forest communities may provide suitable habitat, the species was not detected during field investigations.	This species was not observed during breeding bird surveys completed in 2018. Therefore, it is unlikely that this species is present within the study area. No further actions are required.
Insects	Monarch <i>Danaus plexippus</i>	SC	No Status	SC	Throughout their life cycle, Monarchs use three different types of habitat. Only the caterpillars feed on milkweed plants and are confined to meadows and open areas where milkweed grows. Adult butterflies can be found in more diverse habitats where they feed on nectar from a variety of wildflowers. Monarchs spend the winter in Oyamel Fir forests found in central Mexico. This species can typically be associated with the following ELC communities: AI, TP and CUM where milkweed plants are present.	The Monarch's range extends from Central America to southern Canada. In Canada, Monarchs are most abundant in southern Ontario and Quebec where milkweed plants and breeding habitat are widespread. During late summer and fall, Monarchs from Ontario migrate to central Mexico where they spend the winter months. During migration, groups of Monarchs numbering in the thousands can be seen along the north shores of Lake Ontario and Lake Erie.	None	N/A	Confirmed This species was observed during field investigations. Confirmed Cultural meadow communities with milkweed provide suitable habitat.	This species was observed during field investigations completed in 2018. Habitat for this species is considered Significant Wildlife Habitat in accordance with the Provincial Policy Statement (2014) and will be addressed further in Section 3.5 and Appendix H.

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1, 2}	Known Species Range ^{1, 2}	Source Identifying Species Record	Habitat Identified During Background	Species Observed During Field Investigations	Conclusions/ Recommendations
Mammals	Little Brown Myotis (Bat) <i>Myotis lucifugus</i>	END	No Status	END	<p>Bats are nocturnal. During the day they roost in trees and buildings. They often select attics, abandoned buildings and barns for summer colonies where they can raise their young. Bats can squeeze through very tiny spaces (as small as six millimetres across) and this is how they access many roosting areas.</p> <p>Little brown bats hibernate from October or November to March or April, most often in caves or abandoned mines that are humid and remain above freezing. This species can typically be associated with any community where suitable roosting (i.e. cavity trees, houses, abandoned buildings, barns, etc.) habitat is available.</p>	The little brown bat is widespread in southern Ontario and found as far north as Moose Factory and Favourable Lake. Outside Ontario, this bat is found across Canada (except in Nunavut) and most of the United States.	SARO online, MNRF Aylmer District	Moderate Probability Forest communities present in the study area may contain cavity trees.	No This species was not observed during field investigations. Candidate Forest and swamp communities provide suitable habitat.	Should tree removal be required within Candidate habitat, further consultation with the MNRF is required. It is recommended that all vegetation clearing be completed outside of the bat roosting season (April 1st - September 30th).
Mammals	Eastern Small-footed Myotis <i>Myotis leibii</i>	END			<p>In the spring and summer, eastern small-footed bats will roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees.</p> <p>These bats often change their roosting locations every day. At night, they hunt for insects to eat, including beetles, mosquitos, moths, and flies.</p> <p>In the winter, these bats hibernate, most often in caves and abandoned mines. They seem to choose colder and drier sites than similar bats and will return to the same spot each year.</p>	The eastern small-footed bat has been found from south of Georgian Bay to Lake Erie and east to the Pembroke area. There are also records from the Bruce Peninsula, the Espanola area, and Lake Superior Provincial Park. Most documented sightings are of bats in their winter hibernation sites.	SARO online, MNRF Aylmer District	Moderate Probability Forest communities present in the study area may contain cavity trees.	No This species was not observed during field investigations. Candidate Forest and swamp communities provide suitable habitat.	Should tree removal be required within Candidate habitat, further consultation with the MNRF is required. It is recommended that all vegetation clearing be completed outside of the bat roosting season (April 1st - September 30th).
Mammals	Northern (Long-eared) Myotis (Bat) <i>Myotis septentrionalis</i>	END	No Status	END	<p>Northern long-eared bats are associated with boreal forests, choosing to roost under loose bark and in the cavities of trees. These bats hibernate from October or November to March or April, most often in caves or abandoned mines.</p> <p>This species can typically be associated with the following ELC communities: FOC, FOM, FOD, SWC, SWM and SWD where suitable roosting (i.e. cavity trees and trees with loose bark) habitat is available.</p>	<p>The northern long-eared bat is found throughout forested areas in southern Ontario, to the north shore of Lake Superior and occasionally as far north as Moosonee, and west to Lake Nipigon.</p> <p>This bat is found in all Canadian provinces as well as the Yukon and Northwest Territories.</p>	SARO online, MNRF Aylmer District	Moderate Probability Forest communities present in the study area may contain cavity trees.	No This species was not observed during field investigations. Candidate Forest and swamp communities provide suitable habitat.	Should tree removal be required within Candidate habitat, further consultation with the MNRF is required. It is recommended that all vegetation clearing be completed outside of the bat roosting season (April 1st - September 30th).

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1,2}	Known Species Range ^{1,2}	Source Identifying Species Record	Habitat Identified During Background	Species Observed During Field Investigations	Conclusions/ Recommendations
Mammals	Tri-colored Bat <i>Perimyotis subflavus</i>	END	END Schedule 1	END	In Ontario, the Tri-colored Bat lives in forested habitats, forming day roosts and maternity colonies in older forest within foliage or in high tree cavities, occasionally also in barns or other structures. This species forages over water and along streams in forests. At the close of the summer season, this species congregate at a location to swarm, usually near caves, mines or underground locations where they will winter; it has a strong fidelity to its winter hibernation sites. This bat overwinters in caves, typically individually instead of as a group.	This bat is found in Southern Ontario and ranging as far north as Espanola, near Sudbury, having a scattered distribution. Its broad range sweeps from eastern North America down to Central America.	SARO online, MNRF Aylmer District	Moderate Probability Forest communities present in the study area may contain cavity trees.	No This species was not observed during field investigations. Candidate Forest and swamp communities provide suitable habitat.	Should tree removal be required within Candidate habitat, further consultation with the MNRF is required. It is recommended that all vegetation clearing be completed outside of the bat roosting season (April 1st - September 30th).
Mammals	Woodland Vole <i>Microtus pinetorum</i>	SC	SC Schedule 1	SC	In Ontario, the Woodland Vole lives in mature deciduous forest in the Carolinian region where there is a deep litter layer that allows it to burrow. This species can typically be associated with the following ELC communities: FOD with a deep leaf litter and loose soils.	In Ontario, it is known to exist at 30 sites from the Municipality of Chatham-Kent and Lambton County, east to Haldimand County, and north to Halton Regional Municipality and the City of Hamilton. Because it spends most of its time below ground, this species is difficult to spot and may have been missed at other locations in the province.	NHIC, SARO online	Moderate Probability Forest communities present in the study area may be suitable if deep litter layer and loose soils are present.	No This species was not observed during field investigations. No Suitable habitat was not identified.	This species was not observed during field investigations. Suitable habitat for this species was not identified. No further action is required.
Mosses	Spoon-leaved Moss <i>Bryoandersonia illecebra</i>	END	END Schedule 1	END	Spoon-leaved Moss grows in a range of habitat types but most Canadian populations are located on soil in low-lying areas that are seasonally flooded under trees or shrub thickets. It is often found in close proximity to a species of moss called narrow-leaved wetland plume moss, which is associated with swamps, marshes, and wet meadows. This species can typically be associated with the following ELC communities: SWD , SWT , MAS and MAM that are seasonally flooded.	Spoon-leaved Moss is found only in eastern North America, from southern Ontario south to Texas and Florida. In Canada, it is restricted to a few sites in southern Ontario – Elgin, Essex and Welland counties, and the Niagara Region.	NHIC, SARO online	Moderate Probability Wetland communities present in the study area may provide suitable habitat.	No This species was not observed during field investigations. No Although swamp and marsh communities may provide suitable habitat, the species was not detected during field investigations.	This species was not observed during botanical surveys completed in 2018. Therefore, it is unlikely that this species is present within the study area. No further actions are required.

