



Regional Municipality of Halton

New North Oakville Transportation Corridor and Crossing of Sixteen Mile Creek

Appendix J: Natural Environment Review

Regional Municipality of Halton

New North Oakville Transportation Corridor Class Environmental Assessment (EA) - Natural Environment Report

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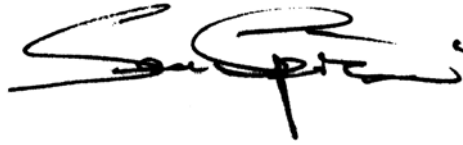
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1. Introduction

A new transportation corridor in the vicinity of Burnhamthorpe Road (Regional Road 27) within the Town of Oakville has been identified to satisfy east-west capacity requirements in a number of previous studies, including the Region of Halton Transportation Master Plan. AECOM was retained by the Regional Municipality of Halton to complete the New North Oakville Transportation Corridor Class Environmental Assessment (EA) in compliance with Schedule C of the Municipal Engineers Association (MEA) Municipal Class EA.

The initial study area was bounded by Lower Baseline Road, 4th Line and Highway 407 ETR to the north, Ninth Line (Regional Road 13) to the east, Dundas Street (Regional Road 5) to the south, and Bronte Road (Regional Road 25) to the west. As the evaluation of alternatives progressed, the study area's northern boundary was adjusted to 407 ETR and Burnhamthorpe Road (north of 407 ETR), as illustrated on Figure 1.

This report presents the findings and recommendations of the natural heritage investigations. After presenting existing conditions, the evaluation process for alignment alternatives is briefly discussed, followed by a more detailed discussion on the potential impacts and mitigation opportunities associated with the technically preferred undertaking. The report may be appended to AECOM's Transportation Environmental Study Report (TESR) as a stand-alone technical document in support of the overall Environmental Assessment Process.

Concurrently, AECOM has also prepared a separate stand-alone report on hydrogeology (issued under the former operating company Gartner Lee Limited). We have therefore limited our comments here on earth science features and functions.

2. Methodological Approach

2.1 Available Secondary Source Information Collection and Review

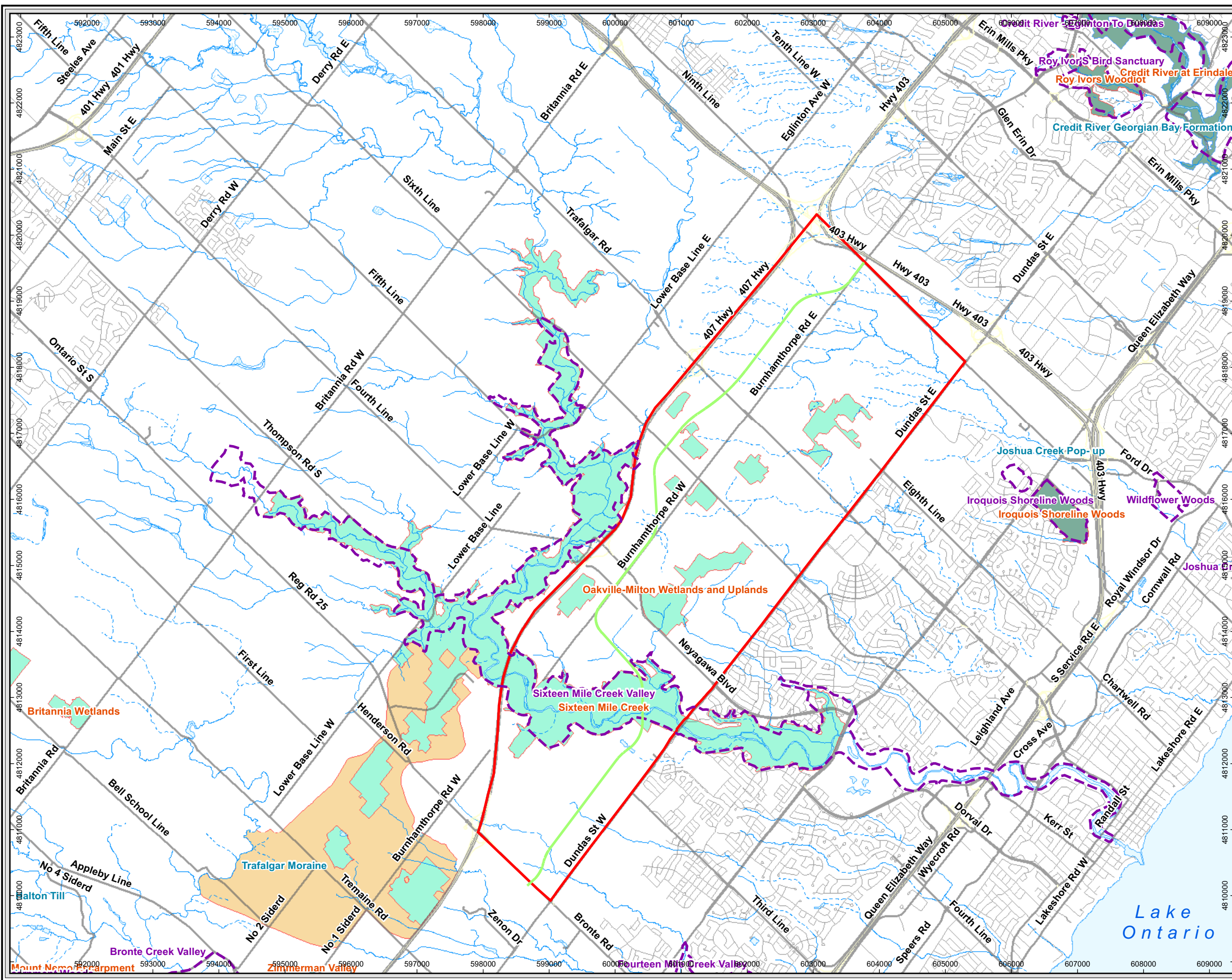
On the basis of a literature review and desktop analysis, known natural heritage features and functions were compiled for the study area. The literature review incorporated information from the Ministry of Natural Resources, Conservation Halton, Halton Region, and the Town of Oakville, including the North Oakville Creeks Subwatershed Study. Applicable data identified in the background review is used in concert with data collected during field investigations to assess potential impacts (Section 5) of the alternative methods on the natural environment. Documentation reviewed is listed in Section 7 (References).

2.2 Agency Correspondence and Meetings

The following list provides a summary of agency correspondence and meetings of particular importance to natural environment issues within the context of the New North Oakville Transportation Corridor Class EA:

- a) November 26, 2004 (resent December 1, 2005) letter from Gartner Lee Limited (GLL; former operating company of AECOM) to MNR, Steve Varga. Re: request for most current wetland report and current status/delineation of Trafalgar Moraine Candidate Earth Science ANSI.
- b) August 2, 2005 meeting with Conservation Halton to discuss Conservation Halton staff's questions and concerns regarding the study progress of the Burnhamthorpe project.
- c) October 27, 2005 letter from the Town of Oakville to Ontario Realty Corporation regarding potential land disposition within the study area.
- d) October 24, 2005 email request from GLL to Town of Oakville for the most recent breeding bird results.

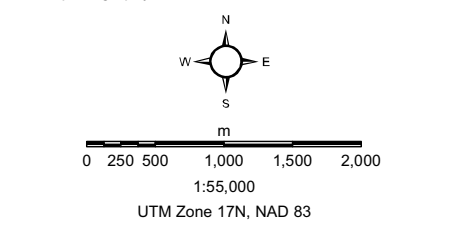
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- ### Legend
- Preferred Alternative
 - Freeway
 - Highway
 - Major Road
 - Local Road
 - Ramp
 - Intermittent Stream
 - Permanent Stream
 - Waterbody
 - Wetland Area
 - Study Area
 - Provincially Significant Life Science ANSI
 - Provincially Significant Candidate Life Science ANSI
 - Regionally Significant Life Science ANSI
 - Provincially Significant Candidate Earth Science ANSI



Basemapping from Ontario Ministry of Natural Resources Orthophotography, 2002



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New North Oakville
 Transportation Corridor Class EA

Regional Context

March 2010
 Project 107909

Figure 1

- e) December 20, 2005 letter from Conservation Halton to the Region of Halton with comments on GLL's Detailed Ecological Study Plan for Sixteen Mile Creek Valley.
- f) November 23, 2005 meeting with Town of Oakville to review the available land use and constraints mapping and short-listed route alternatives to incorporate updated information and refine the route alternatives.
- g) December 21, 2005 and subsequent email follow-up from GLL to MNR, Emma Followes, to request details on sensitive species element occurrences.
- h) March 22, 2006 meeting with Town of Oakville and Conservation Halton to discuss existing inventory of natural environment information and finalize requirements for addition field work.
- i) April 18, 2006 letter from GLL to MNR, Steve Varga and subsequent email follow-up with Emma Followes to request an update of natural heritage data (significant species) with reference to MNR (2003) and Halton Region (2005) species lists.
- j) June 28, 2006 meeting with Town of Oakville and Conservation Halton to discuss the findings of Alternative Route Assessment and identification of a Preferred Alternative.
- k) December 10, 2008 meetings with MNR, Town of Oakville and Conservation Halton to discuss the Draft Natural Environment Report (GLL May 2008).

2.3 Field Investigations

Field investigations were completed to supplement existing secondary source information to ensure that data was comparable across the study area and, at the same time, detailed enough to facilitate an impact assessment of the alternative methods (Section 5). For the purposes of comparing alternative alignments outside of Sixteen Mile Creek Valley, existing information was considered to be adequate in most cases and field work was limited to walkovers of potentially critical areas. However, the Sixteen Mile Creek Valley was identified as requiring more detailed field work for the following reasons:

1. As the largest contiguous natural heritage area, the valley is known to support the highest relative proportion of environmental features and functions within the study area.
2. The 2004 Town of Oakville North Oakville Subwatershed Study, the basis for the proposed Oakville Natural Heritage System, focused its effort on compiling and updating data around Sixteen Mile Creek Valley. This was considered to be adequate at the time because little or no development encroachment into the Valley was expected. However, for the purposes of properly evaluating possible crossings of the Valley for extending Burnhamthorpe Rd, more data was required.
3. In particular, the entire valley needed to be classified using the Ecological Land Classification (ELC) system for Southern Ontario (Lee et al., 1998). ELC mapping provided by Conservation Halton, based upon 2002 aerial photography, did include the valley but did not go further than the level of Community Series. Mapping from the subwatershed study was as detailed as Vegetation Type but excluded the valley (identified as only as Core Area no. 1 in Figure 6.3.3 ELC mapping).
4. Existing vegetation species data also needed to be considered in light of any recent changes in rankings.¹ Locational data, especially for relatively high numbers of regionally or locally significant plant species in the valley, was generally unavailable or not specific enough for use in comparing alignment alternatives. Field confirmations were required.

1. For example, the butternut (*Juglans cinerea*) was designated nationally endangered in July 2005 because of the effect of butternut canker (*Sirococcus clavignenti-juglandacearum*). (Refer to the federal Species at Risk Act, schedule I, part 2). This species had apparently been reported for the Sixteen Mile Creek corridor (in the pre-2005 draft Halton Natural Areas Inventory) but its exact location(s) needed to be confirmed in the field.

5. Furthermore, Conservation Halton expressed concern that previous faunal surveys needed to be updated, especially for breeding birds, amphibians, snakes and other reptiles, fish habitat, mammals, butterflies and Odonates (damselflies and dragonflies).

Where feasible, field investigations focused on potential alignments crossing the Sixteen Mile Creek valley, including tableland portions that support natural area contiguous with the valleylands.

Field work was completed by the following AECOM staff on 12 dates during the period between June 2004 and June 2006:

- a) DL – Dale Leadbeater, B.Sc., B.Ed., Senior Biologist
- b) JK – James Kamstra, B.Sc., M.E.S., Senior Biologist
- c) RC – Rosalind Chaundy, B.Sc., M.Sc.F., Terrestrial Ecologist
- d) SS – Sean Spisani, B.Sc., ERPG, Terrestrial Ecologist
- e) DG – Dan Gibson, B.Sc., Fish Ecologist
- f) CA – Christen Audet, R.P.F., M.Sc., Senior Ecologist and Forester

Table 1 provides a summary of field investigations completed in the Sixteen Mile Creek Valley and associated tablelands. Incidental observations of any wildlife species were recorded on all site visits. The following sections provide a greater description of survey methodologies. All results – combining analysis of background information and field work data - are presented in Section 3.

Table 1. Summary of Sixteen Mile Creek Field Investigations Sorted by Survey Type and Surveyor

	June 4, 2004	June 10, 2005	June 27, 2005	Oct. 20, 2005	Dec. 5, 2005	Dec. 8, 2005	Mar. 16, 2006	Apr. 28, 2006	May 1, 2006	May 1, 2006	June 2, 2006	June 5, 2006	June 22, 2006
Vegetation		DL	JK	CA	SS	SS	SS	SS	SS		JK	JK	
Breeding Birds	RC	DL	JK					SS			JK	JK	
Amphibians										SS			SS
Reptiles (Snake Cover)								SS			JK		SS
Fish Habitat (Rapid OSAP)							DG						
Incidental Wildlife	RC	DL	JK	CA	SS	SS	DG	SS	SS		JK	JK	SS
Survey Time	8:40 am – 9:25 am	7:30 am – 11:45 am	6:00 am (end time not recorded)	N/A (survey time not recorded)	9:30 am – 4:00 pm	9:00 am – 3:30 pm	8:30 am – 5:15 pm	8:30 am – 4:45 pm	9:00 am – 5:30pm	9:00 pm – 11:45 pm	6:20 am – 9:12 pm	5:45 am (end time not recorded)	9:30 pm – 12:00 am
Temperate (Celsius)	14	20 to 25	17	N/A	-9	-10	2 to 11	7	7	11	13 to 20	14	20
Cloud Cover	0%	Overcast to clear	0	N/A	N/A	N/A	N/A	N/A	N/A	0%	10%	100%	0%
Wind	1-2	N/A	1	N/A	N/A	N/A	N/A	N/A	N/A	0	1	0	2

2.3.1 Vegetation

Field investigations were completed on nine occasions between June 10, 2005 and June 2, 2006 to document existing flora species and classify vegetation communities within the Sixteen Mile Creek Valley and associated tablelands. Vegetation community descriptions were based on the Ecological Land Classification (ELC) System for Southern Ontario (Lee *et al.*, 1998). This is the provincially accepted standard for classifying vegetation communities in Ontario; based on this standard, vegetation communities were identified down to Vegetation Type where possible. Information regarding the structure and composition of these vegetation units included information describing dominant species, cover, community structure, community disturbance and other notable features. Vegetation communities were visited twice during each of the Spring, Summer and Autumn seasons to document the peak flowering season for all Terrestrial and Wetland Community Series encountered. All field investigations were preceded by air-photo interpretation and classification to the broad ELC category of Community Series where possible.

A review of available background information (Section 2.1) provided the basis for field investigations, including substantial ELC coverage of the Study Area outside Sixteen Mile Creek Valley. In such areas where ELC classification was previously documented, field investigations and/or air-photo interpretation was conducted only to confirm the accuracy of classification and the delineation of community boundaries.

2.3.2 Breeding Birds

Breeding bird surveys were carried out by AECOM biologists on six dates in the Spring (May to June) of 2004, 2005 and 2006. During the spring season, breeding birds are present on breeding territories and are readily identified by song and other breeding behaviours. Completion of six surveys provided diligent coverage of Sixteen Mile Creek Valley and optimized chances of compiling a complete record of all birds present. The survey method was based on the Ontario Breeding Bird Atlas. Birds identified during walking surveys that optimized coverage of the valley. All species seen or heard were recorded by location and were considered to be breeding species unless otherwise noted (i.e., some species observed during the May 1, 2006 visit were considered migrants).

2.3.3 Amphibians

AECOM ecologists conducted nocturnal amphibian calling surveys at 11 stations throughout Sixteen Mile Creek Valley and adjacent tablelands. Each site was visited on two separate occasions in an attempt to record the presence of amphibian species which call at different times during the breeding season. The methodology was based on the Marsh Monitoring Protocol and the call count manual by the Ontario Task Force on Declining Amphibian Populations, modified to include two site visits (Gartshore *et al.*, 2000). At each station all calling frogs and toads were recorded. Species and numbers of individuals were documented. When too many individuals of one species were calling, making it difficult to detect and separate individuals and, to estimate their number, they were recorded as a chorus.

Gartshore *et al.* (2000) recommend three site visits and provide the following date and night-time air temperature guidelines to inform timing of the surveys in Southern Ontario:

- Survey #1 - April 1 to 15; 5 to 12 degrees Celsius;
- Survey #2 - May 1 to 15; 10 to 20 degrees Celsius; and,
- Survey #3 = June 1 to 15; 17 to 28 degrees Celsius.

AECOM ecologists tracked weather conditions and amphibian calling activity to optimise survey efforts. As a result, two surveys were completed on the following dates and night-time air temperatures:

- Survey #1 – May 1; 7 degrees Celsius; and,
- Survey #2 – June 22; 20 degrees Celsius.

Call surveys were coupled with mapping of all incidental observations.

2.3.4 Snakes

Correspondence with the OMNR (2006c) identified a recent record (1988) of the provincially significant milksnake (*Lampropeltis triangulum*) at one location near Sixteen Mile Creek valley. Milksnakes are considered a relatively secretive snake species and are frequently discovered beneath objects in direct sunlight, absorbing heat from the underside (Environment Canada 2006).

AECOM established 22 artificial cover habitats on March 16, 2006 to establish fixed sampling stations throughout Sixteen Mile Creek valley and associated tablelands. Artificial cover habits were constructed of black landscaping geotextile typically used for weed suppression purposes, and were fixed to the ground using a textile pegs, rocks and logs as necessary. All cover sampling stations were a minimum of 1 m long by 0.5 m wide.



Photograph 1. Artificial Cover Sampling Station 4

Placement of artificial cover habitats was designed to correspond with milksnake habitat as reported by Environment Canada (2006) and the OMNR (2000) Significant Wildlife Habitat Technical Guide, i.e., placement occurred in direct sunlight and in proximity to open water. Sampling occurred on two occasions (April 28 and June 22) after milksnakes have emerged from hibernacula. On both sampling dates, investigations turned over rocks and other appropriate debris to improve the likelihood of finding all snake species, including milksnake.

2.3.5 Incidental Faunal Observations (Terrestrial)

During specific surveys for flora or other faunal species, incidental observations were recorded on any other fauna. In particular, we gave special attention of evidence of mammals, reptiles, butterflies and Odonata (damselflies and dragonflies). This included direct observations or indications of habitat use or habitat potential.

2.3.6 Fish Community

Preliminary fisheries data was gathered in 2005 and 2006, for the entire study area (both upstream and downstream). Due to the abundance of relevant fish community data, primary collections were not conducted during the course of this study. Fish habitat assessments for quality as part of the Ontario Stream Assessment Protocol (OSAP) however, were conducted by an AECOM fisheries biologist throughout the study area. Through the OSAP surveys an assessment of available spawning habitat (quality and quantity) within the potential watercourse crossings was evaluated. Through understanding the fish community structure and their individual life history requirements (through secondary source information), evaluation of available spawning habitat provided a means for identifying reaches of watercourse critical to species spawning and recruitment success. This provided sufficient complimentary detail to evaluate the alternate methods with respect to current fish community structure throughout the study area.

2.3.7 Fish Habitat

A review of existing fisheries and aquatic habitat data included data obtained from Halton Region Conservation and the Ministry of Natural Resources. On March 17, 2006, during a period of low flow conditions a fish habitat assessment was conducted at each sampling location using the Ontario Stream Assessment Protocol–Rapid Assessment Methodology (OSAP-RAM). Fish habitat assessments were purposely undertaken during low flow conditions as water clarity was observed to be high and habitat features (i.e. undercut banks, crevasse's, instream vegetation and habitat cover) were clearly identifiable. The protocol was used as an aid to standardize the habitat assessments and to accurately document the characteristics and the quality of fish habitat² throughout the study area.

Stations for the OSAP survey were strategically placed within the footprint of the short list of bridge crossings of the Sixteen Mile Creek valley. Each OSAP survey station was approximately 50 m in length and included 10 transects across the stream. This is the number of transects necessary for the survey as determined by the mean width of the stream. Fish habitat information collected at each station included temperatures, morphological measurements (depths of riffles and pools), an approximation of flow, and a description of the substrates, in stream cover, bank stability and canopy cover.

3. Existing Conditions

3.1 Physiography

Most of the study area is dominated by the Peel Plain Physiographic Region. Landforms are described in more detail in GLL's Hydrogeology report. We have limited our discussion to key points of interest for the natural environment.

2. For the purposes of the habitat surveys, as outlined in section 3.3 of the *Oak Ridges Moraine (ORM) Technical Papers Document (OMNR, 2004)*, fish habitat was defined as: "the spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out life processes, as further identified by the Department of Fisheries and Oceans (Canada)."

3.1.1 Trafalgar Moraine

The Trafalgar Moraine is a silt and clay rich Halton Till ground moraine extending in a northeast direction along the north boundary of the study area. The ridge crest is located north of Burnhamthorpe Road and roughly parallels Highway 407 ETR. The Trafalgar Moraine is expressed by a variety of topographic features including distinct fluted land forms immediately west of Regional Road 25 and the study area, and pitted depressions throughout the study area (Parish 2002).

3.1.2 Sixteen Mile Creek Valley

The Sixteen Mile Creek Valley is the largest natural corridor in the study area draining a total area of 377 m² (Town of Oakville 2002) and extending from Lake Ontario in the south to the Niagara Escarpment in the north. The regionally significant river valley supports a diversity of topographic features and related vegetation communities. The valley itself cuts through part of the Trafalgar Moraine just north of the 407 ETR and through underlying geological features to create gorges that extend throughout much of the study area.

3.1.3 Pitted Depressions

Pitted depressions are an important terrain feature for natural environment, especially wetlands. Such features are not necessarily located in low lying areas and are usually isolated from other surface water features. The pitted features are fed by direct precipitation, stormwater runoff if located in low lying areas, and groundwater where the pits extend below the water table. If the depression is deep, the local water table around it is expected to dip inwards to the pitted feature. Shallow groundwater flows slowly inward and discharges to the depression to replenish loss due to open water evaporation.

Two types of pitted features may exist, including:

1. *Warm pitted features* (or seasonal features), which represent depressions in the ground that are mainly fed by surface water, when available; and
2. *Cold pitted features* (perennial features) are usually deep and are partly fed by groundwater, provided there are permeable geologic pathways to do so.

It appears that the pitted depressions features in this area are warm features. However GLL (2008) recommends in the *Hydrogeological Assessment of Proposed Burnhamthorpe Road Realignment* that the temperature regime of the pits be inspected and confirmed in the field. The presence of groundwater-fed cooler features may be important for wildlife, especially fish communities, when they outlet to fish bearing waterbodies. The quality of groundwater may also influence vegetation communities.

3.2 Environmental Planning Areas

The background review defines the study property in a natural heritage context that is consistent with the existing policies and guidelines. The study area contains the following significant land use designations (see also Figure 1):

- a) Sixteen Mile Creek Regionally Significant Life Science ANSI, the Trafalgar Moraine Candidate Earth Science ANSI and the Oakville-Milton Wetlands & Uplands Candidate Life Science ANSI (mapped in Appendix A).
- b) Sixteen Mile Creek Environmentally Sensitive Area (ESA #16), as designated by the Region of Halton and the Trafalgar Moraine Environmentally Sensitive Area (ESA #48). For the latter, the boundary had not yet been finalized.

- c) The Ontario Land Assembly (OLA): 304 ha of the total 451 ha of OLA in the study area, managed by Ontario Realty Corporation (ORC), were designated in November 2004 as provincially protected "Open Space". These designated lots are located off of Dundas Street, west of Sixteen Mile Creek.
- d) The Region of Halton Official Plan designated the Sixteen Mile Creek Valley system "Greenlands A" (below top-of-bank) and "Greenlands B" (above top-of-bank to include some uplands forests and tablelands).
- e) The Region of Halton Official Plan designated Joshua Creek and associated headwater tributaries "Greenlands A". (The MNR NHIC site identified Joshua Creek Valley as locally significant based on the 1978 ESA Study for the Regional Municipality of Halton).
- f) Oakville OPA 198 (Official Plan Amendment) designated lands south of Highway 407 (to Dundas Street East between Tremaine Road and Ninth Line) as "Urban Special Study Area". Lands north of Highway 407 are designated as "Parkway Belt".
- g) Town of Oakville Secondary Plan Boundaries divide areas east and west of Sixteen Mile Creek within the study area.
- h) The Town of Oakville Natural Heritage System includes Core and Linkage areas throughout the study area.
- i) North-Oakville Milton East Provincially Significant Wetland Complex (2006a).
- j) A number of significant woodlands were designated according four of seven criteria established for the Region of Halton by Gartner Lee Limited (2002) (Town of Oakville 2002 and 2003). Previous studies do not identify significant woodlots according to these same accepted criteria. In any case, their delineation requires confirmation through field investigations.
- k) Lands north of Highway 407 are designated "Protected Countryside" under the provincial Greenbelt Protection Plan for the Golden Horseshoe (around the western part of Lake Ontario).

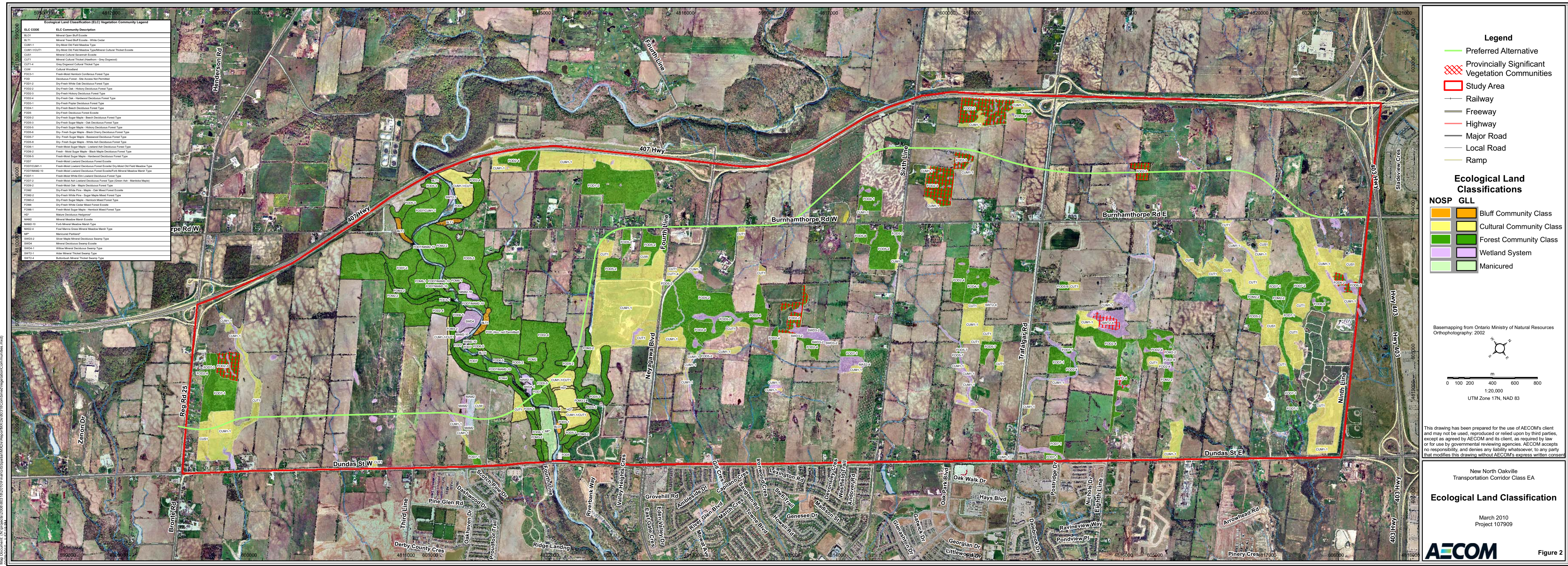
3.3 Terrestrial Resources

3.3.1 Vegetation Communities

Previous studies provide ELC mapping for selected natural areas throughout the study area, including LGL (1999) and Town of Oakville (2003b) and Conservation Halton (2005a). Conservation Halton provided ELC mapping to Community Series. Secondary ELC mapping was not available for the Sixteen Mile Creek Valley and was completed by AECOM based on field visits in 2005 and 2006. Figure 2 illustrates complete ELC mapping for the study from the Town of Oakville (2003b).

