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8. Description of the Environment Potentially Affected

8.1 Introduction

As noted in the EA Guidelines, “The required level of detail in the description of the existing environment will be less where the potential interactions between the project and various components of the environment are limited, or remote in time and/or space”. As such, when describing the environment potentially affected, consideration was given to the appropriate focus for each environmental component. For some environmental components the description of the environment potentially affected was provided for the entire 407 East Transportation Corridor Regional Study Area (RSA), while for others, the description focuses on the Site Study Area (SSA) and/or the Local Study Area (LSA) for the Projects subject to Federal EA. **Table 8-1** summarizes the rationale for the selected level of detail for each environmental component.

Table 8-1 Level of Detail Considerations

Environmental Component	Level of Detail	Rationale
Air Quality and Climate	Transportation Corridor	<ul style="list-style-type: none"> ▶ Existing air quality and climatic conditions do not vary substantially across the 407 East Transportation Corridor RSA. ▶ Ambient air quality data are not available from monitoring stations located within the SSA and LSA for each Project subject to Federal EA.
Noise and Vibration	Transportation Corridor	<ul style="list-style-type: none"> ▶ Existing noise and vibration conditions do not vary substantially across the 407 East Transportation Corridor RSA. ▶ Ambient noise levels were measured at locations throughout the RSA and not within the SSA and LSA for each Project subject to Federal EA.
Surface and Subsurface Geology and Soils	Transportation Corridor	▶ Existing surface and subsurface geological and soil conditions do not vary substantially across the 407 East Transportation Corridor RSA. Areas that pose an erosion and sedimentation risk are expected to be identified along the full length of the 407 East Transportation Corridor.
Groundwater	Transportation Corridor	▶ Existing groundwater conditions do not vary substantially across the 407 East Transportation Corridor. Areas that may be subject to effects on groundwater are expected to occur along the full length of the 407 East Transportation Corridor and would be largely associated with deep cuts and major fills.
Surface Water	Projects subject to Federal EA	<ul style="list-style-type: none"> ▶ Surface water conditions may vary substantially at each watercourse crossing or Project subject to Federal EA. ▶ Effects on surface water have a direct bearing on effects to fish and fish habitat. These require consideration by the RAs under the Fisheries Act.
Vegetation and Vegetation Communities	Projects subject to Federal EA	<ul style="list-style-type: none"> ▶ Vegetation and vegetation communities may vary substantially within the SSA and LSA for each Project subject to Federal EA. ▶ Effects on vegetation and vegetation communities have a direct bearing on migratory birds and species at risk. These require consideration by the RAs under the Migratory Bird Convention Act and the Species at Risk Act.
Wetlands	Projects subject to Federal EA	<ul style="list-style-type: none"> ▶ The types and functions of wetlands potentially affected by the 407 East Transportation Corridor may vary substantially within the SSA and LSA for each Project subject to Federal EA. ▶ Effects on wetlands have a direct bearing on migratory birds and species at risk. These require consideration by the RAs under the Migratory Bird Convention Act and the Species at Risk Act. ▶ Effects on wetlands require consideration by the RAs under the Federal Policy for Wetland Conservation and the Canadian Biodiversity Strategy.
Fish and Fish Habitat	Projects subject to Federal EA	<ul style="list-style-type: none"> ▶ The types of fish and fish habitat potentially affected by the 407 East Transportation Corridor may vary substantially within the SSA and LSA for each Project subject to Federal EA. ▶ Effects on fish and fish habitat require consideration by the RAs under the Fisheries Act.

Table 8-1 Level of Detail Considerations

Environmental Component	Level of Detail	Rationale
Wildlife And Wildlife Habitat Including Migratory Birds	Projects subject to Federal EA	<ul style="list-style-type: none"> ▶ The presence of, types and sensitivities of the wildlife and wildlife habitats potentially affected by the 407 East Transportation Corridor may vary substantially within the SSA and LSA for each Project subject to Federal EA. ▶ Effects on wildlife and migratory birds require consideration by the RAs under the Migratory Bird Convention Act and the Species at Risk Act. ▶ Effects on wildlife and wildlife habitat (including migratory birds) require consideration by the RAs under the Canadian Biodiversity Strategy.
Species at Risk	Projects subject to Federal EA	<ul style="list-style-type: none"> ▶ The presence of, types and sensitivities of Species at Risk potentially affected by the 407 East Transportation Corridor may vary substantially within the SSA and LSA for each Project subject to Federal EA. ▶ Effects on species at risk require consideration by the RAs under the Species at Risk Act.
Socio-Economic Environment	Transportation Corridor	▶ There are very few individual residences located within the SSAs defined for the Projects subject to Federal EA. Although each community and neighbourhood is unique, and adjacent and nearby land uses vary across the 407 East Transportation Corridor, they are best described broadly in the context of the RSA rather than for each Project subject to Federal EA.
Cultural Environment	Transportation Corridor	▶ There are likely to be very few individual archaeological sites, built heritage features or substantially different cultural landscape features located within the SSA or LSAs defined for the Projects subject to Federal EA.
Current Use of Lands and Resources By Aboriginal People	Transportation Corridor	▶ The use of lands and resources by Aboriginal People are not necessarily limited to an individual watercourse crossing location. The environment potentially affected is best described broadly in the context of the RSA rather than for each Project subject to Federal EA.
Contaminated Sites and Waste Management	Transportation Corridor	▶ There are very few contaminated sites or waste management facilities located within the SSA and LSA for the Projects subject to Federal EA.

8.2 Air Quality and Climate (Transportation Corridor)

The following description of the environment potentially affected applies to the entire 407 East Transportation Corridor.

8.2.1 Air Quality

For the purposes of this Environmental Screening Report, the following contaminants of concern were considered most relevant because they are the main contaminants emitted from vehicle tailpipes and roadway surfaces, and depending on concentrations and human exposure, they may have potential health effects associated with them:

Carbon Monoxide (CO) is a colourless, odourless, tasteless, and potentially poisonous gas produced primarily by incomplete combustion of fossil fuels. Exposure to high levels of CO is linked with impairment of vision, work capacity, learning ability, and performance of difficult tasks.

All combustion in air produces **Oxides of Nitrogen (NO_x)**, of which nitrogen dioxide (NO₂) is a component. NO₂ is a reddish brown gas with a pungent and irritating odour. It transforms in the air to form gaseous nitric acid and toxic organic nitrates. NO₂ also plays a major role in atmospheric reactions that produce ground

level ozone, a major component of smog. It is also a precursor to nitrates, which contribute to increased respirable particle levels in the atmosphere. Exposure to high levels can irritate the lungs and lower resistance to respiratory infection. People with asthma and bronchitis have increased sensitivity.

Particulate Matter (PM) is the general term used for a mixture of solid particles and liquid droplets found in the air. These particles, which come in a wide range of sizes, are emitted directly from sources or formed in the atmosphere by the transformation of gaseous emissions into secondary pollutants.

- **Total suspended particulate matter (TSP)**, refers to the fraction of PM having a diameter less than or equal to 100 microns.
- **Inhalable particulate matter**, or **PM₁₀**, refers to the fraction of PM having a diameter less than or equal to 10 microns. Respirable particulate matter, or **PM_{2.5}**, refers to the fraction of PM having a diameter less than or equal to 2.5 microns.

The smaller the particle size, the farther the particle can penetrate into the lungs. Therefore, smaller particles pose the greatest potential for human health effects. The greatest effect on human health is from particles 10 microns or less in diameter, which can aggravate bronchitis, asthma, and other respiratory diseases. People with asthma, cardiovascular or lung disease, children, and elderly people, are considered to be the most sensitive to the effects of PM₁₀ or PM_{2.5}.

Volatile Organic Compounds (VOCs) require special attention because they are capable of being transported very long distances in the atmosphere and play an important role in the formation of ground level ozone and fine particles. Many are also toxic and/ or odorous. VOCs are emitted into the atmosphere from a variety of sources, including, vehicles, petroleum refining, solvent use (industrial and residential), and paint application. The following VOCs were identified as contaminants of concern for the 407 East Transportation Corridor Environmental Screening:

- **Formaldehyde** is a colourless gas with a pungent, suffocating odour at room temperature. Formaldehyde is used mainly to produce resins. The major emission sources are power plants, manufacturing facilities, incinerators, and vehicle exhaust. Inhalation exposure to high levels of formaldehyde in humans can result in respiratory symptoms, and eye, nose, and throat irritation. Formaldehyde is classified as a probable human carcinogen.
- **Acetaldehyde** is a colourless, flammable liquid, volatile at ambient temperature and pressure, with an irritating odour. Acetaldehyde is used commercially in a wide variety of chemical reactions including the manufacturing of acetic acid. It is both directly emitted into the atmosphere through incomplete combustion as well as formed in the atmosphere from a variety of precursors. Acetaldehyde is classified as a probable human carcinogen.
- **1,3-Butadiene** is a colourless gas with a mild gasoline-like odour and is used in the production of rubber and plastics. Motor vehicle exhaust is a constant source of trace levels of 1,3-butadiene. Inhalation exposure in humans at elevated levels can result in irritation of the eyes, nasal passages, throat, and lungs. 1,3-Butadiene is classified as a probable human carcinogen.

- **Benzene** is primarily used in the production of plastics and other chemical products, and has been linked to various types of leukemia, lymphoma, and blood diseases. Benzene is classified as a human carcinogen.
- **Acrolein** is manufactured as an end-use product and as an un-isolated intermediate in the production of acrylic acid. It is also a potential by-product of incomplete combustion. Acrolein is not commercially produced in Canada but is imported from the United States for use mainly as a pesticide. Exposure to humans can cause eye irritation at low levels of exposure, and has effects on the respiratory system and even fatality at elevated levels of exposure.

There are several Provincial and Federal guidelines, in the form of ambient air quality criteria, which have been used in this Environmental Screening. The Ontario Ministry of the Environment (MOE) has developed Ambient Air Quality Criteria (AAQCs) for numerous contaminants, including those that are typically emitted from vehicular traffic and are known to have the potential to cause human health or environmental impacts. Environment Canada (EC) has established National Ambient Air Quality Objectives (NAAQOs) for the same contaminants. In general, these objectives represent desirable or acceptable ambient contaminant levels. The Canadian Council of Ministers of the Environment (CCME) created a Canada Wide Standard (CWS) for PM_{2.5}. The CWS for PM_{2.5} was established for the year 2010 and is based on the 98th percentile ambient measurement (24-hour) annually averaged over three consecutive years. With the exception of Total Suspended Particulate Matter (TSP), which is a nuisance contaminant, all contaminants considered in this assessment are related to potential human health effects. These air quality criteria, objectives and standards represent air quality thresholds for the purpose of this assessment and are summarized in **Table 8-2**. It should be noted that these values represent target levels and are not enforceable within any of the jurisdictions.

Table 8-2 Summary of Relevant Air Quality Thresholds (µg/m³)

Contaminant	Averaging Time			Source			Air Quality Threshold
	1 hr	8 hr	24 hr	AAQC	NAAQO	CWS	
CO	X			X			36,200*
	X				X		35,000*
		X		X			15,700*
		X			X		15,000*
NO ₂	X			X			400
			X		X		200
PM _{2.5}			X			X	30
PM ₁₀			X				50
TSP			X	X			120
1,3-Butadiene							N/A
Benzene							N/A
Formaldehyde			X	X			65
Acetaldehyde			X	X			500
Acrolein			X	X			0.08

Notes: * The AAQC and NAAQO for CO represent the same value in parts per million (ppm). The two jurisdictions base their conversion from ppm to (µg/m³) on different ambient temperatures.

Nearest the 407 East Transportation Corridor, the Ministry of the Environment (MOE) operates three ambient air quality-monitoring stations between Pickering and Clarington, Ontario. These ambient air quality monitoring stations are located in:

- Stouffville (MOE Station No. 48002, Hwy 47/East of Hwy 48);
- Oshawa (MOE Station No. 45025, Ritson Road and Olive Avenue); and
- Newmarket (MOE Station No. 48006, Eagle Street/McCaffrey Road).

The Stouffville monitoring station is located in rural, agricultural lands and its monitoring data were considered to be representative of rural sections of the 407 East Transportation Corridor. The Oshawa monitoring station is located in downtown Oshawa near industrial land uses and its monitoring data were considered to be representative of urban sections of the 407 East Transportation Corridor. The Newmarket monitoring station is located in the downtown, and its monitoring data were also considered to be representative of the urban sections of the 407 East Transportation Corridor. A five-year summary (1999-2003) of the measurements from these monitoring stations in the RSA is provided in **Table 8-3**.

Table 8-3 Summary of Ambient Measurements from MOE Station No. 45025, Ritson Road and Olive Avenue, Oshawa, MOE Station No. 48006, Eagle Street/McCaffrey Road, Newmarket [3-5]

Pollutant	Statistic	1999	2000	2001	2002	2003	Average
CO (ppm) ⁽¹⁾	1-hr Max	7.00	n/a	2.83	2.25	7.05	5
	8-hr Max	3.40	n/a	1.80	1.49	2.22	2
	Annual Mean	0.70	n/a	n/a	0.53	0.43	1
	1-hr 90 th Percentile	1.00	n/a	0.87	0.85	0.71	1
	Times > 1-hr AAQC (30 ppm)	0	n/a	0	0	0	0
	Times > 8-hr AAQC (13 ppm)	0	n/a	0	0	0	0
NO ₂ (ppb) ⁽²⁾	1-hr Max	95	84	85	83	82	86
	24-hr Max	53	47	50	40	48	48
	Annual Mean	22	20	19	17	16	19
	1-hr 90 th Percentile	39	37	35	33	31	35
	Times > 1-hr AAQC (200 ppb)	0	0	0	0	0	0
	Times > 24-hr AAQC (100 ppb)	0	0	0	0	0	0
PM _{2.5} TEOM (µg/m ³) ⁽³⁾	1-hr Max	83	55	68	133	60	80
	24-hr Max	57	34	40	57	46	47
	Annual Mean	10	8	9	9	8	9
	1-hr 90 th Percentile	22	19	20	21	17	20
	Times > 24-hr CWS (30 µg/m ³)	6	3	8	14	6	7
PM ₁₀ TEOM (µg/m ³) ^[3]	1-hr Max	138	92	113	222	100	133
	24-hr Max	95	57	67	95	77	78
	Annual Mean	16	14	15	15	13	15
	1-hr 90 th Percentile	37	32	33	35	28	33
	Times > 24-hr AAQC (50 µg/m ³) *	n/a	n/a	n/a	n/a	n/a	n/a

Notes: (1) Measurements taken from MOE Station No.48006, Eagle Street/McCaffrey Road, Newmarket
(2) Measurements taken from MOE Station No. 45025, Ritson Road and Olive Ave., Oshawa
(3) Measurements taken from MOE Station No.45025, Ritson Road and Olive Ave., Oshawa, PM₁₀ data was not available and was estimated using PM₁₀ = PM_{2.5}/0.6 (equation provided by MOE)
n/a – Not available
TEOM – Tapered Element Oscillating Microbalance (Continuous Monitor)
AAQC – Ambient Air Quality Criterion
CWS – Canada Wide Standard
* Interim AAQC

The review of historical ambient air quality measurements indicates that levels of CO and NO₂ are well below their respective ambient air quality guidelines at the monitoring sites. The PM₁₀ and PM_{2.5} air quality levels measured at Oshawa monitoring station are common to many cities in Southern Ontario, where there are infrequent measured levels in excess of guideline levels for particulate matter. Particulate matter levels are associated with long-range transport and complex chemical interactions in the atmosphere. Fine particulate matter is emitted from vehicles in addition to being formed in the atmosphere.

Table 8-4 provides a summary of ambient air quality data from the closest ambient air monitoring station to the 407 East Transportation Corridor (i.e., Oshawa at 2200 Simcoe St. N., near Durham College). Data from this station was applied, where available. Data for contaminants not monitored at this station were derived from the nearest alternative stations (Newmarket, Toronto and Windsor). The mean values are representative of typical conditions, 90th percentile values (exceeded only 10% of the time) are representative of credible worst-case conditions, and maximum values are representative of rare peak events. The measured values summarized in **Table 8-4** are from a combination of local and regional sources and trans boundary effects.

In the case of PM_{2.5}, elevated levels that occur during smog events are commonly related to regional photochemical processes. According to the MOE’s “Air Quality in Ontario – 2005 Report” and “Transboundary Air Quality in Ontario – 2005 Report”, trans-boundary air pollution (mainly from United States) is one of the largest contributors to Ontario’s smog events in the summer.

Table 8-4 Summary of Ambient Air Measurements (µg/m³)

Contaminant	Averaging Period	90th Percentile	Mean	Maximum	Threshold	No. of Times > Threshold
CO	1 hr	760	494	4,353	36,200	0
NO ₂	1 hr	28	INS	91	400	0
PM _{2.5}	24 hr	20	8	44	30	12
PM ₁₀ *	24 hr	33	-	-	50	-
TSP**	24 hr	76	-	-	120	-
1,3-Butadiene	24 hr	0.2	-	0.4	-	-
Benzene	24 hr	2.1	-	3.4	-	-
Formaldehyde	24 hr	4.5	-	6.6	65	-
Acetaldehyde	24 hr	3.2	-	5.0	500	-
Acrolein	24 hr	0.18	0.10	0.35	0.08	-

In the context of this air quality assessment, sensitive receptors refer to human land uses, residences, churches, daycare facilities, schools, hospitals and senior housing facilities throughout the study area. Special consideration is given to these latter receptors because of the increased potential for adverse health effects at these locations. A total of 1,861 sensitive receptors were identified within approximately 600 m of the 407 East Transportation Corridor.

8.2.2 Climate

The 407 East Transportation Corridor is in an area that represents the transition from Southwestern Ontario to Eastern Ontario. Climate normals based on data from Lester B. Pearson International Airport and Peterborough are presented in order to bracket the range of climate conditions along the length of the

Undertaking. Both the Pearson Airport and Peterborough are located several kilometres inland from the north shore of Lake Ontario, which is reasonably consistent with the location of 407 East. Data from these stations are summarized in **Table 8-5**.

Table 8-5 Regional Study Area Climate Normals

Parameter	Value	Units
Most frequent wind direction	W – NW	
Mean wind speed – January	13 – 18	Km/hr
Mean wind speed – July	9 – 12	Km/hr
Extreme gust speed	135	Km/hr
Daily max/min temperature – January	-2 to -4 / -11 to -14	°C
Daily max/min temperature – July	26 to 27 / 13 to 15	°C
Extreme minimum temperature	-31 to -38	°C
Extreme maximum temperature	36 to 38	°C
Average afternoon relative humidity	63	%
Annual snowfall	115 – 162	Cm
Annual rainfall	682 – 685	Mm
Average snow depth – February	6 - 22	Cm
Rainfall greater than 0.2 mm	112 – 117	Days/year
Snowfall greater than 1 cm	60 – 74	Days/year

Source: Canadian Climate Normals, 1971-2000 for Peterborough A and Pearson International A

The RSA generally has warm, humid summers and cold winters. Due to the moderating effect of the Great Lakes, the climate is relatively temperate, compared to mid-continental locations that are away from the lakes. During the summer months, the daytime temperatures are usually below 30°C and the night-time temperatures are typically around 15°C. Daytime humidity during the summer is moderate, usually averaging between 50 and 60%. Winter weather conditions are also moderate, with high temperatures usually above -10°C, and low temperatures seldom below -20°C.

The RSA receives between 115 and 162 cm of snowfall on an average winter, with the maximum depth of snow on the ground averaging at less than 22 cm. Snowfall occurs often through the winter, with appreciable amounts (greater than 1 cm) occurring on an average of 60 to 74 days/year.

Annual rainfall is around 682 to 685 mm. Like snowfall in winter, rain in the warmer months occurs fairly often, with appreciable rainfall (greater than 0.2 mm) occurring on 112 to 117 days/year, on average. The driest month of the year is February, with an average precipitation of 43 to 51 mm; however, the months with the fewest number of days of precipitation are June through August. July experiences an average of approximately 10 days of rainfall above 0.2 mm. The summer months generally experience a smaller number of heavier precipitation events, compared to other times of year. The wettest month tends to be August, with an average of 80 to 83 mm of rainfall.

Table 8-6 presents data on hazardous weather conditions in the RSA. Freezing rain is infrequent, typically occurring less than 22 hours/year, which is similar to most other parts of Southern Ontario, but lower than Eastern Ontario (Ottawa Valley) and some highland areas south of Georgian Bay (e.g., Shelburne, Ontario). The freezing rain is typically spread out over about 10 days/year.

Table 8-6 Regional Study Area Atmospheric Hazards

Parameter	Value	Units
Freezing Rain	17 – 22	Hours/year
Freezing Rain	9 – 11	Days/year
Snowfall greater than 10 cm	2 – 3	Days/year
Extreme snowfall	31 – 46	cm
Fog with 0 km visibility	8 – 15	Hours/year
Fog with visibility less than 1 km	26 – 27	Days/year
Rainfall greater than 25 mm	4 – 5	Days/year
Rainfall greater than 50 mm/hr or 75 mm in 3 hours	24 – 46	Events in 25 years
Consecutive 7-day wet periods	0 – 4	% of the time
Tornadoes	0.8 – 1.2	Tornadoes/yr/10,000 km ²

Source: Ontario.hazards.ca

Heavy snowfall events are also infrequent, with daily snowfalls greater than 10 cm generally occurring only 2 to 3 days/year. Very heavy snowfall events occur from time to time, with the extreme being in the range of 31 to 46 cm. Similarly, heavy rainfall events (greater than 25 mm) are infrequent, occurring 4 to 5 days/year on average. Very heavy rainfall rates, greater than 50 mm/hr, occur only 1 to 2 times per year.

Fog with visibility less than 1 km occurs about 27 days/year, on average, and fog with zero visibility occurs occasionally but very infrequently (only 8 to 15 hours/year).

The RSA is susceptible to tornadoes, with the annual average frequency being in the range of 0.8 to 1.2 tornadoes/ 10,000 km². This is lower than much of Southwestern Ontario, where the frequency is between 1.6 and 2 tornadoes/10,000 km².

8.3 Noise and Vibration (Transportation Corridor)

The following description of the environment potentially affected applies to the entire 407 East Transportation Corridor.

Sound is, in its simplest form, a dynamic, fluctuating pressure, in a fluid medium. That medium can be air, other gases, or liquids such as water. These fluctuations are transmitted by pressure waves through the medium from the source to the receiver. For the 407 East Transportation Corridor Environmental Screening, the primary interest is with sound waves in air, with human beings as the receptor. Noise is defined as unwanted sound. The standard practice within the acoustical industry is to use these two terms interchangeably.

People experience a wide range of sound levels in their daily activities. **Table 8-7** presents “typical” noise levels which might be encountered, and the general human perception of the level.

Table 8-7 Ranges of Sound Levels

Sound Levels		Sources of Noise
Human Perception	SPL, in dBA	
Deafening	125	Sonic booms
	120	Threshold of Feeling / Pain
	115	Maximum level, hard rock band concert
	110	Accelerating Motorcycle at a few feet away
Very Loud	105	Loud auto horn at 3 m (10 ft) away
	100	Dance club / maximum human vocal output at 1 m (3 ft) distance
	95	Jack hammer at 15 m (50 ft) distance
	90	Indoors in a noisy factory
Loud	85	Heavy truck pass-by at 15 m (50 ft) distance
	80	School cafeteria / noisy bar; Vacuum Cleaner at 1.5 m (5 ft)
	75	Near edge of major Highway
	70	Inside automobile at 60 km/h
	65	Normal human speech (unraised voice) at 1 m (3 ft) distance
Moderate	60	Typical background noise levels in a large department store
	55	General objective for outdoor sound levels; typical urban sound level (24h)
	50	Typical suburban / semi-rural sound level (24h)
	45	Typical noise levels in an office due to HVAC; typical rural levels (24h)
Faint	40	Typical background noise levels in a library
	35	
	30	Broadcast Studio
	25	Average whisper
Very Faint	20	Deep woods on a very calm day
	15	
	10	
	5	Human breathing
	0	Quietest sound that can be heard

Sound levels from 40 to 65 dBA are in the faint to moderate range. The vast majority of the outdoor noise environment, even within the busiest city cores, will lie within this area. Sound levels from 65 to 90 dBA are perceived as loud. This includes very noisy commercial and industrial areas. Sound levels greater than 90 dB are very loud to deafening and may result in hearing damage.

Ambient noise measurements were undertaken at various locations throughout the RSA using a Larson-Davis Model 824 Precision Integrating Sound Level Meter (SLM) and real-time analyzer. The measured data indicates that sound levels are higher in areas close to existing roadways with large volumes of traffic compared to areas which are surrounded by green space or agricultural lands. Within the RSA, ambient sound levels varied between a minimum level of 46 dBA and a maximum level of 69 dBA. Applying the human perception definitions in Table 3, noise levels in the RSA can be characterized as “moderate” to “loud”.

In an effort to manage noise levels from construction projects in their communities, several municipalities have enacted noise by-laws which stipulate the times of day when the operation of construction equipment is prohibited. **Table 8-8** identifies those jurisdictions that have such a by-law and their respective by-law provisions.

Table 8-8 Existing Municipal Noise By-laws

Jurisdiction	By-law No.	By-law Provision
Region of Durham	None	None
City of Pickering	6834/98	Operation of construction equipment prohibited: ▶ between 7 pm and 7 am, Monday to Saturday ▶ all day on Sundays and statutory holidays
Town of Ajax	60-98	Operation of construction equipment prohibited: ▶ between 8 pm and 7 am, Monday to Friday ▶ between 5 pm Friday and 9 am Saturday ▶ between 5 pm Saturday and 7 am Monday ▶ all day on Sundays and statutory holidays
Town of Whitby	292-70, as amended	Operation of construction equipment prohibited: ▶ between 8 pm and 7 am, Monday to Saturday ▶ all day on Sundays
City of Oshawa	112-82	Operation of construction equipment prohibited: ▶ between 7 pm and 7 am, Monday to Saturday ▶ all day on Sundays and statutory holidays
Municipality of Clarington	2007-071	Operation of construction equipment prohibited: ▶ between 11 pm and 7 am, Monday to Saturday ▶ between 11 pm Saturday and 10 am Sunday ▶ between 5 pm Sunday and 7 am Monday ▶ Sunday work not to include mechanically powered excavation or earth moving equipment

Under the MTO *Environmental Guide for Noise*, Noise Sensitive Areas (NSAs) include the following land uses, provided they have an Outdoor Living Area (OLA) associated with them (MTO 2006):

- Private homes (single family units and townhouses)
- Multiple unit buildings such as apartments, provided they have a communal OLA associated with them
- Hospitals and nursing homes for the aged, provided they have an OLA for use by patients
- Schools, educational facilities and daycare centres where there are OLAs for students
- Campgrounds that provide overnight accommodation
- Hotels and motels with outdoor communal OLAs (e.g., swimming pools) for visitors

Health Canada acts as an advisor on environmental noise issues to RAs under CEAA. In 2005, Health Canada personnel published a draft “Fact Sheet for Noise Issues”, outlining their proposed approach to conducting noise impact assessments (Health Canada, Draft Fact Sheet for Noise). Health Canada includes residential land uses as noise sensitive receptors. It also includes hospitals, schools, daycares, and senior’s residences, and sites where significant First Nations cultural or religious activities take place, but does not include commercial or industrial land uses and makes no mention of churches or non-First Nations places of worship. As these guidelines are still in draft form and still under considerable revision, they have not been applied directly to this project. In accordance with the direction of the EA Guidelines, Provincial noise policies (MTO’s *Environmental Guide for Noise*) have been used instead.

In total, there are an estimated 1,841 Noise Sensitive Areas (NSAs) within 500 m of the 407 East Transportation Corridor which may be potentially affected by noise.

8.4 Surface and Subsurface Geology and Soils (Transportation Corridor)

The following description of the environment potentially affected applies to the entire 407 East Transportation Corridor.

8.4.1 Surface Geology and Soils

The RSA for the 407 East Transportation Corridor is characterized, from north to south, by three east-west trending physiographic regions: the Oak Ridges Moraine (ORM), the South Slope, and the Iroquois Plain (Chapman and Putnam, 1984).

The ORM, which forms the northern boundary of the RSA, is one of the most distinctive physiographic regions in southern Ontario. It extends over 160 km from the Niagara Escarpment to the Trent River, ranges in width from 5 to 15 km, and reaches an elevation of about 400 m in places. The ORM in the RSA forms the drainage divide between water flowing south into Lake Ontario and water flowing north into the Trent-Severn Waterway system.

The ORM formed about 13,300 years ago in a glacial lake trapped between the Laurentide Ice Sheet to the north and a smaller lobe of ice in the Lake Ontario basin to the south. Its hummocky, knob-and-kettle surface topography reflects the variety of glacial and meltwater processes that led to its formation. The hills are predominantly composed of sand and gravel, but some, including the highest, are composed of till (Chapman and Putnam, 1984).

The South Slope physiographic region begins at a sharp break-in-slope on the south side of the ORM and slopes downward towards Lake Ontario (Chapman and Putnam, 1984). The South Slope is a gently rolling till plain, characterized by numerous drumlins oriented upslope. Upon deglaciation, about 12,000 years ago, meltwater streams cut sharp valleys in the till, locally exposing the underlying ORM sediments in the northern section.

The gently sloping lowland extending from the till plain of the South Slope down to Lake Ontario is the Iroquois Plain physiographic region (Chapman and Putnam, 1984). As glaciers retreated from the ORM, but while ice still occupied the St. Lawrence Valley, the area surrounding Lake Ontario was inundated by meltwater to an elevation of about 110 to 150 m (Sharp et al., 1999). While boulder pavements and gravel beaches formed along the shore of Glacial Lake Iroquois, sand was deposited in nearshore areas, grading to silts and clays in the more calm offshore areas. The shoreline bluff is still easily identified north of flat lying deposits of sand and provides a marked difference from the undulating till plains to the north. Although the glaciolacustrine sediments overlie till to depths of 20 m (Barnett, 1996), a few drumlins in the southeastern portion of the RSA remained islands even during the lake's highest stage.

8.4.2 Subsurface Geology

The influence of subsurface materials on groundwater movement necessitates a description of the geology within the RSA. Although the characteristics of the underlying bedrock are important in understanding regional-scale aquifers and groundwater flow, the shallow overburden sediments are most relevant to this

study, given their thickness and the relatively shallow impacts associated with highway construction. The following description proceeds from the lowermost (oldest) stratigraphic units to the uppermost (youngest) units. **Figure 8-1** provides an overview of the geological cross sections across the RSA.

The bedrock is comprised of flat-lying **Paleozoic limestones and shales** underlying the overburden sediments throughout the RSA. Both the limestone of the Lindsay Formation and the blue-grey shale of the Blue Mountain Formation¹ are Upper Ordovician in age (Liberty, 1969). Only minor outcrops of the rock exist in stream valleys near the shore of Lake Ontario. The topography is predominantly controlled by thick deposits of glacial sediments, which were deposited between about 135,000 and 12,000 years ago (Eyles, 2002).

The lowermost sediments were mainly deposited in proglacial lakes and overlie bedrock throughout the RSA. Because they are separated from the shallower sediments by a major aquitard² however, only a brief description of each stratigraphic unit is provided. The suite of lowermost sediments, from oldest to youngest, includes the Scarborough Formation, Sunnybrook Drift, and Thorncliffe Formation. These are described in sequence below.

The **Scarborough Formation** consists of 30 m of clayey silt, overlain by 20 m of sand aquifer (Kelly and Martini, 1986)³. It forms high bluffs along Lake Ontario and has been identified in drill core north of Lake Ontario (Sharp et al., 1999). The **Sunnybrook Drift**, an aquitard, is a clayey silt material with few stones (Karrow, 1967). This drift material is not continuous across the RSA but is a major marker bed when intersected. Inclusions of laminated clay and silt indicate that it may have been deposited subaqueously. These two deeper formations are often not present to the south.

The **Thorncliffe Formation**, comprising laminated clay, silt, and sand, is a major regional aquifer due to its extent and thickness (Karrow, 1967). It is exposed in lakeside bluffs and, according to deep water well records and seismic profiles (Pugin et al., 1996), extends northward beneath the Oak Ridges Moraine. The Thorncliffe Formation thins eastward and is overlain and separated from shallow aquifers, by the Newmarket Till.

The **Newmarket Till** was deposited, initially into standing water formed in advance of the Laurentide Ice Sheet. It is laterally extensive within the Greater Toronto Area and extends across the entire RSA. The Newmarket Till has a distinct and consistent lithology (Sharp et al., 1999), and is a dense, stony, sandy silt diamicton, ranging in thickness from about 5 to 50 m. It occurs as beds 3 to 5 m thick, locally separated by stone lines and sandy interbeds, 1 to 5 m thick (Sharp et al., 1999). Most drumlins within the RSA, including those in the Bowmanville area, are composed of Newmarket Till⁴. The hydrogeological significance of the Newmarket Till is that it separates the major underlying aquifers from the permeable Oak Ridges Moraine sediments.

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1. Also referred to locally as the Whitby Formation
 2. An aquitard is a layer of soil or rock that substantially impedes but does not entirely stop groundwater movement.
 3. Thicknesses are reported based on the literature, and will vary across the RSA.
 4. Older documents refer to the Newmarket Till as the Bowmanville Till, although this term is no longer in use.

