

# APPENDIX

**E**

FISH AND MUSSEL  
CAPTURE RECORDS

## Appendix E: Fish and Mussel Capture Records for all Sites

Common Name	Scientific Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 7
<b>Fish</b>							
Black Bullhead	<i>Ameiurus melas</i>					X <sup>^</sup>	
Black Crappie	<i>Pomoxis nigromaculatus</i>			X <sup>^</sup>			
Black Redhorse	<i>Moxostoma duquesnei</i>			X <sup>**</sup>			
Blacknose Dace	<i>Rhinichthys obtusus</i>			X <sup>*</sup>			
Blackside Darter	<i>Percina maculata</i>			X <sup>**</sup>	X <sup>*</sup>	X <sup>**</sup>	
Bluegill	<i>Lepomis macrochirus</i>			X <sup>**</sup>	X <sup>*</sup>		
Bluntnose Minnow	<i>Pimephales notatus</i>			X <sup>**</sup>	X <sup>*</sup>	X <sup>**</sup>	
Brook Stickleback	<i>Culaea inconstans</i>	X <sup>^</sup>		X <sup>*</sup>			X <sup>@</sup>
Central Stoneroller	<i>Campostoma anomalum</i>	X <sup>*</sup>		X <sup>**</sup>	X <sup>*</sup>	X <sup>**</sup>	
Creek Chub	<i>Semotilus atromaculatus</i>	X <sup>*</sup>					X <sup>@</sup>
Common Carp	<i>Cyprinus carpio</i>			X <sup>**</sup>	X <sup>*</sup>	X <sup>**</sup>	
Common Shiner	<i>Luxilus cornutus</i>		X <sup>*</sup>	X <sup>**</sup>	X <sup>*</sup>	X <sup>**</sup>	
Fathead Minnow	<i>Pimephales promelas</i>	X <sup>*</sup>		X <sup>*</sup>			
Fantail Darter	<i>Etheostoma flabellare</i>			X <sup>**</sup>	X <sup>*</sup>		
Fourspine Stickleback	<i>Apeltes quadracus</i>			X <sup>^</sup>			
Golden Redhorse	<i>Moxostoma erythrurum</i>			X <sup>**</sup>	X <sup>*</sup>	X <sup>^</sup>	
Greater Redhorse	<i>Moxostoma valenciennesi</i>			X <sup>^</sup>	X <sup>*</sup>		
Greenside Darter	<i>Etheostoma blennioides</i>			X <sup>**</sup>	X <sup>*</sup>	X <sup>**</sup>	
Hornyhead Chub	<i>Nocomis biguttatus</i>			X <sup>**</sup>			
Johnny Darter	<i>Etheostoma nigrum</i>		X <sup>^</sup>	X <sup>**</sup>	X <sup>*</sup>	X <sup>**</sup>	
Largemouth Bass	<i>Micropterus salmoides</i>			X <sup>*</sup>			X <sup>@</sup>
Logperch	<i>Percina caprodes</i>			X <sup>*</sup>	X <sup>*</sup>	X <sup>**</sup>	
Longnose Dace	<i>Rhinichthys cataractae</i>			X <sup>**</sup>	X <sup>*</sup>		
Longnose Gar	<i>Lepisosteus osseus</i>			X <sup>**</sup>	X <sup>*</sup>		
Mimic Shiner	<i>Notropis volucellus</i>			X <sup>**</sup>	X <sup>*</sup>	X <sup>*</sup>	
Northern Hog Sucker	<i>Hypentelium nigricans</i>		X <sup>^</sup>	X <sup>**</sup>	X <sup>*</sup>	X <sup>**</sup>	
Pumpkinseed	<i>Lepomis gibbosus</i>						X <sup>@</sup>
Quillback	<i>Carpiodes cyprinus</i>			X <sup>**</sup>	X <sup>*</sup>		
Rainbow Darter	<i>Etheostoma caeruleu</i>		X <sup>^</sup>	X <sup>**</sup>	X <sup>*</sup>		
River Chub	<i>Nocomis micropogon</i>			X <sup>**</sup>	X <sup>*</sup>	X <sup>^</sup>	
Rock Bass	<i>Ambloplites rupestris</i>		X <sup>^</sup>	X <sup>**</sup>	X <sup>*</sup>	X <sup>**</sup>	

Common Name	Scientific Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 7
Rosyface Shiner	<i>Notropis rubellus</i>			X*	X*	X*	
Shorthead Redhorse	<i>Moxostoma macrolepidotum</i>			X*	X*		
Silver Redhorse	<i>Moxostoma anisurum</i>			X*	X*		
Silver Shiner	<i>Notropis photogenis</i>			X*	X*	X*	
Smallmouth Bass	<i>Micropterus dolomieu</i>		X^	X*	X*	X*	
Spotfin Shiner	<i>Cyprinella spiloptera</i>	X*		X*	X*	X*	
Stonecat	<i>Noturus flavus</i>			X*	X*	X*	
Striped Shiner	<i>Luxilus chrysocephalus</i>			X*	X*	X*	
Walleye	<i>Sander vitreus</i>		X^	X*	X*		
White Sucker	<i>Catostomus commersonii</i>	X*	X^	X^	X*	X*	X@
Yellow Bullhead	<i>Ameiurus natalis</i>		X^	X^			
<b>Mussels</b>							
Creeper	<i>Strophitus undulatus</i>			X@		X^	
Elktoe	<i>Alasmidonta marginata</i>		X*	X^		X^	
Flutedshell	<i>Lasmigona costata</i>		X*	X^		X^	
Fragile Papershell	<i>Leptodea fragilis</i>		X*				
Giant Floater	<i>Pyganodon grandis</i>		X^	X^			
Pink Heelsplitter	<i>Potamilus alatus</i>		X*				
Plain Pocketbook	<i>Lampsilis cardium</i>		X*				
Mucket	<i>Actinonaias carinata</i>		X*	X^		X*	
Spike	<i>Elliptio dilatata</i>			X^		X*	
Wabash Pigtoe	<i>Fusconaia flava</i>		X*			X*	
Wavy-rayed Lampmussel	<i>Lampsilis fasciola</i>		X*	X*@		X*	
White Heelsplitter	<i>Lampsilis fasciola</i>		X^			X*	
Zebra Mussel	<i>Dreissena polymorpha</i>		X^				

\* - MNRF fisheries Information.

^ - UTRCA fisheries information

@ - WSP collection results

# APPENDIX

**F**

SAR AND SCC  
SCREENING TABLE

**Appendix F: Species at Risk and Species of Conservation Concern Screening List**

SPECIES	PREFERRED HABITAT	SRANK <sup>1</sup>	COSEWIC <sup>2</sup>	MNRF <sup>3</sup>	SARA Status <sup>4</sup>	Schedule <sup>5</sup>	POTENTIAL SUITABLE HABITAT PRESENT WITHIN STUDY AREA	OBSERVATIONS DURING FIELD SURVEYS	RECORD SOURCE
<b>AVIFAUNA</b>									
Bald Eagle <i>(Haliaeetus leucocephalus)</i>	Breeding habitat most commonly includes areas close to (within 4 km) coastal areas, bays, rivers, lakes, reservoirs, or other bodies of water that reflect the general availability of primary food sources including fish, waterfowl, or seabirds. Nests usually are in tall trees or on pinnacles or cliffs near water. Tree species used for nesting vary regionally and may include pine, spruce, fir, cottonwood, poplar, willow, sycamore, oak, beech, or others (NatureServe, 2016).	S4B, SZN	NAR	SC	NA	NA	Bald Eagles are known to nest along the Thames River; however, nests sites were not identified within the Study Area.	YES	WSP Field Observation (August 28, 2015)
Bank Swallow <i>(Riparia riparia)</i>	The species traditionally nested in exposed banks along waterways. It continues to nest in these areas but also makes use of sand and gravel pits and stockpiles of soils and other materials.	S4B	THR	THR	THR	1	A single Bank Swallow was observed flying over the western edge of Saunders Pond beyond the eastern boundary of Site 6. Suitable nesting habitat was not observed within the immediate area and it is assumed the bird was likely foraging.	YES	WSP Field Observation (June 3, 2016)
Barn Swallow <i>(Hirundo rustica)</i>	Breeding habitat usually contains open areas (fields, meadows) for foraging, nest site that includes a vertical or horizontal substrate (often enclosed) underneath some type of roof or ceiling, and a body of water that provides mud for nest-building (Brown et al., 1999).	S4B	THR	THR	THR	1	Barn Swallows were observed during surveys at Sites 2, 3, 4, 5 and 6. In each situation the birds were foraging for insects. A large colony of Barn Swallows nest on the Kensington Bridge at Site 2. Nests were not observed on other bridges or crossings within the study area.	YES	MNRF Aylmer District (2015d), WSP Field Observation (June 3 and June 13, 2016; June 22, and August 4, 2017)
Cerulean Warbler <i>(Dendroica cerulea)</i>	Routinely identified with predominantly forested landscapes, mature forest, large and tall trees of broad-leaved, deciduous species with an open understory; in wet bottomlands, or upland situations. This species will occupy second-growth as well as mature forest. Usually considered an area-sensitive species. In Ontario, found breeding in tracts as small as 10 ha. Gaps in the canopy, or openings, are important for this species. Important habitat elements throughout the species range appear to include large tracts of forest with big deciduous trees in mature to older-growth forest with horizontal heterogeneity of, or openings in, the canopy. White oaks and bitternut hickories appear to be preferred in much of their range for nesting, foraging, and as song posts, while red oaks and red maples are typically avoided for most uses. The pattern of vertical distribution of foliage in the canopy is also important (Beuhler et al., 2013).	S3B	END	THR	END	1	Suitable habitat is not present within the Study Area. While Cerulean Warbler has been known to breed in parts of Middlesex County including Skunk's Misery near Wardsville and Chippewa of the Thames First Nation near Muncey, there are no recent breeding records from the City of London. There were no records of Cerulean Warbler from the City of London during the Ontario Breeding Bird Atlas (Cadman et al., 2007). Furthermore, the species was not identified during the WSP field surveys.	NO	MNRF (2015b)
Chimney Swift <i>(Chaetura pelagica)</i>	Appears more concentrated in urban areas where there are large concentrations of chimneys for nest sites and communal roosts. Most sightings occur in cities, towns, or small villages or open habitats near human settlement. However, in some relatively unpopulated areas, this species may still nest in hollow trees, tree cavities, or caves. Forages in a variety of habitats, even over forests, but most common over open country; above ponds and lakes, where insects concentrate; and residential areas (Cink et al., 2002).	S4B, S4N	THR	THR	THR	1	Chimney Swifts were observed in flight foraging for insects at sites 3A and 4. Chimney Swifts are known to forage over a wide area from their roosting and nesting locations. Chimneys providing suitable nesting or roosting locations are widespread throughout the City of London; and it is likely that the Chimney Swifts observed on Sites 3A and 4 nest or roost within one of the chimneys within the City. Surveys were completed in 2017 to determine if properties that may face expropriation and subsequent building alterations or demolition have suitable nest/roost habitat for this species.	YES	MNRF Aylmer District (2015d), WSP Field Observation (June 3 and June 13, 2016, August 4, 2017)

SPECIES	PREFERRED HABITAT	SRANK <sup>1</sup>	COSEWIC <sup>2</sup>	MNRF <sup>3</sup>	SARA Status <sup>4</sup>	Schedule <sup>5</sup>	POTENTIAL SUITABLE HABITAT PRESENT WITHIN STUDY AREA	OBSERVATIONS DURING FIELD SURVEYS	RECORD SOURCE
Eastern Meadowlark ( <i>Sturnella magna</i> )	The Eastern Meadowlark is most common in pastures, followed by hayfields, native grasslands, and savannahs. It also nests in a wide variety of other grassland habitats, including weedy meadows, young orchards, golf courses, restored grasslands on surface mines, grassy roadside verges, young oak plantations, grain fields, herbaceous fencerows, and grassy airfields. Like the Bobolink, it rarely nests in row crops such as corn and soybean, except perhaps when grassed waterways are present. At the field scale, the Eastern Meadowlark's response to vegetation structure varies among studies. Optimal nesting habitat generally contains moderately tall (25 to 50 cm) grass with abundant litter cover, a high proportion of grass cover (>80% is optimal; <20% is inadequate), moderate forb density, low proportions of shrub and woody vegetation cover (<5%; >35% is too dense), and low percent cover of bare ground. Litter cover, plant diversity and vegetation patchiness increase, whereas total plant cover, legume cover, and vegetation height decrease. Grass-dominated hayfields are preferred over Alfalfa fields. The Eastern Meadowlark is not especially area-sensitive; nevertheless, large tracts of grasslands are generally preferred over smaller ones. The minimum size required is about five hectares. Eastern Meadowlarks have a higher tolerance to the presence of patches of bare ground (e.g., 0.5-8.5%) than Bobolinks (e.g., 0.3%) (Lanyon, 1995; McCracken et al., 2013).	S4B	THR	THR	THR	1	Eastern Meadowlark was observed on Site 7 and was given a breeding code of "S7 - Probable" due to the observation of a singing male on territory for at least 7 days. However, potential suitable habitat on site is limited to small areas of cultural meadow and breeding evidence was not confirmed on site.	YES	MNRF (2015b), MNRF Aylmer District (2015d), WSP Field Observation (June 22 and July 6, 2017).
Eastern Wood Pewee ( <i>Contopus virens</i> )	Inhabits a wide variety of wooded upland and lowland habitats including deciduous, coniferous, or mixed forests. Occurs most frequently in forests with some degree of openness, whether the result of forest structure, natural disturbance, or human alteration. Intermediate-aged forests with a relatively sparse midstory are preferred. Territories in such forests can be equally abundant under both an open or closed canopy. However, under some circumstances may be absent from closed-canopied forests. Tends to inhabit edges of younger forests having a relatively dense midstory. Also occurs in anthropogenic habitats providing an open forested aspect such as parks and suburban neighborhoods (NatureServe, 2016).	S4B	SC	SC	SC	1	Eastern Wood-Pewees were observed on two of the Sites; north of Oxford St W on Site 1, and east of Wellington Road at Site 6. Both of these areas provide suitable nesting habitats, and Eastern Wood-Pewees were given a breeding code of "S7 - Probable" due to the observation of a singing male on territory for at least 7 days. Potential suitable habitat also occurs at Sites 3, 4 and 5.	YES	WSP Field Observation (June 3 and 13, 2016)
Henslow's Sparrow ( <i>Ammodramus henslowii</i> )	Breeds in the northeastern and east-central United States, and reaches its northeastern limit in Ontario. It has also been found in abandoned farm fields, pastures, and wet meadows. It tends to avoid fields that have been grazed or are crowded with trees and shrubs. It prefers extensive, dense, tall grasslands where it can more easily conceal its small ground nest (MNRF, 2016).	SHB	END	END	END	1	Suitable habitat was not identified, and this species was not observed. There are no recent nesting records of Henslow's Sparrow within Middlesex County.	NO	MNRF (2015b)
Louisiana Waterthrush ( <i>Seiurus motacilla</i> )	Most frequently breeds along medium to high-gradient, first to third-order, clear, perennial streams flowing through closed-canopy, hilly, deciduous or mixed-evergreen forest. Territory density and occupancy are reduced along streams with degraded benthic macroinvertebrate communities (Mattson et al., 2009).	S3B	SC	SC	SC	1	Suitable nesting habitat was not identified within the vicinity of the sites. This species was not observed.	NO	MNRF (2015b)
Peregrine Falcon ( <i>Falco peregrinus</i> )	Most commonly occupied habitats contain cliffs, for nesting, with open gulfs of air (rather than in confined areas) and generally open landscapes for foraging. May breed to 3,600 m (asl). In some regions; threatened by chemical contamination; reintroduction efforts have been attempted in numerous locations throughout Ontario <sup>2</sup> . Peregrine Falcons usually nest on tall, steep cliff ledges adjacent to large waterbodies, but some birds adapt to urban environments and raise their young on ledges of tall buildings, even in densely populated downtown areas. <sup>5</sup> Traditionally nest on cliffs ranging from about 8 to 400 m high; cliffs 50–200 m preferred (Cadman et al., 2007).	S3B	SC	SC	SC	1	Peregrine Falcons are known to be nesting in downtown London, near the vicinity of Wellington St and King St. This species was not observed during the field investigations and additional nests were not identified.	NO	MNRF Aylmer District (2015d)
White-eyed Vireo ( <i>Vireo griseus</i> )	Considered a habitat generalist on the wintering grounds. Observed in all habitat types, including field, pasture, shrubby, early successional habitat), semi-deciduous forest, semi-evergreen forest, moist tropical forest, mangrove forest and coastal scrub. Inhabits early-late successional, shrubby habitats such as deciduous scrub, old fields, abandoned pastures, regenerating clearcuts or other heavily logged areas, drainage and streamside thickets, forest edges, reclaimed strip mines, and mangrove swamps (NatureServe, 2016).	S2B	–	–	–	–	Suitable habitat was not identified within the vicinity of the sites, and the species was not observed. White-eyed Vireo is nearly extirpated in Ontario as a breeding species. In 2014 and 2015 White-eyed Vireos were likely nesting at Clark Wright Conservation Area near Strathroy, apparently the only recent known nesting locale from Middlesex County.	NO	MNRF Aylmer District (2015d)

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Wood Thrush ( <i>Hylocichla mustelina</i> )	Interior and edges of deciduous and mixed forests, especially upland mesic ones with a dense tree canopy and a fairly well developed deciduous understory. Bottomlands and other rich hardwood forests are prime habitats. Also frequents pine forests with a deciduous understory. Key elements of oft-used sites: trees >16 m in height, high variety of deciduous tree species, moderate sub canopy and shrub density, shade, fairly open forest floor, moist soil, and decaying leaf litter. More likely to occur in larger-area forests but may nest in 1ha fragments and semi-wooded residential areas and parks (NatureServe, 2016; Evans et al., 2011).	S4B	THR	SC	THR	1	A single Wood Thrush was identified approximately 150 m east of Wellington Road at Site 6. It was assigned a breeding code of “S7 - Probable” due to the observation of a singing bird on territory for at least seven days. Potential suitable Wood Thrush habitat also occurs at Sites 1 and 3.	YES	WSP Field Observation (June 3 and 13, 2016).
<b>FISH AND MUSSELS</b>									
Black Redhorse ( <i>Moxostoma duquesnei</i> )	Pools and riffle areas of medium-sized rivers and streams that are usually less than two metres deep. These rivers usually have few aquatic plants, a moderate to fast current, and a sandy or gravel bottom. In the spring, it migrates to breeding habitat where eggs are laid on gravel in fast water. The winter is spent in deeper pools (MNRF, 2016).	S2	THR	THR	N/A	N/A	In the Study Area, this species has been observed in Medway Creek and the North Thames River. The run habitat present at both Sites 3 and 4 suggests less than ideal habitat; however, with nearby inlets and low-moving water, there is potential for this species to occur at both sites. The species may pass through these areas during daily or seasonal movement, and during foraging activities.	NO	UTRCA Fish Records (UTRCA, 2015)
Lake Sturgeon ( <i>Acipenser fulvescens</i> )	Bottoms of lakes and large rivers, usually 5 to 10 m deep, over clay, mud, sand and gravel; preferred water temperature range 15-17°C (Eakins, 2014).	S2, S3	THR	THR	NA	NA	Known to be in the Thames River Basin, historically near Sites 2 and 5.	NO	MNRF (2015b)
Northern Brook Lamprey ( <i>Ichthyomyzon fossor</i> )	Adults prefer clean, clear riffles and runs of small rivers with gravel and sand substrates; ammocoetes occupy quiet water with sand, silt and detritus substrates (Eakins, 2014).	S3	SC	SC	SC	1	Known to be in the Thames River Basin, historically near Sites 2 and 5. The larval habitat is available for this species at Sites 4 and 5, and the adult spawning habitat is available at Site 2.	NO	MNRF (2015b)
Rainbow Mussel ( <i>Villosa iris</i> )	Most abundant in shallow, well- oxygenated reaches of small- to medium-sized rivers and sometimes lakes, on substrates of cobble, gravel, sand and occasionally mud (MNRF Guelph - Wellington List 2015)	S2S3	SC	THR	END	1	DFO indicated that the potential for this species should be considered within Thames River, and North Thames within the study limits. Preferred habitat is present to some degree at Site 2 and Site 4 downstream of the University Drive bridge, but is not available within the study limits of Site 5.	NO	DFO Correspondence, 2017
Rayed Bean ( <i>Villosa fabalis</i> )	This species is typically found in small tributaries and headwater features with clear, riffles of sand and gravel. They are usually found buried in the sand and gravel substrates amongst the roots of aquatic vegetation.	S1	END	END	END	1	Known to be in the Thames River Basin, historically near Sites 2 and 5. Preferred habitat is most available at Sites 5 and 7. Sites 2 and 4 lacked instream vegetation within the London RT corridor crossings, and generally the Thames River and its major tributaries are not small, headwater features.	NO	MNRF (2015b)
Round Pigtoe ( <i>Pleurobema sintoxia</i> )	This species appears to be a habitat generalist, preferring habitat of rivers of various sizes, over various substrates including sand, rock or mud bottoms. They have been found in sandy substrates in deeper water of large rivers, and the near-shore areas of some of the Great Lakes.	S1	END	END	END	1	This general habitat description is available in all sites in some form. It may be easier to eliminate the potential for this species at all sites by identifying the presence of their host species fish within the London RT corridor. Known host species for this mussel species include Bluegill, Spottfin Shiner, Bluntnose Minnow and Northern Redbelly Dace. Historical records for this species exist for the Thames River Basin, near Site 5.	NO	MNRF (2015b)