AECOM identified a total of six Community Classes (Bluff, Cultural, Forest, Marsh and Swamp) in the Sixteen Mile Creek Study area and associated tablelands. Community Series were further refined to 28 distinct Ecosites and Vegetation Types as illustrated on Figure 2.

Vegetation cover in the Sixteen Mile Creek Valley is dominated by mature Forest Community Classes. North-facing valley slopes (along the western valley slope) are predominantly covered by mixed forest units that include sugar maple (*Acer saccharum* spp. *saccharum*) - eastern hemlock (*Tsuga canadensis*), sugar maple - white pine (*Pinus strobus*), and eastern white cedar – mixed hardwood as common canopy associates. The cool north-facing slopes also support rich fern layers including marginal wood fern (*Dryopteris marginalis*), spinulose wood fern (*Dryopteris carthusiana*), ostrich fern (*Matteuccia struthiopteris*), and sensitive fern (*Onoclea sensibilis*). South-facing slopes are dominated by sugar maple – white oak (*Quercus alba*) – American beech (*Fagus grandifolia*) and hickory (*Carya* sp.) associations. Dry, open white oak forest supports a number of species with prairie affinities including New Jersey tea (*Ceanothus americanus*), Carolina rose (*Rosa carolina*), buffaloberry (*Shepherdia canadensis*) and dryland blueberry (*Vaccinium pallidum*). The valley floodplain supports a mixture of forest, swamp and marsh units. Floodplain forests are notable for their indicators of calcium rich soils, including sycamore (*Platanus americana*) and black maple (*Acer saccharum* ssp. *nigrum*). Open and treed bluffs, some unmapped ELC inclusions (> 0.5 ha) are located throughout the steep valley corridor.



Ecological Land Classification (ELC) Vegetation Community Legend

ELC CODE	ELC Community Description
BL01	Mineral Open Bluff Ecotope
BL01	Mineral Open Bluff Ecotope - White Cedar
CUM1-1	Dry-Most Old Field Meadow Type
CUM1-1CUT1	Dry-Most Old Field Meadow Type/Mineral Cultural Thicket Ecotope
CUS1	Mineral Cultural Savannah Ecotope
CUT1	Mineral Cultural Thicket (Hawthorn - Grey Dogwood)
CUT1-4	Grey Dogwood Cultural Thicket Type
CUM1-1	Cultural Woodland
FO03-1	Fresh-Most Hemlock Coniferous Forest Type
FO03	Deciduous Forest - Site Access Not Permitted
FO02-1	Dry-Fresh White Oak Deciduous Forest Type
FO02-2	Dry-Fresh Oak - Hickory Deciduous Forest Type
FO02-3	Dry-Fresh Hickory Deciduous Forest Type
FO02-4	Dry-Fresh Oak - Hardwood Deciduous Forest Type
FO03-1	Dry-Fresh Poplar Deciduous Forest Type
FO04-1	Dry-Fresh Beech Deciduous Forest Type
FO05	Dry-Fresh Deciduous Forest Ecotope
FO05-2	Dry-Fresh Sugar Maple - Beech Deciduous Forest Type
FO05-3	Dry-Fresh Sugar Maple - Oak Deciduous Forest Type
FO05-5	Dry-Fresh Sugar Maple - Hickory Deciduous Forest Type
FO05-6	Dry-Fresh Sugar Maple - Black Cherry Deciduous Forest Type
FO05-7	Dry-Fresh Sugar Maple - Basswood Deciduous Forest Type
FO05-8	Dry-Fresh Sugar Maple - White Ash Deciduous Forest Type
FO06-1	Fresh-Most Sugar Maple - Lowland Ash Deciduous Forest Type
FO06-2	Fresh-Most Sugar Maple - Black Maple Deciduous Forest Type
FO06-5	Fresh-Most Sugar Maple - Hardwood Deciduous Forest Type
FO07	Fresh-Most Lowland Deciduous Forest Ecotope
FO07/CUM1-1	Fresh-Most Lowland Deciduous Forest Ecotope/Dry-Most Old Field Meadow Type
FO07/MAM2-10	Fresh-Most Lowland Deciduous Forest Ecotope/Forb Mineral Meadow Marsh Type
FO07-1	Fresh-Most White Elm Lowland Deciduous Forest Type
FO07-2	Fresh-Most Ash Lowland Deciduous Forest Type (Green Ash - Maritima Maple)
FO07-3	Fresh-Most Oak - Maple Deciduous Forest Type
FO07-4	Dry-Fresh White Pine - Maple - Oak Mixed Forest Ecotope
FO07-5	Dry-Fresh White Pine - Sugar Maple Mixed Forest Type
FO07-6	Dry-Fresh Sugar Maple - Hemlock Mixed Forest Type
FO07-7	Dry-Fresh White Cedar Mixed Forest Ecotope
FO08-1	Fresh-Most Sugar Maple - Hemlock Mixed Forest Type
HD	Mature Deciduous Hedgerow
MAM2	Mineral Meadow Marsh Ecotope
MAM2-10	Forb Mineral Meadow Marsh Type
MAM2-4	Forb Mineral Meadow Marsh Type
MP	Mineral Pasture
SWD3-2	Shrub Marsh Mineral Deciduous Swamp Type
SWD4	Mineral Deciduous Swamp Ecotope
SWD4-1	Willow Mineral Deciduous Swamp Type
SWT2-1	Alder Mineral Thicket Swamp Type
SWT2-4	Butcherbush Mineral Thicket Swamp Type

- Legend**
- Preferred Alternative
 - Provincially Significant Vegetation Communities
 - Study Area
 - Railway
 - Freeway
 - Highway
 - Major Road
 - Local Road
 - Ramp

Ecological Land Classifications

NOSP	GLL	Community Class
		Bluff Community Class
		Cultural Community Class
		Forest Community Class
		Wetland System
		Manicured

Basemapping from Ontario Ministry of Natural Resources Orthophotography, 2002

Scale: 0 100 200 400 600 800 m
1:20,000
UTM Zone 17N, NAD 83

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New North Oakville
Transportation Corridor Class EA

Ecological Land Classification

March 2010
Project 107909

AECOM

Figure 2

3.3.2 Flora

The Town of Oakville summarizes vascular plant records within the North Oakville Subwatershed Study Areas (2002 and 2003); a total of 705 species east of Sixteen Mile Creek (2002) and 382 species west of Sixteen Mile Creek (2003) are reported. A total of 103 species of national, provincial, regional or local significance were reported based upon rarity as defined by the NHIC database or as defined by regional/local authorities. Significant flora species are presented in Appendix B and located in "habitat units" established by LGL (1999) and Town of Oakville (2003b).

AECOM field investigations identified a total of 270 species of vascular plants in the Sixteen Mile Creek Valley study area. 51 species identified are non-native occurrences, representing approximately 19% of all species recorded. Introduced species are most abundant in terms of cover and species richness in the cultural communities throughout the study area. A complete list of AECOM vascular plant species appears in Appendix C.

Vegetation species significance was determined using rarity rankings at four scales: local, regional, provincial and national. Nationally significant species are those defined as Endangered, Threatened or Special Concern in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Provincial rankings are consistent with those listed in the NHIC database. Rarity rankings at the local (Regional Municipality of Halton) and regional (Greater Toronto Area) levels were established according to Varga *et al.* (2000).

AECOM identified one nationally significant species, butternut (*Juglans cinerea*) in the study area. Survival of butternut throughout its range is threatened by butternut canker, a lethal disease caused by the fungus *Sirococcus clavigignenti-juglandacearum*. In November 2003, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated butternut a nationally endangered species. This status was legislated under the Species at Risk Act (SARA) in July 2005, which has been replicated in Ontario under a special agreement with the federal government.

Butternuts trees infected with butternut canker exhibit canopy die-back, stem cankering and the secretion of a black liquid from stem wounds. AECOM identified one individual in a small, naturalized tree cluster in Lyons Gate Park as indicated on Figure 3. This individual demonstrated signs of advanced infection of the lethal butternut canker, including less than 50% live crown and greater than 50% of bole and root flares affected by cankers. Both of these indicators suggest that the trees have no reasonable chance of surviving over the next 15 years.

AECOM identified an additional 35 significant vascular plant species, including six species ranked S3 (rare to uncommon) in Ontario by the NHIC database, 26 ranked rare (located at 40 or fewer stations) or uncommon (41 to 80 stations) in the Greater Toronto Area, and 3 species ranked rare (five or fewer stations) or uncommon (six to 15 stations) Regional Municipality of Halton (where stations are defined by a radius of 1 km around the occurrence). Significant species of all scales are located on Figure 3.



Photograph 2. Treed Bluff Community in Sixteen Mile Creek Valley

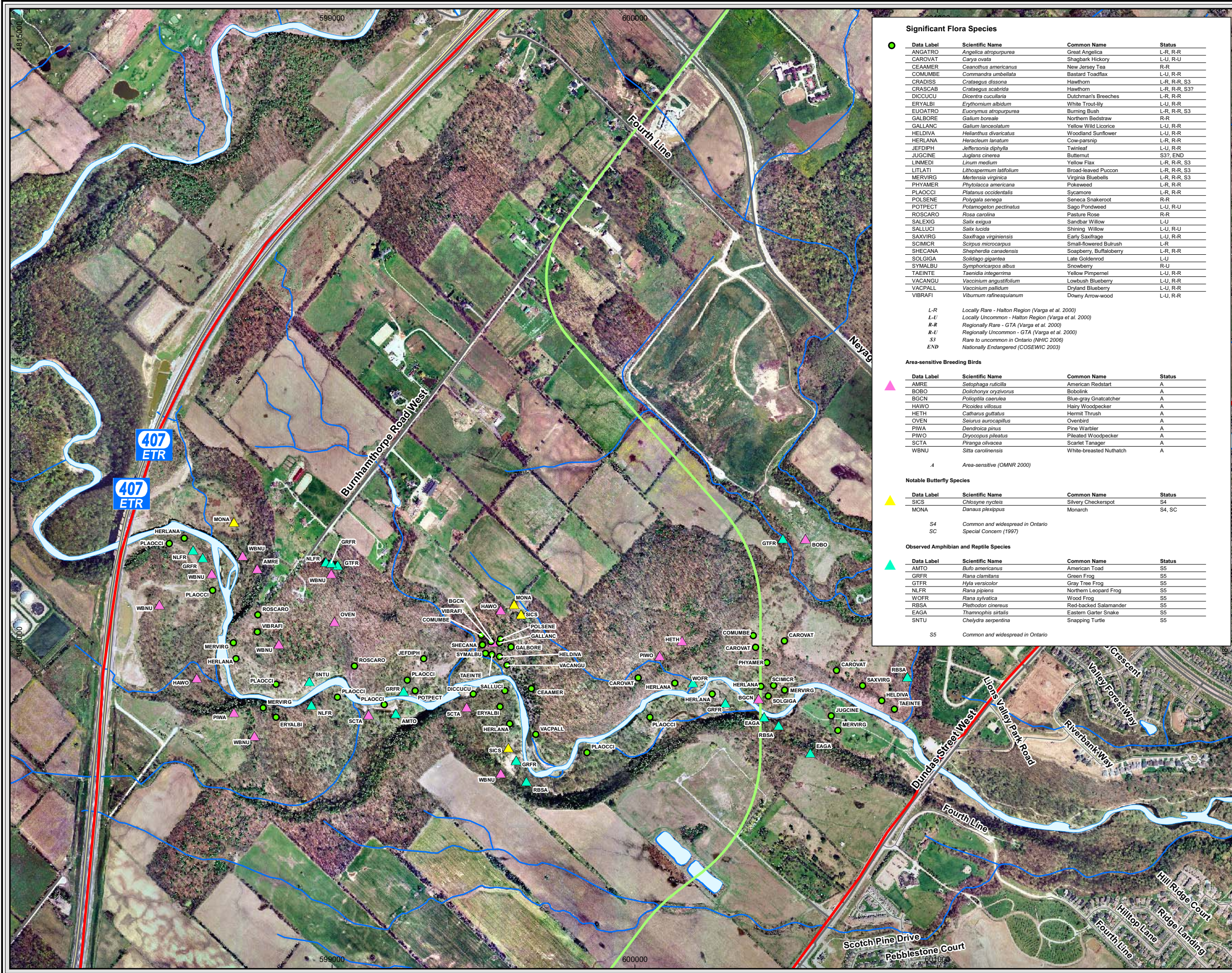


Photograph 3. Floodplain Forest with Sycamore Trees

3.3.3 Birds

AECOM investigations identified 52 breeding bird species in the Sixteen Mile Creek and associated tablelands. The species list includes birds from all habitats present in the region, including forests, thickets, marshes, and meadows. All species are common and widespread breeders according to the NHIC database (2006).

Ten species are considered area-sensitive breeders by the OMNR (2000). Area-sensitive bird species require larger patches of habitat to breed or which breed in greater density in larger patches. Generally speaking, the larger the number of area-sensitive species that are present in an area the higher the quality of habitat. Area-sensitivity is also somewhat of a surrogate for disturbance sensitivity, i.e., most species with some degree of area-sensitivity are also sensitive in some way to human disturbances and activities. Table 2 provides a summary of habitat requirements of the area-sensitive birds identified in the Sixteen Mile Creek and associated tablelands according to the OMNR (2000) Significant Wildlife Habitat Technical Guide, a reference for area-sensitive species. Area-sensitive bird species are located on Figure 3. A complete list of breeding bird species is provided in Appendix D.



Significant Flora Species

Data Label	Scientific Name	Common Name	Status
ANGATRO	<i>Angelica atropurpurea</i>	Great Angelica	L-R, R-R
CAROVAT	<i>Carya ovata</i>	Shagbark Hickory	L-U, R-U
CEAAMER	<i>Ceanothus americanus</i>	New Jersey Tea	R-R
COMUMBE	<i>Comandra umbellata</i>	Bastard Toadflax	L-U, R-R
CRADISS	<i>Crataegus dissona</i>	Hawthorn	L-R, R-R, S3
CRASCAB	<i>Crataegus scabrifolia</i>	Hawthorn	L-R, R-R, S3?
DICCUCU	<i>Dicentra cucullaria</i>	Dutchman's Breeches	L-R, R-R
ERYALBI	<i>Erythronium albidum</i>	White Trout-lily	L-U, R-R
EUOATRO	<i>Euonymus atropurpurea</i>	Burning Bush	L-R, R-R, S3
GALBORE	<i>Galium boreale</i>	Northern Bedstraw	R-R
GALLANC	<i>Galium lanceolatum</i>	Yellow Wild Licorice	L-U, R-R
HELDIVA	<i>Helianthus divaricatus</i>	Woodland Sunflower	L-U, R-R
HERLANA	<i>Heracleum lanatum</i>	Cow-parsnip	L-R, R-R
JFDIPH	<i>Jeffersonia diphylla</i>	Twingleaf	L-U, R-R
JUGCINE	<i>Juglans cinerea</i>	Butternut	S3?, END
LINMEDI	<i>Linum medium</i>	Yellow Flax	L-R, R-R, S3
LITLATI	<i>Lithospermum latifolium</i>	Broad-leaved Puccoon	L-R, R-R, S3
MERVIRG	<i>Mertensia virginica</i>	Virginia Bluebells	L-R, R-R, S3
PHYAMER	<i>Phytolacca americana</i>	Pokeweed	L-R, R-R
PLAOCCI	<i>Platanus occidentalis</i>	Sycamore	L-R, R-R
POLSENE	<i>Polygala senega</i>	Seneca Snakeroot	R-R
POTPECT	<i>Potamogeton pectinatus</i>	Sago Pondweed	L-U, R-U
ROSCARO	<i>Rosa carolina</i>	Pasture Rose	R-R
SALEXIG	<i>Salix exigua</i>	Sandbar Willow	L-U
SALLUCI	<i>Salix lucida</i>	Shining Willow	L-U, R-U
SAXVIRG	<i>Saxifraga virginensis</i>	Early Saxifrage	L-U, R-U
SCIMICR	<i>Scirpus microcarpus</i>	Small-flowered Bulrush	L-R
SHECANA	<i>Shepherdia canadensis</i>	Soapberry, Buffaloberry	L-R, R-R
SOLGIGA	<i>Solidago gigantea</i>	Late Goldenrod	L-U
SYMALBU	<i>Symphoricarpos albus</i>	Snowberry	R-U
TAEINTE	<i>Taenidia integerrima</i>	Yellow Pimpernel	L-U, R-R
VACANGU	<i>Vaccinium angustifolium</i>	Lowbush Blueberry	L-U, R-R
VACPALL	<i>Vaccinium pallidum</i>	Dryland Blueberry	L-U, R-R
VIBRAFI	<i>Viburnum rafinesquianum</i>	Downy Arrow-wood	L-U, R-R

L-R Locally Rare - Halton Region (Varga et al. 2000)
 L-U Locally Uncommon - Halton Region (Varga et al. 2000)
 R-R Regionally Rare - GTA (Varga et al. 2000)
 R-U Regionally Uncommon - GTA (Varga et al. 2000)
 S3 Rare to uncommon in Ontario (NHIC 2006)
 END Nationally Endangered (COSEWIC 2003)

Area-sensitive Breeding Birds

Data Label	Scientific Name	Common Name	Status
AMIRE	<i>Selophaga rubicilla</i>	American Redstart	A
BOBO	<i>Dolichonyx oryzivorus</i>	Bobolink	A
BGCN	<i>Poliophtila caerulea</i>	Blue-gray Gnatcatcher	A
HAWO	<i>Picoides villosus</i>	Hairy Woodpecker	A
HETH	<i>Catharus guttatus</i>	Hermit Thrush	A
OVEN	<i>Seiurus aurocapillus</i>	Ovenbird	A
PIWA	<i>Dendroica pinus</i>	Pine Warbler	A
PIWO	<i>Dryocopus pileatus</i>	Pileated Woodpecker	A
SCTA	<i>Piranga olivacea</i>	Scarlet Tanager	A
WBNU	<i>Sitta carolinensis</i>	White-breasted Nuthatch	A

A Area-sensitive (OMNR 2000)

Notable Butterfly Species

Data Label	Scientific Name	Common Name	Status
SICS	<i>Chlosyne myctes</i>	Silvery Checkerspot	S4
MONA	<i>Danaus plexippus</i>	Monarch	S4, SC

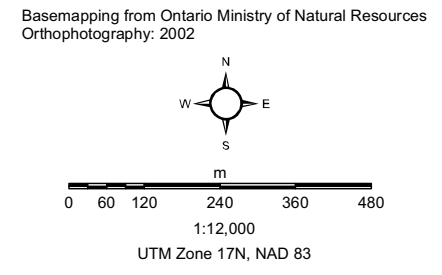
S4 Common and widespread in Ontario
 SC Special Concern (1997)

Observed Amphibian and Reptile Species

Data Label	Scientific Name	Common Name	Status
AMTO	<i>Bufo americanus</i>	American Toad	S5
GRFR	<i>Rana clamitans</i>	Green Frog	S5
GTFR	<i>Hyla versicolor</i>	Gray Tree Frog	S5
NLFR	<i>Rana pipiens</i>	Northern Leopard Frog	S5
WOFR	<i>Rana sylvatica</i>	Wood Frog	S5
RBSA	<i>Plethodon cinereus</i>	Red-backed Salamander	S5
EAGA	<i>Thamnophis sirtalis</i>	Eastern Garter Snake	S5
SNTU	<i>Chelydra serpentina</i>	Snapping Turtle	S5

S5 Common and widespread in Ontario

Legend
 Preferred Alternative
 Study Area



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New North Oakville
 Transportation Corridor Class EA

**Sixteen Mile Creek Notable
 Flora and Fauna Observations**

March 2010
 Project 107909

Table 2. Habitat Requirements of Area-sensitive Bird Species

Species	Habitat Requirement
Hairy woodpecker (<i>Picoides villosus</i>)	<ul style="list-style-type: none"> • mixed or deciduous forests; prefer mature trees, but use wide range in size and canopy cover; forest edges; • requires a number of tall trees and snags; • requires trees >25 cm dbh; territories cover 4 to 8 ha.
Pileated woodpecker (<i>Dryocopus pileatus</i>)	<ul style="list-style-type: none"> • extensive tracts of mature deciduous or mixed forest with water and large diameter (40+ cm) trees for cavity construction; • both lowland, upland forests; sometimes found in more open agricultural areas and parks with large trees; • requires 40 to 260 ha; • requires trees >25 cm dbh for nesting and trees 40+ cm dbh for roosting.
White-breasted nuthatch (<i>Sitta carolinensis</i>)	<ul style="list-style-type: none"> • mature, broad-leafed woodland; tolerates mixed forest; • orchards, shade trees in suburban and rural areas; • uses natural cavities in trees with dbh > 30 cm; • needs at least 10 ha or more of continuous forest.
Blue-gray gnatcatcher (<i>Poliophtila caerulea</i>)	<ul style="list-style-type: none"> • deciduous or mixed woods; oak-pine woods or oak savannahs; open, moist woodlands with brushy clearings; • bottomland forests with closed canopies, wooded swamps; stream-side thickets; • requires about 30 ha of forest.
Hermit thrush (<i>Catharus guttatus</i>)	<ul style="list-style-type: none"> • rocky, dry, pine forests, dry sandy coniferous or deciduous woods with dense young undergrowth; • borders of wooded swamps and damp forest, brushy pasture; • appears to need at least 100 ha of forest in southern portions of range (i.e., southern limits of Great Lakes – St. Lawrence zone)
Pine warbler (<i>Dendroica pinus</i>)	<ul style="list-style-type: none"> • mature white forests; • 40 to 50 year old pine plantations; • requires at least 15 to 30 ha of habitat.
American redstart (<i>Setophaga ruticilla</i>)	<ul style="list-style-type: none"> • deciduous or mixed woods with closed canopy of either tall shrubs or dense young trees or mature trees; • woodland edges; upland or lowland; • requires >100 ha of forest habitat.
Ovenbird (<i>Seiurus aurocapillus</i>)	<ul style="list-style-type: none"> • undisturbed, open, mature deciduous or mixed forest with closed canopy, little ground vegetation, lots of fallen leaves, logs or rocks; • forested ravines or well-drained riverbanks; • nests in depression of dead leaves at base of tree or log; • requires >70 ha of continuous forest.
Scarlet tanager (<i>Piranga olivacea</i>)	<ul style="list-style-type: none"> • upland, undisturbed, mature deciduous or mixed forests; • nests in thick growth of small trees bordering forests of larger trees and also damp, alder, willow thickets; • requires at least 20 ha of forest
Bobolink (<i>Dolichonyx oryzivorus</i>)	<ul style="list-style-type: none"> • large, open expansive grasslands with dense ground cover, hayfields, meadows or fallow fields, marshes; • requires tracts of grassland >50 ha

LGL (1999), the Town of Oakville (2002-2004), and Natural Resource Solutions (2005) provided secondary source breeding bird data for portions of the study area location both within and outside of Sixteen Mile Creek Valley. The sources document breeding birds by areas of natural vegetation identified and described as “habitat units”. Mapping of habitat units and associated characteristics, including number of bird species and significant records are provided in Appendix B. A review of the secondary source identified 14 additional area-sensitive and four nationally significant breeding species (Appendix B3).

Natural Resource Solutions Inc. (NRSI) (2006) winter bird surveys on three dates in January and February 2006 identified 24 species at six point count locations throughout the study area. (The NRSI included one additional point

count location to the west of the study area). The winter survey data does not provide a complete inventory of winter birds, however it does provide a current characterization of winter bird use, particularly in field habitats. All birds are considered common winter residence in Ontario, south of the Canadian Shield. Notable observations include a relatively high concentration of wintering raptors, i.e. seven red-tailed hawks (*Buteo jamaicensis*) and one rough-legged hawk (*Buteo lagopus*), documented on the west side of Sixteen Mile Creek Valley. Complete results of the winter NRSI inventory are included in Appendix D.

3.3.4 Amphibians

AECOM amphibian surveys identified seven species of frogs at sampling stations throughout the Sixteen Mile Creek valley. Frog calls were recorded at ten of the total 11 sampling stations; these productive stations are indicated as “confirmed breeding locations” in Figure 4. Species included:

- a) spring peepers (*Pseudacris crucifer*) were recorded as the most widespread species (calling at six stations);
- b) wood frog (*Rana sylvatica*) (4 stations);
- c) leopard frog (*Rana pipiens*) (3 stations);
- d) green frog (*Hyla versicolor*) (2 stations);
- e) gray tree frog (*Hyla versicolor*) (1 station);
- f) western chorus frog (*Pseudacris triseriata*) (1 station); and
- g) American toad (*Bufo americanus*) (1 station).

