Natural Heritage Report

STAGE 2 ION LRT
FROM KITCHENER TO CAMBRIDGE
TRANSIT PROJECT ASSESSMENT PROCESS

prepared for:

prepared by:

JULY 2020

NATURAL HERITAGE REPORT

STAGE 2 ION LRT FROM KITCHENER TO CAMBRIDGE TRANSIT PROJECT ASSESSMENT PROCESS

prepared by:

Lisa Catcher, Hons. BA
Botanist/ISA Certified Arborist

Erin Blenkhorn, B.Sc.
Aquatic Biologist/
Ecologist
CISEC Inspector

Julia Shonfield, Ph.D
Terrestrial Ecologist

reviewed by:

GRANT KAUFFMAN, M.E.S.
Vice President, Ontario Region

LGL Limited
environmental research associates
22 Fisher Street, P.O. Box 280
King City, Ontario L7B 1A6
Telephone: 905-833-1244
Facsimile: 905-833-1255
URL: www.lgl.com

July 2020

LGL Project # TA8430

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

In June 2011, Region of Waterloo Council approved a staged approach to Light Rail Transit (LRT) from Waterloo to Cambridge. Stage 1 ION includes LRT from Waterloo to Kitchener, which is currently under construction. Stage 1 ION also includes Bus Rapid Transit (BRT) between Kitchener and Cambridge, which was launched in September 2015. Stage 2 ION will see BRT replaced by LRT, creating a continuous LRT system across the Region's three urban centres.

The environmental impact of this transit project is being assessed in accordance with the Transit Project Assessment Process (TPAP) as outlined in Ontario Regulation 231/08. As part of the TPAP, an Environmental Project Report is in preparation and will be available for public review in 2020.

WSP was retained by the Region of Waterloo to lead the Stage 2 ION LRT project and LGL Limited was retained by WSP to carry out a natural heritage assessment for this project. The purpose of this Natural Heritage Report is to document the results of the natural heritage investigation including data collection and analysis, field investigations, impact assessment and identification of mitigation measures.

2.0 STUDY AREA

The study area extends from CF Fairview Park Mall in Kitchener to Downtown Cambridge. The study area was established to encompass route alternatives within each of four sub-areas: Fairway; Kitchener and North Cambridge; Central Cambridge; and, South Cambridge. The study area is presented in **Figure 1**.

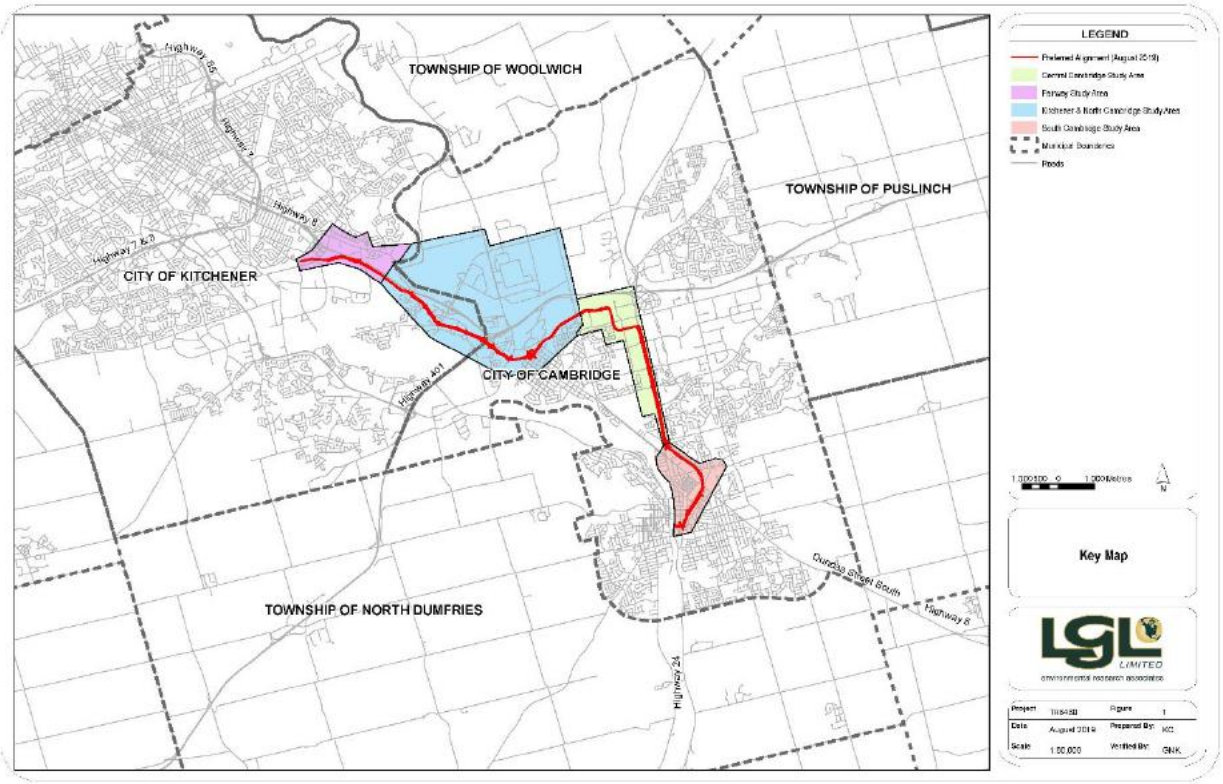


FIGURE 1: STUDY AREA

3.0 EXISTING CONDITIONS

This section describes the existing conditions in the study area related to natural heritage, including: physiography, bedrock and surficial geology and soils; fish and fish habitat: vegetation and vegetation communities; wildlife and wildlife habitat; and, designated natural areas.

3.1 Physiography, Bedrock and Surficial Geology and Soils

3.1.1 Purpose

A secondary source investigation was undertaken to identify physiography, bedrock and surficial geology and soils within the study area.

3.1.2 Data Sources

Information regarding physiography, bedrock and surficial geology and soils within the study area was obtained through:

- Chapman, L.J. and D.F. Putnam. 1984. *The Physiography of Southern Ontario.* Published for the Ontario Geological Survey Special Volume 2;
- Lake Erie Source Protection Technical Team. 2008. Draft Grand River Watershed Characterization Report;
- Ontario Geological Survey 1991. Bedrock geology of Ontario, southern sheet; Ontario Geological Survey, Map 2544, scale 1: 1 000 000;
- Barnett, P.J., Cowan, W.R. and Henry, A.P. 1991. Quaternary geology of Ontario, southern sheet. Ontario, Geological Survey, Map 2556, scale 1:1 000 000; and,
- Present, E.W. and R.E. Wicklund. 1971. *The Soils of Waterloo County*. Report #44 of the Ontario Soil Survey.

3.1.3 Results

The study area lies within the Waterloo Hills and Guelph Drumlin Field physiographic regions. The Waterloo Hills is characterized by Chapman and Putnam (1984) as sandy hills, including ridges of sandy till and other kames. Fine sand is prevalent within the region, and the soils are well drained. The Guelph Drumlin Field is characterized by loamy and calcareous till, containing fragments of underlying red shale. The till throughout the region is stony with large surface boulders in some locations. There are numerous interconnecting cross-valleys between drumlins, with sand and gravel terraces and swampy bottoms.

Bedrock geology comprises the Guelph Bedrock Formation that is middle Silurian in age and comprised of brown or tan dolostone.

Surficial geology comprises glaciofluvial outwash deposits in the north part of the study area, glaciofluvial ice-contact deposits in the south part of the study area, with pockets of Port Stanley Till. Glaciofluvial outwash deposits consist of gravel and sand, including proglacial river and deltaic deposits. Glaciofluvial ice-contact deposits consist of gravel and sand, minor till, including esker, kame and end moraine ice marginal delta and subaqueous fan deposits. Port Stanley till consists of a silt to sandy silt matrix becoming silt to silty clay near Lake Erie, strong calcareous, with moderate to low clast content decreasing southward.

The soils found in the study area are primarily Burford – Fox, a gently sloping loamy sand. Other soils found within the study area include Brant – Waterloo, a gently sloping loam; Grand – Kirkland, a level loam; Guelph, a gently sloping loam; Farmington, a level sandy loam; and Freeport – Woolwich, a gently sloping sand over loam. All of the soils in the study area have good drainage.

3.2 Fisheries and Aquatic Ecosystems

3.2.1 Purpose

A secondary source investigation and field surveys were carried out to characterize fisheries and aquatic ecosystems within the study area.

3.2.2 Data Sources

Information regarding fisheries and aquatic habitat within the study area was obtained through:

- Species at risk screening through Department of Fisheries and Oceans (DFO)/Grand River Conservation Authority (GRCA) aquatic species at risk mapping;
- the Natural Heritage Information Centre data available through *Make a Map* (MNRF 2019);
- Land Information Ontario (LIO), Aquatic Resource Area (ARA) layers (2019);
- Review of the Grand River Fisheries Management Plan (GRCA 2005);
- Review of the Surface Water Quality Monitoring Program Fisheries Data (LGL Limited 2010, 2013); and,
- Review of the Hidden Valley Road Extension studies (LGL Limited 2014).

In addition, correspondence with the Ministry of Natural Resources and Forestry (MNRF) Guelph District Office and GRCA was carried out.

LGL conducted surveys of aquatic habitat on the following dates:

- August 29, September 2, and September 3, 2014;
- May 13, May 29, 2015;
- October 11, 2016 (Mussel habitat review); and,
- September 21 and October 10, 2018.

Field investigations were conducted to characterize multi-seasonal aquatic habitat within the study area. The fish habitat along the proposed ROW was assessed approximately 50 m upstream and 100 m downstream of each watercourse feature, where applicable and accessible. Some of these field visits were conducted on previous LRT alignments and formed part of the route selection process. Only data from the preferred alignment is included herein.

Physical habitat features were surveyed in sufficient detail to enable identification of key habitat types. The physical habitat attributes assessed included: (a) instream cover, (b) bank stability, (c) substrate characteristics, (d) stream dimensions, (e) barriers, (f) stream morphology, (g) terrain characteristics, (h) stream canopy cover, (i) stream gradient, (j) aquatic vegetation, (k) ground water seepage areas, and (l) general comments. Representative photographs were taken. **Figure 2a-2l** presents the location of the watercourses and an aquatic habitat summary is presented below. Site photos of the crossings are provided in **Appendix A**.

LEGEND

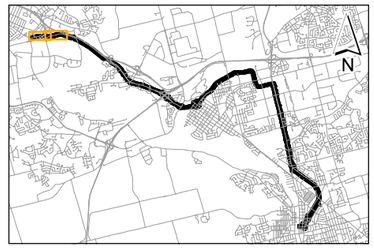
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



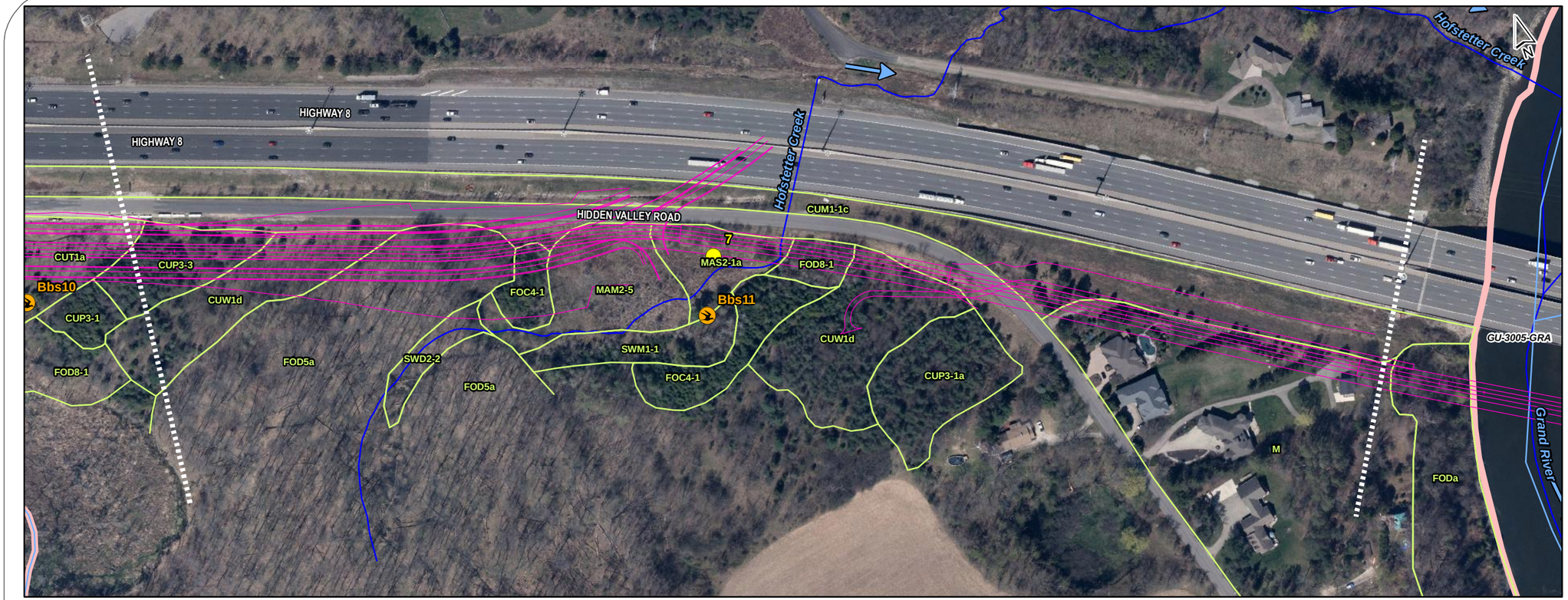
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2a
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK



LEGEND

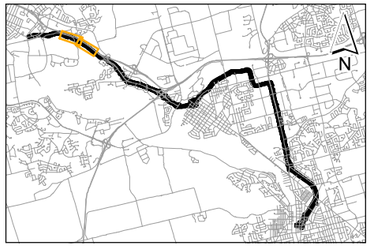
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