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Silver Shiner ( <i>Notropis photogenis</i> )	Deep runs, riffles and pools with variable (clay to boulder) substrates in relatively clear, medium to large streams (>20 m) with swift currents (Eakins, 2014).	S2, S3	THR	THR	SC	3	In the Study Area, this species has been observed at the crossing of Medway Creek at Western Road (Site 3), and the crossing of the North Thames River at University Drive (Site 4). It was also observed within the Thames River south of Site 2 during sampling completed as part of the One River project. Suitable habitat also occurs at Site 5.	NO	MNRF (2015b), MNRF Aylmer District (2015d), UTRCA Fish Records (UTRCA, 2015); Matrix Solutions Inc., 2017b
Spotted Sucker ( <i>Minytrema melanops</i> )	Clear creeks and small to moderate sized rivers with sand, gravel, or hard-clay bottoms, usually free of silt. Spawning occurs in rocky riffle areas in late spring (MNRF Species Profile Online 2014).	S2	SC	SC	SC	1	DFO indicated that the potential for this species should be considered within Thames River, and North Thames in the study limits. This habitat is not available at Sites 2, 4 or 7.	NO	DFO Correspondence, 2017
Wavy-rayed Lampmussel ( <i>Lampsilis fasciola</i> )	Small to medium rivers with clear water. It lives in shallow riffle areas with clean gravel or sand bottoms. The Wavy-rayed lampmussel's fish hosts are the Largemouth bass and Smallmouth bass. The presence of fish hosts is one of the key features for an area to support a healthy mussel population (MNRF, 2016). This species has been previously observed at all crossings of the Thames River, North Thames River and Medway Creek in the Study Area.	S1	SC	THR	SC	1	Preferred habitat can be found at Sites 2, 3, and portions of Site 4 downstream of University Drive. The habitat at the crossings for Sites 4 and 5 appears to be too deep and turbid to support this species within close proximity of the bridges associated with the London RT corridor, but they have been confirmed in the broader study limits by UTRCA and MNRF. WSP confirmed presence within the London RT corridor at Site 3.	YES	UTRCA Fish Records (UTRCA, 2015); WSP Passive Searches, 2017
<b>VASCULAR PLANTS</b>									
American Chestnut ( <i>Castanea dentata</i> )	The American Chestnut prefers dryer upland deciduous forests with sandy, acidic to neutral soils. In Ontario, it is only found in the Carolinian Zone between Lake Erie and Lake Huron. The species grows alongside Red Oak, Black Cherry, Sugar Maple, American Beech and other deciduous tree species (MNRF, 2016).	S2	END	END	END	1	Some potential habitat located outside of study area in upland forests. Wooded habitat within study area is limited mainly to swamp and lowland forests or managed sugar maple forest.	NO	MNRF (2015b), MNRF Aylmer District (2015d)
Bird's-foot Violet ( <i>Viola pedata</i> )	Favours dry, open, sandy sites which include savannas and prairies, most often in association with Oak and Pine (Bickerton, 2013 [recovery strategy]).	S1	END	END	END	1	No suitable habitat within study area.	NO	MNRF (2015b)
Broad Beech Fern ( <i>Phegopteris hexagonoptera</i> )	The Broad Beech Fern prefers to grow in rich soils in deciduous forests, often in areas dominated by maple and beech trees (MNRF, 2016).	S3	SC	SC	SC	3	Limited potential to occur in FOD habitat within study area.	NO	MNRF (2015b), MNRF Aylmer District (2015d)
Butternut ( <i>Juglans cinerea</i> )	The range of butternut extends through most of the southern and eastern mixed deciduous forests in Ontario except the Bruce Peninsula and Manitoulin Island. Previously a scattered, uncommon tree, the species is now threatened with a canker disease and is listed as Endangered. Naturally occurring trees are protected by the Endangered Species Act, 2007 (MNRF, 2016)	S3?	END	END	END	1	Can occur in a range of forested habitats with openings in the forest canopy. Two individuals were observed southeast of Lambton Drive within the university campus. Both trees are part of the Sherwood Fox Arboretum collection and likely represent naturally occurring (unplanted) specimens.	YES	MNRF Aylmer District (2015d); WSP Field observation Oct 22, 2017.
Drooping Trillium ( <i>Trillium flexipes</i> )	Drooping Trillium grows on damp sandy soil in mature, deciduous forests in association with Maple, White Ash, Basswood, Hackberry, White Elm, and Blue Ash tree (MNRF, 2016).	S1	END	END	END	1	Very limited potential to occur in FOD habitat within study area.	NO	MNRF (2015b)
Eastern Flowering Dogwood ( <i>Cornus florida</i> )	Eastern Flowering Dogwood grows under taller trees in deciduous or mixed forests, most commonly on floodplains, slopes, and ravines, but also found along roadsides and fencerows (MNRF, 2016).	S2?	END	END	END	1	Some potential to occur within study area in hedgerows and fence lines.	NO	MNRF (2015b), MNRF Aylmer District (2015d)



SPECIES	PREFERRED HABITAT	SRANK <sup>1</sup>	COSEWIC <sup>2</sup>	MNRF <sup>3</sup>	SARA Status <sup>4</sup>	Schedule <sup>5</sup>	POTENTIAL SUITABLE HABITAT PRESENT WITHIN STUDY AREA	OBSERVATIONS DURING FIELD SURVEYS	RECORD SOURCE
Eastern Prairie Fringed Orchid ( <i>Platanthera leucophaea</i> )	Wetlands, fens, swamps and tallgrass prairie. It has been found in ditches and railroad rights of way (MNRF, 2016).	S2	END	END	END	1	Potential habitat in moist forests and wetlands such as Sites 1 and 6.	NO	MNRF (2015b)
False Rue-anemone ( <i>Enemion biternatum</i> )	False Rue-anemone grows in deciduous forests and thickets with rich, moist soil, and is frequently found close to watercourses within mature forests with lots of maple and beech trees. It prefers partly shaded conditions (MNRF, 2016).	S2	THR	THR	THR	1	Some potential to occur within drier SWD and riparian areas within study area.	NO	MNRF (2015b)
Green Dragon ( <i>Arisaema dracontium</i> )	The Green Dragon grows in somewhat wet to wet deciduous forests along streams, particularly maple forest and forest dominated by Red Ash and White Elm trees (MNRF, 2016).	S3	SC	SC	SC	3	Potential habitat in deciduous swamp ELC communities.	NO	MNRF (2015b), MNRF Aylmer District (2015d)
Kentucky Coffeetree ( <i>Gymnocladus dioicus</i> )	Kentucky Coffee-tree is found in a variety of habitats, but grows best on moist, rich soil. As a result it is often found in floodplains, but has been found in shallow rocky or sandy soils. It is shade-intolerant, and therefore grows along the edges of woodlots or relies on canopy openings in forests and woodlots (MNRF, 2016).	S2	THR	THR	THR	1	Potential habitat for this species is found in valleys and floodplains in the study area. Thirty trees were observed at six locations along the RT Route. Planted and naturally seeded specimens receive protection under the ESA.	YES	WSP field observations (August and October 2016)
Spoon-leaved Moss ( <i>Bryoandersonia illecebra</i> )	Spoon-leaved moss grows in a range of habitats but most populations are located in low-lying, seasonally-flooded areas under trees or shrub thickets (MNRF, 2016).	S1	END	END	END	1	Potential habitat in moist forests and swamps throughout study area.	NO	MNRF (2015b)
Striped Cream Violet ( <i>Viola stirata</i> )	Floodplain woods (Oldham and Brinker, 2009)	S3	-	-	-	-	Potential habitat in moist forests and wetlands such as Sites 1 and 6.	NO	MNRF Aylmer District (2015d)
Tall Coreopsis ( <i>Coreopsis tripteris</i> )	Prairies and open woods (Oldham and Brinker, 2009)	S2	-	-	-	-	Potential habitat in the Westminster Ponds/Pond Mills ESA. Some potential	YES	WSP Field Observation (Aug 28, 2015).
<b>TERRESTRIAL FAUNA</b>									
American Badger ( <i>Taxidea taxus</i> )	The American Badger <i>jacksoni</i> subspecies requires relatively large areas of suitable grassland and/or scrubland habitat that support sufficient prey to maintain a viable population. Preferred areas include natural and undisturbed grasslands, shrubby areas, and woodlots. Historically, the <i>jacksoni</i> subspecies probably inhabited large tracts of Tallgrass prairie and Oak Savanna around the Great Lakes. Today, it is also associated with old fields, pastureland, the edges of agricultural fields and orchards, scrubland, wooded ravines, and woodlots. Prey items include groundhog, eastern cottontail, meadow vole, mice, and likely Franklin's ground squirrel in northwestern Ontario. Being fossorial or burrowing mammals, badgers require sandy or other friable soils to create dens for resting, rearing young, and overwintering. Soils should be coarse enough to resist collapse when wet, but should contain enough organic matter and adhesion qualities to prevent collapse under dry conditions (such as would be the case with pure sands). Owing to fragmentation of habitats in southern Ontario, less disturbed vegetation communities, such as old fields, hedgerows, and woodland edges, provide important areas for breeding and migration corridors for the dispersal of young (Ontario American Badger Recovery Team, 2009).	S2	END	END	END	1	Suitable habitat was not identified within the Study Area, and the species was not observed. A historical record of American Badger from Medway Valley Heritage Forest ESA was submitted by a member of the public; it was suspected that this individual was a transient as suitable habitat was not identified within the ESA (Dillon, 2015). Site 3A is located at the east terminus of the Medway Valley Heritage Forest ESA.	NO	MNRF Aylmer District (2015d), Medway Valley Heritage Forest ESA: Natural Heritage Inventory and Evaluation (Dillon, 2015).

SPECIES	PREFERRED HABITAT	SRANK <sup>1</sup>	COSEWIC <sup>2</sup>	MNRF <sup>3</sup>	SARA Status <sup>4</sup>	Schedule <sup>5</sup>	POTENTIAL SUITABLE HABITAT PRESENT WITHIN STUDY AREA	OBSERVATIONS DURING FIELD SURVEYS	RECORD SOURCE
Little Brown Myotis ( <i>Myotis lucifuga</i> )	Has adapted to using human-made structures for resting and maternity sites; also uses caves and hollow trees. Foraging habitat requirements are generalized; usually forages in woodlands near water. In winter, a relatively constant temperature of about 1-5 °C and 80-100% relative humidity is required within the hibernacula (uses caves, tunnels, abandoned mines, and similar sites). Maternity colonies commonly are in warm sites in buildings and other structures; also infrequently in hollow trees. Narrow microclimate is suitable for raising young, and availability of suitable maternity sites may limit abundance and distribution (NatureServe, 2016).	S4	END	END	END	1	Little Brown Myotis was found within the Medway Valley Heritage Forest ESA (Site 3) and Mud Creek valley corridor (Site 1), identified from its vocal signature based on audio recordings taken by members of the public (Dillon, 2015) and LGL Ltd (2016), respectively. Suitable foraging habitat for this species may also occur in the Westminster Ponds area, east of Site 6.	NO	Medway Valley Heritage Forest ESA: Natural Heritage Inventory and Evaluation (Dillon, 2015); Mud Creek Subwatershed EA SLSR and EIS (LGL Ltd., 2016)
Northern Myotis ( <i>Myotis septentrionalis</i> )	Generally associated with forested communities. Hibernates in caves, mines, and tunnels from late fall through early spring. Hibernators frequently roost in crevices, drill holes, and similar sites, but roosting in the open is not uncommon. The principal requirements of a suitable <b>hibernation site</b> are winter-long, low temperatures above freezing, high humidity, and lack of disturbances, both natural (floods) and anthropogenic (visitation). Caves, mines, and quarry tunnels are used as <b>night roosts</b> . <b>Daytime roosting</b> observations typically are of individuals in crevices or hollows or under loose bark on trees and in a variety of small spaces associated with buildings and other structures. <b>Nursery colonies</b> include barns, cabins, with the majority likely occurring under the loose bark of trees. Small, highly fragmented, or young forests that provide limited areas of subcanopy foraging habitat may not be suitable. Young forests may also lack appropriate nursery sites. A lack of suitable hibernacula may prevent occupancy of areas that otherwise have adequate habitat (NatureServe, 2016).	S3	END	END	END	1	Northern Myotis was found within the Medway Valley Heritage Forest ESA (Site 3) and Mud Creek valley corridor (Site 1), identified from its vocal signature based on audio recordings taken by members of the public (Dillon, 2015) and LGL Ltd (2016), respectively. Suitable foraging, roosting and nesting habitat for this species may also occur in the Westminster Ponds area, east of Site 6.	NO	Medway Valley Heritage Forest ESA: Natural Heritage Inventory and Evaluation (Dillon, 2015); Mud Creek Subwatershed EA SLSR and EIS (LGL Ltd., 2016).
Tri-colored Bat ( <i>Perimyotis subflavus</i> )	During the summer, the Tri-colored Bat is found in a variety of forested habitats. It forms day roosts and maternity colonies in older forest and occasionally in barns or other structures. They forage over water and along streams in the forest. Tri-colored Bats eat flying insects and spiders gleaned from webs. At the end of the summer they travel to a location where they will overwinter; it is generally near the cave or underground location where they will overwinter. They overwinter in caves where they typically roost by themselves rather than part of a group (MNRF, 2016).	S3?	END	END	END	1	Tri-colored Bat was found within the Medway Valley Heritage Forest ESA, identified from its vocal signature based on audio recordings taken by members of the public (Dillon, 2015). Site 3A is located at the east terminus of the Medway Valley Heritage Forest ESA. Suitable foraging, roosting and nesting habitat for this species may also occur in the Westminster Ponds area, east of Site 6.	NO	Medway Valley Heritage Forest ESA: Natural Heritage Inventory and Evaluation (Dillon, 2015).
<b>REPTILES AND AMPHIBIANS</b>									
Blanding's Turtle ( <i>Emydoidea blandingii</i> )	Inhabits marshes, ponds, swamps, lake shallows, backwater sloughs, flooded graminoid-dominated meadows, beaver regulated wetlands, shallow slow-moving rivers, man-made channels, protected coves and inlets of large lakes, oxbows, and pools adjacent to rivers. Waterbodies are characterized as eutrophic with soft organic substrates, shallow water, and abundant aquatic vegetation. Nesting occurs in open sunny locations and eggs are deposited in a variety of loose substrates including sand, organic soil, cobblestone, and gravel. Nest sites include sand beaches, soil-filled crevices on rocky outcrops, lawns, gardens, plowed fields, muskrat and beaver lodges, and gravel roads or gravel road edges. Females may travel >1km to reach suitable nesting habitat. This species will hibernate in substrate at the bottom of permanent wetlands. This species will bask on aquatic emergent structures such as muskrat lodges, hummocks, logs, floating mats of vegetation, or amongst emergent grasses or sedges next to the water (COSEWIC, 2016; Harding, 1997; NatureServe, 2016).	S3	END	THR	THR	1	Suitable habitat in the Study Area occurs in the Westminster Ponds area, east of Site 6; however, there are no recent records of this species in the London area.	NO	MNRF (2015b)
Eastern Ribbonsnake ( <i>Thamnophis sauritus</i> )	The Eastern Ribbonsnake is usually found close to water, especially in marshes, where it hunts for frogs and small fish. A good swimmer, it will dive in shallow water, especially if it is fleeing from a potential predator. At the onset of cold weather, these snakes congregate in underground burrows or rock crevices to hibernate together (MNRF, 2016).	S4	SC	SC	SC	1	Potential suitable habitat (vegetated riparian areas) occurs at all Sites within the Study Area; however, there are no recent records of this species in the London area.	NO	MNRF (2015b)

SPECIES	PREFERRED HABITAT	SRANK <sup>1</sup>	COSEWIC <sup>2</sup>	MNRF <sup>3</sup>	SARA Status <sup>4</sup>	Schedule <sup>5</sup>	POTENTIAL SUITABLE HABITAT PRESENT WITHIN STUDY AREA	OBSERVATIONS DURING FIELD SURVEYS	RECORD SOURCE
Northern Map Turtle ( <i>Graptemys geographica</i> )	Inhabits rivers, lakes, streams, and creeks with slow to moderate flows. Watercourse substrate is highly variable and includes soft mud, clay, sand, gravel, marl, bedrock, organic muck, cobble, and rock. They require well-oxygenated waters that support mollusk prey (bivalves, snails, crayfish, and benthic invertebrates) and shallow water areas for foraging. The habitat must maintain abundant basking sites such as rocky shoals and islands, emergent logs or rocks, and exposed banks. Later in the season, aquatic mats of floating vegetation may be used for basking. This species will nest in sand or soft soil along sandbars or sandbanks, laneways, gardens, or even atop rock outcrops with thin strips of soil. Deep, highly-oxygenated pools are required for hibernation. This species prefers areas of natural shoreline and can be found in shallow waters with emergent vegetation (Harding, 1997; COSEWIC, 2012).	S3	SC	SC	SC	1	Habitat for Northern Map Turtle exists along the length of the Thames River and its associated tributaries throughout the Study Area.	YES	MNRF (2015b), MNRF Aylmer District (2015d), WSP Field Observation (2015-2017), UTRCA (2017a,b)
Queensnake ( <i>Regina septemvittata</i> )	Inhabits shallow rocky-bottomed areas of rivers and streams but also rarely found in marshes. Three general conditions: i) a permanent still or flowing body of water with temperatures at or above 18°C for most of the active season; ii) an abundance of cover material, such as flat rocks along the banks; and iii) a large crayfish population. Avoid shorelines that are heavily shaded. Shoreline features include clay banks, abundant rocks, grasses, low-lying broad-leaved plants, willows ( <i>Salix</i> spp.), and cottonwoods ( <i>Populus deltoides</i> ). Queensnakes often hide or thermoregulate beneath flat rocks or amongst grasses near the water's edge but will also use geotextile erosion mats for this purpose. This species hibernates underground in moist areas along the watercourse that are above the high-water mark, and could include seepage areas, crayfish burrows, rock outcrops, and bridge abutments (COSEWIC, 2010).	S2	END	END	END	1	While Queensnakes were not identified during the field surveys, and the previous studies for the Study Area made no reference to Queensnakes during their field programs, potential habitat exists throughout the length of the Thames River and its associated tributaries throughout the Study Area. MNRF and UTRCA staff indicated that potential for this species needs to be considered for Sites 3 and 4.	NO	MNRF (2015b), UTRCA (2017a,b)
Snapping Turtle ( <i>Chelydra serpentina</i> )	Snapping turtles occupy all types of freshwater habitats (streams, lakes, reservoirs, ponds, marshes, swamps), especially those with slow-moving waters, soft mud bottoms, and abundant aquatic vegetation or submerged brush and logs. Preferred nesting areas are open and sunny with moist well-drained sand or soil. Females generally nest on sand and gravel embankments, but muskrat houses, abandoned beaver lodges, road shoulders, fissures in rocky shorelines, sawdust heaps, freshly dug soil, gardens, lawns, and forest clearings will also be utilized. Turtles hibernate in small streams, along lakeshores, or in marshes either buried in substrate or wedged beneath or adjacent to submerged logs or woody debris (COSEWIC, 2008, Harding, 1997, NatureServe, 2016).	S3	SC	SC	SC	1	Habitat for Snapping Turtle exists along the length of the Thames River and its associated tributaries throughout the Study Area. There is also potential for this species to occur within the Westminster Ponds ESA, east of Site 6, and within the Mud Creek valleyland south of Site 1.	NO	MNRF (2015b), MNRF Aylmer District (2015d), UTRCA (2017a,b)
Spiny Softshell ( <i>Apalone spinifera</i> )	Inhabits rivers and the larger streams, inland lakes, reservoirs, protected bays, and river mouth areas of the Great Lakes themselves. Prefers rivers with soft sand, or mud bottoms, but will also use rivers with sand-gravel substrates. They generally avoid streams with sharp-edged rocks. Open habitats with little aquatic vegetation are favoured. They can tolerate a swift current. These turtles require gravelly or sandy areas close to the water for nesting and deep water for hibernating. Females may travel in excess of 30km to reach nesting areas. Basking habitat includes exposed banks, emergent boulders or logs in the water, shallow water sandy or muddy backbays, and shallow water gravel or sand bars. Heavily vegetated shallow backwaters with soft substrates are important nursery habitat. Softshells are typically associated with river bend areas (COSEWIC, 2016, Harding, 1997; Ontario Nature, 2016).	S2	END	END	THR	1	Habitat for Spiny Softshells exists along the length of the Thames River and its associated tributaries throughout the Study Area.	YES	MNRF (2015b), MNRF Aylmer District (2015d), WSP Field Observation (2015-2017), UTRCA (2017a,b)
<b>Insects</b>									
Eastern Amberwing ( <i>Perithemis tenera</i> )	Ponds, lakes, occasionally the still areas of streams (Bug Guide, 2016).	S3	-	-	-	-	Potential habitat in the Westminster Ponds/Pond Mills ESA.	NO	MNRF Aylmer District (2015d)
Monarch ( <i>Danaus plexippus</i> )	Throughout their life cycle, Monarchs use three different types of habitat. Only the caterpillars feed on milkweed plants and are confined to meadows and open areas where milkweed grows. Adult butterflies can be found in more diverse habitats where they feed on nectar from a variety of wildflowers. Monarchs spend the winter in Oyamel Fir forests found in central Mexico (MNRF, 2016).	S4	END	SC	SC	1	Potential breeding habitat present within the study area wherever Milkweed is found, and limited areas are found within the Study Area. This species was confirmed at Site 1 and Site 7.	YES	WSP Field Observations
Slender Bluet ( <i>Enallagma traviatum</i> )	Slender bluets are found along large ponds and lakes, particularly those with the forest edge nearby.	S1	-	-	-	-	Potential habitat in the Westminster Ponds/Pond Mills ESA.	NO	MNRF Aylmer District (2015d)

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## **LEGEND**

### Status Sources:

#### **<sup>1</sup>S-Ranks (provincial)**

Provincial (or Subnational) ranks are used by the Natural Heritage Information Centre (NHIC) to set protection priorities for rare species and natural communities. These ranks are not legal designations. Provincial ranks are assigned in a manner similar to that described for global ranks, but consider only those factors within the political boundaries of Ontario.  
(Provincial Status from MNR NHIC 2014)

S1 Critically Imperiled - Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.

S2 Imperiled - Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.

S3 Vulnerable - Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.

S4 Apparently Secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 Secure - Common, widespread, and abundant in the nation or state/province.