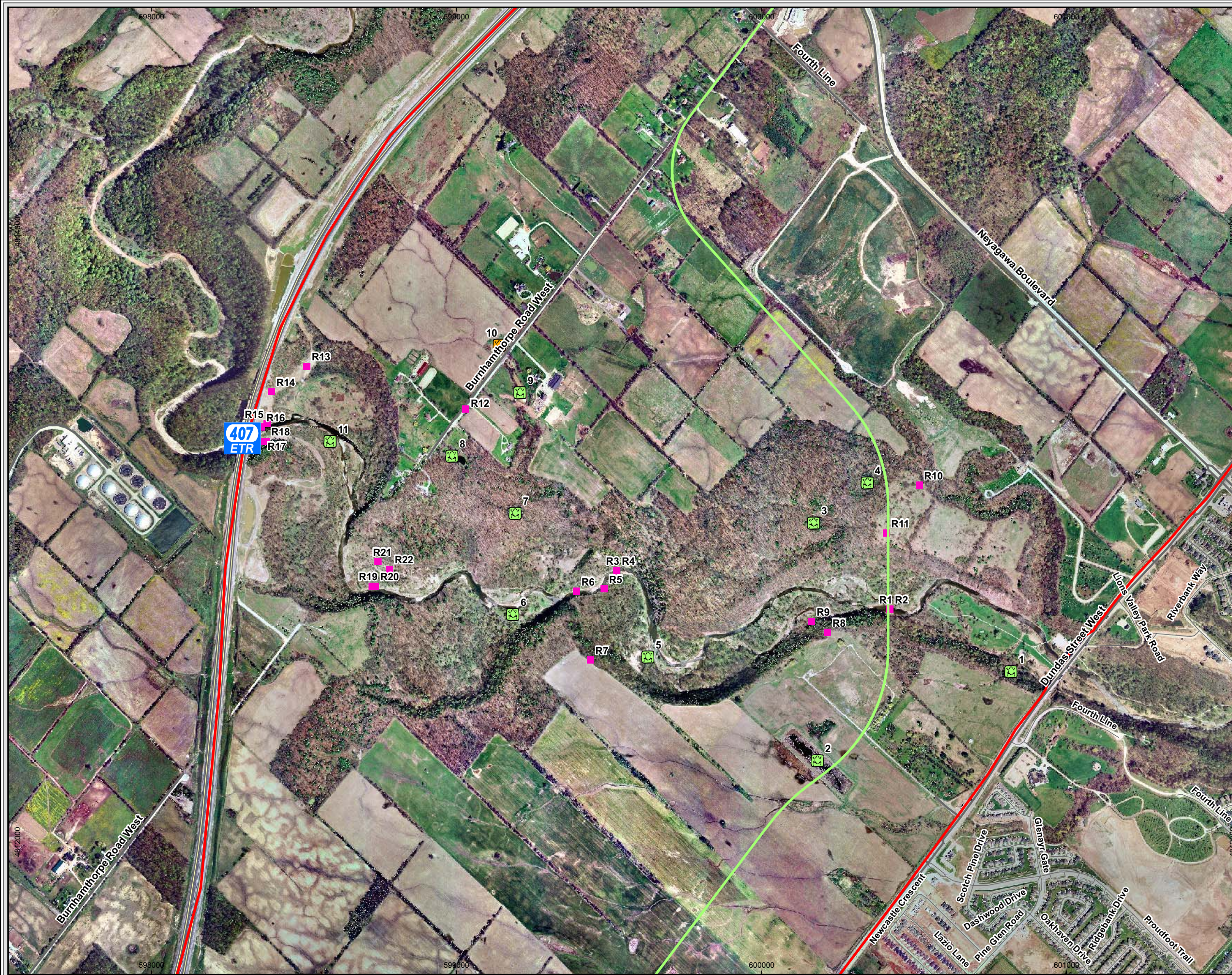
No choruses of any species were recorded at any of the productive sampling stations. Amphibian species are sorted by sampling station in Appendix E. Incidental observations of amphibian species are located on Figure 3, including multiple records of eastern redback salamander (*Plethodon cinereus*). Secondary source information identified five additional amphibian species in the Sixteen Mile Creek valley, bullfrog (*Rana catesbeiana*), red-spotted newt (*Notophthalmus viridescens*), Jefferson salamander (*Ambystoma maculatum*), blue-spotted salamander (*Ambystoma laterale*) and yellow-spotted salamander (*Plethodon cinereus*). Jefferson salamander is threatened in Canada according to the Committee of the Status of Wildlife in Canada (COSEWIC 2000). Five other amphibian species are considered rare or uncommon in site district 7E4 (OMNR 2003a). According to their website, Conservation Halton (2004) is also concerned about observed decline in western chorus frog. A complete list of all amphibian species found in the study area, including rarity rankings, appears in Appendix E.

3.3.5 Snakes

AECOM snake cover habitat surveys identified only one snake species: the common garter snake (*Thamnophis sirtalis*). The lone Gartner snake individual was found at Cover Station 2 on June 22, 2006. All cover habitat sampling stations are illustrated on Figure 4. Additional garter snakes were encountered throughout the course of the study as incidental and are mapped on Figure 3. No other reptile species were observed.

The OMNR (2006) identified five location records of eastern milksnake (*Lampropeltis triangulum*) throughout the study area. The eastern milksnake is a provincially significant species (designated special concern by the Committee on the Status of Endangered Wildlife in Canada in 2002). Locations of milksnake are considered sensitive data and are not presented in this report; however they are considered in the evaluation of alternatives (Section 5). LGL (1999) and Town of Oakville (2002) also report the presence of the regionally significant northern ribbon snake (*Thamnophis sauritus septentrionalis*) (rare to Site District 7E4).

Map Document: (N:\projects\2008\1803_18\2008\Final\GIS\Spatial\MXDs\Report\MXDs\Feb09\0318AmphibianAndSnakeMonitoringStations.mxd)
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Legend

Amphibian Monitoring Stations

- Productive Site
- Non-productive Site
- Snake Cover Sampling Station
- Preferred Alternative
- Study Area
- Freeway
- Expressway / Highway
- Major Road
- Local Road
- Ramp

Basemapping from Ontario Ministry of Natural Resources
Orthophotography: 2002

0 60 120 240 360 480
1:12,000
UTM Zone 17N, NAD 83

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New North Oakville
Transportation Corridor Class EA

Amphibian and Snake Monitoring Stations

March 2010
Project 107909

Figure 4

3.3.6 Other Wildlife

Wildlife observations in Sixteen Mile Creek and associated tablelands occurred during all AECOM field visits, including documentation of mammals, reptiles, butterflies and Odonata (dragonflies and damselflies). The following table provides a summary of incidental observations, including a summary of available secondary source information for portions of the study area outside Sixteen Mile Creek valley. Significant species records from secondary source data are provided by “habitat unit” in Appendix B. Complete species lists for AECOM observations are located in Appendix F. AECOM wildlife observations include one nationally significant species (designated Special Concern by COSEWIC in 2001), *monarch (Danaus plexippus)*, recorded at two locations in the valley. Monarch butterflies are considered common migrants throughout Ontario, however, they are designated by COSEWIC because of limited availability of wintering habitat in Central America. All other wildlife species recorded by AECOM are common and widespread throughout southern Ontario according to the NHIC database.

Locations of notable wildlife observations appear in Figure 3. Refer to Table 3 for a summary of wildlife data.

Table 3. Summary of Wildlife Data

	Sixteen Mile Creek AECOM Observations		Secondary Source Data (Town of Oakville 2002)	
	No. of Species	No. of Significant Species	No. of Species	No. of Significant Species
Mammals	7	None	72	<ul style="list-style-type: none"> • Seven Regionally Rare species (Halton) • Three Provincially Rare species • One Nationally Significant species (Special Concern)
Reptiles	2	None	12	<ul style="list-style-type: none"> • One Regionally Rare species (site district 7E4) • Seven Nationally significant species (Special Concern)
Butterflies	17	One Nationally Significant species (Special Concern)	59	<ul style="list-style-type: none"> • One Nationally Significant species (Special Concern) • One Provincially Rare species
Odonata	9	None	NA	<ul style="list-style-type: none"> • NA

3.4 Aquatic Resources

The study area includes portions of a number of individual subwatersheds that drain to the south, outletting to Sixteen Mile Creek or directly to Lake Ontario. The subwatersheds occurring in the study area are as follows, identified from west to east (Figure 5): Fourteen Mile Creek, McCraney Creek, Taplow Creek, Glen Oaks Creek, Sixteen Mile Creek, Shannon’s Creek, Munn’s Creek, Morrison Creek, and Joshua Creek.

3.4.1 Fish Communities

Fish community data for the New North Oakville Transportation Corridor study area was obtained from secondary source information. The OMNR (2003c-d) and Town of Oakville (2002 and 2003a-b) compiled species list from available data, including information from the Conservation Halton database (2006a) and LGL (1999), and fish species by watershed (Town of Oakville, 2006f) as summarized in Table 4 appearing below.



- Legend**
- Preferred Alignment
 - Thermal Assessment of Watercourses**
 - - - Intermittent, Coldwater
 - - - Intermittent, No data
 - - - Intermittent, Coolwater
 - - - Intermittent, Unassigned
 - - - Intermittent, Warmwater
 - Permanent, No data
 - Permanent, Coolwater
 - Permanent, Unassigned
 - Permanent, Warmwater
 - Permanent, Coldwater
 - Study Area
 - Watersheds
 - Railway
 - Freeway
 - Highway
 - Major Road
 - Local Road
 - Ramp

Basemapping from Ontario Ministry of Natural Resources
Orthophotography, 2002

0 100 200 400 600 800
m
1:20,000
UTM Zone 17N, NAD 83

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New North Oakville
Transportation Corridor Class EA

Watershed Boundaries

March 2010
Project 107909

Table 4. Number of Fish Species by Watershed

	Watershed			
	Taplow Creek	Sixteen Mile Creek	Morrison Creek	Joshua Creek
No. of Species	4	37	9	11
Provincially Rare Species	None	silver shiner (<i>Notropis photogenis</i>)	None	None
Nationally Significant Species	None	reidside dace (<i>Clinostomus elongatus</i>)	reidside dace (<i>Clinostomus elongatus</i>)	None
Locally Rare (Site District 7E4)	None	None	None	None

The findings of previous studies are summarized in the following sections to characterize watercourses throughout the New North Oakville Transportation Corridor Class EA study area, including LGL (1999), the North Oakville Secondary Plan Hydrological Features mapping by the Town of Oakville (2003a-b, 2006b-c), and OMNR (2006a) Thermal Status mapping. In addition to the watercourses presented below, a number of poorly defined agricultural swales and ditches receive intermittent flow and for a variety of reasons do not provide sufficient habitat to support fish (LGL 1999). A number of permanent and ephemeral ponds also exist throughout the study area.

3.4.1.1 Sixteen Mile Creek

Sixteen Mile Creek is the largest watercourse in the study area and includes three main branches forming a confluence north of Burnhamthorpe Road between Neyagawa Boulevard and Regional Road 25. North of the study area, upstream reaches of the two western branches exhibit cool to coldwater temperatures and support brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) residents and migratory occurrences of rainbow trout (*Oncorhynchus mykiss*); tributaries of the eastern branches support resident populations of rare reidside dace (*Clinostomus elongatus*) (Town of Oakville 2002).

Within the study boundaries, Sixteen Mile Creek becomes a deeply incised warm to cool water stream and supports resident populations of smallmouth bass (*Micropterus dolomieu*) and migratory runs of rainbow trout, Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*Oncorhynchus kisutch*) (LGL 1999). The middle and east tributaries occurring to the north of Highway 407 (north of the study area) support resident populations of reidside dace (*Clinostomus elongates*) (Town of Oakville 2006f). Reidside are listed as a Species at Risk by both the federal Species at Risk Act (SARA) and the provincial Endangered Species Act (ESA).

Gore & Storrie and Ecoplans (1996) completed a benthic community analysis for the entire course of Sixteen Mile Creek. Results indicate a continuum of relatively undisturbed water with low turbidity in the upper reaches to nutrient enriched and turbid water in the lower reaches.

3.4.1.2 Morrison Creek

Morrison Creek originates in two branches south of Burnhamthorpe Road within the study area and eventually feeds into Sixteen Mile Creek. Both branches are positioned in an agricultural dominated landscape and are generally ploughed. The western reach supports flow throughout most of the year, although the water course is damned immediately above and below Dundas Street (Town of Oakville 2006f). Flow within the eastern reach is intermittent (Town of Oakville 2002). Reports of reidside dace downstream of the study area indicate potential coldwater habitat in the lower reaches of Morrison Creek (LGL 1999).

3.4.1.3 *McCraney Creek*

McCraney Creek functions primarily as an ephemeral agricultural swale throughout the study area with little natural vegetation cover or fish habitat (LGL 1999 and Town of Oakville 2006f). LGL (1999) report no fisheries potential for the agricultural swales. No fish were found during sampling events occurring in April and May 2002 and April 2005 in McCraney Creek (Town of Oakville 2006f). A review of 2002 orthophotography indicates that McCraney creek is channelized and ploughed throughout the study area, except within the lower reaches (near Dundas Street), where limited riparian vegetation occurs.

3.4.1.4 *Taplow Creek*

Taplow Creek functions primarily as an ephemeral agricultural swale throughout the study area. The creek is devoid of any substantial vegetation cover with the exception of one small woodlot (LGL 1999 and Town of Oakville 2006f). No fish were found during sampling events occurring in April and May 2002 and April 2005 in Taplow Creek (Town of Oakville 2006f).

3.4.1.5 *Glen Oaks*

Glen Oaks functions primarily as an intermittent agricultural swale that is dry for most of the summer months and void of any substantial vegetation cover throughout the study area (LGL 1999 and Town of Oakville 2006f). No fish were found during sampling events occurring in April and May 2002 and April 2005 in Glen Oaks Creek (Town of Oakville 2006f).

3.4.1.6 *Shannon's Creek*

Shannon's Creek functions primarily as an ephemeral agricultural swale within the study area (LGL 1999 and Town of Oakville 2003). Little fisheries information exists for this reach and no fish potential has been identified (LGL 1999).

3.4.1.7 *Munn's Creek*

Munn's Creek functions primarily as an ephemeral agricultural swale within the study area (LGL 1999 and Town of Oakville 2003). Little fisheries information exists for this reach and no fish potential has been identified (LGL 1999).

3.4.1.8 *Joshua's Creek*

Joshua's Creek is the second largest system in the study area. Marshall Macklin Monaghan and LGL (1992) and LGL (1999) recorded only warm water tolerant fish species in this watercourse, indicating limited fisheries potential. Upper reaches of Joshua Creek experience seasonal flow and little groundwater contribution to baseflow (LGL 1999); lower reaches occurring within the Oakville urban matrix have been altered and channelized. The Town of Oakville (2006f) reports intermittent to near permanent flow with little groundwater contribution. The presence of white sucker (*Catostomus commersoni*) indicates the potential for seasonal spawning access from Lake Ontario spawning migrants (LGL 1999).

3.4.1.9 Fourteen Mile Creek

The headwaters of Fourteen Mile Creek originate primarily west of the study area, with a main branch and tributary running through the southwest portion of the study area. Fourteen Mile Creek runs in a north – south direction, ultimately out-letting into Lake Ontario. Creek portions occurring within the study area cross are buffered by cultural meadow and forest communities. The main branch and tributary form a confluence immediately upstream of an online pond at Dundas Street. Water temperatures recorded on May 23, 2002 ranged between 22 C in the agricultural fields south of Highway 407, and 23 C in the meadow communities north of Dundas Street (Town of Oakville 2003a). Previous studies report the presence of redbreast dace (LGL 1999; Town of Oakville 2006f) in the watershed.

3.4.2 Fish Habitat

For the purposes of this study, it was considered necessary to obtain additional fish habitat information for Sixteen Mile Creek. Habitat quality/sensitivity throughout the Sixteen Mile Creek study area is considered high because of opportunities for permanent refuge, feeding, rearing and nursery habitat for diverse fish community. To this end, “High” sensitivity habitat is a characterization largely based on DFO’s Risk Management Framework (DFO, 2005) using attributes encompassing fish species presence, abundance, habitat resiliency and the species interrelationships and dependencies on the habitat attained through primary and secondary sources as well as best known science. The following sections present the details of the AECOM habitat assessment at each assessment location along Sixteen Mile Creek, as illustrated in Appendix G. Assessment locations correspond to the four Sixteen Mile Creek crossing locations of the short list of alternative alignments.

Site 1: Alternate Alignment Crossing W4/W6

Site 1 is located in the southern portion of the study area approximately 750 m upstream of Dundas Street West (Alternate Crossing W4/W6 in Appendix G) and is a permanent reach of Sixteen Mile Creek. There is evidence of groundwater discharge within the stream because of the presence of a number of small groundwater seeps originating along the valley walls. Riparian cover consists of mature trees and shrubs while the surrounding land consists of forested areas throughout the valley. In-stream habitat consists of run/riffle habitat with abundant in-stream cover in the form of round rock with some large woody debris and some overhanging banks. The watercourse is well defined with some eroding banks on the west side of the river. The substrates consist primarily of cobble and gravel substrate. The average stream width was approximately 12 m and the average depth of the stream was 600 mm within the site reach. This stream provides permanent refuge, spawning, feeding, rearing and nursery habitat for fish species and serves as a major migratory pathway for fish migrations from Lake Ontario at differing times of the year.

Site 2: Alternate Alignment Crossing W1

Site 2 is located in the central portion of the study area approximately 1,500 m upstream of Site 1 (Alternate Crossing W1 in Appendix G) and is a permanent reach of Sixteen Mile Creek. There is evidence of groundwater discharge within the stream because of the presence of a number of small groundwater seeps originated along the valley walls. Riparian cover consists of mature trees and shrubs while the surrounding land consists of forested areas throughout the valley. In-stream habitat consists of run/riffle habitat with abundant in-stream cover in the form of round rock with some large woody debris and some overhanging banks. The watercourse is well defined with some eroding banks on the west side of the river. The substrates consist primarily of cobble and gravel substrate with some areas of fine sands. The average stream width was approximately 12 m and the average depth of the stream was 400 mm within the site reach. This stream provides permanent refuge, spawning, feeding, rearing and nursery habitat for fish species and serves as a major migratory pathway for fish migrations from Lake Ontario at differing times of the year.

Site 3: Alternate Alignment Crossing W3/W5

Site 3 is located in the northern portion of the study area, approximately 1000 m downstream of the Highway 407 bridge crossing (Alternate Crossing W3/W5 in Appendix G) and is a permanent reach of Sixteen Mile Creek. There is evidence of groundwater discharge within the stream because of the presence of a number of small groundwater seeps originating along the valley walls. Riparian cover consists of mature trees and shrubs while the surrounding land consists of forested areas throughout the valley. There is a large eroding bluff on the west side of Sixteen Mile Creek at site 3. In-stream habitat consists of run/riffle habitat with abundant in-stream cover in the form of round and flat rock with some overhanging banks. The watercourse is well defined with ongoing erosion occurring along the banks on the west side of the river. The substrates consist primarily of cobble and gravel substrate. The average stream width was approximately 10 m and the average depth of the stream was 300 mm within the site reach. This stream provides permanent refuge, spawning, feeding, rearing and nursery habitat for fish species and serves as a major migratory pathway for fish migrations from Lake Ontario at differing times of the year.

Site 4: Alternate Alignment Crossing W2

Site 4 is located in the northern portion of the study area immediately south of the Highway 407 bridge crossing (Alternate Crossing W2 in Appendix G) and is a permanent reach of Sixteen Mile Creek. There is no evidence of groundwater discharge within the stream but the potential is high because of the presence of a number of small groundwater seeps originating along the valley walls upstream and downstream. Riparian cover consists of mature trees and shrubs on the west side and meadow/scrubland on the east side. The surrounding land consists of forested areas throughout the rest of the valley. There is some minor erosion occurring along both shorelines within the site reach at site 3. In-stream habitat consists of run/riffle habitat with abundant in-stream cover in the form of round and flat rock with some overhanging banks. The watercourse is well defined and the substrates consist primarily of cobble and gravel substrate. The average stream width was approximately 7 m and the average depth of the stream was 300 mm within the site reach. This stream provides permanent refuge, spawning, feeding, rearing and nursery habitat for fish species and serves as a major migratory pathway for fish migrations from Lake Ontario at differing times of the year.

Fish and Fish Habitat Summary

Each survey location presented high sensitivity feeding, spawning, refuge and rearing habitat with little difference between sites. The only notable difference would be at Site 4 where the river is a straight run with less pristine riparian areas (parkland) including some poorly vegetated banks that are eroding within a slightly more disturbed area. From a fish habitat (riparian cover) perspective this would likely be the poorest in terms of quality in comparison to the other sites. However, this is still considered high quality/sensitivity fish habitat.

3.5 Ecology Features and Functions

3.5.1 Terrestrial Habitat

3.5.1.1 Historical Vegetation Cover

The study area is located in the northern reaches of Carolinian Forest zone, near the boundary of the Great Lakes – St. Lawrence Forest zone. Also known as the deciduous forest region and ecological site region 7E, the Carolinian zone is characterized by a mixture of hardwood species both common through eastern Canada, including sugar maple (*Acer saccharum ssp. saccharum*), red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), basswood (*Tilia americana*) and bitternut hickory (*Carya ovata*), and those more representative of forests located in the United States, including pawpaw (*Asimina triloba*), sassafras (*Sassafras albidum*), black gum (*Nyssa sylvatica*), cucumber tree (*Magnolia acuminata*), Kentucky coffee tree (*Gymnocladus dioica*), eastern flowering dogwood (*Cornus florida*) and tulip tree (*Liriodendron tulipifera*). Forests in the northern reaches of Carolinian zone commonly support characteristic species of the mixed wood communities of the Great

Lakes – St. Lawrence Forest zone, including white pine (*Pinus strobus*), eastern hemlock (*tsuga canadensis*), eastern white cedar (*Thuja occidentalis*) and yellow birch (*Betula alleghaniensis*).

LGL (1999) reports that local pre-settlement forest cover was dominated by oak (*Quercus spp.*) and hickory (*Carya spp.*) species on dry sites mixed hardwood stands on fresh sites. Savannah and tallgrass prairie communities are suspected of having historically occupied drier south-facing valley slopes of Sixteen Mile Creek within the study area. Less common today, these community types would have been maintained, relative to forest encroachment, by a disturbance regime involving erosion processes, drought, and periodic fire.

Existing land use is dominated by agriculture and includes approximately ten percent coverage of scattered woodlots and wetlands (Town of Oakville 2002). AECOM forest cover estimates identify approximately 325 ha (approximately 11%) of forest throughout the New North Oakville Transportation Corridor Class EA study area, 190 ha (approximately 7%) of which is associated with the Sixteen Mile Creek ANSI. Other habitat types throughout the study area include pasture, hedgerow, pioneer communities and prairie ecosystems (LGL 1999; Gore & Storrie and Ecoplans 1996). The study area is bound by dense urban developments to the south and fragmented by Regional Roads throughout. Vegetated creek corridors contribute most to connectivity between habitat patches throughout the study area and on adjacent lands.

Oak (*Quercus sp.*) and hickory (*Carya sp.*) species are currently well represented in the study area. However, shade-tolerant hardwood regeneration, including sugar maple (*Acer saccharum spp. saccharum*), American beech (*Fagus grandifolia*) and white ash (*Fraxinus americana*) has modified historical community composition. Dry valley rims and bluffs along Sixteen Mile Creek, and dry tablelands still include some species with prairie and savannah affinities. Fresh sites support hardwood associations including sugar maple, red maple (*Acer rubrum*), shagbark hickory (*Carya ovata*), basswood (*Tilia Americana*), red oak (*Quercus rubra*), bur oak (*Quercus macrocarpa*), white oak (*Quercus alba*), American beech, white ash, ironwood (*Ostrya virginiana*) and muscle-wood (*Carpinus caroliniana*). Green ash (*Fraxinus pennsylvanica*), yellow birch (*Betula alleghaniensis*) and white birch (*Betula papyrifera*) are abundant on lower slopes and fresh to moist depressions. Poorly drained depressions in upland habitats support swamp communities dominated by swamp maple (*Acer x freemanii*), black ash (*Fraxinus nigra*), green ash and thicket species including shrub willows (*Salix spp.*), dogwoods (*Cornus spp.*), winterberry (*Ilex verticillata*) and buttonbush (*Cephalanthus occidentalis*).

3.5.1.2 Significant Vegetation Communities

LGL (1999) and the Town of Oakville (2002 and 2003) report four provincially significant vegetation communities (Figure 2) within the study area (with corresponding NHIC database rankings):

- a) Dry-Fresh Oak-Hickory Deciduous Forest (FOD2-2, rare to uncommon);
- b) Dry-Fresh Hickory Deciduous Forest (FOD2-3, rare to uncommon);
- c) Fresh-Moist Sugar Maple-Black Maple Deciduous Forest (FOD6-2, rare to uncommon); and,
- d) Buttonbush Mineral Thicket Swamp (SWT2-4, rare to uncommon)

All other Vegetation Types are common and widespread in southern Ontario according to the NHIC database (ranked S4 or S5).

3.5.1.3 Wetlands

The OMNR (2006a) identified a total of 104 wetlands covering 34.67 ha in the North Oakville – Milton West & East Wetland Complexes study area bounded by Highway 407 to the north, Dundas Street to the south (formerly Highway 5), to the west by Sixteen Mile Creek Valley, and east to Highway 403 (OMNR 2006b). Most of these wetlands

occur in the New North Oakville Transportation Corridor Class EA study area, however, a large number do occur beyond the northern (407 ETR) and eastern (Bronte Road) limits. All wetlands in the New North Oakville Transportation Corridor Class EA study area are under 2 ha in size.

The North Oakville Milton East Wetland Complex has been designated provincially significant by the OMNR (Appendix A2). These wetlands are considered uncommon on the Trafalgar Moraine and rare within the surrounding district (7E4); covering only 2% of the land base (OMNR 2006). Wetlands are in good condition, with a high diversity of wetland and community types providing habitat for a large number of significant plant species, migratory bird stopover areas, fish and amphibian habitat (OMNR 2006).

All North Oakville – Milton Wetlands are isolated or palustrine wetland types occurring exclusively on mineral substrates. The isolated wetlands are dependent on spring runoff of rainfall and snowmelt and are typically dry by midsummer. Palustrine wetlands are of two types:

1. **Headwater isolated wetlands.** These wetlands supply spring overflow to watercourses and are typically dry during summer months.
2. **Downstream wetlands with defined inflows.** These types are also typically flooded in the spring and dry during the summer months.

The North Oakville - Milton Wetlands support a variety of wetland types, including the following (listed in order of decreasing abundance): Cattail Marshes, Graminoid Marshes, Herbaceous Marshes, Open Water, Swamps and Swamp Thickets.

The North Oakville Creeks Subwatershed Study (NOCSS; Town of Oakville 2006d) identifies additional wet features and depressions that are not picked up by MNR (2006a) PSW or ELC mapping of the subject area (Section 3.3.1 of this report). The NOCSS (2006e) Management Report (Section 6.3.4.4) indicates this feature mapping includes “a number of relatively small depressions ...some of these depressions are in areas that are currently used for other purposes (i.e. recreational ponds and agriculture) and have been significantly modified from their original form and function.”

3.5.1.4 *Significant Woodlands*

All but one woodlot (a small FOD7-1 unit abutting the north side of Dundas Street, east of Trafalgar Road) surveyed by the Town of Oakville (2002) were considered “Significant Woodlands” according to criteria established for the Region of Halton by Gartner Lee Limited (2002).

3.5.1.5 *Interior Forest Habitat*

Interior forest habitat is a sheltered environment away from the influence of forest edges and open habitats. The presence of forest interior is a good sign of woodland health, and is directly related to the woodland’s size and shape. Large woodlands with round or square outlines have the greatest amount of forest interior, while narrow, linear woodlands are less likely to support interior forest habitat.

Most authors recognize the interior forest habitat located more than 100 m away from the forest edge (Riley and Mohr, 1994). The 100 m rule has been adopted by most planning level studies; however, tolerance of edge disturbance should be considered on a species by species basis. The Wildlife Habitat Technical Guide (OMNR 2000) has adopted an “area-sensitive species” concept to treat species-specific tolerances to edge effects, and to use breeding bird observations as evidence of suitable habitat availability. Area-sensitive bird species data and interpretation is provided in Section 3.1.5

An estimate of interior forest habitat within the New North Oakville Transportation Corridor Class study area was identified by applying the 100 m rule to all Forest Community Classes identified according to ELC protocol, and illustrated on Figure 2. A total of 133 ha of interior forest habitat are located throughout the New North Oakville Transportation Corridor Class EA study area as illustrated on Figure 6.