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1, 2}	Known Species Range ^{1, 2}	Source Identifying Species Record	Habitat Identified During Background	Species Observed During Field Investigations	Conclusions/ Recommendations
Plants	Bird's-foot Violet <i>Viola pedata</i>	END	END Schedule 1	END	In Ontario, Bird's-foot Violet is found only in black oak savanna, a very rare vegetation type having widely spaced open-grown trees with an understorey of tallgrass prairie herbs. Natural disturbances caused by drought or fire are important for removing trees and shrubs that would otherwise shade out the tiny Bird's-foot Violet. This species can typically be associated with the following ELC communities: TPS1-1 and TPW1-1 .	In Canada, Bird's-foot Violet is found only in southern Ontario at a handful of sites. In 2001, the population was estimated to be fewer than 7,000 plants at only five locations.	NHIC	Low Probability Suitable habitat for this species was not identified through background review.	No This species was not observed during field investigations. No Suitable habitat was not identified.	This species was not observed during field investigations. Suitable habitat for this species was not identified. No further action is required.
Plants	Broad Beech Fern <i>Phegopteris hexagonoptera</i>	SC	SC Schedule 3	SC	The Broad Beech Fern prefers to grow in rich soils in deciduous forests, often in areas dominated by maple and beech trees. It requires moist soil and usually grows in full shade. This species can typically be associated with the following ELC communities: FOD5 and FOD6 with moist soils and closed canopies.	The Broad Beech Fern grows in eastern North America from the southern Great Lakes region west to southeast Kansas and northeast Oklahoma, south to northeast Texas and the Gulf Coast and east to the Atlantic coast. In Ontario, the species is found in forest remnants in southern Muskoka, along Lake Erie, and in the eastern Lake Ontario-St. Lawrence River region.	NHIC, SARO online	Low Probability Suitable habitat for this species was not identified through background review.	No This species was not observed during field investigations. No Suitable habitat was not identified.	This species was not observed during field investigations. Suitable habitat for this species was not identified. No further action is required.
Reptiles	Eastern Ribbonsnake <i>Thamnophis sauritus</i>	SC	SC Schedule 1	SC	The Eastern Ribbonsnake is usually found close to water, especially in marshes, where it hunts for frogs and small fish. A good swimmer, it will dive in shallow water, especially if it is fleeing from a potential predator. At the onset of cold weather, these snakes congregate in underground burrows or rock crevices to hibernate together. This species can typically be associated with the following ELC communities: FOC, FOM, FOD, SWC, SWM, SWD, MAM, MAS, OAO, SAS, SAM and SAF containing or near year round standing or flowing water.	The Eastern Ribbon Snake is found from southern Ontario west to Michigan and Wisconsin (isolated pockets), south to Illinois and Ohio, and east to New York State and Nova Scotia, where there is an isolated population. In Ontario, this snake occurs throughout southern and eastern Ontario and is locally common in parts of the Bruce Peninsula, Georgian Bay and eastern Ontario.	NHIC, ORAA, SARO online	Moderate Probability Suitable habitat may be present in the study area if year round standing water is present.	No This species was not observed during field investigations. No Although forest and swamp communities, as well as ponds within the wetland communities may provide suitable habitat, the species was not detected during field investigations.	This species was not observed during coverboard surveys and area searches completed in 2018. Therefore, it is unlikely that this species is present within the study area. No further actions are required.

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1, 2}	Known Species Range ^{1, 2}	Source Identifying Species Record	Habitat Identified During Background	Species Observed During Field Investigations	Conclusions/ Recommendations
Reptiles	Milksnake <i>Lampropeltis triangulum</i>	No Status	SC Schedule 1	SC	<p>The Milksnake can be found in a range of habitats including rocky outcrops, fields and forest edges. In southern Ontario, it is often found in old farm fields and farm buildings where there is an abundance of mice. The Milksnake hibernates underground, in rotting logs or in the foundations of old buildings.</p> <p>This species can be associated with the following ELC communities: BL, TA, AL, RB, TP, CUM, FOC, FOM and FOD.</p>	The Milksnake range extends from Quebec and Maine south to Alabama and Georgia, and west to Minnesota and Iowa. In Ontario, it is widespread and locally common in southern Ontario, and can be found as far north as Lake Nipissing and Sault Ste. Marie.	ORAA	<p>Moderate Probability</p> <p>Suitable habitat may be present in the study area.</p>	<p>No</p> <p>This species was not observed during field investigations.</p> <p>No</p> <p>Suitable habitat was not identified.</p>	<p>This species was not observed during field investigations. Suitable habitat for this species was not identified.</p> <p>No further action is required.</p>
Reptiles	Snapping turtle <i>Chelydra serpentina</i>	SC	SC Schedule 1	SC	<p>Snapping Turtles spend most of their lives in water. They prefer shallow waters so they can hide under the soft mud and leaf litter, with only their noses exposed to the surface to breathe. During the nesting season, from early to mid summer, females travel overland in search of a suitable nesting site, usually gravelly or sandy areas along streams. Snapping Turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams and aggregate pits.</p> <p>This species can typically be associated with the following ELC communities: OAO, SA near gravelly or sandy areas.</p>	The Snapping Turtle's range extends from Ecuador to Canada. In Canada this turtle can be found from Saskatchewan to Nova Scotia. It is primarily limited to the southern part of Ontario. The Snapping Turtle's range is contracting.	ORAA, SARO online	<p>Moderate Probability</p> <p>Wetland communities present in the study area may provide suitable habitat if open water is present.</p>	<p>No</p> <p>This species was not observed during field investigations.</p> <p>Candidate</p> <p>Although wetlands may provide suitable habitat, the species was not detected during field investigations. However, basking surveys were not conducted.</p>	Should development encroach upon candidate habitat, additional surveys may be required.

Appendix **K**

Significant Wildlife Habitat Screening

SWH Ecoregion 7E Criterion Schedule

Table 1.1 Seasonal Concentration Areas of Animals.

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
Waterfowl Stopover and Staging Areas (Terrestrial) <u>Rationale:</u> Habitat important to migrating waterfowl.	American Black Duck Northern Pintail Gadwall Blue-winged Teal Green-winged Teal American Wigeon Northern Shoveler Tundra Swan	CUM1 CUT1 - Plus evidence of annual spring flooding from melt water or run-off within these Ecosites. - Fields with waste grain in the Long Point, Rondeau, Lk. St. Clair, Grand Bend and Pt. Pelee areas may be important to Tundra Swans.	<p>Fields with sheet water during Spring (mid- March to May).</p> <ul style="list-style-type: none">• Fields flooding during spring melt and run-off provide important invertebrate foraging habitat for migrating waterfowl.• Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available. <p><u>Information Sources</u></p> <ul style="list-style-type: none">• Anecdotal information from the landowner, adjacent landowners or local naturalist clubs may be good information in determining occurrence.• Reports and other information available from Conservation Authorities (CAs)• Sites documented through waterfowl planning processes (eg. EHJV implementation plan)• Field Naturalist Clubs• Ducks Unlimited Canada• Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	<p>Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}</p> <ul style="list-style-type: none">• Any mixed species aggregations of 100[€]• or more individuals required.• The area of the flooded field ecosite habitat plus a 100-300m radius buffer dependant on local site conditions and adjacent land use is the significant wildlife habitat ^{cxlviii}.• Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates).• SWHMIST^{cxlix} Index #7 provides development effects and mitigation measures.	<p>Low Probability;</p> <p>Candidate Habitat not present within the study area.</p> <p>The study area is not within close proximity to Long Point, Rondeau, Lk. St. Clair, Grand Bend or Point Pelee and does not contain historical records of aggregations of 100 or more individuals utilizing sheet water on fields.</p>	<p>No;</p> <p>Confirmed habitat was not observed during field investigations.</p>	No further action required.
Waterfowl Stopover and Staging Areas (Aquatic)	Northern Shoveler American Wigeon Gadwall Green-winged Teal	MAS1 MAS2 MAS3 SAS1	<p><u>Information Sources</u></p> <ul style="list-style-type: none">• Environment Canada• Naturalist clubs often are aware of staging/stopover areas.	<p>Studies carried out and verified presence of:</p> <ul style="list-style-type: none">• Aggregations of 100 [€] or more of listed	<p>No;</p> <p>Candidate Habitat not present within</p>	<p>No;</p> <p>Confirmed habitat was not observed</p>	No further action required.