S#S# Range Rank - A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

SAN Non-breeding accidental.

SE Exotic - not believed to be a native component of Ontario's fauna.

SZN Non-breeding migrants/vagrants.

SZB Breeding migrants/vagrants.

#### **<sup>2</sup>COSEWIC (Committee on the Status of Endangered Wildlife in Canada)**

(federal status from COSEWIC)

EXT Extinct - A species that no longer exists.

EXP Extirpated - A species no longer existing in the wild in Canada, but occurring elsewhere.

END Endangered - A species facing imminent extirpation or extinction.

THR Threatened - A species likely to become endangered if limiting factors are not reversed.

SC Special Concern (formerly vulnerable) - A species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

NAR Not At Risk - A species that has been evaluated and found to be not at risk of extinction given the current circumstances.

DD Data Deficient (formerly Indeterminate) - Available information is insufficient to resolve a species' eligibility for assessment or to permit an assessment of the species' risk of extinction.

#### **<sup>3</sup>SARO (Species at Risk Ontario) (provincial status from MNR 2014)**

The provincial review process is implemented by the MNR's Committee on the Status of Species at Risk in Ontario (COSSARO).

EXT Extinct - A species that no longer exists anywhere.

EXP Extirpated - A species that no longer exists in the wild in Ontario but still occurs elsewhere.

END Endangered - A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's Endangered Species Act (ESA) (END-R designations are no longer relevant as species are covered under new ESA April 2009)

THR Threatened - A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.

SC Special Concern (formerly Vulnerable) - A species with characteristics that make it sensitive to human activities or natural events.

NAR Not at Risk - A species that has been evaluated and found to be not at risk.

DD Data Deficient (formerly Indeterminate) - A species for which there is insufficient information for a provincial status recommendation.

#### **<sup>4</sup>SARA (Species at Risk Act) Status and Schedule**

The Act establishes Schedule 1, as the official list of wildlife species at risk. It classifies those species as being either Extirpated, Endangered, Threatened, or a Special Concern. Once listed, the measures to protect and recover a listed wildlife species are implemented.

EXT Extinct - A wildlife species that no longer exists.

EXP Extirpated - A wildlife species that no longer exists in the wild in Canada, but exists elsewhere in the wild.

END Endangered - A wildlife species that is facing imminent extirpation or extinction.

THR Threatened - A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

SC Special Concern - A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.

#### **<sup>5</sup>SARA Schedules**

Schedule 1: is the official list of species that are classified as extirpated, endangered, threatened, and of special concern.

Schedule 2: species listed in Schedule 2 are species that had been designated as endangered or threatened, and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1.

Schedule 3: species listed in Schedule 3 are species that had been designated as special concern, and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1.

The Act establishes Schedule 1 as the official list of wildlife species at risk. However, please note that while Schedule 1 lists species that are extirpated, endangered, threatened and of special concern, the prohibitions do not apply to species of special concern.

Species that were designated at risk by COSEWIC prior to October 1999 (Schedule 2 & 3) must be reassessed using revised criteria before they can be considered for addition to Schedule 1 of SARA. After they have been assessed, the Governor in Council may on the recommendation of the Minister, decide on whether or not they should be added to the List of Wildlife Species at Risk.

Government of Canada. Species at Risk Public Registry. Website: [[http://www.sararegistry.gc.ca/default\\_e.cfm](http://www.sararegistry.gc.ca/default_e.cfm)]

Glossary: [http://www.sararegistry.gc.ca/about/glossary/default\\_e.cfm#e](http://www.sararegistry.gc.ca/about/glossary/default_e.cfm#e)

Species Index A-Z: [http://www.sararegistry.gc.ca/sar/index/default\\_e.cfm](http://www.sararegistry.gc.ca/sar/index/default_e.cfm)

Species Listing by Schedule: [http://www.sararegistry.gc.ca/sar/listing/default\\_e.cfm](http://www.sararegistry.gc.ca/sar/listing/default_e.cfm)

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# APPENDIX

**G**

IMPACTS, MITIGATION  
AND NET EFFECTS

**Appendix G: Assessment of Anticipated Impacts, Recommended Mitigation Measures and Net Effects for Identified Natural Features, Functions and Species within the Study Area**

Item No.	Natural Heritage Feature, Function or Species	Sites / Areas	Anticipated Impact	Recommended Mitigation Measures	Net Effects
<b>Vegetation</b>					
1	General vegetation / Individual Street Trees	RT Corridors	<ul style="list-style-type: none"> <li>Individual street tree removal may be required to accommodate the widened ROW. With the exception of Kentucky Coffeetree and Butternut as described in Items 10 and 11, below, no provincially or regionally significant species are anticipated to be impacted.</li> <li>Minor vegetation removals are expected within the ROW to accommodate road widening, intersection improvements and platform creation as part of the RT corridors. Vegetation within the ROW is largely comprised of common, disturbance tolerant species. Small areas of encroachment beyond the ROW into natural woodland and wetland vegetation communities is addressed in Items 2 to 6, below.</li> </ul>	<ul style="list-style-type: none"> <li>Minimize vegetation clearing where possible.</li> <li>Clearly delineate vegetation clearing zones and vegetation retention zones (i.e. using silt fencing or tree protection fencing) on both the construction drawings and in the field with the Contractor prior to clearing and grading.</li> <li>Stabilize and re-vegetate exposed surfaces as soon as possible upon completion of works.</li> <li>Tree and vegetation protection is recommended for trees and vegetation to be retained. Tree protection should be outlined in a Tree Protection Plan (TPP). Vegetation protection measures should be detailed on contract drawings and implemented to ensure encroachment is limited to the construction footprint.</li> <li>A mitigation /compensation strategy to address removal of street trees will be developed through consultation with the City during the detailed design phase. There is to be no net loss in tree canopy cover as a result of the RT project.</li> </ul>	<ul style="list-style-type: none"> <li>Minor loss of disturbed vegetation within the ROW</li> <li>Reduction in tree cover for 20 to 40 years associated with removal and replanting of street trees.</li> <li>Opportunity for positive net effect where removal of non-native or invasive species is proposed followed by ecological restoration plan incorporating appropriate native species</li> </ul>
<b>Natural Heritage Features on Map 5 of the London Plan</b>					
2	Significant Woodlands and Woodlands	Sites 1, 3, 4, and 5 (unmapped woodlands also occur at Site 6 within the Environmentally Significant Area)	<ul style="list-style-type: none"> <li>Minor encroachment into woodlands outside the ROW is anticipated to accommodate road widening and/or associated watercourse crossings at Sites 1, 3, 4, 5 and 6. Potential impacts to vegetation at Site 6 are addressed in Items 4 and 6.</li> <li>Potential indirect impacts to woodlands include damage to vegetation outside the work zone, sedimentation, spills of contaminants / fuel, root pruning, and soil compaction (refer to Appendix H).</li> <li><b>Site 1:</b> Woodlands north (unnumbered Patch: FODM4-11) and south (Patch 6007: FODM1-4) of Oxford Street West may be impacted by the proposed works. Minor encroachment beyond the ROW to the north may impact woodlands if they are present when the RT road widening and associated grading activities occur. Anticipated private development to the north and realignment/enhancement of the Mud Creek corridor is expected to occur in advance of the RT works. Encroachment into the woodland to the south is not anticipated, however, implementation of measures to address indirect impacts are required. Common Evening Primrose, a regionally rare plant species (UTRCA, 2003), was noted at this Site. There is potential for impacts to this species if it occurs within the area to be disturbed.</li> </ul>	<ul style="list-style-type: none"> <li>Minimize vegetation clearing where possible.</li> <li>Clearly delineate vegetation clearing zones and vegetation retention zones (i.e. using silt fencing or tree protection fencing) on both the construction drawings and in the field with the Contractor prior to clearing and grading.</li> <li>Survey vegetation within the clearing zone prior to the commencement of works to identify regionally rare plant species. Surveys should be completed during appropriate timing windows when the plant species is readily identified (e.g., flowering stage, leaf on). A ‘best effort’ approach should be taken to relocate affected individuals to suitable habitat beyond the area of disturbance.</li> <li>Tree and vegetation protection is recommended for trees and vegetation to be retained. Tree protection should be outlined in a Tree Protection Plan (TPP). Vegetation protection measures should be detailed on contract drawings and implemented to ensure encroachment is limited to the construction footprint.</li> </ul>	<ul style="list-style-type: none"> <li>Minor vegetation removal in woodland communities outside of the ROW is expected at Sites 1, 3, 4, and 5</li> <li>The degree of encroachment is not anticipated to alter the designation of these woodlands as significant</li> <li>Minor vegetation removals are not anticipated to affect resident significant flora or fauna species (following transplantation, if necessary, of Kentucky Coffeetree and Common Evening Primrose individuals, at Sites 4 and 1, respectively)</li> <li>Resident wildlife will be displaced to adjacent natural areas</li> <li>Reduction in tree cover for 20 to 40 years while newly planted woodland replacement areas grow</li> </ul>

Item No.	Natural Heritage Feature, Function or Species	Sites / Areas	Anticipated Impact	Recommended Mitigation Measures	Net Effects
			<ul style="list-style-type: none"> <li>• <b>Site 3:</b> Direct impacts to woodlands (FODM3-1 and WODM4-4) on the west side of Western Road are not anticipated as a result of the proposed road alignment and widening. Minor impacts to wooded areas east of the existing bridge may occur to accommodate the widened bridge abutments.</li> <li>• <b>Site 4:</b> Woodlands (FODM7) on both sides of the North Thames, including patch #3001 to the northwest, which was assumed to be significant as part of this study, will be impacted as a result of the road widening and relocation of the piers and abutments. A Kentucky Coffeetree within the wooded area adjacent to the northeast abutment may need to be transplanted to avoid impacts (Item 11).</li> <li>• <b>Site 5:</b> Woodlands (FODM4-5) on the east side of the Wellington Road crossing may experience minor impacts as a result of the proposed bridge widening and alterations to the grade of the northeast Thames Valley trail access to meet accessibility standards. Work in this area also has the potential to impact adjacent turtle nesting areas (refer to Item 30).</li> <li>• The extent to which these vegetation communities will be impacted will need to be assessed once the grading limits and extent of disturbance is confirmed during detailed design.</li> </ul>	<ul style="list-style-type: none"> <li>• Equipment, materials and other construction activities will not be permitted in vegetation retention zones.</li> <li>• Avoid unnecessary traffic, dumping and storage of materials over tree root zones adjacent to the proposed works.</li> <li>• Stabilize and re-vegetate exposed surfaces as soon as possible upon completion of works.</li> <li>• To offset for the removal of vegetation communities / habitat associated with significant natural features within the Natural Heritage System, mitigation in the form of habitat replacement at a ratio greater than 1:1 land area is required through plantings of appropriate native species. Where feasible, creation of replacement habitat should occur adjacent to the impacted feature. If not possible, replacement habitat should be created as close to the site of impact as possible, and preferably within the same subwatershed. Plantings should strive to meet woodland densities for trees and shrubs, and should include establishment of a healthy understory.</li> <li>• At all sites there is an opportunity to provide additional compensatory mitigation through the implementation of an invasive species removal and management plan, and/or feature enhancement through plantings of appropriate native species. Due to the sensitive nature of the Natural Heritage System at Sites 3, 4, and 5, compensatory mitigation is recommended to offset impacts to the natural features and functions. Comprehensive compensation plans are to be developed through consultation with the City and relevant agencies.</li> </ul>	<ul style="list-style-type: none"> <li>• Compensation through habitat replacement at a ratio greater than 1:1 land area, enhancement of the riparian areas through removal and management of invasive species, and/or planting of native species are proposed to achieve a net positive effect at Sites 3, 4 and 5</li> <li>• Net effects are not anticipated at Site 1</li> </ul>
3	Wetlands and Unevaluated Wetlands	Sites 1, 3, and 7	<ul style="list-style-type: none"> <li>• Infrastructure footprints and construction activities are not anticipated within wetlands or unevaluated wetlands on Map 5 of The London Plan.</li> <li>• Site 1: Unmapped wetlands occur along Mud Creek on the north side of Oxford Street West (Figure 7). These wetlands are to be removed and replaced as part of the Mud Creek Subwatershed EA. Direct impacts associated with the RT works are not expected. Implementation of measures to address potential indirect impacts associated with grading, sedimentation and erosion impacts, during grading are required.</li> <li>• Site 3: Field investigation by WSP did not support the mapping of unevaluated wetland units on the south side of Medway Creek. Potential impacts to vegetation due to encroachment beyond the ROW is addressed in Item 2.</li> <li>• Site 7: Unmapped wetland units occur along the edges of the Murray Drain. Direct impacts to this feature are not anticipated.</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain a minimum 15 m buffer between proposed works and the edge of the wetland community, if possible.</li> <li>• Minimize vegetation clearing within wetland buffer areas to the extent possible. Clearly delineate vegetation clearing zones and vegetation retention zones (i.e. using silt fencing or other temporary fencing) on both the construction drawings and in the field with the Contractor prior to clearing and grading.</li> <li>• Ensure that a spills management plan is in effect for the construction area.</li> <li>• Implement an Erosion and Sedimentation Control (ESC) plan to minimize the risk of potential impacts from sedimentation on the water quality and quantity within wetlands and surface water features.</li> <li>• Limit grading within the vicinity of wetlands to ensure that changes to surface water drainage and/or moisture regimes within the wetland do not occur.</li> </ul>	<ul style="list-style-type: none"> <li>• Net impacts are not anticipated</li> </ul>

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			<ul style="list-style-type: none"> <li>Indirect impacts to wetlands include changes to water quality and quantity in response to changes in grade, fuel spills, removal of vegetation, increases in impervious surfaces, erosion and sedimentation effects. These impacts if prolonged could result in changes in species assemblages and community composition.</li> </ul>	<ul style="list-style-type: none"> <li>Mitigation measures to address potential construction-related impacts are provided in Appendix H.</li> </ul>	
4	Provincially Significant Wetlands (PSW)	Site 6 – Westminster Ponds / Pond Mills PSW	<ul style="list-style-type: none"> <li>Under the current design concept, minor encroachment into the Cattail Mineral Shallow Marsh (MASM1-1) at Site 6 is expected to accommodate the road widening and associated side slopes at this location. Impacts were reduced to the extent possible, by decreasing the width of the landscape strip between the multi-use trail and the east curb to 1.5 m within the vicinity of the PSW. Underground utilities and light standards occur within this strip, preventing further reduction, or elimination of the landscape strip in this area. By increasing side slopes from 3:1 slope to a 2:1 slope, the area of impact can be reduced by 184.9 m<sup>2</sup> from 418.0 m<sup>2</sup> to 233.1 m<sup>2</sup></li> <li>Temporary disturbance associated with construction (grading, movement of heavy machinery, etc.) may occur.</li> <li>Direct impacts are expected to include loss of habitat, removal of wetland vegetation, and temporary construction related effects (erosion and sedimentation, noise, dust, etc.)</li> <li>Regionally rare plant species, including Sweetflag, Watershield, (North-South Environmental, 2015), and Buffalo Berry (Appendix C), have been observed within the vicinity of Site 6. Although vegetation removal is expected to be largely restricted to the more disturbed area adjacent to the road, there is potential for impacts to regionally rare species if they occur within the area to be disturbed.</li> <li>Hybrid or Blue Cattail (<i>Typha x glauca</i>) was observed within the MASM1-1 vegetation community, along with the parent species, Narrow-leaved Cattail and Broad-leaved Cattail. Blue Cattail is listed as rare within Middlesex County (UTRCA, 2003). Given its hybrid status, and the co-occurrence of the parent species, transplantation may not be warranted. Discussion with UTRCA during detailed design will be completed to verify relocation needs, if any.</li> <li>Indirect or long-term effects include potential impacts associated with increased input of road salts into the PSW and potential alteration to drainage patterns (groundwater and/or surface water flows).</li> </ul>	<ul style="list-style-type: none"> <li>Opportunities to further reduce the area of impact should be investigated during detailed design.</li> <li>Minimize vegetation clearing as much as possible.</li> <li>Avoid use of heavy machinery within the PSW. If unavoidable, use swamp mats or similar materials to avoid soil compaction.</li> <li>Clearly delineate vegetation clearing zones and vegetation retention zones (i.e. using silt fencing or tree protection fencing) on both the construction drawings and in the field with the Contractor prior to clearing and grading.</li> <li>Survey vegetation within the clearing zone prior to the commencement of works to identify regionally rare plant species. Surveys should be completed during appropriate timing windows when the plant species are readily identified (e.g., flowering stage, leaf on). A best effort approach should be taken to relocate affected individuals to suitable habitat beyond the area of disturbance.</li> <li>Minimize changes to drainage patterns to reduce/eliminate potential for changes to the existing wetland moisture regime and site hydrology.</li> <li>Stormwater management plans must ensure that surface water and/or ground water inputs to the PSW are balanced between pre- and post-construction. Preliminary analysis completed by IBI Group indicates that water balance at this site can be achieved; thereby maintaining the existing moisture regime within the PSW.</li> <li>Ensure that a spills management plan is in effect for the construction area.</li> <li>Implement an Erosion and Sedimentation Control (ESC) plan to minimize the risk of potential impacts from sedimentation on the water quality and quantity within wetlands and surface water features.</li> <li>The use of alternative de-icing products / application methods should be considered to reduce the input of road salts into the wetlands and ponds. There are no stormwater management techniques that capture road salts or reduce road salt water pollution.</li> <li>To offset for the removal of wetland communities / habitat, mitigation in the form of habitat replacement at a ratio greater than 1:1 land area is</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation removal within the PSW adjacent to the ROW is to be mitigated at a replacement ratio greater than 1:1 land area</li> <li>Minor encroachment is not anticipated to affect the designation of this wetland as significant</li> <li>Proposed removals are not anticipated to affect significant flora or fauna species</li> <li>Resident wildlife will be displaced to adjacent natural areas</li> <li>Reduction in wetland area for 1 to 3 years while wetland replacement area(s) grow</li> <li>Gains in botanical diversity and quality can be obtained by enhancing adjacent terrestrial portions of the Westminster Ponds / Pond Mills ESA through removal and management of invasive species (European and Glossy Buckthorn) and planting of native species</li> </ul>

Item No.	Natural Heritage Feature, Function or Species	Sites / Areas	Anticipated Impact	Recommended Mitigation Measures	Net Effects
				<p>required through plantings of appropriate native species. Where feasible, creation of replacement habitat should occur adjacent to the impacted feature. If not possible, replacement habitat should be created as close to the site of impact as possible (i.e., elsewhere within the Westminster Ponds / Ponds Mills ESA).</p> <ul style="list-style-type: none"> <li>Due to the significant and sensitive nature of this feature, additional compensatory mitigation is recommended to offset impacts to the feature and its functions. Implementation of an invasive species removal and management plan, in conjunction with enhancement planting plans for other areas within the ESA would provide a net environmental benefit to the area. Vegetation communities in proximity to Wellington Road contain a high proportion of undesirable invasive species (fifteen species including European Buckthorn and Glossy Buckthorn) which are outcompeting native species; thereby decreasing native diversity and degrading associated habitat. Comprehensive compensation plans are to be developed through consultation with the City and relevant agencies.</li> </ul>	
5	Significant Valleylands and Valleylands	Sites 1, 2, 3, 4, 5 and 7	<ul style="list-style-type: none"> <li>Existing infrastructure (roads and bridges) occur within the significant valleylands at Sites 1, 2, 3, 4 and 5.</li> <li>In addition to the functions provided by other natural heritage features associated with valleylands (i.e., watercourses and woodlands), valleylands act as critical linkages between habitats and natural areas within the urban landscape. Potential impacts to wildlife passage is detailed in Item 9 of this table. Habitat for species at risk associated with these valleylands are discussed in Items 12 to 29.</li> <li>Direct impacts to the valleylands are associated with impacts to the natural features and functions associated with each valley feature. Mitigation and compensatory mitigation proposed for other features / species throughout this table, will provide benefit to the valley features of which they are a part.</li> <li>Modifications to the Mud Creek corridor at Site 1 are expected to occur in advance of the RT works. Potential impacts to the valleyland are not anticipated.</li> <li>Alterations to bridges and contouring of banks to improve hydraulic capacity (Sites 3 and 4), have the potential to improve flood and hazard conditions within the valleyland and associated floodplain.</li> <li>The current configuration for the infrastructure at Site 7 encroaches into the significant valleyland of the Murray Drain as defined for the purpose of this EIS as a 30 m wide corridor on either side of the Drain. The infrastructure is proposed within a manicured area and impacts to ecological functions are therefore not anticipated. Efforts should be made</li> </ul>	<ul style="list-style-type: none"> <li>Measures to mitigate impacts to related natural heritage features (woodlands, wildlife habitat, habitat for species at risk, fish habitat, etc.), will provide additional protection to the valley corridor and its functions.</li> <li>Alterations to banks and crossings must be supported by hydraulic modelling to ensure that there is a balance between improved hydraulic capacity, and avoidance of potential downstream issues associated with increased erosion and scouring.</li> <li>The extent of grading along the banks and around the bridge abutments, and the need for scour protection of the pier footings will be determined at later design phases.</li> <li>Maintenance of natural vegetation along the Murray Drain will provide protection to the valley feature and associated wildlife and fish habitat. If grading results in the temporary encroachment into natural vegetation communities within the significant valleyland, appropriate mitigation and compensation measures are to be determined through consultation with the City and UTRCA.</li> <li>Implementation of a spills management plan, and erosion and sedimentation control plan should be completed to address construction-related impacts at each site.</li> </ul>	<ul style="list-style-type: none"> <li>Potential gains may be achieved at Sites 3 and 4 by increasing hydraulic capacity, and improving protection from flooding and other hazard processes.</li> <li>Minor encroachment into other natural heritage features and habitat within the valleylands at Sites 3, 4 and 5 will be offset through mitigation and compensatory mitigation measures for woodlands, and/or overall benefit permits for species at risk, if required at those sites.</li> <li>Net effects are not anticipated at Sites 1, 2, or 7</li> </ul>