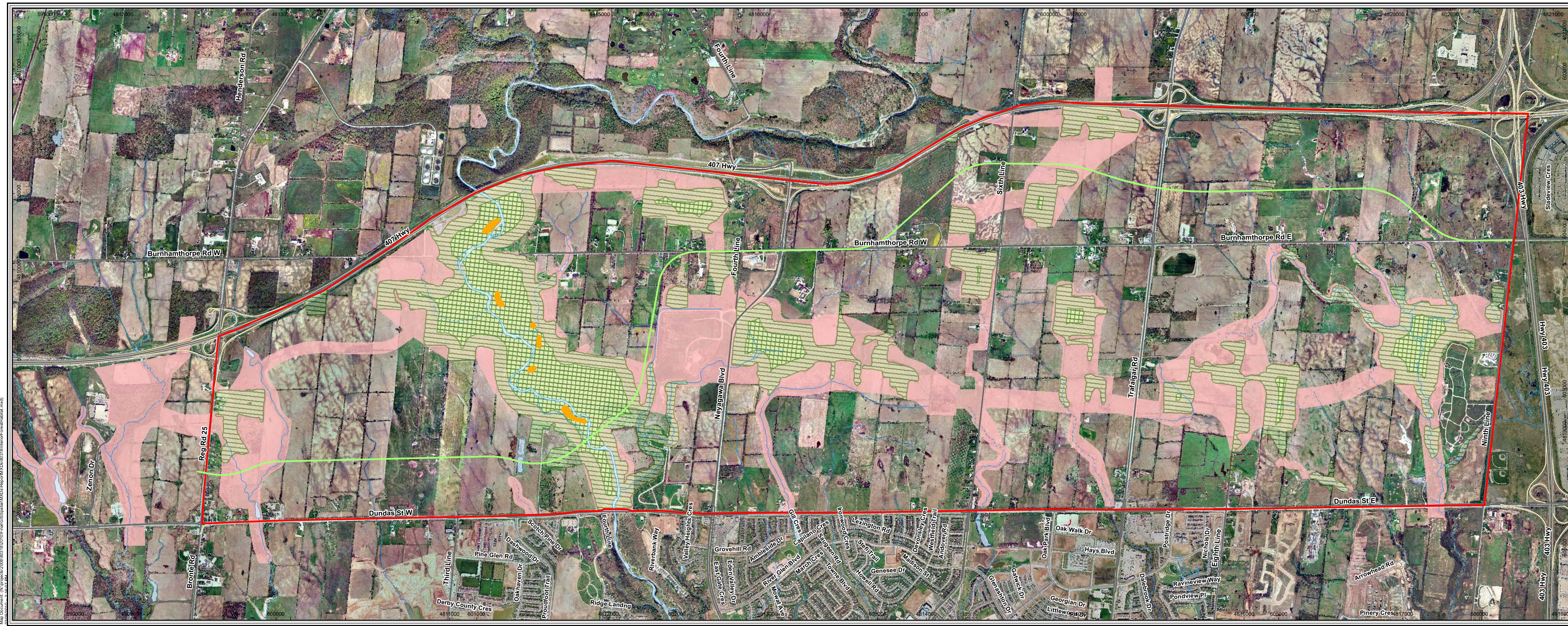
Southern Ontario wildlife populations are also often healthier in regions with relatively more forest cover and where forest fragments are grouped closely together or connected by corridors of natural habitat. Experts believe that 25 to 30 per cent forest cover is required to support high flora and fauna richness attributes associated with historical forest cover (Landowner Resource Centre 2000). Cover by Forest Community Classes of the entire New North Oakville Transportation Corridor Class EA study area was calculated at approximately 325 ha.

3.5.1.6 *Landscape Connectivity*

Landscape connectivity has become recognized as an important part of natural heritage planning. It is generally accepted that a wide range of benefits can be attributed to the maintenance or re-connection of the natural landscape. These benefits include: increased local species richness and biodiversity, more immigration and movement opportunities for individuals between core natural areas, and greater likelihood of seed dispersal and exchange of other genetic material between populations. In contrast, isolated natural heritage units can become impoverished over time in terms of inter and intraspecific diversity.

The Town of Oakville (2003) North Oakville Subwatersheds Studies provide an analysis of contiguous natural vegetation or “habitat units” based on vegetation and wildlife inventories and data summarized in previous reports. The Town identified a number of “core areas” as a basis for a proposed natural heritage/open space system for North Oakville based on the following criteria:

- Diversity:.....areas with rich species diversity were given priority over areas with less diversity;
- Size:.....sufficient size to protect interior habitat;
- Contiguous:designated to create contiguous units;
- Connectivity:potential to link the unit to other units;
- Significance:areas supporting significant species or habitats;
- Features:areas which include appropriate representational features (including the presence of rare species) associated with ANSI or candidate ANSI designations; and
- Watershed Functionality:designated to protect the flow regime of receiving streams.



- Legend**
- Preferred Alternative
 - Study Area
 - Railway
 - Regionally/Locally Significant Species Assemblage
 - Interior Forest Habitat
 - Significant Woodlands
 - Core Preserve and Linkage Areas
 - Freeway
 - Highway
 - Major Road
 - Local Road
 - Ramp

Basemapping from Ontario Ministry of Natural Resources
Orthophotography, 2002

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UTM Zone 17N, NAD 83

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New North Oakville
Transportation Corridor Class EA

Interior Forest Habitat

March 2010
Project 107909

Map Document: N:\projects\2008\803\18\2\0\Final\GIS\Spatial\MXD\318\InteriorForestHabitat.mxd

Core areas consist of existing woodland and wetland area and adjacent features including naturalized areas and active agricultural lands. Since core areas are predominantly isolated within the agricultural landscape matrix of North Oakville, the Town identified a number of factors based on a literature review, to evaluate potential natural heritage linkage opportunities (which included agricultural fields, hedgerows and riparian habitats):

- a) length/width;
- b) composition of the potential linkage feature;
- c) character of the surrounding habitats and presence and size of discontinuities;
- d) identification of “end” habitats to improve connectivity functions of linkages; and
- e) enhancement potential.

Results of the Town’s core area and linkage analysis included a series of Natural Heritage System mapping (including Core Preserve Areas and Linkage Preserve Areas), the most recent of which is dated June 2006 and appears in Appendix H.

In terms of overall regional landscape linkage, the Sixteen Mile Creek and Valley in particular provides an important linkage between Lake Ontario and the Niagara Escarpment, protected by special provincial policy, through an area with expanding urbanization. (Much further north, near Orangeville, the Escarpment also links with the Oak Ridges Moraine)

3.5.1.7 Summary of Terrestrial Habitat Features and Functions

Table 5 summarizes the ecological features and functions of the study area, including results presented above in previous sections (Sections 3.5.1.1 to 3.5.1.6) on Vegetation Cover, Wetlands, Vegetation Communities, Interior Forest Habitat and Landscape Connectivity.

Table 5. Summary of Terrestrial Habitat Features and Functions

Feature or Function	Summary of Findings
Vegetation Cover	<ul style="list-style-type: none"> 11% (325 ha) of the entire study area is currently covered in forest.
Significant Vegetation Communities	<ul style="list-style-type: none"> AECOM identified six community Classes and 28 distinct Ecosites and Vegetation Types in the Sixteen Mile Creek Valley, all common and widespread in Ontario. Note plant assemblages include flora species with prairie affinities located along the top of a treed bluff along short list alternative alignment W1, and a white oak forest community along short list alternative alignments W3/W5. LGL (1999) and the Town of Oakville (2002 and 2003) report three significant vegetation communities within the study area but outside Sixteen Mile Creek Valley (Figure 2).
Wetlands	<ul style="list-style-type: none"> OMNR (2006a) identified a large number of small isolated and palustrine wetland types throughout the study area as part of the North Oakville – Milton East Provincially Significant Wetland Complex.
Significant Woodlands	<ul style="list-style-type: none"> All but one woodlot surveyed by the Town of Oakville (2002 and 2003a) are considered significant woodlands according to criteria established for the Region of Halton (Figure 6).
Forest Interior Habitat	<ul style="list-style-type: none"> Approximately 325 ha of forest is located in the study area, approximately 190 ha of which is associated with Sixteen Mile Creek Valley. 133 ha were design gated interior forest habitat as illustrated in Figure 6. AECOM identified 10 area-sensitive bird species in Sixteen Mile Creek Valley. Secondary source information identified 11 area-sensitive bird species within the study area but outside Sixteen Mile Creek Valley.
Landscape Connectivity	<ul style="list-style-type: none"> Town of Oakville (2006c) provide Natural Heritage System mapping to identify Core Preserve Areas and Linkage Preserve Areas (Appendix H).

3.5.2 Aquatic Habitat

3.5.2.1 Thermal Ranking

The species, abundance, and condition of fish present in a stream are strongly influenced by environmental and water-quality factors including water temperature. Cold water streams and associated fish communities are generally valued as high quality systems, especially in disturbed landscapes, where agricultural and urban land use limit vegetation cover and disrupt groundwater and surface water interacts.

OMNR (2006b) provide thermal status data for watercourses throughout the New North Oakville Transportation Corridor study area in seven categories: coldwater permanent, cold water intermittent, cool water permanent, cool water intermittent, warm water permanent, warm water intermittent and no data (Figure 5). Table 6 provides a summary of thermal status designations in the study area, sorted by watershed and listed in decreasing order of habitat availability, based on the total length of each thermal status designation.

Table 6. Summary of Thermal Status Designations

Watershed	Thermal Status
14 Mile Creek	Permanent cold water > no data
Taplow Creek	No data > permanent warm water
16 Mile Creek	Permanent cool water > intermittent cool water > no data
Morrison Creek	Intermittent cold water > permanent coldwater > no data
Joshua Creek	Intermittent warm water > permanent warm water > no data

Fish assemblages recorded in the NOCSS (North Oakville 2006f) for creeks throughout the study area are comprised of generalist species which are tolerant of warm water temperatures and moderate amounts of organic enrichment, with one exception: redbreast dace was recorded in Fourteen Mile Creek. This species requires clear flowing, cool water.

Riparian Corridor Classification

The Town of Oakville (2003b) developed a classification system to protect and enhance the riparian corridor functions of the watercourses throughout the North Oakville Subwatershed Study area, including a number of headwater streams located in the New North Oakville Transportation Corridor study area. The Town classified riparian corridors according a number of criteria including the following:

- a) Hydrogeology and Water Balance (including groundwater inputs to baseflow, and influence of aquatic life);
- b) Hydraulics (including water quality and quantity functions);
- c) Stream Morphology (including erosional process and associated aquatic habitat quality);
- d) Terrestrial Resources (including linkages between riparian and terrestrial systems); and,
- e) Aquatic Resources (including quality of aquatic habitat).

Aquatic habitats were categorized according to relative importance and sensitivity to development and placed in three categories: critical, important or marginal. The Town of Oakville has since updated the riparian corridor classification system mapping with constraint level designations (high, high requiring rehabilitation, medium and low), (Town of Oakville (2005), - Appendix I) and Town of Oakville (2006b)). Table 7 provides a summary of reach level constraints within the study area, sorted by watershed and listed in decreasing order of constraint ranking, based the total length of each constraint.

Table 7. Summary of Reach Level Constraints

Watershed	Reach Level Constraints
14 Mile Creek	High > medium > low
Taplow Creek	Low > medium
16 Mile Creek	High > low > medium
Morrison Creek	Medium > low > high
Joshua Creek	High > medium > low

3.5.2.2 Summary of Sensitive Aquatic Habitat Features and Functions

The identification of sensitive aquatic habitat features must first be founded in a general understanding of the potential impacts of the undertaking proposed. With regards to watercourse crossings by roadways, the general impacts are often subsidiary effects of land based activities such as vegetation clearing, grading, and excavation. These activities may not directly affect fish and fish habitat but can produce stressors indirectly on the habitat such as reduced bank stability and sediment deposition from erosion of exposed soils.

As stated in Section 3.4.2, high sensitivity habitat is a characterization largely based on DFO’s Risk Management Framework (DFO, 2005) using attributes encompassing fish species presence, abundance, habitat resiliency and the species interrelationships and dependencies on the habitat attained through primary and secondary sources as well as best known science.

With the sensitivity of aquatic features in the study area and the potential effects of the proposed undertaking in mind, Table 8 summarizes the key aquatic ecological features and functions of the study area as they pertain to fish and fish habitat sensitivity (as stated in Section 3.4.1 and Section 3.4.2 of this report).

Table 8. Summary of Aquatic Habitat Features and Functions

Feature or Function	Summary of Findings
Fish Habitat Presence	<ul style="list-style-type: none"> The presence of highly intolerant species (reidside dace) to environmental change and perturbation within Sixteen Mile Creek, Morrison Creek and Fourteen Mile Creek. The presence of moderate and highly intolerant salmonid species to environmental change and perturbation within Sixteen Mile Creek. Two provincially significant species: silver shiner (16 Mile Creek watershed) and reidside dace (16 Mile Creek and Morrison Creek watersheds).
Species Dependence on Habitat	<ul style="list-style-type: none"> Species dependence on spawning, refuge, feeding and rearing habitat is high for salmonid species in Sixteen Mile Creek. Reidside dace are highly dependent on habitat for feeding, spawning and rearing within resident reaches of Sixteen mile Creek, Morrison Creek and Fourteen Mile Creek.
Species/Habitat Rarity	<ul style="list-style-type: none"> The presence of reidside dace which is listed as a SAR federally (SARA) and provincially (ESA). The presence of silver shiner which is listed as a SAR provincially (ESA) Spawning habitat for cold/cool water salmonid species is prevalent within Sixteen Mile Creek main branch.
Habitat Resiliency	<ul style="list-style-type: none"> OMNR (2006b) identify cold water attributes in two watersheds (14 Mile Creek and Morrison Creek) and cool water attributes in one watershed (16 Mile Creek).

3.6 Designated Natural Areas

3.6.1 Sixteen Mile Creek Regionally Significant Life Science ANSI/Sixteen Mile Creek Valley ESA

The Sixteen Mile Creek Valley has been designated as a regionally significant Life Science ANSI since 1984. It is also considered an ESA by the Region of Halton. This corridor is considered to have the highest quality and largest valley forest types within the Trafalgar Moraine and Peel Plain Physiographic Regions.

In general, valley slopes with southern aspects support high quality deciduous forests and prairie communities. Observed species with southern affinities include black maple (*Acer saccharum ssp. nigrum*), white oak, black oak (*Quercus velutina*), chinquapin oak (*Quercus muehlenbergii*), shagbark hickory, bitternut hickory (*Carya cordiformis*), sassafras (*Sassafras albidum*), and moonseed (*Menispermum canadense*). Valley slope forests with northern exposures and tableland communities are dominated by sugar maple, red oak, and white pine (*Pinus strobus*), and also include white birch and eastern hemlock (*Tsuga canadensis*) as common associates. Floodplain communities are dominated by shrub willow and dogwood communities.

3.6.2 Oakville-Milton Wetlands and Uplands Candidate Life Science ANSI

A large number of small wetlands (under 2 ha) are scattered throughout the study area including isolated wetlands associated with the pitted depressions of the Trafalgar Moraine. All North Oakville – Milton Wetlands are isolated or palustrine wetland types occurring exclusively on mineral substrates and are typically dry by midsummer. .

3.6.3 Trafalgar Moraine Candidate Earth Science ANSI

The moraine is relatively well drained, forming the headwaters of Fourteen Mile Creek, McCraney Creek, Shannon's Creek, Munn's Creek, Morrison Creek, and Joshua's Creek. The east branch of Sixteen Mile Creek originating north of 407 ETR is deflected in a westerly course upon approaching the moraine. It then converges with the main branch of Sixteen Mile Creek, cutting through the moraine and exposing the Queenstone Shale bedrock. This creates the effect of gorges, with unique vegetation niches, within the study area.

3.6.4 Provincially Significant Wetlands

Recent evaluation by the OMNR classified some of the wetlands within the study area as Provincially Significant Wetlands (PSW) as documented in Appendix 2.

3.7 Significant Species

Table 9 summarizes rare species data presented in Sections 3.1 and 3.2. Rare species are presented by organism type, including vascular plants, breeding birds, mammals, reptiles, Lepidoptera, Odonata and fish, and scale of significance, including national provincial, regional, and local. Data includes secondary source information presented in preceding sections and results of AECOM surveys of the Sixteen Mile Creek valley and associated tablelands. Only the highest scale of significance is presented for each species (for example, Broad-leaved Puccoon [*Lithospermum latifolium*] is provincially rare, regionally rare and locally rare, however, it is only counted in Table 5 at the provincially level of significance).

Table 9. Summary of Rare Species

	Scale of Significance											
	National		Provincial		Regional		Local		Area-Sensitive		Total Species*	
	SS	AECOM	SS	AECOM	SS	AECOM	SS	AECOM	SS	AECOM	SS	AECOM
Flora	1	1	7	6	53	26	42	3	NA	NA	103	36
Breeding Birds	4	0	0	0	7	0	NA	NA	21	10	28	0
Mammals	1	0	3	0	7	0	0	0	NA	NA	11	0
Reptiles	7	0	1	0	0	0	0	0	NA	NA	8	0
Lepidoptera	1	1	1	0	0	0	0	0	NA	NA	2	1
Odonata	NA	0	NA	0	NA	0	NA	0	NA	NA	NA	0
Fish	1	NA	1	NA	2	NA	2	NA	NA	NA	6	NA
Total Species	15	2	14	6	68	26	61	3	11	10	158	37

Notes: SS – Secondary Sources

* - Area-sensitive birds not included in calculation of TOTAL Species

4. Evaluation of Alternatives

4.1 Long List Alternatives

A long list of 16 Road System Expansion Alternatives was screened by AECOM. Emphasis was put on meeting overall project objectives while minimizing impacts on local residents and environment. AECOM provided input on natural environment factors to eliminate or modify alternatives. Objectives of the natural environmental assessment included:

- avoid fragmenting of significant vegetation communities, corridors and linkages including ANSIs, significant woodlands;
- favour narrower crossing of Sixteen Mile Creek Valley and areas with previous disturbance;
- minimize impact of stream crossings, in terms of quantity and quality;
- minimize impact to wildlife habitat; and
- minimize impact to wetlands.

Table 10 provides a summary of the natural environment criteria used to assess the Long List of Alternatives. Screening was based primarily on a review of secondary source information and cursory field work (prior to detailed field work on Sixteen Mile Creek).

Table 10. Summary of Long List Assessment Criteria

Feature/Function	Assessment Criteria
Watercourse/Fisheries	<ul style="list-style-type: none"> Quality and quantity of watercourse crossings based on Town of Oakville (2002-2004b) and MNR NRVIS data.
Vegetation and Woodlots	<ul style="list-style-type: none"> Length of crossings of woodlots, significant woodlots (GLL 2002), Life Science (LS) and Earth Science (ES) Regional or Candidate Areas of Natural and Scientific Interest (ANSI).
Wildlife	<ul style="list-style-type: none"> Locations of provincially and nationally rare species.
Natural Heritage Systems Connectivity	<ul style="list-style-type: none"> Crossings of "Core preserve areas" and "Linkage preserve areas" as defined by the Town of Oakville (2007).
Wetlands	<ul style="list-style-type: none"> Number of wetlands occurring within development footprint and number of wetlands occurring within 120m of development footprint (based on OMNR 2003).
Groundwater/Surface Water	<ul style="list-style-type: none"> Addressed in separate Hydrogeological Assessment Report (GLL 2008)

4.2 Short List of Alternatives

Screening of the Long List of Alternatives lead to the development of a short list of five alignments (W1-W3, W5 and W6) between Bronte Road and Newagawa Boulevard, and three alignments (E1-E3) between Newagawa Boulevard and Ninth Line. The Short List of Alternatives is mapped in Appendix G. The objectives of the assessment of the natural environment presented in Section 5.1 (Long List) were retained in the assessment of the short list, however, each short list alignment was subjected to a more rigorous assessment, including focused field investigations and detailed analysis of secondary source information. A summary of the short list assessment criteria is presented in Table 11. Results of the assessment are presented in subsequent sections by segment, i.e. Bronte Road to Neyagawa Boulevard, and Neyagawa Boulevard to Ninth Line. In addition to information used to assess the Long List, preliminary field work results from detailed work in Sixteen Mile Creek were also considered at this stage.

Table 11. Summary of Short List Assessment Criteria

Feature/Function	Assessment Criteria
Watercourses/Fisheries	<ul style="list-style-type: none"> Number of watercourse crossings by OMNR (2006) Thermal Status (thermal status is generally considered a high level indicator of habitat sensitivity) Number of watercourse crossings by NOSP Hydrogeological Features (Town of Oakville 2006b)
Vegetation and Woodlots	<ul style="list-style-type: none"> Length of feature crossings: Woodlands, Interior Forest, Sixteen Mile Cr. (Regional) LS ANSI, and Candidate Trafalgar Moraine ES ANSI.
Wildlife	<ul style="list-style-type: none"> Proximity (120 m) to provincially significant species, and regionally/locally significant species assemblages.
Natural Heritage Systems Connectivity	<ul style="list-style-type: none"> Length of Crossing of NOSP Natural Heritage System (Town of Oakville 2006b)
Wetlands	<ul style="list-style-type: none"> Number of wetlands within 120 m of alignment, including wetlands comprising the North Oakville – Milton East PSW Complex (MNR 2006); and the wet features and depressions as identified within the (2006d). Priority is assigned to the protection of PSW designated units. Length of crossing of Candidate Oakville-Milton Wetlands & Upland LS ANSI
Groundwater/Surface Water	<ul style="list-style-type: none"> Considered preliminary results of the GLL (2008) Hydrogeology Study.

Consideration of NOCSS (Town of Oakville 2006d-e) wet features and depressions not classified as PSW or documented using ELC (Section 3.3.1) did not influence the outcome of the ecological evaluation of alternatives; i.e., all routes crossed six or fewer of these low-ecological functioning features. However, wet features and depressions may contribute to storage as described in Section 6.3.4.4 of the Management Report, and exact losses should be quantified for the preferred route during detailed design.

4.2.1 Alternative Routes Between Bronte Road and Neyagawa Boulevard

The natural environment evaluation identified “Least Preferred” and “Most Preferred” alignments based on the Short List assessment criteria summarized above (Section 5.2). All alternatives require new bridge crossing of Sixteen Mile Creek. Alternative W3 follows the existing alignment of Burnhamthorpe Road, requiring the widening and improvement of the existing road. All other alignments are well outside existing roads and require the construction of a new road.

Impacts to the natural environment are minimized by alternative W3 as it is restricted to the widening along the existing Burnhamthorpe alignment. Therefore, W3 was designated as the natural environment most preferred alternative. Table 12 provides a summary of the natural environment assessment of alternative routes occurring between Bronte Road and Neyagawa Boulevard. The complete assessment results are located in Appendix J.

**Table 12. Summary of Natural Environment Alternate Route Assessment -
Neyagawa Boulevard to Bronte Road**

Alternative	Natural Environment Assessment Summary
W1	<ul style="list-style-type: none"> • 13 new (and no existing) watercourse crossings; two coldwater crossings impacted. • Three high constraint and three medium constraint watercourses crossed. • Moderate impact on woodlands and ANSIs, greatest impact on interior forest. • Greatest impact on terrestrial wildlife. • Moderate impact on natural heritage system connectivity. • Least impact on wetlands/marsh areas. • LEAST PREFERRED
W2	<ul style="list-style-type: none"> • Five new and two existing watercourse crossings; two coldwater crossings impacted. • Zero high constraint and zero medium constraint watercourses crossed. • Moderate impact on woodlands, ANSIs and interior forest. • Least impact on terrestrial wildlife. • Least impact on natural heritage system connectivity. • Greatest impact on wetlands/marsh areas.
W3	<ul style="list-style-type: none"> • Three new and three existing watercourse crossings; one coldwater crossing impacted. • One high constraint and zero medium constraint watercourses crossed. • Least impact on woodlands, and ANSIs, and moderate impact on interior forest. • Moderate impact on terrestrial wildlife. • Moderate impact on natural heritage system connectivity. • Least impact on wetlands/marsh areas. • Expansion of existing route (except at Sixteen Mile Creek crossing), therefore impacts are greatly minimized. • MOST PREFERRED
W5	<ul style="list-style-type: none"> • Six new and two existing watercourse crossings; two coldwater crossings impacted. • Four high constraint and two medium constraint watercourses crossed. • Moderate impact on woodlands, ANSIs and interior forest. • Moderate impact on terrestrial wildlife. • Greatest impact on natural heritage system connectivity. • Moderate impact on wetlands/marsh areas.
W6	<ul style="list-style-type: none"> • 11 new (and no existing) watercourse crossings; two coldwater crossings impacted. • Three high constraint and three medium constraint watercourses crossed. • Greatest impact on woodlands, moderate impact on ANSIs, and minimal impact on interior forest; Shortest crossing of Sixteen Mile Creek Valley • Moderate impact on terrestrial wildlife. • Moderate impact on natural heritage system connectivity. • Moderate impact on wetlands/marsh areas.

4.2.2 Alternative Routes Between Neyagawa Boulevard and Ninth Line

The natural environment assessment identified “Least Preferred” and “Most Preferred” alignments based on the Short List assessment criteria summarized above (Table 11). Alternative E2 follows the existing alignment of Burnhamthorpe Road, requiring the expansion of the existing road. All other alignments do not follow existing roads and require the construction of a new road. Impacts to the natural environment are minimized by widening the existing Burnhamthorpe alignment; therefore, E2 was designated as the natural environment most preferred alternative. Table 13 provides a summary of the natural environment assessment of alternate routes occurring between Neyagawa Blvd. and Ninth Line. The complete assessment results are located in Appendix J.

**Table 13. Summary of Natural Environment Alternate Route Assessment -
 Ninth Line to Neyagawa Boulevard**

Alternative	Natural Environment Assessment Summary
E1	<ul style="list-style-type: none"> • Eight new and two existing watercourse crossings; no coldwater crossings impacted. • Zero high constraint and two medium constraint watercourses crossed. • Comparable impact on woodlands; greatest impact on Trafalgar Moraine ES ANSI. • No significant impact on terrestrial wildlife. • Least impact on natural heritage system connectivity. • Greatest impact on wetlands/marsh areas.
E2	<ul style="list-style-type: none"> • Zero new and ten existing watercourse crossings to be modified; one coldwater crossing impacted. • Zero high constraint and three medium constraint watercourses crossed. • Comparable impact on woodlands; moderate impact on Trafalgar Moraine ES ANSI. • No significant impact on terrestrial wildlife. • Least impact on natural heritage system connectivity. • Least impact on wetlands/marsh areas. • Expansion of existing route, therefore impacts are greatly minimized. • MOST PREFERRED
E3	<ul style="list-style-type: none"> • Seven new and five existing watercourse crossings; two coldwater crossings impacted. • Two high constraint and four medium constraint watercourses crossed. • Comparable impact on woodlands; no impact on Trafalgar Moraine ES ANSI. • No significant impact on terrestrial wildlife. • Greatest impact on natural heritage system connectivity. • Moderate impact on wetlands/marsh areas. • LEAST PREFERRED

4.3 Assessment and Mitigation of the Preferred Alternative

The Short List of Alternate Routes was assessed by AECOM with input from a number of disciplines including transportation, natural environment, social environment, cultural environment, economic environment and engineering, to identify the overall preferred alternative.

The assessment recommended W6 as the most overall preferred of the five Short List alternatives located between Bronte Road and Newagaya Boulevard, and is the most preferred in transportation, social, cultural and economic environments and engineering disciplines.

W6 was not the most preferred in natural environment because it requires construction of a new road; however, it provides least impacts when compared to the other “cross country” alignments including the shortest crossing of Sixteen Mile Creek Valley. (Only alternative W3 did not require construction of a new road – making it the preferred option for natural environment). The W6 Sixteen Mile Creek crossing location is also considered to have the least impact because it is located in close proximity to Lyons Gate Park, providing access for bridge construction through existing parkland which is already relatively disturbed relative to the alternatives.

AECOM identified Alignment E1 as the most overall preferred of the three Short List alternatives located between Newagaya Boulevard and Ninth Line. E1 is also the most preferred alternative in transportation, social, cultural and economic environments and engineering disciplines.

E1 is not the most preferred alternative in natural environment because it requires construction of a new road; however it provides least impacts when compared to the other “cross country” alignment (E3).

Assessment of the preferred alignment is based on the following design parameters (TSH 2006a):

- a) four lane facility (two through lanes per direction);
- b) 35 m right-of-way (ROW) width; and
- c) New bridge crossing at Sixteen Mile Creek.