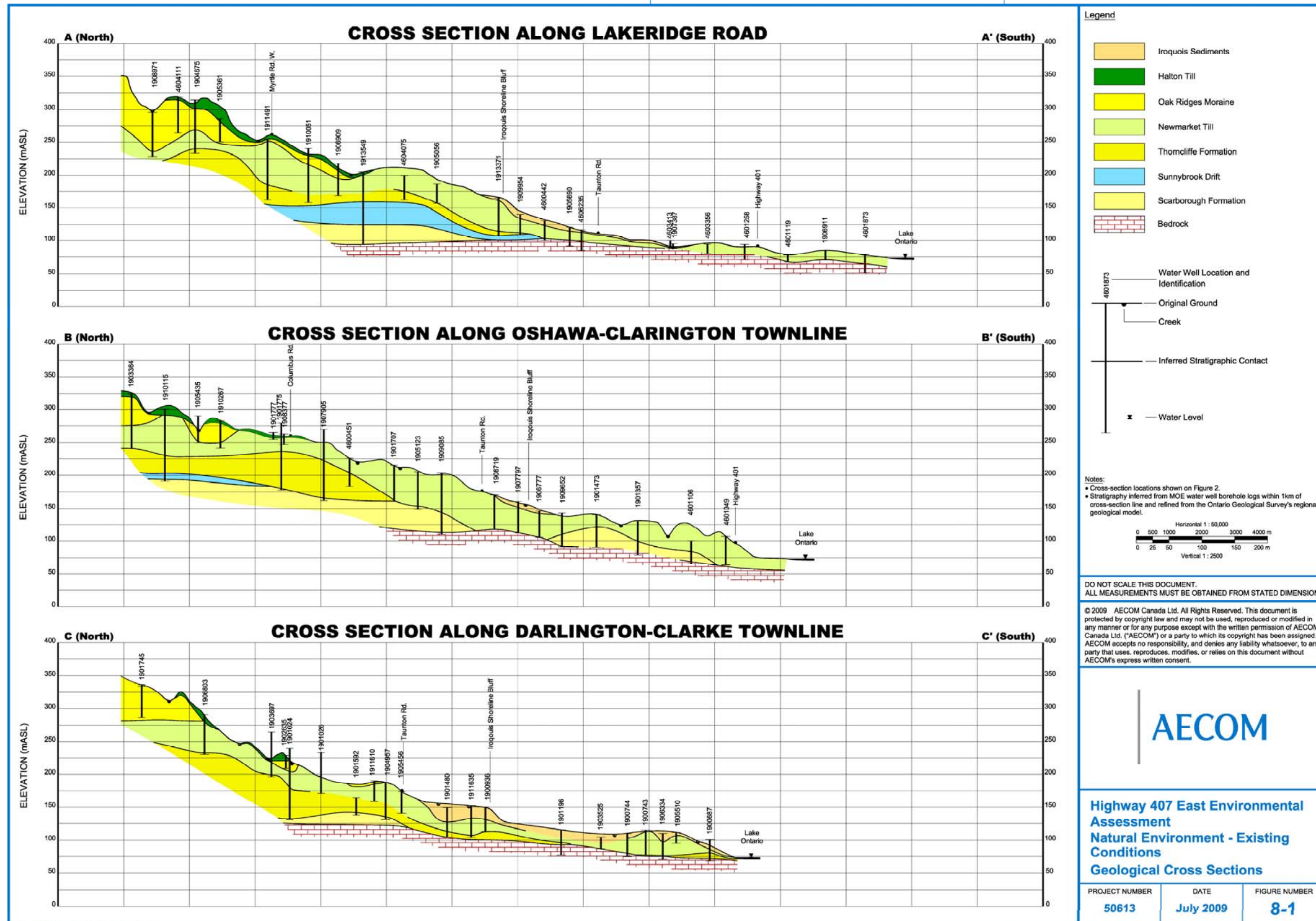


Figure 8-1 Geological Cross-Sections

The **Oak Ridges Moraine** (ORM) was deposited about 13,300 years ago on the meltwater flood-scoured surface of the Newmarket Till (Barnett et al., 1998) in a deep glacial lake. This lake was trapped between the Laurentide Ice Sheet to the north and a separate ice lobe in the Lake Ontario basin to the south. Whereas the core is largely the result of glaciofluvial deposition, the flanks of the moraine better reflect glaciolacustrine sedimentation. The ORM consists of four major wedges of stratified sediment (Sharp et al., 1999), their depths partly controlled by the irregular erosional surface on which they were deposited. Fine sands and silt are dominant near the ground surface, but coarse sands and gravels are common at depth and in fans (Barnett, 1995). Sharpe et al. (1996) identified a few soil deposits of tens of metres, which become coarser with depth, which grade from medium sand to silty clay laminate. Numerous “finger-like” protrusions of highly permeable ORM sediments extend southward toward Lake Ontario, but pinch out beneath the Halton Till. These are occasionally exposed at surface where valleys have incised the Halton till.

Re-advance of the southern lobe of the ice sheet near the end of the last glaciation (~12,000 years ago) deposited the **Halton Till** on the Newmarket Till and/or the ORM. The Halton Till ranges in thickness from about 10 to 20 m and thins within the RSA to the north and east. It has a predominantly clayey silt to silt matrix and contains isolated lenses of laminated sand, silt, and clay (Sharp et al., 1999). Stones held within the silty matrix are generally fine to coarse gravel-sized fragments of subangular to subrounded shale and limestone. Where the Halton Till is thin, gravel pits have been established to extract aggregate from the underlying ORM sediments.

As the ice retreated eastward in the Lake Ontario basin, meltwater was impounded within the basin to an elevation of approximately 110 to 150 m in the RSA (Sharp et al., 1999). Wave action along the shores of this glacial lake (called Lake Iroquois) eroded the till uplands and formed gravelly beaches, which are still visible today. Nearshore deposits of sand and gravel grade to laminated silt and clay in the offshore areas where water was more calm. These glacial lake sediments are up to 20 m thick in the lowlands around the shore of Lake Ontario (Barnett, 1996).

Considerable erosion and re-deposition of glacial sediments occurred following deglaciation. Streams cut gullies through till and glaciolacustrine plains, and wind erosion stripped fine sediment from exposed hills and deposited it in sand dunes or hollows. Organic material accumulated in isolated basins and kettles, particularly where groundwater upwelled. Revegetation of plains and hillsides reduced sediment delivery to watercourses, thereby causing rivers to incise and abandon old floodplains.

8.5 Groundwater (Transportation Corridor)

The following description of the environment potentially affected applies to the entire 407 East Transportation Corridor.

8.5.1 Hydrostratigraphic Units

The hydrostratigraphic units that comprise the shallow groundwater system are classified as either aquifers or aquitards:

Aquifers:An aquifer is classically defined as a layer of soil that is permeable enough to permit a usable supply of water to be extracted.

Aquitards:.....An aquitard is a layer of soil that inhibits groundwater movement due to its low permeability.

The shallow groundwater system within the RSA is influenced by four key hydrostratigraphic units: the Newmarket Aquitard, Oak Ridges Moraine Aquifer, Halton Till Aquitard, and Iroquois Plain Shallow Aquifer comprising sands and silts over clay.

The **Newmarket Aquitard** is a major regional aquitard, given its low hydraulic conductivity (10^{-9} to 10^{-8} cm/s, Sharp et al., 1996) and consistent presence throughout the RSA. It separates the shallow aquifers from the deep aquifers. For these reasons this report focuses on the more shallow groundwater system. Where Newmarket Till is exposed at the surface, such as on the lower South Slope, the water table is high within the till because of the poorly drained till soils. In such areas, a well developed surface drainage network is visible in aerial photographs, due to centuries of erosion.

The **Oak Ridges Moraine Aquifer** is a major regional aquifer within the RSA and an important groundwater recharge area. Its sandy and gravelly composition gives it a high permeability and, combined with the hummocky surface topography, facilitates infiltration. Recharge rates along the crest of the moraine are more than four times greater than on the south flank of the moraine (EarthFx, 2004). The lack of streams along the crest of the moraine is a testament to the high permeability of the sediments. Coarse-grained sediments associated with the ORM extend and thin southward, acting as important aquifers for residential use. The major contribution to groundwater recharge provided by the ORM highlights the importance of maintaining a contaminant-free natural ground surface in the crest area.

The **Halton Till Aquitard** is a clayey silt to silt till with hydraulic conductivities ranging from about 10^{-8} to 10^{-4} cm/s (Interim Waste Authority, 1994). Differences in conductivities are due to spatial differences in matrix composition, interstitial lenses of sand, and degree of weathering. On a regional scale, the Halton Till Aquitard acts as a surficial aquitard, inhibiting local groundwater recharge and reducing the exposure of underlying aquifers to contamination (Sharp et al., 1996). Isolated lenses of silt and fine sand within the till, however, collect groundwater and locally provide enough water for residential use. Fields underlain by Halton Till are distinguished in aerial photographs from those underlain by ORM sediments on the basis of their well developed surface drainage networks.⁵

In the southern half of the RSA, shoreline sand and gravel deposits and glaciolacustrine silts and clays from Glacial Lake Iroquois overlie the Newmarket Till. Where the surficial sands are permeable enough, they form the unconfined **Iroquois Plain Shallow Aquifer**. The high permeability of the sandy nearshore deposits provides a pathway for local groundwater upwelling. The water table is typically near surface because the underlying clays on the Newmarket Till do not permit drainage to depth. Therefore numerous wetlands and lowland stream headwaters coincide with the Iroquois sands. The low permeability silt and clay plains farther south inhibit both groundwater recharge and discharge. Precipitation and snowmelt in this area runs off the surface directly into stream channels and most groundwater flow at this point enters Lake Ontario directly.

5. This is because the ORM deposits are very permeable and precipitation merely soaks in, leaving little runoff to erode channels.

8.5.2 Groundwater Flow

Groundwater flow is the result of differences in hydraulic head or, simply stated, water table elevation, from one location to another. Numerous studies, based on water well records, include water table contour maps (e.g., Singer, 1974; Funk, 1977). Water table contours subtly reflect the topographic contours in the RSA, indicating the influence of topography on the shallow groundwater flow system. Regional groundwater flow in the aquifers within the RSA is south-southeast from the ORM towards Lake Ontario, except where major river valleys exist. Locally, groundwater flow paths bend into river valleys and isolated topographic depressions.

8.5.3 Groundwater Recharge

Recharge is the term used to describe downward flowing groundwater, that is, from the ground surface towards the water table. Of all precipitation that reaches the ground surface, some is lost to evapotranspiration and some runs off the surface directly into streams. The remainder infiltrates into the ground. Recharge areas are important because they replenish the groundwater. As mentioned, the ORM (where exposed) exhibits the greatest rate of groundwater recharge in the RSA. Nearly all of the precipitation infiltrates into the crest area of the ORM due to the high permeabilities of these surficial deposits. Piezometer nests installed in the ORM confirm downward groundwater flow directions and a deep water table (e.g., Singer, 1977). Minor groundwater recharge also occurs in areas of the South Slope that are underlain by ORM sediments and where the Halton Till is thin. In the areas of thicker Halton Till and/or Newmarket Till, runoff exceeds recharge due to these low permeability deposits.

Groundwater recharge is not limited to the crest of the ORM. Topographic highs are generally groundwater recharge zones. For example, groundwater commonly flows slowly downward within ridges between streams and within drumlins. Although groundwater discharge is predominant along the Iroquois shoreline, groundwater flow in the Iroquois Plain Shallow Aquifer is predominantly horizontal due to the Newmarket Aquitard below. In fact, some piezometer nests indicate localized recharge areas within the nearshore deposits of the Iroquois Plain (Funk, 1977).

8.5.4 Groundwater Discharge

Discharge is defined as upward flowing groundwater that is where the water table intersects the ground surface. Groundwater discharge is important for a variety of reasons. First, it sustains a minimum flow (baseflow) in some streams, commonly even during the dry months of summer. Without groundwater contributions, many fish-bearing streams in the RSA would dry up periodically throughout the year. Second, it moderates stream temperatures, particularly during hot summer days, and dampens stream temperature fluctuations. Fish species such as Brook Trout in the RSA are highly sensitive to changes in water temperature. Third, groundwater upwelling supports wetland vegetation and animal habitat. Fourth, some water bottling companies (e.g., Claremont Springs) obtain their water from groundwater springs located in the flanks of the ORM.

EarthFx (2004) estimates that nearly 90% of the groundwater recharge that occurs between Lake Ontario and the crest of the ORM discharges into stream networks. That study was conducted to the west of this RSA;

however, the geology is very similar and hence the same effect can be expected here. Groundwater flow paths are commonly directed towards topographic lows such as stream valleys. As long as the permeability of the sediment within which the stream exists is sufficiently high, enough groundwater can flow into the beds and from the banks of streams. The groundwater contribution, or baseflow, varies seasonally, from reach to reach, and from stream to stream. For instance, nearly all water flowing within a particular stream during the dry summer months or cold winter months may be baseflow. During and immediately after storms and during spring freshet, however, baseflow may comprise only a small fraction of the total stream flow.

Streams that are perched in low permeability tills may derive much of their water from surface runoff; such streams are commonly ephemeral. Regionally, streams that originate from the ORM warm up as they flow over the South Slope till soils due to little moderation by groundwater. Streams that originate on the low permeability till plain of the lower South Slope initially derive most of their water from surface runoff, but receive a significant proportion of their flow from groundwater discharge as they flow across the sandy Iroquois shoreline. Piezometer nests located along the sharp break-in-slope between the ORM and the South Slope indicate local upward gradients and even, locally, artesian conditions (Funk, 1977). Shallow groundwater discharges where the sand and gravel of the ORM pinches out beneath the Halton Till and create stream headwaters.

The watercourse thermal ratings provide a preliminary indication of the local groundwater contribution to stream flows. Reaches that provide cold water aquatic habitat likely have a significant baseflow contribution, whereas reaches designated as warm water are likely dominated by surface runoff. This thermal assessment provides further evidence for areas of groundwater discharge. For example, several small streams originate in springs near the Iroquois shoreline and have been defined as “cold water”. Their designation changes to warm water as the decline in cold groundwater volumes eliminates thermal buffering on the clay plain bordering Lake Ontario.

Some wetlands exist in depressions where surface water becomes trapped due to topography and underlying low permeability sediments. However, many wetlands within the RSA are associated with areas of groundwater discharge. The high water table and localized groundwater upwelling within the Iroquois sands provide ideal conditions for wetlands to form. A variety of vegetation species found in such wetlands rely on groundwater, not just as a source of relatively cold water, but also for its particular concentrations of certain minerals. For example, watercress, a common wetland species within the area, is generally found in wetland areas sustained, at least partially, by groundwater discharge.

8.5.5 Groundwater Wells and Groundwater Quality

A residential water well survey was undertaken in 2008 within a 1 km radius of the 407 East Transportation Corridor ROW centreline where sand deposits are present at surface and within a 500 m radius of the transportation corridor ROW centreline where till deposits are present at surface. A total of 1,328 residential groundwater wells were documented. Of the documented private wells:

- 327 (25%) are shallow dug wells;
- 191 (14%) are deep drilled wells; and,
- 810 (61%) have unknown construction details because the well owner was not available for an interview or did not know the construction details of their well.

A well survey was undertaken for all homes and businesses identified as having a groundwater well. While all homes and businesses were visited, interviews were only possible with 574 residents (43.2%). Well water quality samples were collected at 87 residences to obtain a representative lateral and vertical distribution of the baseline water quality across the study area. Wells were selected to gather information from upgradient and downgradient of the 407 East Transportation Corridor, to gather information from shallow and deep aquifer units, and to gather information from low sensitivity and high sensitivity aquifer units. All wells considered to be at risk were included in the program, if possible.

8.6 Surface Water (Projects subject to Federal EA)

The following description of the environment potentially affected applies to the Projects subject to Federal EA. An overview of the 407 East Transportation Corridor RSA (by watershed) is provided as context for the detailed description of the individual Projects subject to Federal EA.

8.6.1 Regional Overview

There are thirteen major watercourses and their associated watersheds within the RSA, crossing the jurisdictions of Toronto and Region Conservation Authority (TRCA), Central Lake Ontario Conservation Authority (CLOCA) and Ganaraska Region Conservation Authority (GRCA). The watercourses and watersheds traversed by the 407 East Transportation Corridor RSA are shown on **Figure 7-1**. The area drained by each of the major watercourses are shown in **Table 8-9** below.

Table 8-9 Drainage Areas of Major Watersheds

Major Watershed	Area (ha)
Duffins Creek	28,766
Carruthers Creek	3,830
Lynde Creek	13,497
Pringle Creek	3,082
Corbett Creek	1,490
Oshawa Creek	10,797
Goodman Creek	982.0
Farewell Creek	3,707
Harmony Creek	4,849
Black Creek	2,359
Bowmanville Creek	9,048
Soper Creek	7,915
Wilmot Creek	8,797

Each major watercourse and its associated watershed are described below. Smaller watercourses within the RSA, with drainage areas from 3 to 6 km², flow directly into Lake Ontario. These include Robinson Creek, Tooley Creek, Darlington Creek and West Side Creek, which collectively drain 39 km² of Lake Iroquois Plain between Farewell Creek and Bowmanville Creek.

Duffins Creek

The Duffins Creek watershed lies primarily within the Regional Municipality of Durham (Durham Region), however the western limits extend into the Regional Municipality of York. The Duffins Creek watershed is the largest watershed in the 407 East Transportation Corridor RSA at approximately 28,766 ha and is noted as the healthiest watershed in Toronto Region Conservation Authority's jurisdiction (Cook and Clayton 2004).

The headwaters of Duffins Creek originate on the Oak Ridges Moraine. From the ORM, the creek crosses the Halton Till Plain, the Lake Iroquois Shoreline and the Lake Iroquois Plain, where it empties into Lake Ontario at the Duffins Creek Marsh. Water quality for Duffins Creek was assessed using water quality parameters from the Provincial Water Quality Monitoring Network (PWQMN) over a 20-year period (TRCA 2003). Duffins Creek tributaries have the best water quality conditions of all streams within the TRCA jurisdiction (TRCA 2003).

Carruthers Creek

The Carruthers Creek watershed lies completely within Durham Region but crosses two municipal jurisdictions: the City of Pickering and the Town of Ajax. The watershed is approximately 3,830 ha, 20 km long and 3 km at its widest point. Unlike many of the Lake Ontario watersheds, the headwaters of Carruthers Creek are not on the ORM, but rather on the Halton Till Plain, north of Highway 7. From the Halton Till Plain, Carruthers Creek crosses the shoreline of glacial Lake Iroquois and flows across the Lake Iroquois Plain, where it empties into Lake Ontario at the Carruthers Creek Marsh (TRCA 2003). Water quality for Carruthers Creek was assessed using water quality parameters from the PWQMN between 1983 and 1993 (TRCA 2003). Water quality conditions are generally good in comparison to other watersheds in the TRCA jurisdiction (TRCA 2003).

Lynde Creek

The Lynde Creek watershed lies completely within Durham Region and crosses several municipal jurisdictions including the Town of Whitby, Town of Ajax, City of Pickering, City of Oshawa, Township of Scugog and Township of Uxbridge. The watershed is the second largest watershed in the 407 East Transportation Corridor RSA, occupying approximately 13,497 ha. Lynde Creek headwaters originate on the ORM. The creek crosses the Till Plain, Lake Iroquois Shoreline and Lake Iroquois Plain before outletting to Lake Ontario at the Lynde Creek Marsh.

Pringle Creek

The Pringle Creek watershed lies completely within Durham Region and crosses two municipal jurisdictions: the Town of Whitby and the City of Oshawa. The watershed is relatively small, about 3,082 ha. The Pringle Creek headwaters originate on the Till Plain. The creek crosses the Lake Iroquois Shoreline and Lake Iroquois Plain before outletting to Lake Ontario.

Corbett Creek

The Corbett Creek watershed lies completely within Durham Region and crosses two municipal jurisdictions: the Town of Whitby and the City of Oshawa. Corbett Creek is a small watershed, about 1,490 ha, and is

largely urbanized (4.1% forested based on OMNR NRVIS mapping). Both the east and west branches of Corbett Creek headwaters originate on the Lake Iroquois Plain and outlet to Lake Ontario at the Corbett Creek Marsh, in the Town of Whitby.

Goodman Creek

Goodman Creek is a tributary of Oshawa Creek and converges with the main branch of Oshawa Creek from the west. The Goodman Creek watershed lies entirely within Durham Region and primarily within the City of Oshawa. The watershed limits cross into the Town of Whitby. Goodman Creek has the second smallest watershed in the 407 East Transportation Corridor RSA, about 982 ha, and is highly urbanized. The watershed is 12.3% forested (OMNR NRVIS mapping).

The headwaters of Goodman Creek do not originate on the ORM, but rather from a wetland in the Lake Iroquois Beach physiographic region. Goodman Creek then flows through the Lake Iroquois Plain before converging with Oshawa Creek, north of Bloor Street (CLOCA 2002).

Biological water quality sampling was conducted by CLOCA using a Water Quality Index (WQI) based on a study of the benthic macroinvertebrate community at discrete sampling points throughout the Oshawa and Goodman Creek systems (CLOCA 2002). The only water quality sampling station in Goodman Creek was located near the confluence with Oshawa Creek, in a high-density residential area. This station revealed impaired water quality with organic pollution and nutrient enrichment (CLOCA 2002). Chemical water quality testing that was completed in 1995 found that Goodman Creek had “consistently poor quality for virtually all of the chemical parameters” (CLOCA 2002).

Oshawa Creek

The Oshawa Creek watershed lies completely within the Durham Region and crosses four municipal jurisdictions: the Town of Whitby, City of Oshawa, Municipality of Clarington and the Township of Scugog. The watershed is the third largest watershed in the 407 East Transportation Corridor RSA, about 10,797 ha. Of this total area, 14.8% of the watershed is forested (OMNR NRVIS mapping).

The headwaters of Oshawa Creek originate on the ORM from four main branches. From there the creek flows south across the Till Plain, Lake Iroquois Beach, and the Lake Iroquois Plain where it outlets to Lake Ontario at the Oshawa Harbour.

Biological water quality sampling was conducted by CLOCA using a Water Quality Index (WQI) based on a study of the benthic macroinvertebrate community at several discrete sampling points throughout the Oshawa Creek system (CLOCA 2002). The following key conclusions from that work were:

- a) 75% of all study sites within urban areas had impaired water quality;
- b) 83% of all study sites within agricultural areas had impaired water quality, however the magnitude of impairment was not as severe as in urban / suburban or built up areas; and
- c) none of the study sites located within natural areas showed any indication of water quality impairment (CLOCA 2002).

Several chemical water quality studies have been carried out within the Oshawa Creek watershed (CLOCA, 2002). Results of those studies generally support the conclusions drawn from the biological water quality testing (CLOCA 2002).

Farewell Creek

The Farewell Creek Watershed occurs largely in the Municipality of Clarington, draining into the City of Oshawa in its lower reaches and outletting at Oshawa Second Marsh. Farewell Creek has two major tributaries (Black and Harmony Creeks) and a combined watershed of 10,915 ha. The main branch of Farewell Creek and Black Creek Tributary originate in the drumlinized till on the South Slope of the ORM. Flowing south, Farewell Creek meets the Lake Iroquois Shoreline, then flows southwest to Lake Ontario through Oshawa Second Marsh. The Farewell Creek watershed is 16.4% forested (OMNR NRVIS mapping).

With respect to water quality, the headwaters of Farewell Creek are described as fairly clean with a small amount of nutrient input and contaminants (CLOCA 1979). Further downstream, just north of Highway 401, water quality was again described as fairly good, but indicators of nutrient inputs have been documented (CLOCA 1979).

Black Creek

Black Creek is a tributary of Farewell Creek with the confluence located at the Lake Iroquois Shoreline. Based on OMNR NRVIS mapping, the watershed is 23% forested. Water quality in the headwaters of Black Creek is described as having considerable nutrient enrichment, likely, in part, attributed to the location of a duck pond upstream of the water sampling station (CLOCA 1979). Water sampled further downstream was recorded as having good water quality.

Harmony Creek

Harmony Creek and its tributaries originate in the Lake Iroquois Beach area, north of the City of Oshawa. The main channel flows south through the Harmony Valley Wetland/Golf Course Wetland and continues south where it meanders within the heavily developed East Oshawa urban area. It merges with Farewell Creek about 2 km north of Oshawa Second Marsh within the City of Oshawa. Of the total area of the watershed, 10.6% is forested (OMNR NRVIS mapping).

Water sampled in the upstream reaches of Harmony Creek had a small amount of organic enrichment and slightly high levels of phosphorus and nitrogen reflected in the presence of Canadian pondweed (CLOCA 1979). Water quality just north of Highway 401 is fairly poor with evidence of pollutants entering the creek (CLOCA 1979). The Harmony Creek Watershed Plan Study concluded surface water quality does not appear to have a significant impact on the environmental health of the stream system, although exceedance of Provincial Water Quality Objectives (PWQO) occur (Aquafor Beech Limited 2001).

Bowmanville Creek

Bowmanville Creek and its major tributary, Soper Creek, originate in the ORM. Bowmanville Creek flows southeast to its confluence with the Soper Creek about 2.5 km from its outlet into Lake Ontario. The

Bowmanville/Soper Creek watershed is one of the largest and least urbanized of the watersheds under CLOCA's jurisdiction, draining a total of 16,963 ha. The watershed is 29.1% forested, based on OMNR NRVIS mapping.

The Bowmanville Creek Watershed Aquatic Resource Management Plan (CLOCA *et al.* 2000) concludes that the majority of the Bowmanville/Soper Creek watershed is unimpaired with respect to water quality. The main east and west branches of Bowmanville Creek, although unimpaired, are organically enriched (CLOCA *et al.* 2000). The main branch of Bowmanville Creek that runs through the Town of Bowmanville, also considered unimpaired, has lower WQI values than other areas as a result of adjacent, older developments in this area without stormwater treatment facilities (CLOCA *et al.* 2000).

Soper Creek

Although the Soper Creek is largely unimpaired, the east branch of Soper Creek is described as being impaired by a lack of riparian vegetation and its close proximity to intensive agriculture (CLOCA *et al.*, 2000).

Wilmot Creek

The headwaters of the Wilmot Creek watershed originate within the ORM. Wilmot Creek outlets to Lake Ontario southwest of the Town of Newcastle through the Wilmot Rivermouth Wetland. The forest cover for this watershed is 23.1% (OMNR NRVIS mapping).

8.6.2 Local Study Area

The following table provides a description of the existing environmental conditions related to Surface Water within each Local Study Area, corresponding to each of the Projects subject to the Federal EA (as presented in **Table 8-10**). Overall, none of the watercourses are used as a supply of drinking water. Although none of the watercourses were considered to be navigable at the point of crossing and are unlikely to be used for recreational purposes such as boating, they may be used by some local residents for recreational purposes such as fishing, nature viewing and unorganized play.

Table 8-10 Existing Surface Water Conditions for Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions
West Mainline – Section 1 (Brock Road to Audley Road)	Project Site 1	▶ None Identified
	Project Site 3	▶ The site crossing is part of the Duffins Creek Watershed and the west branch of Brougham Creek. ▶ The drainage area of the crossing site is 363.3 ha. ▶ Immediately downstream of Sideline 16 culvert the channel displays bank and valley wall erosion, but then the channel narrows, displays a steep channel gradient and low lying banks further downstream. ▶ Modelled flow rates vary from 2.19m ³ /s (2-year storm event) to 28.8 m ³ /s (Regional storm event)
	Project Site 3a	▶ The site is part of the Duffins Creek Watershed and the west branch of Brougham Creek. ▶ The drainage area of the crossing site is 404.2 ha. ▶ Modelled flow rates vary from 2.20m ³ /s (2-year storm event) to 30.11 m ³ /s (Regional storm event)
	Project Site 7	▶ The site is part of the Duffins Creek Watershed and is a tributary of Brougham Creek. This tributary flows south through two-on-line ponds upstream of Highway 7 before joining ▶ The drainage area of the crossing site is 113 ha. ▶ Within the proposed 407 ROW the channel displays active bank erosion and sedimentation (infilling). ▶ Modelled flow rates vary from 1.9m ³ /s (2-year storm event) to 13.9 m ³ /s (Regional storm event)

Table 8-10 Existing Surface Water Conditions for Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions
	Project Site 8	<ul style="list-style-type: none"> ▶ The site is part of the Duffins Creek watershed and part of Spring Creek. ▶ The drainage area of the crossing site is 402.8 ha. ▶ The watercourse flows in a southeastern direction from its origin. ▶ Modelled flow rates vary from 2.51m³/s (2-year storm event) to 30.07 m³/s (Regional storm event)
	Project Site 9	<ul style="list-style-type: none"> ▶ The site is part of the Duffins Creek Watershed and is located on the main branch of East Duffins Creek. It is a permanent watercourse that flows in a southerly direction. ▶ Flows originate within the Oak Ridges Moraine. ▶ The drainage area is 6410 ha. ▶ Modelled flow rates vary from 18.4m³/s (2-year storm event) to 338.3 m³/s (Regional storm event)
	Project Site 11	<ul style="list-style-type: none"> ▶ The crossing is part of Carruthers Creek Watershed and is one of five tributaries of Carruthers Creek crossed by the 407 mainline. ▶ The drainage area is 329 ha. ▶ Channel is relatively deep and well defined ▶ Modelled flow rates vary from 4.0m³/s (2-year storm event) to 32.8 m³/s (Regional storm event)
	Project Site 12	<ul style="list-style-type: none"> ▶ The site is part of Carruthers Creek watershed a tributary of Carruthers Creek. ▶ The drainage area for this crossing is 191.5 ha. ▶ Based on field observations, the flow is not continuous during the summer months at least some years. ▶ Modelled flow rates vary from 2.17m³/s (2-year storm event) to 21.96 m³/s (Regional storm event)
West Mainline – Section 2 (Audley Road to Ashburn Road)	Project Site 17	<ul style="list-style-type: none"> ▶ The site is part of the Lynde Creek Watershed and is an intermittent tributary of Lynde Creek. ▶ The watercourse through the ROW is relatively straight. ▶ The drainage area for this water crossing is 162 ha. ▶ Modelled flow rates vary from 1.02m³/s (2-year storm event) to 14.54 m³/s (Regional storm event)
	Project Site 18	<ul style="list-style-type: none"> ▶ The site is part of the Lynde Creek Watershed and is an intermittent tributary of Lynde Creek. ▶ The drainage area for the site is 67.5 ha. ▶ The channel is uniform with a linear morphology and stable banks ▶ Modelled flow rates vary from 0.51m³/s (2-year storm event) to 6.72 m³/s (Regional storm event)
	Project Site 19	<ul style="list-style-type: none"> ▶ The site is part of the Lynde Creek Watershed and is located on West Lynde Creek. ▶ Headwaters of West Lynde Creek originate within the Oak Ridges Moraine. Flow is permanent. ▶ The channel has a relatively straight plan form, with gentle meanders through the ROW ▶ The drainage area is 1820.3 ha. ▶ Modelled flow rates vary from 7.36m³/s (2-year storm event) to 138.23 m³/s (Regional storm event)
	Project Site 20	<ul style="list-style-type: none"> ▶ The crossing is located within the Lynde Creek Watershed and is an intermittent tributary of West Lynde Creek. ▶ The drainage area for this site is 559.5 ha. ▶ Modelled flow rates vary from 2.22 m³/s (2-year storm event) to 39.10 m³/s (Regional storm event)
	Project Site 21	<ul style="list-style-type: none"> ▶ The crossing is located within the Lynde Creek Watershed and is an intermittent tributary of Lynde Creek. ▶ The drainage area for this site is 451.9 ha. ▶ Modelled flow rates vary from 1.92m³/s (2-year storm event) to 34.05 m³/s (Regional storm event)
Central Mainline – Section 3 (Ashburn Road to Simcoe Street)	Project Site 24	<ul style="list-style-type: none"> ▶ The site is part of the Lynde Creek Watershed and is on the main branch of Lynde Creek and it supports a permanent flow through a well defined meandering channel. ▶ The drainage area for this site is 4036 ha. ▶ Modelled flow rates vary from 19.2m³/s (2-year storm event) to 316.1 m³/s (Regional storm event)
	Project Site 28	<ul style="list-style-type: none"> ▶ The site is part of the Oshawa Creek Watershed and is located on Oshawa Creek West. ▶ The upstream drainage area of the site crossing is 3625 ha. ▶ The site supports a permanent flow in a well defined, stable, meandering channel. ▶ Modelled flow rates vary from 41.8 m³/s (2-year storm event) to 377.9 m³/s (Regional storm event)
Central Mainline – Section 4 (Simcoe Street to Enfield Road)	Project Site 35	<ul style="list-style-type: none"> ▶ The site crossing is part of the Oshawa Creek Watershed and is situated on the east branch of Oshawa Creek. ▶ The creek flows in southerly direction. ▶ The drainage area for the site crossing is 2012 ha. ▶ Modelled flow rates up to 205.39 m³/s (Regional storm event)
	Project Site 38 a	<ul style="list-style-type: none"> ▶ The site is part of the Oshawa Creek Watershed and is a permanent coldwater tributary of Oshawa Creek East. ▶ The drainage area for this site is 1193.7 ha. ▶ Modelled flow rates vary from 5.47m³/s (2-year storm event) to 97.40 m³/s (Regional storm event)
	Project Site 54	<ul style="list-style-type: none"> ▶ The site crossing is located within the Harmony Creek watershed and is an intermittent tributary of Harmony Creek ▶ The drainage area for this site is 341.4 ha. ▶ Modelled flow rates vary from 2.03m³/s (2-year storm event) to 28.24m³/s (Regional storm event)

Table 8-10 Existing Surface Water Conditions for Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions
East Mainline – Section 5 (Enfield Road to Highway 35/115)	Project Site 57a	<ul style="list-style-type: none"> ▶ The site crossing is part of the Farewell Creek Watershed and Farewell Creek which flows from the northwest to the east with a northern tributary joining the main branch east of Enfield Road. ▶ The drainage area for this site is 509.4 ha. ▶ Modelled flow rates vary from 2.43m³/s (2-year storm event) to 39.02m³/s (Regional storm event)
West Link – Section 6 (West Durham Link)	Project Site 44	<ul style="list-style-type: none"> ▶ The site is located within the Lynde Creek watershed and is an intermittent tributary of Lynde Creek. ▶ The channel is moderately meandering with evidence of seasonal fluctuations in flow. ▶ The drainage area for the site is 427 ha. ▶ Modelled flow rates vary from 1.93m³/s (2-year storm event) to 33.12m³/s (Regional storm event)
	Project Site 47	<ul style="list-style-type: none"> ▶ The site is part of the Lynde Creek Watershed and is an intermittent tributary of Lynde Creek ▶ The drainage area for the site is 591 ha. ▶ Modelled flow rates vary from 2.49m³/s (2-year storm event) to 38.85m³/s (Regional storm event)
	Project Site 47a	<ul style="list-style-type: none"> ▶ The site is part of the Lynde Creek Watershed and is an intermittent tributary of Lynde Creek
	Project Site 51	<ul style="list-style-type: none"> ▶ The crossing is part of the Lynde Creek Watershed and is situated on Tributary A of Lynde Creek. ▶ The drainage area for the site is 1838.5 ha ▶ Modelled flow rates vary from 8.57m³/s (2-year storm event) to 134.46 m³/s (Regional storm event)
	Project Site 97	<ul style="list-style-type: none"> ▶ The site part of the Lynde Creek Watershed and is an intermittent tributary of Lynde Creek ▶ The drainage area for the site is 742.6 ha ▶ Modelled flow rates vary from 2.96m³/s (2-year storm event) to 54.02 m³/s (Regional storm event)
	Project Site 100	<ul style="list-style-type: none"> ▶ The site is part of the Lynde Creek Watershed and the main reaches of the lower Lynde Creek. ▶ These reaches of Lynde Creek are slow-moving, flat gradient and meandering. ▶ The drainage area for this site is 10,948 ha. ▶ Modelled flow rates vary from 36.63m³/s (2-year storm event) to 739.25 m³/s (Regional storm event)
East Link – Section 7 (East Durham Link)	Project Site 90	<ul style="list-style-type: none"> ▶ The site is part of the Black Creek watershed and a tributary of Black Creek. ▶ The drainage area for the site is 16.9 ha. ▶ Modelled flow rates vary from 0.33m³/s (2-year storm event) to 2.59 m³/s (Regional storm event)
	Project Site 92	<ul style="list-style-type: none"> ▶ The site crossing is part of the Black Creek watershed and the watercourse is a main channel of Black Creek, with an upstream reach that flows towards the southwest direction ▶ The drainage area for this site crossing is 1888.4 ha. ▶ Modelled flow rates vary from 7.05m³/s (2-year storm event) to 130.70 m³/s (Regional storm event)
	Project Site 104	<ul style="list-style-type: none"> ▶ The site crossing is within the Tooley Creek Watershed and the main channel of Tooley Creek. ▶ The upstream reach meanders in a southerly direction and turns to a southwesterly direction downstream of Baseline Road ▶ The drainage area for this site is 840.3 ha. ▶ Modelled flow rates vary from 11.27m³/s (2-year storm event) to 99.84 m³/s (Regional storm event) for Structure ▶ Modelled flow rates vary from 10.09m³/s (2-year storm event) to 91.51 m³/s (Regional storm event) for Structure 104-2 (Bridge at Realigned N/S-W Ramp)

8.7 Vegetation and Vegetation Communities (Projects subject to Federal EA)

The following description of the environment potentially affected applies to the Projects subject to Federal EA. An overview of the 407 East Transportation Corridor RSA (by watershed) is provided as context for the detailed description of the individual Projects subject to Federal EA.