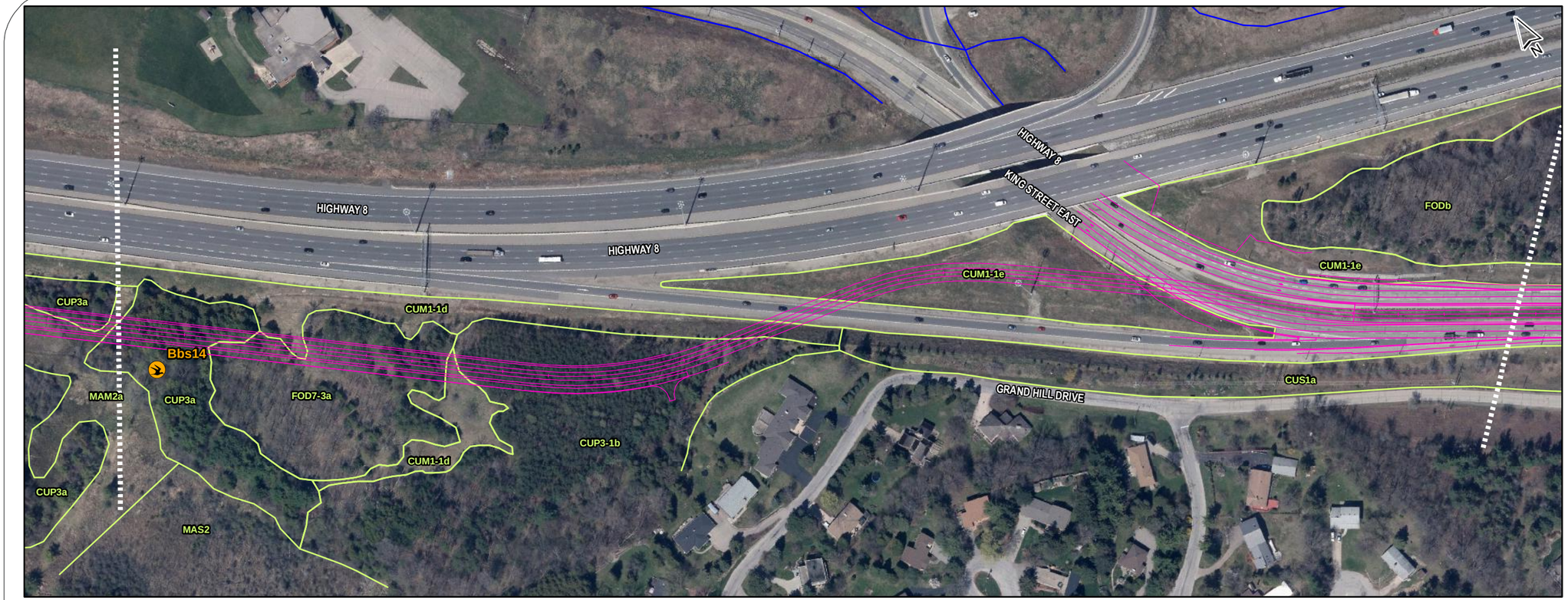
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

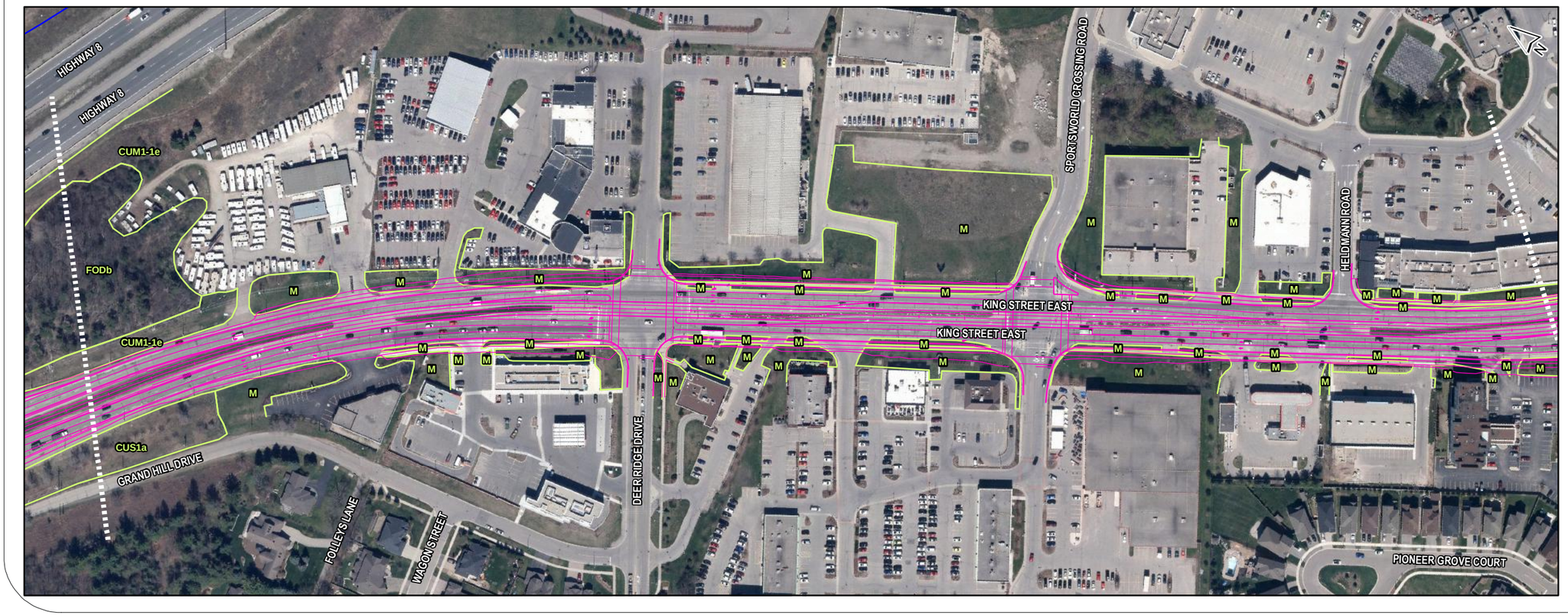
50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2b
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK





LEGEND

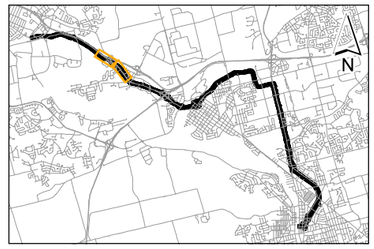
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



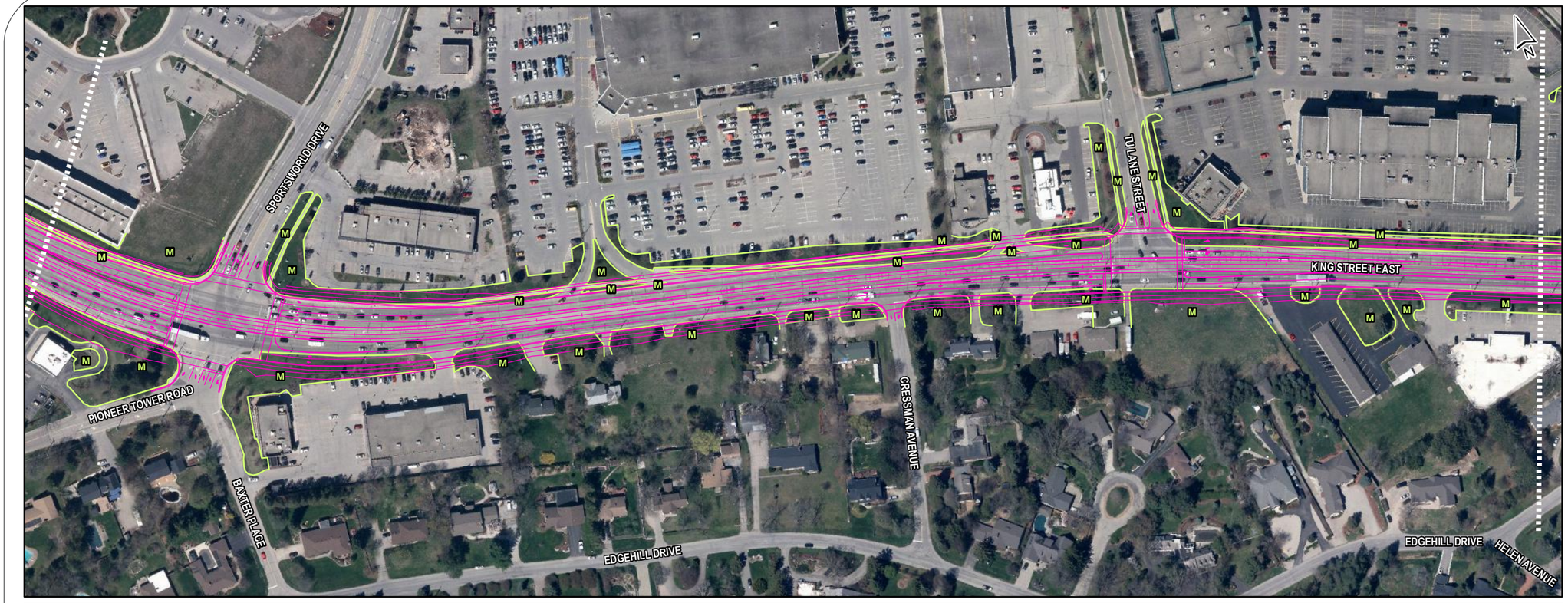
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

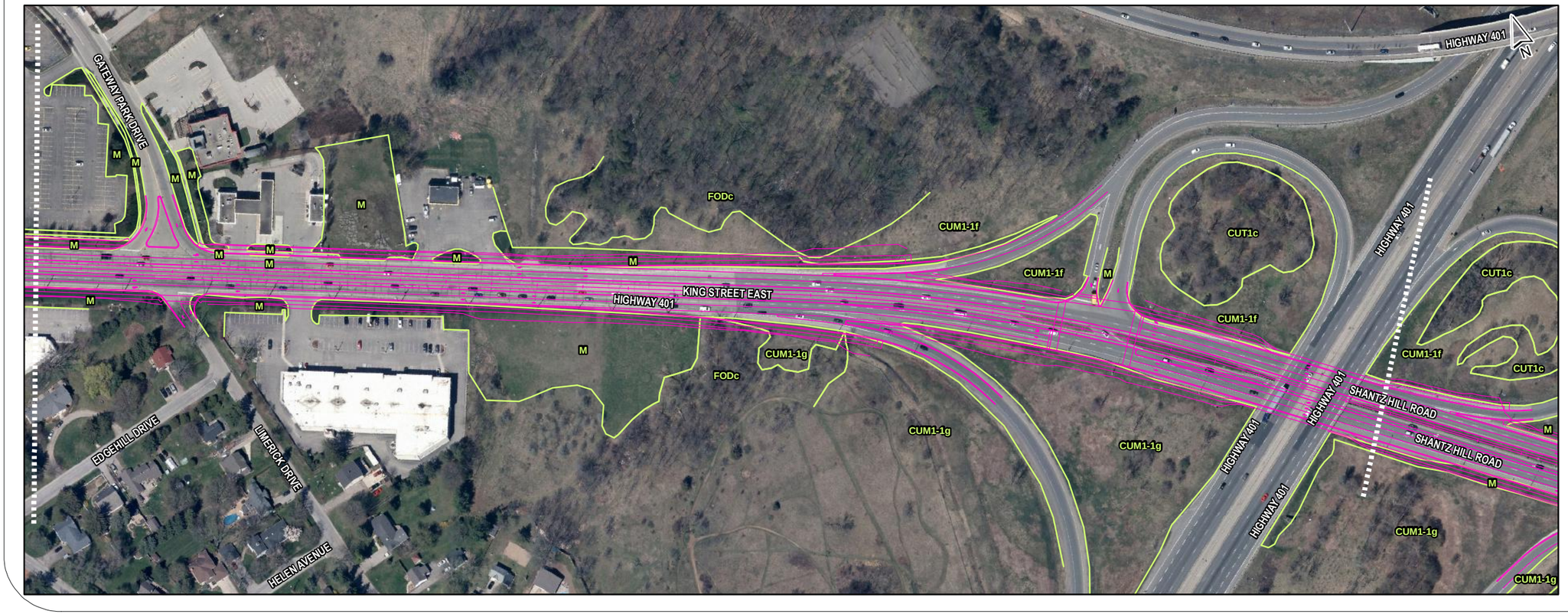
50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2c
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK





LEGEND

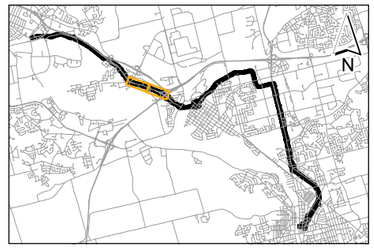
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