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
<p><u>Rationale:</u> Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district.</p>	Blue-winged Teal Hooded Merganser Common Merganser Lesser Scaup Greater Scaup Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Ring-necked duck Common Goldeneye Bufflehead Redhead Ruddy Duck Red-breasted Merganser Brant Canvasback Ruddy Duck	SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	<ul style="list-style-type: none"> • OMNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. • Sites documented through waterfowl planning processes (eg. EHJV implementation plan) • Ducks Unlimited projects • Element occurrence specification by Nature Serve: http://www.natureserve.org • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area 	<p>species for 7 days^㉔, results in > 700 waterfowl use days.</p> <ul style="list-style-type: none"> • Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH ^{cxlix} • The combined area of the ELC ecosites and a 100m radius area is the SWH ^{cxlviii} • Wetland area and shorelines associated with sites identified within the SWHTG ^{cxlviii} Appendix K ^{cxlix} are significant wildlife habitat. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi} • Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWH MIST^{cxlix} Index #7 provides development effects and mitigation measures. 	<p>the study area.</p> <p>Aquatic habitat within the study area is of insufficient size to support large numbers of waterfowl species.</p>	<p>during field investigations.</p>	
<p>Shorebird Migratory Stopover Area</p> <p><u>Rationale:</u> High quality shorebird stopover habitat is extremely rare and typically has a long history of</p>	Greater Yellowlegs Lesser Yellowlegs Marbled Godwit Hudsonian Godwit Black-bellied Plover American Golden-Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated	BBO1 BBO2 BBS1 BBS2 BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2	<p>Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats.</p> <p>Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June</p>	<p>Studies confirming:</p> <ul style="list-style-type: none"> • Presence of 3 or more of listed species and > 1000^í shorebird use days during spring or fall migration period. (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period) 	<p>No;</p> <p>Suitable shoreline habitat is not present within the study area.</p>	<p>No;</p> <p>Confirmed habitat was not observed during field investigations.</p>	<p>No further action required.</p>

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
use.	Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird’s Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin	MAM3 MAM4 MAM5	and early July to October. Sewage treatment ponds and storm water ponds do not qualify as a SWH, <u>Information Sources</u> <ul style="list-style-type: none"> Western hemisphere shorebird reserve network. Canadian Wildlife Service (CWS) Ontario Shorebird Survey. Bird Studies Canada Ontario Nature Local birders and naturalist clubs NHIC Shorebird Migratory Concentration Area 	<ul style="list-style-type: none"> Whimbrel stop briefly (<24hrs) during spring migration, any site with >100^l Whimbrel used for 3 years or more is significant. The area of significant shorebird habitat includes the mapped ELC shoreline ecosites plus a 100m radius area ^{cxlviii} Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi} SWH MIST^{cxlix} Index #8 provides development effects and mitigation measures. 			
Raptor Wintering Area Rationale: Sites used by multiple species, a high number of individuals and used annually are most significant	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl Special Concern: Short-eared Owl Bald Eagle	Hawks/Owls Combination of ELC Community Series; need to have present one Community Series from each land class; Forest: FOD, FOM, FOC. Upland: CUM; CUT; CUS; CUW. Bald Eagle: Forest community Series: FOD, FOM, FOC, SWD, SWM or SWC on shoreline areas adjacent to large rivers or lakes with open water (hunting areas).	The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. Raptor wintering(hawk/owl) sites need to be > 20 ha ^{cxlviii, cxlix} with a combination of forest and upland. ^{xvi, xvii, xviii, xix, xx, xxi} Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15ha) with adjacent woodlands ^{cxlix} Field area of the habitat is to be wind swept with limited snow depth or accumulation. Eagle sites have open water and large trees and snags available for roosting. <u>Information Sources:</u> <ul style="list-style-type: none"> OMNR Ecologist or Biologist Naturalist club Natural Heritage Information Center (NHIC) Raptor Winter Concentration Area Data from Bird Studies Canada, most notably for 	Studies confirm the use of these habitats by: <ul style="list-style-type: none"> One or more Short-eared Owls or; One of more Bald Eagles or; At least 10 individuals and two of listed hawk/owl species [Ⓔ]. To be significant a site must be used regularly (3 in 5 years) ^{cxlix} for a minimum of 20 days by the above number of birds[Ⓔ]. The habitat area for an Eagle winter site is the shoreline forest ecosites directly adjacent to the prime hunting area [Ⓔ]. Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi} SWH MIST^{cxlix} Index #10 and #11 provides development effects and mitigation 	No; Candidate Habitat not present within the study area. Qualifying ecosites are present within the study area but are of insufficient size to support raptor wintering (hawks/owls). No shorelines adjacent to large rivers or lakes are present to support Bald Eagles.	No; Confirmed habitat was not observed during field investigations.	No further action required.

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
			Short-eared Owls. <ul style="list-style-type: none"> Results of Christmas Bird Counts. Reports and other information available from Conservation Authorities. 	measures.			
Bat Hibernacula Rationale: Bat hibernacula are rare habitats in all Ontario landscapes.	Big Brown Bat Tri-colored Bat	Bat Hibernacula may be found in these ecosites: CCR1 CCR2 CCA1 CCA2 (Note: buildings are not considered to be SWH)	Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. Active mine sites should not be considered as SWH. The locations of bat hibernacula are relatively poorly known. <u>Information Sources</u> <ul style="list-style-type: none"> OMNR for possible locations and contact for local experts Natural Heritage Information Center (NHIC) Bat Hibernaculum Ministry of Northern Development and Mines for location of mine shafts. Clubs that explore caves (eg. Sierra Club) University Biology Departments with bat experts. 	<ul style="list-style-type: none"> All sites with confirmed hibernating bats are SWH [㊦]. The area includes 200m radius around the entrance of the hibernaculum ^{cxlviii, ccvii}, [㊦] for most development types and 1000m for wind farms. Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the “Guideline for Wind Power Projects Potential Impacts to Bats and Bat Habitats”^{ccv}. SWH MIST^{cxlix} Index #1 provides development effects and mitigation measures. 	No; There are no caves, mine shafts, underground foundations or Karsts within the study area.	No; Confirmed habitat was not observed during field investigations.	No further action required.

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
<p>Bat Maternity Colonies</p> <p><u>Rationale:</u> Known locations of forested bat maternity colonies is extremely rare in all Ontario landscapes.</p>	Big Brown Bat Silver-haired Bat	<p>Maternity colonies considered SWH are found in forested Ecosites.</p> <p>All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM</p>	<p>Maternity colonies can be found in tree cavities, vegetation and often in buildings^{xxii, xxv, xxvi, xxvii, xxxi} (buildings are not considered to be SWH). Maternity roosts are not found in caves and mines in Ontario^{xxii}.</p> <ul style="list-style-type: none"> Maternity colonies located in Mature deciduous or mixed forest stands^{ccix, ccx} with >10/ha large diameter (>25cm dbh) wildlife trees^{ccvii} Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3 ^{ccxiv} or class 1 or 2 ^{ccxii}. Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferred^{ccx} <p><u>Information Sources</u></p> <ul style="list-style-type: none"> OMNR for possible locations and contact for local experts University Biology Departments with bat experts. 	<ul style="list-style-type: none"> Maternity Colonies with confirmed use by; <ul style="list-style-type: none"> >10 Big Brown Bats^l >5 Adult Female Silver-haired Bats^l The area of the habitat includes the entire woodland or the forest stand ELC Ecosite containing the maternity colonies^l. Evaluation methods for maternity colonies should be conducted following methods outlined in the “Bats and Bat Habitats: Guidelines for Wind Power Projects”^{”ccv}. SWH MIST^{cxlix} Index #12 provides development effects and mitigation measures. 	<p>High Probability;</p> <p>Forest communities are present within the study area.</p>	<p>Candidate;</p> <p>A full bat habitat assessment was not completed, however candidate habitat was observed during a cavity tree assessment.</p>	<p>Candidate bat cavity trees were observed within the study area.</p> <p>Should vegetation removal occur that encroaches into the woodlands, additional surveys may be required. The MNRF <i>Species at Risk Bats within Treed Habitats</i> (2017) is the recommended protocol.</p> <p>It is recommended that any vegetation removal be conducted outside of the bat roosting season (April 1st - September 30th).</p>
<p>Turtle Wintering Areas</p> <p><u>Rationale:</u> Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.</p>	Midland Painted Turtle <u>Special Concern:</u> Northern Map Turtle Snapping Turtle	<p>Snapping and Midland Painted turtles; ELC Community Classes; SW, MA, OA and SA. ELC Community Series; FEO and BOO</p> <p>Northern Map Turtle - Open Water areas such as deeper rivers or streams and lakes with current</p>	<p>For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates.</p> <ul style="list-style-type: none"> Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen. ^{cix, cx, cxi, cxviii} Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH. 	<ul style="list-style-type: none"> Presence of 5 over-wintering Midland Painted Turtles is significant^l. One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant^l. The mapped ELC ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep-water pool where the turtles are over wintering is the SWH. 	<p>High Probability;</p> <p>Open water and wetland communities are present within the study area.</p>	<p>Candidate;</p> <p>Overwintering surveys were not completed, however, turtles were observed within the study area during field investigations.</p>	<p>Should development encroach into candidate habitat, additional surveys may be required.</p>