8.7.1 Regional Overview

Duffins Creek Watershed

The majority of the vegetation features in this watershed are found along watercourses and on valley slopes that generally extend in a north to south direction. Groundwater seepage along valley slopes was common in this watershed. The tablelands between watercourses have largely been converted to agriculture with scattered rural residential development. There are two natural area designations within the vicinity of the 407 East Transportation Corridor and both are along portions of the East Duffins Creek Valley:

- The Byer-Saddler Area Environmentally Significant Area (ESA) is north of the Transportation Corridor and encompasses the East Duffins Creek valley from 7th Concession to approximately 200 m north of the Transportation Corridor.
- The Duffins Creek Valley Regional Life Science ANSI is along the valley from Highway 7 north to 8th Concession (approximately 3 km north of the Transportation Corridor) and is crossed by the Transportation Corridor.

All vegetation communities within 120 m of the Transportation Corridor are Provincially common (Bakowsky 1996).

During field investigations, 224 plant species were identified within the Study Area of the East Duffins Creek watershed and 18 additional plants were identified to genus. Of these species, 59 are non-native (26%). The relatively high percentage of invasive species is typical of disturbed habitats. Five regionally rare species were identified within the RSA of the East Duffins Creek Watershed and are listed in **Table 8-11** below. Regionally rare species are those designated as “Rare” by Varga (2000).

Table 8-11 Regionally Rare Flora in the Study Area of the East Duffins Creek Watershed

Common Name	Scientific Name
Canada Horse-balm	<i>Collinsonia canadensis</i>
Shining Ladies'-tresses	<i>Spiranthes lucida</i>
Virginia Stickseed	<i>Hackelia virginiana</i>
Pale Jewel-weed	<i>Impatiens pallida</i>
Wild Geranium	<i>Geranium maculatum</i>

Twenty-nine locally rare plant species were identified within the Regional Study Area of the East Duffins Creek Watershed and are listed in **Table 8-12** below. Locally rare species are those ranked as L1, L2 and L3 by TRCA.

Table 8-12 Locally Rare Plant Species Identified within the Regional Study Area of the East Duffins Creek Watershed

Common Name	Scientific Name	LRank
Red Pine	<i>Pinus resinosa</i>	L1
Shining Ladies'-tresses	<i>Spiranthes lucida</i>	L1
Blue Cohosh	<i>Caulophyllum thalictroides</i>	L2
Canada Horse-balm	<i>Collinsonia canadensis</i>	L2
Goldthread	<i>Coptis trifolia ssp groenlandica</i>	L2
Purple Avens	<i>Geum rivale</i>	L2
Cinnamon Fern	<i>Osmunda cinnamomea</i>	L2
Royal Fern	<i>Osmunda regalis var spectabilis</i>	L2
Highbush Cranberry	<i>Viburnum trilobum</i>	L2
Balsam Fir	<i>Abies balsamea</i>	L3
Wild Leek	<i>Allium tricoccum</i>	L3
American Spikenard	<i>Aralia racemosa ssp racemosa</i>	L3
Bulb-bearing Water-hemlock	<i>Cicuta bulbifera</i>	L3
Crested Wood Fern	<i>Dryopteris cristata</i>	L3
Meadow Horsetail	<i>Equisetum pratense</i>	L3
Dwarf Scouring Rush	<i>Equisetum scirpoides</i>	L3
Oak Fern	<i>Gymnocarpium dryopteris</i>	L3

Table 8-12 Locally Rare Plant Species Identified within the Regional Study Area of the East Duffins Creek Watershed

Common Name	Scientific Name	LRank
American Water-pennywort	<i>Hydrocotyle americana</i>	L3
Blueflag	<i>Iris versicolor</i>	L3
Butternut	<i>Juglans cinerea</i>	L3
American Larch	<i>Larix laricina</i>	L3
Great Blue Lobelia	<i>Lobelia siphilitica</i>	L3
Naked Bishop's-cap	<i>Mitella nuda</i>	L3
White Spruce	<i>Picea glauca</i>	L3
Downy Solomon's Seal	<i>Polygonatum pubescens</i>	L3
Meadow Willow	<i>Salix petiolaris</i>	L3
Canadian Yew	<i>Taxus canadensis</i>	L3
White Trillium	<i>Trillium grandiflorum</i>	L3
Marsh Blue Violet	<i>Viola cucullata</i>	L3

Carruthers Creek Watershed

The Carruthers Creek Watershed is primarily agricultural with scattered rural residential development. There are no designated natural areas and all vegetation communities within 120 m of the Transportation Corridor are Provincially common. Vegetation communities are limited to linear features along watercourses with a single upland deciduous forest and a cultural mosaic of deciduous plantation, thicket and meadow. All vegetation units are adjacent to agricultural land.

During field investigations, 143 plant species were identified within the Study Area of the Carruthers Creek watershed and 7 additional plants were identified to genus. Of these species, 39 are non-native (27%). This high percentage of invasive species is typical of disturbed habitats.

Field investigations in support of the impact assessment did not identify any Provincially rare flora species. One regionally rare species was identified within the RSA portion of the Carruthers Creek Watershed. Regionally rare species are those ranked as "Rare" by Varga (2000). Marsh Bellflower (*Campanula aparinoides*) was observed in Unit WS8-2. Twelve locally rare plant species were identified within the RSA portion of the Carruthers Creek Watershed and are listed in **Table 8-13** below.

Table 8-13 Locally Rare Flora in the Study Area of the Carruthers Creek Watershed

Common Name	Scientific Name	LRank
Marsh Bellflower	<i>Campanula aparinoides te te</i>	L2
Blue Cohosh	<i>Caulophyllum thalictroides</i>	L2
Highbush Cranberry	<i>Viburnum trilobum</i>	L2
Wild Leek	<i>Allium tricoccum</i>	L3
Yellow Sedge	<i>Carex flava</i>	L3
Bristly-stalk Sedge	<i>Carex leptalea ssp. leptalea</i>	L3
Michigan Lily	<i>Lilium michiganense</i>	L3
White Spruce	<i>Picea glauca</i>	L3
Downy Solomon's Seal	<i>Polygonatum pubescens</i>	L3
Meadow Willow	<i>Salix petiolaris</i>	L3
Red Trillium	<i>Trillium erectum</i>	L3
White Trillium	<i>Trillium grandiflorum</i>	L3

Lynde Creek Watershed

Lynde Creek – Main Line

The majority of the vegetation features of this watershed are found along watercourses and on valley slopes. The tablelands between watercourses have largely been converted to agriculture with scattered rural residential development and some urban development (community of Brooklin). All vegetation communities within 120 m of the Transportation Corridor are Provincially common (Bakowsky 1996). There are two natural area designations within the vicinity of the Transportation Corridor. Both are ESAs along valley features.

- The West Lynde Creek Valley (Till Plain) ESA extends along the valley of West Lynde Creek from an area north of the Transportation Corridor to Winchester Road. It is considered highly sensitive (Gartner Lee 1978).
- The Upper Lynde Creek to Chalk Lake ESA extends along Lynde Creek from Winchester Road south beyond the Transportation Corridor. It is also considered highly sensitive (Gartner Lee 1978).

During field investigations, 212 plant species were identified within the RSA portion of the Lynde Creek Watershed-Mainline and 26 additional plants were identified to genus. Of these species, 59 are non-native (28%). This high percentage of invasive species is typical of disturbed habitats.

Field investigations identified one Provincially rare flora species. Provincially rare species are those ranked as S1-S3 according to the Natural Heritage Information Centre (NHIC). Butternut is ranked “S3?” meaning that it is considered “vulnerable”, however the “?” indicates the rank is uncertain.

Seven regionally rare species were identified within vegetation units crossed by the Transportation Corridor in the Lynde Creek Watershed-Mainline and are listed in **Table 8-14** below.

Table 8-14 Regionally Rare Plant Species in the Study Area of the Lynde Creek Watershed (Mainline)

Common Name	Scientific Name
Horse Gentian	<i>Triosteum aurantiacum</i>
Gray Dogwood	<i>Cornus foemina ssp racemosa</i>
Little Bluestem	<i>Schizachyrium scoparium</i>
Black Maple	<i>Acer saccharum ssp nigrum</i>
Swamp Rose	<i>Rosa palustris</i>
Black Willow	<i>Salix nigra</i>
Pale Jewel-weed	<i>Impatiens pallida</i>

Lynde Creek – West Durham Link

Vegetation features along the West Durham Link are primarily located along watercourses or scattered across the tablelands within a matrix of agricultural land and rural residential development. There are four

natural area designations within the vicinity of the West Durham Link including three ESAs and one Provincially Significant Wetland (PSW).

- The Lynde Valley – Iroquois Beach ESA includes Lynde Creek and tributaries of Lynde Creek as well as wetlands and forests of the Heber Down area.
- The Lynde Creek Valley ESA encompasses the forested valley along West Lynde Creek from just south of 5th Concession to Highway 401. It is also considered highly sensitive (Gartner Lee 1978).
- The Westerly Creek Valleys ESA is considered low to moderate sensitivity (Gartner Lee 1978). It includes the narrow vegetated areas along several watercourses west of Lynde Creek.
- The Lynde Creek Coastal Provincially Significant Wetland Complex includes two areas adjacent to the Transportation Corridor near Highway 401.

All vegetation communities within 120 m of the Transportation Corridor are Provincially common (Bakowsky 1996).

Field investigations identified one Provincially rare flora species, the Butternut. Nine regionally rare species were identified in vegetation units crossed by the Transportation Corridor within the West Durham Link portion of the Lynde Creek Watershed and are listed in **Table 8-15** below. Regionally rare species are those designated as “Rare” by Varga (2000).

Table 8-15 Regionally Rare Plant Species in the Study Area of the Lynde Creek Watershed (West Durham Link)

Common Name	Common Name
Long-fruited Anemone	<i>Anemone cylindrica</i>
Showy Lady's-slipper	<i>Cypripedium reginae</i>
Round-lobed Hepatica	<i>Anemone americana</i>
Gray Dogwood	<i>Cornus foemina ssp racemosa</i>
Bottle-brush Grass	<i>Elymus hystrix</i>
Black Maple	<i>Acer saccharum ssp nigrum</i>
Virginia Stickseed	<i>Hackelia virginiana</i>
White Rattlesnake-root	<i>Prenanthes alba</i>
Canada Waterleaf	<i>Hydrophyllum canadense</i>

The recommended design of the West Durham Link (WDL) crosses a portion of the Lynde Creek watershed that is transitioning from agricultural to urban land use, particularly in the areas east of Lake Ridge Road in the Town of Whitby. As such, most of the natural vegetation was historically cleared for agriculture and more recently for urban development. In general, the open agricultural fields, cultural / marsh meadows, thicket and forest areas that occupy the majority of the Transportation Corridor and adjacent lands provide habitat for a suite of common, generalist species that are tolerant of semi-urban and rural/agricultural conditions.

Oshawa Creek and Pringle Creek Watersheds

Similar to most of the RSA, the Oshawa and Pringle Creek Watersheds are primarily agricultural with rural residential development. Natural areas are primarily within the ESAs along the branches of Oshawa Creek with smaller isolated features scattered on the tablelands between these valleys. The two Environmentally Sensitive Areas (ESAs) are:

- West Branch of Oshawa Creek; and
- East Branch of Oshawa Creek.

Both ESAs generally encompass valley and associated upland vegetation along these watercourses and are considered highly sensitive within the Study Area according to CLOCA’s Environmental Sensitivity Mapping Project (Gartner Lee Limited 1978). Although not crossed by the Transportation Corridor at this location, the Oak Ridges Moraine (Countryside Area) is approximately 8 m from the Transportation Corridor, near the Harmony Road interchange.

During field investigations, 165 plant species were identified within the RSA portion of the Oshawa Creek watershed and an additional 31 plants were identified to genus. Of these species, 46 are non-native (28%). This high percentage reflects the disturbed nature of many of the units within this watershed.

Field investigations identified one Provincially rare flora species. Provincially rare species are those ranked as S1-S3 according to the Natural Heritage Information Centre (NHIC). Butternut is ranked “S3?” meaning that it is considered “vulnerable”, however the “?” indicates the rank is uncertain.

Four regionally rare species were identified within the RSA portion of the Oshawa Creek Watershed and are listed in **Table 8-16** below. Regionally rare species are those designated as “Rare” by Varga (2000).

Table 8-16 Regionally Rare Flora in the Study Area of the Oshawa and Pringle Creek Watersheds

Common Name	Scientific Name
Virginia Stickseed	<i>Hackelia virginiana</i>
Canada Moonseed	<i>Menispermum canadense</i>
Black Willow	<i>Salix nigra</i>
Rock Elm	<i>Ulmus thomasii</i>

Harmony Creek Watershed

This is a small section of the Transportation Corridor that is almost exclusively agricultural with scattered rural residential development. As a result, there are few natural vegetation communities within this section of the Study Area. There are no designated natural areas and all vegetation communities within 120 m of the Transportation Corridor are Provincially common (Bakowsky 1996). Natural areas consist of small (2.5 to 4 ha), isolated deciduous forests, cultural plantations, cultural woodlands, a cultural thicket and a meadow marsh community.

During field investigations, 61 plant species were identified in vegetation units within or adjacent to the Transportation Corridor footprint of the Harmony Creek watershed and an additional 9 plants were identified to genus. Of these species, 16 are non-native (26%). This relatively high percentage reflects the disturbed nature of this section of the route.

Field investigations did not identify any Provincially rare flora species. One regionally rare species was identified within the RSA portion of the Harmony Creek Watershed. Regionally rare species are those ranked as “Rare” by Varga (2000). Black Willow (*Salix nigra*) was observed in Unit CHAR-4.

Farewell Creek, Black Creek, Bowmanville Creek, Soper Creek Watersheds

The natural vegetation throughout this section is primarily characterized by large, contiguous forested valleylands. The tablelands between watercourses have largely been converted to agriculture. Cedar-dominated forests are the most common forest type in this area, with smaller areas of mixed and deciduous forest and plantation communities. Here there are also seven large, linear Environmentally Sensitive Areas (ESAs) oriented in a north-south direction: Solina Bog, Solina Woods, Upper Black Creek, Bowmanville Creek (East Branches), Bowmanville Creek (West Branches), Mackie Creek Valley, Upper Soper Creek. The largest unevaluated wetland, a White Cedar – Conifer Organic Swamp was delineated along West Bowmanville Creek.

During field investigations, 275 plant species were identified within the RSA portion of the Farewell Creek, Black Creek, Bowmanville Creek and Soper Creek watersheds. Of these species, 67 are non-native (24%). Non-native species are most abundant in terms of cover and species richness in the cultural and woodland communities throughout this section.

Field investigations identified one Provincially rare flora species, the Butternut. Twelve regionally rare species were identified and are listed in **Table 8-17** below. Regional significance was based on rarity rankings assigned by Varga *et al.* (2000).

Table 8-17 Regionally Rare Flora in the Study Area of the Farewell Creek, Black Creek, Bowmanville Creek and Soper Creek Watersheds

Common Name	Scientific Name
Pale Jewelweed	<i>Impatiens pallida</i>
Woolly Sedge	<i>Carex lanuginose Michx</i>
Tall Blue Lettuce	<i>Lactuca biennis (Moench) Fern</i>
Closed Gentian	<i>Gentiana andrewsii Griseb</i>
Fringed Gentian	<i>Gentiana crinita Froel</i>
Foxglove Beard-tongue	<i>Penstemon digitalis Nutt</i>
Muhly Grass	<i>Muhlenbergia glomerata</i>
Common Juniper	<i>Juniperus communis L</i>
Slender Gerardia	<i>Agalinus tenuifolia (Vahl) Raf.</i>
Wood-sorrel	<i>Oxalis acetosella</i>
Nodding Ladies' Tresses	<i>Spiranthes cernua</i>
Long-leaved Starwort	<i>Stellaria longifolia</i>

Wilmot Creek Watershed

A portion (79 ha) of the 407 East Transportation Corridor encroaches into the Oak Ridges Moraine (ORM). The ORM is an ecologically important geological landform. The ecologically diverse moraine is the water source for many headwater streams flowing south into Lake Ontario and north into rivers draining into Georgian Bay and Lake Simcoe. The moraine has a unique concentration of environmental, geological and hydrological features. The wetlands, woodlands, watercourses, kettle lakes and bogs provide an environment suitable for significant flora and fauna communities to develop and thrive.

The natural vegetation in the Wilmot Creek watershed is primarily characterized by the two forested valleys associated with Orono and Wilmot Creeks. The tablelands between these watercourses have largely been converted to agriculture.

During field investigations, 228 plant species were identified within the RSA portion of the Wilmot Creek watershed. Of these species, 82 are non-native (36%). Non-native species are most abundant in terms of cover and species richness in the cultural and woodland communities throughout this section.

Field Investigations in support of the impact assessment did not identify any Provincially rare flora species. Two regionally rare species were identified within the RSA portion of the Wilmot Creek watershed and are listed in **Table 8-18** below. Regional significance was based on rarity rankings assigned by Varga *et al.* (2000).

Table 8-18 Regionally Rare Flora in the Study Area of the Wilmot Creek Watershed

Common Name	Scientific Name
Chair-maker's Rush	<i>Scripus pungens.</i>
Clearweed	<i>Pilea Fontana (Lunell)</i>

Black Creek, Tooley Creek and Darlington Creek Watersheds

This section of the Transportation Corridor crosses the Harmony-Farewell Iroquois Beach Wetland and Maple Grove Wetland Complexes in three locations. It also crosses the following four Environmentally Sensitive Areas (ESAs): Upper Black Creek, Courtice Wetlands, Farewell Creek Valley Through Beach and Black Creek Valley.

The East Durham Link (within and adjacent to the Transportation Corridor) is characterized predominately by agricultural land use, interspersed with large natural areas through its centre section, typically associated with the wetland complexes. Natural areas in the southern section (south of Highway 2) are generally smaller, more fragmented and more highly disturbed than the area between Highway 2 to north of Taunton Road. A high diversity of wetland community types are represented along the East Durham Link including coniferous, mixed and deciduous swamp, thicket swamp, shallow and meadow marsh communities. There are notably smaller amounts of the latter two communities. Other natural areas in the East Durham Link Study Area consist of a fairly equal mix of common upland communities including coniferous, mixed and deciduous forest and cultural communities including cultural meadow, thicket and woodland communities and units of plantation.

During field investigations 166 plant species were identified within the East Durham Link Study Area. Of these species, 52 are non-native (31%). Introduced species are most abundant in terms of cover and species richness in the cultural communities throughout the Study Area.

Field investigations identified one Provincially rare flora species, the Butternut. Nine regionally rare species were identified within the East Durham Link Study Area and are listed in **Table 8-19** below. Regional significance was based on rarity rankings assigned by Varga *et al.* (2000).

Table 8-19 Regionally Rare Flora in the Study Area of the Black Creek, Tooley Creek and Darlington Creek Watersheds

Common Name	Scientific Name
Tall Blue Lettuce	<i>Lactuca Biennis</i>
Grey Dogwood	<i>Cornus foemina</i>
False Loosestrife	<i>Ludwigia palustris</i>
Fragrant Cudweed	<i>Gnaphalium obtusifolium</i>
Slender Gerardia	<i>Agalinus tenuifolia</i>
Swamp Dewberry	<i>Rubus hispidus</i>
Bog Goldenrod	<i>Solidago uliginosa</i>
Mild Waterpepper	<i>Polygonum hydropiperoides</i>
Closed Gentian	<i>Gentiana andrewsii</i>

8.7.2 Local Study Area

Table 8-20 provides a description of the existing environmental conditions related to Vegetation and Vegetation Communities within each Local Study Area, corresponding to each of the Projects subject to the Federal EA.

8.8 Wetlands (Projects subject to Federal EA)

The following description of the environment potentially affected applies to the Projects subject to Federal EA. An overview of the 407 East Transportation Corridor RSA is provided as context for the detailed description of the individual Projects subject to Federal EA.

8.8.1 Regional Overview

Wetlands are defined as:

Lands that are seasonally or permanently flooded by shallow water as well as land where the water table is close to the surface; in either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic or water tolerant plants.” (OMNR 1993)

Table 8-20 Existing Vegetation and Vegetation Communities Associated with the Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions Site Study Area (SSA)	Summary of Existing Conditions Local Study Area (LSA)
West Mainline – Section (Brock Road to Audley Road)	Federal Airport Lands	<ul style="list-style-type: none"> ▶ A 9.6 ha Dry-Fresh White Cedar Coniferous Forest ▶ A 6.3 ha White Cedar Organic Coniferous Swamp and Fresh-Moist White Cedar Hardwood Mixed Forest ▶ A 1.8 ha deciduous forest community ▶ There is one Butternut (Endangered Provincially and Federally) of poor health, located approximately 75 m from the ROW. ▶ A 1.5 ha mid-aged to mature valley forest composed of White Cedar Organic Swamp ▶ A 2.4 ha community composed of Cultural Meadow and Shallow Aquatic unit. ▶ An 8.8 ha pioneer community composed of Dry-Moist Old Field Meadow and Mineral Cultural Thicket Ecosite. ▶ A small 1.3 ha, isolated Deciduous Forest. ▶ Rare Flora Species include 9 TRCA L3-ranked Species: American Spikenard, Great Blue Lobelia, Crested Wood Fern, Marsh Blue violet, American Water-pennywort, Oak Fern, Meadow Willow and Dwarf Scouring Rush 	<ul style="list-style-type: none"> ▶ None
	Project Site 3	<ul style="list-style-type: none"> ▶ A small inclusion of Scotch Pine Coniferous Plantation ▶ A 6.6 ha vegetation community, south of Highway 7 and east of Brock Road, is comprised of Mixed Forest and Fresh Moist Lowland Deciduous Forest. There is a small inclusion of an open seepage area with high diversity (e.g., Great Blie Lobelia, Marsh Fern, and Common Boneset) and a Hemlock dominated inclusion with Bulblet Fern and Broadleaved Goldenrod. ▶ Rare Flora Species include 4 TRCA L3-ranked Species: Greak-Blue Lobelia, Highbush Cranberry, Dwarf Scouring Rush and Michigan Lily and 18 Butternut Species 	<ul style="list-style-type: none"> ▶ A small 1.1 ha, isolated mid-aged forest with low diversity located north of Highway 7 and east of Brock Road. ▶ A narrow 1.3 ha vegetation unit comprised of fresh-moist ash lowland deciduous forest type and dry moist old field meadow ▶ An additional Fresh-Moist Ash Lowland Deciduous Forest community and one Mineral Cultural Woodland Ecosite ▶ A 1.1 ha of particularly closed canopy of Fresh-Moist Ash Lowland Deciduous Forest ▶ No Rare Flora Species found
	Project Site 3a	<ul style="list-style-type: none"> ▶ A 6.6 ha vegetation community, south of Highway 7 and east of Brock Road, is comprised of Mixed Forest and Fresh Moist Lowland Deciduous Forest. There is a small inclusion of an open seepage area with high diversity (e.g., Great Blie Lobelia, Marsh Fern, and Common Boneset) and a Hemlock dominated inclusion with Bulblet Fern and Broadleaved Goldenrod. ▶ A narrow 1.3 ha vegetation unit comprised of Fresh-Moist Ash Lowland Deciduous forest type and dry moist old field meadow ▶ A 1.1 ha of particularly closed canopy of Fresh-Moist Ash Lowland Deciduous Forest consisting of Green Ash and Black Ash species. ▶ An additional Fresh-Moist Ash Lowland Deciduous Forest community ▶ Rare Flora Species include 3 TRCA L3-ranked Species: Highbush Cranberry, Dwarf Scouring Rush and Michigan Lily and 2 Butternut Species 	<ul style="list-style-type: none"> ▶ A Deciduous Forest vegetation community consisting of a 6.3 ha White Cedar Organic Coniferous Swamp and Fresh-Moist White Cedar Hardwood Mixed Forest. Overall ecological significance of this vegetation community is high. ▶ A 1.8 ha deciduous forest community. The northern half is dominated by Poplar, with occasional Basswood, Sugar maple and Black Cherry whereas the southern half is dominated by mature Red Oak. ▶ Rare Flora Species include 6 L3-ranked Species: American, Spikenard, Great Blue Lobelia, Crested Wood Fern, Oak Fern, Marsh Blue violet and American Waterpennywort.
	Project Site 7	<ul style="list-style-type: none"> ▶ A 1.5 ha mid-aged to mature valley forest with abundant seepage along the west valley slope. Overall ecological significance and sensitivity of the vegetation community is moderate to high. ▶ Rare Flora Species include 3 TRCA L3-ranked Species: Great Blue Lobelia, Oak Fern, Meadow Willow 	<ul style="list-style-type: none"> ▶ A 2.4 ha community is a large irrigation pond with a narrow perimeter of cultural meadow vegetation. Overall ecological significance and sensitivity of the vegetation community is low to moderate. ▶ A 9.6 ha Dry-Fresh White Cedar Coniferous Forest community part of a larger forest that contains interior forest habitat. The overall ecological significance and sensitivity of the vegetation community is high. ▶ A 6.3 ha Fresh-Moist White Cedar Hardwood Mixed Forest community. The overall ecological significance and sensitivity of the vegetation community is high. ▶ Rare Flora Species include 6 TRCA L3-ranked Species: American Spikenard, Great Blue Lobelia, Crested Wood Fern, Oak Fern, Marsh Blue Violet, American Water-pennywort ▶ There is a Butternut of poor health.
	Project Site 8	<ul style="list-style-type: none"> ▶ A 5.8 ha vegetation community of young to mid-aged forest and meadow marsh consisting of Reed-canary Grass Mineral Meadow Marsh, Fresh-Moist Willow Lowland Deciduous Forest, Dry-Moist Old Field Meadow, Submerged Shallow Aquatic Ecosite and Cattail Mineral Shallow Marsh. ▶ Rare Flora Species include 2 TRCA L3-ranked species: Bulbbearing Waterhemlock and Blueflag 	<ul style="list-style-type: none"> ▶ Moist Lowland Deciduous Forest Ecosite vegetation unit ▶ A young, highly disturbed 2.6 ha unit of low ecological significance and sensitivity consisting of Mineral Cultural Woodland and Dry-Moist Old Field Meadow. ▶ A small, isolated, young community with abundant disturbance tolerant species and non-native species. Vegetation Communities include a Deciduous Forest unit and a Dry-Moist Old Field Meadow. ▶ A 3.4 ha mosaic of Narrow-leaved Sedge Mineral Meadow Marsh and Dry-Moist Old Field Meadow considered. ▶ A 2.2 ha young to mid-aged vegetation unit consisting of Fresh-Moist Poplar Deciduous Forest and Dry-Moist Old Field Meadow. ▶ Rare Flora Species include Wild German and 1 TRCA L3-ranked Species – Downy Solomon’s Seal.
	Project Site 9	<ul style="list-style-type: none"> ▶ The valley system through the crossing location is part of the Duffins Creek Life Science ANSI and is considered regionally significant because of its high quality, good regeneration Sugar Maple-American Beech-Eastern Hemlock Forest. ▶ A 8.2 ha unit part of a large forested valley system that includes a mosaic of upland and wetland vegetation communities with some very high quality areas and a mature tree component. The dominant vegetation unit in this community is a Black Ash Mineral Deciduous Swamp. ▶ A 9.2 ha unit part of a large forested valley system. The unit includes some very high quality areas. Vegetation communities include White Cedar- Hardwood Mineral Mixed Swamp, Dry-Fresh Sugar Maple – Hemlock Mixed Forest and Coniferous Cultural Plantation. ▶ Rare Flora Species include Pale-Jewel-weed, considered rare in Durham Region, 2 TRCA L2-ranked species – Blue Cohosh and Cinnamon Fern and 4 TRCA L3-ranked species – Downy Solomon’s Seal, Crested Wood Fern, Meadow Willow and White Trillium. 	<ul style="list-style-type: none"> ▶ The valley system immediately north of the crossing location is designated as the Byer-Saddler Area ESA. ▶ A 1.8 ha mid-aged to mature coniferous forest unit with abundant deadfall logs and snags. The Vegetation communities in this unit are White Cedar Mineral Coniferous Swamp, White Cedar-Hardwood Mineral Mixed Swamp and Dry-Fresh White Cedar Coniferous Forest. ▶ Rare Flora Species include one Butternut (assessed as not retainable) listed as Endangered Federally and Provincially. One TRCA L2-ranked species – Royal Fern and seven L3-ranked species - Balsam Fir, Butternut, American Spikenard, Crested Wood Fern, American Larch, Naked Bishop’s-cap and Meadow Willow (L3). ▶ A 2.2 ha narrow community consisting of Fresh-Moist White Cedar Coniferous Forest and Dry-Moist Old field Meadow vegetation communities. This unit is connected to a large high quality forested valley system to the west. ▶ A very narrow 1.2 ha pioneer community consisting of Reed-canary Grass Mineral Meadow Marsh, Dry-Moist Old Field Meadow, a shallow marsh and Fresh-Moist White Elm Lowland Deciduous Forest
	Project Site 11	<ul style="list-style-type: none"> ▶ A 10.9 ha mid-aged to mature forest unit with frequent large diameter Sugar Maples (>50 cm dbh). The forest was historically logged and has remnant logging trails throughout. Vegetation communities include Dry-Fresh Sugar Maple – Beech Deciduous Forest and Fresh-Moist Willow Lowland Deciduous Forest. ▶ A 10.3 ha open community along a shallow valley with sparse, scatter trees along a meandering watercourse between farm fields south of 7th Concession Road. This unit is considered to be low to moderate quality. Vegetation communities include a mosaic of Dry-Moist Old Field Meadow and Meadow Marsh. ▶ Rare Flora Species include one TRCA L2-ranked species – Blue Cohosh and 6 TRCA L3-ranked species – Bristly-stalk Sedge, Michigan Lily, Wild Leek, Downy Solomon’s Seal, Red Trillium and White Trillium. 	<ul style="list-style-type: none"> ▶ A 2.1 ha shallow valley with meandering watercourse, moderate diversity and frequent non-native species. The dominant vegetation communities within this unit are a mosaic of Dry-Moist Old Field Meadow and Reed-canary Grass Mineral Meadow Marsh. ▶ Rare Flora Species include one TRCA L2-ranked species – Bellflower and one TRCA L3-ranked species – Meadow Willow. Meadow Willow is considered a Rare species in Durham Region.