Detailed engineering design of the new bridge required to cross Sixteen Mile Creek is not yet available, however preliminary design concepts indicate that three sets of paired pier footings are required to cross approximately 300 m of the valley (TSH 2006b).

In the absence of detailed engineering design drawings, in order to reduce the risk to fish habitat the following assumptions/guiding principles are made regarding new crossings within the study area. Based on preliminary design concepts the risk to fish and fish habitat will be low provided;

- fish passage is maintained during operation and life of the water crossing as per fisheries management objective.
- no channel realignment is required;
- no impact to highly sensitive fish habitat (e.g., limiting or sensitive fish habitat protected under the Fisheries Act);
- water crossing spans bankfull width including the placement of abutments, footings or armouring,
- no infilling on important floodplain fish habitat (e.g., pike spawning habitat, floodplain fish passage use);

Further to this, based on preliminary design, many of these guiding principles have been established and maintained as little to no in-water work is anticipated (over Sixteen Mile Creek) as piers are positioned outside of the watercourse.

Table 14 provides an evaluation of potential impacts on natural environment and corresponding mitigation measures for the preferred alignments in each of the two project sections.

Potential indirect effects include short term construction impacts, such as erosion and downstream sedimentation affecting receiving watercourses, and longer term impacts from stormwater runoff (which can, at times, increase thermal regimes of receiving water bodies). Short term potential impacts from construction activities can generally be mitigated through the proper installation and maintenance of erosion and sediment control devices, such as silt fencing, straw bale and rock checks, etc. The recommendation for use and deployment of these devices are discussed further below.

Table 14. Natural Environment Impact Assessment of Preferred Alternative and Proposed Mitigation Measures

Evaluation Criteria		Impact Assessment	Specific Mitigation Measures
Aquatic Environment			
Direct or indirect loss of aquatic habitats or fish communities.	W6	<ul style="list-style-type: none"> • Eleven anticipated culvert and bridge crossings of watercourses (including two cold water crossings) along W6; crossings are identified as low risk to fish and fish habitat. 	<ul style="list-style-type: none"> • Detailed design should consider stormwater management practices to limit untreated road runoff from entering watercourses. • BMPs are required during the construction phase (refer to Section 6.1). • Refer to general recommendations in the event of in-water work.

Table 14. Natural Environment Impact Assessment of Preferred Alternative and Proposed Mitigation Measures

Evaluation Criteria		Impact Assessment	Specific Mitigation Measures
Direct or indirect loss of aquatic habitats or fish communities.	E1	<ul style="list-style-type: none"> Eight anticipated culvert and bridge crossings of watercourses along E1; crossings are identified as low risk to fish and fish habitat. No cold water (high sensitivity) watercourses are crossed. 	<ul style="list-style-type: none"> Detailed design should consider stormwater management practices to limit untreated road runoff from entering watercourses. BMPs are required during the construction phase (refer to Section 6.1). Refer to general recommendations in the event of in-water work.
Loss of riparian areas vegetation.	W6	<ul style="list-style-type: none"> Naturalized riparian areas will be lost in the 35 m ROW of W6. Riparian habitat is lost due to construction impacts beneath the bridge, including temporary impact to forest from construction and permanent impact from bridge footing. 	<ul style="list-style-type: none"> Post-construction restoration should restore disturbed riparian areas with fast growing trees and shrubs. Restoration works should only incorporate locally sourced native plants appropriate for site conditions.
	E1	<ul style="list-style-type: none"> Naturalized riparian areas will be lost in the 35 m ROW of E1. 	<ul style="list-style-type: none"> Post-construction restoration should restore disturbed riparian areas with fast growing trees and shrubs. Restoration works should only incorporate locally sourced native plant appropriate for site conditions.
Impact on species at risk, including rare, of special concern, threatened, endangered and species of local concern.	W6	<ul style="list-style-type: none"> Redside dace and silver shiner are both provincially significant species known to occur in Sixteen Mile Creek, however, vegetation along the edge of the watercourse will be retained beneath the W6 bridge crossing and no impacts to significant species are anticipated. Redside dace are known to occur in Fourteen Mile Creek; crossing will remove some riparian habitat, however, no impacts to significant species are anticipated. 	<ul style="list-style-type: none"> Post-construction restoration should restore disturbed riparian areas with fast-growing trees and shrubs to shade watercourse and provide feeding habitat for redside dace
	E1	<ul style="list-style-type: none"> Redside dace is a provincially significant species known to occur in Morrison Creek, however E1 is located to the north of the headwater tributaries, therefore, no impacts to significant species are anticipated. 	<ul style="list-style-type: none"> Post-construction restoration should restore disturbed riparian areas with fast-growing trees and shrubs to shade watercourse and provide feeding habitat for redside dace.
Changes in groundwater recharge and discharge in relation to aquatic/wetland habitat	W6	<ul style="list-style-type: none"> Potential impacts to pitted depression wetlands and watercourses are associated with changes in water quality (via temperature increases and contamination runoff). Refer to Gartner Lee (2008) for hydrogeological evaluation. 	<ul style="list-style-type: none"> Groundwater recharge to wetlands should be maintained via recommendations of the hydrogeological evaluation (Gartner Lee 2008).
	E1	<ul style="list-style-type: none"> Potential impacts to pitted depression wetlands and watercourses are associated with changes in water quality (via temperature increases and contamination runoff). Refer to Gartner Lee (2008) for hydrogeological evaluation. Shallow water table conditions may require dewatering during construction process (Gartner Lee 2006). 	<ul style="list-style-type: none"> Groundwater recharge to wetlands should be maintained via recommendations of the hydrogeological evaluation (Gartner Lee 2008).

Table 14. Natural Environment Impact Assessment of Preferred Alternative and Proposed Mitigation Measures

Evaluation Criteria	Impact Assessment	Specific Mitigation Measures
Terrestrial Environment		
Direct or indirect loss of vegetation communities	<p>W6</p> <ul style="list-style-type: none"> W6 has potential direct impacts on 35,700 m² (3.57 ha) of forest communities (1,020 m crossing length multiplied by 35 m ROW), including Sixteen Mile Creek ANSI, and two FOD5-2 (sugar maple – beech) units located in the southwest quadrant of Burnhamthorpe Road and Neyagawa Boulevard intersection. Vegetation communities will be retained beneath much of the 300 m bridge crossing of Sixteen Mile Creek valley; however, indirect impacts include changes in species composition as a result of shade cast. Construction access will create short-term disturbance to bottomland vegetation communities located immediately north of Lyons Gate Park. 	<ul style="list-style-type: none"> Appropriate mitigation includes restoration of 25,200 m² (720 m of total crossing length multiplied by 35 m ROW) at an appropriate location within the study area, to create no net loss of vegetation communities. Siting for restoration works should take place during the detailed design stage and should give priority to potential enhancement areas identified by the Town of Oakville’s Natural Heritage System (2006). Restoration works should only incorporate locally sourced native plant appropriate for site conditions. Vegetation communities temporarily disturbed by construction should be replanted to replicate pre-construction conditions.
	<p>E1</p> <ul style="list-style-type: none"> The southern portion of a small (approximately 2 ha) FOD2-3 (hickory forest) woodlot will be fragmented by E1. Approximately 4,200 m² (0.42 ha) is lost to E1 (120 m crossing multiplied by 35 m wide ROW). Although many trees may be retained, the new edges created by E1 may lead to a decline in the floristic quality of the community. 	<ul style="list-style-type: none"> Potential mitigation includes restoration of an equivalent area in an appropriate location throughout the study area. Siting for restoration works should take place during the detailed design stage and should give priority to potential enhancement areas identified by the Town of Oakville’s Natural Heritage System (2006). Restoration works should only incorporate locally sourced native plant appropriate for site conditions. Restoration works should consider the appropriateness of a plant salvage program to preserve genetics contained within the hickory woodlot.
Direct or indirect loss of wildlife habitats and functions.	<p>W6</p> <ul style="list-style-type: none"> Greatest noise impacts will be associated with bird species breeding in close proximity to the W6 bridge crossing. 	<ul style="list-style-type: none"> Bridge considerations should reduce noise and light pollution entering Sixteen Mile Creek Valley.
	<p>E1</p> <ul style="list-style-type: none"> E1 crosses the minimal distance of the Town of Oakville Natural Heritage System (2006) (approximately 200 m), therefore, indirect impacts are generally restricted to this location. 	<ul style="list-style-type: none"> No mitigation recommended.

Table 14. Natural Environment Impact Assessment of Preferred Alternative and Proposed Mitigation Measures

Evaluation Criteria		Impact Assessment	Specific Mitigation Measures
Potential for encroachment into Significant Wildlife Habitat, Significant Woodlands, Significant Valleylands or Significant Wetlands	W6	<ul style="list-style-type: none"> W6 crosses 1020 m of Halton Region Significant Woodlands (Gartner Lee 2002) including Sixteen Mile Creek ANSI, and two FOD5-2 (sugar maple – beech) units located in the southwest quadrant of Burnhamthorpe Road and Neyagawa Boulevard. W6 does not cross any wetlands identified by OMNR (2003b). However, eight wetlands units are within 120 m of W6. W6 crosses a location in the valley that supports: <ul style="list-style-type: none"> two locally significant species (late goldenrod [<i>Solidago gigantea</i>] and small-flowered bulrush [<i>Scirpus microcarpus</i>]); one area-sensitive breeding bird (blue-gray gnatcatcher), one provincially significant plant species (Virginia bluebells [<i>Mertensia virginiana</i>]), three regionally significant species, (shagbark hickory [<i>Carya ovata</i>], pokeweed [<i>Phytolacca americana</i>] and bastard toadflax [<i>Comandra umbellata</i>]). 	<ul style="list-style-type: none"> The detailed design stage should quantify losses and determine appropriate mitigation. For example, Virginia bluebells is common throughout Sixteen Mile Creek valley within the study area and lends itself well to transplanting. Potential mitigation includes transplanting of provincially significant plant species elsewhere in the valley if required, and planting additional shagbark hickory trees in appropriate proportions elsewhere in the study area. Best management practices are required to protect wetlands during the construction phase according to the recommendations in Section 6.1. and the GLL's hydrogeology report.
	E1	<ul style="list-style-type: none"> No Halton Region Significant Woodlands are crossed by E1. No Significant Valleylands are crossed by E1. E1 will cross approximately 55 m of wetlands identified by OMNR (2003b). An additional 13 wetland units are located within 120 m of E1. No significant breeding birds or other wildlife species are located in either habitat unit (12 and 17) crossed or abutting E1. Two locally, and one regionally significant plant species (two sedge species <i>Carex flava</i> and <i>Carex cephalophora</i>, and shagbark hickory [<i>Carya ovata</i>]) are located in habitat unit 17 (the hickory woodlot crossed by E1). 	<ul style="list-style-type: none"> The detailed design stage should quantify losses and determine appropriate mitigation. Potential mitigation includes planting additional shagbark hickory trees at an appropriate ratio elsewhere in the study area. Best management practices are required to protect wetlands during the construction phase according to the recommendations in Section 6.1. Groundwater recharge to wetlands should be maintained via recommendations of the hydrogeological evaluation (Gartner Lee 2008).
Effect on overall ecological features and functions including biodiversity, connectivity and long-term ecological function.	W6	<ul style="list-style-type: none"> W6 crosses approximately 2000 m of the Town of Oakville Natural Heritage System (Town of Oakville 2006), primarily Core Preserve Areas associated with Sixteen Mile Creek. Flora and Fauna movement is expected to be maintained beneath the W6 bridge crossing. 	<ul style="list-style-type: none"> Potential mitigation includes the identification and restoration of an appropriate location area within the Natural Heritage System, to be identified during the detailed design stage.
	E1	<ul style="list-style-type: none"> E1 crosses approximately 120 m of Linkage Preserve Area (Town of Oakville 2006). E1 does not cross any areas identified as interior forest habitat. 	<ul style="list-style-type: none"> Potential mitigation includes the identification and restoration of an appropriate location area within the Natural Heritage System, to be identified during the detailed design stage.

5. Conclusions and Recommendations

AECOM considered input from a number of disciplines including transportation, natural environment, social environment, cultural environment, economic environment and engineering, and identified routes W6 (west section, Neyagawa Boulevard to Bronte Road) and E1 (east section, Ninth Line to Neyagawa Boulevard) as the preferred alternatives.

As described in Section 5.2, W6 and E1 were not determined through this evaluation to be the most preferred alignments from a natural environment perspective because both alignments require construction of new road right of ways, i.e., road expansion alternatives were available for both the west and east sections and were evaluated as the most preferred. However:

- a) W6 is considered to create the least impact to Sixteen Mile Creek Valley, including the shortest valley crossing and least impact on interior forest habitat. W6 was also evaluated favourable against all non-expansion alternatives.
- b) E1 presents the least impact on both the natural heritage system and wetlands of all the alternatives and was evaluated favourably against the non-expansion alternative in the east section.

Evaluation of the preferred alignments (Section 5.3) identified impacts to the natural environment and appropriate mitigation opportunities to ensure net losses are minimized. Construction of the Sixteen Mile Creek valley crossing presents short-term disturbance, however, impacts as greatly reduced by the availability of existing construction access to valley bottomlands via Lyons Gate Park. Specific mitigation opportunities include restoration of short-term construction disturbance to emulate pre-construction conditions. General recommendations are provided below to minimize construction and post-construction impacts.

5.1 General Mitigation and Monitoring Recommendations

The following is summary of recommendations for the protection of terrestrial and aquatic features within the study area during the construction of the new North Oakville Transportation Corridor.

5.1.1 Terrestrial Environment

5.1.1.1 *Materials Management*

A construction work plan should be outlined which designates locations for stockpiling of soils and other materials, as well as refuelling. All excavated materials requiring stockpiling should be in accordance with OPSS 180.07.06 and placed in pre-determined locations. The perimeters of stockpiles should be encircled with silt fencing, according to OPSD 219.110.

Low impact construction machinery, such as smaller equipment, should be used wherever possible to reduce impacts such as soil mixing and compaction.

Prior to commencement of construction, the limits of protection areas should be delineated and fenced to avoid inadvertent intrusion of machinery or other activities such a stock piling of excess material. This fencing should be maintained and remain in place until final grading and landscaping has been completed.

5.1.1.2 *Vegetation Protection and Restoration*

Trees or large shrubs identified for preservation within and immediately adjacent to construction zones should be protected with appropriate hoarding (fence or similar structure using OPSD 220.01) at an appropriate distance from the tree stem, as determined by a qualified professional. Tree wells may be necessary where significant grading affects soil levels. In the event that roots or branches of trees to be protected are inadvertently damaged during construction, they should be pruned clean as soon as possible. Exposed roots should then be covered with topsoil.

Trees slated for removal should be properly inventoried at the detailed design stage in order to compensate with an appropriate landscape planting plan using native species and species that blend into the surrounding environment. At the time of construction, they should be marked and felled into the easement to avoid damage to adjacent vegetation.

All exposed surfaces susceptible to erosion should be revegetated through the placement of seeding, mulching or sodding immediately upon completion of construction activities or within 45 days of exposure and with sufficient time to allow for successful establishment prior to winter (OPSS 572). Native plants and seeds should be favoured in all restoration. Abandoned paved surface should also be ripped up and restored to native and landscaped vegetation through a planting plan.

All areas disturbed during construction, including staging and access routes be restored using ecologically appropriate restoration approaches. For example, the use of locally native species, species selected may need to be salt tolerant, species and planting layout should blend well with existing adjacent flora.

5.1.1.3 *Wetland Protection*

Standard construction mitigation should be considered for roadwork within 120 m of wetlands:

- a) silt fencing (OPSD 219.110) adjacent to 30 m wetland buffers;
- b) rock checks (OPSD 219.210) and/or silt fence flow checks (OPSD 219.190) in all ditches leading toward wetland areas;
- c) demarcation of fill areas;
- d) removal from the site of any excess fill or stockpiled excavated materials; and
- e) protection from refuelling within 50 m of wetland areas.

5.1.1.4 *Wet Features and Depressions*

Detailed design should quantify exact losses resulting from infill of wet features and depressions as identified in NOCSS (Town of Oakville 2006d-e). If appropriate, a plan to mitigate loss of depression storage should be developed to the satisfaction of Conservation Halton.

5.1.1.5 *Wildlife Movement*

Detailed design should incorporate ecopassages where the preferred alignment crosses areas of contiguous woodlands and natural heritage core and linkage areas (Section 6.3.3 f the NOCSS; Town of Oakville 2006e). Section 7.4.2.7 (Wildlife Crossings) of the NOCSS provides a variety of ecopassages that should be considered, such as dry culverts to allow for the movement of mammals and herpetofauna, creating appropriate sight lines and installing signage, and ensuring at grade crossings are incorporated into design.

Specific ecological linkages should be identified and designed or identified with an understanding of the species that are anticipated to use the connection, including the protection of the existing linkages as recommended by the NOCSS, including the following considerations:

- selecting sizeable roadway and linkage alignments to avoid unsafe intersections (e.g. at curves)
- use of plantings and wing-walls to direct wildlife using the linkage to culvert/structure crossings; and
- design culverts/structures to accommodate wildlife movement.

The design of these crossings would include recommendations for focusing wildlife movements to appropriate crossing locations and/or structures. These measures would depend on site specific features and reported collision hazards.

The preferred alignment segregates woodlots east of Sixth Line and west of Trafalgar Road. These woodlots support a high number of provincially significant wetlands that are habitat for regionally rare breeding amphibians such as chorus frogs and spring peepers. The crossing of the Natural Heritage System linkage between these woodlots can result in amphibian road mortality and effectively divide the existing populations of breeding frogs utilizing this area. An amphibian crossing should be constructed where the NNOTC crosses the core linkage area east of Sixth Line and west of Trafalgar Road (between 18+200 and 18+400). Specific details of this culvert crossing should be considered during detail design in consultation with Conservation Halton.

The preferred alignment west of Neyagawa Blvd creates an additional north – south crossing of the Natural Heritage System (adjacent to the landfill site/North Park area) that can be expected to result in the additional disruption to wildlife passage as well as creating a concentration point for deer / vehicle collisions. The Region of Halton has committed to constructing a wildlife crossing/ecopassage in this area of the corridor (approximately 13+700). The specific details of this crossing should be confirmed in consultation with the Ministry of Natural Resources, Conservation Halton and the Town of Oakville at the commencement of detail design, and balanced with other planning initiatives.

Commitment to the following design components is acknowledged:

- an amphibian crossing/passageway will be provided east of Sixth Line between 18+200 and 18+400 as per Section 6.6.1 of the ESR.
- warning signs with an advisory speed tab will be implemented through core area crossings.
- implement wildlife crossing at North Park in consultation with MNR, Conservation Halton and the Town of Oakville.

5.1.2 Aquatic Environment

5.1.2.1 Riparian Zone Protection

Where no in-water work is required, general recommendations still apply to protect riparian zones surrounding watercourses. Best Management Practices (BMPs), including the use of standard erosion and sediment control devices, should be reviewed at the detailed design stage. These plans should adhere to the principles of reducing the risk of erosion and trapping mobilized sediment as close to the source as possible. Sediment and erosion control measures should be inspected daily with particular scrutiny after rain events, and repaired as necessary. All sediment and erosion control measures should remain intact until vegetation cover is established on all exposed soil.

A construction plan should identify a contingency plan for accidental sediment release. An emergency spill kit should be kept on-site in case of any fuel or chemical leaks.

Disruption to riparian vegetation should be minimized by defining the necessary work area using construction fencing. Post construction restoration efforts should include fast-growing tree and/or shrubs where riparian vegetation has been removed. Restoration works should only incorporate locally sourced native plant appropriate for site conditions.

5.1.2.2 *Authorization and Mitigation for In-Water Work*

In the event that in-water works are required (identified during Detail Design), the project undertaking will be addressed using the DFO Risk Management Framework to determine the projects risk to fish habitat. Note that in-water work is not anticipated in Sixteen Mile Creek. In the event of harmful alteration, disruption or destruction of fish habitat (HADD), Department of Fisheries and Oceans (DFO) approvals will be required. In order to obtain Authorization for Works or Undertakings Affecting Fish Habitat, a detailed Letter of Intent to Implement Construction Measures will need to be submitted to DFO via a designated delegate agency. Additionally, construction mitigation measures (to minimize intrusion) and a Fisheries Habitat Compensation Plan (to replace habitat lost) will need to be developed, in accordance with DFO's No Net Loss Policy.

Authorizations under federal Fisheries Act Legislation may be necessary for a new road crossing at other locations, including crossings of high and medium constraint reach levels identified in the NOCSS (i.e., 16WA-1A, JC-10A, JC-14 and 14E-2A) and any requirements for stream re-alignments. Screening of potential HADDs requires General Arrangements of each crossing for accuracy and efficiency. As such, authorizations will be explored during detail design.

In order to reduce and/or eliminate potential impacts to fisheries habitat and aquatic resources, design modifications and avoidance/mitigation techniques will be considered. Detailed design will consult a qualified engineer to identify appropriate timing for any in-stream works. The timing window is intended to protect fish communities present. To protect downstream fisheries resources, standard erosion and sediment control devices should be used in areas requiring excavation or in-channel works in order to slow runoff velocities and reduce erosive forces, including:

- a) upgraded silt fencing (heavy duty paige wire silt fence) should be used at crossing locations where rare species are present (eg. Sixteen Mile Creek);
- b) rock checks or silt fence flow checks are to be placed in all ditches immediately upstream of their discharge into a watercourse;
- c) straw bale dams are to be placed in advance of sewer inlets;
- d) finished slopes should be graded to an acceptable slope minimum and planted according to Conservation Halton's Landscaping and Tree Preservation Guidelines; large cuts should be terraced to minimize surface erosion;
- e) all excavated materials requiring stockpiling should be in accordance with OPSS 180.07.06 and placed in pre-determined locations. The perimeters of stockpiles should be encircled with silt fencing, according to OPSD 219.110;
- f) any in-water work that is necessary must be conducted in dry conditions within that appropriate fisheries timing window.
- g) cleaning and refuelling of machinery should be prohibited within 50 m of a watercourse to prevent the discharge of petroleum products;
- h) excess silt fence, straw bales and rip-rap should be maintained on site, prior to the commencement of grading operations and throughout the duration of the construction, in case of an emergency; and
- i) the integrity of all sediment trapping devices should be monitored regularly (at least weekly, and immediately following rain events) and properly maintained. Such structures should be removed only after the soils of the construction areas have been stabilized and then only after the trapped sediments have been removed.

With regards to the preferred route alignment, it is acknowledged that the proposed crossing involves spanning sensitive fish habitat and that protection of the natural environment during construction will present numerous challenges. Recognizing the environmental constraints and sensitivities of the crossing, standard/common Pathways of Effects Mitigation measures (DFO Risk Management Framework) will be utilized. Further to this however, additional construction mitigation measures may also include:

- a) Standard construction mitigation methods may be utilized to limit the need for construction de-watering;
- b) Flow mitigation to creek if loss of base flow contributions are anticipated as a result of de-watering;
- c) Adherence to cold water construction timing window (July 1 - September 15);
- d) Permit(s) to Take Water during construction will be obtained if required;
- e) Ensure bridge span maximizes light penetration if feasible to encourage riparian vegetation growth underneath the structure; and,
- f) Replace riparian vegetation lost during construction of bridge abutments and re-naturalize as soon as possible after construction to minimize erosion of bare riparian sections.

5.1.2.3 Additional Design Considerations

With regards to the preferred route alignment, it is acknowledged that the proposed crossing involves spanning sensitive fish habitat and that protection of the natural environment during construction will present numerous challenges. Recognizing the environmental constraints and sensitivities of the crossing, standard/common Pathways of Effects Mitigation measures (DFO Risk Management Framework) will be utilized. Further to this however, additional construction mitigation measures may also include:

- a) Avoidance through design principles considered before construction;
- b) Proposed bridge footings/abutments will be constructed outside the bank full width of the existing channel;
- c) Concrete H-Piles will be used where applicable to reduce the need for de-watering;
- d) Standard construction mitigation methods such as sealed Caissons for concrete footings may be utilized to limit the need for construction de-watering;
- e) Flow mitigation to creek if loss of base flow contributions are anticipated as a result of de-watering;
- f) Adherence to appropriate in-water construction timing window
- g) Consider bridge spans that maximize light penetration if feasible to encourage riparian vegetation growth underneath the structure; and,
- h) Replace riparian vegetation lost during construction of bridge abutments and re-naturalize as soon as possible after construction to minimize erosion of bare riparian sections.

5.1.3 Monitoring and Maintenance

Monitoring and maintenance should be conducted during construction to ensure that:

- a) individual mitigating measures are providing the expected control and/or protection continuously throughout the construction period. In particular, sediment and erosion control measures should be inspected daily with particular scrutiny after rain events, and repaired as necessary;
- b) Restoration plantings should be monitored for two years and any dead species replaced at this time
- c) mitigating measures are adequate to minimize or eliminate adverse impacts;

- d) additional mitigating measures are provided if required to address any unanticipated environmental impacts which arise during construction; and
- e) Additional monitoring both during and post-construction may be required as part of the requirements of environmental permits and approvals to be obtained during detail design.

Environmental monitoring should be combined with construction supervision to include periodic site visits and inspections throughout the course of the work (e.g., confirm the proper placement and maintenance of all erosion and sediment control measures). In the event that controls are unacceptable, operations should be suspended until the root cause is identified and corrected.

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- Site Plan – 2002/2003 Monitoring Program Closed Oakville Fourth Line Landfill Site for the Regional Municipality of Halton, Figure 1-2 (March 2004)
- Cross-Section A-A – 2002/2003 Monitoring Program Closed Oakville Fourth Line Landfill Site for the Regional Municipality of Halton, Figure 2-1 (March 2004)
- Shallow Groundwater Flow Regime – November 2002 – 2002/2003 Monitoring Program Closed Oakville Fourth Line Landfill Site for the Regional Municipality of Halton, Figure 2-2 (March 2004)
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Appendix A

OMNR Wetland and ANSI Mapping

- North Oakville and Vicinity Wetlands and ANSIs (OMNR 2003b)
- North Oakville – Milton East Complex PSW (OMNR 2006a)

North Oakville & Vicinity Wetlands and ANSIs

May 2003


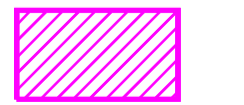

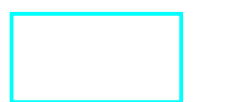


Mississauga

Milton

Oakville

Burlington

Legend

-  Oakville-Milton Wetlands & Uplands Candidate Life Science ANSI
-  Candidate Earth Science ANSI
-  Sixteen Mile Creek ANSI
-  Wetland
-  OPA 198 Boundary
-  Road



NOTE

The information in this document constitutes base information collected by the Ministry of Natural Resources. This information, along with information from other sources, is to serve as input to the Planning Authorities Interagency Review in accordance with the Terms of Reference. The completion of the Planning Authorities Interagency Review will assist the MNR in identifying significant natural heritage features and areas within North Oakville in accordance with its responsibilities.

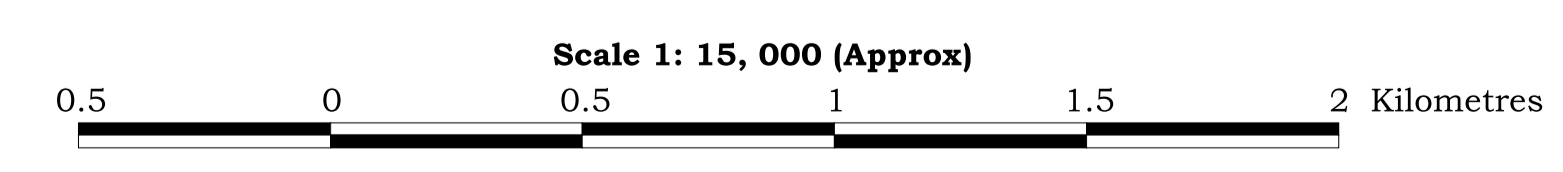
The information displayed on this map has been compiled from various sources. While every effort has been made to accurately depict the information, this map should be viewed as illustrative only.