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
		can also be used as over-wintering habitat.	<u>Information Sources</u> <ul style="list-style-type: none"> EIS studies carried out by Conservation Authorities. Field Naturalist Clubs OMNRF Ecologist or Biologist Natural Heritage Information Center (NHIC) 	<ul style="list-style-type: none"> Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. – Oct.) or spring (Mar. – May) ^{cvii}. Congregation of turtles is more common where wintering areas are limited and therefore significant ^{cix, cx, cxi, cxii}. SWH MIST^{cxlix} Index #28 provides development effects and mitigation measures for turtle wintering habitat. 			
Reptile Hibernaculum <u>Rationale:</u> Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	<u>Snakes:</u> Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake <u>Special Concern:</u> Milksnake Eastern Ribbonsnake	For all snakes, habitat may be found in any ecosite other than very wet ones. Talus, Rock Barren, Crevice and Cave, and Alvar sites may be directly related to these habitats. Observations of congregations of snakes on sunny warm days in the spring or fall is a good indicator.	For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural or naturalized locations. The existence of features that go below frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH. Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line ^{xliv, l, li, lii, cxii} . Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. <u>Information Sources</u> <ul style="list-style-type: none"> In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). Reports and other 	Studies confirming: <ul style="list-style-type: none"> Presence of snake hibernacula used by a minimum of five individuals of a snake sp. <u>or</u>; individuals of two or more snake spp. Congregations of a minimum of five individuals of a snake sp. <u>or</u>; individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct)^l. <u>Note:</u> If there are Special Concern Species present, then site is SWH <u>Note:</u> Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population [i.e. strong hibernation site fidelity.]. Other critical life processes (e.g. mating) often take place 	Moderate Probability; Suitable habitat features may be present in the study area. There is potential for burrows, rock crevices, rock piles, stone fences or crumbling foundations to be found in association with the study area.	No; Confirmed habitat was not observed during field investigations. A pile of concrete rubble was observed during field investigations. However, thresholds for numbers of species and/or individual snakes were not observed during field investigations.	No further action required.

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
			information available from Conservation Authorities. <ul style="list-style-type: none"> Field Naturalist Clubs University herpetologists. Natural Heritage Information Center (NHIC) 	in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30 m buffer is the SWH [Ⓔ] <ul style="list-style-type: none"> SWH MIST^{cxlix} Index #13 provides development effects and mitigation measures for snake hibernacula. 			
Colonially - Nesting Bird Breeding Habitat (Bank and Cliff) Rationale: Historical use and number of nests in a colony make this habitat significant. An identified colony can be very important to local populations. All swallow population are declining in Ontario.	Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies).	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles, cliff faces, bridge abutments, silos, barns (Cliff Swallows). Habitat found in the following ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1	<ul style="list-style-type: none"> Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed/permitted aggregate area. Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. Does not include a licensed/permitted Mineral Aggregate Operation. <u>Information Sources</u> <ul style="list-style-type: none"> Reports and other information available from Conservation Authorities Ontario Breeding Bird Atlas^{ccv} Bird Studies Canada; <i>NatureCounts</i> http://www.birdscanada.org/birdmon/ Field Naturalist Clubs. 	Studies confirming: <ul style="list-style-type: none"> Presence of 1 or more nesting sites with 8^{cxlvix} or more cliff swallow pairs and/or rough-winged swallow pairs during the breeding season. A colony identified as SWH will include a 50m radius habitat area from the peripheral nests^{ccvii} Field surveys to observe and count swallow nests are to be completed during the breeding season (May-June). Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi} SWH MIST^{cxlix} Index #4 provides development effects and mitigation measures 	No; Although habitat may be present in the study area, it is likely to be man made and/or disturbed or recently disturbed and therefore does not qualify.	No; Confirmed habitat was not observed during field investigations. The study area does not contain suitable ecosites.	No further action required.
Colonially - Nesting Bird Breeding Habitat (Tree/Shrubs)	Great Blue Heron Black-crowned Night-Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	<ul style="list-style-type: none"> Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. 	Studies confirming: <ul style="list-style-type: none"> Presence of 2[Ⓔ] or more active nests of Great Blue Heron or other listed species.. 	High Probability; Suitable ecosites were identified within the study area.	No; No colony sites were observed during field investigations.	No further action required.

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
<p><u>Rationale:</u> Large colonies are important to local bird population, typically sites are only known colony in area and are used annually.</p>			<ul style="list-style-type: none"> Most nests in trees are 11 to 15 m from ground, near the top of the tree. <p><u>Information Sources</u></p> <ul style="list-style-type: none"> Ontario Breeding Bird Atlas ^{ccv}, colonial nest records. Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF). Natural Heritage Information Center (NHIC) Mixed Wader Nesting Colony Aerial photographs can help identify large heronries. Reports and other information available from Conservation Authorities MNRF District Offices. Local naturalist clubs. 	<ul style="list-style-type: none"> The habitat extends from the edge of the colony and a minimum 300 m radius or extend of the Forest Ecosite containing the colony or any island <15.0ha with a colony is the SWH ^{cc, ccvii} Confirmation of active heronries are to be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and/or eggshells SWH MIST^{cxlix} Index #5 provides development effects and mitigation measures. 			
<p>Colonially - Nesting Bird Breeding Habitat (Ground)</p> <p><u>Rationale:</u> Colonies are important to local bird population, typically sites are only known colony in area and are used annually.</p>	<p>Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird</p>	<p>Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1;50,000 NTS map).</p> <p>Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird)</p> <p>MAM1 – 6; MAS1 – 3; CUM CUT CUS</p>	<ul style="list-style-type: none"> Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas. Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands. <p><u>Information Sources</u></p> <ul style="list-style-type: none"> Ontario Breeding Bird Atlas ^{ccv}, rare/colonial species records. Canadian Wildlife Service Reports and other information available from Conservation Authorities Natural Heritage Information Center (NHIC) Colonial Waterbird Nesting Area 	<p>Studies confirming:</p> <ul style="list-style-type: none"> Presence of > 25 active nests for Herring Gulls or Ring-billed Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern[ⓔ]. Presence of 5 or more pairs for Brewer's Blackbird[ⓔ] Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant[ⓔ]. The edge of the colony and a minimum 150m radius area of habitat, or the extent of the ELC ecosites containing the colony or any island <3.0ha with a colony is the SWH ^{cc, ccvii} Studies would be done 	<p>Low Probability;</p> <p>Candidate Habitat not present within the study area.</p> <p>No rocky islands or peninsulas associated with a large lake or river are present within the study area.</p> <p>Suitable habitat may be present for Brewer's Blackbird</p>	<p>No;</p> <p>Confirmed habitat was not observed during field investigations.</p> <p>During breeding bird surveys target species were not observed.</p>	<p>No further action required.</p>

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
			<ul style="list-style-type: none"> MNRF District Offices. Field Naturalist Clubs. 	during May/June when actively nesting. Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” ^{ccxi} <ul style="list-style-type: none"> SWH MIST^{cxlix} Index #6 provides development effects and mitigation measures. 			
Migratory Butterfly Stopover Areas Rationale: Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter.	Painted Lady Red Admiral <u>Special Concern</u> Monarch	Combination of ELC Community Series; need to have present one Community Series from each landclass: <u>Field:</u> CUM CUT CUS <u>Forest:</u> FOC FOD FOM CUP Anecdotally, a candidate site for butterfly stopover will have a history of butterflies being observed.	A butterfly stopover area will be a minimum of 10 ha in size with a combination of field and forest habitat present, and will be located within 5 km of Lake Erie and Ontario cxlix. <ul style="list-style-type: none"> The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south xxxii, xxxiii, xxxiv, xxxv, xxxvi. The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat ^{cxlviii, cxlix}. Stopover areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes xxxvii, xxxviii, xxxix, xl, xli. <u>Information Sources</u> <ul style="list-style-type: none"> MNRF district Offices Natural Heritage Information Center (NHIC) Agriculture Canada in Ottawa may have list of butterfly experts. Field Naturalist Clubs Toronto Entomologists 	Studies confirm: <ul style="list-style-type: none"> The presence of Monarch Use Days (MUD) during fall migration (Aug/Oct)xliii. MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500/dayxxxvii, significant variation can occur between years and multiple years of sampling should occur xl, xlii. Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD MUD of >5000 or >3000 with the presence of Painted Ladies or Red Admiral’s is to be considered significant.® SWH MIST ^{cxlix} Index #16 provides development effects and mitigation measures.	No; The study area is more than 5km away from Lake Ontario and Lake Erie.	No; Candidate habitat was not identified.	No further action required.