Table 8-20 Existing Vegetation and Vegetation Communities Associated with the Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions Site Study Area (SSA)	Summary of Existing Conditions Local Study Area (LSA)
	Project Site 12	<ul style="list-style-type: none"> ▶ A 2.1 ha shallow valley with meandering watercourse, moderate diversity and frequent non-native species. The dominant vegetation communities within this unit are a mosaic of Dry-Moist Old Field Meadow and Reed-canary Grass Mineral Meadow Marsh. ▶ Rare Flora Species include one TRCA L2-ranked species – Bellflower and one TRCA L3-ranked species – Meadow Willow. Meadow Willow is considered a Rare species in Durham Region. ▶ A 10.9 ha mid-aged to mature forest unit with frequent large diameter Sugar Maples (>50 cm dbh). The forest was historically logged and has remnant logging trails throughout. Vegetation communities include Dry-Fresh Sugar Maple – Beech Deciduous Forest and Fresh-Moist Willow Lowland Deciduous Forest. ▶ Rare Flora Species include one TRCA L2-ranked species – Blue Cohosh and 6 TRCA L3-ranked species – Bristly-stalk Sedge, Michigan Lily, Wild Leek, Downy Solomon’s Seal, Red Trillium and White Trillium. 	<ul style="list-style-type: none"> ▶ A 10.3 ha open community along a shallow valley with sparse, scatter trees along a meandering watercourse between farm fields south of 7th Concession Road. This unit is considered to be low to moderate quality. Vegetation communities include a mosaic of Dry-Moist Old Field Meadow and Meadow Marsh. ▶ No Rare Flora Species found
West Mainline – Section 2 (Audley Road to Ashburn Road)	Project Site 17	<ul style="list-style-type: none"> ▶ A mid-aged riparian forest composed of Fresh-Moist Ash Lowland Deciduous Forest and Dry-Fresh Sugar Maple-Ironwood Deciduous Forest surrounded by Mineral Cultural Thicket. The vegetation communities exhibit frequent snags and occasional downfall logs, with some gaps in the forest cover and frequent patches of non-native vegetation species. The overall habitat quality has been characterized as low to moderate. ▶ A young to mid-aged narrow riparian forest composed of Fresh-Moist Sugar Maple-Lowland Ash Deciduous Forest. This unit also contains a Mineral Cultural Woodland, a Dry-Moist Old Field Meadow and a Mineral Meadow Marsh. The relative habitat quality of the vegetation unit is low to moderate, and the narrow riparian forest exhibits frequent snags and downfall logs. ▶ A low quality Pioneer community composed of Mineral Cultural Thicket, Dry-Moist Old field Meadow, Mineral Meadow Marsh and Fresh-Moist Willow Lowland Deciduous Forest. This vegetation unit is characterized as a large farm field planted with trees and regenerating with early successional species. ▶ One regionally rare (Durham region) vegetation species was identified through field investigations: Swamp Rose. ▶ The SSA includes numerous Butternut trees. One species of conservation concern (Butternut) was recorded at this crossing location. Butternut is considered Endangered both Provincially and Federally. 	<ul style="list-style-type: none"> ▶ Dry-Moist Old Field Meadow ▶ Dry-Fresh Sugar Maple Deciduous Forest ▶ No Rare Flora Species found
	Project Site 18	<ul style="list-style-type: none"> ▶ The vegetation community in the vicinity of the crossing consists of a very narrow, young vegetation community of cultural and woodland species that provides low quality wildlife habitat. ▶ No regionally rare or MNR area sensitive species were observed within the ROW. ▶ This watercourse and its surrounding riparian corridor are situated within the West Lynde Creek Valley (Till Plain) Environmentally Sensitive Area (ESA), and have been designated as Environmental Protection under the local official plan, protecting the habitat from future development and ensuring that this valley system will persist as a linkage in the future. 	<ul style="list-style-type: none"> ▶ No other vegetation communities were identified within the LSA
	Project Site 19	<ul style="list-style-type: none"> ▶ A mid-aged to mature forest vegetation community that includes some interior forest with high quality habitat. The forest consists of a Fresh-Moist White Cedar Coniferous Forest, Dry-Fresh White Cedar Coniferous Forest and Dry-Fresh Sugar Maple – Oak Deciduous Forest. ▶ The West Lynde Creek valley (including the confluence of the tributary) is situated within the West Lynde Creek Valley (Till Plain) ESA, and have been designated as Environmental Protection under the local official plan, protecting the habitat from future development and ensuring that this valley system will persist as a linkage in the future. ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ One regionally rare tree species (outside the ROW) - Black Maple. ▶ Butternut was observed in the LSA of the crossing. Butternut is considered Endangered both Provincially and Federally.
	Project Site 20	<ul style="list-style-type: none"> ▶ A vegetation unit comprised of young to mid-aged Fresh-Moist Ash Lowland Deciduous Forest and Dry-Moist Old Field Meadow. This vegetation unit has low quality habitat with a low diversity of plant species and occasional patches of non-native species. ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ None ▶ No Rare Flora Species found
	Project Site 21	<ul style="list-style-type: none"> ▶ Reed-canary Grass Mineral Meadow, a Jewelweed Mineral Meadow Marsh and a Dry-Moist Old Field. The vegetation unit has low quality habitat with abundant non-native plant species, high disturbance throughout reach (cow pastures) and a low to moderate diversity. ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ A vegetation unit comprised of Dry-Moist Old Field Meadow, and Reed-canary Grass Mineral Meadow Marsh. This vegetation unit provides low quality habitat with high disturbance and abundant non-native species. ▶ A Shallow Water (SA) artificial farm pond unit, surrounded by a pasture of Dry- Moist Old Field Meadow, and a Reed-canary Grass Mineral Meadow Marsh. This vegetation unit has a low quality habitat. ▶ The watercourse and its riparian corridor have also been designated as Green Space in the local Official Plan ▶ No Rare Flora Species found
	Project Site 24	<ul style="list-style-type: none"> ▶ A vegetation unit comprised of Cultural Meadow, Cultural Thicket, Reed Canary Grass Mineral Meadow Marsh, Willow Lowland Deciduous Forest, and White Cedar Coniferous Forest vegetation communities with moderate quality habitat. This is a large early succession bottomland unit along Lynde Creek. There is a high abundance of non-native and moderate diversity of native plant species. ▶ The valley system is designated as the Upper Lynde Creek to Chalk Lake ESA. This ESA extends from Heber Down, along the Lynde Creek valley through the proposed crossing location to just south of Winchester road (Highway 7). It resumes near Columbus Road, north of Brooklin. This ESA is considered highly sensitive given that it follows the main branch of Lynde Creek and ‘connects’ key natural areas within the middle and north portion of the watershed ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ A vegetation unit that is a former pasture regenerating as an early succession Cultural Meadow, Sumac Cultural Thicket and Cultural Woodland with low to moderate habitat quality.
	Project Site 28	<ul style="list-style-type: none"> ▶ A 5.0 ha unit includes bottomland along a meandering watercourse and its adjacent upland slopes. Vegetation Communities include Fresh-Moist White Cedar Hardwood Mixed Forest, Fresh-Moist Aspen Deciduous Forest and inclusions of Dry-Moist Old Field Meadow and Meadow Marsh. The vegetation community is considered to be moderate quality. 	<ul style="list-style-type: none"> ▶ A 2.0 ha unit that is a White Cedar dominated valley slope along the confluence of Oshawa Creek West and a tributary of Oshawa Creek West, with some small open patches of cultural meadow. It has a low diversity, as is typical of cedar dominated communities, and some disturbance from trails and invasive species. ▶ A 2.8 ha mid-aged mixed forest community dominated by Cedar-Hardwood mixed forest with patches of cultural meadow. It contains occasional non-native species and is considered to be moderate quality.

Table 8-20 Existing Vegetation and Vegetation Communities Associated with the Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions Site Study Area (SSA)	Summary of Existing Conditions Local Study Area (LSA)
	Project Site 28	<ul style="list-style-type: none"> ▶ A 3.4 ha, early succession community with moderate diversity and frequent non-native species. Vegetation communities include Dry-Moist Old Field Meadow, Reed-Canary Grass Mineral Meadow Marsh, Fresh Moist Willow Lowland Forest and Fresh-Moist White Cedar Coniferous Forest. ▶ The valley system is designated as the West Branch of Oshawa Creek Environmentally Sensitive Area (ESA). The ESA is considered highly sensitive. ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ A 6.6 ha early succession unit which is a mosaic of Dry-Moist Old field Meadow, Coniferous Forest and Reed-Canary Grass Mineral Meadow Marsh.
Central Mainline – Section 4 (Simcoe Street to Enfield Road)	Project Site 35	<ul style="list-style-type: none"> ▶ A 1.5 ha early succession vegetation community which is primarily a Dry-Moist Old Field Meadow and Forb Mineral Meadow Marsh type community. ▶ A 0.5 ha early mid-aged vegetation community composed of Fresh-Moist White Cedar Coniferous Forest. The overall ecological significance and sensitivity of this unit is considered low to moderate. ▶ A 3.2 ha mid-aged to mature forest unit composed of Dry-Fresh White Cedar Coniferous Forest and Dry-Old Field Meadow. This unit is within the Greenbelt policy area. ▶ Rare Flora species include Black Willow, which is considered rare in Durham Region. ▶ One Butternut tree was recorded adjacent to the ROW and is considered retainable. This species is listed as Endangered Federally and Provincially. ▶ The valley system is designated as the East Branch of Oshawa Creek Environmentally Sensitive Area (ESA) which is considered highly sensitive. 	<ul style="list-style-type: none"> ▶ A 1.3 ha, young, isolated Dry-Fresh White Ash Deciduous Forest surrounded by fields with abundant non-native species. ▶ No Rare Flora Species found
	Project Site 38 a	<ul style="list-style-type: none"> ▶ A 3.3 ha mid-aged vegetation community along a steep valley slope. Vegetation communities include Dry-Moist Old Field Meadow, Mineral Cultural Thicket Ecosite and Willow Mineral Thicket Swamp. ▶ A 2.0 ha young deciduous forest dominated by Trembling Aspen with White Elm and many dead Elm (possibly due to disease) and is considered to be of moderate quality ▶ A 3.2 ha mature forest vegetation community composed of Fresh-Moist White Cedar Coniferous Forest and White Pine Coniferous Forest. ▶ Rare flora species include Virginia Stickseed which is considered rare in Durham Region. ▶ A 1.6 ha mid aged forest unit composed of Fresh-Moist Lowland Deciduous Forest and Mineral Cultural Woodland. ▶ A 0.3 ha vegetation unit composed of Mineral Cultural Thicket Ecosite and Dry-Moist Cultural Meadow. ▶ The east branch of Oshawa Creek and its riparian corridor are a part of the East Branch of Oshawa Creek ESA ▶ The vegetation communities in the SSA are within the Greenbelt policy area ▶ The vegetation units are identified as high quality regional linkages connecting with Oshawa Creek East. ▶ Rare flora species include 4 Butternut trees, one of which is considered retainable. This species is listed as Endangered Federally and Provincially. Rock Elm, which is considered rare in Durham Region, is also located within the SSA. 	<ul style="list-style-type: none"> ▶ A 1.0 ha deciduous forest unit dominated by Sugar Maple with Hemlock and American Beech. ▶ A 0.4 ha vegetation unit composed of Mineral Cultural Thicket Ecosite and Dry-Moist Cultural Meadow. ▶ A 0.5 ha vegetation unit composed of Dry-Moist Old Field Meadow and Reed-Canary Grass Mineral Meadow Marsh type vegetation. The unit is located along an agricultural swale between farm fields and is considered to be low quality. ▶ A narrow 0.6 ha vegetation unit composed of Hawthorn Cultural Savannah and is considered to be low quality. ▶ A 1.3 ha coniferous forest dominated by White Cedar with minimal cover in the understorey. ▶ The east branch of Oshawa Creek and its riparian corridor are a part of the East Branch of Oshawa Creek ESA ▶ The vegetation communities in the SSA are within the Greenbelt policy area ▶ No Rare Flora Species found
	Project Site 54	<ul style="list-style-type: none"> ▶ A linear 2.4 ha pioneer community composed of Forb Mineral Meadow Marsh and Dry-Moist Old Field Meadow vegetation communities. ▶ A 2.0 mid-aged forest unit composed of Fresh-Moist Willow Lowland Deciduous Forest with abundant Basswood and Crack Willow with White Ash, Black Cherry and Sugar Maple. ▶ The vegetation communities are within the Greenbelt policy area ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ A 1.9 ha young community that is a Mineral Cultural Thicket Ecosite and includes Red-osier Mineral Thicket Swamp. ▶ The vegetation communities are within the Greenbelt policy area
East Mainline – Section 5 (Enfield Road to Highway 35/115)	Project Site 57a	<ul style="list-style-type: none"> ▶ A wetland unit which is part of a larger 11.1 ha riparian swamp unit and is composed of Meadow Marsh and Willow Mineral Thicket Swamp vegetation communities. This unit is within the Greenbelt ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ A 0.6 ha isolated, mid-aged woodlot composed of Fresh-Moist Willow Lowland Deciduous Forest ▶ No Rare Flora Species found
West Link – Section 6 (West Durham Link)	Project Site 44	<ul style="list-style-type: none"> ▶ A narrow 5.6 ha mosaic of Reed-canary Grass Mineral Meadow Marsh, Dry - Moist Old Field Meadow, Red-osier Mineral Thicket Swamp and inclusions of Shallow Water (Dug pond). Overall ecological significance and sensitivity of the vegetation community is moderate. ▶ A 8.6 ha vegetation unit composed of Fresh - Moist Willow Lowland Deciduous Forest, Dry - Fresh Sugar Maple Deciduous Forest, Dry - Moist Old Field Meadow and Coniferous Plantation vegetation communities with inclusions of Dry - Moist Old Field Meadow. The overall ecological significance and sensitivity of the vegetation community is moderate. ▶ Rare Flora species include 12 Butternuts within the ROW. Two Butternut trees were considered retainable, a health assessment was not completed for 9 of the trees due to a lack of property access. Canada Waterleaf is also found in the SSA and is considered rare in Durham Region. 	<ul style="list-style-type: none"> ▶ A 3.2 ha meadow marsh with occasional pockets of cultural meadow. Vegetation communities include Reed-canary Grass Mineral Meadow Marsh and Dry - Moist Old Field Meadow ▶ A 0.6 ha vegetation unit that is a cultural meadow surrounding a young coniferous plantation inclusion. ▶ A 2.6 ha young White Pine Coniferous Plantation with inclusions of Red-osier Mineral Thicket Swamp and Meadow Marsh. Overall ecological significance and sensitivity of this unit is low ▶ A 0.6 ha vegetation unit that is a cultural meadow surrounding a young coniferous plantation inclusion. ▶ A portion of these vegetation units are within the Westerly Creek Valleys Environmentally Sensitive Area (ESA) ▶ These vegetation units are within the Greenbelt policy area ▶ No Rare Flora Species found
	Project Site 47	<ul style="list-style-type: none"> ▶ A 2.6 ha unit composed of Dry-Moist Old Field Meadow vegetation community with inclusions of Mineral Cultural Savannah Ecosite and Mineral Meadow Marsh Ecosite. The overall ecological significance and sensitivity of the unit is low. ▶ A 6.7 ha unit composed of Fresh-Moist Hemlock Coniferous Forest and Fresh-Moist Hemlock-Hardwood Mixed Forest communities. The canopy is dominated by mature Eastern Hemlock with a greater deciduous component along the watercourse and east border of the unit. ▶ The valley system is designated as the Westerly Creek Valleys Environmentally Sensitive Area (ESA). This ESA includes the narrow vegetated areas along several watercourses west of Lynde Creek and is considered low to moderate quality due to the narrow, patchy and culturally influenced vegetation communities ▶ Rare Flora Species include one Butternut sapling, which is considered retainable. This species is listed as Endangered Federally and Provincially. Black Maple, which considered rare in Durham Region, was also observed. 	<ul style="list-style-type: none"> ▶ A 5.9 ha mid-aged maple swamp with occasional deadfall logs and high botanical quality. Freeman's Maple is the dominant component of the diverse canopy/sub-canopy. The overall ecological significance and sensitivity is high. ▶ A 1.8 ha mature Red Pine Coniferous Plantation planted in 1939 and is succeeding to Sugar Maple. ▶ A small 1.1 ha mature Dry-Fresh Sugar Maple Deciduous Forest. The overall ecological significance and sensitivity of the vegetation community is moderate. The vegetation community is within the Greenbelt policy area. ▶ A 2.1 ha Dry-Moist Old Field Meadow which is a heavily grazed pasture. The overall ecological significance and sensitivity of the vegetation community is low. This unit is within the Greenbelt policy area. ▶ The vegetation units are within the Westerly Creek Valleys Environmentally Sensitive Area (ESA). ▶ Rare Flora Species include one patch of Showy Ladies-slipper. This species are rare in Durham Region.

Table 8-20 Existing Vegetation and Vegetation Communities Associated with the Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions Site Study Area (SSA)	Summary of Existing Conditions Local Study Area (LSA)
	Project Site 47a	<ul style="list-style-type: none"> ▶ A small 1.1 ha mature Dry-Fresh Sugar Maple Deciduous Forest. The overall ecological significance and sensitivity of the vegetation community is moderate. ▶ A 2.1 ha Dry-Moist Old Field Meadow which is a heavily grazed pasture. The overall ecological significance and sensitivity of the vegetation community is low. ▶ The vegetation communities are within the Greenbelt policy area. ▶ The vegetation units are within the Westerly Creek Valleys Environmentally Sensitive Area (ESA). ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ A 6.7 ha unit composed of Fresh-Moist Hemlock Coniferous Forest and Fresh-Moist Hemlock-Hardwood Mixed Forest communities. The canopy is dominated by mature Eastern Hemlock with a greater deciduous component along the watercourse and east border of the unit. ▶ The vegetation communities are within the Westerly Creek Valleys Environmentally Sensitive Area (ESA). ▶ Rare Flora Species include one Butternut sapling, which is considered retainable. This species is listed as Endangered Federally and Provincially. Black Maple, which considered rare in Durham Region, was also observed.
	Project Site 51	<ul style="list-style-type: none"> ▶ A 6.6 ha young culturally influenced vegetation community composed of Forb Mineral Meadow Marsh, Dry-Moist Old Field Meadow and Mineral Cultural Thicket Ecosite. Overall ecological significance and sensitivity is low ▶ The watercourse and its riparian corridor are a part of the Westerly Creek Valleys Environmentally Sensitive Area (ESA). This ESA includes the narrow vegetated areas along several watercourses west of Lynde Creek and is considered low to moderate quality due to the narrow, patchy and culturally influenced vegetation communities ▶ The vegetation units are within the Greenbelt policy area. ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ A 4.8 ha young culturally influenced vegetation community composed of Forb Mineral Meadow Marsh and Mineral Cultural Thicket Ecosite. The overall ecological significance and sensitivity is low to moderate. ▶ The vegetation units are within the Greenbelt policy area. ▶ The vegetation units are within the Westerly Creek Valley ESA. ▶ No Rare Flora Species found
	Project Site 97	<ul style="list-style-type: none"> ▶ A 4.2 ha vegetation unit composed of Dry-Moist Old Field Meadow dominated by grasses. Overall ecological significance and sensitivity of the vegetation community is low. ▶ This vegetation community is within the Westerly Creek Valleys ESA and is within the Greenbelt policy area. ▶ No Rare Flora species found. 	<ul style="list-style-type: none"> ▶ A small, 1.1 ha mature Dry-Fresh Sugar Maple Deciduous Forest. ▶ A 2.1 ha Dry-Moist Old field Meadow which is a heavily grazed pasture. This unit is within the Westerly Creek Valleys ESA. ▶ A 6.7 ha vegetation unit composed of Fresh-Moist Hemlock Coniferous Forest and Fresh-Moist Hemlock-Hardwood Mixed Forest. A portion of this unit is within the Westerly Creek Valleys ESA. ▶ An isolated, 7.3 ha regenerating pasture composed of Hawthorn Cultural Savannah and Mineral Cultural Thicket Ecosite. A portion of this unit is within the Westerly Creek Valleys ESA. ▶ These vegetation communities are within the Greenbelt policy area. ▶ Rare Flora Species found include 1 Butternut tree (Endangered Provincially and Federally) which is considered retainable and Black Maple (rare in Durham Region).
	Project Site 100	<ul style="list-style-type: none"> ▶ An 11.3 ha unit which is a shallow marsh composed of Cattail Mineral Shallow Marsh and Submerged Shallow Aquatic Ecosite. ▶ The valley system is designated as the Lynde Creek Valley Environmentally Sensitive Area (ESA) ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ A 8.2 ha cultural meadow community composed of Dry-Moist Old field Meadow and Cultural Thicket. A portion of this unit is within the Lynde Creek Valley ESA. ▶ A narrow 5.0 ha unit composed of Cultural Woodland and Green Ash Mineral Deciduous Swamp. ▶ Rare Flora species observed include Gray Dogwood which is considered rare in Durham Region.
East Link – Section 7 (East Durham Link)	Project Site 90	<ul style="list-style-type: none"> ▶ A 2.7 ha unit composed of Dry-Fresh Poplar Deciduous Forest vegetation communities. A portion of this unit is identified as part of a Core Area (> 25 ha) as this portion is adjacent to the larger forest/swamp to the east. ▶ A 10.1 ha vegetation unit composed of Fresh-Moist White Cedar-Sugar Maple Mixed Forest, Dry-Fresh Sugar Maple-Black Cherry Deciduous Forest, Green Ash Mineral Deciduous Swamp and Cultural Thicket. A portion of this unit is within the Black Creek Valley Environmentally Sensitive Area (ESA). The unit is identified as Core Area (> than 25 ha) which contains 1.1 ha of forest interior habitat. ▶ The vegetation units are entirely within the Greenbelt. ▶ Rare Flora Species include Fragrant Cudweed(2 plants at the edge of cultural thicker), False Loosestrife (a patch on bare ground along creek), Grey Dogwood (2 low shrubs – 50 cm tall) and Tall Blue Lettuce (Regionally Rare). 	<ul style="list-style-type: none"> ▶ A 1.9 ha vegetation unit composed of Willow Mineral Deciduous Swamp, Dry-Fresh White Cedar Coniferous Forest, Dry-Fresh White Cedar-Poplar Mixed Forest communities and Open Aquatic. ▶ The vegetation unit is entirely within the Greenbelt and almost entirely within the Black Creek Valley Environmentally Sensitive Area (ESA). ▶ Rare flora species include 1 Butternut tree (Endangered Provincially and Federally) which is considered retainable; Swamp Dewberry (Regionally Rare). Tall Blue Lettuce (Regionally Rare), False Loosestrife, Grey Dogwood (2 low shrubs – 50 cm tall and Slender Gerardia (several dozen plants on east side of pond).
	Project Site 92	<ul style="list-style-type: none"> ▶ A 1.9 ha vegetation unit composed of Willow Mineral Deciduous Swamp, Dry-Fresh White Cedar Coniferous Forest, Dry-Fresh White Cedar-Poplar Mixed Forest communities and Open Aquatic. ▶ The vegetation unit is entirely within the Greenbelt and almost entirely within the Black Creek Valley Environmentally Sensitive Area (ESA). ▶ Rare flora species include 1 Butternut tree (Endangered Provincially and Federally) which is considered retainable; Swamp Dewberry (Regionally Rare) and Slender Gerardia (several dozen plants on east side of pond) 	<ul style="list-style-type: none"> ▶ A 2.7 ha unit composed of Dry-Fresh Poplar Deciduous Forest vegetation communities. A portion of this unit is identified as part of a Core Area (> 25 ha) as this portion is adjacent to the larger forest/swamp to the east. ▶ A 1.9 ha vegetation unit composed of Willow Mineral Deciduous Swamp, Dry-Fresh White Cedar Coniferous Forest and Sumac Cultural Thicket vegetation communities. This unit is entirely within the Black Creek Valley ESA. ▶ A small, 0.89 ha, unit composed of Dry-Fresh White Cedar Coniferous Forest. This unit is entirely within the Black Creek Valley ESA. ▶ A 0.74 unit composed of Mineral Cultural Thicket and Mineral Cultural Meadow. This unit is entirely within the Black Creek Valley ESA. ▶ A 10.1 ha vegetation unit composed of Fresh-Moist White Cedar-Sugar Maple Mixed Forest, Dry-Fresh Sugar Maple-Black Cherry Deciduous Forest, Green Ash Mineral Deciduous Swamp and Cultural Thicket. A portion of this unit is within the Black Creek Valley Environmentally Sensitive Area (ESA). The unit is identified as Core Area (> than 25 ha) which contains 1.1 ha of forest interior habitat. ▶ The vegetation units are entirely within the Greenbelt ▶ Rare Flora Species include Fragrant Cudweed(2 plants at the edge of cultural thicker)
	Project Site 104	<ul style="list-style-type: none"> ▶ A 2.7 ha unit composed of Dry-Fresh Sugar Male-White Ash Deciduous Forest. ▶ A small 3.0 ha unit composed of early successional communities. Some trees and shrubs are present. ▶ A 0.5 ha deciduous forest unit. ▶ Most of the vegetation units are within the Tooley Creek Valley ESA ▶ No Rare Flora Species found 	<ul style="list-style-type: none"> ▶ A 3.1 ha unit composed of isolated Thicket Swamp (weeping Willow), Cultural Thicket and Cultural Meadow vegetation communities. ▶ No Rare Flora Species found

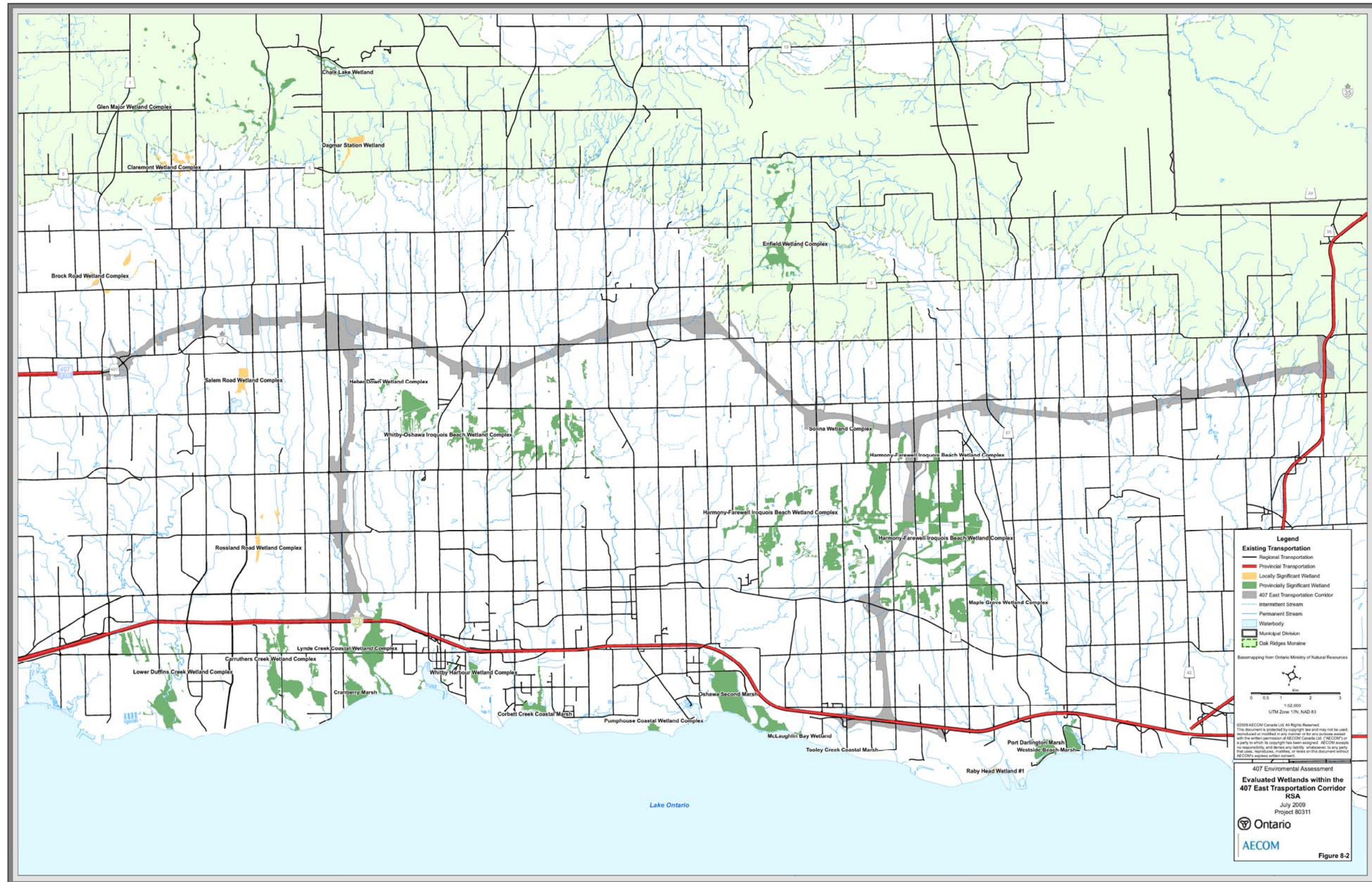


Figure 8-2 Evaluated Wetlands within the 407 East Transportation Corridor Regional Study Area

The designation of wetlands, as either locally or Provincially significant, is completed through a standardized assessment developed by the OMNR, known as the Ontario Wetland Evaluation System. The four principal components that are considered in a wetland evaluation are the biological, social, hydrological, and special features. Based on scoring a wetland can fall into one of two classes, Provincially Significant or Locally Significant (non-Provincially significant).

Table 8-21 lists and provides a summary of evaluated wetlands within the RSA. Figure 8-2 provides the location of Provincially Significant wetlands.

Table 8-21 Evaluated Wetlands within the 407 East Transportation Corridor RSA

Wetland Name	Significance	Year of Last Evaluation	Area (ha)	Wetland Description
Brock Road Wetland Complex	Local	June 1990	6.9	Complex composed of 3 individual wetlands; 55% marsh; 45% swamp (NHIC Natural Areas Data Record)
South of Claremont Wetland Complex	Local	July 1990	8.7	Complex composed of 3 individual wetlands; 66% swamp, 34% marsh; mineral soils; palustrine (NHIC Natural Areas Record)
Claremont Wetland Complex	Local	July 1990	21.1	Complex composed of 13 individual wetlands, on the Oak Ridges Moraine; 80% swamp, 20% marsh; mineral soils; palustrine (66%), isolated (34%) (NHIC Natural Areas Record)
Lower Duffins Creek Wetland Complex	Provincial	In Progress	99.0	Evaluation recently completed, but data not available at this time. Combines the evaluated wetlands of Duffins Creek Lakeshore Marsh and Bayly St. Wetland Complex. (Followes pers. comm. 2006)
Glen Major Wetland Complex	Provincial	June 1987	73.6	Complex is composed of 76 wetlands; 75% swamp; 18% marsh; 1% bog; 6% other; palustrine (82%); isolated (18%) (OMNR 1987). Complex includes Pleasure Valley Bog (2).
Salem Road Wetland Complex	Local	June 1992	22.7	Complex composed of 2 widely separated wetlands; 80% marsh, 20% swamp; mineral soils; palustrine (NHIC Natural Areas Record)
Rossland Road Wetland Complex	Local	June 1990	15.3	Complex composed of 3 individual wetlands; 61% swamp, 39% marsh; 60% organic soils; palustrine (93%), isolated (7%). Rossland Road separates two of the wetlands from the third in the complex. (NHIC Natural Areas Record)
Carruthers Creek Wetland Complex	Provincial	March 1998	144.5	Complex composed of 8 individual wetlands; 81% swamp, 19% marsh; mineral soils; riverine (88%), palustrine (6%), lacustrine (5%), isolated (1%) (Gerson <i>et al.</i> 2001).
Chalk Lake Wetland	Provincial	In progress	12.8	Official evaluation pending (Visser, pers. comm. 2005)
Dagmar Station Wetland	Local	Aug 1988	42.6	Individual wetland on the Oak Ridges Moraine; 100% swamp; 20% organic soils; palustrine (NHIC Natural Areas Record)
Cranberry Marsh	Provincial	July 1983	91.6	Coastal wetland; 68% marsh, 32% swamp; organic soils; lacustrine (NHIC Natural Area Record)
Lynde Creek Coastal Wetland Complex	Provincial	July 1983	146.8	Coastal wetland; 60% marsh, 40% swamp; organic; lacustrine (NHIC Natural Areas Record)
Herber (Heber) Down Wetland Complex	Provincial	Nov 2001	88.4	Complex composed of 16 wetlands; 96% swamp, 4% marsh; organic & mineral soils; riverine, isolated & tableland (NHIC Natural Areas Record)
Whitby-Oshawa Iroquois Beach Wetland Complex	Provincial	June 2005	200.8	Complex is composed of 81 wetlands; 87% swamp; 13% marsh; palustrine (100%) (OMNR 2005)
Whitby Harbour Wetland Complex	Provincial	March 2005	22.8	Evaluation information is pending (Visser, pers. 8-38omm.. 2005).
Corbett Creek Coastal Marsh	Provincial	Aug 1987	27.6	Coastal wetland; 83% marsh, 17% swamp; organic soils; lacustrine (bay & rivermouth) (NHIC Natural Areas Record)
Gold Point Coastal Wetland	Provincial	December 2006	3.7	1 wetland unit; 65% marsh; 35% swamp
Pumphouse Coastal Marsh	Provincial	Oct 1983	7.2	Coastal wetland; 80% marsh, 20% swamp; mineral soils; lacustrine (NHIC Natural Areas Record)

Table 8-21 Evaluated Wetlands within the 407 East Transportation Corridor RSA

Wetland Name	Significance	Year of Last Evaluation	Area (ha)	Wetland Description
Oshawa Creek Coastal Wetland Complex	Provincial	January 2007	20.2	Complex composed of 7 wetland units; 59% swamp; 41% marsh
Enfield Wetland Complex	Provincial	2005	88.2	Complex composed of 24 wetlands on the Oak Ridges Moraine; 97% swamp, 3% marsh; 22% organic soils; palustrine (68%), isolated (9%) (NHIC Natural Areas Record). Updated in 2005 to PSW (Visser, pers. comm. 2005)
Oshawa Second Marsh	Provincial	June 1983	132.5	Oshawa Second Marsh is a coastal wetland composed of two wetland types (29.0% swamp, 71.0% marsh). Wetland consists of large body of open water surrounded by cattails, wet graminoid meadows, willow shrub thickets and wet or moist Poplar-Ash woodlands.
McLaughlin Bay Wetland	Provincial	Aug 1984	43.9	McLaughlin Bay Wetland is a coastal wetland, composed of two wetland types (13% swamp, 87% marsh) (NHIC Natural Areas Report). The marsh has sparse submerged vegetation and intermittent connection to Lake Ontario (Environment Canada 2004). The Marsh provides habitat structure to support a fish community with some diversity of native fish species (Environment Canada 2004).
Harmony-Farewell Iroquois Beach Wetland Complex	Provincial	Sept 2005	687.7	The Harmony-Farewell Iroquois Beach Wetland Complex (70 wetland units) includes what was formally the Black-Farewell Wetland Complex and includes wetlands within the Harmony Creek watershed that were not included in the 1999 evaluation (the Complex now includes the formally separate Harmony Valley Wetland and the Golf Course Wetland). Key feature of the complex include its high number of significant plants and animals, its heron rookery and its coldwater fisheries with resident populations of Brook Trout (OMNR 2005).
Solina Wetland Complex	Provincial	Aug 1999	11.0	Solina Wetland Complex (formally Mitchell's Corner's Wetland) is a small kettle wetland that includes a fen component. The core is a peat-accumulating wetland, surrounded by a Silver Maple Swamp. The wetland provides interior wildlife habitat and supports 13 plant species that are regionally rare in Durham (Henshaw and Leadbeater 1999).
Tooley Creek Coastal Marsh	Local	March 2005	0.3	Tooley Creek Coastal Marsh is a newly designated wetland (2005). Evaluation information is pending (Visser, pers. comm. 2005).
Maple Grove Wetland Complex	Provincial	Feb 2004	149.1	Maple Grove includes 17 wetland units. The wetland complex crosses the headwaters of reaches of the Tooley, Darlington and Bowmanville watersheds. Deciduous swamps are most common, covering 60.2% of the complex. Wetlands such as Maple Grove are rare on the Lake Iroquois Plain (NHIC Natural Areas Report).
Raby Head Wetland #1	Local	July 1984	5.4	Raby Head Wetland is a coastal wetland composed of two wetland types (35% swamp, 65% marsh) (NHIC Natural Areas Report).
Westside Beach Marsh	Provincial	Oct 1983	44.7	Westside Beach Marsh is a coastal wetland, composed of two wetland types (6% swamp, 94% marsh) (NHIC Natural Areas Report). The northern end of the wetland is being quarried for limestone and as a result, Westside Creek will be re-routed around the quarry to enter the marsh from its east side (Environment Canada 2004).
Port Darlington Marsh	Provincial	Aug 1984	30.7	The drainage area of the Port Darlington Marsh (also known as Bowmanville Marsh) is relatively small and is within the Bowmanville Harbour Conservation Area. The marsh is extremely important for spawning, shelter and as a food source (CLOCA et al., 2000) The marsh represents shoreline and riparian landforms and supports representative cattail marsh with wetland meadows, thickets and deciduous forest and riparian aquatics. The area is one of the few cattail marsh areas remaining on the Lake Ontario shoreline (NHIC Natural Areas Data Record).