For detailed information on natural features such as their location, size or status, the individual files held by the Aurora district office of the Ministry of Natural Resources should be consulted.

SOURCE OF INFORMATION

Information provided by the Ministry of Natural Resources district office in Aurora, Ministry of Natural Resources
Aurora District
50 Bloomington Rd. W.
Aurora, ON.
L4G 3G8

Base information derived from the Ontario Base Map, 1983 scale 1 : 10,000, Peterborough, Ontario and Natural Resources Value Information System (NRVIS).
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May 2003.

North American Datum 1983
Universal Transverse Mercator
(6 degree) projection, Zone 17

North Oakville - Milton Wetlands - East

September 2006 (Revised)



- Wetland
- Wetland Internal Community
- 1** Wetland Number
- ne M1-A Wetland Type Number
- OPA 198 Boundary
- Road
- Waterbody

NOTE
The information in this document constitutes base information collected by the Ministry of Natural Resources. This information, along with information from other sources, is to serve as input to the Planning Authorities Interagency.

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Base information derived from the Ontario Base Map, 1983 scale 1 : 10,000, Peterborough, Ontario, and Natural Resource Value Information System (NRVIS)

SOURCE INFORMATION

Information provided by the Ministry of Natural Resources district office in Aurora.

Ministry of Natural Resources

Aurora District

50 Bloomington Rd. W.

Aurora, ON

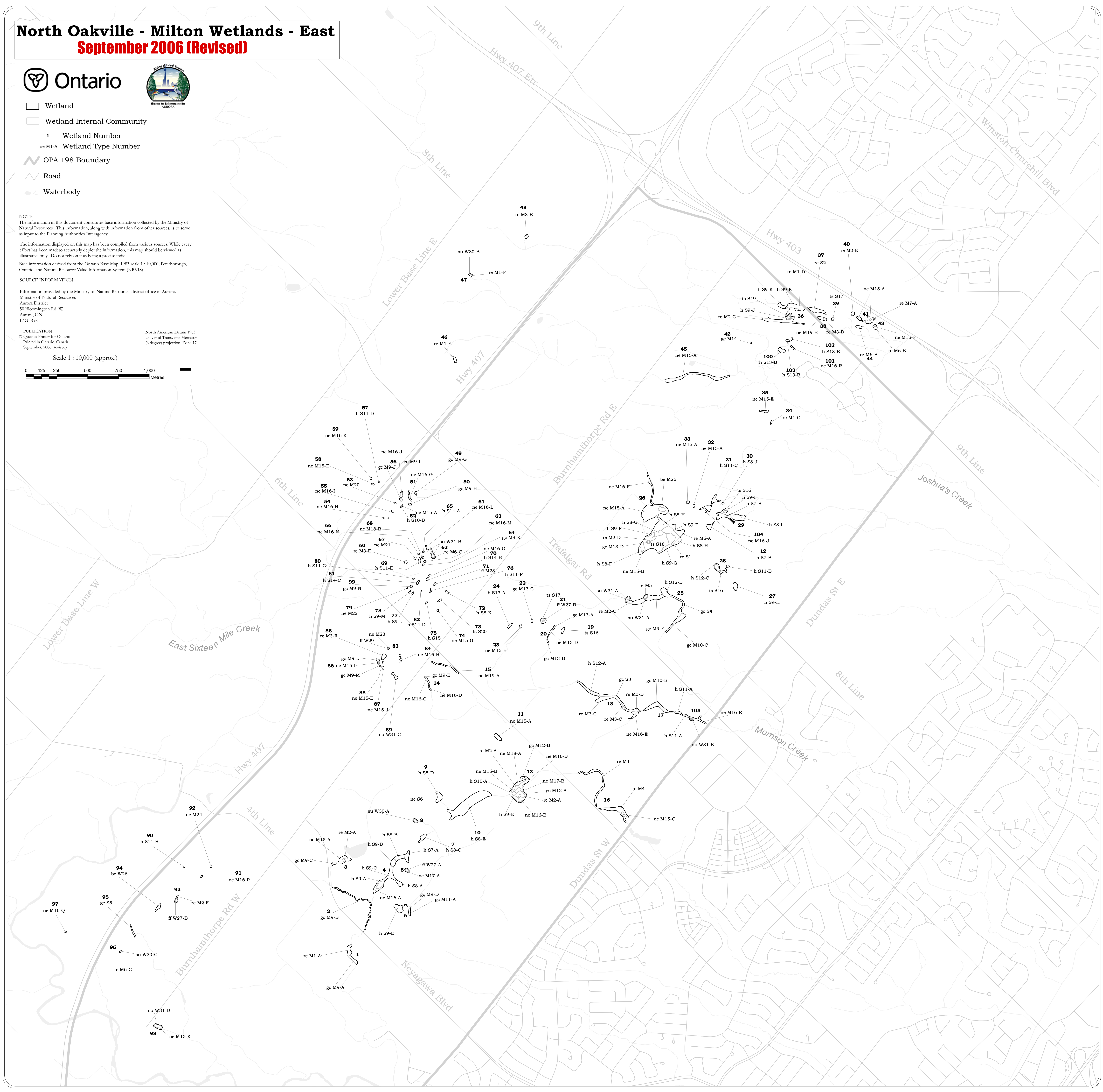
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North American Datum 1983

Universal Transverse Mercator

(6 degree) projection, Zone 17

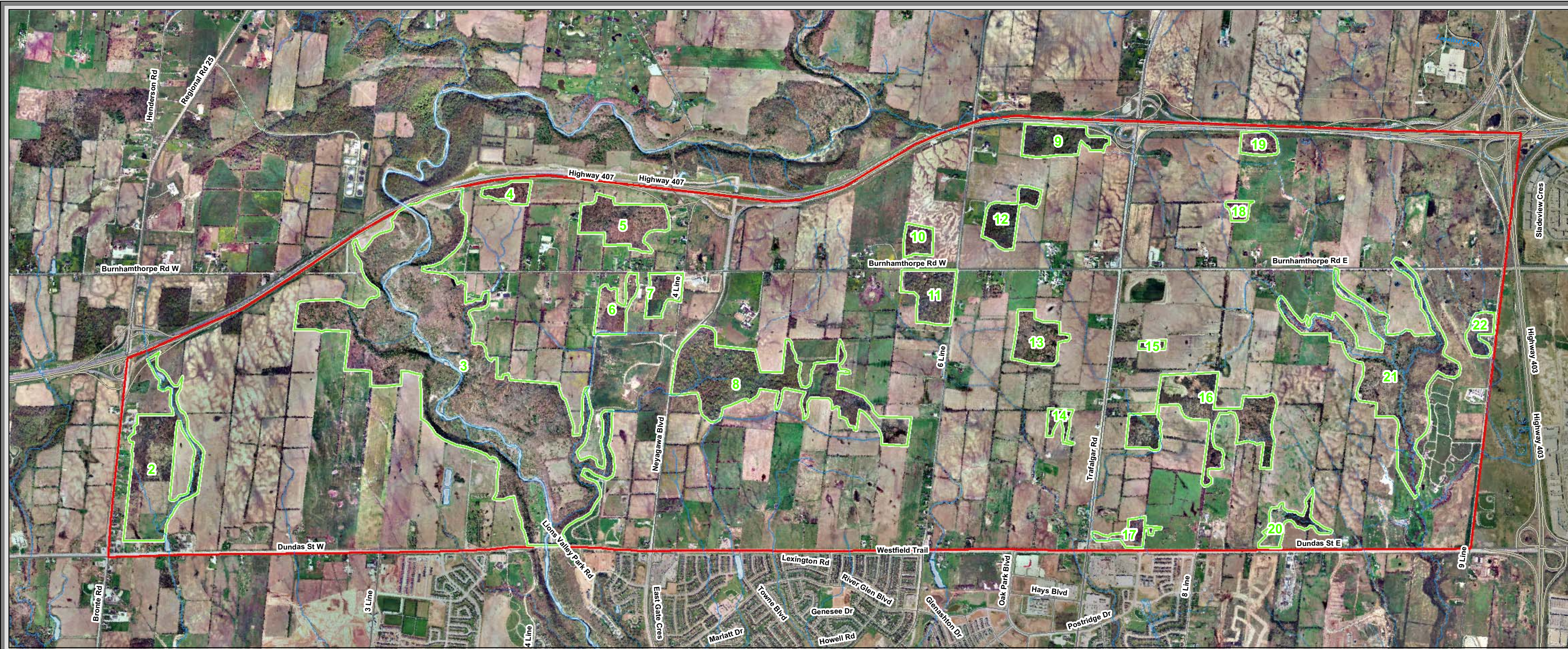
Scale 1 : 10,000 (approx.)



Appendix B

Secondary Source Significant Species Records

- **Habitat Unit Mapping
(Town of Oakville 2003b)**
- **Secondary Source Significant Plant
Species by Habitat Unit**
- **Secondary Source Significant Breeding
Bird Species by Habitat Unit**
- **Secondary Source Significant Wildlife
Species by Habitat Unit**



Legend

- Study Area
 - NOSS Habitat Units
- Roads**
- Expressway
 - Highway
 - Major Road
 - Local Road
 - Trail

Orthoimagery: 2002

NOSS Habitat Units	Appendix A
New Burnhamthorpe Road Transportation Corridor Class EA	
Project 40875, August 2006	
Gartner Lee Limited	
	1:20,000

Secondary Source Significant Wildlife Species by Habitat Unit(Town of Oakville 2003b)

 Gartner Lee

Common Name	Scientific Name	Status			Habitat Unit #								
		COSEWIC (national) ^a	COSSARO (provincial) ^a	Regional Status	1	2	3	13	16	16 Mile Cr.	Joshua's Cr.	Morrison Cr.	Study Area
MAMMALS													
Virginia Opossum	<i>Didelphis virginiana</i>		S4	h						X		X	X
Smoky Shrew	<i>Sorex fumeus</i>		S5	h						X		X	
Pygmy Shrew	<i>Sorex hoyi</i>		S4	h									X
Hoary Bat	<i>Lasiurus cinereus</i>		S4	h						X			
Small-footed Bat	<i>Myotis leibii</i>		S2S3	h									X
Northern Long-eared Bat	<i>Myotis septentrionalis</i>		S3?	h									X
Eastern Pipistrelle	<i>Pipistrellus subflavus</i>		S3?	h									X
Southern Flying squirrel	<i>Glaucomys volans</i>	SC	S3	h									X
REPTILES													
Northern Ring-necked Snake	<i>Diadophis punctatus edwardsii</i>		S4	h						X			
Northern Ribbon snake	<i>Thamnophis sauritus septentrionalis</i>	SC	S3	L,h					X		X	X	
Eastern Milk Snake	<i>Lampropeltis triangulum</i>	SC	S3	L				X		X		X	
Common Map Turtle	<i>Graptemys geographica</i>	SC	S3							X			
Spotted Turtle	<i>Clemmys guttata</i>	SC, VUL	S3	h									X
AMPHIBIANS													
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	THR	S2	h						X			
Fish													
Silver Shinner	<i>Notropis photogenis</i>	SC	S2S3				X						

- SC Special Concern
- S3 Rare to Uncommon in Ontario
- S2 Very rare in Ontario
- R Regionally Rare
- L Locally Rare
- h Rare in Halton Region

Appendix C

GLL Vascular Plant Species List

Master Vascular Plant Species List - GLL 16 Mile Creek Valley Study Area

 Gartner Lee

Family / Species	Common Name	Status	Community Class					
			FO	CU	MA	SW	BL	
<u>PTERIDOPHYTA</u>	<u>FERNS AND ALLIES</u>							
<u>DRYOPTERIDACEAE</u>	<u>WOOD FERN FAMILY</u>							
<i>Athyrium filix-femina (L.) Roth</i>	Northeastern Lady Fern		X					
<i>Dryopteris carthusiana (Vill.) H.P.Fuchs</i>	Spinulose Wood Fern		X					
<i>Dryopteris cristata (L.) Gray</i>	Crested Wood Fern						X	
<i>Dryopteris marginalis (L.) Gray</i>	Marginal Wood Fern		X					
<i>Matteuccia struthiopteris (L.) Todaro</i>	American Ostrich Fern		X		X		X	
<i>Onoclea sensibilis L.</i>	Sensitive Fern						X	
<i>Polystichum acrostichoides (Michx.) Schoff</i>	Christmas Fern		X					
<u>DENNSTAEDTIACEAE</u>	<u>BRACKEN FAMILY</u>							
<i>Pteridium aquilinum (L.) Kuhn</i>	Eastern Bracken			X				
<u>EQUISETACEAE</u>	<u>HORSETAIL FAMILY</u>							
<i>Equisetum arvense L.</i>	Field Horsetail					X		
<i>Equisetum palustre L.</i>	Marsh Horsetail					X		
<u>GYMNOSPERMAE</u>	<u>CONIFERS</u>							
<u>CUPRESSACEAE</u>	<u>CYPRESS FAMILY</u>							
<i>Thuja occidentalis L.</i>	White Cedar		X	X				X
<u>PINACEAE</u>	<u>PINE FAMILY</u>							
<i>Pinus strobus L.</i>	White Pine		X	X				
<i>Tsuga canadensis (L.) Carr.</i>	Eastern Hemlock		X					
<u>LILIOPSIDA</u>	<u>MONOCOTS</u>							
<u>ALISMATACEAE</u>	<u>WATER-PLANTAIN FAMILY</u>							
<i>Sagittaria latifolia Willd.</i>	Broad-leaved Arrowhead					X		
<u>ARACEAE</u>	<u>ARUM FAMILY</u>							
<i>Arisaema triphyllum (L.) Schott</i>	Jack-in-the-pulpit		X					
<u>CYPERACEAE</u>	<u>SEDGE FAMILY</u>							
<i>Carex blanda Dew.</i>	Woodland Sedge		X			X		
<i>Carex comosa Boott</i>	Bristly Sedge					X		
<i>Carex crinita Lam.</i>	Fringed Sedge					X		
<i>Carex cristatella Britt.</i>	Crested Sedge						X	
<i>Carex digitalis Willd.</i>	Sedge		X					
<i>Carex gracillima Schw.</i>	Graceful Sedge		X	X				
<i>Carex intumescens Rudge</i>	Bladder Sedge					X		
<i>Carex lacustris Willd.</i>	Lake Bank Sedge					X		
<i>Carex pennsylvanica Lam.</i>	Pennsylvanica Sedge		X					
<i>Carex plantaginea Lam.</i>	Plantain-leaved Sedge		X					
<i>Carex platyphylla Carey</i>	Sedge		X	X				
<i>Carex radiata</i>	Radiating Sedge		X					
<i>Carex retrorsa Schw.</i>	Retorse Sedge						X	
<i>Carex rosea Schk. ex Willd.</i>	Rose-like Sedge		X					
<i>Carex spicata Huds.</i>	Sedge	+		X				
<i>Carex stricta Lam.</i>	Tussock Sedge					X		
<i>Carex vulpinoidea Michx.</i>	Fox Tail Sedge					X	X	
<i>Eleocharis erythropoda Steud.</i>	Spike-rush					X		
<i>Scirpus atrovirens Willd.</i>	Black Bulrush					X		
<i>Scirpus microcarpus J. & K. Presl</i>	Small-flowered Bulrush	L-R				X		
<i>Scirpus validus Vahl.</i>	Softstem Bulrush					X		
<u>IRIDACEAE</u>	<u>IRIS FAMILY</u>							
<i>Iris pseudacorus</i>	Yellow Iris	+				X		
<i>Iris versicolor L.</i>	Wild Blue Flag					X		
<i>Sisyrinchium montanum Greene</i>	Little Blue-eyed Grass					X		

Family / Species	Common Name	Status	Community Class					
			FO	CU	MA	SW	BL	
<u>JUNCACEAE</u>	<u>RUSH FAMILY</u>							
<i>Juncus effusus</i> L.	Rush				X			
<i>Juncus tenuis</i> Willd.	Path Rush			X				
<i>Juncus torreyi</i> Cov.	Rush				X			
<u>LEMNACEAE</u>	<u>DUCKWEED FAMILY</u>							
<i>Lemna minor</i> L.	Common Duckweed				X			
<u>LILIACEAE</u>	<u>LILY FAMILY</u>							
<i>Allium tricoccum</i> Ait.	Wild Leek; Ramps		X					
<i>Clintonia borealis</i> (Ait.) Raf.	Bluebead-lily		X					
<i>Erythronium albidum</i> Ker	White Trout Lily	L-R, R-R	X					
<i>Erythronium americanum</i> Ker	Yellow Trout Lily		X	X				
<i>Maianthemum canadense</i> Desf.	Canada Mayflower		X				X	
<i>Maianthemum racemosum</i> (L.) Link	False Solomon's-seal		X					
<i>Maianthemum stellatum</i> (L.) Link	Starry False Solomon's-seal		X					
<i>Polygonatum pubescens</i> (Willd.) Pursh	Solomon's-seal		X					
<i>Trillium grandiflorum</i> (Michx.) Salisb.	White Trillium		X					
<u>ORCHIDACEAE</u>	<u>ORCHID FAMILY</u>							
<i>Epipactis helleborine</i> (L.) Crantz	Helleborine	+	X	X				
<u>POACEAE</u>	<u>GRASS FAMILY</u>							
<i>Agrostis gigantea</i> Roth.	Redtop	+		X				
<i>Agrostis stolonifera</i> L.	Creeping Bent Grass			X				
<i>Bromus inermis</i> Leyss.	Smooth Brome Grass	+		X				
<i>Dactylis glomerata</i> L.	Orchard Grass	+		X				
<i>Danthonia spicata</i> (L.) R. & S.	Poverty Oat Grass			X				
<i>Elymus hystrix</i> L.	Bottle-brush Grass		X					
<i>Elymus virginicus</i> L.	Virginia Wild-rye				X	X		
<i>Glyceria striata</i> (Lam.) A.S. Hitchc.	Fowl Manna Grass				X	X		
<i>Muhlenbergia mexicana</i> (L.) Trin.	Muhly Grass	+			X			
<i>Phalaris arundinacea</i> L.	Reed Canary Grass				X			
<i>Phleum pratense</i> L.	Timothy	+		X				
<i>Poa annua</i> L.	Annual Blue Grass	+		X				
<i>Poa palustris</i> L.	Fowl Meadow Grass		X					
<i>Poa pratensis</i> L.	Kentucky Blue Grass	+		X				
<u>POTAMOGETONACEAE</u>	<u>PONDWEED FAMILY</u>							
<i>Potamogeton pectinatus</i> L.	Sago Pondweed	L-U, R-U			X			
MAGNOLIOPSIDA	DICOTS							
<u>ACERACEAE</u>	<u>MAPLE FAMILY</u>							
<i>Acer negundo</i> L.	Manitoba Maple		X	X	X	X		
<i>Acer nigrum</i> Michx.	Black Maple		X					
<i>Acer rubrum</i> L.	Red Maple		X			X		
<i>Acer saccharinum</i> L.	Silver Maple		X	X				
<i>Acer freemani</i>	Hybrid Maple					X		
<u>ANACARDIACEAE</u>	<u>CASHEW FAMILY</u>							
<i>Rhus radicans</i> L.	Poison-ivy			X				
<i>Rhus typhina</i> L.	Staghorn Sumac			X				
<u>APIACEAE</u>	<u>CARROT FAMILY</u>							
<i>Angelica atropurpurea</i> L.	Great Angelica	L-R, U-R			X			
<i>Cicuta bulbifera</i> L.	Bulbous Water-hemlock				X	X		
<i>Cicuta maculata</i> L.	Spotted Water-hemlock				X			
<i>Daucus carota</i> L.	Wild Carrot, Queen Anne's Lace	+		X				
<i>Heracleum lanatum</i> Michaux.	Cow-parsnip	L-R, R-R			X			
<i>Pastinaca sativa</i> L.	Wild Parsnip	+		X				
<i>Taenidia integerrima</i> (L.) Drude	Yellow Pimpernel	L-U, R-R	X					

Family / Species	Common Name	Status	Community Class					
			FO	CU	MA	SW	BL	
<u>APOCYNACEAE</u>	<u>DOGBANE FAMILY</u>							
<i>Apocynum androsaemifolium</i> L.	Spreading Dogbane			X				
<u>ARALIACEAE</u>	<u>GINSENG FAMILY</u>							
<i>Aralia nudicaulis</i> L.	Wild Sarsaparilla		X					
<u>ARISTOLOCHIACEAE</u>	<u>BIRTHWORT FAMILY</u>							
<i>Asarum canadense</i> L.	Wild Ginger		X					
<u>ASCLEPIADACEAE</u>	<u>MILKWEED FAMILY</u>							
<i>Asclepias exaltata</i> L.	Poke Milkweed		X					
<i>Asclepias syriaca</i> L.	Common Milkweed		X					
<i>Asclepias tuberosa</i> L.	Butterfly-weed		X					
<u>ASTERACEAE</u>	<u>ASTER FAMILY</u>							
<i>Ambrosia artemisiifolia</i> L.	Common Ragweed		X					
<i>Ambrosia trifida</i> L.	Giant Ragweed					X		
<i>Arctium minus</i> (Hill) Bernh.	Common Burdock	+		X	X			
<i>Aster cordifolius</i> L.	Heart-leaved Aster		X	X				
<i>Aster eriocoides</i> L.	Heath Aster			X				
<i>Aster lanceolatus</i> Willd.	Tall White Aster				X	X		
<i>Aster lateriflorus</i> (L.) Britt.	One-sided Aster		X					
<i>Aster macrophyllus</i> L.	Large-leaved Aster		X					
<i>Aster novae-angliae</i> L.	New England Aster			X	X			
<i>Aster puniceus</i> L.	Red-stemmed Aster				X			
<i>Bidens cernua</i> L.	Nodding Beggarticks				X			
<i>Bidens frondosa</i> L.	Devil's Beggarticks				X			
<i>Carduus nutans</i> L.	Nodding Thistle	+		X				
<i>Centaurea maculosa</i> Lam.	Spotted Knapweed	+		X				
<i>Chrysanthemum leucanthemum</i> L.	Ox-eye Daisy	+		X				
<i>Cirsium vulgare</i> (Savi) Tenore	Bull Thistle	+		X				
<i>Erigeron annuus</i> (L.) Pers.	Daisy Fleabane			X				
<i>Eupatorium maculatum</i> L.	Spotted Joe-Pye Weed					X		
<i>Eupatorium perfoliatum</i> L.	Boneset					X		
<i>Eupatorium rugosum</i> Houtt.	White Snakeroot		X					
<i>Euthamia graminifolia</i> (L.) Nutt.	Narrow-leaf Goldenrod			X	X			
<i>Helianthus divaricatus</i> L.	Woodland Sunflower	L-U, R-U	X					
<i>Helianthus tuberosus</i> L.	Jerusalem Artichoke	+			X			
<i>Hieracium pilosella</i> L.	Mouse-eared Hawkweed	+		X				
<i>Inula helenium</i> L.	Elecampane	+			X			
<i>Lapsana communis</i> L.	Nipplewort	+	X					
<i>Petasites palmatus</i> (Ait.) Gray	Sweet Coltsfoot				X			
<i>Prenanthes altissima</i> L.	Tall White Lettuce		X					
<i>Rudbeckia hirta</i> L.	Black-eyed Susan			X				
<i>Solidago altissima</i> L.	Tall Goldenrod			X	X			
<i>Solidago caesia</i> L.	Blue-stem Goldenrod		X					
<i>Solidago canadensis</i> L.	Canada Goldenrod				X			
<i>Solidago flexicaulis</i> L.	Zig-zag Goldenrod		X					
<i>Solidago gigantea</i> Ait.	Late Goldenrod	L-U			X			
<i>Solidago nemoralis</i> Ait.	Gray Goldenrod			X				
<i>Solidago rugosa</i> Ait.	Rough Goldenrod						X	
<i>Sonchus arvensis</i> L.	Field Sow-thistle	+		X				
<i>Sonchus asper</i> (L.) Hill	Spiny Annual Sow-thistle	+		X				
<i>Tragopogon dubius</i> Scop.	Goat's-beard	+		X				
<i>Tussilago farfara</i> L.	Coltsfoot	+	X					X
<u>BALSAMINACEAE</u>	<u>TOUCH-ME-NOT-FAMILY</u>							
<i>Impatiens capensis</i> Meerb.	Spotted Jewelweed				X	X		

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			FO	CU	MA	SW	BL		
<u>BERBERIDACEAE</u>	<u>BARBERRY FAMILY</u>								
<i>Jeffersonia diphylla</i> L.	Twinleaf	L-U, R-R	X						
<i>Podophyllum peltatum</i> L.	May-apple		X						
<u>BETULACEAE</u>	<u>BIRCH FAMILY</u>								
<i>Alnus glutinosa</i> (L.) Gaertn.	Black Alder	+			X	X			
<i>Alnus incana</i> (L.) Moench	Speckled Alder				X	X			
<i>Betula alleghaniensis</i> Britt.	Yellow Birch		X						
<i>Betula papyrifera</i> Marsh.	Paper Birch		X						
<i>Carpinus caroliniana</i> Walt.	Blue Beech		X						
<i>Corylus cornuta</i> Marsh.	Beaked Hazelnut		X						
<i>Ostrya virginiana</i> (Mill.) K. Koch	Hop Hornbeam		X						
<u>BORAGINACEAE</u>	<u>BORAGE FAMILY</u>								
<i>Lithospermum latifolium</i> Michx.	Broad-leaved Puccoon	L-R, R-R, S3	X						
<i>Mertensia virginica</i> (Aiton) G.Don	Virginia Bluebells	L-R, R-R, S3	X						
<i>Myosotis laxa</i> Lehm.	Smaller Forget-me-not				X				
<i>Myosotis scorpioides</i> L.	True Forget-me-not	+			X				
<u>BRASSICACEAE</u>	<u>MUSTARD FAMILY</u>								
<i>Alliaria petiolata</i> (Bieb.) Cavara & Grande	Garlic Mustard	+	X	X					
<i>Cardamine concatenata</i> (Michx.) Schwein.	Cutleaf Toothwort		X						
<i>Cardamine diphylla</i> (Michx.) Alph. Wood	Toothwort		X						
<i>Hesperis matronalis</i> L.	Dame's-rocket	+	X	X					
<i>Nasturtium microphyllum</i> (Boenn.) Reichb.	Water Cress	+			X				
<u>CAPRIFOLIACEAE</u>	<u>HONEYSUCKLE FAMILY</u>								
<i>Diervilla lonicera</i> Mill.	Bush-honeysuckle		X						
<i>Lonicera canadensis</i> Marsh.	Fly Honeysuckle		X						
<i>Lonicera dioica</i> L.	Wild Honeysuckle		X	X					
<i>Lonicera tatarica</i> L.	Tartarian Honeysuckle	+	X	X					
<i>Symphoricarpos albus</i> (L.) Blake	Snowberry	R-U	X						
<i>Viburnum acerifolium</i> L.	Maple-leaved Viburnum		X						
<i>Viburnum lentago</i> L.	Nannyberry				X	X			
<i>Viburnum rafinesquianum</i> Schultes	Downy Arrow-wood	L-U, R-R		X					
<i>Viburnum trilobum</i> Marsh.	Highbush-cranberry				X	X			
<u>CARYOPHYLLACEAE</u>	<u>PINK FAMILY</u>								
<i>Dianthus armeria</i> L.	Deptford Pink	+		X					
<i>Saponaria officinalis</i> L.	Bouncing-bet	+		X					
<i>Silene vulgaris</i> (Moench) Garcke	Bladder Campion	+		X					
<u>CELASTRACEAE</u>	<u>STAFF-TREE FAMILY</u>								
<i>Euonymus atropurpurea</i> Jacq.	Burning Bush	L-R, R-R, S3	X						
<i>Euonymus obovatus</i> Nutt.	Running Strawberry-bush		X						
<u>CERATOPHYLLACEAE</u>	<u>HORNWORT FAMILY</u>								
<i>Ceratophyllum demersum</i> L.	Common Coontail				X				
<u>CONVOLVULACEAE</u>	<u>MORNING GLORY FAMILY</u>								
<i>Convolvulus arvensis</i> L.	Field Bindweed	+		X					
<u>CORNACEAE</u>	<u>DOGWOOD FAMILY</u>								
<i>Cornus alternifolia</i> L.f.	Alternate-leaved Dogwood		X						
<i>Cornus foemina</i> Mill.	Grey Dogwood		X	X			X		
<i>Cornus stolonifera</i> Michx.	Red-osier Dogwood				X		X		
<u>CUCURBITACEAE</u>	<u>GOURD FAMILY</u>								
<i>Echinocystis lobata</i> (Michx.) T. & G.	Wild Cucumber				X	X			
<u>ELAEAGNACEAE</u>	<u>OLEASTER FAMILY</u>								
<i>Shepherdia canadensis</i> (L.) Nutt.	Soapberry, Buffaloberry	L-R, R-R	X						
<u>ERICACEAE</u>	<u>HEATH FAMILY</u>								
<i>Vaccinium angustifolium</i> Ait.	Lowbush Blueberry	L-U, R-R	X						
<i>Vaccinium pallidum</i> Ait.	Dryland Blueberry	L-U, R-R	X						