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
			Association <ul style="list-style-type: none"> Conservation Authorities 				
Landbird Migratory Stopover Areas Rationale: Sites with a high diversity of species as well as high numbers are most significant.	All migratory songbirds. Canadian Wildlife Service Ontario website: http://www.ec.gc.ca/nature/default.asp?lang=En&n=421B7A9D-1 All migrant raptors species: Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors)	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	Woodlots need to be >5 ha [㊦] in size and within 5 km iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv of Lake Ontario and Erie. If woodlands are rare in an area of shoreline, woodland fragments 2-5ha can be considered for this habitat. ㊦ <ul style="list-style-type: none"> If multiple woodlands are located along the shoreline those Woodlands <2km from Lake Erie and Lake Ontario are more significant ^{cxlix} Sites have a variety of habitats; forest, grassland and wetland complexes ^{cxlix}. The largest sites are more significant ^{cxlix} Woodlots and forest fragments are important habitats to migrating birds^{ccxviii}, these features located along the shore and located within 5km of Lake Erie and Lake Ontario are Candidate SWH ^{cxlviii}. <u>Information Sources</u> <ul style="list-style-type: none"> Bird Studies Canada Ontario Nature Local birders and naturalist club Ontario Important Bird Areas (IBA) Program 	Studies confirm: <ul style="list-style-type: none"> Use of the woodlot by >200 birds/day and with >35 spp with at least 10 bird spp. recorded on at least 5 different survey dates[㊦]. This abundance and diversity of migrant bird species is considered above average and significant. Studies should be completed during spring (March to May) and fall (Aug to Oct) migration using standardized assessment techniques. Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi} SWH MIST ^{cxlix} Index #9 provides development effects and mitigation measures. 	No; The study area is more than 5km away from Lake Ontario and Lake Erie.	No; Candidate habitat was not identified.	No further action required.
Deer Winter Congregation Areas Rationale: Deer movement	White-tailed Deer	All Forested Ecosites with these ELC Community Series; FOC	<ul style="list-style-type: none"> Woodlots >100 ha in size or if large woodlots are rare in a planning area woodlots>50ha ㊦. Deer movement during 	Studies confirm: <ul style="list-style-type: none"> Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF ^{cxlviii}. 	Low Probability; Forested ecosites present within the study area are likely not large	No; Candidate habitat was not identified.	No further action required.

Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
during winter in the southern areas of Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions ^{cxlviii} .		FOM FOD SWC SWM SWD Conifer plantations much smaller than 50 ha may also be used.	winter in the southern areas Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands ^{cxlviii} . <ul style="list-style-type: none"> Large woodlots > 100ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha ^{ccxxiv}. Woodlots with high densities of deer due to artificial feeding are not significant[©]. <u>Information Sources</u> <ul style="list-style-type: none"> MNRF District Offices. LIO/NRVIS 	<ul style="list-style-type: none"> Use of the woodlot by white-tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF[©] Studies should be completed during winter (Jan/Feb) when >20cm of snow is on the ground using aerial survey techniques^{ccxxiv}, ground or road surveys, or a pellet count deer density survey^{ccxxv}. SWH MIST ^{cxlix} Index #2 provides development effects and mitigation measures. 	enough to support significant numbers of deer.		

Table 1.2.1 Rare Vegetation Communities.

Rare Vegetation Community	CANDIDATE SWH			CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/Recommendations
	ELC Ecosite Code	Habitat Description	Detailed Information and Sources	Defining Criteria			
Cliffs and Talus Slopes Rationale: Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO CLO TAS CLS TAT CLT	A Cliff is vertical to near vertical bedrock >3m in height. A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris	Most cliff and talus slopes occur along the Niagara Escarpment. <u>Information Sources</u> <ul style="list-style-type: none">The Niagara Escarpment Commission has detailed information on location of these habitats.OMNRF DistrictsNatural Heritage Information Center (NHIC) has location information available their websiteField Naturalist ClubsConservation Authorities	<ul style="list-style-type: none">Confirm any ELC Vegetation Type for Cliffs or Talus Slopes lxxviiiSWH MIST^{cxlix} Index #21 provides development effects and mitigation measures.	No; No cliff or talus communities were identified within the study area.	No; Candidate habitat was not identified.	No further action required.
Sand Barren Rationale: Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry	ELC Ecosites: SBO1 SBS1 SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket-like (SBS1), or more closed and treed (SBT1). Tree cover always ≤ 60%.	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered but less than 60%.	A sand barren area >0.5ha in size [Ⓔ] . <u>Information Sources</u> <ul style="list-style-type: none">OMNRF Destricts.Natural Heritage Information Center (NHIC) has location information available on their websiteField Naturalist ClubsConservation Authorities	<ul style="list-style-type: none">Confirm any ELC Vegetation Type for Sand Barrens lxxviiiSite must not be dominated by exotic or introduced species (<50% vegetative cover exotics) [Ⓔ].SWHMIST^{cxlix} Index #20 provides development effects and mitigation measures.	No; No sand barren communities were identified within the study area.	No; Candidate habitat was not identified.	No further action required.
Alvar Rationale: Alvars are extremely rare habitats in Ecoregion 7E.	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 Five Alvar	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating	An Alvar site > 0.5 ha in size ^{lxxv} . Alvar is particularly rare in Ecoregion 7E where the only known sites are found in the western islands of Lake Erie. ^{cxix} <u>Information Sources</u> <ul style="list-style-type: none">Alvars of Ontario (2000), Federation of Ontario Naturalists ^{lxxvi}.	Field studies identify four of the five [Ⓔ] Alvar Indicator Species ^{lxxv} at a Candidate Alvar site is Significant. <ul style="list-style-type: none">Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics).The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land	No; No alvar communities were identified within the study area.	No; Candidate habitat was not identified.	No further action required.

Rare Vegetation Community	CANDIDATE SWH			CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/Recommendations
	ELC Ecosite Code	Habitat Description	Detailed Information and Sources	Defining Criteria			
	Indicator Species: 1) <i>Carex crawei</i> 2) <i>Panicum philadelphicum</i> 3) <i>Elocharis compressa</i> 4) <i>Scutellaria parvula</i> 5) <i>Trichostema brachiatum</i> These indicator species are very specific to Alvars within Ecoregion 7E [®] .	periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plant. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover ^{lxxviii} .	<ul style="list-style-type: none"> Ontario Nature – Conserving Great Lakes Alvars^{ccviii}. Natural Heritage Information Center (NHIC) has location information available on their website OMNRF Staff. Field Naturalist Clubs. Conservation Authorities. 	uses ^{lxxv} . <ul style="list-style-type: none"> SWH MIST^{cxlix} Index #17 provides development effects and mitigation measures. 			
Old Growth Forest Rationale: Due to historic logging practices and land clearance for agriculture, old growth forest is rare in Ecoregion 7E.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old-growth forests are characterized by heavy mortality or turnover of over-storey trees resulting in mosaic of gaps that encourage development of multi-layered canopy and an abundance of snags and downed woody debris.	<ul style="list-style-type: none"> Woodland area is >0.5 ha[®]. Information Sources <ul style="list-style-type: none"> OMNRF Forest Resource Inventory mapping OMNRF Districts. Field Naturalist Clubs Conservation Authorities Sustainable Forestry Licence (SFL) companies will possibly know locations through field operations. Municipal forestry departments 	Field Studies will determine: <ul style="list-style-type: none"> If dominant trees species of the ecosite are >140 years old, then area containing these trees is Significant Wildlife Habitat ^{cxlviii}. The forested area containing the old growth characteristics will have experienced no recognizable forestry activities (cut steps will not be present) The area of forest ecosites combined or an eco-element within an ecosite that contain the old growth characteristics is the SWH. Determine ELC vegetation types for the forest area containing the old growth characteristics^{lxxviii}. SWH MIST^{cxlix} Index #23 provides development effects and mitigation measures. 	Moderate Probability; Forested ecosites are present within the study area.	No; Candidate habitat was not identified as the age of trees observed does meet the criteria for old-growth forest.	No further action required.
Savannah Rationale: Savannahs are extremely	TPS1 TPS2 TPW1 TPW2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 –	No minimum size to site [®] Site must be restored or a natural site. Remnant sites such as railway right of ways	Field studies confirm one or more of the Savannah indicator species listed in ^{lxxv} Appendix N should be present [®] . Note: Savannah plant spp. list from Ecoregion	No; No savannah communities were	No; Candidate habitat was not identified.	No further action required.