Lower Duffins Creek, Cranberry Marsh and Oshawa Second Marsh, are also Provincial ANSIs. Glen Major Wetland Complex and Chalk Lake Wetland Complex are within Provincial Candidate ANSIs. Carruthers Creek and Lynde Creek Wetland Complexes are also Regional ANSIs and Enfield Wetland Complex is a Regional Candidate ANSI. The designated wetland areas that are within ANSIs are also ESAs, as designated by TRCA or CLOCA.

Many of the wetlands described above occur along the Lake Ontario Shoreline and are therefore further described as Coastal Wetlands. This unique type of wetland has been the subject of much study in Durham Region. Durham Region is involved in a Coastal Wetland monitoring project, which has monitored 15 wetlands in 2002 and 2003. Great Lakes coastal wetlands have formed at the mouths of stream and rivers where they empty into the lakes and in open or protected bays along the shoreline (Environment Canada 2004). Coastal wetlands can support a mix of plant communities, as a result of their location between the permanent deep water of the lake and the dry upland areas (Environment Canada 2004). Durham Region coastal wetlands within the RSA include:

- | | |
|--|--|
| 1. Duffins Creek (now Lower Duffins Creek Wetland Complex)
2. Carruthers Creek Marsh
3. Cranberry Marsh
4. Lynde Creek Coastal Marsh
5. Corbett Creek Coastal Marsh
6. Gold Point Coastal Wetland
7. Pumphouse Marsh | 8. Oshawa Creek Coastal Wetland Complex
9. Oshawa Second Marsh
10. McLaughin Bay Marsh
11. Raby Head Wetland #1
12. Westside Marsh
13. Port Darlington Marsh (also known as Bowmanville Marsh)
(Environment Canada and OMNR, 2003) |
|--|--|

8.8.2 Local Study Area

The following table provides a description of the existing environmental conditions related to Wetlands within each Local Study Area, corresponding to each of the Projects subject to the Federal EA (as presented in Table 8-22).

Table 8-22 Existing Wetlands Associated with Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions Site Study Area (SSA)	Summary of Existing Conditions Local Study Area (LSA)
West Mainline – Section 1 (Brock Road to Audley Road)	Federal Airport Lands	▶ White Cedar Organic Coniferous Swamp unit	▶ None
	Project Site 3	▶ A 1.8 ha Willow Mineral Deciduous Swamp with a small Scotch Pine Coniferous Plantation adjacent to Highway 7. This riparian vegetation unit consists of Crack willow and Balsam Poplar with Green Ash. The understorey is sparse with Red-osier Dogwood. The dense ground layer is dominated by facultative and obligate wetland species including sedges, Spotted Jewel weed, Broad-leaf Cattail, Narrow-leaved Cattail, Spotted Joe pye Weed, Swamp Milkweed, Bugleweed and Purple-stemmed Aster.	▶ None

Table 8-22 Existing Wetlands Associated with Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions Site Study Area (SSA)	Summary of Existing Conditions Local Study Area (LSA)
	<i>Project Site 3a</i>	▶ None	▶ White Cedar Organic Coniferous Swamp dominated by White Cedar. The high diversity ground layer includes Spotted Jewelweed, Field Horsetail, Sedges, Oak Fern, Great Blue Lobelia, Marsh Fern, Sensitive Fern and Marsh Marigold.
	<i>Project Site 7</i>	▶ White Cedar Organic Coniferous Swamp dominated by mature White Cedar, with Yellow Birch, Eastern Hemlock, Sugar Maple, and Eastern White Pine. The understorey is primarily regenerating White Cedar. The ground layer is composed of abundant ferns including Sensitive Fern and Bulblet Fern, with Jack-in-the-pulpit, Spotted Jewelweed, Foam Flower and Great Blue Lobelia.	▶ None
	<i>Project Site 8</i>	▶ Reed-canary Grass Mineral Meadow Marsh ▶ Cattail Mineral Shallow Marsh dominated by Narrow-leaved Cattail with Soft-stemmed Bulrush, Lake-bank Sedge, Small-fruit Bulrush and Blueflag.	▶ Narrow-leaved Sedge Mineral Meadow Marsh
	<i>Project Site 9</i>	▶ A Black Ash Mineral Deciduous Swamp mid-aged wetland community. The canopy is dominated by Black Ash with frequent to occasional Green Ash, American Basswood, White Cedar, Balsam Poplar and some Manitoba Maple along the forest edge. Frequent species in the understorey include young Black and Green Ash, and Alternate-leaved Dogwood. In the ground layer there is abundant Ostrich Fern with frequent Spotted Jewelweed and White Snakeroot. Other occasional species include Starflowered Solomon's Seal, Jack-in-the-Pulpit, White Avens and Broad-leaved Goldenrod. ▶ White Cedar- Hardwood Mineral Mixed Swamp wetland community with White Cedar up to 70 cm dbh. The canopy is dominated by White Cedar with Basswood, Black Ash and Sugar Maple. The understorey is composed of Alternate-leaved Dogwood and young Black Ash and White Cedar. Ostrich Fern is abundant in the groundlayer with frequent to occasional species including Wood Nettle, Jack-in-the-Pulpit, White Snakeroot, Bulblet Fern, Spotted Jewelweed and moss.	▶ White Cedar Mineral Coniferous Mixed Swamp.
	<i>Project Site 11</i>	▶ Meadow Marsh	▶ Reed-canary Grass Mineral Meadow Marsh
	<i>Project Site 12</i>	▶ Reed-canary Grass Mineral Meadow Marsh Type	▶ Meadow Marsh
West Mainline – Section 2 (Audley Road to Ashburn Road)	<i>Project Site 17</i>	▶ Reed-canary Grass Mineral Meadow Marsh	▶ None
	<i>Project Site 18</i>	▶ None	▶ A Forb Mineral Meadow Marsh is found around the edges of LSA for this crossing.
	<i>Project Site 19</i>	▶ None	▶ A Forb Mineral Meadow Marsh is found around the edges of LSA for this crossing.
	<i>Project Site 20</i>	▶ None	▶ None
	<i>Project Site 21</i>	▶ Reed-canary Grass Mineral Meadow Marsh	▶ None

Table 8-22 Existing Wetlands Associated with Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions Site Study Area (SSA)	Summary of Existing Conditions Local Study Area (LSA)
Central Mainline – Section 3 (Ashburn Road to Simcoe Street)	<i>Project Site 24</i>	▶ Reed Canary Grass Mineral Meadow Marsh	▶ None
	<i>Project Site 28</i>	▶ Meadow Marsh ▶ Reed-Canary Grass Mineral Meadow Marsh	▶ A 1.2 ha unit which is bottomland mixed swamp. Vegetation communities include White Cedar-Harwood Mineral Mixed Swamp and Cattail Mineral Shallow Marsh ▶ Reed-Canary Grass Mineral Meadow Marsh
Central Mainline – Section 4 (Simcoe Street to Enfield Road)	<i>Project Site 35</i>	▶ Forb Mineral Meadow Marsh	▶ None
	<i>Project Site 38 a</i>	▶ Willow Mineral Thicket Swamp	▶ Reed-canary Grass Mineral Meadow Marsh
	<i>Project Site 54</i>	▶ Forb Mineral Meadow Marsh	▶ Red-osier Mineral Thicket Swamp
East Mainline – Section 5 (Enfield Road to Highway 35/115)	<i>Project Site 57a</i>	▶ Meadow Marsh and Willow Mineral Thicket Swamp	▶ A 2.2 ha unit composed of Willow Mineral Deciduous Swamp. ▶ A 0.93 ha isolated swamp community composed of White Cedar Hardwood Organic Mixed Swamp.
West Link – Section 6 (West Durham Link)	<i>Project Site 44</i>	▶ Reed-canary Grass Mineral Meadow Marsh ▶ Red-osier Mineral Thicket Swamp	▶ Reed-canary Grass Mineral Meadow Marsh ▶ Red-osier Mineral Thicket Swamp and Meadow Marsh
	<i>Project Site 47</i>	▶ Mineral Meadow Marsh Ecosite	▶ Swamp Maple Mineral Deciduous Swamp
	<i>Project Site 47a</i>	▶ None	▶ None
	<i>Project Site 51</i>	▶ Forb Mineral Meadow Marsh associated with the meanders and banks of Lynde Creek	▶ Forb Mineral Meadow Marsh ▶ A 6.7 ha Willow Mineral Deciduous Swamp dominated by Crack Willow and Manitoba Maple with occasional Apple.
	<i>Project Site 97</i>	▶ None	▶ None
	<i>Project Site 100</i>	▶ An 11.3 ha shallow marsh unit dominated by Narrow-leaved Cattail with Reed Canary Grass, Purple Loosestrife, Broad-leaf Cattail, Northern Bugleweed and Yellow Iris. The unit is part of the Lynde Creek Coastal Wetland Complex, which is a large (156.7 ha) Provincially Significant Wetland (PSW)	▶ A Green Ash Mineral Deciduous Swamp unit, portion of which is within the Lynde Creek Coastal Wetland Complex PSW. ▶ A 4.0 ha Cattail Mineral Shallow Marsh. A portion of this unit is within the Lynde Creek Coastal Wetland Complex PSW.
East Link – Section 7 (East Durham Link)	<i>Project Site 90</i>	▶ Green Ash Mineral Deciduous Swamp ▶ A portion of the vegetation communities are within the Harmony-Farewell Iroquois Beach Wetland Complex designated as Provincially Significant Wetland (PSW)	▶ Willow Mineral Deciduous Swamp community dominated by Hybrid White Willow and Manitoba Maple.
	<i>Project Site 92</i>	▶ Willow Mineral Deciduous Swamp community dominated by Hybrid White Willow and Manitoba Maple	▶ Willow Mineral Deciduous Swamp ▶ A portion of the vegetation communities are within the Harmony-Farewell Iroquois Beach Wetland Complex designated as Provincially Significant Wetland (PSW)
	<i>Project Site 104</i>	▶ None	▶ Thicket Swamp dominated by Weeping Willow with some Red Ash. Red Ash and Common Buckthorn are dominant in the sub-canopy. Red-osier Dogwood and Red Ash are common in the understorey.

8.9 Fish and Fish Habitat (Projects subject to Federal EA)

The following description of the environment potentially affected applies to the Projects subject to Federal EA. An overview of the 407 East Transportation Corridor RSA is provided as context for the detailed description of the individual Projects subject to Federal EA.

8.9.1 Regional Overview

Each major watercourse is described below in terms of its habitat classification (i.e., warm water, cool water, cold water), and the fish species likely present.

Duffins Creek

Most of Duffins Creek (333.8 km) is considered coldwater habitat, with 37.5 km classified as warm water. The remainder (8.0 km) is unclassified. Duffins Creek supports a diverse fish community with 33 species recorded during the 2000 and 2002 fish community surveys (Cook and Clayton 2004). Species recorded include resident and migratory salmonids (e.g., brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), chinook salmon (*Oncorhynchus tshawytscha*) and rainbow trout (*Oncorhynchus mykiss*), among others [TRCA 2003]). An additional 18 species have historically been found in Duffins Creek watershed (Cook and Clayton 2004).

Carruthers Creek

Approximately two thirds (40.1 km) of Carruthers Creek is considered coldwater habitat (the middle and upper reaches) with one third (21.6 km) classified as warmwater. The remainder (1.3 km) is unclassified (OMNR NRVIS mapping). Carruthers Creek is one of the least-studied watersheds within the TRCA jurisdiction. Although historically this system would have supported a range of coldwater species including Atlantic salmon (*Salmo salar*), brook trout, slimy sculpin (*Cottus cognatus*) and mottled sculpin (*Cottus bairdi*), most of these species are no longer present, with the exception of mottled sculpin (TRCA 2003). It has been suggested (based on anecdotal information) that Redside Dace (*Clinostomus elongates*), a Federal and Provincial Species at Risk (SAR), is present but sparsely distributed in Carruthers Creek (Cook and Clayton 2004). The recent fish surveys undertaken in 2000 and 2002 recorded 18 fish species (Cook and Clayton 2004). However, this relatively low diversity may be partly explained by a small sampling effort (TRCA 2003). Historically, an additional 23 species have been found in Carruthers Creek (Cook and Clayton 2004).

Lynde Creek

Most (195.4 km) of Lynde Creek is considered coldwater habitat with a small portion (23.8 km) classified as warmwater. The remainder (10.7 km) is unclassified (OMNR NRVIS data). Lynde Creek and its tributaries support both warm and coldwater fish species including migratory salmonids from Lake Ontario. Fish species observed in the Lynde Creek system include: rainbow trout, brook trout, white sucker (*Catostomus commersoni*), smallmouth bass (*Micropterus Dolomieu*), largemouth bass (*Micropterus salmoides*) and yellow perch (*Perca flavescens*), among others (CLOCA, 2005). Redside dace, a Federal and Provincial Species at Risk (SAR) has been recorded in Lynde Creek (Tarandus 2002, CLOCA 2005).

Pringle Creek

Approximately 50 percent (17.1 km) of Pringle Creek is considered coldwater habitat with a small portion (2.5 km) classified as coolwater (lower reaches). A further 13.9 km is classified as warmwater (middle reaches) while the remainder (0.5 km) is unclassified (OMNR NRVIS mapping). The fish community of the Pringle Creek watershed includes: rainbow trout, chinook salmon, white sucker, walleye (*Stizostedion vitreum*), pumpkinseed (*Lepomis gibbosus*), and largemouth bass, among others (CLOCA 2005).

Corbett Creek

Most (16.5 km) of Corbett Creek is considered warmwater habitat with a small portion (4.4 km) that is unclassified. Only 400 m of the creek is classified as coldwater (OMNR NRVIS mapping). The fish community of the Corbett Creek watershed includes chinook salmon, white sucker, pumpkinseed, brown bullhead (*Ameiurus nebulosus*) and northern Pike (*Esox lucius*), among others (CLOCA 2005).

Goodman Creek

All 11.5 km of Goodman Creek is classified as warmwater habitat (OMNR NRVIS mapping). In a fish sampling study in 2000, only ten fish species were recorded in Goodman Creek (CLOCA 2002). Species observed included primarily cyprinids as well as rock bass and white sucker. One non-native and invasive species, goldfish (*Carassius auratus*), was also found in abundance in a stormwater retention pond along the Goodman Creek system and this species is considered “a very serious threat to the aquatic resource of the watershed” (CLOCA 2002).

Oshawa Creek

Most (264.1 km) of Oshawa Creek is considered coldwater habitat with a small portion (8.7 km) classified as warmwater (lower reaches). The remainder (6.9 km) is unclassified (OMNR NRVIS mapping). In a fish sampling study in 2000, 30 fish species were recorded in the Oshawa Creek system, including the Oshawa Harbour (CLOCA 2002). As would be expected, the fish community differed depending on the sampling station location. For example, species richness in the headwater reaches was low. However these reaches supported species indicative of cold, uncontaminated water that were not found elsewhere in the system (i.e., brook trout, slimy sculpin and northern redbelly dace (*Phoxinus eos*) [CLOCA 2002]). Species richness was greatest in the lower reaches and included species tolerant of a wide range of contaminant and temperature conditions (CLOCA 2002). The most abundant salmonid species captured were rainbow trout and brown trout, which have likely played a role in reducing the prevalence of brook trout, once the most abundant salmonid species in the system (CLOCA 2002).

Farewell Creek

Farewell Creek is classified as a coldwater stream for 57.3 km of its entire length (63.5 km), with small sections where the thermal classification is unknown according to the OMNR Thermal Assessment mapping. Gartner Lee (1978) identified the reach between Grandview Street in Oshawa and the hamlet of Solina, as the most significant portion of coldwater habitat in Farewell Creek. CLOCA's Watershed Inventory (1979)

describes Farewell as a significant trout fishery, offering the potential for the development of a fishery for lake-run trout or salmon. Fish community surveys conducted as part of the Harmony Creek Subwatershed Study, confirmed the presence of rainbow and brown Trout (Fenco MacLaren 1995).

Black Creek

Black Creek, measuring 37.9 km in total length, is classified as a coldwater stream, with the exception of 1.6 km of stream where the thermal classification is unknown (OMNR NRVIS mapping).

Harmony Creek

Warmwater and coldwater classifications are represented in Harmony Creek, according to OMNR NRVIS data. Harmony Creek is 71.5 km in total length, with 48 km of coldwater habitat, 16.7 km of warmwater habitat and 6.7 km of unknown thermal status. Overall, Harmony Creek is considered a coolwater system (Haslett, pers comm. 2004) supporting coldwater fish communities (McCauley, per comm. 2005). Sampling by MNR in 1993 and CLOCA in 2002 revealed the following species: blacknose dace (*Rhinichthys atratulus*), longnose dace (*Rhinichthys cataractae*), white sucker, Creek Chub (*Semotilus atromaculatus*), fathead minnow (*Pimephales promelas*), johnny darter (*Etheostoma nigrum*), brook stickleback (*Culaea inconstans*) and rainbow trout (Ecoplans Limited and McCormick Rankin Corporation 2005).

Bowmanville Creek

According to the OMNR Thermal Assessment, Bowmanville Creek is primarily coldwater habitat, with the exception of 0.8 km of coolwater habitat and 1.6 km where the thermal status is unknown. The total stream length of Bowmanville Creek is 199.1 km. CLOCA's Bowmanville/Soper Creek Watershed Aquatic Resource Management Plan (CLOCA *et al.* 2000), identified 48 species of fish that are native to the watershed and seven species that have been introduced to the watershed, many of which has been introduced to expand sport-fishing opportunities in the watershed or in Lake Ontario. Non-native species include carp (*Cyprinus carpio*), brown trout and rainbow trout and Salmon species [Chinook and Coho (*Oncorhynchus kisutch*)]. Native species of note include lake sturgeon (*Acipenser fulvescens*), tessellated darter (*Etheostoma nigrum olmstedii*), longnose gar (*Lepisosteus osseus*) and the invasive sea lamprey (*Petromyzon marinus*) (CLOCA *et al.* 2000).

Soper Creek

Soper Creek is classified as a predominately coldwater fishery. Soper Creek is classified as coldwater for 147 km of its 159.9 km total length. Warmwater reaches total 8.5 km in length with 0.9 km and 3.5 km of coolwater reaches and reaches of unknown thermal status respectively. The Environmental Sensitivity Mapping Project (Gartner Lee Limited, 1978) identified Soper Creek as a high quality coldwater stream. The forest cover for this watershed is 21.2% (OMNR NRVIS mapping).

Wilmot Creek

Wilmot Creek is classified as a coldwater stream for 132.1 km of its 158.7 km total length (OMNR NRVIS mapping). Reaches where the thermal status is unknown measure 26.5 km. Wilmot Creek is regarded as highly important with respect to quality of trout habitat and spawning habitat for migratory salmonids (Fenco MacLaren Inc 1995). Fish species common in the watersheds described above have similarly been recorded in Wilmot Creek including: rainbow, brook and brown trout species, blacknose dace, longnose dace, johnny darter and salmon species (Tarandus Associates Limited 2002).

Robinson, Tooley and Darlington Creeks

Robinson (6.6 km) and Darlington (26.4 km) creeks are warmwater streams (OMNR NRVIS mapping). The thermal status for Tooley Creek is unknown for most of its total length of 15.7 km, although reaches of Tooley Creek totalling 5.9 km are classed as coolwater. The ability of these creeks to support warm or cold water sport fisheries and long-term survival of salmonids and migratory lake-run salmonids are greatly impaired by high summer water temperatures, low dissolved oxygen levels (compared to high quality trout streams), small volumes of water and poor physical condition of the creek (CLOCA 1979). Fish species occurring in these creeks include: rainbow trout, white sucker, blacknose dace, creek chub and fathead minnow (CLOCA 2005).

8.9.2 Local Study Area

Table 8-23 provides a description of the existing environmental conditions related to Fish and Fish Habitat within each Local Study Area, corresponding to each of the Projects subject to the Federal EA.

Table 8-23 Existing Fish and Fish Habitat Conditions Associated with Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Habitat Conditions	Habitat Sensitivity	Fish Species
West Mainline – Section 1 (Brock Road to Audley Road)	Federal Pickering Lands	▶ None	None	▶ None
	Project Site 3	▶ The channel is defined with generally mixed morphology and substrates and riparian cover transitioning from cultural thicket to mixed forest. ▶ Channel displays riffle/pool/flat morphology with substrates of boulders/cobbles/gravel and sand.	Low	▶ Permanent Baitfish Community with salmonid species ▶ Rainbow and Brook Trout are present downstream of the ROW
	Project Site 3a	▶ The channel is defined with generally mixed morphology and substrates and riparian cover transitioning from cultural thicket to mixed forest. ▶ Channel displays riffle/pool/flat morphology with substrates of boulders/cobbles/gravel and sand.	Low	▶ Permanent Baitfish Community with salmonid species ▶ Rainbow and Brook Trout are present downstream of the ROW
	Project Site 7	▶ Substrates are mixed coarse materials (cobble and small boulder through sand) and morphology is dominated by riffles. The crossing is within a well defined valley, with mixed forest riparian cover. ▶ Abundant instream cover provided by boulders, cobbles and woody debris, as well as finer materials from valley and bank erosion (gravel and sand)	High	▶ Brook Trout, Bluntnose Minnow, Blacknose Dace and Slimy Sculpin
	Project Site 8	▶ The channel is relatively straight, with sand and gravel dominated substrates with some fines, and morphology dominated by runs. Several beaver dams were present during the 2008 surveys.	High	▶ Redside Dace, associated with the deeper pool habitats and overhanging vegetation downstream of the ROW boundary.
	Project Site 9	▶ The channel morphology is dominated by riffles and runs in a highly meandering setting. ▶ The riparian zone consists of lowland forest community providing a high degree of instream shading for aquatic organisms. Approximately 85% of the instream cover is provided by undercut banks, woody debris, boulders and over-hanging vegetation. ▶ Approximately 220 m upstream of the proposed ROW there is a large concrete dam acting as a permanent barrier to upstream migration. Further upstream there are other low lying weir structures and laneway crossings.	High	▶ Coldwater sport fish and diverse forage/baitfish community
	Project Site 11	▶ Substrates are coarse, and morphology is composed of riffles, flats and pools (~20% representation). Riparian vegetation consists of shrub thicket and a small woodlot. ▶ Instream cover is provided by woody debris, undercut banks, boulders and riparian vegetation ▶ Riparian vegetation consists of a narrow woodland, shrub thicket and meadow ▶ Erosion and slumping of banks noted in some reaches	High	▶ Coolwater forage/baitfish community with Redside Dace
	Project Site 12	▶ Pool features represent ~10% of the channel morphology along the reach (remainder is riffles and flats). ▶ Riparian vegetation is composed of cultural meadow and deciduous forest. Instream cover was provided by undercut banks and emergent vegetation.	High	▶ Watercourse supports a baitfish community with Redside Dace or SAR species present. ▶ Creek Chub, Johnny Darter and Brook Stickleback observed in potential spawning conditions (based on colour)
West Mainline – Section 2 (Audley Road to Ashburn Road)	Project Site 17	▶ The channel is relatively straight and defined, and the banks display evidence of minor erosion. ▶ Substrates are predominantly boulder and cobbles with some finer gravel and sand intermixed, and riparian vegetation consists of mixed forest surrounded by agricultural fields (crops). ▶ There are some small, relatively deep pools that offer refuge habitat to resident fish during drier parts of the year; however these pools may not be persistent. ▶ Numerous woody debris jam barriers that impede movement of fish	Low	▶ Diverse warmwater baitfish community
	Project Site 18	▶ The channel flows in a southern direction through woodlands, agricultural fields and residential parcels, before joining with main West Lynde Creek in a forested area. ▶ Intermittent or intermittent/ephemeral flow, and marginal or only potential seasonal baitfish use. In most cases these features are straight, with limited channel definition, limited to no riparian cover, uniform morphological development and mixed substrates. ▶ Primary functions include indirect seasonal flow contribution and nutrients/allochthonous inputs to habitat downstream.	Low	▶ Seasonal warmwater baitfish community
	Project Site 19	▶ Deep pools and instream cover consisting of boulders and woody debris provide excellent structural habitat for fish	High	▶ Permanent salmonid spawning and rearing community ▶ Presence of salmonids (Rainbow and Brook Trout), as well as other coldwater species (Mottled Sculpin) ▶ Redside Dace were caught approximately 1.2 km upstream and 700 m downstream of the ROW
	Project Site 20	▶ Stable and relatively uniform channel, with riparian vegetation dominated by grasses, raspberry, and some mixed hardwood trees such as maple, poplar, and basswood. Bed substrates are dominated by sand, boulders, and gravel, with a riffle/pool morphology along most of the reaches.	High	▶ Warmwater forage and baitfish community including Redside Dace
	Project Site 21	▶ On-line pond approximately 900 m upstream of the ROW may present a barrier to fish movement. ▶ Significant amounts of brown algae growing on the bed and cobbles ▶ Abundant/dense overhanging grasses and herbs provide overhead cover ▶ Good riffle-pool sequencing present through the downstream and ROW reaches. Upstream of the ROW, the channel morphology was predominantly flats.	High	▶ Watercourse supports a warmwater forage and baitfish community including Redside Dace/SAR species. ▶ Numerous baitfish were seen in the channel downstream and through the ROW

Table 8-23 Existing Fish and Fish Habitat Conditions Associated with Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Habitat Conditions	Habitat Sensitivity	Fish Species
Central Mainline – Section 3 (Ashburn Road to Simcoe Street)	Project Site 24	<ul style="list-style-type: none"> ▶ Riparian area consists of a mosaic of cultural meadow and woodland communities with a relatively open canopy over the channel ▶ Channel morphology consists of mainly flats and pools with some riffle area ▶ Instream cover is provided by undercut banks, boulders, and overhanging riparian vegetation ▶ Substrates dominated by coarse gravel and sand materials 	High	▶ Watercourse supports migratory and resident coldwater, cool and warmwater fish species including Mottled and Slimy Sculpin and Rainbow Trout (Y-O-Y and parr)
	Project Site 28	<ul style="list-style-type: none"> ▶ Channel morphology consists of a relatively even distribution of riffle, pools and runs ▶ Coarse substrates dominated by cobble, gravel and sand ▶ Some erosion control bank stabilization measures already implemented within the ROW at meander bends 	High	▶ Watercourse identified as a coldwater fishery offering spawning habitat and a migratory corridor for coldwater species such as Chinook salmon and Rainbow Trout
Central Mainline – Section 4 (Simcoe Street to Enfield Road)	Project Site 35	<ul style="list-style-type: none"> ▶ The riparian vegetation consists of cultural herb and grass species, as well as Eastern White Cedar stands on both banks ▶ Scattered large boulders, overhanging vegetation and undercut banks provide overhead and instream cover for fish ▶ Channel morphology consists of riffles and pools with scattered runs 	High	▶ Permanent coldwater salmonid community including Rainbow and Brown Trout (observed fingerlings and juveniles).
	Project Site 38 a	<ul style="list-style-type: none"> ▶ Riparian vegetation is a mix of cultural thicket and poplar deciduous forest ▶ Good quality habitat for salmonids (e.g., long riffles with coarse substrates, undercut banks, woody debris throughout wetted perimeter, good riffle and pool habitat) ▶ Abundant overhanging woody vegetation within the riparian corridor provides cover and habitat for fish 	High	▶ Permanent coldwater Salmonid spawning/ rearing fishery including Rainbow Trout and Mottled Sculpin (Rainbow Trout)
	Project Site 54	<ul style="list-style-type: none"> ▶ Riparian vegetation is discontinuous with active agricultural field and cultural meadow ▶ Most of the channel immediately downstream of ROW was densely choked by vegetation ▶ There were small woody debris jams and knick points that may create seasonal barriers to upstream movement immediately downstream of the ROW 	Low	▶ Seasonal forage and baitfish use
East Mainline – Section 5 (Enfield Road to Highway 35/115)	Project Site 57a	<ul style="list-style-type: none"> ▶ Originates in Oak Ridges Moraine to the north ▶ Low gradient system ▶ Minor evidence of pools, runs and flats ▶ Substrate is predominantly fine 	Low	<ul style="list-style-type: none"> ▶ Fish community includes: Creek chub, fathead minnow and pumpkinseed ▶ Supports baitfish and warmwater tolerant species ▶ YOY creek chub observed during habitat surveys
West Link – Section 6 (West Durham Link)	Project Site 44	<ul style="list-style-type: none"> ▶ Substrate consists of a mix of coarse and fine materials (cobbles, gravel, sand and some clay) ▶ Channel morphology consists mainly of flats and pools, with some riffles and runs ▶ Boulders have been placed in the stream to dissipate flow energy and deflector logs placed on banks to prevent continued erosion in areas ▶ Riparian vegetation is a mix of Hemlock, Sugar Maple and mixed forests, cattle pasture (cattle have full access to the watercourse and riparian vegetation has been grazed) and cultural thicket regeneration on former pasture land ▶ Abundance of non-native plant species in the understorey and shrub layer (buckthorn) A poorly maintained timber weir (approximately 0.4 m drop) acts as a barrier to upstream fish movement particularly during low flow conditions, as do numerous woody debris jams observed throughout the corridor 	Low	▶ Resident bait/forage fish community
	Project Site 47	<ul style="list-style-type: none"> ▶ Substrate consists of a mix of coarse and fine materials (cobbles, gravel, sand and some clay) ▶ Channel morphology consists mainly of flats and pools, with some riffles and runs ▶ Boulders have been placed in the stream to dissipate flow energy and deflector logs placed on banks to prevent continued erosion in areas ▶ Riparian vegetation is a mix of Hemlock, Sugar Maple and mixed forests, cattle pasture (cattle have full access to the watercourse and riparian vegetation has been grazed) and cultural thicket regeneration on former pasture land ▶ Abundance of non-native plant species in the understorey and shrub layer (buckthorn) A poorly maintained timber weir (approximately 0.4 m drop) acts as a barrier to upstream fish movement particularly during low flow conditions, as do numerous woody debris jams observed throughout the corridor 	Low	▶ Seasonal forage and baitfish use
	Project Site 47a	<ul style="list-style-type: none"> ▶ Substrate consists of a mix of coarse and fine materials (cobbles, gravel, sand and some clay) ▶ Channel morphology consists mainly of flats and pools, with some riffles and runs ▶ Boulders have been placed in the stream to dissipate flow energy and deflector logs placed on banks to prevent continued erosion in areas ▶ Riparian vegetation is a mix of Hemlock, Sugar Maple and mixed forests, cattle pasture (cattle have full access to the watercourse and riparian vegetation has been grazed) and cultural thicket regeneration on former pasture land ▶ Abundance of non-native plant species in the understorey and shrub layer (buckthorn) A poorly maintained timber weir (approximately 0.4 m drop) acts as a barrier to upstream fish movement particularly during low flow conditions, as do numerous woody debris jams observed throughout the corridor 	Low	▶ Seasonal forage and baitfish use
	Project Site 51	<ul style="list-style-type: none"> ▶ Highly sinuous channel form, with sharp meander bends and slumping banks at pool locations. Severe bank erosion in some areas with bank heights up to 1.60 m high. ▶ Channel morphology dominated by flats with a few pools; substrates dominated by fine materials (i.e., sand, clay and muck). ▶ Small beaver dam located approximately 120 m upstream of Highway 401 is a seasonal barrier to fish ▶ Riparian vegetation comprised of mix of meadow marsh, with some cultural woodland and thicket swamp; general lack of woody vegetation in riparian area; little overhead shading provided 	Moderate	▶ Permanent warmwater – Northern Pike

Table 8-23 Existing Fish and Fish Habitat Conditions Associated with Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Habitat Conditions	Habitat Sensitivity	Fish Species
	Project Site 97	<ul style="list-style-type: none"> ▶ Originates from agricultural lands and wooded areas approximately 9.3 km upstream of the proposed ROW (approximately 3.2 km north of Highway 7) ▶ Banks well vegetated with low to moderate occurrence of overhanging herbaceous vegetation present. Some erosion and undercut banks noted ▶ Substrates dominated by soft sediments, with some gravel and boulders present ▶ Riparian area consists of a narrow buffer (5 to 10 m) of cultural meadow and cultural thicket, surrounded by agricultural fields 	Low	<ul style="list-style-type: none"> ▶ Seasonal forage/baitfish community. ▶ Species found approximately 1 km downstream of the ROW included Bluntnose Minnow, Fathead Minnow, Blacknose Dace, Brook Stickleback and Johnny Darter
	Project Site 100	<ul style="list-style-type: none"> ▶ Flat gradient, slow moving flow; turbid during field assessments. ▶ Channel morphology dominated by flats with some deeper pool sections. ▶ Predominantly soft substrates with scattered boulders throughout ROW reach ▶ Banks are well vegetated with herbaceous species and grasses, however they display erosion and slumping. ▶ Riparian cover comprised of narrow band of deciduous forest along east side of the channel, and meadow marsh (cattails and Reed-canary Grass) along the western bank. 	Moderate	<ul style="list-style-type: none"> ▶ Permanent baitfish with migratory salmonids (e.g., Chinook Salmon, Rainbow Trout and Brook Trout). ▶ Fish species include Creek Chub and Pumpkinseed.
East Link – Section 7 (East Durham Link)	Project Site 90	<ul style="list-style-type: none"> ▶ Originates north of Nash Road and east of Hancock Road ▶ Constructed drainage ditch with seasonal flow ▶ Thick riparian cover 	Low	<ul style="list-style-type: none"> ▶ Potential migratory/spawning habitat in spring
	Project Site 92	<ul style="list-style-type: none"> ▶ Good/permanent fish habitat/stream flow and instream cover ▶ Dams downstream with large pond on the south side of Nash Road ▶ Residents built rocky bank to secure shoreline 	High	<ul style="list-style-type: none"> ▶ The fish community is diverse and includes: Brook Trout and a range of warmwater species such as Pumpkinseed, White Sucker, as well as several species of forage fish ▶ Survey observed diverse coolwater fish community including Rainbow Trout, Rainbow Darter, Johnny Dart, Blacknose Dace, Mottled Sculpin, Pumpkin seed and Sea Lamprey
	Project Site 104	<ul style="list-style-type: none"> ▶ Predominately surrounded by agriculture ▶ Feature is well defined with riffle/pool sequences and good mixture of sand, gravel and cobble substrates ▶ Large woody debris is also abundant within the active channel 	Moderate	<ul style="list-style-type: none"> ▶ Supports diverse coolwater baitfish and sportfish community. ▶ Fish community includes: Creek chub, blacknose dace, northern redbelly dace, brook stickleback, white sucker, fathead minor, pumpkinseed, brown bullhead, bluntnose minnow and rainbow trout

8.10 Wildlife and Wildlife Habitat, including Migratory Birds (Projects subject to Federal EA)

The following description of the environment potentially affected applies to the Projects subject to Federal EA. An overview of the 407 East Transportation Corridor (by watershed) is provided as context for the detailed description of the individual Projects subject to Federal EA.