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			<p>during detailed design to modify the infrastructure footprint at Site 7 to achieve a minimum setback of 30 m from the high water mark of Murray Drain, if possible.</p>		
6	Environmentally Significant Areas	Sites 3 and 6	<ul style="list-style-type: none"> <li>Minor encroachment to accommodate road widening and/or modifications to the crossings may occur at Site 3 and is anticipated at Site 6.</li> <li>Site 3: Medway Valley Heritage Forest ESA occurs adjacent to the southwest corner of the Medway Creek crossing on Western Road. Works may result in minor impacts to disturbed vegetation within the ROW; however, encroachment beyond the ROW into the ESA is not anticipated. The extent of grading within this area is not currently known and further assessment will be necessary at the detailed design phase.</li> <li>Site 6: Westminster Ponds / Pond Mills ESA / PSW / ANSI occurs on the east side of Wellington Road. Minor encroachment beyond the ROW into thicket, woodland, and wetland communities is anticipated under the current configuration. The thicket and woodland communities contain a high proportion of non-native and invasive species, namely European and Glossy Buckthorn. Potential impacts to the PSW are discussed in Item 4.</li> <li>Indirect impacts to wildlife may occur during construction (refer to Items 7, 8 and 9); however, long-term impacts are not anticipated given the infrastructure is proposed in areas that are already developed and the proposed works do not involve a change in land use.</li> </ul>	<ul style="list-style-type: none"> <li>Encroachment into the ESAs should be limited as much as possible. Opportunities to further reduce the area of impact should be investigated at the detailed design phase (e.g. increased side slopes to reduce grading requirements, relocation of multi-use trail, etc.).</li> <li>General recommendations for Significant Woodlands and Provincially Significant Wetlands in Items 2 and 4, respectively should be implemented to reduce the potential for impacts to these significant areas, as appropriate.</li> <li>To offset for the removal of vegetation / habitat, mitigation in the form of habitat replacement at a minimum ratio of 1:1 land area is required through plantings of appropriate native species. Where feasible, creation of replacement habitat should occur adjacent to the impacted feature. If not possible, replacement habitat should be created as close to the site of impact as possible.</li> <li>Due to the significant and sensitive nature of these features, compensatory mitigation is required to offset impacts to the features and their functions. Opportunities include, replacement of habitat at a ratio greater than 1:1 land area, implementation of an invasive species removal and management plan, and enhancement of other areas within the ESAs.</li> </ul>	<ul style="list-style-type: none"> <li>Net environmental gains can be achieved at Site 6 through the implementation of an invasive species management plan focusing on removal of invasive species and replacement and enhancement with appropriate native species.</li> <li>Minor encroachment into the ESA at Site 6 can be offset through mitigation and compensatory mitigation measures. Impacts will not affect the designation of this area as an ESA.</li> <li>While limited, where mature trees are to be removed, reduction in tree cover for 20 to 40 years may occur while newly planted woodland replacement areas grow.</li> <li>Net effects at Site 3 are not anticipated.</li> </ul>
<b>General Wildlife</b>					
7	Impacts to Wildlife	All Sites	<ul style="list-style-type: none"> <li>Impacts to wildlife are directly associated with impacts to vegetation, which encompasses their habitat. Permanent encroachment of infrastructure into woodlands, wetlands and ESAs will result in habitat loss.</li> <li>Noise, dust and vibrations associated with construction activities have the potential to cause short-term disturbance to wildlife and may cause certain wildlife to abandon or avoid the area.</li> <li>Long-term impacts are not expected as the infrastructure is proposed in areas that are already developed and the proposed works do not involve a change in land use.</li> </ul>	<ul style="list-style-type: none"> <li>Measures proposed in Items 1 to 7 will provide additional protection for wildlife within the study area. Mitigation and compensatory mitigation for removal of natural heritage features will serve to replace habitat loss.</li> <li>To avoid disturbance to local wildlife and comply with the MBCA, avoid tree and vegetation clearing (including grubbing) during the bird nesting season (approximately April 1 to August 31).</li> <li>Exclusion fencing is recommended to prevent species from entering the construction area. Once work is completed, fencing should be removed to facilitate passage by wildlife.</li> <li>In the event an animal is found within the construction area, it should remain undisturbed and be allowed to leave on its own. Photos for identification should be taken of animals observed onsite, if possible. If Threatened or Endangered species are discovered during site preparation or construction activities will stop, or be modified to avoid negative impacts to Species at Risk until further direction is provided by the MNRF. The Aylmer District office should be contacted promptly upon the discovery of a Threatened or Endangered species within the construction area.</li> </ul>	<ul style="list-style-type: none"> <li>Habitat associated with woodland replacement will be reduced for 20 to 40 years while newly planted trees grow.</li> <li>Replacement of wetland area is expected to result in short-term (1 to 3 years) reduction of habitat.</li> <li>Compensatory mitigation for removal of natural features may provide additional benefit through habitat enhancements for wildlife.</li> </ul>

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				<ul style="list-style-type: none"> <li>Contractor Awareness and Encounter Protocols should be implemented to ensure that appropriate measures are in place for the identification, handling, translocation and reporting of SAR.</li> </ul>	
8	Migratory Birds	All Sites and RT Route	<ul style="list-style-type: none"> <li>Migratory birds are protected under the Migratory Birds Convention Act (MBCA; Government of Canada, 1994).</li> <li>Minor tree and vegetation removal is anticipated at each site to accommodate widening of the road and/or crossings. Removal of individual street trees may also occur along the RT Route.</li> <li>Removal of vegetation has the potential to impact breeding birds, nests, eggs and young if clearing occurs during the nesting period.</li> </ul>	<ul style="list-style-type: none"> <li>No work is permitted to proceed that would result in the destruction of active nests (nests with eggs or young birds), or the wounding or killing of birds species protected under the MBCA and / or Regulations under that Act.</li> <li>To comply with the MBCA, avoid tree and vegetation clearing (including grubbing) during the bird nesting season (approximately end of March to end of August).</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>
9	Wildlife Passage	Site 1, 2, 3, 4, 5 and 7	<ul style="list-style-type: none"> <li>Valleylands within the Study Area act as critical movement corridors for wildlife, providing linkages between various habitat types and natural heritage features. The function of the valleylands as movement corridors may be impacted during and after construction should expansion of the abutments or alterations to the valley walls create an obstruction to wildlife. If obstructed, wildlife may attempt to cross widened roadways in order to reach habitat upstream or downstream of the bridges, increasing the likelihood of road mortality.</li> <li><b>Site 1:</b> Oxford Street West separates natural areas along the Mud Creek valley corridor. Widening to accommodate the RT works may create a nominal increase in wildlife road mortality due to increased crossing distance. The culvert proposed as part of the Mud Creek Subwatershed EA is larger than the existing culvert and may provide opportunities for wildlife passage (refer to Section 8.1 of the report).</li> <li><b>Site 2:</b> No in-water works or works to the abutments are anticipated at this site. Impacts to wildlife passage are likely to be limited to temporary disturbance associated with construction (e.g., noise, dust, etc.)</li> <li><b>Sites 3, 4 and 5:</b> Wildlife movement through the valley corridors at these sites may be temporarily disturbed during construction, particularly in the case of terrestrial species that move along the banks of the rivers. Movement by aquatic species is to be maintained despite temporary restrictions associated with works to expand the existing piers.</li> <li><b>Site 7:</b> The proposed Park and Ride facility at this site will not affect the function of the valleyland as a movement corridor for wildlife. The proposed infrastructure does not involve a crossing of the Murray Drain. Direct impacts to natural, un-manicured riparian vegetation adjacent to the watercourse is not expected.</li> </ul>	<ul style="list-style-type: none"> <li>To promote wildlife movement between the valleyland north and south of Oxford Street West at <b>Site 1</b>: <ul style="list-style-type: none"> <li>Construction of a larger, open-bottom box culvert (12 m wide, 3 m high, 42 m long according to preliminary design) as part of the Mud Creek Subwatershed EA may provide opportunities for movement by amphibians, reptiles and small mammals provided dry passage is maintained.</li> <li>Realignment and enhancement of the creek and valley corridor as part of the Subwatershed EA will help to focus animal crossings at the culvert. While not expected, use of permanent wildlife fencing could be implemented if road mortality becomes an issue at this site.</li> </ul> </li> <li>At <b>Sites 3, 4 and 5</b> to reduce the potential for impacts to wildlife: <ul style="list-style-type: none"> <li>Maintenance of movement corridors for terrestrial wildlife should be considered during detailed design. If obstructions are anticipated, during construction, temporary measures to facilitate movement by wildlife should be implemented. If obstructions are likely to be permanent, the inclusion of an eco-passage to provide safe passage through the valleyland and/or erection of wildlife fencing to discourage animals from entering the roadway should be incorporated into the design.</li> <li>Vegetation clearing is not to occur during the bird nesting period (April 1 to August 31).</li> <li>Exclusion fencing is recommended to prevent species from entering the construction area. Once work is completed, fencing should be removed to facilitate passage by wildlife.</li> <li>In the event an animal is found within the construction area, it should remain undisturbed and be allowed to leave on its own. Photos for identification should be taken of animals observed onsite,</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Disturbance to wildlife, and potential altered movement patterns through the corridors is expected to be temporary (during construction only)</li> <li>Opportunities to enhance the banks at Site 4 to improve movement by terrestrial species may be possible due to the increased span length and relocation of the abutments</li> <li>Net effects are not anticipated</li> </ul>

Item No.	Natural Heritage Feature, Function or Species	Sites / Areas	Anticipated Impact	Recommended Mitigation Measures	Net Effects
				<p>if possible. If Threatened or Endangered species are discovered during site preparation or construction activities will stop, or be modified to avoid negative impacts to Species at Risk until further direction is provided by the OMNRF. Aylmer District office should be contacted promptly upon the discovery of a Threatened or Endangered species within the construction area.</p> <ul style="list-style-type: none"> <li>• At <b>Site 4</b>, where the abutments are to be set back further from the centreline of the river, there is an opportunity to enhance the exposed banks to provide additional riparian cover.</li> <li>• At <b>Site 7</b>: <ul style="list-style-type: none"> <li>- Efforts should be made during detailed design to reduce the infrastructure footprint to achieve a minimum setback of 30 m from the high water mark of Murray Drain, if possible.</li> <li>- Removal of natural riparian vegetation is to be avoided, and enhanced where possible, to provide additional cover for wildlife movement.</li> <li>- Should temporary alteration (i.e., grading) be unavoidable, appropriate mitigation and compensation measures are to be determined through consultation with the City and UTRCA.</li> </ul> </li> </ul>	
<b>SAR / SCC</b>					
10	Butternut	Adjacent to Lambton Drive, Western University	<ul style="list-style-type: none"> <li>• Butternut and their habitat are protected by the ESA, 2007. The level of protection afforded to an individual tree is related to the Category assigned to a tree as part of an evaluation completed by a Butternut Health Assessor. Exemptions under the ESA allow for removal of Category 1 and Category 2 trees, provided specific conditions are satisfied, as outlined within Ontario Regulation 242/08 Section 23.7.</li> <li>• Two individuals (45 cm and 37 cm in dbh) were identified on the east side of Lambton Drive approximately 13 m and 28 m from the existing right of way, respectively. They occur within manicured areas between the road and athletic facilities. Both exhibit sooty marks associated with Butternut canker.</li> <li>• Though not anticipated, if widening of the roadway toward the trees is to occur, impacts to the trees or their habitat (land within 50 m radius) may occur.</li> <li>• The MNRF should be consulted at the detailed design phase of the project to establish whether the planned works are perceived as ‘harm’ under the ESA.</li> </ul>	<ul style="list-style-type: none"> <li>• Mitigation measures proposed for protection of street trees and vegetation, particularly, the use of tree protection fencing, should be employed to protect these trees.</li> <li>• If impacts to one or both of these trees or their habitat is anticipated, an assessment by a certified Butternut Health Assessor should be completed to determine if the individual is eligible for exemptions under the Endangered Species Act. Subsequent consultation with the MNRF will be necessary to determine appropriate mitigation or compensation. Compensation may include plantings of Butternut trees elsewhere on the university campus.</li> </ul>	<ul style="list-style-type: none"> <li>• No net negative effects are anticipated.</li> <li>• Should impacts occur, requirements under the Endangered Species Act and associated regulations require that overall benefit to the species be ensured. If required, such actions would result in a net positive effect to the species.</li> </ul>



Item No.	Natural Heritage Feature, Function or Species	Sites / Areas	Anticipated Impact	Recommended Mitigation Measures	Net Effects
11	Kentucky Coffeetree	Site 4, adjacent to the northeast bridge abutment  RT Route - Adjacent to Lambton Drive, Western University; Wellington Road; and Victoria Park	<ul style="list-style-type: none"> <li>Kentucky Coffeetree receives species and habitat protection under the Endangered Species Act. Critical habitat is considered to be lands within a 20 m radius of the stem as per the federal recovery strategy, such that works within 20 m is considered harm.</li> <li>A single individual was observed between the walking trail and the road near the northeast bridge abutment. If required as part of the preferred design, modification to this abutment may result in impacts to vegetation, including this tree, to allow for construction and grading.</li> <li>Six trees are located on the south side of Lambton Drive northwest of the FIMS Nursing Building. Widening in the vicinity of these trees is not expected.</li> <li>Twelve trees are located adjacent to the RT Route on Richmond Street (Victoria Park), and at two locations on Wellington Road (Figure 27).</li> </ul>	<ul style="list-style-type: none"> <li>Transplantation of the young individual tree at Site 4, should occur in advance of bridge widening and alteration to the east abutment if works are to occur within 20 m of the tree. A transplantation plan, including mitigation and compensation, is to be prepared in consultation with the MNRF. Permitting for this species may be necessary.</li> <li>Tree protection for Kentucky Coffeetrees located adjacent to the RT route should be outlined within a Tree Protection Plan (TPP). Tree protection measures should be approved by the MNRF and detailed on contract drawings and implemented to ensure encroachment is limited to the construction footprint. In the event accidental encroachment into the tree protection zones or damage to individual trees occur during construction, the MNRF must be contacted immediately.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> <li>Should impacts occur, requirements under the Endangered Species Act and associated regulations require that overall benefit to the species be ensured. If required, such actions would result in a net positive effect to the species.</li> </ul>
12	Bald Eagle	Observed at Site 1 (potential at Sites 2, 4, and 5)	<ul style="list-style-type: none"> <li>The Bald Eagle is listed as Special Concern and does not receive habitat protection under the ESA, 2007.</li> <li>An individual juvenile Bald Eagle was seen flying over Site 1 in August 2015, during the botanical inventories. The individual was only flying over, and the area is not likely breeding habitat.</li> <li>Sites 2, 4, and 5 maintain potential habitat; however, no large raptor stick nests were observed during the surveys and thus no impacts to Bald Eagle breeding habitat are anticipated.</li> <li>If present, disturbance to the species may occur during construction; however, long-term impacts are not anticipated given the the infrastructure is proposed in areas that are already developed and the proposed works do not involve a change in land use.</li> </ul>	<ul style="list-style-type: none"> <li>Impacts to this species are not anticipated.</li> <li>Mitigation measures proposed for wildlife (Items 7 and 8), as well as those proposed to maintain fish habitat (Items 36 - 48) will provide benefit to this species and their food sources.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>
13	Bank Swallow	Site 6	<ul style="list-style-type: none"> <li>As a Threatened species, Bank Swallow receives species and habitat protection under the ESA, 2007.</li> <li>A single Bank Swallow was observed flying over Saunders Pond. Suitable nesting habitat for this species does not occur within the area to be disturbed as part of the proposed road widening. Direct impacts to this species are not anticipated.</li> <li>Removal or degradation of natural habitat (including mature trees, wetland areas and waterways) that support aerial insect populations has the potential to negatively impact this species by decreasing the availability of insect prey. Removal of natural habitats associated with the RT works are expected to be minor and long-term impacts are not anticipated.</li> </ul>	<ul style="list-style-type: none"> <li>Impacts to natural areas that support aerial insect populations at any stage in their life cycle should be minimized where possible.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>

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14	Barn Swallow	Sites 2, 3, 4, 5, and 6	<ul style="list-style-type: none"> <li>As a Threatened species, Bank Swallow receives species and habitat protection under the ESA, 2007.</li> <li>Barn Swallows nest on human-made structures, including bridges, culverts and buildings.</li> <li>Barn Swallows were observed nesting on the Kensington Bridge at Site 2, and foraging over Sites 2, 4, and 5. Two individuals were also observed flying over Saunders Pond east of Site 6, and in the general area of Site 3.</li> <li>Barn Swallow were not nesting on bridges / crossings that are to be modified as a result of the RT works. Direct impacts to the species are therefore not anticipated.</li> <li>Removal or degradation of natural habitat (including mature trees, wetland areas and waterways) that support aerial insect populations has the potential to negatively impact this species by decreasing the availability of insect prey. Removal of natural habitats associated with the RT works are expected to be minor and long-term impacts are not anticipated.</li> </ul>	<ul style="list-style-type: none"> <li>Surveys to confirm species presence / absence at bridges where works are proposed should be completed during the breeding season before construction/site preparation activities are to commence. Surveys are to be completed using an MNRF-approved protocol.</li> <li>In the event Barn Swallows nests are present and impacts are unavoidable, requirements under Ontario Regulation 242/08 will need to be addressed to offset the loss of habitat. Under the current version of the regulation, an Overall Benefit Permit would not be required and compensation can proceed under the proponent-driven Notice of Activity process. Requirements should be confirmed with the MNRF prior to implementation.</li> <li>Impacts to natural areas that support aerial insect populations at any stage in their life cycle should be minimized where possible.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> <li>Should impacts to nesting / roosting habitat be unavoidable, requirements under the ESA and associated regulations require that appropriate compensation be provided for impacts to habitat.</li> </ul>
15	Chimney Swift	Sites 2, 3, and 4; RT Route	<ul style="list-style-type: none"> <li>As a Threatened species, Chimney Swift receives species and habitat protection under the ESA, 2007.</li> <li>Chimney Swifts were observed foraging for insects above Sites 2, 3 and 4 and above Oxford Street West in the vicinity of Platt's Lane. In each situation breeding evidence was not observed. Chimney Swifts can forage over a relatively large area throughout the day, and were likely using the airspace above Sites 2, 3 and 4 for this purpose.</li> <li>Expropriation of properties and subsequent demolition of buildings with suitable nesting/roosting habitat has the potential to decrease habitat availability within the City. If the chimneys are actively used during the breeding season, removal/demolition would be considered damage or destruction of habitat, which is prohibited under Section 10 of the ESA.</li> <li>Surveys were completed during 2017 to identify suitable chimneys in buildings that may be impacted as a result of the road widening activities. Potentially suitable habitat was identified at seven addresses where impacts to existing structures are possible (refer to Section 5.3.1 of the report). Two active chimneys have been documented by secondary sources (W. Wake, pers. comm. March 17, 2018) at one of the addresses.</li> <li>Removal or degradation of natural habitat (including mature trees, wetland areas and waterways) that support aerial insect populations has the potential to negatively impact this species by decreasing the availability of</li> </ul>	<ul style="list-style-type: none"> <li>Mitigation for works at Sites 2, 3 and 4 are not considered necessary as suitable nesting / roosting habitat is not present, and impacts to individual birds is unlikely to occur.</li> <li>Should expropriation of buildings along the route occur, particularly those that have been identified as having suitable chimneys, species-specific surveys should be completed according to current, approved protocols to establish use prior to any demolition works at affected addresses.</li> <li>Should Chimney Swift nesting habitat be confirmed, further consultation with the MNRF will occur to ensure that steps are taken to reduce harm to the species and their habitat does not occur. Actively used chimneys should be protected, where possible.</li> <li>Provisions for exemption under the ESA for damage or destruction to habitat for this species are outlined in Ontario Regulation 242/08. Mitigation and compensation must be completed in accordance with this regulation to offset impacts to habitat and minimize harm to the species. Under the current version of the regulation, an Overall Benefit Permit would not be required and compensation can proceed under the proponent-driven Notice of Activity process. Requirements should be confirmed with MNRF prior to implementation.</li> <li>Impacts to natural areas that support aerial insect populations at any stage in their life cycle should be minimized where possible.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> <li>Should impacts to nesting / roosting habitat be unavoidable, requirements under the ESA and associated regulations require that appropriate compensation be provided for impacts to habitat.</li> </ul>