Rare Vegetation Community	CANDIDATE SWH			CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/Recommendations
	ELC Ecosite Code	Habitat Description	Detailed Information and Sources	Defining Criteria			
rare habitats in Ontario.	CUS2	60%. In ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario).	are not considered to be SWH. <u>Information Sources</u> <ul style="list-style-type: none"> Natural Heritage Information Center (NHIC) has location data available on their website. OMNRF Districts. Field Naturalists Clubs. Conservation Authorities. 	7E should be used <ul style="list-style-type: none"> Area of the ELC Ecosite is the SWH. Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). SWH MIST^{cxlix} Index #18 provides development effects and mitigation measures. 	identified within the study area.		
Tallgrass Prairie <u>Rationale:</u> Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover. In ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario). ^{cc}	No minimum size to site ⑥. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. <u>Information Sources</u> <ul style="list-style-type: none"> OMNRF Districts. Natural Heritage Information Center (NHIC) has location data available on their website. Field Naturalists Clubs. Conservation Authorities 	Field studies confirm one or more of the Prairie indicator species listed in ^{lxxv} Appendix N should be present ⑥. Note: Prairie plant spp. list from Ecoregion 7E should be used <ul style="list-style-type: none"> Area of the ELC Ecosite is the SWH Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). SWH MIST^{cxlix} Index #19 provides development effects and mitigation measures. 	No; No tallgrass prairie communities were identified within the study area.	No; Candidate habitat was not identified.	No further action required.
Other Rare Vegetation Communities <u>Rationale:</u> Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG ^{cxlviii} . Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M ^{cxlviii} The OMNRF/NHIC will have up to date listing for rare vegetation communities. <u>Information Sources</u> <ul style="list-style-type: none"> OMNRF Districts. 	Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTG ^{cxlviii} . <ul style="list-style-type: none"> Area of the ELC Vegetation Type polygon is the SWH. SWH MIST ^{cxlix} Index #37 provides development effects and mitigation measures. 	No; No rare vegetation communities were identified within the study area.	No; Candidate habitat was not identified.	No further action required.

Rare Vegetation Community	CANDIDATE SWH			CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/Recommendations
	ELC Ecosite Code	Habitat Description	Detailed Information and Sources	Defining Criteria			
	Rare is Candidate SWH.		<ul style="list-style-type: none">• Natural Heritage Information Center (NHIC) has location data available on their website.• Field Naturalists Clubs.• Conservation Authorities•				

Table 1.2.2 Specialized Habitats of Wildlife considered SWH.

Specialized Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
Waterfowl Nesting Area <u>Rationale:</u> Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant.	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 Note: includes adjacency to Provincially Significant Wetlands	A waterfowl nesting area extends 120 m ^{cxlix} from a wetland (> 0.5 ha) or a wetland (>0.5 ha) with small wetlands (<0.5ha) within 120m or a cluster of 3 or more small (<0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur ^{cxlix} . <ul style="list-style-type: none">Upland areas should be at least 120m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests.Wood Ducks and Hooded Mergansers utilize large diameter trees (>40cm dbh) in woodlands for cavity nest sites. <u>Information Sources</u> <ul style="list-style-type: none">Ducks Unlimited staff may know the locations of particularly productive nesting sites.OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat.Reports and other information available from Conservation Authorities	Studies confirmed: <ul style="list-style-type: none">Presence of 3 or more nesting pairs for listed species excluding Mallards[®] , or;Presence of 10 or more nesting pairs for listed species including Mallards[®]Any active nesting site of an American Black Duck is considered significant.Nesting studies should be completed during the spring breeding season (April - June). Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120 m ^{cxlviii} from the wetland and will provide enough habitat for waterfowl to successfully nest.SWH MIST^{cxlix} Index #25 provides development effects and mitigation measures.	Moderate Probability; Wetland communities adjacent to upland habitat were identified within the study area.	No; Although both open and wooded upland communities adjacent to wetlands meet width thresholds, species and abundance thresholds were not observed during field investigations.	No further action required.
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat <u>Rationale:</u> Nest sites are fairly uncommon in Ecoregion 7E and are used	Osprey Special Concern Bald Eagle	ELC Forest Community Series: FOD, FOM, FOC, SWD, SWM and SWC directly adjacent to riparian areas – rivers, lakes, ponds and wetlands	Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. <ul style="list-style-type: none">Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree’s canopy.Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms).	Studies confirm the use of these nests by: <ul style="list-style-type: none">One or more active Osprey or Bald Eagle nests in an area^{cxlviii} .Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH.For an Osprey, the active	Moderate Probability; Qualifying vegetation communities adjacent to ponds and wetlands are present within the study area.	No; No nest sites were observed and target species were not identified during breeding bird surveys.	No further action required.

Specialized Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
<p>annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.</p>			<p><u>Information Sources</u></p> <ul style="list-style-type: none"> Natural Heritage Information Center (NHIC) compiles all known nesting sites for Bald Eagles in Ontario. MNRF values information (LIO/NRVIS) will list known nesting locations, Note: data from NRVIS is provided as a point and does not represent all the habitat. Nature Counts, Ontario Nest Records Scheme data. OMNRF Districts. Check the Ontario Breeding Bird Atlas ^{ccv} or Rare Breeding Birds in Ontario for species documented Reports and other information available from Conservation Authorities Field naturalist Clubs 	<p>nest and a 300 m radius around the nest or the contiguous woodland stand is the SWH ^{ccvii}, maintaining undisturbed shorelines with large trees within this area is important^{*cxlviii}.</p> <ul style="list-style-type: none"> For a Bald Eagle the active nest and a 400-800 m radius around the nest is the SWH. ^{cvi, ccvii} Area of the habitat from 400-800m is dependant on site lines from the nest to the development and inclusion of perching and foraging habitat ^{cvi} To be significant a site must be used annually. When found inactive, the site must be known to be inactive for ≥ 3 years or suspected of not being used for >5 years before being considered not significant. ^{ccvii} Observational studies to determine nest site use, perching sites and foraging areas need to be done from mid March to mid August. Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi} SWH MIST^{cxlix} Index #26 provides development effects and mitigation measures 			
<p>Woodland Raptor Nesting Habitat</p> <p>Rationale: Nests sites for these species are rarely identified; these area sensitive habitats are often used annually by</p>	<p>Northern Goshawk Cooper’s Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl Broad-winged Hawk</p>	<p>May be found in all forested ELC Ecosites.</p> <p>May also be found in SWC, SWM, SWD and CUP3</p>	<p>All natural or conifer plantation woodland/forest stands combined >30ha or with >4 ha of interior habitat ^{lxxxviii, lxxxix, xc, xci, xciii, xciv, xcv,xcvi, cxxxiii}. Interior habitat determined with a 200m buffer^{cxlviii}</p> <ul style="list-style-type: none"> Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore 	<p>Studies confirm:</p> <ul style="list-style-type: none"> Presence of 1 or more active nests from species list is considered significant^{*cxlviii}. Red-shouldered Hawk and Northern Goshawk – A 400m radius around the nest or 28 ha habitat area would be applied where optimal habitat is irregularly shaped around the nest) ^{ccvii}. Barred Owl – A 200m radius around the nest is the SWH 	<p>No;</p> <p>Forest communities identified within the study area are not large enough to meet the size requirement for significance.</p>	<p>No;</p> <p>Candidate habitat was not identified.</p>	<p>No further action required.</p>

Specialized Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
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these species.			<p>islands.</p> <ul style="list-style-type: none"> In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest. <p><u>Information Sources</u></p> <ul style="list-style-type: none"> OMNRF Districts. Check the Ontario Breeding Bird Atlas ^{ccv} or Rare Breeding Birds in Ontario for species documented. Check data from Bird Studies Canada. Reports and other information available from Conservation Authorities 	<p>^{ccvii}.</p> <ul style="list-style-type: none"> Broad-winged Hawk and Coopers Hawk, – A 100m radius around the nest is the SWH^{ccvii}. Sharp-Shinned Hawk – A 50m radius around the nest is the SWH^{ccvii}. Conduct field investigations from mid-March to end of May. The use of call broadcasts can help in locating territorial (courting/nesting) raptors and facilitate the discovery of nests by narrowing down the search area. SWH MIST^{cxlix} Index #27 provides development effects and mitigation measures. 			
<p>Turtle Nesting Areas</p> <p><u>Rationale:</u> These habitats are rare and when identified will often be the only breeding site for local populations of turtles.</p>	<p>Midland Painted Turtle</p> <p><u>Special Concern Species</u> Northern Map Turtle Snapping Turtle</p>	<p>Exposed mineral soil (sand or gravel) areas adjacent (<100m) ^{cxlviii} or within the following ELC Ecosites:</p> <p>MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1</p>	<ul style="list-style-type: none"> Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons or other animals. For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers are most frequently used. <p><u>Information Sources</u></p> <ul style="list-style-type: none"> Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels). Check the Ontario Herpetofaunal Atlas records (or other similar atlases) for uncommon turtles; location information may help to find 	<p>Studies confirm:</p> <ul style="list-style-type: none"> Presence of 5 or more nesting Midland Painted Turtles® One or more Northern Map Turtle or Snapping Turtle nesting is a SWH®. The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30-100m around the nesting area dependant on slope, riparian vegetation and adjacent land use is the SWH. ^{cxlviii} Travel routes from wetland to nesting area are to be considered within the SWH as a part of the 30-100m area of habitat. ^{cxlix} Field investigations should be conducted in prime nesting season typically late spring to early summer. Observational studies observing the turtles nesting 	<p>Moderate Probability;</p> <p>Suitable ecosites are present within the study area. Exposed mineral soil is present <100m from suitable ecosites.</p>	<p>No;</p> <p>Confirmed habitat was not identified. Although turtles were observed within the study area, no nesting was observed.</p>	<p>No further action required.</p>