8.10.1 Regional Overview

In general much of the natural vegetation cover across the RSA was historically cleared for agriculture. The open agricultural fields, cultural / marsh meadows, thicket and forest areas provide habitat for a suite of common, generalist species that are tolerant of semi-urban and rural/agricultural conditions. For example, the vast majority of the bird species observed are common, habitat generalist species that utilize a variety of habitats (such as agricultural fields, thickets, scattered forests, and meadows) that are common in this culturally influenced landscape (agriculture and suburban/urban development). As such, the following discussion highlights the wildlife and wildlife habitat features along and/or adjacent to the 407 East Transportation Corridor (i.e., within 120 m), focussing on wildlife species, sensitive habitats and landscape connectivity for the purposes of wildlife movement.

While the following description of existing conditions refers to breeding birds, the vast majority of these birds would also be considered to be migratory birds and would be subject to the requirements of the *Migratory Birds Convention Act 1994* (MBCA) and the *Migratory Birds Regulations* which provide for the conservation of migratory birds and for the protection of their nests and eggs and prohibits the possession of a migratory bird, nest or egg without a permit.

East Duffins Creek Watershed

The transportation corridor crosses a portion of the East Duffins Creek watershed that includes the hamlets of Brougham and Greenwood and surrounding rural residential, commercial, and agricultural land uses.

There is 1 known Provincially rare terrestrial wildlife species (Carolina Wren) adjacent to the transportation corridor (within 120 m) crossing of the East Duffins Creek watershed. The transportation corridor crosses or is adjacent to several habitat units containing sensitive and specialized wildlife habitat (SSWH), including potential deer winter habitat, groundwater seepage areas; high quality, mature forest areas; interior forest habitat; and areas with a high abundance of breeding birds.

Herpetofauna habitat is present generally along the watercourses and associated riparian areas, in local wetland habitats and in dug agricultural ponds. These areas provide habitat for localized breeding and movement of common amphibian species. East Duffins Creek has potential habitat for a variety of common turtle species.

A total of 60 breeding bird species were recorded in and adjacent to the transportation corridor (within 120 m). The most abundantly recorded bird species in this area were Song Sparrow, Red-winged Blackbird, and American Goldfinch. These species are typical of a range of habitats including forest edges and openings, open fields, agricultural zones and wet areas.

There were 4 forest area-sensitive bird species recorded in and adjacent to the transportation corridor (within 120 m). These are listed in **Table 8-24** below.

Table 8-24 Forest Area-sensitive Species in the Study Area of the East Duffins Creek Watershed

Common Name	Scientific Name	Number Recorded
Forest Area-Sensitive		
Hairy Woodpecker	<i>Picoides villosus</i>	1
Least Flycatcher	<i>Empidonax minimus</i>	3
Pileated Woodpecker	<i>Dryocopus pileatus</i>	2
Veery	<i>Catharus fuscescens</i>	7

Amphibian calling surveys recorded 5 amphibian species: American Toad, Green Frog, Gray Treefrog, Spring Peeper, and Wood Frog. These species are common, expected for site conditions and typically abundant within Durham Region generally. They are often observed wherever suitable habitat is present. This can include dug ponds, ditches, natural and man-made wetlands.

There are no known Federally (COSEWIC) or Provincially (COSSARO) designated wildlife species at risk within or adjacent to the transportation corridor. The Provincially rare species Carolina Wren was observed in the East Duffins Creek valley. This species can be found in a wide variety of habitats including forests, swamps, and urban areas. Rare bird species are listed in **Table 8-25** below.

Table 8-25 Rare Bird Species in the Study Area of the East Duffins Creek Watershed

Common Name	Scientific Name	Number Recorded
Provincially Rare		
Carolina Wren	<i>Thryothorus ludovicianus</i>	1
Regionally Rare and Forest Area-Sensitive		
Least Flycatcher	<i>Empidonax minimus</i>	3
Pileated Woodpecker	<i>Dryocopus pileatus</i>	2
Veery	<i>Catharus fuscescens</i>	7
Regionally Rare		
American Woodcock	<i>Scolopax minor</i>	4
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>	3
Bobolink	<i>Dolichonyx oryzivorus</i>	4
Brown Thrasher	<i>Toxostoma rufum</i>	1
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	1
Field Sparrow	<i>Spizella pusilla</i>	2
Wood Thrush	<i>Hylocichla mustelina</i>	1

The 407 transportation corridor crosses 6 valleys within the East Duffins Creek watershed. Of these, East Duffins Creek is that largest valley and serves important regional landscape corridor functions. This valley connects large habitat areas on the Oak Ridges Moraine with natural areas along the Lake Iroquois Shoreline and the Lake Ontario shoreline.

The valleys of Brougham Creek and Spring Creek also provide opportunities for wildlife use and movement; and although these systems are more limited in terms of width, natural vegetation cover, habitat diversity and wildlife habitat elements they should continue to provide opportunity for localized wildlife movement.

The smaller valleys of the tributaries of Brougham Creek and the tributary to East Duffins Creek provide more limited and localized wildlife movement opportunities due to discontinuous natural cover in the valley within and north of the transportation corridor and the limited presence of habitat nodes to the north. These valleys tend to have increased natural vegetation cover and habitat diversity in areas south of the transportation corridor. Again, the potential for localized wildlife movement opportunity is recognized.

Carruthers Creek Watershed

The transportation corridor crosses a portion of Carruthers Creek watershed that is dominated by agricultural land use. As such, most of the natural vegetation was historically cleared for agriculture and remaining natural habitat features along the transportation corridor are limited to a single remnant forest block and 4 small tributary valleys and other small pockets of meadow marsh that are too wet for agricultural production. In general, the open agricultural fields, cultural / marsh meadows, thicket and forest areas that occupy the transportation corridor and adjacent lands provide habitat for a suite of common, generalist species that are tolerant of semi-urban and rural/agricultural conditions.

There are no known terrestrial wildlife Species at Risk or known habitat for terrestrial wildlife Species at Risk within the transportation corridor crossing of the Carruthers Creek watershed. No areas of specialized or sensitive wildlife habitat features such as potential deer wintering habitat, vernal pools, seasonal concentration areas or habitats of rare species etc. have been identified within or directly adjacent to the transportation corridor. There is no forest 'interior' habitat (i.e., core forest areas greater than 100 m from edges) present within 500 m of the transportation corridor.

The largest habitat node present in this area is a high quality deciduous forest block located immediately south of the transportation corridor just west of Salem Road. This unit supports forest bird species including Great Crested Flycatcher, Red-eyed Vireo, Wood Thrush and a number of forest area-sensitive species. This forest also provides habitat to White-tailed deer as well as a variety of common small mammals (Grey Squirrel, Woodchuck, Raccoon, Eastern Cottontail, and Striped Skunk).

Although the vegetation communities along the Carruthers Creek and its tributaries are considered low to moderate quality from a botanical perspective, the mosaic of riparian meadow marsh, thicket and cultural meadow communities found along the tributaries had a relatively high bird abundance. While most of these are habitat generalist, disturbance tolerant, urban-adapted species such as American Robin, European Starling, Red-winged Blackbird, Common Grackle and Song Sparrow, a number of forest area-sensitive and/or regionally rare bird species were also observed.

Table 8-26 Forest Area-sensitive Bird Species in the Study Area of the Carruthers Creek Watershed

Common Name	Scientific Name	Number Recorded
Forest Area-Sensitive		
American Redstart	<i>Setophaga ruticilla</i>	4
Broad-winged Hawk	<i>Buteo platypterus</i>	1
Hairy Woodpecker	<i>Picoides villosus</i>	1
Least Flycatcher	<i>Empidonax minimus</i>	1
Northern Harrier	<i>Circus cyaneus</i>	1
White-breasted Nuthatch	<i>Sitta carolinensis</i>	2

Herpetofauna habitat is present generally, along the watercourses and associated riparian areas, in local wetland habitats and in dug agricultural ponds. These areas provide habitat for localized breeding and movement of common amphibian species.

A total of 47 breeding bird species were recorded in and adjacent to the transportation corridor (within 120 m). Many of the bird species (90%) observed are common, habitat generalist species that utilize a variety of habitats (such as agricultural fields, thickets, forests, and meadows) that are common of an anthropogenically (agriculture and suburban/urban development) influenced landscape which is present throughout Durham Region. The most abundantly recorded bird species in this area were Brown-headed Cowbird, Red-winged Blackbird, and European Starling. These species are typical of a range of habitats including forest edges and openings, open fields, agricultural zones and wet areas.

Amphibian calling surveys recorded 4 amphibian species: American Toad, Green Frog, Northern Leopard Frog and Spring Peeper. All 3 of these units are associated with riparian habitat along the Carruthers Creek tributaries and a dug irrigation pond.

No Provincially rare species, Federally (COSEWIC) or Provincially (COSSARO) designated wildlife species at risk were recorded. Rare bird species are listed in **Table 8-27** below.

Table 8-27 Rare Bird Species in the Study Area of the Carruthers Creek Watershed

Common Name	Scientific Name	Number Recorded
Regionally Rare and Forest Area-Sensitive		
American Redstart	<i>Setophaga ruticilla</i>	4
Broad-winged Hawk	<i>Buteo platypterus</i>	1
Least Flycatcher	<i>Empidonax minimus</i>	1
Northern Harrier	<i>Circus cyaneus</i>	1
White-breasted Nuthatch	<i>Sitta carolinensis</i>	1
Regionally Rare		
Bobolink	<i>Dolichonyx oryzivorus</i>	4
Field Sparrow	<i>Spizella pusilla</i>	4

There are 4 Carruthers Creek tributaries that are crossed by the 407 transportation corridor mainline, east and west of Salem Road. These tributary valleys provide local opportunities for wildlife usage and movement however, these systems are limited in terms of width, natural vegetation cover, habitat diversity and wildlife habitat elements. Recognizing the local linkage function, and specific aspects such as the limited presence

of habitat nodes in this portion of the watershed generally, as well as the nature of these valleys (wide, shallow with associated thicket and meadow riparian communities), it is important that these features continue to provide opportunity for localized wildlife movement.

Lynde Creek Watershed

Lynde Creek – Mainline

The transportation corridor mainline crosses a portion of the Lynde Creek watershed that is dominated by urban uses (community of Brooklin), rural residential, commercial and agricultural land use.

No Provincially rare species (S1-S3), Federally (COSEWIC) or Provincially (COSSARO) designated wildlife species at risk were recorded within the transportation corridor mainline crossing of the Lynde Creek watershed. The transportation corridor mainline crosses or is adjacent to several habitat units containing sensitive and specialized wildlife habitat (SSWH) including potential deer winter habitat, groundwater seepage areas; high quality, mature forest areas; interior forest habitat; areas with a high abundance of breeding birds.

Herpetofauna habitat is generally present in the Study Area along the watercourses and associated riparian areas, in the local wetland habitats and in dug agricultural ponds. These areas provide habitat for localized breeding and movement of common amphibian species.

A total of 55 breeding bird species were recorded in and adjacent to the transportation corridor (within 120 m). The most abundantly recorded bird species along the transportation corridor mainline through the Lynde Creek watershed were Song Sparrow, Red-winged Blackbird, and American Goldfinch. These species are typical of a range of habitats including forest edges and openings, open fields, agricultural zones and wet areas.

There were 4 forest area-sensitive bird species recorded in and adjacent to the transportation corridor (within 120 m). These are listed in **Table 8-28** below.

Table 8-28 Forest Area-sensitive Species in the Study Area of the Lynde Creek Watershed (Mainline)

Common Name	Scientific Name	Number Recorded
Forest Area-Sensitive		
American Redstart	<i>Setophaga ruticilla</i>	1
Broad-winged Hawk	<i>Buteo platypterus</i>	1
Least Flycatcher	<i>Empidonax minimus</i>	1
White-breasted Nuthatch	<i>Sitta carolinensis</i>	2

Amphibian calling surveys recorded 3 amphibian species within or adjacent to the transportation corridor including: American Toad, Spring Peeper, and Eastern Grey Treefrog.

There are no known Provincially rare species (S1-S3), Federally (COSEWIC) or Provincially (COSSARO) designated wildlife species at risk within or adjacent to the transportation corridor (within 120 m). There was 1 regionally rare bird, Broad-winged Hawk, recorded within or adjacent to (within 120 m) of the transportation corridor.

The 407 mainline crosses 7 valleys within the Lynde Creek watershed. Of these, 2 are large valley systems that serve important landscape corridor functions; along the West Lynde Creek and Lynde Creek. The West Lynde Creek valley is considered to be a high quality linkage as it connects large habitat areas north and south of the transportation corridor including a wide forested portion of the West Lynde Creek valley that is large enough to provide interior forest habitat, north of the transportation corridor, and the large habitat mosaic associated with Heber Down, west of the transportation corridor. Lynde Creek is considered to be of lower quality given the discontinuous nature of the vegetative cover and the limited connectivity to natural areas north due to the presence of the community of Brooklin. These valleys should continue to provide regional wildlife linkages.

The remaining smaller tributary valleys provide some local linkage opportunities for wildlife use and movement; and although these systems are more limited in terms of width, natural vegetation cover, habitat diversity and wildlife habitat elements they should continue to provide opportunity for localized wildlife movement.

Lynde Creek – West Durham Link

The West Durham Link (WDL) crosses a portion of the Lynde Creek watershed that is transitioning from agricultural to urban land use, particularly in the areas east of Lake Ridge Road in the Town of Whitby. As such, most of the natural vegetation was historically cleared for agriculture and more recently for urban development.

There are 2 Provincially rare terrestrial wildlife species (Rough-legged Hawk and Bohemian Waxwing) recorded within the transportation corridor (WDL) crossing of the Lynde Creek watershed. Neither of these species are considered to be breeding within the watershed. The transportation corridor crosses or is adjacent to several habitat units containing sensitive and specialized wildlife habitat (SSWH), including potential deer winter habitat, groundwater seepage areas; vernal pools; high quality, mature forest areas; interior forest habitat; areas with a high abundance of breeding birds.

Herpetofauna habitat is present generally, along the watercourses and associated riparian areas, in local wetland habitats and in dug agricultural ponds. These areas provide habitat for localized breeding and movement of common amphibian species. The larger valley systems have potential habitat for a variety of common turtle species.

A total of 66 breeding bird species were recorded in and adjacent to the transportation corridor (within 120 m). The most abundantly recorded bird species in this area were Song Sparrow, Red-winged Blackbird, and American Goldfinch. These species are typical of a range of habitats including forest edges and openings, open fields, agricultural zones and wet areas.

There were 11 forest area-sensitive bird species recorded in and adjacent to the transportation corridor (within 120 m). These are listed in **Table 8-29** below.

Table 8-29 Forest Area-sensitive Species in the Study Area of the Lynde Creek Watershed (West Durham Link)

Common Name	Scientific Name	Number Recorded
Forest Area-Sensitive		
American Redstart	<i>Setophaga ruticilla</i>	3
Brown Creeper	<i>Certhia americana</i>	2
Cooper's Hawk	<i>Accipiter cooperi</i>	1
Hairy Woodpecker	<i>Picoides villosus</i>	2
Northern Harrier	<i>Circus cyaneus</i>	1
Ovenbird	<i>Seiurus aurocapillus</i>	2
Pileated Woodpecker	<i>Dryocopus pileatus</i>	1
Red-breasted Nuthatch	<i>Sitta canadensis</i>	1
Sharp-shinned Hawk	<i>Accipiter striatus</i>	1
Veery	<i>Catharus fuscescens</i>	2
White-breasted Nuthatch	<i>Sitta carolinensis</i>	1

Amphibian calling surveys recorded. 3 amphibian species: American Toad, Spring Peeper, and Grey Treefrog. 1 salamander species, Red-backed Salamander (*Plethodon cinereus*), was also observed.

No Federally (COSEWIC) designated wildlife species at risk were recorded within or adjacent to the transportation corridor (within 120 m). Provincially and regionally rare bird species are listed in **Table 8-30** below.

Table 8-30 Rare Bird Species in the Study Area of the Lynde Creek Watershed (West Durham Link)

Common Name	Scientific Name	Number Recorded
Provincially Rare		
Rough-legged Hawk	<i>Buteo lagopus</i>	1
Bohemian Waxwing	<i>Bombycilla garrulus</i>	35
Regionally Rare and Forest Area-Sensitive		
Cooper's Hawk	<i>Accipiter cooperi</i>	3
Sharp-shinned Hawk	<i>Accipiter striatus</i>	7

The most prominent landscape linkage feature in this portion of the transportation corridor corresponds generally to the Lake Iroquois Shoreline. In the vicinity of the WDL, this feature is located approximately between Taunton Road and Highway 7 and is comprised of a relatively contiguous mosaic of natural vegetation (including cultural meadow, thicket, plantation, upland and lowland forest and wetlands). The importance of the corridor is associated with the fact that it forms a natural linkage between the Lynde Creek watershed and Duffins and Carruthers watersheds and further west to the Rouge River. Several prominent core habitat areas and natural areas are associated with this feature including Heber Down and Greenwood Conservation Areas.

Within the WDL portion of the transportation corridor, there are no *north-south* linkages that would be considered significant at a landscape level. South of the Lake Iroquois Shoreline, the transportation corridor (WDL) crosses 2 Lynde Creek tributaries, one of which is crossed several times.

These smaller drainage systems provide local opportunities for wildlife use and movement, however these systems are limited in terms of width, natural vegetation cover, habitat diversity and wildlife habitat elements. These valleys function more on a local linkage scale and should continue to provide opportunity for localized wildlife movement. Adjacent agricultural practices (cattle grazing) reduces the quality of these linkages in some locations.

An existing Highway 401 crossing of Lynde Creek will be replaced/upgraded and will continue to provide an important linkage to the Lynde Marsh and Lake Ontario shoreline, south of the 401. However, the CN/GO Transit crossing will not be replaced, as it is not under MTO jurisdiction to do so.

Oshawa Creek Watershed

The transportation corridor crosses a portion of the Oshawa Creek watershed that is dominated by urban and rural residential, agricultural and recreational (golf course) land uses. As such, most of the natural vegetation was historically cleared for agriculture and more recently for urban development. Remaining natural habitat features along the transportation corridor are limited to 3 large valley systems (Oshawa Creek West, East and a large tributary of Oshawa Creek East, near Harmony Road) and 4 small tributary valleys and their associated riparian vegetation communities (comprised of lowland deciduous forest, meadow marsh and cultural thicket).

In general, the open agricultural fields, cultural / marsh meadows, thicket and forest areas that occupy the transportation corridor and adjacent lands provide habitat for a suite of common, generalist species that are tolerant of semi-urban and rural/agricultural conditions.

The large forested valley systems are the most prominent habitat features in the Oshawa Creek watershed portion of the transportation corridor. These large valleys support a greater number of wildlife species or more specialized habitat given the higher wildlife habitat quality and diversity. These valleys serve as important regional linkages to habitat nodes further north on the Oak Ridges Moraine and provide wildlife refuge in a landscape that is transitioning from rural to urban.

There are no known terrestrial wildlife Species at Risk or known habitat for terrestrial wildlife Species at Risk within the transportation corridor crossing of the Oshawa Creek watershed.

The transportation corridor crosses or is adjacent to several habitat units containing sensitive and specialized wildlife habitat (SSWH) including potential deer winter habitat and areas with a high abundance of breeding birds. There is no forest 'interior' habitat (i.e., core forest areas greater than 100 m from edges) present within 500 m of the transportation corridor.

Herpetofauna habitat is present generally, along the watercourses and associated riparian areas, in local wetland habitats and in dug agricultural ponds. These areas provide habitat for localized breeding and movement of common amphibian species. The larger valley systems have potential habitat for a variety of common turtle species.

A total of 50 breeding bird species were recorded in and adjacent to the transportation corridor (within 120 m). Many of the bird species (90%) observed are common, habitat generalist species that utilize a variety of habitats (such as agricultural fields, thickets, forests, and meadows) that are common of an anthropogenically (agriculture and suburban/urban development) influenced landscape which is present throughout Durham Region. The most abundantly recorded bird species in this area were Song Sparrow, Red-winged Blackbird, and American Goldfinch. These species are typical of a range of habitats including forest edges and openings, open fields, agricultural zones and wet areas.

There were 3 forest area-sensitive bird species recorded in and adjacent to the transportation corridor (within 120 m). These are listed in **Table 8-31** below.

Table 8-31 Forest Area-sensitive Species in the Study Area of the Oshawa Creek Watershed

Common Name	Scientific Name	Number Recorded
Forest Area-Sensitive		
American Redstart	<i>Setophaga ruticilla</i>	5
Black-and-white Warbler	<i>Mniotilta varia</i>	1
Pileated Woodpecker	<i>Dryocopus pileatus</i>	1

American Redstarts typically forage in the understorey of deciduous forests, gleaning insects off the leaves whereas Black-and-white Warblers function much like a nuthatch, foraging along branches and tree trunks. They are common in forests with dense understorey vegetation and riparian thickets such as unit WRIT-10 (dominated by cedar forest). The Pileated Woodpecker requires large expanses of forest for foraging and nesting, with ample dead standing trees and rotting logs.

Amphibian calling surveys recorded 1 amphibian species: Spring Peeper, was recorded in the valleyland of Oshawa Creek East.

No Provincially rare species (S1-S3), Federally (COSEWIC) or Provincially (COSSARO) designated wildlife species at risk were recorded. No regionally rare bird species were recorded.

The 407 transportation corridor crosses 7 valleys within the Oshawa Creek watershed (including 1 tributary of Pringle Creek). Of these, 2 are large valley systems, East and West branches of Oshawa Creek, that serve important regional landscape corridor functions. These corridors connect large habitat areas in the northern portion of the watershed (near the communities of Mount Carmel and Raglan) with natural areas near Taunton Road. A third valley crossing of an eastern tributary of Oshawa Creek East is also considered to be an important regional wildlife linkage, although it is a smaller valley system.

The remaining smaller tributary valleys provide some local linkage opportunities for wildlife use and movement; and although these systems are more limited in terms of width, natural vegetation cover, habitat diversity and wildlife habitat elements they should continue to provide opportunity for localized wildlife movement.

Harmony Creek Watershed

The transportation corridor crosses a portion of Harmony Creek watershed that is dominated by agricultural land use. As such, most of the natural vegetation was historically cleared for agriculture and remaining natural habitat features along the transportation corridor are generally limited to small, scattered remnant upland forest blocks and 2 small tributary valleys and their associated riparian vegetation communities (comprised of lowland deciduous forest, meadow marsh and cultural thicket) and other small pockets of meadow marsh vegetation that are too wet for agricultural production. There is 1 high quality upland deciduous forest patch located east of Langmaid Road and south of Concession 6.

There are no known terrestrial wildlife Species at Risk or known habitat for terrestrial wildlife Species at Risk within the transportation corridor crossing of the Harmony Creek watershed.

No areas of specialized or sensitive wildlife habitat features such as potential deer wintering habitat, vernal pools, seasonal concentration areas or habitats of rare species etc. have been identified within or directly adjacent to the transportation corridor.

There is no forest ‘interior’ habitat (i.e., core forest areas greater than 100 m from edges) present within 500 m of the transportation corridor.

The largest habitat node present in this area is a high quality upland deciduous forest block located immediately south and west of the transportation corridor, abutting the transitway station block near Enfield Road. This unit supports forest bird species including Great Crested Flycatcher, Red-eyed Vireo, Indigo Bunting. This forest also provides habitat to White-tailed deer as well as a variety of common small mammals (Grey Squirrel, Woodchuck, Raccoon, Eastern Cottontail, and Striped Skunk).

The vegetation communities along the Harmony Creek and its tributaries are considered low to moderate quality from a botanical perspective and had relatively low bird abundance. Most of these are habitat generalist, disturbance tolerant, urban-adapted species such as American, European Starling, Red-winged Blackbird, Common Grackle and Song Sparrow. 1 area-sensitive bird species was observed (see **Table 8-32** below).

Table 8-32 Forest Area-sensitive Species in the Study Area of the Harmony Creek Watershed

Common Name	Scientific Name	Number Recorded
Forest Area-Sensitive		
American Redstart	<i>Setophaga ruticilla</i>	1

Herpetofauna habitat may be present generally, along the watercourses and associated riparian areas, in local wetland habitats and in dug agricultural ponds. These areas may provide habitat for localized breeding and movement of common amphibian species.

A total of 18 breeding bird species were recorded in and adjacent to the transportation corridor (within 120 m). Many of the bird species (90%) observed are common, habitat generalist species that utilize a variety of habitats (such as agricultural fields, thickets, forests, and meadows) that are common of an

anthropogenically (agriculture and suburban/urban development) influenced landscape which is present throughout Durham Region. The most abundantly recorded bird species within the area were Black-capped Chickadee, European Starling, and Song Sparrow. These species are typical of a range of habitats including forest edges and openings, open fields, agricultural zones and wet areas.

No amphibian calling surveys were conducted in the Harmony Creek portion of the transportation corridor due to limited amphibian habitat present (vernal pool habitat and open water). Amphibian potential of some of the very small, isolated wet pockets in the transportation corridor is not known, but would be governed by factors such as water depth and duration.

No Provincially rare species, Federally (COSEWIC) or Provincially (COSSARO) designated wildlife species at risk were recorded. No regionally rare bird species were observed.

Within the Study Area, there are no linkages that would be considered significant at a landscape level. The 2 Harmony Creek tributaries that are crossed by the 407 transportation corridor are characterized as ‘weak’ linkages because natural vegetation cover along the creeks is sparse, discontinuous and highly disturbed by agricultural activities. These drainage systems provide some local opportunities for wildlife use and movement. However, these systems are limited in terms of width, natural vegetation cover, habitat diversity and wildlife habitat elements. They are not considered significant ‘movement corridors’; instead, they function more on a local linkage scale and should continue to provide opportunity for localized wildlife movement.

East Mainline – Farewell Creek, Black Creek, Bowmanville Creek, Soper Creek and Wilmot Creek Watersheds

A wide variety of species occur within the Study Area, on account of the aerial extent of the project and the wide variety of habitats crossed. Natural habitats are primarily forest, thickets and field and as a result, terrestrial (upland) fauna is the dominant form. For instance, the bird list does not include many wetland species with the exception of some swamp species. The most commonly found southern Ontario frog species occur within the Study Area (with the exception of Chorus Frog), however breeding populations appear to be generally fairly small. Many mammal species that are common in southern Ontario occur here.

The transportation corridor crosses or is adjacent to several habitat areas containing specialized or sensitive wildlife habitat including mature forest areas; areas with a high abundance of sensitive birds; and productive/diverse amphibian breeding habitat.

Interior forest habitat (that which is 100 m from edge) is provided in 6 areas (10 Vegetation Units), within or adjacent (within 120 m) to the transportation corridor. Interior forest is present within the forested valleys of Farewell Creek, Bowmanville Creek (east and west branches), Mackie Creek and Soper Creek. These areas often coincide with those SSWH that contain area-sensitive species. There is no deep interior forest habitat (that which is 200 m from edge) within this section.

A total of 66 avian species were recorded within the natural vegetation units in and adjacent to the Study Area of the Farewell, Bowmanville and Soper Creek watersheds. The majority (over 90%) of these species likely occur within the transportation corridor and adjacent areas (within 120 m).

The most abundantly recorded birds within this portion of the Study Area include species such as American Robin, Song Sparrow, Red-winged Blackbird and Black-capped Chickadee, as well as others which are abundant southern Ontario species and found in a relatively wide range of habitats. The more specialized Black and White Warbler and Black-throated Green Warbler were also amongst the most abundant species. Their presence reflects the prevalence of conifer dominated forests – a preferred habitat - along this portion of the corridor. These species are also area-sensitive as noted below.

High numbers of forest area-sensitive species were recorded in the Study Area of the Farewell, Bowmanville and Soper Creek watersheds. There are 11 area-sensitive species recorded in the natural vegetation units in and adjacent to the transportation corridor. These are listed in **Table 8-33** below.

Table 8-33 Forest Area Sensitive Species in the Study Area of the Farewell Creek, Black Creek, Bowmanville Creek and Soper Creek Watersheds

Common Name	Scientific Name	Number Recorded
Forest Area-Sensitive		
American Redstart	<i>Setophaga ruticilla</i>	2
Black-and-white Warbler	<i>Mniotilta varia</i>	24
Black-throated Green Warbler	<i>Dendroica virens</i>	19
Hairy Woodpecker	<i>Picoides villosus</i>	5
Least Flycatcher	<i>Empidonax minimus</i>	5
Ovenbird	<i>Seiurus aurocapillus</i>	19
Pine Warbler	<i>Dendroica pinus</i>	1
Red-breasted Nuthatch	<i>Sitta canadensis</i>	3
Scarlet Tanager	<i>Piranga olivacea</i>	1
Veery	<i>Catharus fuscescens</i>	16
White-breasted Nuthatch	<i>Sitta carolinensis</i>	2

There are 7 productive amphibian sites within or up to 120 m from the transportation corridor. Amphibians recorded include American Toad (*Bufo americanus*), Northern Leopard Frog, Wood Frog, Green Frog, Spring Peeper, and Eastern Grey Treefrog.

Rare bird species are listed in **Table 8-34** below.

Table 8-34 Rare Bird Species in the Study Area of the Farewell Creek, Black Creek, Bowmanville Creek and Soper Creek Watersheds

Common Name	Scientific Name	Number Recorded
Species at Risk		
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	1
Regionally Rare and Forest Area-Sensitive		
Blackburnian Warbler	<i>Dendroica fusca</i>	1

There are numerous, strong north-south areas of natural habitat, with much weaker connections in an east-west direction as a result of the intervening agricultural use. The Bowmanville Creek watershed in particular has several north-south oriented valleylands and tablelands. With the exception of the main Farewell Creek valley, the area to the west of Holt Road is less well connected due to higher agricultural use. The large and fairly contiguous forest block along Mackie Creek and its tributaries provides connections to a large habitat area south of the transportation corridor and along Mackie Creek to habitat areas in the northern portion of the watershed.

Ganaraska Region Conservation (GRCA)

Natural habitat features along the transportation corridor are predominately within the Wilmot Creek valley and to a lesser extent, the Orono Creek valley. Natural cover declines in the eastern portion of the watershed where agricultural uses are dominant. The large forested Wilmot Creek valley supports a diversity of habitat types and high numbers of area-sensitive species. The Wilmot Creek valley has been identified as core wildlife habitat that provides interior forest habitat. In general, the open agricultural fields, plantations, meadow marsh, thicket and woodland communities within and adjacent to the transportation corridor provide habitat for a suite of common, generalist species that are tolerant of rural/agricultural conditions.

The transportation corridor crosses several habitat areas where a high abundance of sensitive bird species was observed. Interior forest habitat (that which is 100 m from edge) is provided in two areas within or adjacent (within 120 m) to the transportation corridor. Interior forest is present within the forested valley of Wilmot Creek. These areas often coincide with those SSWH that contain area-sensitive species. There is no deep interior forest habitat (that which is 200 m from edge) within this section.

A total of 56 avian species were recorded within the natural vegetation units in and adjacent to the Study Area of the Wilmot Creek Watershed. The majority (over 90%) of these species likely occur within the transportation corridor and adjacent areas (within 120 m).

The most abundantly recorded birds within this portion of the Study Area include species such as American Robin and Song Sparrow as well as others which are abundant southern Ontario species and found in a relatively wide range of habitats. The more specialized Black and White Warbler and Black-throated Green Warbler were also amongst the most abundant species. Their presence reflects the prevalence of conifer dominated forests – a preferred habitat - along this section of the transportation corridor. These species are also area-sensitive as noted below.

There are 8 area-sensitive species recorded in the natural vegetation units in and adjacent to the Study Area. These are listed in **Table 8-35** below.

Table 8-35 Forest Area-sensitive Species in the Study Area of the Wilmot Creek Watershed

Common Name	Scientific Name	Number Recorded
Forest Area-Sensitive		
Black-and-white Warbler	<i>Mniotilta varia</i>	10
Black-throated Green Warbler	<i>Dendroica virens</i>	10
Hairy Woodpecker	<i>Picoides villosus</i>	1
Ovenbird	<i>Seiurus aurocapillus</i>	9
Pine Warbler	<i>Dendroica pinus</i>	1
Red-breasted Nuthatch	<i>Sitta canadensis</i>	3
Veery	<i>Catharus fuscescens</i>	3
Yellow-rumped Warbler	<i>Dendroica coronata</i>	1

No calling amphibian sites were recorded within or up to 120 m from the transportation corridor, however 4 productive amphibian sites were identified in areas between 400 m and 600 m from the transportation corridor.

Blanding's Turtle has been recorded within the Study Area. Blanding's Turtle is designated Federally and Provincially as Threatened. The Blanding's Turtle was observed within the vicinity of the Wilmot Creek valley. Blanding's Turtle typically occur in large shallow waterbodies and wetlands (COSEWIC 2005). There is a dug pond within the Wilmot Creek valley that is off line with the creek. The pond does not appear to provide good habitat for the Threatened Blanding's Turtle since it has a steep sloping shoreline with minimal emergent marsh along the shoreline. Blanding's typically occurs in shallow ponds with abundant emergent cover. The surrounding cedar forest and woodland is also not optimal habitat for the species. Both Snapping and Painted Turtles, which were observed using the pond, are more adaptable to a broader range of conditions and their presence is not an indication that Blanding's Turtle is also likely to be present. Snapping Turtle has recently (November 2008) been designated as Special Concern by COSEWIC.

Rare bird species are listed in **Table 8-36** below.