Item No.	Natural Heritage Feature, Function or Species	Sites / Areas	Anticipated Impact	Recommended Mitigation Measures	Net Effects
			insect prey. Removal of natural habitats associated with the RT works are expected to be minor and long-term impacts are not anticipated.		
16	Eastern Meadowlark	Site 7	<ul style="list-style-type: none"> <li>As a Threatened species, Eastern Meadowlark receives species and habitat protection under the ESA, 2007.</li> <li>This species was observed at Site 7 and may use the cultural meadow habitat within the eastern portion of the Site for nesting and foraging. Though not anticipated, should construction be proposed within this part of the Site, impacts to the species and their habitat is possible.</li> </ul>	<ul style="list-style-type: none"> <li>Additional breeding bird surveys should be completed within open habitats on Site 7 during the breeding season before construction/site preparation activities are to commence to confirm habitat use by this species. Surveys are to be completed using an MNRF-approved protocol.</li> <li>In the event Eastern Meadowlark are nesting within areas to be permanently impacted by the proposed works, requirements under Ontario Regulation 242/08 will need to be addressed to offset the loss of habitat. Due to the small size of the available habitat (less than 30 ha), compensation can proceed under the Notice of Activity process. Under the current version of the regulation, an Overall Benefit Permit would not be required. Requirements should be confirmed prior to implementation.</li> <li>Vegetation removal is to occur outside of bird breeding period (March to end of August) to avoid impacts to the nesting, rearing of young, and foraging of this species.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>
17	Eastern Wood-pewee	Observed at Site 1 and Site 6 (potential at Sites 3, 4, 5 and 6)	<ul style="list-style-type: none"> <li>The Eastern Wood Pewee is listed as Special Concern and does not receive habitat protection under the ESA, 2007.</li> <li>Direct impacts to the species are related to vegetation removal. Minor encroachment into wooded habitats along the RT Route are unlikely to have a significant impact on the quality or size of habitat for this species.</li> </ul>	<ul style="list-style-type: none"> <li>Special Concern species do not receive habitat protection under the Endangered Species Act; however, opportunities to retain or enhance existing habitat should be considered where possible.</li> <li>Mitigation provided under Item 8 for Migratory Birds will provide protection for this species as well.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>
18	Wood Thrush	Observed at Site 6 (potential at Site 1, 3 and 6)	<ul style="list-style-type: none"> <li>The Wood Thrush is listed as Special Concern and does not receive habitat protection under the ESA, 2007.</li> <li>Impacts to suitable habitat are not anticipated as a result of the proposed widening of Wellington Road.</li> </ul>	<ul style="list-style-type: none"> <li>Special Concern species do not receive habitat protection under the Endangered Species Act; however, opportunities to retain or enhance existing habitat should be considered where possible.</li> <li>Mitigation provided under Item 8 for Migratory Birds will provide protection for this species as well.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>
19	Monarch Butterfly	Sites 1 and 7	<ul style="list-style-type: none"> <li>Impacts to Milkweed plants in proximity to Oxford Street West at Site 1 may result in short-term impacts to habitat for this species.</li> <li>Impacts to this species at Site 7 are expected to be minimal as vegetation removal within the cultural meadow is not currently proposed. The Monarchs were observed on host plants within this vegetation community. No areas with high concentrations of Milkweed will be impacted by the proposed works. Construction at this site will not result in the removal of Monarch habitat.</li> </ul>	<ul style="list-style-type: none"> <li>Special Concern species do not receive habitat protection under the Endangered Species Act; however, opportunities to retain or restore Monarch habitat should be considered where possible.</li> <li>Vegetation restoration in cultural areas should include Milkweed and suitable nectar plants in the seed mix.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>

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20	Northern Map Turtle	Sites 2, 3, 4 and 5	<ul style="list-style-type: none"> <li>The Northern Map Turtle is listed as Special Concern and does not receive habitat protection under the ESA, 2007.</li> <li>In-water works, works along the banks, bridge piers and other structures below the high water mark, have the potential to impact this species and its habitat.</li> </ul>	<ul style="list-style-type: none"> <li>Implementation of mitigation measures for Spiny Softshell (Item 22) will provide additional protection for this species and its habitat.</li> <li>Special Concern species do not receive habitat protection under the Endangered Species Act; however, opportunities to retain or enhance existing habitat should be considered where possible.</li> </ul>	<ul style="list-style-type: none"> <li>Short-term negative impacts associated with construction including, vegetation removal, noise, vibration, and general disturbance are possible.</li> <li>This species will benefit from Overall Benefit Permit actions for Spiny Softshell, if required.</li> </ul>
21	Snapping Turtle	Sites 2, 3, 4, 5 and 6 (potential at Sites 1 and 7)	<ul style="list-style-type: none"> <li>The Snapping Turtle is listed as Special Concern and does not receive habitat protection under the ESA, 2007.</li> <li>Although not observed during surveys conducted by WSP, this species is a habitat generalist and should be assumed present at all sites where an aquatic feature occurs.</li> <li>Secondary sources (UTRCA) indicate that this species is present at Sites 2, 4, 5 and 6, with confirmed nesting at Site 5 (along bridge embankments) and Site 6 (grassy areas surrounding ponds beyond the Study Area).</li> <li>This species may use Mud Creek and Murray Drain as a movement corridor.</li> <li>In-water works, works along the banks, bridge piers and other structures below the high water mark, have the potential to impact this species and its habitat.</li> </ul>	<ul style="list-style-type: none"> <li>Implementation of mitigation measures for Spiny Softshell (Item 22), Wildlife Passage (Item 9), and Turtle Nesting and Wintering Habitat (Items 30 and 31) will provide additional protection for this species and its habitat.</li> <li>At Site 5, trail modifications and grading near the northeast corner of the bridge should not occur during the turtle nesting season (June / July) to avoid disturbing nesting turtles.</li> <li>Special Concern species do not receive habitat protection under the Endangered Species Act; however, opportunities to retain or enhance existing habitat should be considered where possible.</li> </ul>	<ul style="list-style-type: none"> <li>Short-term negative impacts associated with construction including, vegetation removal, noise, vibration, and general disturbance are possible.</li> <li>This species will benefit from Overall Benefit Permit actions for Spiny Softshell, if required.</li> </ul>
22	Spiny Softshell	Sites 2, 3, 4, and 5	<ul style="list-style-type: none"> <li>As an Endangered species, Spiny Softshell receives species and habitat protection under the ESA, 2007.</li> <li>Spiny Softshell turtles were seen basking on rocks in the North Thames River upstream and downstream of the bridge at Site 4.</li> <li>Secondary sources (MNRF, UTRCA) indicate that this species is also known to be present at Site 2, 3 and to a lesser extent 5. The species uses the Thames River system as a movement corridor between foraging, nesting and hibernation sites. Nesting has been confirmed at Site 2 (base of bridge) and in proximity to Site 4.</li> <li>In-water works, works along the banks, bridge piers and other structures below the high water mark, have the potential to impact this species and its habitat.</li> </ul>	<ul style="list-style-type: none"> <li>Minimize amount of in-water works to that which is absolutely required for the bridge widening.</li> <li>At bridges where in-water works are required (Sites 3, 4 and 5), there is to be no de-watering during the turtle hibernation period, unless turtles have been excluded from the area prior to September 1<sup>st</sup>. Timing of works is to be confirmed through consultation with the MNRF.</li> <li>Exclusion fencing should be installed around the construction zone and storage and stockpiling areas prior to May 15<sup>th</sup> and maintained until the end of construction works to keep turtles from entering and potentially nesting within the construction zone.</li> <li>Wire-backed, rather than mesh-backed, fencing should be used to prevent entanglement of wildlife. Heavy-duty geotextile fencing is to be installed with wire on the activity side, and shall be counter-sunk to a depth of 10 to 20 cm (plus a 10 cm horizontal lip), and shall reach a minimum height of 60 cm, to align with best management practices for reptile species within the study area (OMNR, 2013). Design and installation</li> </ul>	<ul style="list-style-type: none"> <li>Short-term negative impacts associated with construction including, vegetation removal, noise, vibration, and general disturbance are possible.</li> <li>Impacts to nesting / hibernation habitat will require an Overall Benefit Permit be obtained under the ESA. Activities to enhance or create basking and/or nesting habitat, protect critical habitat through land acquisition, promote education and awareness through outreach programs may be considered to achieve an overall benefit to the species.</li> </ul>

Item No.	Natural Heritage Feature, Function or Species	Sites / Areas	Anticipated Impact	Recommended Mitigation Measures	Net Effects
				<p>specifications shall be determined through consultation with MNRF and UTRCA to ensure it is effective for the species of interest.</p> <ul style="list-style-type: none"> <li>Gravel and sand required for construction should not be placed or stockpiled in areas that are accessible to nesting turtles.</li> <li>Timing of works is to be confirmed through consultation with the MNRF; however, removal of vegetation on river banks should be completed outside of the hibernation period, unless measures have been implemented (i.e., exclusion fencing) to ensure turtles are not hibernating within the area to be disturbed.</li> <li>The need for an Overall Benefit Permit under the ESA will be determined during detailed design once the extent of disturbance is known. The MNRF is to be contacted. Appropriate offsetting measures will be developed in consultation with UTRCA and MNRF.</li> <li>Opportunities to create permanent barriers to prevent public access to the shoreline from the bridge down to the water's edge should be considered during detailed design (e.g., bank restoration and plantings, installation of fencing). In addition to excluding pedestrian traffic from river banks, fencing should be designed to direct snakes and other wildlife along safe movement corridors within the valley, as opposed to roadways, to decrease potential for road mortality.</li> </ul>	
23	Queensnake	Sites 3 and 4	<ul style="list-style-type: none"> <li>As an Endangered species, Queensnake receives species and habitat protection under the ESA, 2007. Furthermore, its habitat is regulated under the ESA.</li> <li>Secondary sources (UTRCA) indicate that this species should be considered at Sites 3 and 4.</li> <li>In-water works, works along the banks, bridge piers, abutments, and other structures within the valley, have the potential to impact this species and its habitat.</li> </ul>	<ul style="list-style-type: none"> <li>Timing of works is to be confirmed through consultation with the MNRF; however, to minimize impacts and expedite the construction period, it is recommended that no earthworks (i.e. digging below the frostline) or structure removals are to occur during the snake hibernation period, unless measures have been implemented (e.g., exclusion fencing) to ensure snakes are not hibernating within the area to be disturbed.</li> <li>Multiple targeted Queensnake surveys/relocations (during pre-construction and construction period) should be conducted in co-ordination with UTRCA.</li> <li>Exclusion fencing should be installed around the construction zone and storage and stockpiling areas prior to April 1<sup>st</sup> and maintained until the end of construction works to keep snakes from entering the construction zone (MNRF, 2016).</li> <li>Wire-backed rather than mesh-backed fencing should be used to prevent entanglement of wildlife. Heavy-duty geotextile fencing is to be installed with wire on the activity side, and shall be counter-sunk to a depth of 10 to 20 cm (plus a 10 cm horizontal lip), and shall reach a minimum height of 60 cm, to align with best management practices for reptile species within the study area (OMNR, 2013). Design and installation</li> </ul>	<ul style="list-style-type: none"> <li>Short-term negative impacts associated with construction including, vegetation removal, noise, vibration, and general disturbance are possible.</li> <li>Impacts to regulated habitat, including gestation / hibernation habitat, will require an Overall Benefit Permit be obtained under the ESA. Activities to enhance or create gestation habitat, protect critical habitat through land acquisition, promote education and awareness through outreach programs may be considered to achieve an overall benefit to the species.</li> </ul>

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				<p>specifications shall be determined through consultation with MNRF and UTRCA to ensure it is effective for the species of interest.</p> <ul style="list-style-type: none"> <li>The need for an Overall Benefit Permit under the ESA will be determined during detailed design once the extent of disturbance is known. The MNRF is to be contacted. Appropriate offsetting measures will be developed in consultation with UTRCA and MNRF.</li> <li>Opportunities to create permanent barriers to prevent public access to the shoreline from the bridge down to the water's edge should be considered during detailed design (e.g., bank restoration and plantings, installation of fencing). In addition to excluding pedestrian traffic from river banks, fencing should be designed to direct snakes and other wildlife along safe movement corridors within the valley, as opposed to roadways, to decrease potential for road mortality.</li> <li>Where necessary, temporary eco-passages should be installed to facilitate movement around the construction area and away from roadways.</li> </ul>	
24	Wavy-rayed Lampmussel	Site 3 – current (potential at 2, 4 and 5)	<ul style="list-style-type: none"> <li>As a Threatened species listed under the ESA, this mussel species receives species and habitat protection under the ESA. Habitat regulated by the ESA includes the watercourse up to the high water mark where this species has been confirmed. Areas within 30 m of occupied reaches that are either natural or semi natural are also protected (i.e., forest, woodland, wetland, thicket, old field, pasture, or meadow).</li> <li>DFO confirmed through consultation that impacts to this species need to be considered at Sites 2, 3, 4, and 5. WSP confirmed presence within the existing road crossing at Site 3.</li> <li>In-water works, including what is needed for bridge pier extension/replacements, and other infrastructure required for the bridges (drainage features, etc.) within the valley (below the normal high water mark), have the potential to impact this species and its habitat by loss of habitat or altering substrate used by species and/or through indirect impacts such as sediment release to the watercourses which may interfere with feeding patterns of the mussel (filter feeders).</li> <li>In and near water works may also require Fisheries Act Authorization (FAA) to address impacts to the species and its habitat within the study reaches.</li> </ul>	<ul style="list-style-type: none"> <li>Minimize amount of in-water works to that which is absolutely required for the bridge widening.</li> <li>All in-water works should be completed during the permissible in-water timing window to protect specific sensitive life functions of the host fish in order to minimize impacts to the mussels. In-water works are to be avoided between March 15<sup>th</sup> and July 15<sup>th</sup> of any given year.</li> <li>Robust sediment and erosion control measures should be designed to minimize sediment release to the watercourses that has the potential to impact mussels</li> <li>Targeted surveys for Wavy-rayed Lampmussel may be required within in-water footprint areas at Sites 4 and 5 where presence has not yet been confirmed within the impacted area specifically.</li> <li>Debris netting, or similar suitable containment measures (i.e. debris barge) should be designed and installed at Site 2 where in-water works are not required, but works to the bridge decking have the potential to impact mussel species in the river if debris is not properly contained.</li> <li>Isolation areas will need to undergo fish and mussel relocations (if within permanently wet areas) to ensure species are not left within the construction footprint.</li> <li>Mussel rescue/relocations will be required at all locations where mussels have been confirmed within the in-water footprint. These relocations should follow the guidance provided by and approved by MNRF through consultation, and DFO's <i>Protocol for the Detection and Relocation of</i></li> </ul>	<ul style="list-style-type: none"> <li>Short term, indirect impacts to the habitat may occur during in-water works to isolate the construction areas and dewater.</li> <li>Residual effects will include additional footprint impacts within regulated habitat for this species (below the high water mark) for the pier extensions/replacements.</li> <li>Impacts to the regulated habitat will likely require an Overall Benefit Permit under the ESA. Overall benefit plans should consider bank restoration works to address sedimentation issues, habitat enhancement for the species or its host fish species, research and community outreach programs.</li> </ul>

Item No.	Natural Heritage Feature, Function or Species	Sites / Areas	Anticipated Impact	Recommended Mitigation Measures	Net Effects
				<i>Freshwater Mussel species at Risk in Ontario – Great Lakes Area (OGLA).</i>	
25	Round Pigtoe	Site 5 and upstream	<ul style="list-style-type: none"> <li>The Thames River at Site 5 and further upstream is protected as critical habitat for Round Pigtoe, according to DFO's current SAR distribution mapping.</li> <li>Round Pigtoe are listed as Endangered under the ESA and are afforded general habitat protection under the ESA. They are also listed as Endangered under SARA, and as such are afforded habitat protection under SARA as well. That is, the individual species as well as its critical habitat are protected from activities that may impact their habitat unless approved by the Minister.</li> <li>In-water works on habitat that supports Round Pigtoe has the potential to impact the species' life cycle functions if not properly mitigated.</li> <li>If this species' habitat is confirmed within the study reaches at Site 5, the extension to the existing in-water piers will have the potential to impact this habitat such that permitting will be required to carry out the works.</li> <li>In and near water works may require a Fisheries Act Authorization (FAA) to address impacts to the species and its habitat within the study reaches.</li> </ul>	<ul style="list-style-type: none"> <li>Additional surveys will be required to confirm if suitable habitat for Round Pigtoe is likely to be impacted by the in-water works. Passive surveys within the in-water footprint area will need to be completed to identify presence of Round Pigtoe or other aquatic SAR.</li> <li>Minimize amount of in-water works to that which is absolutely required for the bridge widening.</li> <li>All in-water works should be completed during the permissible in-water timing window to protect specific sensitive life functions of the host fish in order to minimize impacts to the mussels. In-water works are to be avoided between March 15<sup>th</sup> and July 15<sup>th</sup> of any given year.</li> <li>Robust sediment and erosion control measures should be designed to minimize sediment release to the watercourses and associated potential impacts to mussels</li> <li>Isolation areas will need to undergo fish and mussel relocations (if within permanently wet areas) to ensure species are not left within construction footprint.</li> <li>Mussel rescue/relocations will be required if mussels have been confirmed within the in-water footprint. These relocations should follow the guidance provided by and approved by MNRF through consultation, and DFO's <i>Protocol for the Detection and Relocation of Freshwater Mussel species at Risk in Ontario – Great Lakes Area (OGLA)</i>.</li> </ul>	<ul style="list-style-type: none"> <li>Short term, indirect impacts to the habitat may occur during in-water works to isolate the construction areas and dewater.</li> <li>Residual effects will include alterations of footprint impacts within regulated/critical habitat for this species (below the high water mark) for the pier extensions/replacements.</li> <li>Impacts to the regulated habitat will likely require an Overall Benefit Permit under the ESA. Impacts to Critical habitat may require SARA permit, but will need to be reviewed by DFO to determine if serious harm is anticipated with the relocation of the pier shaft.</li> <li>Overall benefit and off-setting plans (if required) should consider bank restoration works to address sedimentation issues, habitat enhancement for the species or its host fish species, research and community outreach programs.</li> </ul>
26	Silver Shiner	Sites 2, 3, 4, and 5	<ul style="list-style-type: none"> <li>As a Threatened species listed under the ESA, this fish receives species and habitat protection under the ESA. Habitat regulated by the ESA includes three categories of habitat types with varying levels of protection. Categories include flowing pools runs and riffles of occupied reaches, shallow nearshore habitats with aquatic vegetation in occupied reaches, and floodplain and riparian edges adjacent to occupied reaches.</li> <li>Surveys have confirmed this species at Sites 2, 3, 4 and 5. DFO and MNRF identified its potential within Site 7 initially; however, based on WPS's descriptions of local habitat, MNRF confirmed it is not likely to be present at this location.</li> <li>In-water works, including what is needed for bridge pier extension/replacements, and other infrastructure required for the bridges (drainage features, etc.) within the valley, have the potential to impact this species and its habitat by loss of habitat or altering substrate used by</li> </ul>	<ul style="list-style-type: none"> <li>Minimize amount of works associated with in-water habitat, banks and floodplain that MNRF has identified as habitat supporting Silver Shiner and protected to some degree under the ESA</li> <li>All in and near water works should be completed during the permissible in-water timing window to protect specific sensitive life functions in order to minimize impacts to the species. In-water works are to be avoided between March 15<sup>th</sup> and July 15<sup>th</sup> of any given year.</li> <li>Robust sediment and erosion control measures should be designed to minimize sediment release to the watercourses that has the potential to impact this species sensitive to sedimentation</li> <li>Debris netting, or similar suitable containment measures (i.e. debris barge) should be designed and installed at Site 2 where in-water works</li> </ul>	<ul style="list-style-type: none"> <li>Short term, indirect impacts to the habitat may occur during in-water works to isolate the construction areas at Sites 3, 4 and 5.</li> <li>Residual effects may include additional footprint impacts within regulated habitat for this species (below the high water mark) where pier extensions/ replacements are required at Sites 3 and 5.</li> <li>A net positive effect of relocating the in-water pier at Site 4 to the water's edge may be possible as the relocation allows for habitat creation within the</li> </ul>

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			<p>species and/or through indirect impacts such as sediment release to the watercourses which may interfere with feeding patterns of the mussel (filter feeders).</p> <ul style="list-style-type: none"> <li>In and near water works may also require Fisheries Act Authorization (FAA) to address impacts to the species and its habitat within the study reaches.</li> </ul>	<p>are not required, but works to the bridge decking have the potential to impact aquatic species in the river if debris is not properly contained.</p> <ul style="list-style-type: none"> <li>Isolation areas will need to undergo fish and mussel relocations (if within permanently wet areas) to ensure species are not left within construction footprint.</li> </ul>	<p>area of the existing pier shaft and footing.</p> <ul style="list-style-type: none"> <li>Impacts to regulated habitat may require an overall benefit permit under the ESA depending on review of proposed works with MNRF. Overall benefit plans should consider bank restoration works to address sedimentation issues, bank and floodplain plantings, and habitat enhancement for the species, research and community outreach programs.</li> </ul>
27	Black Redhorse	Sites 3 and 4	<ul style="list-style-type: none"> <li>As a species Threatened under the ESA, it receives general habitat protection. Habitat for this species includes clean, clear rivers free of muddy or polluted habitats with pools and riffle areas usually less than 2 metres deep.</li> <li>Surveys have confirmed this species within Sites 3, and 4, however MNRF suggested it be considered at Site 7 as well. Based on available habitat within Site 7, WSP does not believe that this species is present within Murray Drain, and MNRF confirmed this during agency consultation.</li> <li>In-water works, including what is needed for bridge pier extension/replacements, and other infrastructure required for the bridges (drainage features, etc.) within the valley, have the potential to impact this species and its habitat by, loss of habitat or altering substrate used by species and/or through indirect impacts such as sediment release to the watercourses which could result in buried spawning habitat within the riffles.</li> <li>In and near water works may also require Fisheries Act Authorization (FAA) to address impacts to the species and its habitat within the study reaches.</li> </ul>	<ul style="list-style-type: none"> <li>Minimize amount of works associated with in-water habitat to that which is absolutely required for the bridge widening.</li> <li>All in and near water works should be completed during the permissible in-water timing window to protect specific sensitive life functions in order to minimize impacts to the species. In-water works are to be avoided between March 15<sup>th</sup> and July 15<sup>th</sup> of any given year.</li> <li>Robust sediment and erosion control measures should be designed to minimize sediment release to the watercourses that has the potential to impact this species through burying of spawning habitat within the riffles.</li> <li>Isolation areas will need to undergo fish and mussel relocations (if within permanently wet areas) to ensure species are not left within construction footprint.</li> </ul>	<ul style="list-style-type: none"> <li>Short term, indirect impacts to the habitat may occur during in-water works to isolate the construction areas and dewater.</li> <li>Residual effects will include additional footprint impacts within regulated habitat for this species (below the high water mark) for the pier extensions/replacements, where required.</li> <li>Impacts to the regulated habitat will likely require an Overall Benefit Permit under the ESA. Overall benefit plans should consider bank restoration works to address sedimentation issues, and habitat enhancement measures including development of spawning areas for this species within the London RT corridor.</li> </ul>
28	Spotted Sucker	Sites, 2, 4 and 5	<ul style="list-style-type: none"> <li>DFO indicated that this species should be considered for the larger Thames River and its major tributary crossings within the study limits, although no records of this species have been reported.</li> <li>Spotted Sucker are listed as Special concern under the ESA, and as such do not receive habitat protection under the ESA.</li> <li>In-water works associated with the extensions/replacements to the bridge piers has the potential to impact this species through loss or alteration of</li> </ul>	<ul style="list-style-type: none"> <li>Minimize amount of in-water works to that which is absolutely required for the bridge widening.</li> <li>All in and near water works should be completed during the permissible in-water timing window to protect specific sensitive life functions in order to minimize impacts to the species. In-water works are to be avoided between March 15<sup>th</sup> and July 15<sup>th</sup> of any given year.</li> </ul>	<ul style="list-style-type: none"> <li>Short term, indirect impacts to the habitat may occur during in-water works to isolate the construction areas and dewater.</li> <li>Residual effects will include additional footprint impacts within habitat used by this species for various life cycle functions.</li> </ul>