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			FO	CU	MA	SW	BL	
<u>EUPHORBIACEAE</u>	<u>SPURGE FAMILY</u>							
<i>Acalypha rhomboidea</i> Raf.	Three-seeded Mercury			X				
<u>FAGACEAE</u>	<u>BEECH FAMILY</u>							
<i>Fagus grandifolia</i> Ehrh.	American Beech		X					
<i>Quercus alba</i> L.	White Oak		X					
<i>Quercus macrocarpa</i> Michx.	Bur Oak		X					
<i>Quercus rubra</i> L.	Red Oak		X					
<u>FABACEAE</u>	<u>PEA FAMILY</u>							
<i>Amphicarpaea bracteata</i> (L.) Fern.	Hog-peanut				X			
<i>Melilotus officinalis</i> (L.) Pall.	Yellow Sweet-clover	+		X				
<i>Trifolium pratense</i> L.	Red Clover	+		X				
<i>Vicia cracca</i> L.	Bird Vetch	+		X				
<u>FUMARIACEAE</u>	<u>FUMITORY FAMILY</u>							
<i>Dicentra cucullaria</i> (L.) Bernh.	Dutchman's-breeches	L-R, R-R	X					
<u>GERANIACEAE</u>	<u>GERANIUM FAMILY</u>							
<i>Geranium maculatum</i> L.	Spotted Geranium		X					
<i>Geranium robertianum</i> L.	Herb Robert	+	X					
<u>GROSSULARIACEAE</u>	<u>GOOSEBERRY FAMILY</u>							
<i>Ribes americanum</i> Mill.	Wild Black Currant						X	
<i>Ribes cynosbati</i> L.	Prickly Gooseberry		X					
<i>Ribes rubrum</i> L.	Red Currant	+	X					
<u>HAMAMELIDACEAE</u>	<u>WITCH-HAZEL FAMILY</u>							
<i>Hamamelis virginiana</i> L.	Witch-hazel		X					
<u>HYDROPHYLLACEAE</u>	<u>WATERLEAF FAMILY</u>							
<i>Hydrophyllum canadense</i> L.	Canada Waterleaf		X					
<u>HYPERICACEAE</u>	<u>ST. JOHN'S-WORT FAMILY</u>							
<i>Hypericum perforatum</i> L.	Common St. John's-wort	+		X				
<u>JUGLANDACEAE</u>	<u>WALNUT FAMILY</u>							
<i>Carya cordiformis</i> (Wang.) K.Koch	Bitternut Hickory		X					
<i>Carya ovata</i> (Mill.) K. Koch	Shagbark Hickory	L-U, R-U	X	X				
<i>Juglans cinerea</i> L.	Butternut	S3?, END	X					
<i>Juglans nigra</i> L.	Black Walnut		X					
<u>LAMIACEAE</u>	<u>MINT FAMILY</u>							
<i>Glechoma hederacea</i> L.	Ground-ivy	+		X				
<i>Lycopus americanus</i> Muhl.	American Water-horehound				X	X		
<i>Lycopus uniflorus</i> Michx.	Northern Water-horehound				X			
<i>Mentha arvensis</i> L.	Field or Common Mint				X			
<i>Monarda fistulosa</i> L.	Wild Bergamot			X				
<i>Prunella vulgaris</i> L.	Heal-all	+					X	
<i>Scutellaria galericulata</i> L.	Common Skullcap				X	X		
<u>LINACEAE</u>	<u>FLAX FAMILY</u>							
Yellow Flax	Linum medium	L-R, R-R, S3	X					
<u>LYTHRACEAE</u>	<u>LOOSESTRIFE FAMILY</u>							
<i>Lythrum salicaria</i> L.	Purple Loosestrife	+			X			
<u>OLEACEAE</u>	<u>OLIVE FAMILY</u>							
<i>Fraxinus americana</i> L.	White Ash		X	X				
<i>Fraxinus pennsylvanica</i> Marsh.	Red Ash		X	X			X	
<u>ONAGRACEAE</u>	<u>EVENING-PRIMROSE FAMILY</u>							
<i>Circaea lutetiana</i> L.	Enchanter's Nightshade		X					
<i>Epilobium ciliatum</i> Raf.	Sticky Willowherb				X			
<u>PAPAVERACEAE</u>	<u>POPPY FAMILY</u>							
<i>Sanguinaria canadensis</i> L.	Bloodroot		X					
<u>PHYTOLACCACEAE</u>	<u>POKEWEED FAMILY</u>							
<i>Phytolacca americana</i> L.	Pokeweed	L-R, R-R	X					

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			FO	CU	MA	SW	BL	
<u>PLATANACEAE</u>	<u>PLANE-TREE FAMILY</u>							
<i>Platanus occidentalis</i> L.	Sycamore	L-R, R-R	X		X	X		
<u>POLEMONIACEAE</u>	<u>PHLOX FAMILY</u>							
<i>Phlox divaricata</i> L.	Blue Phlox	R-R	X					
<u>POLYGALACEAE</u>	<u>MILKWORT FAMILY</u>							
<i>Polygala senega</i> L.	Seneca Snakeroot	R-R	X					
<u>PRIMULACEAE</u>	<u>PRIMROSE FAMILY</u>							
<i>Lysimachia ciliata</i> L.	Fringed Loosestrife						X	
<u>PYROLACEAE</u>	<u>WINTERGREEN FAMILY</u>							
<i>Pyrola elliptica</i> Nutt.	Shinleaf		X					
<u>RANUNCULACEAE</u>	<u>BUTTERCUP FAMILY</u>							
<i>Actaea pachypoda</i> Ell.	White Baneberry		X					
<i>Anemone acutiloba</i> (DC.) G. Lawson	Sharp-lobed Hepatica		X					
<i>Anemone canadensis</i> L.	Canada Anemone		X	X				
<i>Clematis virginiana</i> L.	Virgin's-bower				X	X		
<i>Ranunculus abortivus</i> L.	Small-flowered Buttercup				X			
<i>Ranunculus acris</i> L.	Tall Buttercup	+			X			
<i>Ranunculus hispidus</i> Michx.	Swamp Buttercup				X	X		
<i>Ranunculus sceleratus</i> L.	Cursed Crowfoot				X			
<i>Thalictrum dioicum</i> L.	Early Meadow Rue				X			
<i>Thalictrum pubescens</i> Pursh	Tall Meadow Rue				X			
<u>RHAMNACEAE</u>	<u>BUCKTHORN FAMILY</u>							
<i>Ceanothus americanus</i> L.	New Jersey Tea	R-R	X					
<i>Rhamnus cathartica</i> L.	Common Buckthorn	+	X					
<u>ROSACEAE</u>	<u>ROSE FAMILY</u>							
<i>Agrimonia gryposepala</i> Wallr.	Agrimony						X	
<i>Amelanchier arborea</i> (Michx. f.) Fern.	Serviceberry		X					
<i>Crataegus dissona</i> Sarg.	Hawthorn	L-R, R-R, S3		X				
<i>Crataegus pedicellata</i> Sarg.	Scarlet Thorn			X				
<i>Crataegus monogyna</i> Jacq.	English Hawthorn	+		X				
<i>Crataegus punctata</i> Jacq.	Dotted Hawthorn			X				
<i>Crataegus scabrida</i> Sarg.	Hawthorn	L-R, R-R, S3?		X				
<i>Fragaria virginiana</i> Dcne.	Common Strawberry			X		X		
<i>Geum aleppicum</i> Jacq.	Yellow Avens			X	X			
<i>Geum canadense</i> Jacq.	White Avens		X	X				
<i>Potentilla recta</i> L.	Rough-fruited Cinquefoil	+		X				
<i>Prunus serotina</i> Ehrh.	Black Cherry		X					
<i>Prunus virginiana</i> L.	Choke Cherry		X	X				
<i>Rosa carolina</i> L.	Pasture Rose	R-R	X					
<i>Rubus allegheniensis</i> Porter	Common Blackberry			X				
<i>Rubus idaeus</i> L.	Wild Red Raspberry				X	X		
<i>Rubus occidentalis</i> L.	Black Raspberry			X				
<i>Rubus odoratus</i> L.	Flowering Raspberry			X				
<u>RUBIACEAE</u>	<u>MADDER FAMILY</u>							
<i>Galium boreale</i> L.	Northern Bedstraw	R-R	X					
<i>Galium lanceolatum</i> Torr.	Yellow Wild Licorice	L-U, R-R	X					
<i>Galium palustre</i> L.	Marsh Bedstraw				X	X		
<i>Galium verum</i> L.	Yellow Bedstraw	+		X				
<u>SALICACEAE</u>	<u>WILLOW FAMILY</u>							
<i>Populus balsamifera</i> L.	Balsam Poplar		X				X	
<i>Populus deltoides</i> Marsh	Cottonwood		X	X				
<i>Populus grandidentata</i> Michx.	Large-toothed Aspen		X					
<i>Populus tremuloides</i> Michx.	Trembling Aspen		X					X
<i>Salix eriocephala</i> Michx.	Heart-leaved Willow					X	X	

Family / Species	Common Name	Status	Community Class				
			FO	CU	MA	SW	BL
<i>Salix exigua</i> Nutt.	Sandbar Willow	L-U			X	X	
<i>Salix lucida</i> Muhl.	Shining Willow	L-U, R-U				X	
<i>Salix x rubens</i> Schrank.	Hybrid Crack Willow	+			X	X	
<u>SANTALACEAE</u>	<u>SANDALWOOD FAMILY</u>						
<i>Commandra umbellata</i> (L.) Nutt.	Bastard Toadflax	L-U, R-R	X	X			
<u>SAXIFRAGACEAE</u>	<u>SAXIFRAGE FAMILY</u>						
<i>Saxifraga virginiana</i> Michx.	Early Saxifrage	L-R, R-R		X			
<u>SOLANACEAE</u>	<u>NIGHTSHADE FAMILY</u>						
<i>Physalis heterophylla</i> Nees	Clammy Ground-cherry	L-R, R-R		X			
<i>Solanum dulcamara</i> L.	Bittersweet Nightshade	+			X	X	
<u>TILLACEAE</u>	<u>LINDEN FAMILY</u>						
<i>Tilia americana</i> L.	Basswood		X				
<u>ULMACEAE</u>	<u>ELM FAMILY</u>						
<i>Ulmus americana</i> L.	American Elm		X			X	
<u>URTICACEAE</u>	<u>NETTLE FAMILY</u>						
<i>Laportea canadensis</i> (L.) Wedd.	Wood Nettle					X	
<i>Urtica dioica</i> L. subsp. <i>gracilis</i> (Ait.)	American Stinging Nettle				X		
<u>VERBENACEAE</u>	<u>VERVAIN FAMILY</u>						
<i>Verbena hastata</i> L.	Blue Vervain				X		
<i>Verbena urticifolia</i> L.	White Vervain				X		
<u>VIOLACEAE</u>	<u>VIOLET FAMILY</u>						
<i>Viola canadensis</i> L.	Canada Violet		X				
<i>Viola incognita</i> Brain.	White Violet		X				
<i>Viola pubescens</i> Ait.	Downy Yellow Violet		X				
<i>Viola sororia</i> Willd.	Common Blue Violet		X				
<u>VITACEAE</u>	<u>GRAPE FAMILY</u>						
<i>Parthenocissus inserta</i> (A. Kerner) Fritsch	Virginia Creeper				X		
<i>Vitis riparia</i> Michx.	Riverbank Grape		X		X	X	

FO: Forest

CU: Cultural

MA: Marsh

SW: Swamp

BL: Bluff

+ Non-native species

L-R Locally Rare (Halton Region according to Varga et al. 2000)

L-U Locally Uncommon (Halton Region according to Varga et al. 2000)

R-R Regionally Rare (GTA according to Varga et al. 2000)

R-U Regionally Uncommon (GTA according to Varga et al. 2000)

S3 Rare to uncommon in Ontario (NHIC 2006)

Appendix D

Compiled Breeding Bird Species List

Appendix D
Breeding Birds Species List - 16 Mile Creek Study Area



Common Name	Scientific Name	Status		GLL Survey Date*					Winter Surveys** (NRS 2006)	
		Provincially Rare (breeding season SRANK) ¹	Area-sensitive (OMNR) ²	04-Jun-04	10-Jun-05	27-Jun-05	28-Apr-06	02-Jun-06	Newagawa to Bronte	Ninth Line to Newagawa
Great Blue Heron	<i>Ardea herodias</i>						M			
Canada Goose	<i>Branta canadensis</i>						2		320	51
Wood Duck	<i>Aix sponsa</i>							1		
Mallard	<i>Anas platyrhynchos</i>						2	1	2	
Turkey Vulture	<i>Cathartes aura</i>				1					
Red-tailed Hawk	<i>Buteo jamaicensis</i>			1	1	2	1	1	9	1
Rough-legged Hawk	<i>Buteo lagopus</i>								1	
American Kestrel	<i>Falco sparverius</i>									1
Killdeer	<i>Charadrius vociferus</i>					2		1		
Spotted Sandpiper	<i>Actitis macularia</i>				2	5	3			
American Woodcock	<i>Scolopax minor</i>					1				
Ring-billed Gull	<i>Larus delawarensis</i>								8	
Rock Pigeon	<i>Columba livia</i>	SE			10			1	62	111
Mourning Dove	<i>Zenaida macroura</i>				1	3	1	1	22	41
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>			1				1		
Ruby-throated Hummingbird	<i>Archilochus colubris</i>					1		2		
Belted Kingfisher	<i>Ceryle alcyon</i>			1			1	1		
Downy Woodpecker	<i>Picoides pubescens</i>			4		3	3	1	3	3
Hairy Woodpecker	<i>Picoides villosus</i>		A			2		1	1	
Northern Flicker	<i>Colaptes auratus</i>				1	7	1	6	1	
Pileated Woodpecker	<i>Dryocopus pileatus</i>		A	1			1			
Eastern Wood-Pewee	<i>Contopus virens</i>				1	4		15		
Alder Flycatcher	<i>Empidonax alnorum</i>							2		
Eastern Phoebe	<i>Sayornis phoebe</i>			2		3	1	1		
Great Crested Flycatcher	<i>Myiarchus crinitus</i>			1		6		10		
Eastern Kingbird	<i>Tyrannus tyrannus</i>							1		
Horned Lark	<i>Eremophila alpestris</i>								61	7
N. Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>					1				
Bank Swallow	<i>Riparia riparia</i>						1			
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>					1		1		
Barn Swallow	<i>Hirundo rustica</i>					1				
Blue Jay	<i>Cyanocitta cristata</i>				2	7	3	5	19	
American Crow	<i>Corvus brachyrhynchos</i>						1		30	10
Black-capped Chickadee	<i>Poecile atricapillus</i>				13	8	6	13	36	17
White-breasted Nuthatch	<i>Sitta carolinensis</i>		A			9		3	1	
House Wren	<i>Troglodytes aedon</i>			1	1	12		25		
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>		A				M	1		
Hermit Thrush	<i>Catharus guttatus</i>		A		1					
Wood Thrush	<i>Hylocichla mustelina</i>			2	1	7		12		
American Robin	<i>Turdus migratorius</i>			6	8	27	11	30	12	3
Gray Catbird	<i>Dumetella carolinensis</i>			2	1	11		13		
Cedar Waxwing	<i>Bombycilla cedrorum</i>			1	5	1		6		
European Starling	<i>Sturnus vulgaris</i>		SE			1			144	39
Warbling Vireo	<i>Vireo gilvus</i>			1		5	1	4		
Red-eyed Vireo	<i>Vireo olivaceus</i>			4	2	6		17		
Yellow Warbler	<i>Dendroica petechia</i>				13	25	2	26		
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>							1		

**Appendix D
Breeding Birds Species List - 16 Mile Creek Study Area**



Common Name	Scientific Name	Status		GLL Survey Date*					Winter Surveys** (NRS 2006)	
		Provincially Rare (breeding season SRANK) ¹	Area-sensitive (OMNR) ²	04-Jun-04	10-Jun-05	27-Jun-05	28-Apr-06	02-Jun-06	Newagawa to Bronte	Ninth Line to Newagawa
Pine Warbler	<i>Dendroica pinus</i>		A					2		
American Redstart	<i>Setophaga ruticilla</i>		A					1		
Ovenbird	<i>Seiurus aurocapillus</i>		A		2			3		
Mourning Warbler	<i>Oporornis philadelphia</i>					1		5		
Common Yellowthroat	<i>Geothlypis trichas</i>			1	2	3		9		
Scarlet Tanager	<i>Piranga olivacea</i>		A			2		4		
Northern Cardinal	<i>Cardinalis cardinalis</i>			1	4	5	4	12	5	1
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>				3	4		10		
Indigo Bunting	<i>Passerina cyanea</i>					8		16		
Eastern Towhee	<i>Pipilo erythrophthalmus</i>							3		
American Tree Sparrow	<i>Spizella arborea</i>								29	4
Chipping Sparrow	<i>Spizella passerina</i>						M	4		
Field Sparrow	<i>Spizella pusilla</i>					2		11		
Song Sparrow	<i>Melospiza melodia</i>			1	2	38	2	48		
Swamp Sparrow	<i>Melospiza georgiana</i>							1		
Dark-eyed Junco	<i>Junco hyemalis</i>								11	
Snow Bunting	<i>Plectrophenax nivalis</i>								10	4
Bobolink	<i>Dolichonyx oryzivorus</i>		A				M	1		
Red-winged Blackbird	<i>Agelaius phoeniceus</i>			1	13	20	4	29		
Common Grackle	<i>Quiscalus quiscula</i>					9		7	2	
Brown-headed Cowbird	<i>Molothrus ater</i>					8		15		
Baltimore Oriole	<i>Icterus galbula</i>			1		3	1	8		
American Goldfinch	<i>Carduelis tristis</i>			1		10	2	21	33	2

Based on six field visits between 2004 - 2006.

Number of Species: 60
 Number of non-breeding winter residence: 7
 Number of presumed migrants: 1
 Number of (provincial and national) Species at Risk: 0
 Number of S1 to S3 (provincially rare) Species: 0
 Number of Area-sensitive Species: 10

* No. indicates breeding territories identified.
 M "M" indicates presumed migrant.
 ** No. indicates individuals observed over three visits (anuary 23, February 13, and February 24, 2006).

KEY

¹ SRANK (from Natural Heritage Information Centre) shown for breeding status if: S1 (extremely rare), S2 (very rare), S3 (rare to uncommon), and SE (exotic, i.e., introduced) T (tracked species) that are S4 or S5 are also noted. Species actively tracked generally have fewer than 100 recent occurrences in Ontario, or are highly ranked globally. SRANK not shown if: S4 (common), S5 (very common), SZB (breeding migrants or vagrants) and SR (reported as breeding, but no persuasive documentation).

² Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide (Appendix G). 151 p plus appendices.

Appendix E

Compiled Amphibian Species List

Master Amphibian Species List



Gartner Lee

Common Name	Scientific Name	Status	Data Source																		
			GLL Station No.*											OMNR 2003a	LGL 1999	Town of Oakville (2002)	Halton Region 1995	CH 2002			
			1	2	3	4	5	6	7	8	9	10	11								
AMPHIBIANS																					
Eastern Newt	<i>Notophthalmus viridescens</i>																		X		
Blue-spotted Salamander	<i>Ambystoma laterale</i>	s																X	X		
Spotted Salamander	<i>Plethodon cinereus</i>	s															X		X		X
Redback Salamander	<i>Plethodon cinereus</i>																		X		X
American Toad	<i>Bufo americanus</i>																		X		X
Spring Peeper	<i>Pseudacris crucifer</i>	s	1	1	1	1				1	1						X	X	X	X	X
Gray Treefrog	<i>Hyla versicolor</i>	s				2											X	X	X	X	X
Western Chorus Frog	<i>Pseudacris triseriata</i>						1														X
Wood Frog	<i>Rana sylvatica</i>	s	1			1				1	1						X	X	X	X	
Northern Leopard Frog	<i>Rana pipiens</i>						1	1													X
Bullfrog	<i>Rana catesbiana</i>																		X		

* "1" or "2" indicates species recorded on first (May 1, 2006) or second (June 22, 2006) survey.

** "X" indicates species appears in Secondary Source information, however, record is not linked to a location.

*** "X" indicates species located by wetland unit in within study area bounded by 16 Mile Creek on the west, ETR407 on the North, R.R. 25 on the east and Highway 5 on the south, including 16 Mile Creek floodplain pools, as described in the referenced document.

Status Legend

s species of concern being rare or uncommon in site district 7E4 and exhibiting declines (OMNR 2003a).

Appendix F

GLL Incidental Wildlife Observations

- Mammals and Reptiles
- Lepidoptera and Odonata

Mammal and Reptile Species List

16 Mile Creek Study Area

 Gartner Lee

Common Name	Scientific Name
MAMMALS	
Eastern Chipmunk	<i>Tamias striatus</i>
Eastern Grey Squirrel	<i>Sciurus carolinensis</i>
American Beaver	<i>Castor canadensis</i>
Coyote	<i>Canis latrans</i>
Northern Raccoon	<i>Procyon lotor</i>
Striped Skunk	<i>Mephitis mephitis</i>
White-tailed Deer	<i>Odocoileus virginianus</i>
REPTILES	
Common Garter Snake	<i>Thamnophis sirtalis</i>
Snapping Turtle	<i>Chelydra serpentina</i>

Lepidoptera - GLL 16 Mile Creek Study Area

 Gartner Lee

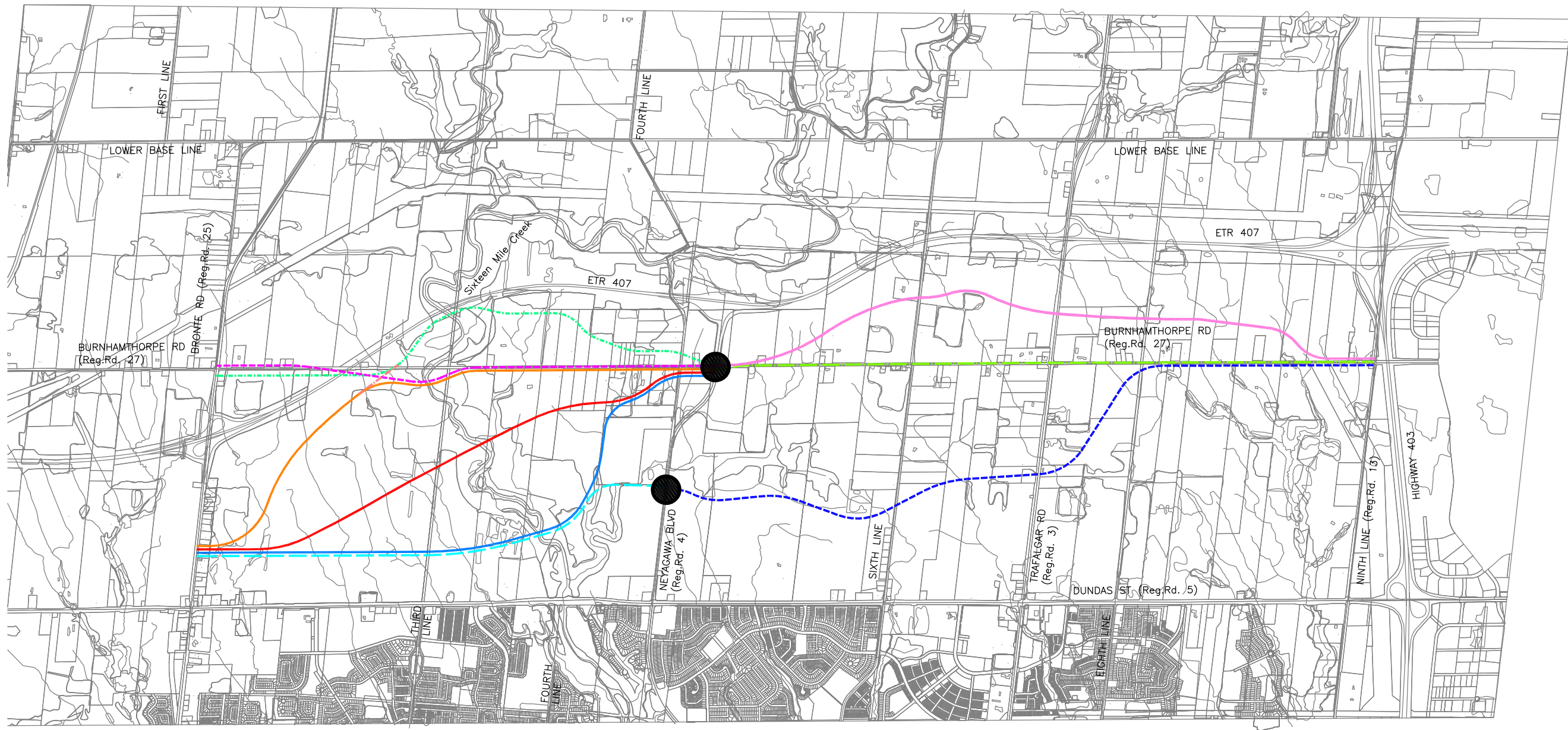
COMMON NAME	SCIENTIFIC NAME	SRANK
SKIPPER FAMILY	HESPERIIDAE	
Northern Cloudywing	<i>Thorybes pylades</i>	S5
Dreamy Duskywing	<i>Erynnis icelus</i>	S5
Juvenal's Duskywing	<i>Erynnis juvenalis</i>	S5
Hobomok Skipper	<i>Poanes hobomok</i>	S5
SWALLOWTAIL FAMILY	PAPILIONIDAE	
Canadian Tiger Swallowtail	<i>Papilio canadensis</i>	S5
SULPHUR AND WHITE FAMILY	PIERIDAE	
Cabbage White	<i>Artogeia rapae</i>	SE
HAIRSTREAK FAMILY	LYCAENIDAE	
Spring Azure	<i>Celastrina ladon</i>	S5
Silvery Blue	<i>Glaucopsyche lygdamus</i>	S5
Bronze Copper	<i>Lycaena hylus</i>	S5
BRUSHFOOT FAMILY	NYMPHALIDAE	
Pearl Crescent	<i>Phyciodes tharos</i>	S4
Question Mark	<i>Polygonia interrogationis</i>	S5
Mourning Cloak	<i>Nymphalis antiopa</i>	S5
Banded Purple	<i>Limenitis arthemis astyanax</i>	S5
Viceroy	<i>Basilarchia archippus</i>	S5
SATYR FAMILY	SATYRIDAE	
Little Wood Satyr	<i>Megisto cymela</i>	S5
Inornate Ringlet	<i>Coenonympha inornata</i>	S5
MILKWEED BUTTERFLY FAMILY	DANAIDAE	
Monarch	<i>Danaus plexippus</i>	S4

Odonata - GLL 16 Mile Creek Study Area

COMMON NAME	SCIENTIFIC NAME	SRANK
Broad-winged Damselflies	Calopterygidae	
	= Agriidae	
Ebony Jewelwing	<i>Calopteryx maculata</i>	S5
Darners	Aeshnidae	
Canada Darner	<i>Aeshna canadensis</i>	S5
Common Green Darner	<i>Anax junius</i>	S5
Common Skimmers	Libellulidae	
Common Whitetail	<i>Libellula lydia</i>	S5
Dog-tailed Whiteface	<i>Leucorrhinia intacta</i>	S5
Widow Skimmer	<i>Libellula luctuosa</i>	S5
Twelve-spot Skimmer	<i>Libellula pulchella</i>	S5
White-faced Meadowhawk	<i>Sympetrum obtrusum</i>	S5
Clubtails	Gomphidae	
Lancet Clubtail	<i>Gomphus exilis</i>	S5

Appendix G

Short List of Alternate Routes



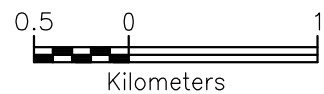
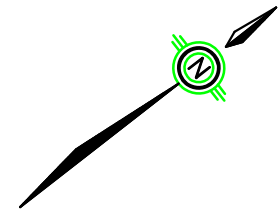
LEGEND

BRONTE ROAD TO NEYAGAWA BOULEVARD

- ALTERNATIVE W1 —
- ALTERNATIVE W2 - - - - -
- ALTERNATIVE W3 - - - - -
- ALTERNATIVE W4 - - - - -
- ALTERNATIVE W5 —
- ALTERNATIVE W6 —
- LINK W2-W5 - - - - -

NEYAGAWA BOULEVARD TO NINTH LINE

- ALTERNATIVE E1 —
- ALTERNATIVE E2 - - - - -
- ALTERNATIVE E3 - - - - -



NEW BURNHAMTHORPE ROAD (REGIONAL ROAD 27) TRANSPORTATION CORRIDOR
AND POTENTIAL FUTURE BRIDGE CROSSING OF SIXTEEN MILE CREEK
CLASS ENVIRONMENTAL ASSESSMENT - TOWN OF OAKVILLE, REGION OF HALTON

SHORT LIST OF ALTERNATIVE ROUTES

Appendix H

North Oakville Natural Heritage System

Notes to Schedule "D"

The aerial photo in Schedule "D", is to scale. The boundaries of the Core Preserve Area, Linkage Preserve Area, and High and Medium Constraint Stream Corridors are as delineated by the yellow line on Schedule "D".