Table 8-36 Rare Bird Species in the Study Area of the Wilmot Creek Watershed

Common Name	Scientific Name	Number Recorded
Regionally Rare and Forest Area-Sensitive		
Hermit Thrush	<i>Catharus guttatus</i>	1
Regionally Rare		
Upland Sandpiper	<i>Bartramia longicauda</i>	3

A very strong north-south habitat corridor extends through the middle portion of the watershed along the Wilmot Creek valley. Across the Study Area, the forested corridor along Wilmot Creek represents one of the largest blocks of contiguous habitat along the transportation corridor. It provides connectivity to natural areas for many kilometres to the north and south. The Orono Creek valley is considered to be a high quality linkage as a result of its connections to the Wilmot Creek Valley to the north and south of the transportation corridor. The eastern portion of the watershed is considered to be lower quality with respect to connectivity, given the discontinuous nature of the vegetative cover and limited connections to natural areas as a result of the dominance of agricultural land uses in this area. These drainage features provide some local opportunities for wildlife use and movements. However, these systems are limited in terms of width and natural vegetation cover.

East Durham Link – Black Creek, Tooley Creek and Darlington Creek Watersheds

A wide variety of species occur within the East Durham Link Study Area, on account of the aerial extent of the project and the wide variety of habitats crossed. Natural habitats are primarily forest, thickets and fields and as a result, terrestrial fauna are dominant. The bird list does not include many open wetland species. In the south end of this section at Highway 401, there are numerous young, early-successional communities which support disturbance tolerance species. Frog species recorded within the Study Area are amongst the most commonly found in southern Ontario with the exception of Chorus Frog, however breeding populations of all recorded species appear to be generally small. As expected, many mammal species that are common in southern Ontario occur across the East Durham Link Study Area. The forest/swamps, which all occur in the central portion of this section, contain the greatest diversity of wildlife species in the East Durham Link Study Area.

The transportation corridor crosses or is adjacent to several habitat areas containing specialized and sensitive wildlife habitat (SSWH), including: area of high abundance sensitive bird species, and areas of productive/diverse amphibian breeding habitat.

Interior forest habitat (that which is 100 m from the edge) is provided in 6 areas, within or adjacent (within 120 m) to the transportation corridor in the East Durham Link Study Area. Interior forest is present in vegetation units which are complexed as part of the Harmony Farewell Iroquois Beach and Maple Grove Wetland complexes. These areas often coincide with those SSWH that contain area-sensitive species. There is no deep interior forest habitat (that which is 200 m from edge) within this section.

A total of 68 species were recorded within the natural vegetation units in and adjacent to the Study Area in the East Durham Link. The majority (over 90%) of these species likely occur within the transportation corridor and adjacent areas (within 120 m). The most abundantly recorded birds within this portion of the Study Area include species such as American Robin, Song Sparrow, Black-capped Chickadee and Red-winged Blackbird as well as others which are abundant southern Ontario species and found in a relatively wide range of habitats.

There are 11 area-sensitive species recorded in the natural vegetation units in and adjacent to the Study Area. These are listed in **Table 8-37** below.

Table 8-37 Forest Area-sensitive Species in the Study Area of the Black Creek, Tooley Creek and Darlington Creek Watersheds

Common Name	Scientific Name	Number Recorded
Forest Area-Sensitive		
American Redstart	<i>Setophaga ruticilla</i>	8
Black-and-white Warbler	<i>Mniotilta varia</i>	11
Black-throated Green Warbler	<i>Dendroica virens</i>	1
Hairy Woodpecker	<i>Picoides villosus</i>	1
Ovenbird	<i>Seiurus aurocapillus</i>	11
Pileated Woodpecker	<i>Dryocopus pileatus</i>	1
Pine Warbler	<i>Dendroica pinus</i>	1
Red-breasted Nuthatch	<i>Sitta canadensis</i>	1
Scarlet Tanager	<i>Piranga olivacea</i>	1
Veery	<i>Catharus fuscescens</i>	10
White-breasted Nuthatch	<i>Sitta carolinensis</i>	1

There are 7 productive amphibian sites in or adjacent to (within 120 m) the transportation corridor in the East Durham Link. Amphibians recorded along the East Durham Link transportation corridor include American Toad, Northern Leopard Frog, Wood Frog, Green Frog, Spring Peeper and Eastern Grey Treefrog.

Table 8-38 identifies four (4) regionally rare forest bird species recorded along the East Durham Link transportation corridor including Blackburnian Warbler, Cooper’s Hawk, Blue-gray Gnatcatcher and Yellow-billed Cuckoo.

Table 8-38 Rare Bird Species of the Study Area of the Black Creek, Tooley Creek and Darlington Creek Watersheds

Common Name	Scientific Name	Number Recorded
Regionally Rare and Forest Area-Sensitive		
Blackburnian Warbler	<i>Dendroica fusca</i>	1
Cooper’s Hawk	<i>Accipiter cooperi</i>	1
Regionally Rare		
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>	1
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	1

No Provincially rare species or Federally or Provincially designated amphibian species at risk were recorded.

Habitat connectivity within the north third of the East Durham Link is relatively poor with only narrow linear areas running north-south that are generally unconnected in an east-west direction as a result of agricultural land use. The central portion of the Link contains the large natural areas associated with the Harmony-Farewell Iroquois Beach Wetland and Maple Grove Wetland Complexes which provide east-west connectivity, as well as connectivity to areas to the north. There are also effective connections along the main Black Creek valley that connect a variety of habitat types. The connection is weaker at Nash Road. Within the south third of the route (mainly Tooley Creek and Darlington Creek watersheds) landscape connectivity is again generally poor. These areas are dominated by agricultural land use and remnant habitat areas.

8.10.2 Local Study Area

The following table provides a description of the existing environmental conditions related to Wildlife and Wildlife Habitat within each Local Study Area, corresponding to each of the Projects subject to the Federal EA (as presented in **Table 8-39**).

Table 8-39 Existing Wildlife and Wildlife Habitat Conditions Associated with Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions Site Study Area (SSA)	Summary of Existing Conditions Local Study Area (LSA)
West Mainline – Section 1 (Brock Road to Audley Road)	<i>Federal Lands Pickering</i>	<ul style="list-style-type: none"> No breeding bird species recorded No amphibian calling survey done in SSA, and no incidental observations 	<ul style="list-style-type: none"> 29 breeding bird species recorded 2 forest area-sensitive species recorded: Pileated Woodpecker and White-breasted Nuthatch Regionally rare* fauna species include: Black-billed Cuckoo, and Pileated Woodpecker No amphibian calling survey done in the LSA, however Grey Treefrog and Wood Frog were incidentally observed. TRCA considers Grey Treefrog and Wood Frog to be of local conservation concern.
	<i>Project Site 3</i>	<ul style="list-style-type: none"> 20 breeding bird species 1 forest area-sensitive bird species: Least Flycatcher Regionally rare* fauna species include: Least Flycatcher and Wood Thrush. No amphibian surveys conducted within SSA, and no incidental observations 	<ul style="list-style-type: none"> 26 breeding bird species 1 forest area-sensitive bird species: Least Flycatcher Regionally rare* fauna species include: Black-billed Cuckoo, Least Flycatcher and Wood Thrush. No amphibian surveys conducted within LSA, and no incidental observations
	<i>Project Site 3a</i>	<ul style="list-style-type: none"> 18 breeding bird species 1 forest-area sensitive bird species: Least Flycatcher Regionally rare fauna* species include: Least Flycatcher and Wood Thrush No amphibian surveys conducted within SSA, and no incidental observations 	<ul style="list-style-type: none"> 18 breeding bird species 1 forest area-sensitive bird species: Least Flycatcher and Pileated Woodpecker Regionally rare* fauna species include: Least Flycatcher, Pileated Woodpecker and Black-billed Cuckoo No amphibian calling survey done in the LSA, however Grey Treefrog and Wood Frog were incidentally observed. TRCA considers Grey Treefrog and Wood Frog to be of local conservation concern.
	<i>Project Site 7</i>	<ul style="list-style-type: none"> 9 breeding bird species observed No forest area-sensitive bird species observed No rare fauna species observed No amphibian surveys conducted within SSA, and no incidental observations 	<ul style="list-style-type: none"> 33 breeding bird species observed 1 forest area-sensitive bird species: Pileated Woodpecker No amphibian calling survey done in the LSA, however Grey Treefrog and Wood Frog were incidentally observed. TRCA considers Grey Treefrog and Wood Frog to be of local conservation concern.
	<i>Project Site 8</i>	<ul style="list-style-type: none"> 19 breeding bird species 1 forest area-sensitive bird species: Least Flycatcher Regionally rare* fauna species include: American Woodcock and Least Flycatcher Spring Peeper and Gray Treefrog are found in low abundance. TRCA considers Grey Treefrog and Spring Peeper to be of local conservation concern. 	<ul style="list-style-type: none"> 32 breeding bird species 1 forest-area sensitive bird species: Least Flycatcher Regionally rare* fauna species include: Least Flycatcher and American Woodcock Spring Peeper and Gray Treefrog are found in low abundance. TRCA considers Grey Treefrog and Spring Peeper to be of local conservation concern.
	<i>Project Site 9</i>	<ul style="list-style-type: none"> 33 breeding bird species Forest area-sensitive species include: Hairy Woodpecker, Pileated Woodpecker and Veery Regionally rare* fauna species include: Veery, American Woodcock, Chestnut-sided Warbler and Pileated Woodpecker and Spring Peeper. No amphibian surveys recorded within SSA 	<ul style="list-style-type: none"> 33 breeding bird species Forest area-sensitive species include: Hairy Woodpecker, Pileated Woodpecker and Veery Regionally rare* fauna species include: Veery, American Woodcock, Chestnut-sided Warbler and Pileated Woodpecker Spring Peeper recorded in high abundance and American Toad and Wood Frog in low abundance. TRCA considers Wood Frog and Spring Peeper to be of local conservation concern.
	<i>Project Site 11</i>	<ul style="list-style-type: none"> 33 breeding bird species 3 forest area-sensitive bird species: Broad-winged Hawk, Hairy, Woodpecker, White-breasted Nuthatch Regionally rare* fauna species include: Bobolink, Wood Thrush and Broad-winged Hawk. No breeding amphibians recorded during survey 	<ul style="list-style-type: none"> 38 breeding bird species 3 forest area-sensitive bird species: Broad-winged Hawk, Hairy Woodpecker, White-breasted Nuthatch Regionally rare* fauna species include: Bobolink, Wood Thrush and Broad-winged Hawk. Green Frog present in low abundance
	<i>Project Site 12</i>	<ul style="list-style-type: none"> No breeding bird surveys conducted No amphibian surveys conducted within SSA, and no incidental observations 	<ul style="list-style-type: none"> 38 breeding bird species 3 forest area-sensitive bird species: Broad-winged Hawk, Hairy Woodpecker and White-breasted Nuthatch Regionally rare* fauna species include: Bobolink, Broad-winged Hawk and Wood Thrush Green Frog present in low abundance
West Mainline – Section 2 (Audley Road to Ashburn Road)	<i>Project Site 17</i>	<ul style="list-style-type: none"> 29 breeding bird species were recorded during field surveys in this unit. 1 forest area-sensitive birds were recorded in this unit: White-breasted Nuthatch No rare fauna species Results of amphibian surveys at this location indicate the presence of Spring Peeper in low abundance. 	<ul style="list-style-type: none"> 36 breeding bird species were recorded during field surveys in this unit. 3 forest area-sensitive birds were recorded in this unit: White-breasted Nuthatch, Least Flycatcher and Broad-winged Hawk Regionally rare fauna species include: Broad-winged Hawk Results of amphibian surveys at this location indicate the presence of Spring Peeper in low abundance.
	<i>Project Site 18</i>	<ul style="list-style-type: none"> No breeding bird surveys conducted No forest area-sensitive bird species No rare fauna species No amphibian surveys conducted within SSA, and no incidental observations 	<ul style="list-style-type: none"> 27 breeding bird species Regionally rare and forest area-sensitive species include: Broad-winged Hawk No rare fauna species Gray Treefrog present in high abundance.
	<i>Project Site 19</i>	<ul style="list-style-type: none"> 14 breeding bird species Regionally rare and forest area-sensitive species include: Broad-winged Hawk Gray Treefrog present in high abundance. 	<ul style="list-style-type: none"> 14 breeding bird species Regionally rare and forest area-sensitive species include: Broad-winged Hawk Gray Treefrog present in high abundance.
	<i>Project Site 20</i>	<ul style="list-style-type: none"> No breeding bird surveys conducted No forest area-sensitive bird species No rare fauna species No amphibian surveys conducted within SSA, and no incidental observations 	<ul style="list-style-type: none"> 9 breeding bird species recorded No forest area-sensitive bird species No rare fauna species No amphibian surveys conducted within LSA, and no incidental observations
	<i>Project Site 21</i>	<ul style="list-style-type: none"> No breeding bird surveys conducted No forest area-sensitive bird species No regionally rare fauna species No amphibian species recorded 	<ul style="list-style-type: none"> 12 breeding bird species No forest area-sensitive bird species No regionally rare fauna species No amphibian species recorded

Table 8-39 Existing Wildlife and Wildlife Habitat Conditions Associated with Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions Site Study Area (SSA)	Summary of Existing Conditions Local Study Area (LSA)
Central Mainline – Section 3 (Ashburn Road to Simcoe Street)	Project Site 24	<ul style="list-style-type: none"> ▶ 24 breeding bird species ▶ No rare fauna species ▶ No amphibian surveys conducted within SSA, and no incidental observations 	<ul style="list-style-type: none"> ▶ 27 breeding bird species ▶ No rare fauna species ▶ American Toad present in low abundance
	Project Site 28	<ul style="list-style-type: none"> ▶ 29 breeding bird species ▶ 1 forest area-sensitive birds were recorded in this unit: American Redstart ▶ No rare fauna species ▶ No amphibian surveys conducted within SSA, and no incidental observations 	<ul style="list-style-type: none"> ▶ 37 breeding bird species ▶ 2 forest area-sensitive birds were recorded: American Redstart and Black-and-white Warbler ▶ No rare fauna species ▶ No breeding amphibians recorded
Central Mainline – Section 4 (Simcoe Street to Enfield Road)	Project Site 35	<ul style="list-style-type: none"> ▶ 16 breeding bird species ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ Spring Peepers recorded in low abundance. 	<ul style="list-style-type: none"> ▶ 20 breeding bird species ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ Spring Peepers recorded in low abundance.
	Project Site 38 a	<ul style="list-style-type: none"> ▶ 14 bird species observed ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian surveys conducted within SSA, and no incidental observations 	<ul style="list-style-type: none"> ▶ 18 bird species observed ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian calling survey done and no incidental observations
	Project Site 54	<ul style="list-style-type: none"> ▶ 18 bird species observed ▶ 1 forest area-sensitive bird species: American Redstart ▶ No amphibian calling survey completed and no incidental observations ▶ No rare fauna species 	<ul style="list-style-type: none"> ▶ 22 bird species observed ▶ 1 forest area-sensitive bird species: American Redstart ▶ No rare fauna species ▶ No amphibian calling survey completed and no incidental observations
East Mainline – Section 5 (Enfield Road to Highway 35/115)	Project Site 57a	<ul style="list-style-type: none"> ▶ No breeding bird surveys conducted ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No Amphibian calling survey completed and no incidental observations 	<ul style="list-style-type: none"> ▶ 24 breeding bird species observed ▶ 1 forest area-sensitive bird species: American Redstart ▶ No rare fauna species ▶ Four species of amphibians were recorded in several different ponds in this area. Species included: Spring Peeper, American Toad, Gray Treefrog and Green Frog
West Link – Section 6 (West Durham Link)	Project Site 44	<ul style="list-style-type: none"> ▶ 19 breeding bird species observed ▶ Regionally rare and forest area-sensitive species include: Coopers Hawk ▶ No rare fauna species ▶ Amphibian survey indicates presence of Gray Treefrog in high abundance 	<ul style="list-style-type: none"> ▶ 34 breeding bird species ▶ 3 forest area-sensitive bird species: Northern Harrier, American Redstart and Cooper's Hawk ▶ Regionally rare fauna species include: Cooper's Hawk ▶ Amphibian survey indicates presence of Gray Treefrog (high abundance), Spring Peeper in low abundance and American Toad in moderate abundance ▶ No rare fauna species
	Project Site 47	<ul style="list-style-type: none"> ▶ 26 breeding bird species ▶ No forest area-sensitive bird species ▶ No amphibian species recorded ▶ No rare fauna species 	<ul style="list-style-type: none"> ▶ 37 breeding bird species ▶ 1 forest area-sensitive bird species observed: Hairy Woodpecker ▶ No rare fauna species ▶ Results of amphibian calling survey indicate presence of American Toad and Gray Treefrog in high abundance.
	Project Site 47a	<ul style="list-style-type: none"> ▶ No breeding bird surveys conducted ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian calling survey done in the SSA 	<ul style="list-style-type: none"> ▶ 36 breeding bird species ▶ 1 forest area-sensitive bird species: Hairy Woodpecker ▶ Results of amphibian calling indicate presence of Gray Treefrog in high abundance. ▶ No rare fauna species
	Project Site 51	<ul style="list-style-type: none"> ▶ No breeding bird surveys conducted ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian calling survey done in the SSA 	<ul style="list-style-type: none"> ▶ No breeding bird surveys conducted ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian calling survey done
	Project Site 97	<ul style="list-style-type: none"> ▶ 7 breeding bird species observed ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian calling survey done in the SSA 	<ul style="list-style-type: none"> ▶ 33 breeding bird species identified ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian calling survey completed and no incidental observations
Project Site 100	<ul style="list-style-type: none"> ▶ No breeding bird surveys conducted ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian calling survey done in the SSA 	<ul style="list-style-type: none"> ▶ 34 breeding bird species observed ▶ 1 forest area-sensitive bird species: White-breasted Nuthatch ▶ No rare fauna species ▶ No amphibian calling survey completed and no incidental observations 	
East Link – Section (East Durham Link)	Project Site 90	<ul style="list-style-type: none"> ▶ 32 breeding bird species observed ▶ 5 forest area-sensitive bird species: Cooper's Hawk, Black and White Warbler, Scarlet Tanager, Veery and Ovenbird ▶ No amphibian calling survey done in the SSA ▶ No rare fauna species 	<ul style="list-style-type: none"> ▶ 41 breeding bird species ▶ 5 forest area-sensitive breeding bird species [Cooper's Hawk, Black and White Warbler, Scarlet Tanager, Veery and Ovenbird ▶ Three species of calling amphibians were recorded – Spring Peeper, American Toad and Wood Frog

Table 8-39 Existing Wildlife and Wildlife Habitat Conditions Associated with Projects subject to Federal EA

Section of the Undertaking	Project subject to Federal EA	Summary of Existing Conditions Site Study Area (SSA)	Summary of Existing Conditions Local Study Area (LSA)
	<i>Project Site 92</i>	<ul style="list-style-type: none"> ▶ No breeding bird surveys conducted ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian species recorded 	<ul style="list-style-type: none"> ▶ 42 breeding bird species ▶ 6 Forest Area-Sensitive breeding bird species: American Redstart, Cooper's Hawk, Black and White Warbler, Scarlet Tanager, Veery and Ovenbird ▶ Two species of calling amphibian– American Toad and Spring Peeper. ▶ No core area, sensitive or specialized wildlife habitat, nor interior forest habitat identified. ▶ No rare fauna identified, although Regionally Rare Yellow-billed Cuckoo was recorded east of this unit.
	<i>Project Site 104</i>	<ul style="list-style-type: none"> ▶ No breeding bird species conducted ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian calling survey done in the SSA 	<ul style="list-style-type: none"> ▶ No breeding bird species conducted ▶ No forest area-sensitive bird species ▶ No rare fauna species ▶ No amphibian calling survey conducted

* Regionally rare bird species are species designated as L1-L3 by TRCA and/or recognized as regionally rare (in Durham Region) by Henshaw 1993.

8.11 Species at Risk (Projects subject to Federal EA)

The following description of the environment potentially affected applies to the Projects subject to Federal EA. An overview of the Species at Risk potentially affected by the 407 East Transportation Corridor is provided as context for the detailed description of the individual Projects subject to Federal EA. For the purposes of this Environmental Screening, this environmental component focuses solely on those Species at Risk that have been identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as either **Endangered** (i.e., a species facing imminent extirpation or extinction), **Threatened** (i.e., a species likely to become endangered if limiting factors are not reversed) or **Extirpated** but reintroduced. COSEWIC assesses the national status of wildlife species that are considered to be at risk in Canada. Other Species at Risk identified by the Province of Ontario, regionally or locally rare species are addressed within the descriptions of the other environmental components.

8.11.1 Regional Overview

Overall, four (4) Species at Risk that have been identified by the COSEWIC as either Endangered or Threatened were identified within the 407 East Transportation corridor and investigated in detail as part of the environmental assessment. These species are described below.

8.11.1.1 Golden Winged Warbler (*Vermivora chrysoptera* Linnaeus, *Paruline à ailes dorées*)

The Golden-winged Warbler (*Vermivora chrysoptera* Linnaeus, *Paruline à ailes dorées*) species has been identified as “Threatened” by COSEWIC. It is a small wood warbler with grey and yellow wing patches and crown. The Golden-winged Warbler breeds in the northeastern United States and southern Ontario, as well as in extreme southwestern Québec, southern Manitoba and southeastern Saskatchewan. On the breeding grounds, Golden-winged Warblers are found in areas of early successional scrub surrounded by mature forests. They are found in dry uplands, swamp forests and marshes. Examples of some preferred habitat areas include hydro/utility right-of-ways, field edges, recently logged areas, beaver marshes and areas that are burned or intermittently farmed.



Golden-winged Warbler (COSEWIC)

The Golden-winged Warbler has been experiencing population declines for at least 30 years. In Canada, the species was showing population growth up until 10 years ago, but since that time the species has started to disappear from regions in the southernmost portions of Ontario. Breeding Bird Survey (BBS) data suggest approximately 20,000 to 50,000 pairs breed in Canada, the vast majority of these in Ontario.

The Golden-winged Warbler was recorded in one habitat unit approximately 150 m from the 407 East Corridor ROW and only a small portion of the suitable habitat at this location is likely to be affected by the Undertaking. The Golden-winged Warbler was recorded on June 22, 2007 at approximately 6:30 am. According to The Durham Region Natural History Report (1993), Golden-winged Warbler is classed as a scarce migrant (11 to 50 records during both migration periods in a year) and very rare breeding species (less than 20 pairs) (Bain and Henshaw, 1994).

In Ontario the species population increased for most of the second half of the 20th century, but in the last decade has declined notably in much of southern Ontario (Ontario Breeding Bird Atlas 2001-2005). The Atlas of Breeding Bird in Ontario (2001-2005) reports that Golden-winged Warbler is concentrated in areas of higher forest cover south of the Shield, primarily along the Niagara Escarpment and Oak Ridges Moraine, where a good supply of old field habitat is available. This species is uncommon in all regions.

8.11.1.2 Blanding's Turtle (*Emydoidea blandingii*)

The Blanding's Turtle (*Emydoidea blandingii*) species has been identified as "Threatened" by COSEWIC. The Blanding's turtle is a relatively large, northern freshwater reptile species. In North America the species' range extends from Nova Scotia and southern Maine, to southwestern Quebec and southern Ontario, around the Great Lakes and westward to central Nebraska.

Very little is known about the occurrence of this species within the RSAS or Ontario as a whole. What is known is that the Great Lakes/St. Lawrence population of Blanding's Turtle is located throughout southern and south-central Ontario. The Great Lakes/St. Lawrence population while widespread and fairly numerous is declining (COSEWIC 2008). Blanding's turtles may use several interconnected lakes, rivers, streams, marshes or ponds and travel upwards of 6760 m in an active season (COSEWIC 2008).



Blanding's Turtle (GLL)

The turtles live in small groups or patches especially at the edge of their range. The population in Ontario is near the most northerly limit of its range. The turtle makes its home in shallow waters and wetlands, including stillwater streams, bogs and shallow plant-filled lake coves. These waters tend to be very dark, tea-coloured. Typically, the females nest on gravel beaches with south facing slopes exposed to the sun. Some turtles even nest on roadsides and in gravel pits. Habitat degradation and loss associated with intensive urbanization is the most important threat to the Blanding's Turtle in Ontario. Contributing factors include the cold climate which often reduces the incubation period and therefore reduces successful egg hatching.

A local resident reported the presence of Blanding's Turtle prompting follow-up field-visits in 2008 to the property where the Blanding's Turtle was reported. There is a dug pond within the Wilmot Creek valley that is off line with the creek. Some water from the creek is diverted from the creek through the pond at the north end. There is also an overflow outlet to the creek at the south end of the pond. The shoreline of the pond is steep sided and consequently there is minimal emergent wetland vegetation along the shoreline. The shoreline areas are mowed and manicured amongst many trees. Dense White Cedar coniferous forest with very low diversity of plant species borders the east side of the pond berm and extends along the creek. Lawn and a senescing Scots Pine plantation with deciduous regeneration occur on the west side. The maximum pond depth is approximately 5 m, and the clear waters indicate there is likely groundwater input. The pond bottom is dominated by an almost continuous cover of stonewort (*Chara* sp.) with some occurrences of Sago Pondweed (*Potamogeton pectinatus*).

The pond does not appear to provide good habitat for the Threatened Blanding's Turtle since it has a steep sloping shoreline with minimal emergent marsh along the shoreline. Blanding's typically occurs in shallow ponds with abundant emergent cover. The surrounding cedar forest and woodland is also not optimal habitat for the species. Both Snapping and Painted Turtles, which were observed using the pond, are more adaptable to a broader range of conditions and their presence is not an indication that Blanding's Turtle is also likely to be present. Snapping Turtle has recently (November 2008) been designated as Special Concern by COSEWIC.

8.11.1.3 *Butternut (Juglans cinerea)*

The Butternut (*Juglans cinerea*) is identified as "Threatened" by COSEWIC. It is a small to medium-sized tree of the walnut family that seldom exceeds 30 m in height. In deeper soils it commonly has a central taproot and numerous widespread lateral roots. Butternut is a relatively short-lived, shade intolerant species. Butternut is known for its edible nuts and its wood is considered to be a specialty product. Butternut also has intrinsic and aesthetic value, and provides wildlife forage and cover.

Butternut is commonly found in riparian habitats, but is also found on rich, moist, well-drained loams, and well-drained gravels, especially those of limestone origin. The Canadian range runs through southern Ontario and southern Quebec to New Brunswick. Within its Canadian range, butternut is widespread, primarily found as a minor component of hardwood stands, but also occurring as extensive pure stands on floodplains. Inventory efforts have been limited to date. Very conservative estimates of populations in Ontario are 13,000 trees in Ontario. In Ontario, the population exhibits high levels of butternut canker, and poor health of many butternut trees. Butternut canker is a serious threat to the species. No known naturally resistant strain of butternut has been identified. Canker-free individuals have been observed within infected stands, though these cases are very rare. Where the canker has been present for decades and mortality rates have been high, surviving individuals may represent some level of resistance even if they are not canker-free.

A total of 83 Butternut trees were identified within the 407 East Transportation Corridor, including 3 seedlings. The majority of the Butternut observed were deemed to be not retainable due to visual signs of Butternut Canker. A total of 34 Butternut trees were determined to be retainable and will be addressed in the mitigation and monitoring sections of this Screening Report.

8.11.1.4 *Redside Dace (Clinostomus elongatus)*

The Redside Dace (*Clinostomus elongatus*) species has been identified as "Endangered" by COSEWIC. It is currently being considered for listing under the Federal Species at Risk Act (SARA). Protection is afforded through the Federal Fisheries Act. If listed under the SARA, it will be afforded additional protection. Under the SARA, a recovery strategy must be developed for this species.

The Redside Dace is a very colourful minnow and a member of the carp and minnow family. It has a discontinuous range in North America. Its Canadian distribution includes tributaries of western Lake Ontario, the Holland River (Lake Simcoe drainage), and in Irvine Creek (Lake Erie drainage). The Canadian range comprises roughly 5% of its global range.

The Redside Dace is a coolwater species found in pools and slow flowing areas of small headwater streams with a moderate to high gradient. Overhanging grasses and shrubs, as well as undercut banks, are an important part of their habitat, as are instream boulders and large woody debris. Substrate is variable and includes silt, gravel and boulders.



Clinostomus elongatus
 Illustration by E. Edmondson & H. Chrisp (NYSDC)

Habitat degradation and loss associated with intensive urbanization is the most important threat to the Redside Dace in Ontario. Contributing factors associated with urban development include changes in the stream structure, such as channel widening and decreased pool depth, removal of bank vegetation that provides cover, food and moderates water temperature, and siltation. Similarly, intensive agricultural practices, such as row cropping and grazing, compromise water quality and habitat of the Redside Dace.

8.11.1.5 Re-Introduced Atlantic Salmon (*Salmo salar*)

The Atlantic Salmon (*Salmo salar*) species has been identified as “Extirpated” by COSEWIC. In Ontario, the Atlantic Salmon is identified as “Presumed Extirpated”. The Atlantic Salmon has a “trout-like” body with an average length of about 18 inches (457 mm), somewhat compressed laterally, with the greatest body depth usually at the dorsal fin origin or slightly posterior to it. A good Atlantic salmon river is described as having clean water seldom rising above about 25°C with a general gradient of about 2-11.5 m/km. The river should



have a naturally graded, stable bed with a stony bottom comprised of particles varying in size from coarse sand and gravel to large boulders.

In North America, the range of the anadromous Atlantic salmon was northward from the Hudson River drainage in New York State, to outer Ungava Bay in Quebec. The current distribution remains similar to the historical range; however, the number of rivers supporting spawning runs as well as the estimated population densities are much lower than those recorded historically.

Approximately 40 tributaries of Lake Ontario were known to support runs of Atlantic salmon. Restoration efforts are currently being undertaken for Atlantic salmon in Lake Ontario and are consistent with a recent Biodiversity Strategy for Ontario. Re-introduced Atlantic salmon was recorded in the reaches of the East Duffins Creek (Site 9) within the ROW.

8.11.2 Local Study Area

The following table provides a description of the existing environmental conditions related to Species at Risk present in the SSA and the LSA for each of the Projects subject to the Federal EA (as presented in **Table 8-**

40). Overall, there will be 82 Butternut trees potentially removed by the transportation corridor (i.e., within ROW) at the Projects subject to Federal EA. Based on a preliminary health assessment (i.e., pending MNR review) this includes 34 Butternuts that have been assessed as retainable. Similarly, there are six (6) watercrossings at which Redside Dace and one (1) watercourse at which Re-introduced Atlantic Salmon may be present within the SSA and LSA.

Table 8-40 Species at Risk Associated with Projects subject to Federal EA

Section of the Undertaking	Site Number	Presence in the SSA	Presence in the LSA
West Mainline – Section 1 (Brock Road to Audley Road)	1	▶ None	▶ None
	3	▶ None	▶ Butternut (END)
	3a	▶ None	▶ Butternut (END)
	7	▶ Redside Dace (END)	▶ Butternut (END) ▶ Redside Dace (END)
	8	▶ Redside Dace (END)	▶ Redside Dace (END)
	9	▶ Atlantic Salmon (EXT)	▶ Butternut (END) ▶ Atlantic Salmon (EXT)
	11	▶ Redside Dace (END)	▶ Redside Dace (END)
	12	▶ Redside Dace (END)	▶ Redside Dace (END)
West Mainline – Section 2 (Audley Road to Ashburn Road)	17	▶ Butternut (END)	▶ None
	18	▶ None	▶ None
	19	▶ None	▶ None
	20	▶ Redside Dace (END)	▶ Redside Dace (END)
	21	▶ Redside Dace (END)	▶ Redside Dace (END)
Central Mainline – Section 3 (Ashburn Road to Simcoe Street)	24	▶ None	▶ None
	28	▶ None	▶ None
Central Mainline – Section 4 (Simcoe Street to Enfield Road)	35	▶ Butternut (END)	▶ None
	38a	▶ Butternut (END)	▶ None
	54	▶ None	▶ None
East Mainline – Section 5 (Enfield Road to Highway 35/115)	57a	▶ None	▶ None
West Link – Section 6 (West Durham Link)	44	▶ Butternut (END)	▶ None
	47	▶ Butternut (END)	▶ None
	47a	▶ None	▶ Butternut (END)
	51	▶ None	▶ None
	97	▶ None	▶ Butternut (END)
	100	▶ None	▶ None
East Link – Section 7 (East Durham Link)	90	▶ None	▶ Butternut (END)
	92	▶ None	▶ Butternut (END)
	104	▶ None	▶ None

Note: END Endangered - A species facing imminent extirpation or extinction. EXT – A species considered extirpated.

The Blanding’s Turtle habitat identified in the Wilmot Creek valley and the Golden-winged Warbler habitat are not affected by any of the Projects subject to Federal EA.

8.12 Socio-economic Environment (Transportation Corridor)

8.12.1 Land Use Planning Context

This section highlights the Planning policy and land use documents that form the basis of the socio-economic environment potentially affected by the 407 East Transportation Corridor. The socio-economic environment has

been and will continue to be affected by a number of public planning policy documents, Provincial policies and plans, and Regional and area municipal Official Plans. The key Provincial policies and plans include:

- Provincial Policy Statement
- Oak Ridges Moraine Conservation Plan
- Greenbelt Protection Plan
- Growth Plan for the Greater Golden Horseshoe
- Metrolinx RTP

Provincial Policy Statement

The Province of Ontario issued a new Provincial Policy Statement (PPS) in 2005, which is intended to provide policy direction on planning matters, related to issues of Provincial interest. The current PPS came into effect on March 1, 2005 and replaced the former 1997 PPS. Changes to the Planning Act require that all decisions affecting planning matters “shall be consistent with” the PPS and will be complemented by Regional and local policies regarding matters of local interest.

The Provincial Policy Statement sets out three key principles concerning the long term economic prosperity, environmental health and social well-being of Ontario, and provides policy directions in the following subject areas: Efficient, cost effective development and land use patterns; Resources; and Public Health and Safety.

The PPS is an overarching consideration within the EA process. The PPS affects the entire RSA. The PPS requires the protection of corridors and rights-of-way for significant transportation and infrastructure facilities such as the 407 East extension. When planning for corridors and rights-of-way for significant transportation facilities, consideration is to be given to significant resources. Consideration of the natural environment has been undertaken with the separate assessment of the Natural Environment (*including Fish and Fish Habitat, Terrestrial Ecosystems and Groundwater*). The 407 East Transportation Corridor is a permitted use within the policies of the PPS.

Oak Ridges Moraine Conservation Plan

The Oak Ridges Moraine (ORM), one of Ontario’s most significant landforms, is an irregular ridge stretching 160 km from the Trent River in the east to the Niagara Escarpment in the west. Together with the Escarpment, the ORM forms the foundation of south-central Ontario’s natural heritage and Greenbelt systems with a unique concentration of environmental, geological and hydrogeological features.