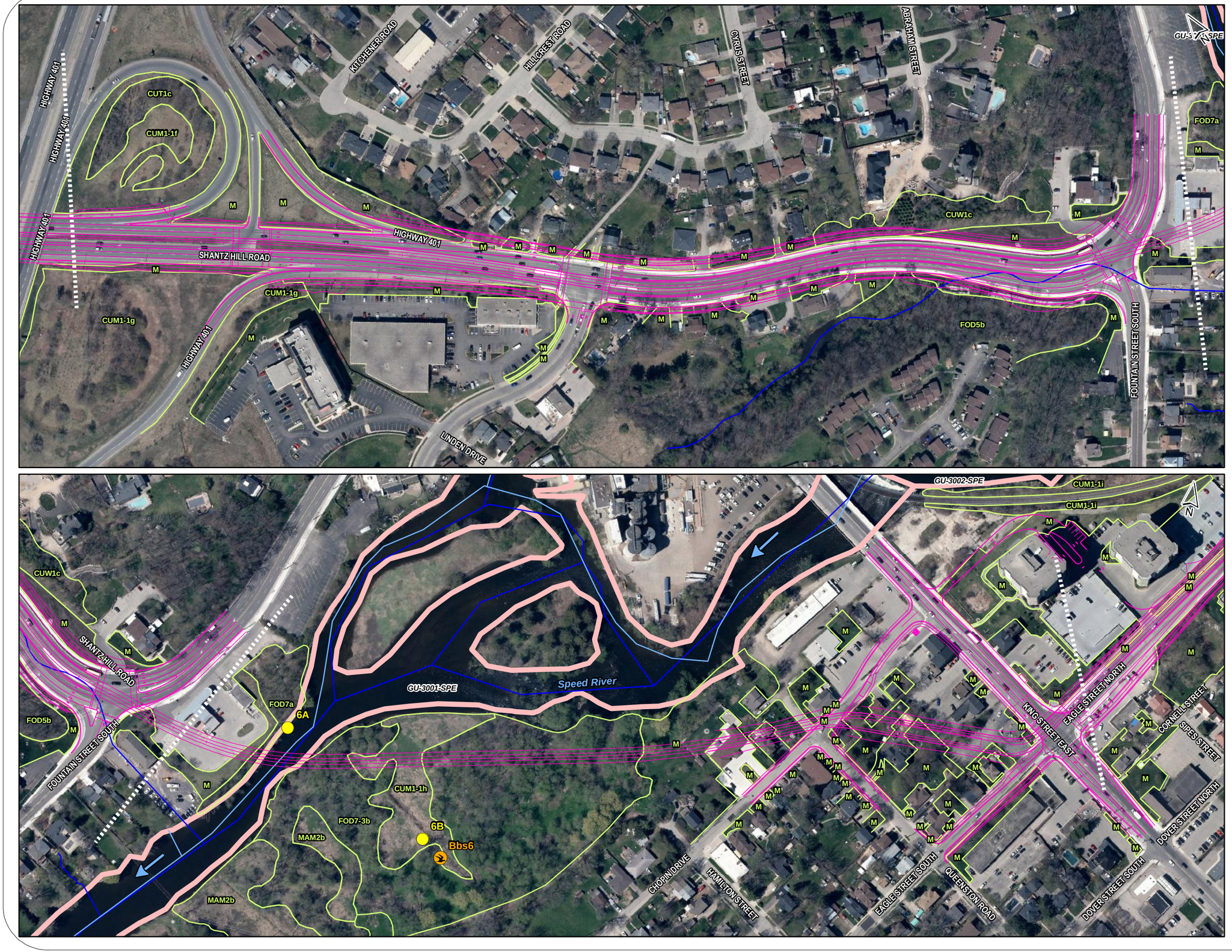
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2d
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK



LEGEND

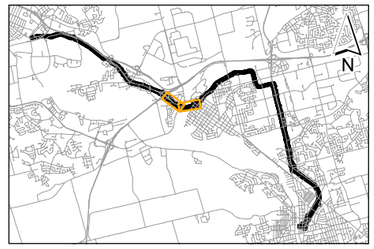
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



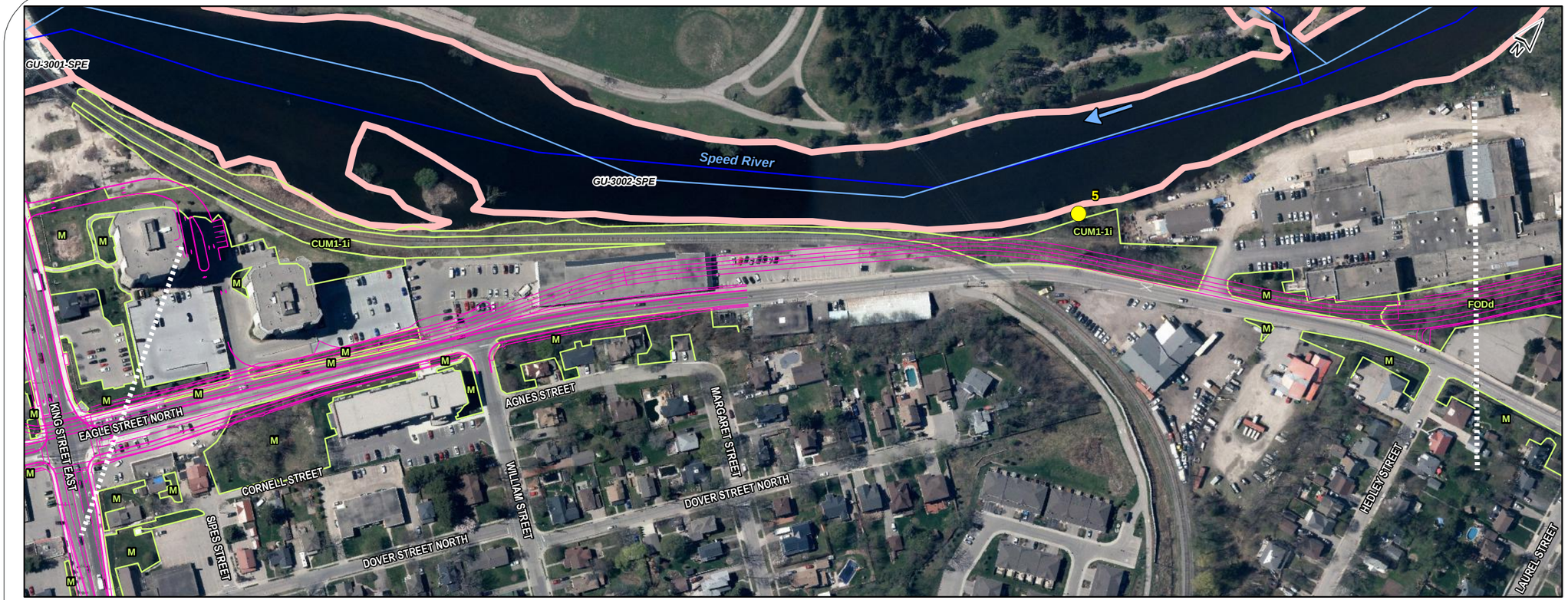
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2e
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK



LEGEND

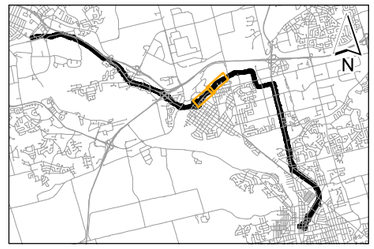
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



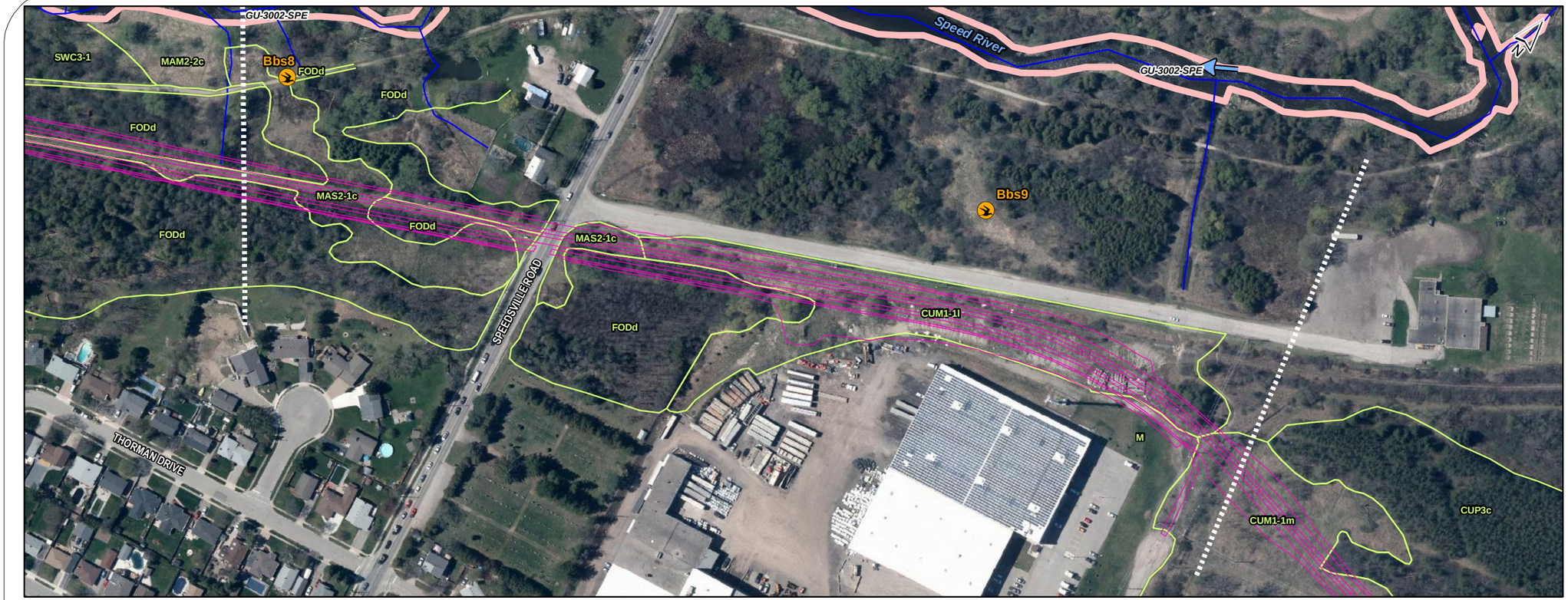
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

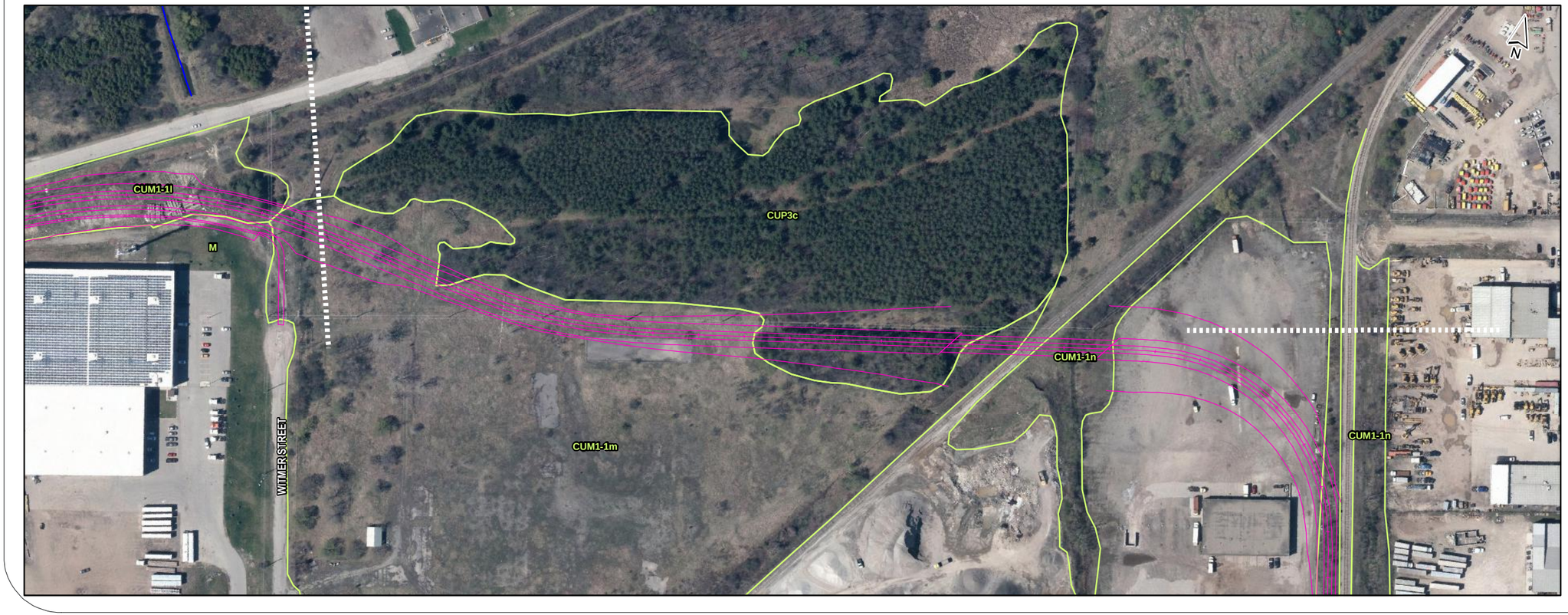
50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2f
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK





LEGEND

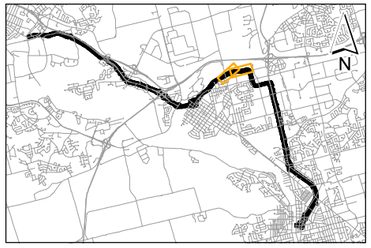
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



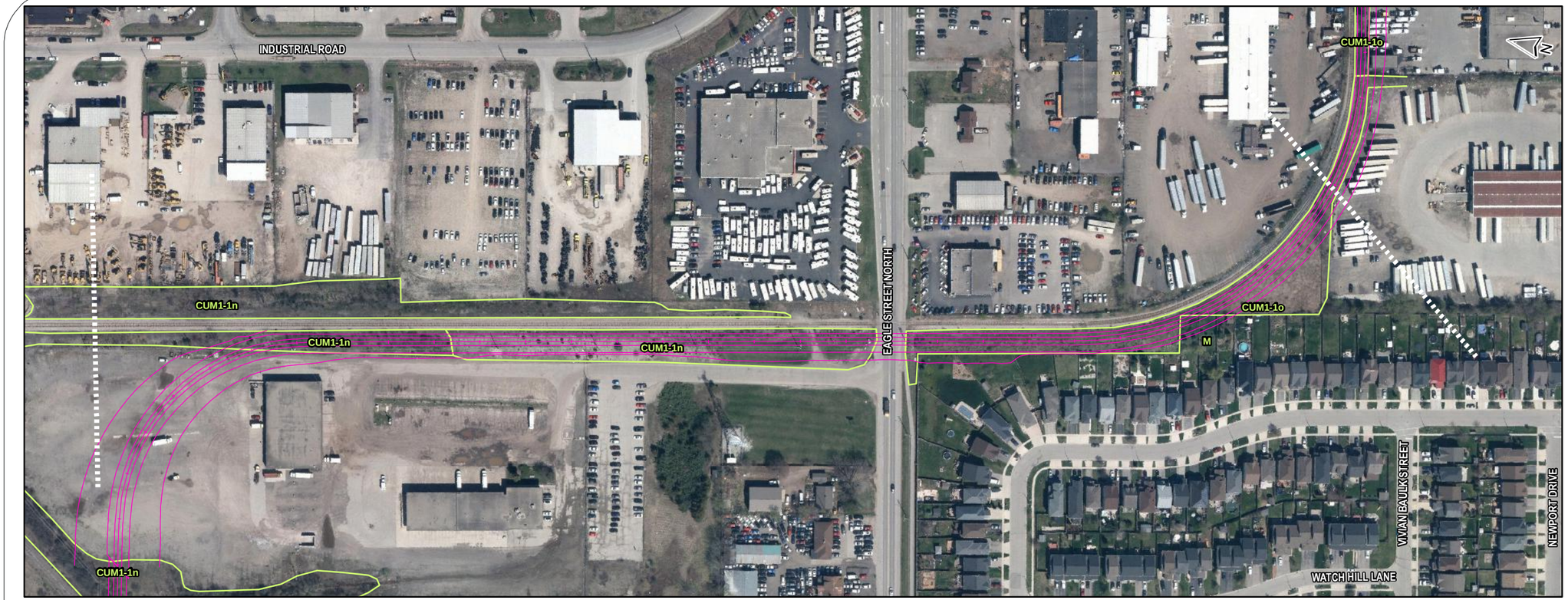
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