Specialized Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
			<p>potential nesting habitat for them.</p> <ul style="list-style-type: none"> Natural Heritage Information Center (NHIC) Field Naturalist Clubs 	<p>is a recommended method.</p> <ul style="list-style-type: none"> SWH MIST ^{cxlix} Index #28 provides development effects and mitigation measures for turtle nesting habitat. 			
<p>Seeps and Springs</p> <p>Rationale: Seeps/Springs are typical of headwater areas and are often at the source of coldwater streams.</p>	<p>Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.</p>	<p>Seeps/Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps/springs.</p>	<p>Any forested area (with <25% meadow/field/pasture) within the headwaters of a stream or river system ^{cxvii, cxlix}.</p> <ul style="list-style-type: none"> Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species ^{cxix, cxx, cxxi, cxxii, cxlii, cxiv}. <p><u>Information Sources</u></p> <ul style="list-style-type: none"> Topographical Map. Thermography. Hydrological surveys conducted by Conservation Authorities and MOE. Field Naturalists Clubs and landowners. Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped. 	<p>Field Studies confirm:</p> <ul style="list-style-type: none"> Presence of a site with 2 or more[®] seeps/springs should be considered SWH. The area of a ELC forest ecosite or ecoelement within ecosite containing the seeps/springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation the habitat ^{cxlviii}. SWH MIST ^{cxlix} Index #30 provides development effects and mitigation measures 	<p>Moderate Probability;</p> <p>Forested ecosites are present within the study area.</p>	<p>No;</p> <p>Confirmed habitat was not observed during field investigations.</p>	<p>No further action required.</p>
<p>Amphibian Breeding Habitat (Woodland).</p> <p>Rationale: These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations</p>	<p>Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog</p>	<p>All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD</p> <p>Breeding pools within the woodland or the shortest distance from forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians</p>	<ul style="list-style-type: none"> Presence of a wetland, pond or woodland pool(including vernal pools) >500m² within or adjacent (within 120m) to a woodland (no minimum size).clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx. Some small wetlands may not be mapped and may be important breeding pools for amphibians. Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat ^{cxlviii} <p><u>Information Sources</u></p> <ul style="list-style-type: none"> Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records Local landowners may also provide assistance as they may hear spring- 	<p>Studies confirm;</p> <ul style="list-style-type: none"> Presence of breeding population of 1 or more of the listed salamander species or 2 or more of the listed frog species with at least 20 individuals (adults, juveniles, eggs/larval masses) lxxi or 2 or more of the listed frog species wioth Call Level Codes of 3 [®]. A combination of observation study and call count survey will be required during the sping (March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands. The habitat is the wetland 	<p>Moderate Probability;</p> <p>Forested and swamp ecosites are present within the study area.</p>	<p>Confirmed;</p> <p>Thresholds for species and individuals were met in the Silver Swamp LSW during amphibian breeding surveys.</p>	<p>As stated in the PPS 2014, development and site alteration is not permitted within Significant Wildlife Habitat (SWH). Additionally, the PPS (2014) states that development is not permitted within adjacent lands to Significant Wildlife Habitat unless “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 their ecological functions”.</p> <p>It is recommended that the proposed development occur outside of confirmed habitat in order to comply with the PPS (2014).</p>

Specialized Wildlife Habitat	Wildlife Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria			
			time choruses of amphibians on their property. <ul style="list-style-type: none"> • OMNRF Districts and wetland evaluations • Field Naturalist Clubs • Canadian Wildlife Service Amphibian Road Call Survey • Ontario Vernal Pool Association: http://www.ontariovernalpools.org 	area plus a 230m radius of area. If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. <ul style="list-style-type: none"> • SWH MIST cxlix Index #14 provides development effects and mitigation measures. 			
Amphibian Breeding Habitat (Wetlands) Rationale: Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario landscapes.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these wetland ecosites will be isolated (>120m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) may be adjacent to woodlands.	<ul style="list-style-type: none"> • Wetlands>500m2 (about 25m diameter))^{ccvii}, supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats^{clxxxii}. • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. • Bullfrogs require permanent water bodies with abundant emergent vegetation. <u>Information Sources</u> <ul style="list-style-type: none"> • Ontario Herpetofaunal Summary Atlas (or other similar atlases) • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNRF Districts and wetland evaluations. • Reports and other information available from Conservation Authorities. 	Studies confirm: <ul style="list-style-type: none"> • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog/toad species with at least 20 individuals (adults or eggs masses)^{lxxi} or 2 or more of the listed frog/toad species with Call Level Codes of 3[ⓔ]. or; Wetland with confirmed breeding Bullfrogs are significant[ⓔ]. • The ELC ecosite wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys^{cviii} will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the wetlands. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWH MIST^{cxlix} Index #15 provides development effects and mitigation measures. 	High Probability; Qualifying ecosites are present within the study area.	No; Confirmed habitat was not observed during field investigations. Thresholds for species and individuals were not met during amphibian breeding surveys.	No further action required.

Table 1.3. Habitats of Species of Conservation Concern considered SWH.

Wildlife	Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria			
Woodland Area-Sensitive Bird Breeding Habitat Rationale: Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.	Yellow-bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager Winter Wren Pileated Woodpecker <u>Special Concern:</u> Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	<ul style="list-style-type: none">Habitats where interior forest breeding birds are breeding, typically large mature (>60 yrs old) forest stands or woodlots >30 ha. cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix, clxiv <u>Information Sources</u> <ul style="list-style-type: none">Local birder clubs.Canadian Wildlife Service (CWS) for the location of forest bird monitoring .Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior speciesReports and other information available from Conservation Authorities	Studies confirm: <ul style="list-style-type: none">Presence of nesting or breeding pairs of 3 or more of the listed wildlife species. ⑥<u>Note:</u> any site with breeding Cerulean Warblers or Canada Warbler is to be considered SWH.⑥Conduct field investigations in spring and early summer when birds are singing and defending their territories.Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}SWH MIST cxlix Index #34 provides development effects and mitigation measures.	No; Forested ecosites within the study area are not large enough to provide interior forest habitat.	No; Confirmed habitat was not observed during field investigations.	No further action required.
Marsh Breeding Bird Habitat Rationale: Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Moorhen American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Green Heron Trumpeter Swan Special Concern: Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites.	<ul style="list-style-type: none">Nesting occurs in wetlands.All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present cxxiv.For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water. <u>Information Sources</u> <ul style="list-style-type: none">OMNRF District and wetland evaluations.Field Naturalist clubsNatural Heritage Information	Studies confirm: <ul style="list-style-type: none">Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren or breeding by any combination of 4 or more of the listed species ⑥.<u>Note:</u> any wetland with breeding of 1 or more Black Terns, Trumpeter Swan, Green Heron or Yellow Rail is SWH ⑥.Area of the ELC ecosite is the SWH.Breeding surveys should be done in May/June when these species are actively nesting in wetland habitats.Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”	High Probability; Qualifying wetland ecosites are present within the study area.	No; Confirmed habitat was not observed during field investigations.	No further action required.