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			<p>the habitat used by the species. This habitat includes silt-free sand, gravel or hard-clay bottomed features.</p> <ul style="list-style-type: none"> <li>In and near water works may also require Fisheries Act Authorization (FAA) to address impacts to the species and its habitat within the study reaches.</li> </ul>	<ul style="list-style-type: none"> <li>Isolation areas will need to undergo fish and mussel relocations (if within permanently wet areas) to ensure species are not left within the construction footprint.</li> <li>Debris netting, or similar suitable containment measures (i.e. debris barge) should be designed and installed at Site 2 where in-water works are not required, but works to the bridge decking have the potential to impact aquatic species in the river if debris is not properly contained.</li> </ul>	<ul style="list-style-type: none"> <li>This species will benefit from Overall benefit plans designed for all the other aquatic species, if required.</li> </ul>
29	Northern Brook Lamprey	Sites 2, 4 and 5	<ul style="list-style-type: none"> <li>DFO indicated that this species should be considered within the Thames River and its major tributaries although there have not been any records reported within the London RT Study Area.</li> <li>This species is listed as Special Concern under the ESA, and therefore does not receive habitat protection under the ESA. However, general mitigation measures required to protect other aquatic SAR within these sites will also provide protection for this species generally.</li> <li>In-water works, included that which is needed for bridge pier extension/replacements, and other infrastructure required for the bridges (drainage features, etc.) within the valley, have the potential to impact this species and its habitat by loss of habitat or altering substrate used by species and/or through indirect impacts such as sediment release to the watercourses.</li> <li>In and near water works may also require Fisheries Act Authorization (FAA) to address impacts to the species and its habitat within the study reaches.</li> </ul>	<ul style="list-style-type: none"> <li>Minimize amount of in-water works to that which is absolutely required for the bridge widening.</li> <li>All in and near water works should be completed during the permissible in-water timing window to protect specific sensitive life functions in order to minimize impacts to the species. In-water works are to be avoided between March 15<sup>th</sup> and July 15<sup>th</sup> of any given year.</li> <li>Isolation areas will need to undergo fish and mussel relocations (if within permanently wet areas) to ensure species are not left within construction footprint.</li> <li>Debris netting, or similar suitable containment measures (i.e. debris barge) should be designed and installed at Site 2 where in-water works are not required, but works to the bridge decking have the potential to impact aquatic species in the river if debris is not properly contained.</li> </ul>	<ul style="list-style-type: none"> <li>Short term, indirect impacts to the habitat during in-water works to isolate the construction areas and dewater.</li> <li>Residual effects will include additional footprint impacts within habitat used by this species for various life cycle functions.</li> <li>This species will benefit from Overall benefit plans designed for all the other aquatic species, if required.</li> </ul>
<b>Significant Wildlife Habitat</b>					
30	Turtle Nesting Area	Sites 2, 4 and 5 (potential at Site 3)	<ul style="list-style-type: none"> <li>Turtle nesting habitat was confirmed at Sites 2 and 5, and in proximity to Site 4, but can occur wherever there are sun-exposed sand/gravel/soil substrates in proximity to an aquatic feature (including for example, watercourse banks, gravel bars and islands, road shoulders and embankments, lawns, gardens and gravel laneways and lots).</li> <li>Potential impacts to the candidate turtle nesting areas may include interruption of nesting turtles, disruption to existing nests, and changes in substrate composition potentially altering the site suitability for nesting.</li> <li>Construction activities, including excavation and dredging have the potential to impact shoreline hydrology, thereby altering shoreline function as turtle nesting habitat. Impacts may be positive or negative, depending on whether potential nesting habitat is created or destroyed. At Site 4, where upstream flooding is known to occur, in part due to the constriction posed by the existing bridge, lengthening the bridge,</li> </ul>	<ul style="list-style-type: none"> <li>No works are permitted within confirmed turtle nesting habitat. Construction should be avoided in proximity to nest sites (e.g., Site 5) during the nesting season (June 1<sup>st</sup> to July 31<sup>st</sup>). Timing of works is to be confirmed with the MNRF.</li> <li>Avoidance and mitigation measures should be utilized to minimize impacts to nesting turtles and the substrates within these nesting areas.</li> <li>Exclusion fencing should be installed around the construction zone and storage and stockpiling areas prior to May 15<sup>th</sup> and maintained until the end of construction works to keep turtles from entering and potentially nesting within the construction zone.</li> <li>Wire-backed, rather than mesh-backed, fencing should be used to prevent entanglement of wildlife. Heavy-duty geotextile fencing is to be installed with wire on the activity side, and shall be counter-sunk to a depth of 10 to 20 cm (plus a 10 cm horizontal lip), and shall reach a minimum height</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated.</li> <li>Creation of nesting habitat has the potential to create a positive net effect.</li> </ul>

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			<p>improving hydraulic capacity, and reducing flood levels and frequency may result in increased nest sites and nesting success for turtles.</p>	<p>of 60 cm, to align with best management practices for reptile species within the study area (OMNR, 2013). Design and installation specifications shall be determined through consultation with MNRF and UTRCA to ensure it is effective for the species of interest.</p> <ul style="list-style-type: none"> <li>Gravel and sand required for construction should not be placed or stockpiled in areas that are accessible to nesting turtles.</li> <li>Access to existing nest sites, and other critical habitat, should be maintained during and after the construction period.</li> <li>Where possible, creation of nesting habitat should be incorporated into the restoration plan at the detailed design stage.</li> </ul>	
31	Turtle Wintering Areas	Sites 4 and 5 (potential at Sites 2 and 3)	<ul style="list-style-type: none"> <li>Numerous turtles, including Northern Map Turtle (current study), Spiny Softshell (current study) and Snapping Turtle (NRSI, 2013b) were identified during the field surveys. Turtle wintering areas should be considered to potentially occur wherever there are water depths of 1m or greater.</li> <li>Disturbance of turtles during hibernation may result in mortality. Most species exhibit fidelity to hibernation sites, as a result, activities resulting in the loss of hibernacula would likely have a significant impact on the local population.</li> <li>Construction activities, including excavation and dredging have the potential to impact shoreline hydrology, thereby altering shoreline function for turtle habitat and potentially destroying or damaging hibernacula.</li> </ul>	<ul style="list-style-type: none"> <li>Timing of works is to be confirmed with the MNRF; however, in general, no in-water works or vegetation removal on the banks is to occur during the turtle hibernation period within proximity of suspected hibernation sites.</li> <li>A spills management plan should be implemented during construction to avoid release of contaminants into water and soil within turtle habitat.</li> <li>Activities (i.e., de-watering) that alter water and oxygen levels within the wintering area are to be avoided.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>
32	Bat Maternity Colonies	Sites 1, 3, 4 5, and 6	<ul style="list-style-type: none"> <li>Candidate habitat may occur within wooded ELC types throughout the study area. Moderate to high potential may exist within the larger forested areas associated with the Mud Creek valley corridor, Medway Valley Heritage Forest ESA and Westminster Ponds/Pond Mills ESA in Sites 1, 3 and 6, respectively.</li> <li>Vegetation and tree removal to accommodate road and bridge widening has the potential to reduce the availability of suitable cavity trees. As vegetation removal is confined to the edge of woodland units, impacts, if any, are expected to be minor.</li> </ul>	<ul style="list-style-type: none"> <li>Removal of mature trees (over 25 cm in diameter at breast height) should be avoided where possible. For trees to be retained, tree protection fencing should be installed as close to the dripline as possible.</li> <li>At the detailed design stage, a survey for suitable cavity trees within 6 m of the proposed works (specifically vegetation removal) at Sites 1, 3, 4 and 6 should be completed during leaf-off to better determine the potential for impacts to this type of habitat. Appropriate avoidance and mitigation measures should be determined through consultation with the MNRF during detailed design.</li> <li>In general, schedule tree and vegetation removal when bats are absent or not nursing young (October 1<sup>st</sup> to March 31<sup>st</sup>), to reduce the potential for impacts to bat populations. Timing of works is to be confirmed with the MNRF.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>

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33	Amphibian Breeding Habitat (Woodland)	Site 6	<ul style="list-style-type: none"> <li>Candidate habitat is present approximately 50 m east of Wellington Road, in a pond west of Saunders Pond. Three species of amphibian were identified during the amphibian surveys, including Spring Peeper, Grey Treefrog, and Green Frog, two of which are identified as target species for significance.</li> <li>Changes in drainage patterns (groundwater and / or surface runoff flow) that can impact water quality and quantity, composition of wetland dependent vegetation, have the potential to impact the function of this pond as amphibian breeding habitat. Direct impacts to this feature are not anticipated, due to its distance from the proposed works.</li> </ul>	<ul style="list-style-type: none"> <li>Mitigation proposed in Item 4 for the Westminster Ponds / Pond Mills Provincially Significant Wetland will provide sufficient protection for this feature.</li> <li>To reduce road mortality in amphibian populations, and other terrestrial taxa (turtles, snakes, small mammals), the installation of permanent exclusion fencing at the eastern limit of development should be considered during detailed design. Fence design should follow best management practices (MNRF, 2016).</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>
34	Other Rare Vegetation Communities	RT Route, Lambton Drive, Western University	<ul style="list-style-type: none"> <li>Fresh-Moist Sugar Maple-Black Maple Deciduous Forest (FODM6-2) is designated as 'S3?'. The question mark denotes uncertainty regarding the 'Vulnerable' or S3 designation.</li> <li>Road widening activities are not anticipated in the vicinity of this vegetation community; however, road resurfacing may occur.</li> <li>Potential impacts are related to movement of heavy machinery and equipment, storage and stockpiling, and other construction-related activities.</li> </ul>	<ul style="list-style-type: none"> <li>Tree and vegetation protection is recommended for all trees and vegetation to be retained. Tree protection should be outlined in a Tree Protection Plan (TPP). Vegetation protection measures should be detailed on contract drawings and implemented to ensure encroachment is limited to the construction footprint.</li> <li>Equipment, materials and other construction activities will not be permitted in vegetation retention zones.</li> <li>Avoid all unnecessary traffic, dumping and storage of materials over tree root zones adjacent to the proposed works.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>
35	Species of Conservation Concern	All Sites	<ul style="list-style-type: none"> <li>Potential impacts to Special Concern and Provincially Rare (S1-S3, SH) plant and animal species observed within the study area are addressed under individual species in the Species at Risk section above.</li> <li>Tall Coreopsis, which is listed as S2, but is not on the SARO List, occurred at Site 6; however, it occurred in a park area and was most likely planted. Impacts to this species are not anticipated.</li> </ul>	<ul style="list-style-type: none"> <li>In many instances, avoidance and mitigation measures recommended for Endangered and Threatened species, or other natural features and areas, will provide protection / benefit to Special Concern species as well.</li> <li>Due to the anticipated construction phasing which is to occur over a nine-year period between 2019 and 2028, it is possible that species listings and associated regulation will change between the publication of this report, and construction at individual sites. The potential for impacts to Species at Risk should be reassessed during detailed design to ensure appropriate measures are taken under the Act.</li> </ul>	<ul style="list-style-type: none"> <li>Net effects are not anticipated</li> </ul>
<b>Fish and Fish Habitat</b>					
36	Thames River	Sites 2, 4, and 5	<ul style="list-style-type: none"> <li>In-water works are not anticipated at Site 2, therefore no impacts to fish and fish habitat assumed at this location</li> <li>At Site 4, the removal of the existing piers, including one that is within the middle of the flow path at Site 4, and widening of the bridge spans so that the new pier locations will be on the banks will decrease the in-water footprint within the river, and minimize impacts on fish and fish habitat within the river.</li> </ul>	<ul style="list-style-type: none"> <li>Minimize overall increases in in-water footprints as much as feasible</li> <li>In-water works will need to occur during permissible in-water window for the Thames River to minimize impacts to the sensitive life cycle functions of the resident species.</li> <li>Construction areas should be isolated from main flow path behind containment measures (i.e., coffer dams or other suitable measures), and fish and mussel rescue/relocations carried out to relocate all aquatic</li> </ul>	<ul style="list-style-type: none"> <li>A decrease in the permanent in-water footprint at Site 4 is possible if the bridge is modified to include wider spans and piers on the shores.</li> <li>An increase in the permanent in-water footprint will be associated with a longer pier at Site 5.</li> </ul>

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			<ul style="list-style-type: none"> <li>At Site 5, extension of the existing in-water pier to the east would result in an increase in the in-water footprint that has the potential to impact fish and mussel habitat present within the study reaches.</li> <li>All three sites support aquatic SAR therefore design details will need to focus on minimizing in-water impacts to the extent feasible, otherwise ESA permits may be required to address concerns for these aquatic SAR.</li> <li>In-water footprint changes that will result in serious harm to fish and fish habitat as defined by DFO (i.e., the alteration, destruction or loss of habitat that results in impacts to that fish's ability to carry out sensitive life functions) may require a Fisheries Act Authorization issued by DFO.</li> </ul>	<ul style="list-style-type: none"> <li>species within construction footprint. Additional Schedule B permitting maybe required for relocation of these species.</li> <li>Sediment and erosion control measures will need to be designed to minimize indirect impacts of sediment release to the watercourse during and following construction measures until the construction area has been re-stabilized.</li> </ul>	<ul style="list-style-type: none"> <li>No net effects assumed for Site 2 since no in-water works are required.</li> <li>Works resulting in permanent in-water footprint increases may require permitting under the ESA associated with the various aquatic SAR, as well as potential FAA permitting to address impacts to fish and fish habitat generally.</li> </ul>
37	Medway Creek	Site 3	<ul style="list-style-type: none"> <li>The pier extension is to be constructed within the permanently wet portion of the channel east of the existing footprint, resulting in potential impacts to fish and mussels, and their habitat.</li> <li>Medway Creek supports aquatic SAR (i.e., Wavy-rayed Lampmussel, Black Redhorse, and Silver Shiner), therefore design details will need to focus on minimizing in-water impacts to the extent feasible; otherwise, ESA permits may be required to address concerns for these aquatic SAR.</li> <li>In-water footprint changes that will result in serious harm to fish and fish habitat as defined by DFO (i.e., the alteration, destruction or loss of habitat that results in impacts to that fish's ability to carry out sensitive life functions) may require a Fisheries Act Authorization issued by DFO.</li> </ul>	<ul style="list-style-type: none"> <li>Minimize overall increases in in-water footprint as much as feasible.</li> <li>In-water works will need to occur during the permissible in-water window for the Medway Creek to minimize impacts to the sensitive life cycle functions of the resident species.</li> <li>Construction areas should be isolated from main flow path behind containment measures (i.e., coffer dams or other suitable measures), and fish and mussel rescue/relocations carried out in the area supporting water at the time of construction to relocate all aquatic species within construction footprint.</li> <li>Sediment and erosion control measures will need to be designed to minimize indirect impacts of sediment release to the watercourse during and following construction measures until the construction area has been re-stabilized.</li> </ul>	<ul style="list-style-type: none"> <li>Increase in permanent in-water footprint associated with longer pier.</li> <li>Works resulting in increases to the permanent in-water footprint may require permitting under the ESA associated with the various aquatic SAR, as well as potential FAA permitting to address impacts to fish and fish habitat generally.</li> </ul>
38	Mud Creek	Site 1	<ul style="list-style-type: none"> <li>Based on a review of the works outlined in the Mud Creek Subwatershed EA, the majority of the existing fish and fish habitat associated with this portion of the creek will be realigned to a new location to the east of the existing culvert, leaving only the flows from the tributary conveyed via a pipe under the parking lot supporting the existing fish and fish habitat at the existing culvert.</li> <li>The existing portion of the creek that flows parallel to the north side of Oxford Street West will be relocated to a new location further to the east. This relocation removes fish and fish habitat from within the future road corridor for the London RT, minimizing impacts to Mud Creek associated with the London RT works specifically.</li> <li>WSP assumes that the habitat that remains at the existing culvert after the creek is realigned will be nominal (and likely intermittent depending on the amount of water conveyed from the tributary), and not likely to support sensitive life cycle functions of the resident species. As such, serious harm to fish and fish habitat associated with works to this feature</li> </ul>	<ul style="list-style-type: none"> <li>Re-assessment of habitat conditions should be carried out following the shifting of flows and realignment of the watercourse to the new culvert further east to determine what habitat remains for fish within the existing culvert crossing location. If fish are still using the habitat, then the following mitigation measures should be implemented to protect that habitat. <ul style="list-style-type: none"> <li>Minimize overall increases in in-water footprint as much as feasible</li> <li>In-water works will need to occur during permissible in-water window for Mud Creek to minimize impacts to the sensitive life cycle functions of the resident species.</li> <li>Construction areas should be isolated from main flow path behind containment measures (i.e., coffer dams or other suitable measures), and fish rescue/relocations carried out in the area</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Net effects are assumed to be nominal given that there is likely going to be very little habitat remaining in the existing culvert once all the channel realignment and habitat enhancement elements associated with the Mud Creek Subwatershed Class EA works are completed.</li> <li>If fish and fish habitat still exist within the culvert following realignment works, net residual effects may include nominal shading of the habitat as well as an increase in the in-water footprint for the longer culvert length.</li> </ul>

Item No.	Natural Heritage Feature, Function or Species	Sites / Areas	Anticipated Impact	Recommended Mitigation Measures	Net Effects
			<p>is not anticipated. This will be confirmed during detail design of the RT project once the channel realignment has been established in association the Class EA Subwatershed Study.</p>	<p>supporting water at the time of construction to relocate all aquatic species within construction footprint.</p> <ul style="list-style-type: none"> <li>Sediment and erosion control measures will need to be designed to minimize indirect impacts of sediment release to the receiving watercourse downstream during and following construction measures until the construction area has been re-stabilized.</li> </ul>	
39	Murray Drain	Site 7	<ul style="list-style-type: none"> <li>As there are no works proposed within the wetted edge or within the high water mark of Murray Drain, the only potential impacts associated with fish habitat are related to the indirect or secondary impacts associated with sediment entrainment from the construction area if not properly mitigated.</li> <li>There is the potential that works within the floodplain have the potential to impact flow and flood conditions within this drain. New development and site alteration is generally not supported in the floodplain.</li> <li>Paving will increase impervious surfaces within the floodplain which may affect flood flows or reduce flood storage capacity. Indirect effects on Murray Drain and other features within the valleyland may occur as a result of these alterations.</li> </ul>	<ul style="list-style-type: none"> <li>Sediment and erosion control measures will need to be designed to minimize indirect impacts of sediment release to the watercourse during and following construction measures until the construction area has been re-stabilized.</li> <li>Additional hydraulic modelling will be required to identify actions that have the potential to reduce the floodplain area at this location in order to address flooding concerns that may result from additional development at this location.</li> <li>Management of surface water flows related to the increase in impervious surfaces should be considered at later design stages. Redirection of flows into existing municipal storm sewers or use of LID features should be considered.</li> </ul>	<ul style="list-style-type: none"> <li>There are no net residual effects anticipated for fish and fish habitat within Murray Drain as there are no direct impacts on the watercourse itself.</li> <li>UTRCA will need to ensure no net residual effects resulting from the changes in the floodplain and flooding conditions within the Drain prior to approving the development parcel.</li> </ul>

# APPENDIX

# H

CONSTRUCTION-  
RELATED IMPACTS,  
MITIGATION AND NET  
EFFECTS

**Appendix H: General Construction-Related Impacts, Mitigation Measures and Net Effects**

Source or Activity	Anticipated Impact	Recommended Mitigation Measures	Net Effects
Grading, vegetation clearing, soil stockpiling	<ul style="list-style-type: none"> <li>Increased erosion and sedimentation effects due to removal of vegetation, soil compaction, grade changes, etc. Sediment-laden run-off has the potential to enter adjacent natural heritage features causing potential water quality impairment and vegetation dieback.</li> <li>Discharges from temporary dewatering have the potential to cause streambed and/or bank erosion and downstream sedimentation if not managed properly.</li> </ul>	<ul style="list-style-type: none"> <li>Implement DFO ‘Measures to Avoid Harm to Fish and Fish Habitat’, including:               <ul style="list-style-type: none"> <li>“Develop and implement an Erosion and Sedimentation Control Plan for the site that minimizes risk of sedimentation during all phases of the project. Erosion and sediment control measures should be maintained until all disturbed ground has been permanently stabilized, suspended sediment has resettled to the bed of the waterbody or settling basin and runoff water is clear.</li> <li>Clearing of riparian vegetation should be kept to a minimum: use existing trails, roads or cut lines wherever possible to avoid disturbance to riparian vegetation and prevent soil compaction. When practical, prune or top the vegetation instead of grubbing/uprooting.</li> <li>Minimize the removal of natural woody debris, rocks, sand or other materials from the banks, the shoreline or the bed of a waterbody below the ordinary high water mark. If material is removed from the waterbody, set it aside and return it to the original location once construction activities are completed.</li> <li>Immediately stabilize shoreline or banks disturbed by any activity associated with the project to prevent erosion and/or sedimentation, preferably through re-vegetation with native species suitable for the site.</li> <li>Restore bed and banks of the waterbody to their original contour and gradient; if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage should be restore.</li> <li>If replacement rock or reinforcement/armouring is required to stabilize eroding or exposed areas, then ensure that appropriately-sized, clean rock is used; and that rock is installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.</li> <li>Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation.</li> <li>Remove all construction materials from the site upon project completion.</li> <li>Minimize duration of in-water work.</li> <li>Conduct in-stream work during periods of low flow, or at low tide, to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.”</li> </ul> </li> <li>Eliminate potential from erosion and sedimentation by restricting access of works to limit of grading. Achieved through clearly demarcating the limit of works through use of ESC structures such as silt fencing.</li> <li>Dissipate any dewatering discharge as to minimize risk of erosion.</li> </ul>	<ul style="list-style-type: none"> <li>None anticipated</li> </ul>
Paving	<ul style="list-style-type: none"> <li>Interruption or change to surface water and ground water flows due to increase of impervious surfaces; also potential degradation of water quality associated with road run-off</li> </ul>	<ul style="list-style-type: none"> <li>Use permeable asphalt or pavement, where possible</li> <li>Incorporate vegetated landscape strips / bioswales into the road / sidewalk design to promote infiltration</li> <li>Maintain water balance in significant wetlands through control of surface water and groundwater inputs</li> <li>Stormwater should be treated prior to entering adjacent watercourses and wetlands</li> </ul>	<ul style="list-style-type: none"> <li>None anticipated provided long-term water balance is maintained</li> </ul>