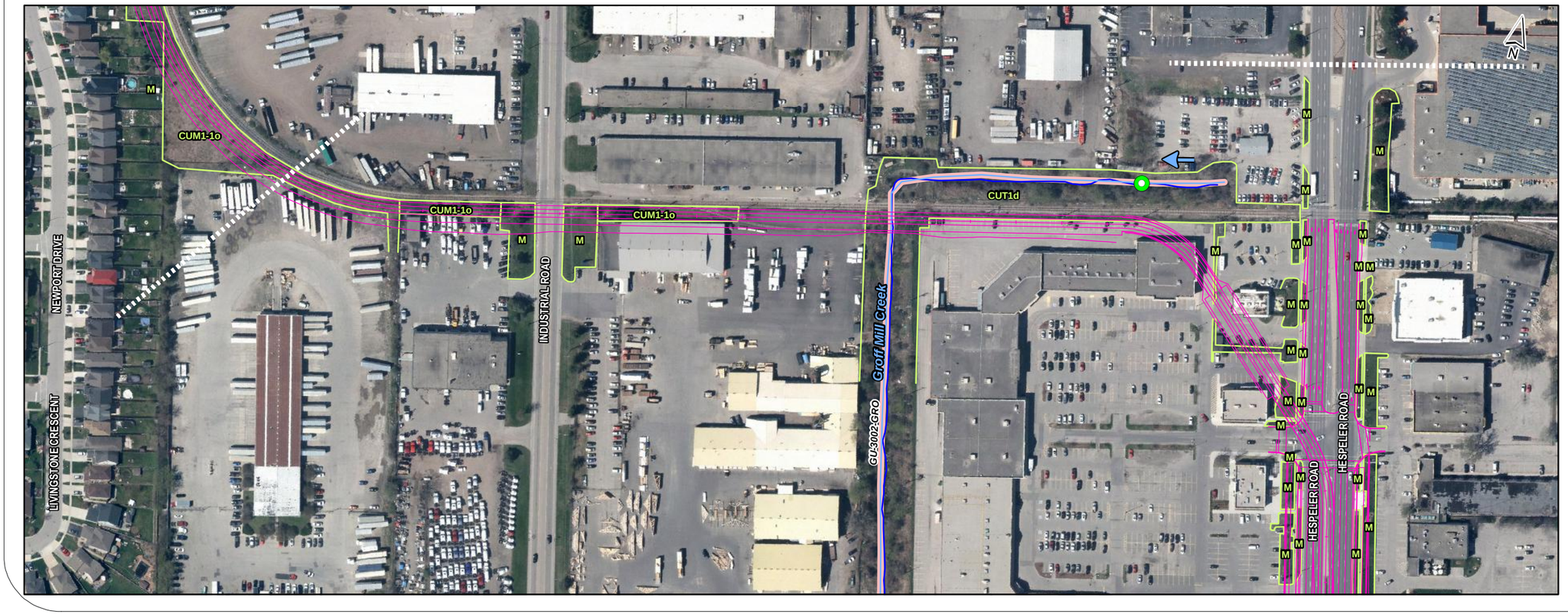
50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2g
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK





LEGEND

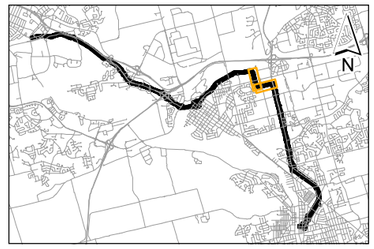
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



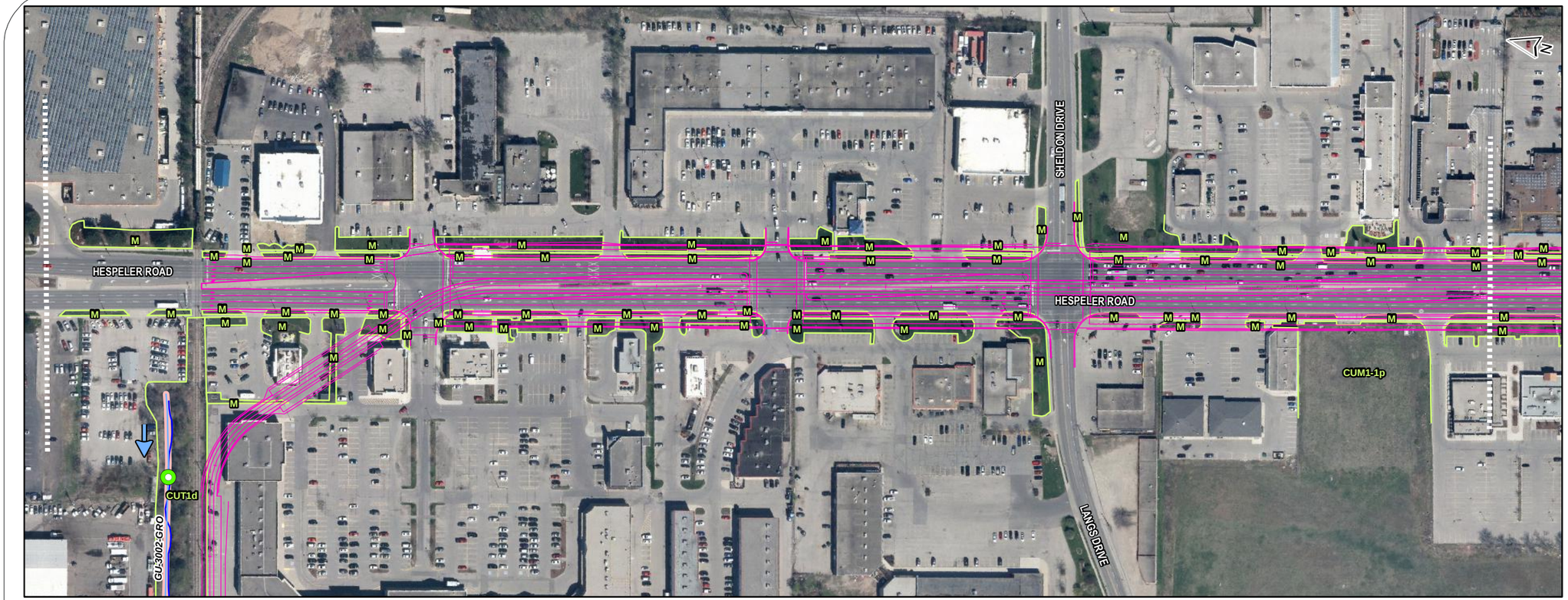
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

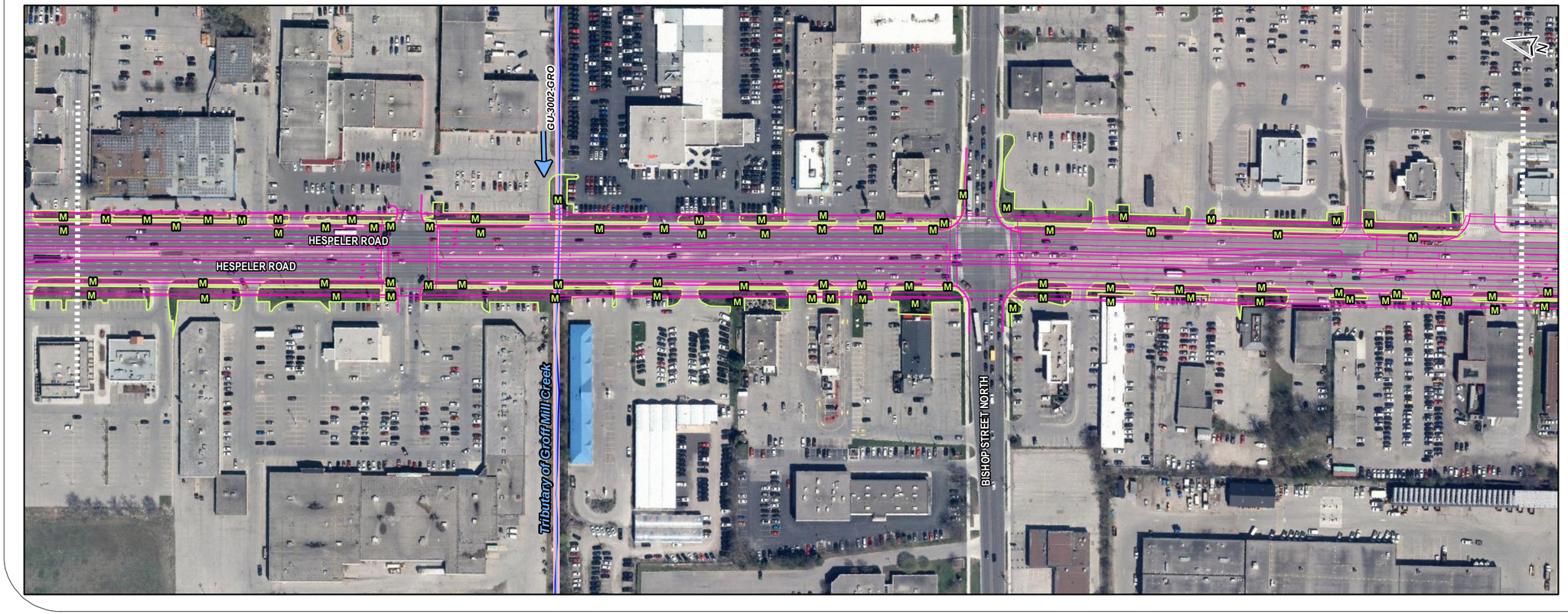
50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2h
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK





LEGEND

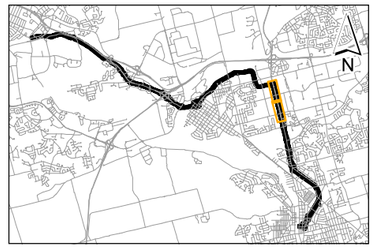
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



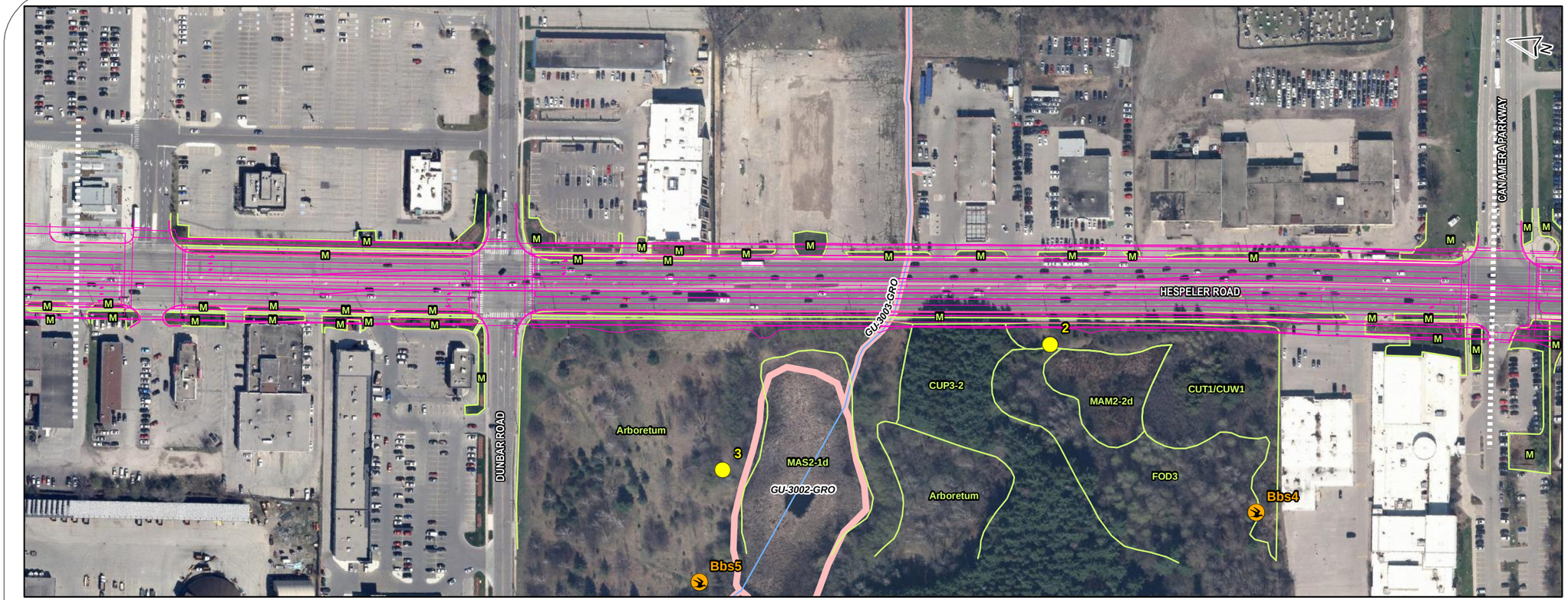
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