Wildlife	Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria			
			<p>Centre (NHIC) Records.</p> <ul style="list-style-type: none"> • Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas. 	<ul style="list-style-type: none"> • SWH MIST Index #35 provides development effects and mitigation measures 			
<p>Open Country Bird Breeding Habitat</p> <p>Rationale: This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.</p>	<p>Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow</p> <p>Special Concern Short-eared Owl</p>	CUM1 CUM2	<p>Large grassland areas (includes natural and cultural fields and meadows) >30 ha ^{clx, clxi, clxii, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix}.</p> <ul style="list-style-type: none"> • Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e. no row cropping or intensive hay or livestock pasturing in the last 5 years) [Ⓔ]. • Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. • The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species. <p>Information Sources Agricultural land classification maps, Ministry of Agriculture. Local bird clubs. Ontario Breeding Bird Atlas EIS Reports and other information available from Conservation Authorities.</p>	<p>Field Studies confirm:</p> <ul style="list-style-type: none"> • Presence of nesting or breeding of 2 or more of the listed species. [Ⓔ] • A field with 1 or more breeding Short-eared Owls is to be considered SWH. • The area of SWH is the contiguous ELC ecosite field areas. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi} • SWH MIST ^{cxlix} Index #32 provides development effects and mitigation measures 	Moderate Probability; Suitable cultural meadow habitat that meets size thresholds is present within the study area.	No; Species and number thresholds were not met during breeding bird surveys.	No further action required.
Shrub/Early	<u>Indicator Spp:</u>	CUT1	Large field areas succeeding	Field Studies confirm:	No;	No;	No further action required.

Wildlife	Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria			
Successional Bird Breeding Habitat Rationale: This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records ^{cxlix} .	Brown Thrasher Clay-coloured Sparrow <u>Common Spp.</u> Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher Special Concern: Yellow-breasted Chat Golden-winged Warbler	CUT2 CUS1 CUS2 CUW1 CUW2 Patches of shrub ecosites can be complexed into a larger habitat for some bird species	to shrub and thicket habitats >10ha ^{clxiv} in size. • Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e. no row-cropping, haying or live-stock pasturing in the last 5 years) [Ⓔ] . • Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species ^{clxxiii} . • Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. Information Sources Agricultural land classification maps, Ministry of Agriculture. Local bird clubs. Ontario Breeding Bird Atlas Reports and other information available from Conservation Authorities.	<ul style="list-style-type: none"> • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species. [Ⓔ] • A habitat with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat. [Ⓔ] • The area of the SWH is the contiguous ELC ecosite field/thicket area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi} • SWH MIST • ^{cxlix} Index #33 provides development effects and mitigation measures. 	Although suitable ecosites are present within the study area they do not meet the size criteria for significance.	Confirmed habitat was not observed during field investigations.	
Terrestrial Crayfish; Rationale: Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare. ^{ccii}	Chimney or Digger Crayfish; <u>(<i>Fallicambarus fodiens</i>)</u> Devil Crawfish or Meadow Crayfish; <u>(<i>Cambarus Diogenes</i>)</u>	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM	Wet meadow and edges of shallow marshes (no minimum size) should be surveyed for terrestrial crayfish. • Constructs burrows in marshes, mudflats, meadows, the ground can’t found far from water. • Both species are a semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. <u>Information Sources</u> • Information sources from “Conservation Status of Freshwater Crayfishes” by Dr. Premek Hamr for the WWF and CNF March 1998	Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable meadow marsh, swamp or moist terrestrial sites ^{cci} • Area of ELC ecosite or an Habitat ecoelement area of meadow marsh or swamp within the larger ecosite area is the SWH. • Surveys should be done April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals is very difficult ^{cci} • SWH MIST ^{cxlix} Index #36 provides development effects and mitigation measures.	Moderate Probability; Suitable wetland ecosites are present within the study area.	Confirmed; Chimneys were observed in suitable habitat during field investigations.	As stated in the PPS 2014, development and site alteration is not permitted within Significant Wildlife Habitat (SWH). Additionally, the PPS (2014) states that development is not permitted within adjacent lands to Significant Wildlife Habitat unless “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 their ecological functions”. It is recommended that the proposed development occur outside of confirmed habitat in order to comply

Wildlife	Species	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria			
							with the PPS (2014).
Special Concern and Rare Wildlife Species Rationale: These species are quite rare or have experienced significant population declines in Ontario.	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre (NHIC).	All plant and animal element occurrences (EO) within a 1 or 10km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy	<ul style="list-style-type: none"> When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites lxxviii Information Sources Natural Heritage Information Centre (NHIC) will have Special Concern and Provincially Rare (S1-S3, SH) species lists with element occurrences data. NHIC Website “Get Information” : http://nhic.mnr.gov.on.ca Ontario Breeding Bird Atlas• Expert advice should be sought as many of the rare spp. have little information available about their requirements. 	Studies Confirm: <ul style="list-style-type: none"> Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable. The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat needs be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat or foraging habitat. SWH MIST Index #37 provides development effects and mitigation measures. 	High Probability; There are records of Special Concern and rare species within or in the vicinity of the study area.	Confirmed; Rare species or species of Special Concern were observed within the study area (Monarch within CUM1-1 on properties: 3298 Scotland Dr 3137 Scotland Dr 3405 Scotland Dr 3465 Scotland Dr 3502 Manning Dr 3595 Scotland Dr 3666 Scotland Dr 3691 Manning Dr 3713 Scotland Dr 6100 White Oak Rd; Eastern Wood-pewee within FOD5-5 on property 3583 Westminster Dr)	As stated in the PPS 2014, development and site alteration is not permitted within Significant Wildlife Habitat (SWH). Additionally, the PPS (2014) states that development is not permitted within adjacent lands to Significant Wildlife Habitat unless “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 their ecological functions”. It is recommended that the proposed development occur outside of confirmed habitat in order to comply with the PPS (2014).

Table 1.4 Animal Movement Corridors

Habitat	SPECIES	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Present within the Study Area	Conclusions/ Recommendations
		ELC Eco-sites	Habitat Criteria and Information Sources	Defining Criteria			
Amphibian Movement Corridors Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	Corridors may be found in all ecosites associated with water. <ul style="list-style-type: none">Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1	<p>Movement corridors between breeding habitat and summer habitat clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi .</p> <p>Movement corridors must be determined when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat – Wetland) of this Schedule ⑤.</p> <p>Information Sources</p> <ul style="list-style-type: none">•MNR District Office.•Natural Heritage Information Centre (NHIC).•Reports and other information available from Conservation Authorities.•Field Naturalist Clubs.	<ul style="list-style-type: none">• Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites.* Corridors should consist of native vegetation, with several layers of vegetation. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant cxlix• Corridors should have at least 15m of vegetation on both sides of waterway cxlix or be up to 200m wide cxlix of woodland habitat and with gaps <20m cxlix .• Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat cxlix.• SWH MIST cxlix Index #40 provides development effects and mitigation measures	Moderate Probability; Qualifying ecosties are present within the study area.	No; Confirmed habitat was not observed during field investigations. Amphibian Breeding Habitat – Wetland was not confirmed during amphibian breeding surveys.	No further action required.

Table 1.5 Significant Wildlife Habitat Exceptions for Ecodistricts within Eco-Region 7E

Habitat	SPECIES	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Present within the Study Area	Conclusions/ Recommendations
		ELC Eco-sites	Habitat Criteria and Information Sources	Defining Criteria			
7E-2	Bat Migratory Stopover Area Rationale: Stopover areas for long distance migrant bats are important during fall migration. Hoary Bat Eastern Red Bat Silver-haired Bat	No specific ELC types.	<ul style="list-style-type: none">• Long distance migratory bats typically migrate during late summer and early fall from summer breeding habitats throughout Ontario to southern wintering areas. Their annual fall migration may concentrate these species of bats at stopover areas.• This is the only known bat migratory stopover habitats based on current information. <p><u>Information Sources</u></p> <ul style="list-style-type: none">• OMNRF for possible	<ul style="list-style-type: none">• Long Point (42°35’N, 80°30’E, to 42°33’N, 80°03’E) has been identified as a significant stop-over habitat for fall migrating Silver-haired Bats, due to significant increases in abundance, activity and feeding that	No; Candidate habitat not present within the study area.	No; Confirmed habitat was not observed during field investigations.	No further action required.

Habitat	SPECIES	CANDIDATE SWH		CONFIRMED SWH	Candidate Habitat Present Within the Study Area	Confirmed Habitat Present within the Study Area	Conclusions/ Recommendations
		ELC Eco-sites	Habitat Criteria and Information Sources	Defining Criteria			
			locations and contact for local experts <ul style="list-style-type: none"> • University of Waterloo, Biology Department 	was documented during fall migration ^{ccxv} . <ul style="list-style-type: none"> • The confirmation criteria and habitat areas for this SWH are still being determined. • SWH MIST ^{cxlix} Index #38 provides development effects and mitigation measures 			