Source or Activity	Anticipated Impact	Recommended Mitigation Measures	Net Effects
Operation of Heavy Machinery	<ul style="list-style-type: none"> <li>• Damage to vegetation surrounding the construction site and access route</li> <li>• Surface water and groundwater contamination due to fuel and/or chemical spills may result in lethal or sub-lethal effects on aquatic life, changes in the composition of aquatic communities and wetland plant communities.</li> <li>• Damage to watercourse banks and habitat below the high water mark on those watercourses that require in or near water works.</li> </ul>	<ul style="list-style-type: none"> <li>• Tree and vegetation protection is recommended for all trees and vegetation to be retained. Tree protection should be outlined in a Tree Protection Plan (TPP). Vegetation protection measures should be detailed on contract drawings and implemented to ensure encroachment is limited to the construction footprint.</li> <li>• The following activities are prohibited beyond the tree protection fencing: storage or stockpiling of materials including fill, top soil, construction equipment and debris; disposal of liquids; and operation of heavy machinery.</li> <li>• Ensure a designated area for equipment maintenance and fuelling that is at least 30 m from the watercourse.</li> <li>• Storage of fuel should not be permitted on-site.</li> <li>• Maintain an emergency spill kit on site in case of emergency.</li> <li>• Machinery entering the channel for in-water works should show up on site clean and free of fine materials that can be entrained with flows and released to the receiving watercourses downstream</li> <li>• Machinery will not be allowed to ford the watercourses unless specified in the drawings or approved by agency staff upon review.</li> <li>• Machinery stored within the floodplain for extended periods of time should be located above the high water mark of the channel.</li> <li>• All banks and areas below the high water mark will be re-stabilized and re-vegetated once construction works are complete.</li> </ul>	<ul style="list-style-type: none"> <li>• None anticipated</li> </ul>
Soil compaction associated with use of heavy machinery, or changes to grade	<ul style="list-style-type: none"> <li>• Increased erosion, sedimentation and turbidity of adjacent watercourses and wetlands due to increased surface runoff and changes to natural drainage, including reduced infiltration</li> </ul>	<ul style="list-style-type: none"> <li>• Implement an erosion and sedimentation control plan</li> <li>• Install siltation fencing</li> <li>• Decompact soils within affected areas prior to application of topsoil (if necessary) and restoration</li> </ul>	<ul style="list-style-type: none"> <li>• None anticipated</li> </ul>
Construction material / debris	<ul style="list-style-type: none"> <li>• Construction materials or vegetative debris stockpiled near a natural heritage features have potential to enter the feature if not properly contained.</li> <li>• Debris entering a water body has the potential to: destroy or disturb fish habitat; disrupt flow patterns increasing risk for flooding or erosion and sedimentation; and impair water quality. The degree of impact on the water body is dependent on the type and amount of material entering the watercourse.</li> <li>• Debris entering wetlands or woodlands has the potential to smother and/or damage vegetation, or impact water quality.</li> </ul>	<ul style="list-style-type: none"> <li>• Stabilize construction debris (e.g., tarps) away from natural heritage features</li> <li>• Dispose of refuse and other material appropriately off-site</li> <li>• Locate storage and staging areas away from natural heritage features (e.g., 30 m)</li> <li>• Use debris netting or barges for bridge works to eliminate entrainment of sediment falling from the bridge into the watercourse below. Both of these measures should be monitored for effectiveness, damage alterations in order to ensure long time use of the method does not result in sediment released to the watercourse.</li> </ul>	<ul style="list-style-type: none"> <li>• None anticipated</li> </ul>



Source or Activity	Anticipated Impact	Recommended Mitigation Measures	Net Effects
Invasive Species Introduction and Contamination	<ul style="list-style-type: none"> <li>Invasive species can spread to new areas by contaminated mud, gravel, soil and plant materials on vehicles and machinery.</li> <li>Invasive species out-compete native species, degrade ecological integrity of natural systems, and decrease native biodiversity.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure that a Clean Equipment Protocol is developed and implemented during construction. The Clean Equipment Protocol for Industry developed by the Peterborough Stewardship Council and Ontario Invasive Species Council (Halloran, Anderson and Tassie, 2016) recommends the following: <ul style="list-style-type: none"> <li>Identification of invasive plants at each site (refer to Table 4, Appendix C);</li> <li>Schedule works so that areas without invasive plants (or with the fewest) are completed first to reduce the risk of unintentional introductions;</li> <li>Inspect vehicles and machinery before and after entering sites or conducting work along roadways; and,</li> <li>Clean vehicle / equipment in an area that will not lead to contamination or spread of seeds.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Opportunities to reduce potential for spread of invasive throughout the City of London's Natural Heritage System</li> </ul>
Road Salts / Dust	<ul style="list-style-type: none"> <li>Salt damage to roadside vegetation, wetlands and watercourses may increase due to the increased surface area of the roadway</li> <li>Road dust may have negative impacts on roadside vegetation by reducing photosynthesis and increasing leaf temperature; however, increases are expected to be limited given the that the RT Routes are located within areas that are already developed, and the proposed works do not involve a change in land use.</li> </ul>	<ul style="list-style-type: none"> <li>There are no stormwater management or LID measures available to remove salt out of stormwater</li> <li>Opportunities to use alternate application methods or de-icing compounds should be investigated particularly for areas adjacent to the Natural Heritage System</li> <li>Stormwater management facilities should be installed to capture excessive nutrients, sediments and other contaminants.</li> </ul>	<ul style="list-style-type: none"> <li>Long-term negative impacts are possible if better alternatives are not found and implemented</li> </ul>
General Wildlife Disturbance/Effects	<ul style="list-style-type: none"> <li>Noise, dust and vibrations associated with construction activities have the potential to cause short-term disturbance to wildlife and may cause certain wildlife to abandon or avoid the area.</li> <li>Increased rates of road mortality are possible due to increased crossing distances, potential use of medians or other types of barriers, etc.</li> <li>Significant long-term impacts are not expected as the infrastructure is proposed in areas that are already developed and the proposed works do not involve a change in land use.</li> </ul>	<ul style="list-style-type: none"> <li>To avoid disturbance to local wildlife and comply with the MBCA, avoid tree and vegetation clearing (including grubbing) during the bird nesting season (approximately April 1 to August 31)</li> <li>Exclusion fencing is recommended to prevent species from entering the construction area. Once work is completed, fencing should be removed to facilitate passage by wildlife.</li> <li>In the event an animal is found within the construction area, it should remain undisturbed and be allowed to leave on its own. Photos for identification should be taken of animals observed onsite, if possible. If Threatened or Endangered species are discovered during site preparation or construction activities will stop, or be modified to avoid negative impacts to Species at Risk until further direction is provided by the OMNRF. Aylmer District office should be contacted promptly upon the discovery of a Threatened or Endangered species within the construction area.</li> <li>Permanent fencing should be considered to limit movement of wildlife from natural areas into roadways</li> </ul>	<ul style="list-style-type: none"> <li>Minor increases in road mortality may occur due to increased road widths</li> </ul>

# APPENDIX



## CURRICULUM VITAE





## ERIN FITZPATRICK, B.Sc., M.Sc.

*Ecologist*

### Areas of practice

*Environmental Impact Assessments*

*Mining & Aggregate Source Investigations*

*Restoration & Reclamation*

*Renewable Energy*

*Benthic Biomonitoring*

### PROFILE

Erin Fitzpatrick (née Corstorphine) is a terrestrial ecologist with seven years of experience in the natural sciences. Erin has developed and implemented detailed work programs for a variety of natural heritage studies, including Oak Ridges Moraine Conformity Studies, Environmental Impact Studies, and Natural Heritage Assessments under the Renewable Energy Approvals Process. She regularly works on Class Environmental Assessments and Aggregate Resource Investigations where she applies sound biological principles to the assessment and mitigation of impacts to the natural environment. Erin has extensive experience completing floral and faunal species at risk surveys, habitat assessments, tree inventories, natural heritage feature review and mapping, and vegetation assessments including the use of Ecological Land Classification.

Through various roles in the public and private sectors, Erin has gained valuable experience with project design, implementation and management, and has developed the skills necessary to work co-operatively within a multi-disciplinary team to meet project requirements and deadlines.

### EDUCATION

M.Sc., Integrative Biology, University of Guelph, ON	2010
B. Sc. (Honours), Applied Ecology, University of Guelph, ON	2000

### PROFESSIONAL DEVELOPMENT

Standard First Aid, CPR and AED Certification	2017
Ontario Wetland Evaluation System (OWES) Certification, MNR	2014
Aquatic Insect Family Level Identification Course, OBBN	2014
Ecological Land Classification, MNR	2012
Northeast Forest Ecosystem Classification Workshop, MNR	1998
Grass, Sedge and Rush Identification Workshop, MNR	1998

### CAREER

Biologist, Environment, WSP	2014 – Present
Biologist, Environment, GENIVAR (now named WSP)	2011 – 2013
Project Co-ordinator, Biodiversity Institute of Ontario, University of Guelph, ON	2010 – 2011
Lab Technician, Biodiversity Institute of Ontario, University of Guelph, ON	2007r
Wildlife/Species at Risk Biologist Intern, Ministry of Natural Resources, NE Region, South Porcupine, ON	2002

**PROFESSIONAL EXPERIENCE***Environmental Impact Assessments*

- Buckhorn Creek Realignment, Glanbrook Landfill, Hamilton, ON (2016-ongoing): Ecology staff have engaged in consultation with regulatory agencies to determine approval and permitting requirements for the realignment of Buckhorn Creek. The Environmental Impact Study work program includes vegetation surveys, ELC and wetland mapping, fish habitat and community assessment, wildlife survey for birds and amphibians, and Species at Risk screening. Client: City of Hamilton.
- Rapid Transit Environmental Assessment, London, ON (2015-ongoing): WSP ecology staff completed a Subject Lands Status Report describing existing conditions, significant features and species to aid in the selection and design of the preferred route. An Environmental Impact Study assessing the potential for negative impacts to features within the Natural Heritage System will be completed for the preferred routes. Client: City of London.
- Seaton Municipal Transfer Station Environmental Assessment, Seaton, ON (2015-2016): Natural heritage inventories were completed for three candidate sites and approximately 5 km of existing hydro corridors as part of this Class B EA. The work program included agency consultation, species at risk screening, breeding bird surveys, and targeted ELC mapping in the case of the candidate sites. Client: Veridian Connections Inc.
- Henderson Park Environmental Impact Study, Bradford-West Gwillimbury, ON (2015): WSP completed assessments of the terrestrial and aquatic environment to identify Natural Heritage Features and Species at Risk with the potential to be impacted during the creation of Henderson Community Park. Surveys were completed for fish and wildlife habitat, and vegetation, including ELC mapping. Client: Town of Bradford-West Gwillimbury.
- Natural Heritage Feature Inventory for Three Bridge Sites, Hamilton, ON (2014-2015): As part of the on-going maintenance schedule, Natural Heritage Inventories for 3 bridge sites were completed. Work programs included agency consultation, the identification and quantification of Natural Heritage Features and Species at Risk and their habitat. Client: City of Hamilton.
- Twinning of the West Trunk Sewer Class Environmental Assessment, Mississauga, ON (2011-2015): A general tree inventory and vegetation overview was prepared for four sites as part of a larger Class Environmental Assessment. In addition, a mitigation and restoration plan was completed for an open-cut crossing at Loyalist Creek to obtain agency approvals and permitting at the detailed design stage. Client: Region of Peel.
- Yorktech Drive Extension, Class C Environmental Assessment, Markham, ON (2014): As part of a Schedule C Class EA, a Natural Heritage Existing Conditions report was completed. Work on the project included consultation with appropriate regulating agencies, a full field program for vegetation including ELC mapping, wildlife, and potential species at risk in the area, and an impact assessment for the alternative routes. Client: City of Markham.
- Class Environmental Assessment, East-West Connection from Mount Pleasant GO Station to West of Mississauga Road, Brampton, ON (2014): Assessments of the natural environment was completed to inform the evaluation of the alternative alignments and determination of a preferred planning solution. Additional support was provided in the form of regulatory agency consultation and securement of relevant permits and approvals, including those associated with species at risk. Client: City of Brampton.



- Existing Conditions Reports, Two Bridge Sites, Hamilton, ON (2013): A survey of existing conditions and potential for species at risk was conducted as part of a roster assignment for the City of Hamilton. Surveys were conducted for flagged species at risk in the study area, including bird, fish, plant, mammal, and herptile species. Client: City of Hamilton.
- Pickering Class Environmental Assessment, Pickering, ON (2013): As part of a Schedule B Class EA, a Natural Heritage Existing Conditions Report was prepared for the re-routing of three sanitary sewers in the City of Pickering. The field investigation focused on the terrestrial environment surrounding four alternative alignments, and included surveys of vegetation, breeding birds and an assessment of habitat potential for species at risk and other wildlife species. Client: Regional Municipality of Durham.
- Scoped Environmental Impact Studies for Pipeline Maintenance, Toronto, Whitby, ON (2013): Scoped environmental impact studies were prepared to obtain permits and approvals required to complete pipeline inspection and repair work at six sites within Southern Ontario. The reports included detailed site plans outlining site mitigation, tree protection and removal specifications, as well as site restoration. Conservation Authority permits, Parks Access Agreements and approvals for work within Ravine and Natural Feature Protection areas were obtained for the sites. Client: Trans-Northern Pipelines Inc.
- Woodend Conservation Area, Outdoor Living Campus, Niagara-on-the-Lake, ON (2012): A scoped Environmental Impact Study was required for the approval of the proposed re-development of two buildings at the Outdoor Living Campus. As part of the EIS, a survey for Species of Conservation Concern, including surveys for breeding birds, and a Tree Inventory and Preservation Plan was completed. Field observations and secondary source information were used to develop measures to eliminate or mitigate environmental impacts associated with the proposed development. Client: District School Board of Niagara.
- Species at Risk Survey, Waterdown Class Environmental Assessment, Waterdown, Hamilton, ON (2011): A species at risk survey was conducted as part of the Class B Environmental Assessment for new road corridors in the Waterdown area. Surveys were conducted for 35 species at risk in the study area, including bird, plant, mammal, herptile and invertebrate species. Scientific Collector's Permits and approved Animal Care Protocols were required for live-capture trapping of Woodland Vole and Jefferson Salamander. Client: City of Hamilton.
- Mayfield Road Class Environmental Assessment, Brampton, ON (2011): An existing conditions report focusing on the terrestrial environment, including vegetation and wildlife species and their habitat, was prepared as part of the initial stages of the Class Environmental Assessment. Ongoing consultation with the client, design team and regulating agencies will continue in the design stages and impact assessment phases of the project. Client: Region of Peel.

*Mining and Aggregate Source Investigations*

- 2017 Northeastern Region Aggregate Source Investigations, Hearst, Sault Ste. Marie, Chapleau, Sudbury, Temagami, and Englehart, ON (ongoing): Engaged in discussions with Ministry of Natural Resources and Forestry staff to establish study requirements for the spring and summer field program, with specific focus on criteria for Species at Risk. Involvement will continue as regulatory agency liaison and technical support person during project implementation phase and preparation of Natural Environment Technical Reports. Client: Ministry of Transportation of Ontario.

- 2014 Northeastern Region Aggregate Source Investigations, North Bay, Matheson, Massey, Thessalon, Shining Tree, Gogama, and Britt, ON (2014): Field surveys for eight potential aggregate sites were completed to document natural heritage features, significant wildlife habitat, and species at risk. Specific species at risk surveys included basking surveys for Blanding’s Turtle, gestation and hibernation habitat surveys for Massasauga Rattlesnake, and evening surveys for Whip-poor-will. Client: Ministry of Transportation of Ontario.
- 2013 Northeastern Region Aggregate Source Investigations, Wawa, Timmins, Copper Cliff, North Bay, Marten River, and Mattawa, ON (2013): Conducted surveys for natural heritage features and species at risk for seven proposed aggregate sites in Northeastern Ontario. Species specific surveys of note included evening Whip-poor-will surveys for all seven sites. Client: Ministry of Transportation of Ontario.
- Minto Mine Project, Shining Tree, ON (2013): Conducted surveys for natural heritage features and species at risk in support of an advanced exploration mining permit for a mining exploration company. Work included the collection of background information, consultation with appropriate regulating agencies, field investigations, and reporting. Client: Creso-Nichromet.
- 2012 Northeastern Region Aggregate Source Investigations, Englehart, Elk Lake, Foleyet, Wawa, Chelmsford, Sudbury, North Bay and Mattawa, ON (2013): Conducted surveys for natural heritage features and species at risk for nine proposed aggregate sites in Northeastern Ontario. Specific species at risk surveys included surveys for Whip-poor-will and Massasauga Rattlesnake habitat. In addition to preparing Natural Environment reports for nine of these sites, assisted the client with Endangered Species Act Overall Benefit Permit Applications and Avoidance and Mitigation Measures Reports for five of the sites. Client: Ministry of Transportation of Ontario.
- 2011 Northeastern Region Aggregate Source Investigations, Cochrane, Englehart, Chapleau, Chelmsford, Massey and Espanola, ON (2012): Surveys of natural heritage features, including species at risk, were conducted for eight proposed aggregate sites. As part of the Aggregate Permit Application process, Natural Environment reports were prepared to identify the presence of significant natural heritage features, assess the potential for negative impacts on these features and their ecological functions, and to provide suggestions for preventative, mitigative and/or remedial measures. Client: Ministry of Transportation of Ontario.

*Restoration and Reclamation*

- Innisfil Closed Landfill Remediation, Innisfil, ON (2013): The County of Simcoe was tasked with remediating a historic closed landfill site. The landfill was located within a mapped Provincially Significant Wetland, as well as within some sensitive natural areas. Provided an existing conditions report, applied for appropriate permitting, and developed a mitigation and planting plan for the site to ensure that the surrounding natural environment was not negatively impacted by the refuse removal. Client: County of Simcoe.
- Ramara Closed Landfill Remediation, Ramara, ON (2013): The County of Simcoe was tasked with remediating a historic closed landfill. The landfill was located within a large wetland complex, as well as within some sensitive natural areas. Provided an existing conditions report, applied for appropriate permitting, and developed a mitigation and planting plan for the site to ensure that the surrounding natural environment was not negatively impacted by the refuse removal. Client: County of Simcoe.

- Remediation Plan for Wutai Shan Buddhist Temple, Township of Cavan, ON (2012): Creation of a remediation plan to ensure that past and future development at the temple site would comply with requirements laid out by the local Conservation Authority and the Ministry of Natural Resources. As part of this remediation plan, a description of existing conditions with respect to terrestrial and aquatic natural heritage features was prepared to assess the potential for future environmental impacts, and mitigate existing impacts associated with development and site alteration. Client: Cham Shan Temple.

*Renewable Energy*

- Renewable Energy (Solar) Natural Heritage Assessments, Lindsay and Oro-Medonte, ON (2011-2014): As part of a multi-disciplinary team, Natural Heritage Assessments and species at risk surveys were completed to meet the environmental requirements outlined with Ontario Regulation 359/09. As part of these assessments Ecological Land Classification, habitat assessment, and environmental impact studies were completed to mitigate potential negative impacts to identified natural heritage features within the vicinity of the proposed solar farms. Following extensive consultation with regulatory agencies, desktop studies and field investigations, MNR approvals were obtained for both sites. Pre-construction surveys were completed in 2013 to meet REA approval requirements for construction in 2014. Client: SunEdison.
- Renewable Energy (Solar and Wind) Natural Heritage Assessments, Various locations, ON (2011-2013): Ontario Regulation 359/09 requires proposed alternative energy projects to complete Natural Heritage Assessments investigating significant wildlife and their habitats, and the potential for proposed projects to have impacts on existing natural features. Completed numerous desktop studies and reports assessing the potential impacts on natural heritage features, including surface water features, associated with proposed renewable energy projects. Client: Various.

*Benthic Biomonitoring*

- Benthic Biomonitoring for the Rosewarne Landfill Site, Bracebridge, ON (2013-2014): As part of an ongoing monitoring program, benthic biomonitoring has been completed as a means to assess water quality within the vicinity of the Rosewarne Landfill. The benthic monitoring program consists of annual spring and fall samples to document changes in the abundance and community structure of macroinvertebrates, data analysis and reporting. Current and historical data is assessed to determine if spatial and/or temporal trends in water quality exist. The project is entering year three of a five year program. Client: District Municipality of Muskoka.
- Benthic Biomonitoring, Green Lane Landfill Site, County of Elgin, ON (2013-2014): Benthic surveys have been completed during 2013 and 2014 as part of a five year monitoring program to assess water quality upstream and downstream of the leachate treatment plant's point of discharge for treated effluent. Inferences regarding present and historical water quality conditions were based on results of annual benthic macroinvertebrate sampling. Client: City of Toronto.