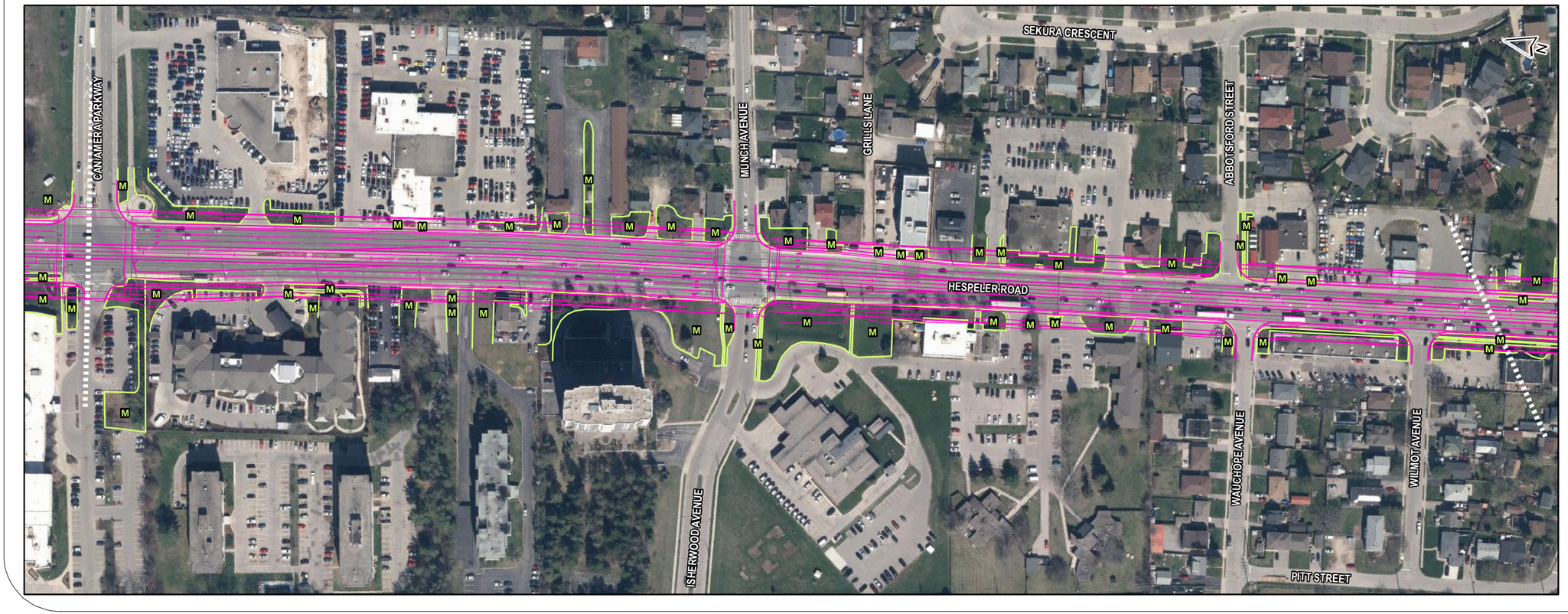
50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2i
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK





LEGEND

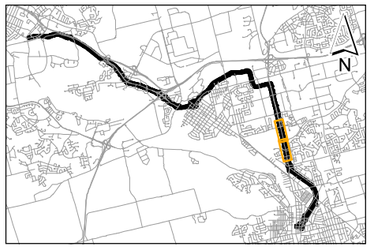
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



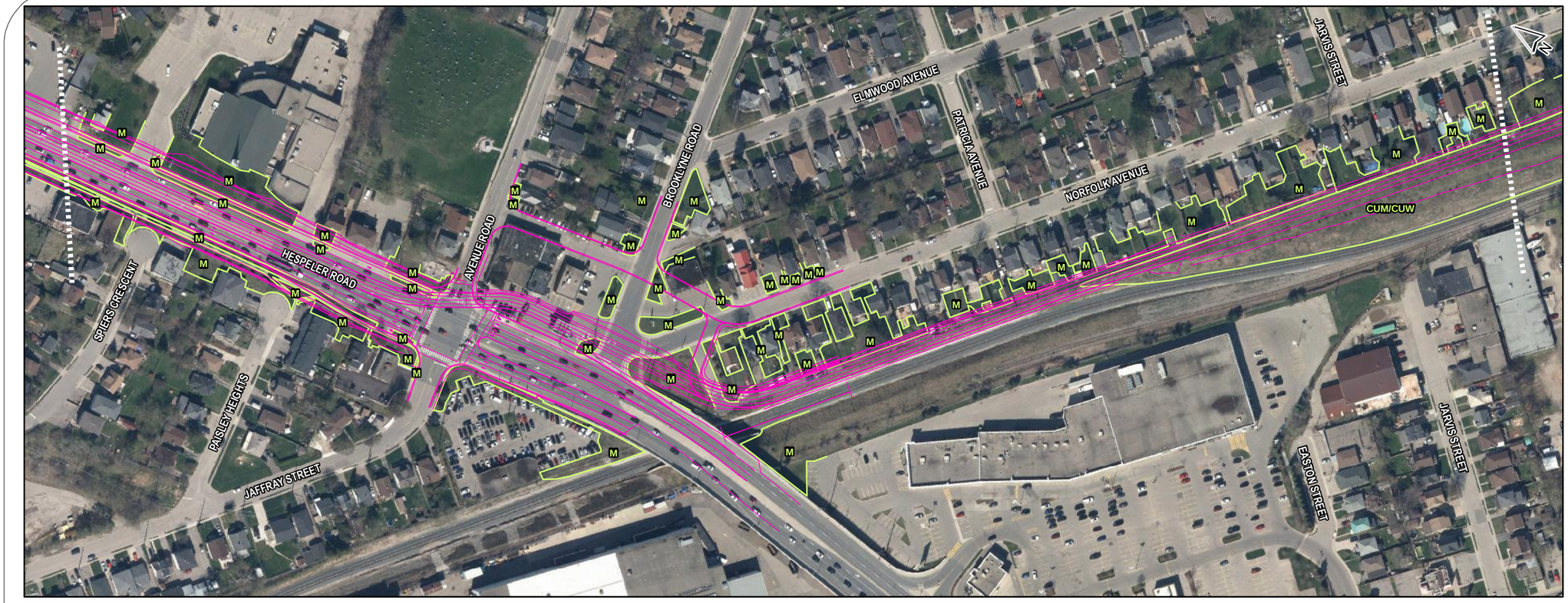
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

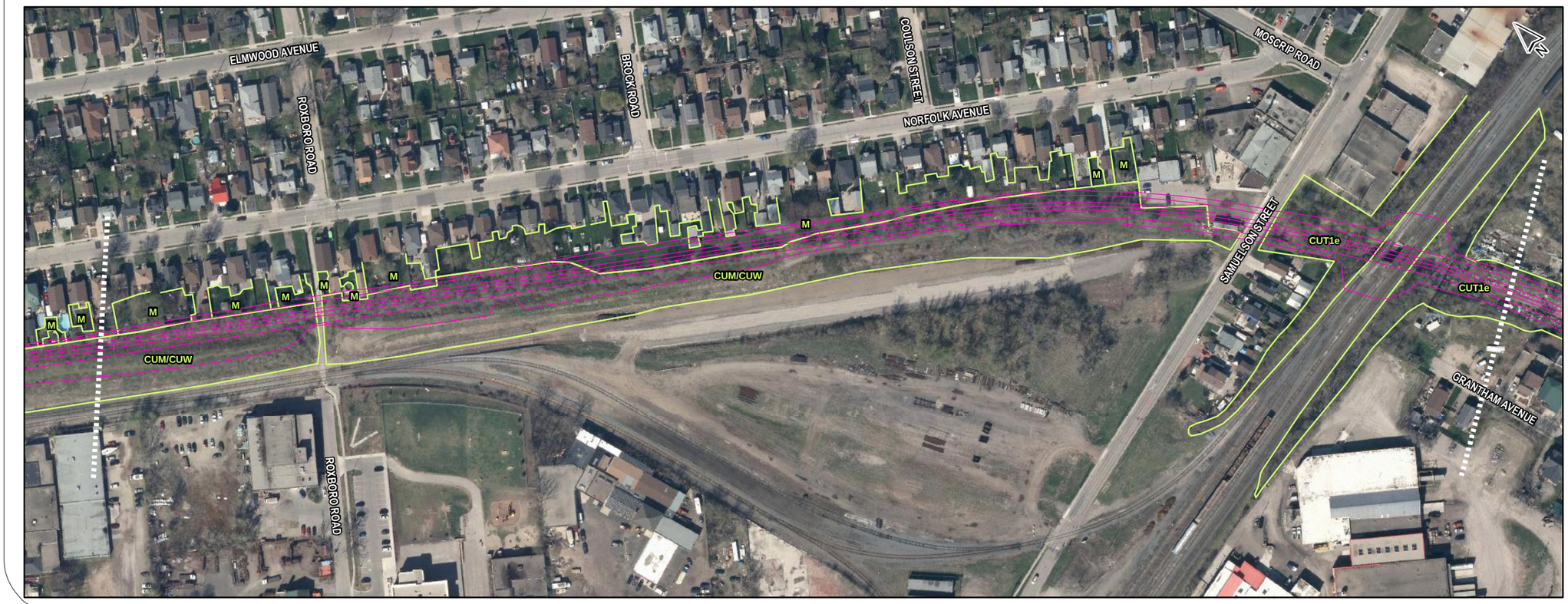
50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2j
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK





LEGEND

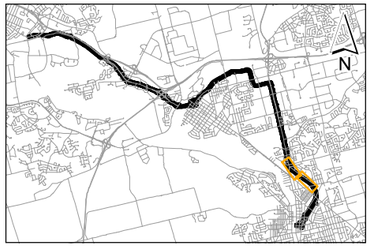
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



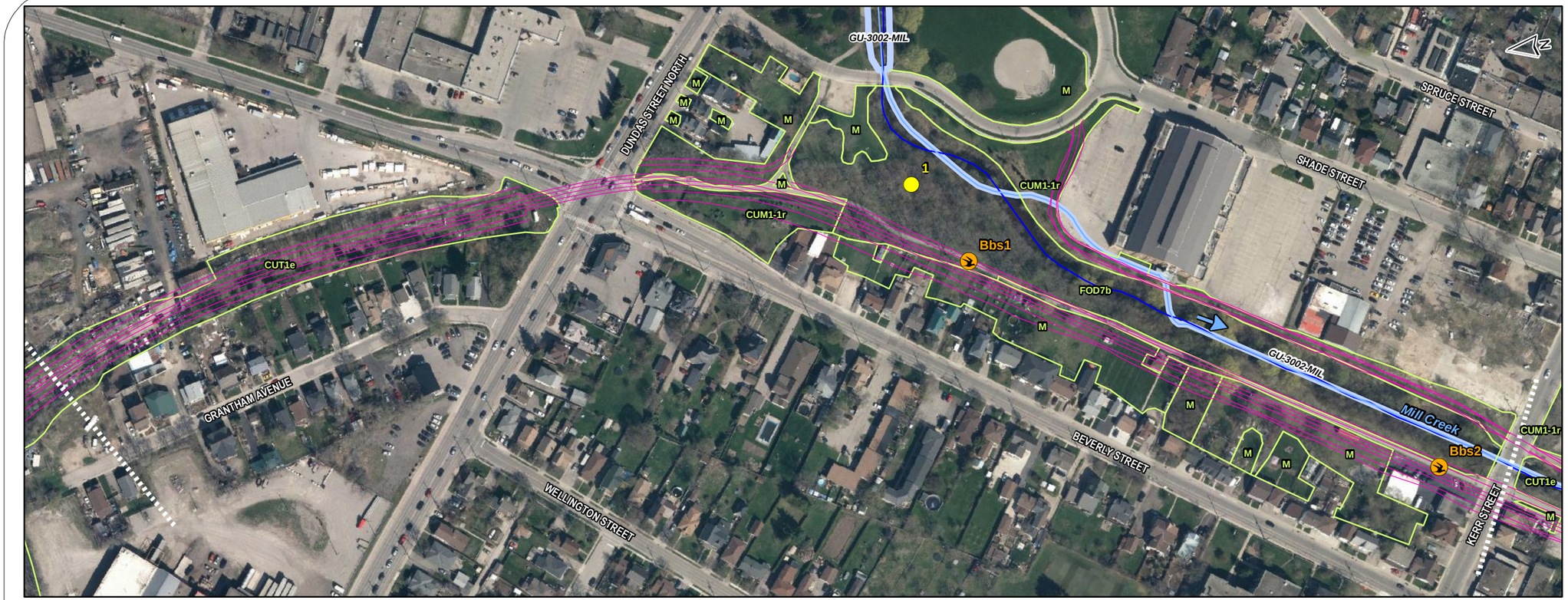
Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

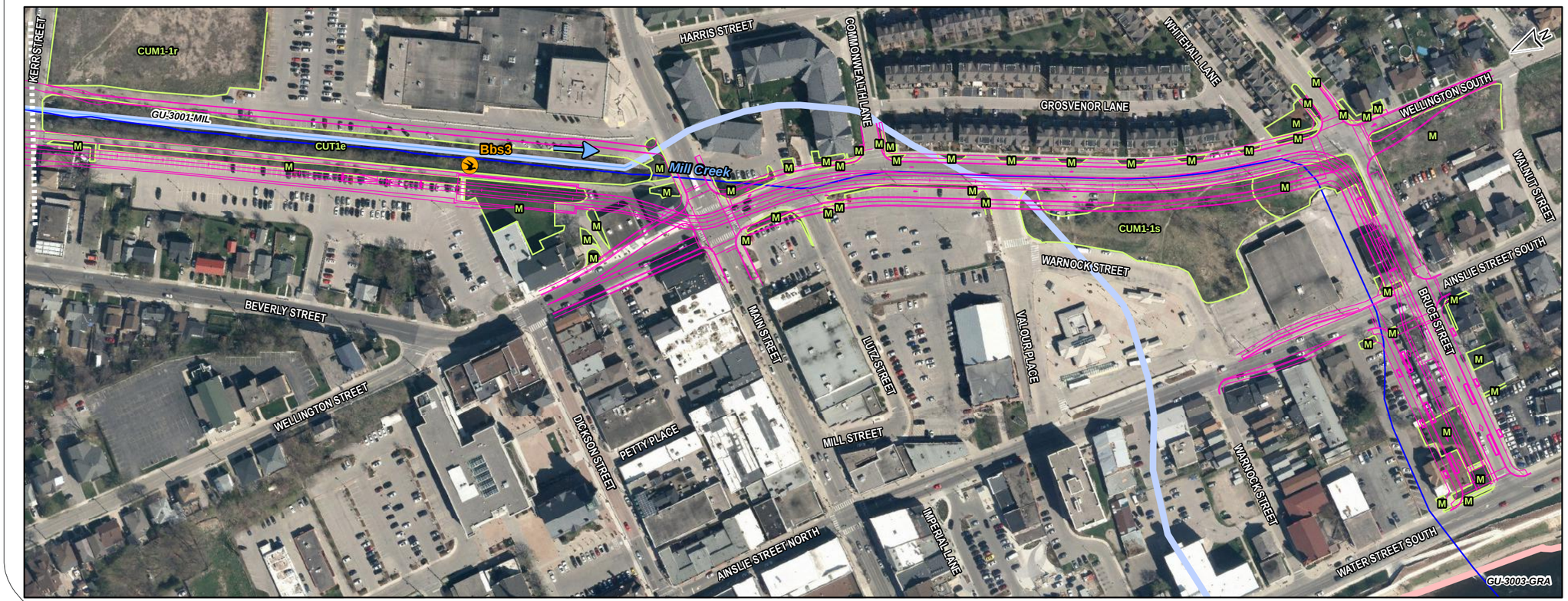
50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2k
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK





LEGEND

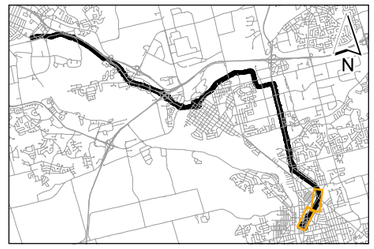
- Preferred Alignment (August 2019)
- Amphibian Monitoring Stations
- Bird Survey Locations (2020)

Fisheries Sampling Stations

- Capture
- No Capture
- Ecological Land Classification Communities Boundary
- Watercourse (LIO)
- Watercourse (GRCA)
- Watercourse Flow Direction
- Reach with No Surface Feature Present

Aquatic Resource Area Summary Thermal Regime (LIO)

- Cold
- Warm
- Match Line



Data Sources: LGL Limited field investigations, Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

50 25 0 50 Metres

Natural Heritage

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	2l
Date	July, 2020	**Prepared By:**	KC
Scale	1:2,500	**Verified By:**	GNK

An assessment of mussel habitat was also conducted, as requested by agencies during this study. Visual mussel presence surveys were conducted on October 11, 2016 and September 21, 2018. The purpose of these surveys was to document mussel habitat and record incidental observations of live mussels or relic shells present within the study area. In order to avoid harm, tactile searches were avoided. Each watercourse was searched using visual observations only, with the aid of polarized glasses or a viewing bucket in deeper reaches. These surveys were conducted to help assess the presence of any mussel species. The Protocol for the Detection and Relocation of Freshwater Mussel Species at Risk in Ontario-Great Lakes Area (Mackie *et al.* 2008) was followed. Many of the sites were located on Stage 2 ION LRT alignments no longer being considered, and as such, this information is not included in this report.

LGL also conducted electrofishing sampling on May 13, 2015 within watercourses where fisheries data was not available from secondary sources. Results of this sampling are incorporated into the watercourse discussions below and in **Table 1**. Electrofishing surveys used qualitative collection methods, focusing of variable habitats present within the reaches fished.

3.2.3 Results

The study area lies within the Grand River watershed and, specifically, within the Middle Grand River Reach, Speed River Sub-basin subwatershed and the Mill Creek Subwatershed. In addition to the main river and creek systems, several smaller tributaries of the Grand River and Speed River were investigated. The Grand River watershed is managed by the GRCA and the MNRF Guelph District Office.

Tributary of the Grand River (Hidden Valley watercourse- ‘North Creek’)

This watercourse originates on the immediate north side of King Street East and eventually flows into the Grand River, through the Hidden Valley area. This creek supports a warmwater thermal regime as identified in the ARA database (LIO 2019). Upstream (north) of King Street, no defining watercourse characteristics exist. Downstream (south) of King Street, flow is in a general southerly direction, between two car dealerships within a 15 m buffer area. The channel measures approximately 4 m in width, and is very diffuse within a corridor of phragmites and cattails for approximately 50 m. Cover along the channel is moderate to high, mostly provided by cattails, tall grasses and herbaceous species along the riparian area. After this point, riffle-flat morphology exists and the channel averages only 0.5 m in width and is 10 cm in depth with substrates dominated by gravel. Approximately 110 m downstream (south) of the King Street culvert opening, the channel flows into a grated CSP which directs flow underneath the car dealership and is piped for approximately 150 m, therefore acting as a barrier to fish movement.

TABLE 1.
FISH COLLECTED WITHIN THE VICINITY OF THE STUDY AREA

Scientific Name	Common Name	COSSARO	COSEWIC	SARA	Grand River	Freeport Creek	Speed River	Groff Mill Creek	Mill Creek
Campostoma anomalum	Central Stoneroller	-	-	-		y			**No fish station data available**
Chrosomus eos	Northern Redbelly Dace	-	-	-					
Cyprinus carpio	Common Carp	-	-	-	x		y		
Luxilus chrysocephalus	Striped Shiner	-	-	-			x		
Luxilus cornutus	Common Shiner	-	-	-	x,y	y	x,y	y	
Margariscus margarita	Pearl Dace	-	-	-				y	
Nocomis biguttatus	Hornyhead Chub	-	-	-	y		x,y		
Notropis atherinoides	Emerald Shiner	-	-	-	x,y	y	x		
Notropis hudsonius	Spottail Shiner	-	-	-			x		
Notropis photogenis	Silver Shiner	THR	THR	Schedule 1/THR	y		y		
Notropis rubellus	Rosyface Shiner	-	-	-	y	x	y		
Pimephales notatus	Bluntnose Minnow	-	-	-	x,y		x,y	y	
Pimephales promelas	Fathead Minnow	-	-	-		y		y	
Rhinichthys atratulus	Blacknose Dace	-	-	-	x			y	
Rhinichthys cataractae	Longnose Dace	-	-	-	y	y	x		
Semotilus atromaculatus	Creek Chub	-	-	-	x	x,y	x	y	
Catostomus commersonii	White Sucker	-	-	-	x	x,y	x,y		
Hypentelium nigricans	Northern Hog Sucker	-	-		x,y		x,y		

TABLE 1.
FISH COLLECTED WITHIN THE VICINITY OF THE STUDY AREA

Scientific Name	Common Name	COSSARO	COSEWIC	SARA	Grand River	Freeport Creek	Speed River	Groff Mill Creek	Mill Creek
Moxostoma valenciennesi	Greater Redhorse	-	-	-	x,y				
Moxostoma duquesnei	Black Redhorse	THR	THR	Schedule 1/THR	x,y				
Moxostoma erythrurum	Golden Redhorse	-	-	-	x,y				
Ameiurus nebulosus	Brown Bullhead	-	-	-			x		
Noturus flavus	Stonecat	-	-	-			y		
Umbra limi	Central Mudminnow	-	-	-		x,y			
Culaea inconstans	Brook Stickleback	-	-	-	x	x,y	y		
Pomoxis nigromaculatus	Black Crappie	-	-	-	x				
Ambloplites rupestris	Rock Bass	-	-		x,y		x,y		
Lepomis cyanellus	Green Sunfish	-	-	-	x,y				
Lepomis gibbosus	Pumpkinseed	-	-	-	x	y			
Micropterus dolomieu	Smallmouth Bass	-	-	-	x		x,y		
Percina maculata	Blackside Darter	-	-	-	x		y		
Etheostoma nigrum	Johnny Darter	-	-	-	x,y	y	x		
Etheostoma blennioides	Greenside Darter	-	-	-	x,y		x,y		
Etheostoma caeruleum	Rainbow Darter	-	-	-	x		x,y		
Etheostoma flabellare	Fantail Darter	-	-	-	y		y		
Sander vitreus	Walleye	-	-	-	x				

x: Fish collection data Grand River Water Quality LGL Sampling (2009, 2012), Electrofishing sampling May 2015
y: Secondary Source Data including personal Correspondence with MNRF, GRCA in 2014-2016.
SARA- Species at Risk Act (Federal legislation); Sch.- Schedule (listing in SARA); THR- Threatened

North Creek outlets from underneath Highway 8 via a box culvert. This structure is perched approximately 1 m, and functions as a complete barrier to fish movement. At the culvert outlet, the adjacent slopes are highly unstable and a large plunge pool is present, measuring approximately 4 m by 4 m and 1 m deep. It appears that this culvert conveys flashy stormwater flows resulting in the bank erosion and a plunge pool. Downstream of the plunge pool, the wetted channel can be described as a trickle during low flow conditions. Some sections of the channel were completely dry, or flow was being conveyed underneath the coarse substrates in late summer 2014 surveys. In higher flow conditions (spring/fall), wetted dimensions measure 1 m to 2 m wide and between 12 cm and 35 cm deep. Bankfull width measures a maximum of 2.6 m (average of 1.7 m), with bankfull depths measuring 0.4 m deep.

Generally, morphology is dominated by 85% flats, 10% pools and 5% riffles. Substrates throughout this section of channel consist of gravel, cobble, boulders, sand, silt, and clay. Boulders have been placed along the banks and instream a short distance downstream of the culvert, likely to provide bank stabilization. Severe erosion was also noted along the banks of the channel around the plunge pool. As the channel continues downstream, evidence of groundwater contributions were noted as iron staining was evident. Approximately 75 m downstream of the Highway 8 outlet, the channel enters a wetland (flow is fairly stagnant) and the wetland is dammed by beavers at the downstream end of this feature. Riparian habitat consists of cultural thicket, including Staghorn Sumac (*Rhus typhina*), Hawthorn (*Crataegus spp*.), Crack Willow (*Salix fragilis*), Alternate-leaved Dogwood (*Cornus alternifolia*) and juniper (*Juniperus spp*.), growing along the banks, before opening up to a Reed Canary Grass (*Phalaris arundinacea*) and Cattail dominant wetland. Instream woody debris and undercut banks are also contributing to instream cover.

A previous study conducted for the *River Road Extension Class Environmental Assessment* (LGL 2014) identified several barriers downstream of the proposed ION ROW. LGL Limited conducted electrofishing surveys during 2014 (downstream of Highway 8) and did not capture fish. In addition, electrofishing sampling conducted by LGL Limited in May 2015 yielded no catch in the reach upstream of Highway 8. As such, this watercourse should be classified as permanent, indirect fish habitat.

Tributary of the Grand River (Hoffstetter Creek).

Hofstetter Creek drains an area that has been referred to as the Hofstetter Basin, which includes a portion of the woodlot adjacent to Highway 8 and flows from the wetland area at the northeast section of Hidden Valley underneath Highway 8. The creek empties into the Grand River on the north side of Highway 8. A spring was located at the edge of the adjacent hardwood forest that contributes flow to Hofstetter Creek and was noted to have water quality characteristics typical of groundwater in the area (Planck 1979).

Hofstetter Creek lost about one third of its contributing area when Highway 8 was constructed, and River Road was re-routed (Limnoterra 1980) as cited in the *River Road Extension Class EA Natural Heritage Features Report* **(**LGL 2014).

As noted, the creek originates from a wetland pocket located on the south side of Hidden Valley Road (shallow marsh/ mixed swamp). In 2004 and recent surveys, groundwater seeps were noted in the wetland. Wetted channel widths ranges from 0.3 m – 1 m, and channel depths of 0.05 m - 0.08 m, with a substrate mix of 100% silt/organics near the wetland, with coarser substrates present within approximately 10 m of the culvert (sand -70%; cobble-20%; gravel-10%). Water conditions were clear and water was slow flowing. Vegetation adjacent to the stream is dominated by ash and poplar, with cattail dominant further upstream within the marsh, and Phragmites dominating the wetland further west. One defined channel is present within approximately 20 m upstream of the culvert, with braided channels present upstream of this point.

The creek flows through a 1.5 m wide open footed culvert under River Road and Highway 8. The channel downstream of Highway 8 is ditched, with placed rip-rap along the banks within approximately 8m downstream of the culvert. The wetted channel measured between 0.9 m to 1.75m wide and 4-9 cm deep at the time of the 2015 survey (approx. 2.3m wide bankfull width). This channel widens into a 20m wide cattail wetland pocket, and drainage flows through another culvert under a private driveway, and into a deciduous forest on the north side of the laneway. As this is private property, the channel could not be followed after this point, but flow is eventually directed through a 75 cm diameter plastic culvert and drains down a high gradient boulder channel (with steps) located within approximately 17 m upstream of the Highway 8 (NBL bridge) at the Grand River.

No fish were observed within Hofstetter Creek during aquatic habitat surveys conducted for this project. LGL sampled this stream in 2004 and no fish were captured (LGL 2014). The gradient of the slope along the Grand River is considered a barrier to upstream fish and mussel movement. DFO and MNRF databases do not identify any species at risk in Hofstetter Creek.

Grand River

The Grand River within the vicinity proposed crossing and 150 m upstream and downstream, measures between 65 m to 70 m wide (bankfull). The Stage 2 ION LRT crossing will be located immediately downstream of the existing Highway 8 bridges. The northbound and southbound highway bridges (two separate structures), support a middle span/pier instream. Distance between the north bank and the middle pier was measured at approximately 41 m.

The channel is slow moving and represents flat/pool morphology through this reach. The majority of the reach is not wadeable, particularly along the north side of the river. Along the north bank, water depths measured approximately 70 cm deep along the bank edge near the downstream most pier edge with shallower conditions at the upstream end of the northbound bridge (25-50 cm). Water depth drops off within 3 m of the bank. Water levels extended beyond the northern most (pier at the time of survey as evidenced by the debris washed up on the bank. Boulders (placed) dominate the shoreline upstream of the bridge.

Along the south bank of the river, a wider littoral zone exists and is vegetated with milfoil, pond lily, sedges, bur-marigold and floating algae, extending mostly within approximately 10 m of the shore. Channel depth measures approximately 35 cm deep within 5 m of the shoreline. Channel substrates appear comprised of cobble, gravel and sand under the southbound bridge with finer substrates at the upstream end (silt, muck, gravel). Cobble is prominent along the downstream bank, with herbaceous species growing throughout the cobble (Reed Canary Grass, Purple Loosestrife, Baneberry).