The Oak Ridges Moraine Protection Act was introduced in May 2001 and after considerable consultation the Oak Ridges Moraine Conservation Act was passed on December 14, 2001 and the Oak Ridges Moraine Conservation Plan came into effect in April 2002. The Plan clarifies the long-term protection and management of the 190,000 ha within the Moraine. All decisions made under the Planning Act and Condominium Act or other prescribed matters must conform to the Plan.

The Plan divides the ORM into four land use designations with varying degrees of protection: Natural Core Areas, Natural Linkage Areas, Countryside Areas and Settlement Areas.

The 407 East Transportation Corridor falls within the Oak Ridges Moraine Conservation Plan at the most easterly edge of the route, where the mainline links in with Highway 35/115. The area falls within the Countryside Area primarily. Countryside Areas are agricultural and rural transitions/buffers between Natural Core Areas/Linkage Areas and the urbanized Settlement Areas. Prime agricultural areas as well as natural features are protected. Allowed uses are those typically allowed in agricultural and other rural areas.

Development in the ORM is generally prohibited within key natural heritage features, hydrological sensitive features and their related minimum vegetation protection zones with some exceptions including transportation if the need for the project has been demonstrated and there is no reasonable alternative in addition to other provisions of the Plan. The 407 East Transportation Corridor is a permitted use within this designation of the ORM as there is no reasonable alternative given the previous assessment through the Alternative Methods assessment.

The Greenbelt Plan

The Greenbelt Plan is a broad band of permanently protected land that sustains the ecological and human health of south central Ontario. Extending from the eastern end of the ORM near Rice Lake to the Niagara River, it is about 325 km long and 80 km at its widest (from the mouth of the Rouge River to the northern tip of Durham Region). The Greenbelt Plan through Durham Region includes the Oak Ridges Moraine Conservation Plan lands as well.

The Greenbelt Plan was authorized by Provincial legislation, the Greenbelt Act in 2005 and is governed by the policies of:

- The Niagara Escarpment Plan;
- The Oak Ridges Moraine Conservation Plan;
- The Parkway Belt West Plan; and,
- The Protected Countryside Policies of the Greenbelt Plan.

Large segments of the 407 East Transportation Corridor go through the Greenbelt, particularly in the east end of the alignment east of Townline Road (Regional Road 55) in the Municipality of Clarington. There are also several locations along the mainline route in Pickering, in Whitby particularly along the West Link and in Oshawa. Most of the land use within the Greenbelt affected by the proposed main line is designated Protected Countryside.

Major infrastructure serving the national, Provincial and inter-regional needs traversing the Greenbelt is recognized under Section 4.2 Infrastructure Policies of the Greenbelt Plan. It further states that it is anticipated that new and/or expanded facilities will be needed in the future to serve the substantial growth projected for southern Ontario. As such, the 407 East Transportation Corridor will serve the significant growth anticipated in this area of southern Ontario and therefore meets the intent of the Greenbelt. The route has minimized (wherever possible), the amount of Greenbelt particularly the Natural Heritage System traversed and occupied. The planning and design of the route has wherever possible minimized the possible negative impacts associated with light and noise, and impacts to natural heritage features as specified in the Greenbelt Plan.

Growth Plan for the Greater Golden Horseshoe

The Growth Plan for the Greater Golden Horseshoe was prepared under the Places to Grow Act, 2006, which is a Plan to guide decision on a wide range of issues including transportation, infrastructure, land use planning, housing, natural heritage and resource protection. The policy directions support managed growth through the provision of built up areas, complete communities, transit use, intensification, optimization of existing infrastructure, preservation of employment opportunities and the preservation of prime agricultural areas and natural heritage resources. The policies of the Plan are intended to guide growth and development to 2031.

The Plan contains population and employment forecasts for Durham Region from 2001 to 2031. The Region is projected to grow in population from 530,000 in 2001 to approximately 960,000 in 2031. Over the same time period employment is expected to grow from 190,000 to approximately 350,000.

Policies of the Plan state that by 2015, and for each year thereafter, a minimum of 40% of all residential development annually within each upper tier municipality such as Durham Region will be within the built-up area. This will be accomplished through facilitating and promoting intensification. The minimum density target for the Urban Growth Centres in Durham, which include Downtown Oshawa and Downtown Pickering, are 200 residents and jobs combined per hectare. The Plan also provides for the adequate supply of lands that will provide locations for a variety of appropriate employment uses to accommodate the projected employment to 2031. Policies for designated Greenfield areas require that the upper tier municipality achieve a minimum density target of not less than 50 residents and jobs per hectare.

The Plan also contains policies for infrastructure planning and strategic investment for transportation, water and wastewater systems and community infrastructure to support growth that will achieve efficient and compact urban form and complete communities.

Similar to the PPS and Greenbelt Plan, this Plan also promotes the protection of natural heritage systems, prime agricultural areas, mineral aggregate resources and includes policies on conservation.

The built boundary was finalized by the Province in April 2008, and sets the limits of the developed urban areas as defined by the Minister of Public Infrastructure Renewal for purposes of measuring intensification targets. The areas between the built-up area and settlement boundaries of Greenfield lands are expected to be built to higher, more compact densities in complete communities. The “Whitebelt” or area between the Greenbelt and existing urban area boundaries is coming under increasing pressure for urban uses having been passed over for Provincial level protection under the Greenbelt Plan.

Although the Growth Plan does not contain land use designations and permission as such, it is a high level Provincial plan that will shape the urban structure of the Region to the year 2031. Upper tier municipalities, such as Durham, are in the process of implementing the Growth Plan through review of population and growth projections and ultimately providing a Regional Official Plan amendment subject to Provincial approval. In addition, the Region will also allocate growth forecasts to its constituent lower-tier municipalities which will precipitate further amendments to the area municipal Official Plans as part of the Growth Plan conformity exercise.

These Provincial Plans and Policies are freestanding, independent Provincial initiatives aimed at reducing sprawl, protecting the environment and resources and managing growth. Municipalities are now required to be consistent with and in conformity with Provincial policies and Plans.

8.12.2 Existing Land Uses and Socio-economic Features Potentially Affected

The RSA is contained largely within the Region of Durham which is the most highly developed and populated economic centre of Ontario. Durham Region lies immediately to the east of the City of Toronto within the Greater Toronto Area and encompasses an area of approximately 2,590 km². The area is characterized by a variety of landscapes and communities. A series of major lakeshore urban communities in the southern portion of Durham Region contrast with a variety of small rural towns, villages, hamlets and farmlands which comprise most of the northern portions of the Region.

The urban communities in Durham Region have developed a reputation for a strong manufacturing sector, largely associated with the presence of General Motors whose head office and assembly plants are located within the City of Oshawa. As such, Durham is endowed with a skilled labour force. It has the utilities, transportation and social infrastructure associated with a modern metropolitan community. Recently, the single most significant economic factor for the Region has been the dramatic increase in residential development. Nevertheless, agriculture remains an important component of Durham Region's economy. Durham Region has a large number of farm operators, equestrian centres, tree farms and nurseries.

The 407 East Transportation Corridor will serve all of southern Ontario including numerous individual communities and hamlets within Durham Region. Communities such as Almond Village, Brooklin, Kinsale, the Macedonian Village, Solina, Leskard, the village of Tyrone and Hampton are all located in proximity to the transportation corridor. Further, there are several proposed future growth areas, employment lands and planned communities located near the transportation corridor.

The transportation corridor traverses the following recreational features:

- Park – Don Beer Memorial Park
- Trail systems – Oak Ridges Moraine, Leskard and Darlington Trail systems

A number of residential, institutional and recreational properties exist both within and in close proximity to the 407 East Transportation Corridor. Further, other properties may be affected through the removal of private access to the properties themselves. There are currently over 500 properties located within the ROW.

The transportation corridor traverses a variety of policy and plan areas with Provincial, regional and municipal development goals and objectives. This includes the designations within the Official Plans for Durham Region, the City of Pickering, the Town of Ajax, the Town of Whitby, the City of Oshawa and the Municipality of Clarington. The transportation corridor has been assessed against the Provincial, regional and municipal planning policies, plans and programmes to determine its compatibility.

The transportation corridor has the opportunity for providing transportation service and stimulating development opportunities for future employment lands in key areas. However, the transportation corridor will also negatively affect some employment lands as well.

The transportation corridor contains a number of non-farm commercial activities including nurseries, orchards, home occupations, places of business, golf courses, driving ranges, equestrian centres, manufacturing centres, auto service centres, bed and breakfasts, and industrial/contractors yard. Eight businesses within the transportation corridor Right-Of-Way may be potentially affected including:

- Nursery
- Orchard
- Equestrian operation
- Landscaping business
- Auto Service Centre
- Driving Range
- Air Strip

The transportation corridor does not affect any existing mineral aggregate operations. It contains a significant amount of agricultural lands, particularly in the eastern portion of the study area (i.e., Clarington). The transportation corridor traverses a range of soil types, however there is a higher percentage of Class 1-3 type soils, which are more fertile than the Class 4-7 type soils. Specifically, the following agricultural features are potentially affected by the transportation corridor:

- 324 active agricultural properties
- 40 agricultural facilities
- 58 sheds
- 15 silos
- Granary
- 13 grain bins
- 10 specialty crop operations (i.e., nursery stock, orchards)
- 39 farm residential units
- 49 barns, both large and small
- 94 severed agricultural properties

8.13 Cultural Environment (Transportation Corridor)

The Cultural environment considers those resources or features of archaeological, historical, cultural, or traditional use significance. This may include archaeological resources, built heritage or cultural heritage landscapes. Heritage resources and features are usually identified by Federal or Provincial agencies, municipalities, municipal heritage committees (sic) or other equivalent heritage groups, and local and regional band councils. Some heritage resources and features are legally protected, and can be found in official sources. Some may only be inventoried or listed, either officially, or by interested stakeholders.

8.13.1 Archaeological Resources

Based on the results of a Stage 1 archaeological assessment, there are approximately 487 registered archaeological sites within the RSA. In relation to the numerous water sources, relict shoreline features, historic transportation corridors, and historic communities throughout the area, it is evident that a

considerable portion of the RSA has potential for the presence of archaeological resources. Areas of archaeological potential account for approximately 80% of the lands in the RSA. Furthermore, this potential is scattered throughout the RSA such that no large geographic area without archaeological potential can be identified. An examination of the physiography and history of the project region has indicated that archaeological resources may include known or potential sites from all periods of human occupation since the last glaciation and that numerous site types, including isolated artifacts, large and small habitations, and burials (including large ossuaries) may be present.

Of the 487 registered archaeological sites identified, 29 are either burial sites or large-scale Aboriginal habitations site that may be associated with burials. These 29 sites include large and small burial sites, villages, and cabin and hamlet sites. In addition, at least 31 possible historic Euro-Canadian cemeteries have been identified based on examination of nineteenth-century maps.

Field investigations were carried out in 2008 as part of this EA and constituted a Stage 2 archaeological assessment of a sample of properties throughout the 407 East Transportation Corridor for which both permission to enter and suitable archaeological field conditions were available. For the properties assessed, this exercise provided a comprehensive inventory of actual archaeological resources, both pre-contact Aboriginal and historic Euro-Canadian. Overall, 75 archaeological sites were identified during the 2008 field survey.

8.13.2 Built Heritage and Cultural Landscapes

The 407 East Transportation Corridor lies in the Regional Municipality of Durham, passing through the City of Pickering, the Town of Whitby, the City of Oshawa and the Municipality of Clarington. Historically, this comprised the geographic townships of Pickering, Whitby and East Whitby in Ontario County, and Darlington and Clarke in Durham County. The study area is largely farmland settled in the late-18th to mid-19th century, and is characterized by the grid pattern of the late-18th century land survey into 200 acre lots and a system of concession and sideline roads. Crossroads, hamlets and villages arose across the grid, often where milling was possible. Historical and continuing community names include Brougham, Greenwood, Kinsale and Brooklin in Ontario County and, Solina, Hampton and Leskard in Durham County. Rural agricultural society produced a landscape of farm complexes at intervals among cultivated fields, pasture, woodlots and shelterbelts. The typical pattern of occupation on the land has been consistent until the latter part of the 20th century when non-agricultural residential and commercial uses were introduced with the encroachment of urban sprawl. However the dominant character remains rural and agricultural.

Overall a total of 188 built heritage / cultural heritage resources were identified along the 407 East Transportation Corridor. These include:

- 33 individual residential buildings,
- 77 farm complexes (including farmhouses, barns and outbuildings),
- 71 roadscapes;
- 1 utility corridor and rail line;
- 1 bridge;
- 2 cemetery; and
- 3 viewsheds.

About 44 of the buildings are designated or candidates for designation under the Ontario Heritage Act or are listed on relevant municipal inventories of heritage structures. None of these resources are recognized by the Federal Government as having NHS.

8.14 Current Use of Land and Resources By Aboriginal People (Transportation Corridor)

There are no First Nation communities located in the RSA. Although there are no First Nation communities in the RSA, members of First Nations may well reside within the RSA. The closest First Nations community, the Mississaugas of Scugog Island, is located approximately 21 km north of the 407 East Transportation Corridor.

- Curve Lake First Nation community is located on two islands and a peninsula in Buckhorn Lake, 15 km north of Peterborough, Ontario.
- The Mississaugas of Scugog Island First Nation community is located on Scugog Island in Lake Scugog within the Regional Municipality of Durham.
- Chippewas of Mnjikaning (Rama) First Nation community is located along Lake Couchiching within Simcoe County, Ontario.
- Chippewas of Beausoleil First Nation community is located on three islands in the south portion of Georgian Bay.
- Chippewas of Georgina Island First Nation community is located on three islands in the southeastern portion of Lake Simcoe within the Regional Municipality of York.
- Hiawatha First Nation community is located on the north side of Rice Lake in Peterborough County, Ontario.
- Alderville First Nation community is located on the south side of Rice Lake near Roseneath in Peterborough County, Ontario.
- Mississauga of New Credit First Nation community is located in Hagersville, southeast of Brantford, Ontario.
- The Mohawks of the Bay of Quinte First Nation community is located in Deseronto of Tyendinaga Mohawk Territory, east of Belleville, Ontario.
- The Kawartha Nishnawbe community is located in Burleigh Falls, Ontario.
- The Huron-Wendat First Nation community is located in Wendake, Quebec on the eastern bank of the St. Charles River and 8 km north of Quebec City. The Huron-Wendat First Nation is the furthest community from the 407 East Transportation Corridor.

Some of these Aboriginal communities have a historical relationship with the lands along the north shore of Lake Ontario from Toronto East to the Bay of Quinte and north to Lake Simcoe and Rice Lake. The historical association with these lands resulted from occupation, traditional land use and related activities prior to European settlement. Beginning in the mid 1700s, the First Nations in the area began to cede their lands along the north shore of Lake Ontario to the British.

There are three treaties with First Nations that are related to the lands comprising the RSA including: The Johnson-Butler Purchase Treaty (1788 and 1805), the Gunshot Treaty (1787); and the Williams Treaties (1923). The Aboriginal peoples in Canada, and as such their Aboriginal and treaty rights are recognized and affirmed under Section 35 of the Constitution Act, 1982.

Based on the research and field studies undertaken as part of the Provincial EA, there does not appear to be any current use of lands, water or resources by the identified First Nation communities along the 407 East Transportation Corridor and the RSA in general. No commercial fishing, traditional activities (i.e., relating to food, camping, travel, social or cultural purposes), nor First Nation communities with a dependence on country foods or harvesting on or near the 407 East Transportation Corridor were identified. At present, the vast majority of the land required for the 407 East Transportation Corridor is privately held.

In 2004, the Ontario Ministry of Natural Resources and the Metis Nation of Ontario (MNO) entered into an interim harvesting agreement allowing Métis Peoples to harvest food in traditional territories conditional upon having a harvesting card. Although there are no Métis settlements in the RSA, persons of Métis heritage may well reside within the RSA. At present, the boundaries and details of the traditional harvesting territories of Métis communities within Ontario are not fully determined. A description of the territories will be the subject of further research and consultations to take place in the near future between the MNO and Ontario Ministry of Natural Resources.

8.15 Contaminated Sites & Waste Management (Transportation Corridor)

The 407 East Transportation Corridor traverses over 500 properties, which are being assessed for potential site contamination. Of these properties, 385 have been assessed to date of which 24 properties have been identified as requiring additional investigations to determine the potential waste and property site contamination. These properties may include and or show the following characteristics:

- construction company;
- aboveground storage tanks;
- underground storage tanks;
- former fuel service station;
- evidence of spill occurrences;
- waste management facility (closed or operating);
- metal valve manufacturing company;
- an automotive dealer exchange facility;
- small waste debris area;
- gravel pit and debris area;
- landscaping and gardening supply centre;
- registered waste generator;
- agricultural equipment company;
- transformer station; and
- autowrecking and recycling facility.

8.16 Identification of Valued Ecosystem Components

Table 8-41 describes the Valued Ecosystem Components (VECs) that were identified for the purposes of this Environmental Screening. They were identified based on the preceding descriptions of existing environmental conditions potentially affected by the 407 East Transportation Corridor and where relevant the Projects subject to Federal EA. These VECs represent specific features or attributes of the environment that are considered to be important for regulatory reasons, or because of their social, cultural, economic or ecological value. For each VEC, the following table provides a brief rationale for why the VEC was selected along with the key considerations and/or indicators to be used (where possible) in the effects assessment (Sections 9 and 10).

Table 8-41 Valued Ecosystem Components

VEC	Rationale	Effects Considerations / Indicators
Air Quality and Climate		
Air Quality Sensitive Receptors (Human Receptors)	<ul style="list-style-type: none"> ▶ Compliance will need to be assessed in terms of Provincial and Federal Ambient Air Quality Criteria for Highway Design ▶ Compliance with the requirements of the Environmental Reference for Highway Design will need to be assessed. ▶ Changes in air quality have the potential to affect socio-economic conditions (e.g., interference with activities and increased annoyance). 	<ul style="list-style-type: none"> ▶ Potential for changes in air quality
Noise and Vibration		
Noise Sensitive Areas (NSAs) (Human Receptors)	<ul style="list-style-type: none"> ▶ Compliance with requirements of the Environmental Guide For Noise will be assessed. ▶ Changes in noise levels have the potential to affect socio-economic conditions (e.g., interference with activities and increased disruption to people's use and enjoyment of property). 	<ul style="list-style-type: none"> ▶ Potential for changes in sound levels during construction ▶ Type and timing of construction activities ▶ Absolute sound exposure levels (Leq (24 h) values, in dBA) at Noise Sensitive Areas ▶ Change in sound exposure levels (L_{eq} (24 h) values, in dBA) at Noise Sensitive Areas
Surface and Subsurface Geology and Soils		
Valley slopes and Landforms	<ul style="list-style-type: none"> ▶ Changes to valley slopes and landforms may affect the landscape composition and consequently community character. Changes to valley slopes and landforms may result in an increased risk of erosion and sedimentation 	<ul style="list-style-type: none"> ▶ Potential for effects to valley slopes and landforms ▶ Erosion and sedimentation risk
Groundwater		
Regional Groundwater Aquifers	<ul style="list-style-type: none"> ▶ Regional groundwater aquifers have social, economic and ecological value. Large, regional aquifers provide a source of potable water sufficient for municipal / industrial uses. They provide baseflow to larger rivers and streams 	<ul style="list-style-type: none"> ▶ Changes to Groundwater quality, water table depth and discharge
Groundwater Wells	<ul style="list-style-type: none"> ▶ Groundwater wells have social, economic and ecological value. They are the primary potable water supply in rural areas. There are a large number of wells located near the proposed 407 East Transportation Corridor (>1,500) 	<ul style="list-style-type: none"> ▶ Changes to drinking water quality and water Level within wells
Ground water table in Surficial Soils	<ul style="list-style-type: none"> ▶ The groundwater table in surficial soils may provide a source of potable water to rural residences. They can provide baseflow to small creeks and streams. 	<ul style="list-style-type: none"> ▶ Changes in the local water table at may cuts and groundwater flow directions at major fills.
Surface Water		
Surface Water Bodies / Water Courses	<ul style="list-style-type: none"> ▶ Surface water bodies and water courses provide habitat for fish and other aquatic species and may serve as a place for some local residents to undertake recreational activities. 	<ul style="list-style-type: none"> ▶ Reduction in surface water quality and flow conditions ▶ Changes in groundwater discharge
Vegetation and Vegetation Communities		
Forested Areas	<ul style="list-style-type: none"> ▶ Forested areas play important ecosystem functions and contribute to Canadian biodiversity. 	<ul style="list-style-type: none"> ▶ Presence and effects on forested areas
Forested Areas with Interior Habitat	<ul style="list-style-type: none"> ▶ Forested areas with interior habitat play important ecosystem functions and contribute to Canadian biodiversity. Some woodlots may provide important wildlife habitat (e.g., breeding and/or migratory birds and Species at Risk) that need to be considered under the <i>Migratory Bird Convention Act</i> and <i>Species at Risk Act</i>. 	<ul style="list-style-type: none"> ▶ Presence and effects on forested areas with interior habitat

Table 8-41 Valued Ecosystem Components

VEC	Rationale	Effects Considerations / Indicators
Wetlands		
Wetlands	► Wetland communities are particularly sensitive to disturbance and are difficult to recreate. Wetlands contribute to Canadian biodiversity. Some wetlands may provide important wildlife habitat (e.g., breeding and/or migratory birds and Species at Risk) that need to be considered under the <i>Migratory Bird Convention Act</i> and <i>Species at Risk Act</i> .	► Presence and effects on wetlands
Fish and Fish Habitat		
High Sensitivity Fish Habitat (e.g., coldwater fish habitat)	► The protection of fish and fish habitat need to be considered under the <i>Fisheries Act</i> . High sensitivity fish habitat offers the greatest potential for a significant harmful alteration, disruption or destruction of habitat (HADD). High sensitivity fish habitat contribute to Canadian biodiversity and may provide important habitat that need to be considered under the <i>Species at Risk Act</i> .	► Presence and effects on: <ul style="list-style-type: none"> • Salmonid/Char spawning and rearing habitat • Redside Dace • Specialized spawning and rearing for other species
Wildlife and Wildlife Habitat (including migratory birds)		
Specialized and Sensitive Wildlife Habitat	► Specialized and sensitive wildlife habitat provide unique habitat functions difficult to reproduce. Such habitats contribute to Canadian biodiversity. Some areas may provide important wildlife habitat (e.g., breeding and/or migratory birds and Species at Risk) that need to be considered under the <i>Migratory Bird Convention Act</i> and <i>Species at Risk Act</i> .	► Presence and effects on: <ul style="list-style-type: none"> • Breeding bird species richness and diversity • Habitat diversity • Species of Conservation Concern • Significant habitat types • Presence of specialized wildlife habitat • Amphibian breeding habitat • Level of anthropogenic disturbance • Habitat block size • Habitat continuity
Mammals, amphibians and breeding/migratory birds	► Mammal, amphibians and breeding/migratory birds are vulnerable to effects of construction and operation of transportation infrastructure.	► Presence and effects on mammals, amphibians, breeding/migratory birds.
Species at Risk		
Federal (COSEWIC) Species at Risk	► Species at Risk are indicators of specialized conditions in study areas. They contribute to Canadian biodiversity and need to be considered under the <i>Federal Species at Risk Act</i> .	► Presence and effects on habitats for: <ul style="list-style-type: none"> • Golden-winged Warbler • Redside Dace • Butternut • Blanding's Turtle • Re-introduced Atlantic Salmon
Socio-Economic Environment		
Use and Enjoyment of Private Property	► Nuisance effects from proximity to the corridor have the potential to affect use and enjoyment of private property	► Projected levels of noise and dust.
Community character	► The project could result in physical separation of smaller communities within a municipality from the other communities and community facilities. Changes in landscape composition, increased noise and dust could disturb the rural/agricultural atmosphere that is valued by local residents.	► Encroachment on the community, division of the community or creation of a barrier from other communities. ► Changes to noise and dust levels.

Table 8-41 Valued Ecosystem Components

VEC	Rationale	Effects Considerations / Indicators
Agricultural Activity	<ul style="list-style-type: none"> ▶ Across Durham Region, agricultural activity is an important component of the local and regional economy. Agriculture also influences a community's character and cohesion, ultimately affecting a community's well-being. Agricultural soils are a natural resource and critical to agricultural operations. Across Durham Region, agricultural operations are an important component of the local and regional economy. Agriculture also influences a community's character and cohesion, ultimately affecting a community's well-being. 	<ul style="list-style-type: none"> ▶ Presence agricultural operations of and effects on: <ul style="list-style-type: none"> • Landscape composition • Presence of Class 1, 2 and 3 Agricultural Soils
Cultural Environment		
Archaeological Sites	<ul style="list-style-type: none"> ▶ Archaeological sites with human burials are protected under the Ontario Heritage Act. ▶ Archaeological sites with human burials will require assessment and compliance with the provisions under the Ontario Cemeteries Act. 	<ul style="list-style-type: none"> ▶ Presence of and effects on: <ul style="list-style-type: none"> • Archaeological sites (with and without human burials)
Euro-Canadian Built Heritage and Cultural Landscapes	<ul style="list-style-type: none"> ▶ Euro-Canadian Built Heritage and Cultural Landscapes have social value, by contributing to our understanding of Euro-Canadian history from the late 18th- to the early-20th century, for research public education purposes, and for their spiritual or cultural meaning to Canadians 	<ul style="list-style-type: none"> ▶ Presence of and effects on: <ul style="list-style-type: none"> • Built Heritage Resource (BHR) containing architecture and/or above-ground structural remains and artifacts • Cultural Heritage Landscapes (CHL) defined by farm complexes, roadscares, waterscapes, railscares, historic settlements, cemeteries, and historic/commemorative sites
Current Use of Land and Resources by Aboriginal People		
None Identified		
Waste / Property Contamination		
Soil Quality	<ul style="list-style-type: none"> ▶ There is potential for encountering contaminated soil during construction activities and as such the contaminated soil will require remediation in accordance with environmental regulations. ▶ Cleaning up contaminated soil is important to the individual property owner and for the environment. 	<ul style="list-style-type: none"> ▶ Activities undertaken at each individual property (e.g., construction activities; waste storage and disposal; vehicle fuelling, maintenance, and storage operations). ▶ Number of properties with potential for contamination.

8.17 References

Aquafor Beech, 2001:

Harmony Creek Subwatershed Plan Study. Final Report. Prepared for The City of Oshawa, June 2001

Bain, M., and B. Henshaw, 1994:

The Durham Region Natural History Report 1993

Bakowsky, W.D., 1996:

Natural Heritage Resources of Ontario: Vegetation communities of southern Ontario. Natural Heritage Information Centre, Ontario Ministry of Natural Resources, Peterborough, Ontario.

Barnett, P.J., 1995:

Geology of the Oak Ridges Moraine area, parts of Peterborough and Victoria Counties and Durham and York regional municipalities, Ontario. In Summary of Fieldwork and Other Activities 1995, Ontario Geological Survey, Miscellaneous Paper 164, p. 177-182.

Barnett, P.J., J.E.P. Dodge and L.A. Henderson, 1996:

Quaternary geology, Scugog area, Ontario. Ontario Geological Survey, Map 2644, scale 1:50000.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage and A.R. Couturier, 2007:

Atlas of the Breeding Birds of Ontario 2001 - 2005

Central Lake Ontario Conservation Authority, 2002:

Oshawa Creek Watershed Aquatic Resource Management Plan. July, 2002.

<http://www.cloca.com/resources/Oshawa%20Creek%20ARMP%20July%202000.pdf>

Central Lake Ontario Conservation Authority, 2005:

Website: Conservation Areas - http://www.cloca.com/con_areas/index.php. Accessed on November 16, 2005

Central Lake Ontario Conservation Authority, Department of Fisheries and Oceans and Ontario Ministry of Natural Resources, 2000:

Bowmanville/Soper Creek Watershed Aquatic Resource Management Plan, September 2000

Chapman, L.J. and D.F. Putnam, 1984:

The physiography of southern Ontario. Ontario Geological Survey, Special Volume 2, 270 p. (third edition).

Committee on the Status of Endangered Wildlife in Canada (COSEWIC), 2005:

Website: About COSEWIC: http://www.cosewic.gc.ca/eng/sct6/index_e.cfm. Accessed between December 2 -13, 2005

Cook, L. and J. Clayton, 2004:

Fisheries Management Plan for Duffins Creek and Carruthers Creek. Toronto and Region Conservation.

EarthFx, 2004:

Draft YPDT Regional Groundwater Model. Currently unpublished.

Ecoplans Limited and McCormick Rankin Corporation, 2005:

Adelaide Avenue Extension Class EA (Draft under review). Prepared for the Regional Municipality of Durham.

Environment Canada and Ontario Ministry of Natural Resources, 2003:

The Ontario Great Lakes Coastal Wetland Atlas- A Summary of Information (1983- 1997).

Environment Canada, 2004:

Durham Region Coastal Wetlands- Baseline Conditions and Study Findings (2002 and 2003).

Eyles, N., 2002:

Ontario rocks: three billion years of environmental change. Fitzhenry & Whiteside Limited.

Fenco MacLaren, 1995:

Highway 407/Transit Transportation Corridor Technical Preferred Route- Detailed Aquatic and Terrestrial Biological Study- Whitby/Oshawa Boundary to Highway 35/115. Volume I East Section- Technical Report- Final Draft

Followes, E., 2006:

Personal communication from E. Followes to S. Flegel, Ecoplans Limited, dated February 7, 2006. Ontario Ministry of Natural Resources Ecologist.

Funk, G., 1977:

Geology and water resources of the Bowmanville, Soper and Wilmot creeks IHD representative drainage basin. Ontario Ministry of the Environment, Water Resources Report 9a.

Gartner Lee Limited, 1978:

Environmental Sensitivity Mapping Project. Central Lake Ontario Conservation Authority. Oshawa, Ontario.

Government of Ontario, 2005:

Provincial Policy Statement. Toronto, ON: Queen's Printer for Ontario.

Government of Ontario, 2006:

Places to Grow – Proposed Growth Plan for the Greater Golden Horseshoe. Toronto, ON: Queen's Printer for Ontario.

Haslett, J., 2004:

Memorandum from Jennifer Haslett to Ecoplans Limited, dated June 24, 2004. Central Lake Ontario Conservation Authority.

Henshaw, B. and D. Leadbeater, 1999:

The Watershed of Farewell Creek: Natural Heritage Features and Restoration Priorities. Prepared for the Central Lake Ontario Conservation Authority and the Friends of the Second Marsh, Stewardship Branch.

Interim Waste Authority, 1994:

Detailed assessment of the proposed site C-34b: Appendix C Geology/Hydrogeology. Prepared for the IWA by Golder Associates.

Karrow, P.F., 1967:

Pleistocene geology of the Scarborough area. Ontario Department of Mines, Geological Report 46, 108 p.

Kelly, R.I. and I.P. Martini, 1986:

Pleistocene Glacio-lacustrine Deltaic Deposits of the Scarborough Formation, Ontario, Canada. *Sedimentary Geology* 47: 27-52.

Liberty, B.A., 1969:

The Towns of Pickering, Ajax, Whitby and the City of Oshawa, Regional Municipality of Durham, ARIM Map 166-2C, Bedrock Resources. Ontario Geological Survey, Aggregate Resources Inventory, 1:50 000 scale.

McCauley, C., 2005:

Email communication from C. McCauley to Ecoplans Limited, dated May 12, 2005. Ontario Ministry of Natural Resources.

Ministry of the Environment, 2004 & 2005:

Air Quality in Ontario Summary Reports: 2004 and 2005
<http://www.ene.gov.on.ca/envision/techdocs/index.htm#AirQuality>.

Natural Heritage information Centre, 2007:

Natural Heritage Information Centre Website. http://nhic.mnr.gov.on.ca/nhic_.cfm. Ontario Ministry of Natural Resources.

Ontario Ministry of Natural Resources, 1987:

Provincially and Regionally Significant Wetlands in Southern Ontario- Interim Report -1987.

Ontario Ministry of Natural Resources, 1993:

Ontario Wetland Evaluation System (3rd Edition) – Southern Manual. NEST Technical Manual TM-002. March 1993. Revised 2002.

-
- Ontario Ministry of Natural Resources, 2005:
Provincially Significant Harmony-Farewell Iroquois Beach Wetland Complex report and Mapping.
- Ontario Ministry of Natural Resources:
NRVIS Mapping
- Ontario Ministry of Transportation, 2006:
Environmental Guide for Noise, as amended June 2008
- Pugin, A., S.E. Pullan and D.R. Sharpe, 1996:
Observations of tunnel channels in glacial sediments with shallow land-based seismic reflection. *Annals of Glaciology* 22: 176-180.
- Sharpe, D.R., L.D. Dyke, M.J. Hinton, S.E. Pullan, H.A.J. Russell, T.A. Brennand, P.J. Barnett and A. Pugin, 1996:
Groundwater prospects in the Oak Ridges Moraine area, southern Ontario: application of regional geologic models. In *Current Research 1996-E*, Geological Survey of Canada, p. 181-190.
- Sharpe, D.R., P.J. Barnett, H.A.J. Russell, T.A. Brennand and G. Gorrell, 1996:
Regional geological mapping of the Oak Ridges Moraine, Greater Toronto Area, southern Ontario. In *Current Research 1999-E*, Geological Survey of Canada, p.123-136.
- Singer, S.N., 1977:
Evaluation of the groundwater responses applied to the Bowmanville, Soper and Wilmot creeks IHD representative drainage basin. Ontario Ministry of the Environment, Water Resources Report 9b.
- Tarandus Associates Limited, 2002:
Assessment of Fisheries and Aquatic Habitat for the Proposed Highway 407 East Completion, between Coronation Road and Highway 35/115, including the Oshawa-Clarington Freeway Link. Prepared for the Ontario Ministry of Transportation, Central Region
- The Oak Ridges Moraine Conservation Act and Plan, 2001:
S.O. 2001, CHAPTER 31
- Toronto and Region Conservation, 2003:
A Watershed Plan – for Duffins Creek and Carruthers Creek: A Report of the Duffins Creek and Carruthers Creek Watershed Task Force. August, 2003.
- Toronto and Region Conservation, 2003:
A Watershed Plan – for Duffins Creek and Carruthers Creek: A Report of the Duffins Creek and Carruthers Creek Watershed Task Force. August, 2003.
- Varga, S., D. Leadbeater, J. Webber, J. Kaiser, B. Crins, J. Kamstra, D. Banville, E. Ashley, G. Miller, C. Kingsley, C. Jacobsen, K. Mewa, L. Tebby, E. Mosley, and E. Zajc., 2000:
Distribution and status of the vascular plants of the greater Toronto Area. Ontario Ministry of Natural Resources, Aurora District. August 2000. 102 pages.