For guidance, the following dimensions were used to develop Schedule "D".

- All linkages are 100m's wide except:
 - The linkage running south of Core 9 to Dundas, which is 120 m;
 - The linkage between Core 5 and 6, which must be scaled.

- The following buffer widths were applied:
 - For woodlands – 10 m. measured from the dripline
 - For wetlands – 30 m
 - For thickets, savannahs and meadows – 0 mProvided however, the boundaries do not always follow the limits of the buffers. Reference should be made to the Town's Subwatershed Study.

These buffers have been included within the Natural Heritage System, and are not to be added to the boundaries shown on Schedule "D".

The final precise boundaries of the Natural Heritage Lands shall be determined by the Environmental Implementation Report accepted by the Town in accordance with the Town's Position (which is intended to "groundtruth", but not substantially revise the boundaries as shown on Schedule "D").



SCHEDULE D

North Oakville - Confidential



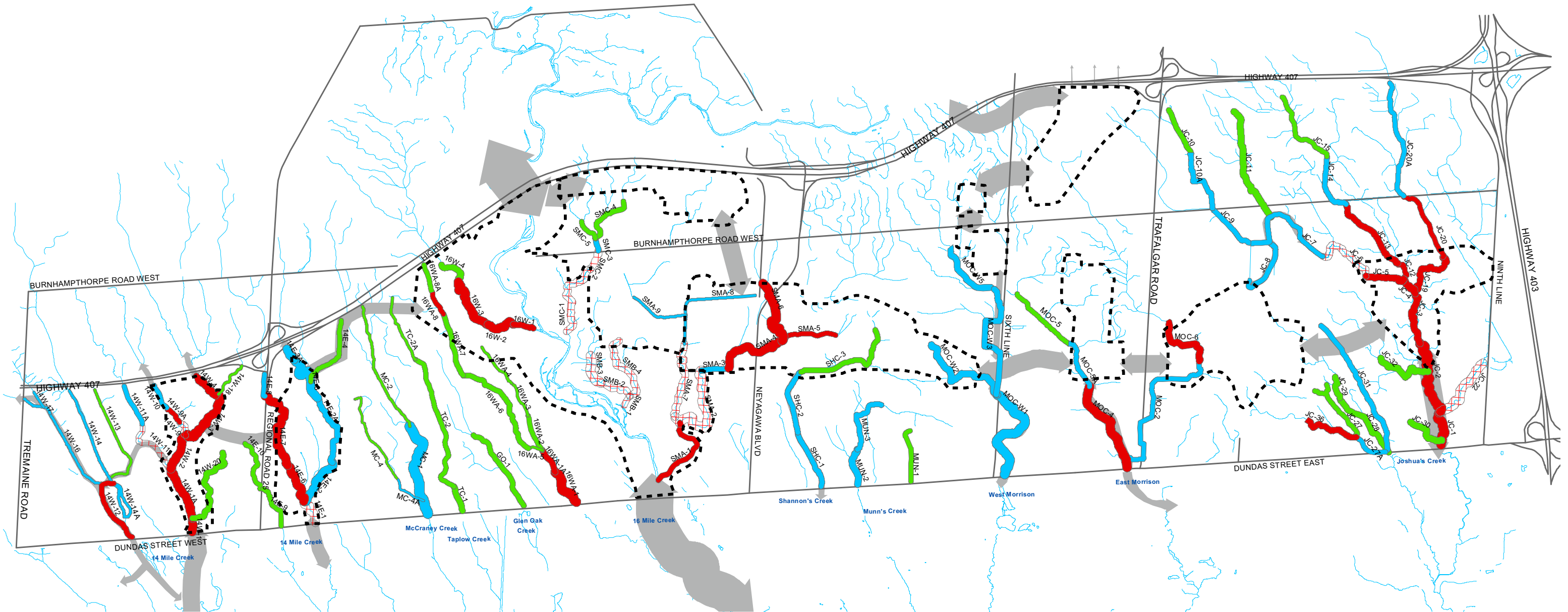
June 8 2006

Appendix I

Reach Level Constraints (Town
of Oakville 2005)

NORTH OAKVILLE SUBWATERSHED STUDY

Riparian Corridor Classification



Donald G. Weatherbe Associates Inc.

Appendix J

Natural Environment Assessment of Short List of Alternate Routes

- Neyagawa Boulevard to Bronte Road
- Ninth Line to Neyagawa Boulevard

Table J1. Assessment of Short List of Route Alternatives: Neyagawa Boulevard to Bronte Road

ASSESSMENT CRITERIA AND SUBFACTOR	MEASURE	ALTERNATIVE ROUTES				
		W1 (Red)	W2 (Dashed Green)	W3 (Dashed Pink)	W5 (Orange)	W6 (Solid Blue)
Natural Environment						
Watercourses/ Fisheries	No. of watercourse crossings by MNR Thermal Status ⁱ	<ul style="list-style-type: none"> Total Watercourse Crossings: 13 Permanent Coldwater: 2 Permanent Coolwater: 1 Intermittent Coldwater: 0 Intermittent Coolwater: 1 <p>LEAST PREFERRED</p>	<ul style="list-style-type: none"> Total Watercourse Crossings: 7 Permanent Coldwater: 2 Permanent Coolwater: 1 Intermittent Coldwater: 0 Intermittent Coolwater: 0 	<ul style="list-style-type: none"> Total Watercourse Crossings: 6 Permanent Coldwater: 1 Permanent Coolwater: 2 Intermittent Coldwater: 0 Intermittent Coolwater: 0 <p>MOST PREFERRED</p>	<ul style="list-style-type: none"> Total Watercourse Crossings: 8 Permanent Coldwater: 2 Permanent Coolwater: 1 Intermittent Coldwater: 0 Intermittent Coolwater: 1 	<ul style="list-style-type: none"> Total Watercourse Crossings: 11 Permanent Coldwater: 2 Permanent Coolwater: 2 Intermittent Coldwater: 0 Intermittent Coolwater: 0 <p>LEAST PREFERRED</p>
	No. of watercourse crossings by NOSP Hydrogeological Features ⁱⁱ	<ul style="list-style-type: none"> No. of Watercourse crossings: High Constraint: 3 Medium Constraint: 3 	<ul style="list-style-type: none"> No. of Watercourse crossings: High Constraint: 0 Medium Constraint: 0 <p>MOST PREFERRED</p>	<ul style="list-style-type: none"> No. of Watercourse crossings: High Constraint: 1 Medium Constraint: 0 	<ul style="list-style-type: none"> No. of Watercourse crossings: High Constraint: 4 Medium Constraint: 2 <p>LEAST PREFERRED</p>	<ul style="list-style-type: none"> No. of Watercourse crossings: High Constraint: 3 Medium Constraint: 3
Vegetation and Woodlots	Length of feature crossings: Woodlands ⁱⁱⁱ , Interior Forest ^{iv} , 16 Mile Cr. (Regional) LS ANSI ^v , and Candidate Trafalgar Moraine ^{vi} ES ANSI ^{vi}	<p>Length of Feature Crossing</p> <ul style="list-style-type: none"> Woodlands: 1020m Interior Forest: 280m 16 Mile Cr. LS ANSI: 550m Trafalgar Moraine ES ANSI: 0m <p>LEAST PREFERRED</p>	<p>Length of Feature Crossing</p> <ul style="list-style-type: none"> Woodlands: 800m Interior Forest: 0m 16 Mile Cr. LS ANSI: 830m Trafalgar Moraine ES ANSI: 0 <p>MOST PREFERRED</p>	<p>Length of Feature Crossing</p> <ul style="list-style-type: none"> Woodlands: 470m Interior Forest: 170m 16 Mile Cr. LS ANSI: 570m Trafalgar Moraine ES ANSI: 0m 	<p>Length of Feature Crossing</p> <ul style="list-style-type: none"> Woodlands: 750m Interior Forest: 170m 16 Mile Cr. LS ANSI: 710m Trafalgar Moraine ES ANSI: 0m 	<p>Length of Feature Crossing</p> <ul style="list-style-type: none"> Woodlands: 1420m Interior Forest: 60m 16 Mile Cr. LS ANSI: 820m Trafalgar Moraine ES ANSI: 0m
Terrestrial Wildlife	Proximity (120m) to provincially significant species ^{vii} , and regionally/locally significant species assemblages ^{viii}	<p>No. of units with 120m of alignment:</p> <ul style="list-style-type: none"> Provincially significant species: 0 Regionally or locally significant species assemblages: 2 <p>LEAST PREFERRED</p>	<p>No. of units with 120m of alignment:</p> <ul style="list-style-type: none"> Provincially significant species: 0 Regionally or locally significant species assemblages: 0 <p>MOST PREFERRED</p>	<p>No. of units with 120m of alignment:</p> <ul style="list-style-type: none"> Provincially significant species: 1 Regionally or locally significant species assemblages: 0 	<p>No. of units with 120m of alignment:</p> <ul style="list-style-type: none"> Provincially significant species: 1 Regionally or locally significant species assemblages: 0 units 	<p>No. of units with 120m of alignment:</p> <ul style="list-style-type: none"> Provincially significant species: 1 Regionally or locally significant species assemblages: 5
Natural Heritage Systems Connectivity	Length of Crossing of NOSP Natural Heritage System ^{ix}	<p>Length of Feature Crossing:</p> <ul style="list-style-type: none"> Natural Heritage System: ~2000m 	<p>Length of Feature Crossing:</p> <ul style="list-style-type: none"> Natural Heritage System: ~600m <p>MOST PREFERRED</p>	<p>Length of Feature Crossing:</p> <ul style="list-style-type: none"> Natural Heritage System: ~800m 	<p>Length of Feature Crossing:</p> <ul style="list-style-type: none"> Natural Heritage System: ~2100m <p>LEAST PREFERRED</p>	<p>Length of Feature Crossing:</p> <ul style="list-style-type: none"> Natural Heritage System: ~1800m

ASSESSMENT CRITERIA AND SUBFACTOR	MEASURE	ALTERNATIVE ROUTES				
		W1 (Red)	W2 (Dashed Green)	W3 (Dashed Pink)	W5 (Orange)	W6 (Solid Blue)
Wetlands/Marsh Areas	Number of wetlands within 120m of alignment. Length of crossing of Candidate Oakville-Milton Wetlands & Upland LS ANSI ^x	No. of wetlands within 120m: 5 Length of Feature Crossing (Candidate Oakville-Milton Wetlands & Upland LS ANSI): 0m MOST PREFERRED	No. of wetlands within 120m: Length of Feature Crossing (Candidate Oakville-Milton Wetlands & Upland LS ANSI): 25m LEAST PREFERRED	No. of wetlands within 120m: 5 Length of Feature Crossing (Candidate Oakville-Milton Wetlands & Upland LS ANSI): 0m MOST PREFERRED	No. of wetlands within 120m: 8 Length of Feature Crossing (Candidate Oakville-Milton Wetlands & Upland LS ANSI): 0m	No. of wetlands within 120m: 8 Length of Feature Crossing (Candidate Oakville-Milton Wetlands & Upland LS ANSI): 0m
SUMMARY	No. of Most Preferred vs. Least Preferred rankings	<ul style="list-style-type: none"> • Most Preferred: 1 • Least Preferred: 3 <p>This alternative is not preferred by approving agencies (i.e., MNR, Conservation Halton, etc.) because of its environmental impacts as they relate to a new crossing the Sixteen Mile Creek and valley at a previously undisturbed area.</p>	<ul style="list-style-type: none"> • Most Preferred: 4 • Least Preferred: 2 	<ul style="list-style-type: none"> • Most Preferred: 2 • Least Preferred: 0 <p>MOST PREFERRED because it uses the existing roadway and therefore minimizes impacts to the natural environment.</p>	<ul style="list-style-type: none"> • Most Preferred: 1 • Least Preferred: 2 	<ul style="list-style-type: none"> • Most Preferred: 0 • Least Preferred: 1
		<ul style="list-style-type: none"> • 13 new watercourse crossings; 2 coldwater crossings impacted. • 3 high constraint and 3 medium constraint watercourses crossed. • Moderate impact on woodlands and ANSIs, greatest impact on interior forest. • Greatest impact on terrestrial wildlife. • Moderate impact on natural heritage system connectivity. • Least impact on wetlands/marsh areas. <p>LEAST PREFERRED</p>	<ul style="list-style-type: none"> • 7 new watercourse crossings; 2 coldwater crossings impacted. • 0 high constraint and 0 medium constraint watercourses crossed. • Moderate impact on woodlands, ANSIs and interior forest. • Least impact on terrestrial wildlife. • Least impact on natural heritage system connectivity. • Greatest impact on wetlands/marsh areas. 	<ul style="list-style-type: none"> • 6 new watercourse crossings; 1 coldwater crossing impacted. • 1 high constraint and 0 medium constraint watercourses crossed. • Least impact on woodlands, and ANSIs, and moderate impact on interior forest. • Moderate impact on terrestrial wildlife. • Moderate impact on natural heritage system connectivity. • Least impact on wetlands/marsh areas. • Expansion of existing route (except at 16 Mile Creek crossing), therefore impacts are greatly minimized. <p>MOST PREFERRED</p>	<ul style="list-style-type: none"> • 8 new watercourse crossings; 2 coldwater crossings impacted. • 4 high constraint and 2 medium constraint watercourses crossed. • Moderate impact on woodlands, ANSIs and interior forest. • Moderate impact on terrestrial wildlife. • Greatest impact on natural heritage system connectivity. • Moderate impact on wetlands/marsh areas. 	<ul style="list-style-type: none"> • 11 new watercourse crossings; 2 coldwater crossings impacted. • 3 high constraint and 3 medium constraint watercourses crossed. • Greatest impact on woodlands, moderate impact on ANSIs, and minimal impact on interior forest. • Moderate impact on terrestrial wildlife. • Moderate impact on natural heritage system connectivity. • Moderate impact on wetlands/marsh areas.

ⁱ Ontario Ministry of Natural 1984-2000. NRVIS data: thermal status of Halton watercourses. Mosaic of data used from 1984 – 2004.

ⁱⁱ Town of Oakville 2006. North Oakville Subwatershed Study. Natural Heritage Component of Natural Heritage and Open Space System including Other Hydrogeological Features, Figure NOW3 and NOE3. Draft – Confidential without Prejudice. April 12, 2006.

ⁱⁱⁱ As defined by: Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray, 1998. Ecological Land Classification for Southern Ontario: First Approximation and Its Application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

^{iv} Ontario Ministry of Natural Resources 1999. Natural Heritage Reference Manual for Policy 2.3 of the Provincial Policy Statement. June 1999.

^v Ontario Ministry of Natural Resources 2003. North Oakville and Vicinity Wetlands and ANSIs. North American Datum 1983. Queen’s Printer for Ontario. May 2003.

^{*} To be refined by hydrogeological study.

^{vi} Ontario Ministry of Natural Resources 2003. North Oakville and Vicinity Wetlands and ANSIs. North American Datum 1983. Queen’s Printer for Ontario. May 2003.

^{vii} Based on provincially significant species location data provided by the OMNR. Additional location data is pending from the OMNR.

^{viii} Based GLL flora and fauna mapping to date.

^{ix} Town of Oakville 2006. North Oakville Subwatershed Study. Community Structure Plan, Natural Heritage Component of Natural Heritage and Open Space System layer, Figure NOW1 and NOE1. Draft – Confidential without Prejudice. April 12, 2006.

^x Ontario Ministry of Natural Resources 2003. North Oakville and Vicinity Wetlands and ANSIs. North American Datum 1983. Queen’s Printer for Ontario. May 2003.

Table J2. Assessment of Short List of Route Alternatives: Ninth Line to Neyagawa Boulevard

ASSESSMENT CRITERIA AND SUBFACTOR	MEASURE	ALTERNATIVE ROUTES		
		E1 (Pink)	E2 (Dashed Green)	E3 (Dashed Blue)
Natural Environment				
Watercourses/ Fisheries	No. of watercourse crossings by MNR Thermal Status ⁱ	<ul style="list-style-type: none"> Total Watercourse Crossings: 10 <ul style="list-style-type: none"> Permanent Coldwater: 0 Permanent Coolwater: 0 Intermittent Coldwater: 0 Intermittent Coolwater: 2 <p style="text-align: center;">MOST PREFERRED</p>	<ul style="list-style-type: none"> Total Watercourse Crossings: 10 <ul style="list-style-type: none"> Permanent Coldwater: 0 Permanent Coolwater: 0 Intermittent Coldwater: 1 Intermittent Coolwater: 2 	<ul style="list-style-type: none"> Total Watercourse Crossings: 12 <ul style="list-style-type: none"> Permanent Coldwater: 0 Permanent Coolwater: 2 Intermittent Coldwater: 2 Intermittent Coolwater: 0 <p style="text-align: center;">LEAST PREFERRED</p>
	No. of watercourse crossings by NOSP Hydrogeological Features ⁱⁱ	<ul style="list-style-type: none"> No. of Watercourse crossings: <ul style="list-style-type: none"> High Constraint: 0 Medium Constraint: 2 <p style="text-align: center;">MOST PREFERRED</p>	<ul style="list-style-type: none"> No. of Watercourse crossings: <ul style="list-style-type: none"> High Constraint: 0 Medium Constraint: 3 	<ul style="list-style-type: none"> No. of Watercourse crossings: <ul style="list-style-type: none"> High Constraint: 2 Medium Constraint: 4 <p style="text-align: center;">LEAST PREFERRED</p>
Vegetation and Woodlots	Length of feature crossings: Woodlands ⁱⁱⁱ , Interior Forest ^{iv} , 16 Mile Cr. (Regional) LS ANSI ^v , and Candidate Trafalgar Moraine ^{ES ANSI} ^{vi}	<ul style="list-style-type: none"> Length of Feature Crossing <ul style="list-style-type: none"> Woodlands: 120m Interior Forest: 0m 16 Mile Cr. LS ANSI: 0m Trafalgar Moraine ES ANSI: 2580m <p style="text-align: center;">LEAST PREFERRED</p>	<ul style="list-style-type: none"> Length of Feature Crossing <ul style="list-style-type: none"> Woodlands: 130m Interior Forest: 0m 16 Mile Cr. LS ANSI: 0m Trafalgar Moraine ES ANSI: 1840m Expansion of existing road, therefore impacts to features are minimized. <p style="text-align: center;">MOST PREFERRED</p>	<ul style="list-style-type: none"> Length of Feature Crossing <ul style="list-style-type: none"> Woodlands: 130m Interior Forest: 0m 16 Mile Cr. LS ANSI: 0m Trafalgar Moraine ES ANSI: 0m

ASSESSMENT CRITERIA AND SUBFACTOR	MEASURE	ALTERNATIVE ROUTES		
		E1 (Pink)	E2 (Dashed Green)	E3 (Dashed Blue)
Terrestrial Wildlife	Proximity (120m) to provincially significant species ^{vii} , and regionally/locally significant species assemblages ^{viii}	No. of units with 120m of alignment: <ul style="list-style-type: none"> Provincially significant species: 0 Regionally or locally significant species assemblages: 0 	No. of units with 120m of alignment: <ul style="list-style-type: none"> Provincially significant species: 0 Regionally or locally significant species assemblages: 0 	<ul style="list-style-type: none"> No. of units with 120m of alignment: Provincially significant species: 0 Regionally or locally significant species assemblages: 0
Natural Heritage Systems Connectivity	Length of Crossing of NOSP Natural Heritage System ^{ix}	Length of Feature Crossing: <ul style="list-style-type: none"> Natural Heritage System: ~200m <p style="text-align: center;">MOST PREFERRED</p>	Length of Feature Crossing: <ul style="list-style-type: none"> Natural Heritage System: ~200m <p style="text-align: center;">MOST PREFERRED</p>	Length of Feature Crossing: <ul style="list-style-type: none"> Natural Heritage System: ~1000m <p style="text-align: center;">LEAST PREFERRED</p>
Wetlands/Marsh Areas	Number of wetlands within 120m of alignment. Length of crossing of Candidate Oakville-Milton Wetlands & Upland LS ANSI ^x	No. of wetlands within 120m of alignment: 13 Length of Feature Crossing (Candidate Oakville-Milton Wetlands & Upland LS ANSI): 55m <p style="text-align: center;">LEAST PREFERRED</p>	No. of wetlands within 120m of alignment: 8 Length of Feature Crossing (Candidate Oakville-Milton Wetlands & Upland LS ANSI): 340m along the edge (involves no fragmentation) Expansion of existing road, therefore impacts to features are minimized. <p style="text-align: center;">MOST PREFERRED</p>	No. of wetlands within 120m of alignment: 11 Length of Feature Crossing (Candidate Oakville-Milton Wetlands & Upland LS ANSI): 0m
SUMMARY	No. of Most Preferred vs. Least Preferred rankings	<ul style="list-style-type: none"> Most Preferred: 3 Least Preferred: 3 <p>Most impact environmental impacts can be mitigated.</p>	<ul style="list-style-type: none"> Most Preferred: 4 Least Preferred: 0 <p>MOST PREFERRED from a natural environmental perspective, primarily because it uses the existing Burnhamthorpe Road and therefore minimizes impacts.</p>	<ul style="list-style-type: none"> Most Preferred: 0 Least Preferred: 3 <p>LEAST PREFERRED from a natural environmental perspective, based on length through sensitive areas including NOSP Natural Heritage System as well as total number and sensitivity of watercrossings.</p>
		<ul style="list-style-type: none"> 8 new and 2 existing watercourse crossings; no coldwater crossings impacted. 0 high constraint and 2 medium constraint watercourses crossed. Comparable impact on woodlands; greatest impact on Trafalgar Moraine ES ANSI. No significant impact on terrestrial wildlife. Least impact on natural heritage system connectivity. Greatest impact on wetlands/marsh areas. 	<ul style="list-style-type: none"> 10 existing watercourse crossings to be modified; 1 coldwater crossing impacted. 0 high constraint and 3 medium constraint watercourses crossed. Comparable impact on woodlands; moderate impact on Trafalgar Moraine ES ANSI. No significant impact on terrestrial wildlife. Least impact on natural heritage system connectivity. Least impact on wetlands/marsh areas. Expansion of existing route, therefore impacts are greatly minimized. <p style="text-align: center;">MOST PREFERRED</p>	<ul style="list-style-type: none"> 7 new and 5 existing watercourse crossings; 2 coldwater crossings impacted. 2 high constraint and 4 medium constraint watercourses crossed. Comparable impact on woodlands; no impact on Trafalgar Moraine ES ANSI. No significant impact on terrestrial wildlife. Greatest impact on natural heritage system connectivity. Moderate impact on wetlands/marsh areas. <p style="text-align: center;">LEAST PREFERRED</p>

ⁱ Ontario Ministry of Natural 1984-2000. NRVIS data: thermal status of Halton watercourses. Mosaic of data used from 1984 – 2004.

ⁱⁱ Town of Oakville 2006. North Oakville Subwatershed Study. Natural Heritage Component of Natural Heritage and Open Space System including Other Hydrogeological Features, Figure NOW3 and NOE3. Draft – Confidential without Prejudice. April 12, 2006.

ⁱⁱⁱ As defined by: Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray, 1998. Ecological Land Classification for Southern Ontario: First Approximation and Its Application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

^{iv} Ontario Ministry of Natural Resources 1999. Natural Heritage Reference Manual for Policy 2.3 of the Provincial Policy Statement. June 1999.

^v Ontario Ministry of Natural Resources 2003. North Oakville and Vicinity Wetlands and ANSIs. North American Datum 1983. Queen’s Printer for Ontario. May 2003.

* To be refined by hydrogeological study.

^{vi} Ontario Ministry of Natural Resources 2003. North Oakville and Vicinity Wetlands and ANSIs. North American Datum 1983. Queen’s Printer for Ontario. May 2003.

^{vii} Based on provincially significant species location data provided by the OMNR. Additional location data is pending from the OMNR.

^{viii} Based GLL flora and fauna mapping to date.

^{ix} Town of Oakville 2006. North Oakville Subwatershed Study. Community Structure Plan, Natural Heritage Component of Natural Heritage and Open Space System layer, Figure NOW1 and NOE1. Draft – Confidential without Prejudice. April 12, 2006.

^x Ontario Ministry of Natural Resources 2003. North Oakville and Vicinity Wetlands and ANSIs. North American Datum 1983. Queen’s Printer for Ontario. May 2003.