Along the north bank of the river, a steeply forested slope exists comprised of mostly deciduous growth (willow species, maple, oak, Eastern White Cedar), with Manitoba Maple, Basswood and buckthorn growing on the upper slope. Riparian vegetation along the south bank of the river is comprised of mostly herbaceous species including Reed Canary Grass, Large Ragweed, Stinging Nettle, Burdock, Baneberry, Elecampane, with Crack Willow growth (mostly distanced from the bank). A small tributary (Freeport Creek) outlets to the south bank of the Grand River within 250m downstream of the Highway 8 bridges; and another shorter wetland tributary outlets to the river within 120 m upstream along this side. Riparian vegetation/cover immediately upstream of the Highway 8 bridge (south bank), also supports mainly wetland species including Reed canary Grass, Smartweed, and Giant Ragweed.

Fish sampling was not conducted within the Grand River due to the abundance of existing fisheries data which was collected from the OMNRF (2015) and LGL (2009 and 2012). The Grand River is host to a wide variety of warm/coolwater fish species and supports a warmwater thermal regime (LIO 2019). A full list of fish species present within the Grand River can be found in **Table 1**.

The Grand River, within the vicinity of the proposed ROW (CNR Bridge north of King Street) is habitat for two fish species at risk; Silver Shiner (*Notropis photogenis*) and Black Redhorse (*Moxostoma duquesnei*). Both species are designated as Threatened and regulated under the ESA. Under COSEWIC, these two species are also designated as Threatened and listed on Schedule 1 of SARA.

In addition, two mussel species at risk; Wavy-rayed Lampmussel (*Lampsilis fasciola)* and Rainbow Mussel (*Villosa iris*) are both known to occur within the Grand River within the vicinity of the proposed alignment. Wavy-rayed Lampmussel is regulated as a Threatened species under the ESA and Rainbow Mussel receives protection under both the ESA and SARA as an Endangered Species, listed on Schedule 1. The Grand River at this location is also designated as “critical habitat” for Rainbow Mussel. (DFO 2019).

Tributary of the Grand River (Freeport Creek)

Freeport Creek originates in a large wetland complex located approximately 2 km upstream of the Grand River mouth. This creek flows through several culverts (at the CP Rail track, King Street East, Highway 8) and has been channelized within the reach immediately downstream of Highway 8. This creek was investigated by LGL around King Street as well as within the reach downstream of Highway 8; where the preferred Stage 2 ION LRT alignment will cross the creek. Freeport Creek outlets to the Grand River within approximately 300 m downstream of the proposed LRT crossing and is classified as warmwater, as identified in the ARA database (LIO 2019).

At Highway 8, an open-bottomed culvert exists measuring approximately 1.5 m wide, 1.1 m high and a minimum of 98 m long. Downstream, within the highway ROW (12 m reach), the channel was dry at the time of the September 21, 2018 survey. The channel width measures 1.75 m wide, and approximately 30 cm deep (bankfull) and is predominantly cobble bottom within this area. Downstream of the highway ROW, the channel is difficult to follow as it flows through meadow marsh; supporting 90 percent overhanging vegetation, mostly by Reed Canary Grass. Soft substrates are dominant here. Riparian vegetation within this reach is comprised of grasses and herbaceous species (Reed Canary Grass, Giant Ragweed, asters, goldenrod and bindweed).

Approximately 45 m downstream of the highway, the creek flows through a treed area (willows, buckthorn dominated). The channel is flat bottomed and measures an average of 2 m wide and 35 cm deep, with mostly sand and gravel substrates (dry at the time of survey). Downstream of this point, the channel continues to flow through the Reed Canary Grass dominant wetland, with channel widths averaging 1 m wide and between 25-50 cm deep. Flow is conveyed through a 650 mm CSP (with collapsed outlet) under a walking path. At the creek outlet, no barriers were noted.

Although the creek is highly altered (channelized) and crossed by several crossing structures, it appears to be providing good quality warm/coolwater fish habitat within the reach fished (460 m upstream of the proposed LRT crossing). This creek does appear to support an intermittent flow regime, at least downstream of Highway 8, based on the dry conditions observed in September 2018. Upstream reaches may support more standing water, given the influence of upstream wetlands.

Background fisheries information made available by the MNRF in 2015 indicated a warm/coolwater fish community. In addition, LGL conducted electrofishing surveys upstream of King Street E in May 2015. Species captured within this reach include; Brook Stickleback (*Culaea inconstans*), White Sucker (*Catostomus commersonii*), Creek Chub, Central Mudminnow (*Umbra limi*) and Rosyface Shiner (*Notropis rubellus*). The full species list for Freeport Creek from secondary source and LGL sampling is present in **Table 1**.

DFO Aquatic Species at Risk mapping identified Wavy Rayed Lampmussel and Rainbow Mussel within Freeport Creek. Further details on the mussel habitat assessment are discussed further in Section 3.2.4.

Speed River at Shantz Hill Road (proposed crossing)
The proposed crossing of the Speed River is naturalized and no road crossing currently exists at this location. Along the north bank, existing commercial use (gas stations/parking lot) exists, with low density residential housing present along the downstream reach. Along the east bank, open space exists with residential abutting the floodplain. Closer to King Street East, residential lots extend to the river's edge, some of which is manicured grass to the edge of bank.

The watercourse measures 28 m to 35 m wide and appears to be greater than 1 m in depth. Exact depth was not able to be determined as this reach is not wadeable. There are two islands present within 80 m and 150 m upstream of the proposed alignment. Morphology through the upstream reach is dominated by riffles, while the proposed crossing area is comprised of a deep flat/pool morphology. The profile of the channel along the crossing drops off fairly rapidly along the west bank, with a small littoral zone. Along the east bank, bank/channel gradient is more gradual, with water depths measuring approximately 40 cm deep within 3m of the wetted edge in September 2018. Substrates observed within this reach appeared soft downstream of the proposed crossing, with a mixture of cobble, gravel, sand, and detritus within the crossing area and upstream reach. Concrete cinder blocks/slabs and other construction debris is notable along the west shoreline and extending instream. This bank appears to have been used as a dumping ground in the past.

Instream vegetation/cover is comprised of submergent vegetation (pondweed), Yellow Pond Lily, floating algae and woody debris, mostly along the east bank. Riparian vegetation is comprised of mostly Crack Willow, Black Locust, Black Walnut, buckthorn, dogwood, raspberry, Giant Ragweed and Bur-Marigold.

The Speed River is habitat to a diverse warm/coolwater fish community and a warmwater thermal regime (LIO 2019). Two fish Species at Risk; Silver Shiner (*Notropis photogenis*) and Black Redhorse (*Moxostoma duquesnei*) (LGL, 2009, 2015), in

addition to the Wavy-Rayed Lampmussel (*Lampsilis fasciola*). (DFO 2019). Wavy-rayed Lampmussel shells were observed near the CPR bridge, located immediately upstream of King Street E. The DFO Aquatic Species at Risk mapping shows the extent of the mussels located downstream of the Riverside Park Dam (at King Street); however, this species has been documented as far upstream as Highway 401 based on anecdotal evidence.

Speed River-Eagle Street

Land use in the area is urban in character, with high rise condominiums located on the south side of the river, near King Street East and the Eagle Street intersection, as well as some commercial land use farther upstream, along this shoreline. Riverside Park abuts the northern shoreline of the Speed River.

The proposed Stage 2 ION LRT will travel parallel to Eagle Street and cross the existing CPR line, immediately north of the existing CPR/Eagle Street crossing. The LRT would extend a short distance from the Speed River paralleling the river for approximately 50 m. This reach of the Speed River is ponded and supports very slow flow, as a result of the 2 m (approx.) high dam present immediately upstream of King Street. Along the south side of the river, the CPR railway lies within close proximity to the shoreline, located at the top of bank, to a maximum of approximately 12 m from the wetted edge of the river. Near the proposed LRT, the railway veers away from the river, and the river banks are steep, with water depth dropping off quickly, to approximately 0.5 m deep within 2 m of the bank edge. Substrates are dominated by sand and gravel, overlain by silt with some cobble present. Overhanging cover is generally fairly limited, due to the presence of the adjacent CPR line.

Further downstream, wetland species line the banks, extending a 100 m reach along the shoreline. Substrates along the vegetated shoreline are comprised mostly of silt and muck, with abundant submergent vegetation present, dominated by Canada Waterweed, pondweed and milfoil species as well as some pond lily. Floating algae is also abundant. The wetland vegetation is dominated by Reed Canary Grass, in addition to cattail, Skunk Cabbage and Yellow Flag Iris. Some overhanging woody vegetation is present upstream of the proposed ION Crossing, mostly by overhanging willow. Riparian species present along the south side of the river includes willow, raspberry, honeysuckle, dogwood, Viburnum species, young poplar and Virginia Creeper.

At the time of the spring assessment (May 2015), schools of minnows and pinhead (young of year) were observed in several locations along both banks of the Speed River. One juvenile Smallmouth Bass was observed near the upstream end of reach, along the south shoreline. Carp were actively spawning in the reach along the southern shoreline, within the vicinity of the cattail vegetation. The spawning and feeding activity

of the carp, left the water murky as well as plants uprooted. A local fisherman indicated that carp, bass and pike fishing is popular within this reach. As indicated previously, the DFO Aquatic Species at Risk mapping shows the extent of the mussels located downstream of the Riverside Park Dam (at King Street); however, this species has been documented as far upstream as Highway 401 based on anecdotal evidence.

Tributary of the Speed River (At Russ Street Park)

This tributary appears to surface immediately downstream of a pedestrian trail (within the vicinity of the proposed LRT crossing). This feature daylights from a circular plastic pipe at the trail and flows into the Speed River approximately 120 m from this pipe. A defined channel exists downstream of the pipe, measuring approximately 3 m wide and averaging 10 cm to 15 cm deep. The bankfull width appears to measure approximately 4 m wide. Substrates within the channel are comprised of mostly sand, with some boulder sections. Iron floc and watercress is abundant within the channel, which may indicate some groundwater influence. Overall, the channel appears to suffer from storm sewer inputs, given the prevalence of eroded banks and anthropogenic debris present within the channel. This channel is confirmed to support direct fish habitat. Baitfish (minnow species) were observed within this channel during an October 11, 2016 survey. No species at risk have not been identified within this tributary of the Speed River.

Groff Mill Creek

This watercourse originates from a concrete CSP approximately 40 m west of the route (Hespeler Road). From air photo interpretation, no watercourse occurs upstream of this point, and flow is likely all resulting from stormwater/surface runoff. This watercourse was historically realigned and flows in a channelized manner in a westerly direction for 175 m, then flows south in a channelized corridor between industrial facilities. Eventually, this watercourse flows through Dumfries Conservation Area and ultimately the Grand River. Aquatic conditions in the vicinity of Hespeler Road are extremely poor. This watercourse averages 1.0 m to 1.5 m in width and flow was stagnant during spring and fall site visits in 2014/2015. Substrates within the channel are dominated by sand, gravel and silt. No morphology other than flat/stagnant conditions were observed within the channel. This channel appears to experience very rapid fluctuations in flow during rain events as erosion was abundant at the culvert outlet.

Background review indicated the fish community within this watercourse is comprised of tolerant, warmwater fish species in the vicinity of Dumfries Conservation Area (GRCA, 2004) and supports a warmwater thermal regime (LIO 2019). A full list of species can be found in **Table 1**. MNRF did not have any fish capture data for Groff Mill Creek near the proposed LRT crossing. LGL conducted electrofishing sampling in May of 2015 and did not capture fish within this watercourse. Based on the observed conditions, it is likely

that this watercourse supports indirect fish habitat within the reach assessed, near Hespeler Road.

Tributary of Groff Mill Creek

A tributary of Groff Mill Creek crosses Hespeler Road approximately 230 m north of Bishop Street. The channel was mostly dry, with the exception of a section of standing water within the culvert during the spring site investigation. This creek crosses Hespeler Road via a concrete box culvert indicating it's highly affected by urbanization and likely experiences flashy flows during periods of extended precipitation. The channel is incised and flows through mostly heavy riparian cover consisting of shrubs and grasses with the exception of a 13 m reach of channel immediately east of Hespeler Road which supports manicured grasses through the channel. Due to the channel being dry during the spring 2015 site investigation, this channel flows ephemerally, and provides fish habitat indirectly, to the downstream fish community in Groff Mill Creek of tolerant, warmwater fish species (GRCA, 2004).

Mill Creek

Mill Creek is a tributary of the Grand River, originating northeast of Aberfoyle. Groundwater contributions to this stream are high downstream of Aberfoyle where the Paris and Galt Moraines contribute groundwater to the system. This creek flows through Shades Mill Reservoir and Dam, which largely controls low flows downstream through Cambridge to the outlet with the Grand River. Mill Creek continues to support a coldwater thermal regime through Cambridge, based on the ARA database results (LIO 2019). The Stage 2 ION LRT will travel along an existing pedestrian trail between Dundas Street North and Main Street (downstream of Soper Park), which parallels a channelized portion of Mill Creek for approximately 830 m. This section of the watercourse is highly urbanized and downstream of Main Street, appears to flow underground before outletting to the Grand River. Although the LRT will not cross the creek, an assessment of this creek is included given its proximity to the preferred LRT line (less than 15 m away). The existing trail will be relocated to the east side of the creek corridor.

Within the reach adjacent to the Galt Arena Gardens, the creek is a natural channel measuring approximately 9 m wide bankfull. Wetted dimensions at the time of survey measures 4.8 wide and 42 cm deep. Morphology is dominated by riffles and runs, coarse substrates and clear water. Overhead cover constitutes approximately 60 to 80%, of the stream, mostly by deciduous tree species including Crack Willow, Manitoba Maple and ash species. The creek flows under Kerr Street via a 2-cell culvert that is located approximately 8 m from the pedestrian pathway. Within this reach, the creek measured approximately 12 m wide (wetted conditions), at the time of the September 2018 survey.