**PUBLICATIONS AND PRESENTATIONS**

*Publications*

- Layton, K.K.S., E.A. Corstorphine, P.D.N. Hebert. 2016. "Exploring Canadian Echinoderm Diversity through DNA Barcodes." *PLoS ONE 11* (11): e0166118. doi:10.1371/journal.pone.0166118.



**ERIN FITZPATRICK, B.Sc., M.Sc.**

*Ecologist*

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- Mincks, Hardy, S., C.M. Carr, M. Hardman, D. Steinke, E. Corstorphine, and C. Mah. 2010. “Biodiversity and phylogeography of Arctic marine fauna: insights from molecular tools.” *Marine Biodiversity*, 41(1): 195-210.
- Corstorphine, E.A. 2010. “DNA Barcoding of Echinoderms: Species Diversity and Patterns of Molecular Evolution” M.Sc. Thesis. University of Guelph.

*Presentations*

- Corstorphine, E. and P.D.N. Hebert. “Do life histories and environmental factors affect molecular evolution of the cytochrome c oxidase subunit I gene in the Echinodermata?” Evolution, University of Minnesota, Minneapolis, MN (*poster presentation*), 2008.





**KIM LEBRUN, B.SC.,**  
*Senior Ecologist - Fisheries*

**Areas of practice**

*Impact and Serious Harm Assessments on Fish and Fish Habitat*

*Federal Fisheries Act Authorizations and Off-setting Plan Development/Monitoring*

*Species at Risk Assessments / Development of Overall Benefit Plans*

*Detailed Assessments of Fish and Fish Habitat*

*Collection and Identification of Benthic Invertebrates*

*Assessment of Construction Impacts/Post Construction Monitoring*

*Fluvial Geomorphological Assessments/Design of Channel Realignment*

**Languages**

*English*

**PROFILE**

Kim LeBrun has extensive experience in aquatic ecosystems throughout Ontario and the Northern United States. She has undertaken: sampling of fish communities and populations including Redside Dace electrofishing on Irvine Creek, assessments of fish habitats, collection and identification of benthic invertebrates, and basic flow and water quality monitoring.

Kim has conducted construction monitoring on several watercourses in southern Ontario, including collection and identification of pre-construction baseline data, during construction data collection, and post construction assessment and documentation of construction related impacts for both DFO and Conservation Authority permits.

She has experience in collecting fisheries and fish habitat data for subdivision and subwatershed studies on watercourses throughout South and Central Ontario. Responsibilities for these projects include identification and collection of background information by study area, fish habitat and community assessment and sampling (habitat mapping, electrofishing, spawning surveys), constraint mapping, assessment of construction impacts, and recommendations for mitigation.

Kim also obtained fluvial geomorphological experience in over 100 watercourses in Ontario and the United States. She conducted long term monitoring of several tributaries of the Rouge River in Markham and Richmond Hill; construction monitoring for road crossings, extensions and channel re-alignments; sub-watershed studies and small-scale erosion concerns.

**EDUCATION**

H.B.Sc., Biology and Environmental Sciences, Sir Wilfrid Laurier University, Ontario (2001) 2001

**PROFESSIONAL DEVELOPMENT**

Class 1 Backpack Electrofishing Crew Member	2016
RAQ's Certified Fisheries Assessment Specialist	2014
CN Safety for Canadian Contractors	2014
Emergency First Aid and CPR	2014
Certification for MTO / DFO / MNR Environmental Guide for Fish and Fish Habitat,	2009 updated 2013
Ontario Benthos Biomonitoring Network Certificate of Training)	2011
Certificate for Linear Construction - Stormwater compliance for road and utility construction	2011
Certificate for TMDL - Total Maximum Daily Load for road and utility construction	2011



### **PROFESSIONAL ASSOCIATIONS**

Member – American Fisheries Society

Newsletter Co-Editor – American Fisheries Society – Ontario Chapter

### **CAREER**

Senior Ecologist – Fisheries, MMM Group Ltd. (now WSP Canada Group Limited, Kitchener, ON)	2015-Present
Ecologist - Fisheries, MMM Group Ltd. (now WSP Canada Group Limited, Kitchener, ON)	2007-2015
Fluvial Systems Analyst, Parish Geomorphic Ltd., Georgetown, ON	2002 – 2007

### **SELECTED PROJECT EXPERIENCE**

#### **Linear Infrastructure**

- Senior Aquatic Ecologist, Highways 566 and 66 Rehabilitation (GWP 5013-E-0031), MTO Northeast Region, Matachewan, ON (2015 - on-going): This project involved the assessment of watercourse crossings replacement / rehabilitation works for a number of watercrossings along a section of Highway 566 from 0.5 km West of Highway 66 to Highway 66, and along Highway 66 from Highway 566 easterly 15.2 km to 10.6 km East of Highway 65, Matachewan area, Ontario. Responsibilities included senior project oversight (including budget management), coordination of field investigations including multiple seasons of surveys for both fish and aquatic Species at Risk turtles, fish and fish habitat assessment, risk assessment and documentation of project risk related to Fisheries Act authorizations.
- Senior Aquatic Ecologist, Highway 11 Rehabilitation (GWP 5110-06-00), MTO Northeast Region, North Bay, ON (2014 - 2015): This project involved the assessment of watercourse crossings replacement / rehabilitation works for a number of watercrossings along Highway 11 just north of North Bay, Ontario. Responsibilities included senior project oversight (including budget management), coordination of field investigations including both aquatic and terrestrial investigations, fish and fish habitat assessment, risk assessment and documentation of project risk related to Fisheries Act authorizations.
- Senior Aquatic Ecologist, Highway 11 Rehabilitation (GWP 5200-10-00), MTO Northeast Region, Temagami, ON (2013 - 2014): This project involved the assessment of watercourse crossings replacement / rehabilitation works for a number of watercrossings along Highway 11 just south of the Town of Temagami. Responsibilities included senior project oversight (including budget management), coordination of field investigations including multiple seasons of surveys for both fish and aquatic Species at Risk turtles, fish and fish habitat assessment, risk assessment and documentation of project risk related to Fisheries Act authorizations.
- Senior Aquatic Ecologist, Highway 11b Rehabilitation (GWP 5421-04-00), MTO Northeast Region, Coleman, ON (2013 - 2014): This project involved the assessment of watercourse crossings replacement / rehabilitation works for a number of watercrossings along Highway 11b just south of the Town of Cobalt. Responsibilities included senior project oversight (including budget management), coordination of field investigations including fall spawning surveys, fish and fish habitat assessment, risk assessment and documentation of project risk related to Fisheries Act authorizations.
- Senior Aquatic Ecologist, Highway 560 Rehabilitation (GWP 5199-10-00), MTO Northeast Region, Gowganda, ON (2013 - 2014): This project involved the assessment of watercourse crossings replacement / rehabilitation works for a number of watercrossings throughout along Highway 560 east and west of the town of Gowganda. Responsibilities included senior project oversight (including budget management), coordination of field investigations including fall spawning surveys, fish and fish habitat assessment, risk assessment and documentation of project risk related to Fisheries Act authorizations.



- Senior Aquatic Ecologist, Highway 112 and 650 Rehabilitation (GWP 5110-06-00), MTO Northeast Region, Kirkland Lake, ON (2013 - 2015): This project involved the assessment of watercourse crossings replacement / rehabilitation works for a number of watercrossings along Highways 112 and 650 from Highway 11 to Highway 66, as well as a short section of Highway 650 from its intersection with Highway 112 extending 1.6 km east. Responsibilities included senior project oversight (including budget management), coordination of field investigations including multiple seasons of surveys for both fish and aquatic Species at Risk turtles, fish and fish habitat assessment, risk assessment and documentation of project risk related to Fisheries Act authorizations.
- Aquatic Ecologist, Highway 407 East Completion - Brock Road to Leask Road, MTO Central region, Toronto-Oshawa, ON (2009 - 2013): This project included the development of a preferred route for a new highway corridor extension from the existing highway 407, east to highway 135 / 15. Works completed included preliminary assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, identification and design of crossing known to support Redside Dace, development of mitigation measures and preliminary assessment of project risk to fish and fish habitat for a number of watercourse crossings along the project limits. Recommendations for future works and enhancement opportunities were also reviewed and included in the report document.
- Aquatic Ecologist, Highway 69 from 1.0 km north of New Highway 559 Interchange to 5.3 km North of Existing Woods Road, MTO NE Region, North of Parry Sound, ON (on-going): This project included the four-laning of a section of Highway 69 from Highway 559 to Woods Road and included new culvert and bridge constructions, existing culvert replacements and new corridor sections. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures and assessment of project risk to fish and fish habitat for a number of watercourses along the study limits. Submission of DFO notification forms was also completed, including preparation of Fish Habitat compensation plans negotiated with relevant agencies (MNRF, CA's, DFO) to obtain Fisheries Act Authorization and CEEA Clearance.
- Aquatic Ecologist, Dundas Street BRT (3 sections) from Brant Street to Trafalgar Road, MTO, Oakville – Burlington, ON (2014): The project required the assessment of watercourses along Highway 5 / Dundas Street for a proposed widened corridor to accommodate the growth plans of the towns of Burlington and Oakville. Works completed included fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures and assessment of project risk to fish and fish habitat for a number of watercourses along the study area.
- Aquatic Ecologist, Highway 11 / 17 Route Planning Study from North Bay to Bonfield, MTO, ON (2013): This project involved the assessment of natural environmental features along a new highway corridor, assessment of potential preliminary impacts and mitigation measures proposed to address the impacts.
- Aquatic Ecologist, Highway 11 / 17 Route Planning and Fisheries Impact 630 to 24.4 km East of Highway 533, MTO, Mattawa, ON (2013): This project involved the assessment of natural environmental features along a new highway corridor, assessment of potential preliminary impacts, and mitigation measures proposed to address the impacts.
- Aquatic Ecologist, Mississauga BRT from Winston Churchill Boulevard to Erin Mills Parkway, City of Mississauga, ON (2011): This project required the assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures and assessment of project risk to fish and fish habitat for a number of watercourses along the study area. Submission of DFO notification forms was also completed.
- Aquatic Ecologist, West Transitway Extension from Bayshore Station to Moodie Drive, City of Ottawa, ON (2011): This project involved the widening of the highway corridor to accommodate a transitway system adjacent to the existing Highway 416. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures and assessment of project risk to fish and fish habitat for a number of watercourses along the study area. Submission of DFO notification forms was also completed.
- Aquatic Ecologist, Highway 407 Extension Brock Road to Oshawa, MTO Central Region, Toronto – Oshawa, ON (2010): This project included the development of a preferred route for a new highway corridor extension from the existing highway 407, east to Highway 135 / 15. Works completed included preliminary assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures and preliminary assessment of project risk to fish and fish habitat for a number of watercourses along the study limits.



Recommendations for future works and enhancement opportunities were also reviewed and included in the report document.

#### **Aquatic Habitat and Fisheries Assessment - Transportation Planning, Design and Construction**

- Senior Aquatic Ecologist, Hwy Structures - New Liskeard (GWP 5014-E-0019), MTO Northeast Region, New Liskeard Area, ON (2015 - on-going): This project involves the rehabilitation / replacement of 11 highway crossing structures throughout the greater New Liskeard Area. Roles included senior project oversight and field investigations lead, aquatic habitat detailed field investigations, including fall spawning surveys, Species at Risk habitat assessments and screening documentation, project risk assessment and documentation of project risk, including DFO Request for Reviews and Low Risk Notification forms.
- Senior Aquatic Ecologist, Local Road Board Structures - New Liskeard (GWP 5014-E-0024), MTO Northeast Region, New Liskeard Area, ON (2015 - on-going): This project involves the rehabilitation / replacement of seven local road crossing structures throughout the greater New Liskeard Area. Roles included senior project oversight and field investigations lead, aquatic habitat detailed field investigations, including fall spawning surveys, Species at Risk habitat assessments and screening documentation, project risk assessment and documentation of project risk, including DFO Request for Reviews and Low Risk Notification forms.
- Aquatic Ecologist, (Mega 4) 59 Bridge Rehabilitations (GWP 2013-3021), MTO Central Region, Ontario (2013 - on-going): This project involves the rehabilitation / replacement of 59 highway crossing structures throughout southwestern Ontario. Roles included field investigations lead, aquatic habitat detailed field investigations, including Species at Risk fish and mussel habitat assessments and screening documentation, project risk assessment and documentation of project risk, including DFO Request for Reviews and Low Risk Notification forms.
- Aquatic Ecologist, Highway 69 Four-laning from 1.0 km north of New Highway 559 Interchange to 5.3 km North of Existing Woods Road, MTO, French River, ON (on-going): This project included the four-laning of a section of Highway 69 from Highway 559 to Woods Road and included new culvert and bridge constructions, existing culvert replacement and new corridor sections. Works included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures, and assessment of project risk to fish and fish habitat for a number of watercourses along the study area. Submission of DFO notification forms was also completed, including preparation of Fish Habitat Compensation plans negotiated with relevant agencies (MNRF, CA's, DFO) to obtain Fisheries Act Authorization and CEAA clearance.
- Aquatic Ecologist, Highway 17 Four-laning Manitoba to Kenora Sections 1 and 2, MTO, Kenora, ON (on-going): This project involved the four-laning of a section of Highway 17 from the Manitoba / Ontario border to the Town of Kenora. Works completed under this assignment included assessment of fish and fish habitat existing conditions, and sensitivity analysis, assessment of potential impacts and development of proposed mitigation measures.
- Aquatic Ecologist, Wonderland Road EIS from Highway 402 to Exeter Road, City of London, ON, (on-going): This project included proposed improvements to Wonderland Road from Highway 402 north to Exeter Road. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts to fish and fish habitat, and development of mitigation measures addressing these impacts.
- Aquatic Ecologist, Highway 26 Collingwood to Thornbury Road Resurfacing and Culvert Replacement, MTO, Town of Blue Mountains, ON (2015): This project included highway resurfacing and culvert works along a section of Highway 26 from Thornbury to Collingwood, with channel regrading works, culvert replacements and ditching. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures, including channel realignment of two channels, and assessment of project risk to fish and fish habitat for a number of watercourses along the study area. Submission of DFO notification forms was also completed.
- Aquatic Ecologist, Highway 11 / 17 Four-laning Red Rock to Nipigon, MTO, Red Rock, ON (2014): This project included the four-laning of a section of Highway 11 / 17 east of Red Rock. Works included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures, including channel construction of a new bridge on Nipigon River with aquatic SAR, and assessment of project risk to



fish and fish habitat for a number of watercourses along the study area. Submission of DFO notification forms was also completed.

- Aquatic Ecologist, Retainer Assignments (6 assignments), MTO – NE Region, Temagami, New Liskeard, Kirkland Lake, Cobalt, Gowganga, North Bay, ON (2013-2014): wherein fish and fish habitat existing conditions were assessed, potential impacts identified, mitigation measures developed to address potential impacts and an including risk assessment risk of the proposed works on fish and fish habitat for six design built assignments.
- Aquatic Ecologist, Highway 17 Mattawa Realignment from 8 km east of Highway 630 to 24.4 km east of Highway 533, MTO NE Region, Mattawa, ON (2013): This project involved the assessment of natural environmental features along a new highway corridor sections, assessment of potential preliminary impacts, and mitigation measures proposed to address the potential impacts.
- Aquatic Ecologist, Highway 144 Rehabilitation (3 sections) from Township of Dowling north to 52 km south of Highway 560, MTO – NE Region, Greater Sudbury Area, ON (2013): These projects included highway resurfacing and culvert works along three sections of Highway 144 from Dowling Township north to Highway 560, with culvert replacement and lining works. Works completed include assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures, and assessment of project risk to fish and fish habitat for a number of watercourses along the study area. Submission of DFO notification forms was also completed.
- Aquatic Ecologist, Highway 6 Rehabilitation from Springmount to Hepworth, MTO NE Region, Springmount – Hepworth, ON (2013): This project included the highway resurfacing, replacement of three bridges and a number of culverts along the study limits. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures, and assessment of project risk to fish and fish habitat for a number of watercourse crossings within the study area. Submission of DFO notification forms was also completed.
- Aquatic Ecologist, Highway 60 Huntsville to Dwight, MTO NE Region, Huntsville – Dwight, ON (2013): This project included the highway resurfacing and potential widening of a section of Highway 60 between Huntsville and Dwight, including interchange works at Highway 60 and Highway 11 interchange. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures, and preliminary assessment of project risk to fish and fish habitat for a number of watercourse crossings within the study area.
- Aquatic Ecologist, Highway 427 Albion Road to Highway 7, MTO Central Region, Brampton, ON (2013): This project included the widening of a section of Highway 427 from Albion Road to Highway 7 and future planning route for the Highway 427 Transitway corridor. Potential works included structure extensions, replacements, and elimination of drainage features. Works completed included assessment of fish and fish habitat existing conditions, assessment of preliminary proposed works for the highway widening and transitway corridor development, assessment of potential impacts, development of preliminary mitigation measures, and assessment of project risk to fish and fish habitat for a number of watercourse crossings within the study area.
- Aquatic Ecologist, Hamilton Bridges, City of Hamilton, Greenville and Woodburn, ON (2013): This project included proposed improvements to two bridges over Spencer Creek and Twenty Mile Creek respectively. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts to fish and fish habitat, and development of mitigation measures addressing these impacts.
- Aquatic Ecologist, Highway 11 / 17 Four-laning Hodder Avenue to Highway 527, MTO – NW Region Thunder Bay, ON (2012): This project included the four-laning of a section of Highway 11 / 17 east of Thunder Bay. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures, including channel realignment of two channels, and assessment of project risk to fish and fish habitat for a number of watercourses along the study area. Submission of DFO notification forms was also completed.
- Aquatic Ecologist, Highway 26 Widening, Pretty River Road to Sixth Line, MTO Central Region, Collingwood, ON (2012): This project included the widening of a section of Highway 26 from Pretty River Road to Sixth Line, and included



potential structure extensions, and replacements. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures, and assessment of project risk to fish and fish habitat for a number of watercourse crossings within the study area. Submission of DFO notification forms was also completed.

- Aquatic Ecologist, Highway 8 Road Improvements, City of Hamilton, Greenville, ON (2012): This project included the resurfacing, and paving of shoulders associated with Highway 8 through Greenville, Ontario. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works for bridge replacement road works, assessment of potential impacts to fish and fish habitat, and development of mitigation measures addressing these impacts.
- Aquatic Ecologist, Highway 11 / 17 527 to Mackenzie Station, MTO NW Region, Mackenzie Station, ON (2011): This project included the four-laning of a section of Highway 11 / 17 east of Thunder Bay, and included structure replacements, new structural crossings and barrier removals (perched culverts). Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures, and assessment of project risk to fish and fish habitat for the five watercourse crossings within the study area. Submission of DFO notification forms was also completed.
- Aquatic Ecologist, Highway 11 / 17 Red Rock to Nipigon, MTO NW Region, Red Rock, ON (2011): This project included the four-laning of a section of Highway 11 / 17 east of Red Rock, and included structure replacements, new structural crossings, and new bridge crossing over Nipigon River with aquatic species at risk. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures including H-pile drilling issues on Lake Sturgeon, Brook Trout and Walleye spawning areas, and assessment of project risk to fish and fish habitat for a number of watercourse crossings within the study area. Submission of DFO notification forms was also completed.
- Aquatic Ecologist, Highway 60 Bridges, MTO NE Region, Algonquin Park, ON (2010): This project involved the replacement of two bridges along Highway 60 over Clark Creek and Kearney Creek in Algonquin Park. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works and potential impacts, development of mitigation measures, and assessment of project risk to fish and fish habitat for the two watercourse crossings within the study area. Submission of DFO notification forms was also completed.
- Aquatic Ecologist, Highway 417 Widening, Eagleson Road to Highway 7, Ottawa, ON (2009): This project included the widening of a section of Highway 417 from Eagleson Road to Highway 7 and future planning route for the Highway 417 Transitway corridor. Potential works included structure extensions and replacements. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works for the highway widening and transitway corridor development, assessment of potential impacts, development of mitigation measures, and assessment of project risk to fish and fish habitat for a number of watercourse crossings within the study area. Submission of DFO notification forms was also completed.
- Aquatic Ecologist, Barnstable Bridge Replacement, 16 Mile Creek at Lower Baseline and Dundas Street; Town of Milton, ON (2007): This project included the replacement of Barnstable Bridge over the east branch of Sixteen Mile Creek in the Town of Milton. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed works for bridge replacement and potential impacts to fish and fish habitat. Monitoring of the fish and fish habitat during the construction phase, including multiple fish relocations and Erosion and Sediment Control measures monitoring was also completed as part of the Fisheries Act authorization.

#### Resource Management - Watershed and Natural Heritage Planning

- Aquatic Ecologist, Forbes Creek, Mattamy (Hespler) Limited, Cambridge, ON, (2014): This project included the realigning of Forbes Creek, a coldwater river, and re-establishment of Brook Trout spawning habitat within study reaches. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed channel realignment of potential impacts to fish and fish habitat, development of mitigation measures addressing these impacts, pre, during and post construction monitoring of the fish and fish habitat within Forbes Creek to address



Fisheries Act Authorization requirements. Works also included multiple fish rescue / relocation visits as the works were staged.

- Aquatic Ecologist, 16 Mile Creek at Dundas Bridge, Region of Halton, Burlington, ON (2013): This project included the widening of the Dundas Street Crossing over 16 Mile Creek with channel realignment of creek below new bridge. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed channel realignment and potential impacts to fish and fish habitat, development of mitigation measures addressing these impacts, and pre, during and post construction monitoring of the fish and fish habitat within 16 Mile Creek to address Fisheries Act Authorization requirements. Works also included multiple fish rescue / relocation visits as the works were staged.

#### Resource Management - Community Planning

- Aquatic Ecologist, Vales of Humber, City of Brampton, ON, 2009: This project included the development of a Master Environmental Servicing Plan for a parcel of land in southwest Brampton. Works completed included assessment of fish and fish habitat existing conditions, assessment of proposed municipal road crossings and development land parcels, and potential impacts to fish and fish habitat from this development, development of mitigation measures addressing these impacts.