Within the reach between Kerr Street and Main Street, the channel bottom and banks appear hardened for most of this reach; comprised of concrete. As a result, flow is faster than the upstream reach; comprised of 100% riffle/runs. The channel measured approximately 5 m to 6 m wide (wetted) and averaging between 20-25 cm deep at the time of the September 2018 survey. Riparian vegetation provides approximately 30 percent cover mostly by Willow trees, Manitoba Maple and Red-osier Dogwood and the banks are very steep. Downstream of Main Street, flow appeared piped (no surface feature was noted).

3.2.4 Aquatic Species at Risk

Based upon a review of the MNRF Natural Heritage Information Centre – Biodiversity Explorer on-line database, GRCA, MNRF and DFO Species at Risk mapping, LGL Sampling Data and correspondence with the Guelph District MNRF, several Aquatic Species at Risk are known to occur within the study area.

Fish Species at Risk, Silver Shiner (*Notropis photogenis*) and Black Redhorse (*Moxostoma duquesnei*), both regulated as “Threatened” under the Ontario *Endangered Species Act* are known to occur within the study area within both the Grand River and Speed River (MNRF 2015) (LGL 2009/2012).

Mussel Species at Risk, Wavy-rayed Lampmussel (*Lampsilis fasciola*) and Rainbow Mussel (*Villosa iris*), are both known to occur within the study area. Wavy-rayed Lampmussel is known to inhabit reaches of the Speed River from the Riverside Park Dam downstream to the Grand River confluence as well as the Grand River. The Rainbow Mussel is known to occur in the Grand River within the vicinity of the Highway 8 Crossing and Critical Habitat is mapped for this species within this reach. Both species are regulated as “Threatened” under the Ontario *Endangered Species Act.* In addition, the Rainbow Mussel is also listed as “Endangered” and is afforded protection under Schedule 1 of the Federal *Species at Risk Act*.

3.2.5 Mussel Detection Survey and Habitat Assessment Summary

Visual mussel presence surveys were conducted on October 11, 2016 and September 21, 2018. Surveys were conducted on smaller tributaries of the Grand and Speed River. Information was also gathered on aquatic habitat conditions as well as a review of fisheries information, as mussels require particular fish hosts to complete their life cycle. The SAR mussel species of interest are Wavy-rayed Lampmussel and Rainbow Mussel. Fish hosts for Wavy-rayed Lampmussel are Largemouth Bass and Smallmouth Bass. Habitat requirements are small to medium-sized rivers with steady flow and clear water in and around riffle areas in gravel or sand often stabilized with cobble or boulders (Metcalfe-Smith *et al.* 2005).

Fish hosts for Rainbow Mussel are more diverse and may be Striped Shiner, Smallmouth Bass, Largemouth Bass, Green Sunfish, Greenside Darter, Rainbow Darter and Yellow Perch. Habitat requirements are small stream to small river in coarse sand or gravel substrates in or near riffles or along the edges of emergent vegetation in moderate to strong current (Metcalfe-Smith *et al.* 2005).

Information on two tributaries - Freeport Creek and the Tributary of the Speed River at Russ Street - are included in this report. Other tributaries of the Grand and Speed Rivers included in this report have known barriers between the main system and the Stage 2 ION LRT crossings and have low potential to support mussel species at risk.

Freeport Creek, within reaches upstream of King Street, appears to support physical habitat attributes for mussel species (coarse substrates, well oxygenated waters); however, the fish species present (based on background and current sampling data), would not serve as hosts for this species. In addition, the long culvert under Highway 8, in addition to intermittent conditions downstream of Highway 8 (near the LRT crossing) would also appear to deter mussel movement upstream from the Grand River. The majority of the reach downstream of Highway 8 supports fine substrates and likely flat morphology (through wetland) and therefore does not support habitat conditions conducive for mussels, in addition to its intermittency. This creek was highlighted as potentially supporting habitat for both mussel species on DFO Aquatic Species at Risk mapping (DFO 2019).

The Tributary of the Speed River (at Russ Street) does not support optimal habitat conditions for mussels. This tributary conveys stormwater flows, supports soft substrates and flat morphology. This tributary was not highlighted as potentially supporting habitat for both mussel species on DFO Aquatic Species at Risk mapping (DFO 2019); however, it was included in assessments given its proximity to the Speed River.

Neither one of these tributaries support habitat conditions and/or connectivity that would allow mussel movement upstream.

3.3 Vegetation and Vegetation Communities

3.3.1 Purpose

The geographical extent, composition, structure and function of vegetation communities were identified through air photo interpretation and field investigations. Air photos were interpreted to determine the limits and characteristics of vegetation communities.

3.3.2 Data Sources

A field investigation of the vegetation communities within and adjacent to the preferred alignment of the Waterloo Ion Phase 2 was conducted on July 30 and 31, September 2,

4 and 24, 2014, September 22 and October 2, 2016, June 25, 26 and 27, 2015, July 24 and 25 and August 1, 2019. The field investigations included a multi-season vegetation survey.

Vegetation communities were classified according to the Ecological Land Classification for Southern Ontario: First Approximation and Its Application (Lee *et al*. 1998). The communities were sampled using a plotless method for the purpose of determining general composition and structure of the vegetation. Plant species status was reviewed for Ontario (Oldham 2009), and the Region of Waterloo (Riley 1989). Vascular plant nomenclature follows Newmaster *et al*. (1998) with a few exceptions that have been updated to Newmaster *et al.* (2007). Vegetation communities are presented in **Figures 2a-2l**.

3.3.3 Results

Vegetation communities within the study area consist of a mixture of forest, wetland and cultural communities. The majority of the vegetation within the study area has been disturbed by existing land uses including agricultural, residential, and infrastructure. Cultural vegetation communities typically persist in areas that are regularly disturbed, and as a result, generally contain a high proportion of invasive and non-native plant species that are disturbance tolerant.

Natural/semi-natural features within the study area are generally restricted to the valleylands associated with the watercourses in the study area. The valleyland units contain a mixture of forest and wetland communities. These areas are generally of higher quality and contain a high proportion of specialized and native plant species.

A total of twenty-five ecosites were identified within the study area. These communities include: Dry-Moist Old Field Meadow (CUM1-1), Mineral Cultural Savannah (CUS1), Mineral Cultural Thicket (CUT1), Mineral Cultural Woodland (CUW1), Coniferous Plantation (CUP3-1, CUP3-2, CUP3-3, and CUP3), Coniferous Forest (FOC3-1 and FOC4-1), Deciduous Forest (FOD3, FOD5, FOD7-3, FOD7, FOD8-1, and FOD), Meadow Marsh (MAM2-2, MAM2-5, and MAM2), Shallow Marsh (MAS2, MAS2-1), Coniferous Swamp (SWC3-1), Deciduous Swamp (SWD2-2), Mixed Swamp (SWM1-1), and Swamp Thicket (SWT2-2).

There are several areas that are not identified by the ELC such as areas of manicured grass (M) which include mown lawns, gardens and planted trees and hedgerows (H) which include trees that have been planted or that have been maintained for the purposes of preserving windbreaks between agricultural fields and screens between residential units and local roadways. All vegetation communities identified are described in **Table 2**. All of the vegetation communities within the study area are considered widespread and common in Ontario and are secure globally.

3.3.3.1 Flora

A total of 305 plant species have been recorded within the study area. Nine of these plants could only be identified to genus and are not included in the following calculations. Of the 296 plants identified to species, 185 (63%) plant species identified are native to Ontario and 111 (37%) plant species are considered introduced and non-native to Ontario. A list of vascular plants is presented in **AppendixB**. Definitions of the acronyms and species ranks used in **Appendix B** are described in **Appendix C**.

3.3.4 Species at Risk

One plant species regulated under the Ontario *Endangered Species Act, 2007* was identified during LGL's botanical investigations. One butternut (*Juglans cinerea*) was identified on the south side of Shantz Hill Road and Fountain Street South. Butternut is regulated as Endangered under the Ontario *Endangered Species Act, 2007*.

A total of six plant species identified within the study area are considered rare in the Region of Waterloo. **Table 3** provides a summary of the rare species identified and in which vegetation community they occur.

TABLE 2.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES

ELC Code	Vegetation Type	Species Association	Community Characteristics
TERRESTRIAL – NATURAL/SEMI-NATURAL			
FOD	Deciduous Forest		
FOD	Deciduous Forest	**Canopy:** includes black walnut (*Juglans nigra*), basswood (*Tilia americana*), trembling aspen (*Populus tremuloides*), and white pine (*Pinus strobus*). **Understory:** includes common buckthorn (*Rhamnus cathartica*), red-osier dogwood (*Cornus stolonifera*), staghorn sumac (*Rhus typhina*), and riverbank grape (*Vitis riparia*). **Ground cover:** includes spotted crane's-bill (*Geranium maculatum*), western poison-ivy (*Rhus rydbergii*), yellow avens (*Geum aleppicum*), and Canada goldenrod (*Solidago canadensis*).	• Tree cover > 60 % (FO). • Deciduous trees > 75 % of canopy cover (D).
FOD3	Dry-Fresh Poplar-White Birch Deciduous Forest	**Canopy:** includes trembling aspen, large-tooth aspen (*Populus grandidentata*), red oak (*Quercus rubra*), and American beech (*Fagus graandifolia*). **Understory:** includes trembling aspen, common buckthorn, glossy buckthorn (*Rhamnus frangula*), and red panicled dogwood (*Cornus foemina* ssp. *racemose*). **Ground Cover:** includes sensitive fern (*Onoclea sensibilis*), yellow avens, wild red raspberry (*Rubus idaeus* ssp. *melanolasius*), garlic mustard (*Alliaria petiolata*), and creeping partridge-berry (*Mitchella repens*).	• Tree cover > 60 % (FO). • Deciduous trees > 75 % of canopy cover (D). • Poplar dominant (3).
FOD5	Dry-Fresh Sugar Maple Deciduous Forest	**Canopy:** includes sugar maple (*Acer saccharum* ssp. *saccharum*), basswood, white birch (*Betulua papyrifera*), white elm (*Ulmus americana*), and American beech. **Understory:** includes ironwood (*Ostrya virginiana*), common buckthorn, alternate-leaved dogwood (*Cornus alternifolia*), and sugar maple. **Ground cover:** includes heart-leaved aster (*Aster cordifolius*), yellow avens, field horsetail (*Equisetum arvense*), wild ginger (*Asarum canadense*), and violets (*Viola* sp.).	• Tree cover > 60 % (FO). • Deciduous trees > 75 % of canopy cover (D). • Moderately dry to fresh moisture regime, sugar maple dominant (5).

TABLE 2.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES

ELC Code	Vegetation Type	Species Association	Community Characteristics
FOD7	Fresh-Moist Lowland Deciduous Forest	**Canopy:** includes Manitoba maple (*Acer negundo*), red ash (*Fraxinus pennsylvanica*), black walnut, and willow (*Salix* sp.). **Understory:** includes white mulberry (*Morus alba)*, common buckthorn, Manitoba maple, and Tartarian honeysuckle (*Lonicera tatarica*). **Ground Cover:** includes tall buttercup (*Ranunculus acris*), wood nettle (*Laportea canadensis*), awnless brome (*Bromus inermis* ssp. *inermis*), giant ragweed (*Ambrosia trifida*), yellow avens, and garlic mustard.	• Tree cover > 60 % (FO). • Deciduous trees > 75 % of canopy cover (D). • Middle to lower slopes, seepage areas and bottomlands topographic positions (7).
FOD7-3	Fresh-Moist Willow Lowland Deciduous Forest	**Canopy:** includes crack willow (*Salix fragilis*), slender willow (*Salix petiolaris*), Manitoba maple, silver maple (*Acer saccharinum***),** and red ash. **Understory:** includes Tartarian honeysuckle, staghorn sumac, slender willow, common buckthorn, and pussy willow (*Salix discolour)*. **Ground cover:** includes fringed loosestrife (*Lyimachia ciliata*), spotted touch-not-me (*Impatiens capensis*), giant ragweed, and white vervain (*Verbena urticifolia*).	• Tree cover > 60 % (FO). • Deciduous trees > 75 % of canopy cover (D). • Middle to lower slopes, seepage areas and bottomlands topographic positions (7). • Willow dominant (-3).
FOD8-1	Fresh-Moist Poplar Deciduous Forest	**Canopy:** includes trembling aspen, large-tooth aspen, white ash (*Fraxinus americana*), and balsam poplar (*Populus balsamifera* ssp. *balsamifera*). **Understory:** includes common buckthorn, red-berried elderberry (*Sambucus racemosa* ssp. *pubens*), and trembling aspen. **Ground Cover:** includes field horsetail, sensitive fern, western poison-ivy, and spotted-touch-me-not.	• Tree cover > 60 % (FO). • Deciduous trees > 75 % of canopy cover (D). • Fresh to moist, typically represents a young forest (8). • Poplar dominant (-1).
FOC	Coniferous Forest		
FOC3-1	Fresh-Moist Hemlock Coniferous Forest	**Canopy:** includes eastern hemlock (*Tsuga canadensis*), eastern red cedar (*Juniperus virginiana*), trembling aspen, and balsam poplar. **Understory:** includes eastern hemlock, white mulberry, choke cherry (*Prunus virginiana* ssp. *virginiana*), and common buckthorn. **Ground cover**: includes field horsetail, Kentucky bluegrass (*Poa pratensis* ssp. *pratensis*), Canada goldenrod, and New England aster (*Aster novae-angliae*).	• Tree cover > 60 % (FO). • Coniferous trees > 75 % of canopy cover (C). • Hemlock dominant (3). • Hemlock dominant, white cedar <25% of canopy (-1).

TABLE 2.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES

ELC Code	Vegetation Type	Species Association	Community Characteristics
FOC4-1	Fresh-Moist White Cedar Coniferous	**Canopy**: includes eastern white cedar (*Thuja occidentalis*), eastern hemlock and yellow birch (*Betula alleghaniensis*). **Understory:** includes common buckthorn, Tartarian honeysuckle, and eastern white cedar. **Ground cover:** includes field horsetail and Christmas fern (*Polystichum acrostichoides*).	• Tree cover > 60 % (FO). • Coniferous trees > 75 % of canopy cover (C). • White cedar dominant (4). • Dominated entirely by white cedar (-1).
TERRESTRIAL – CULTURAL			
CUM	Cultural Meadow		
CUM1-1	Dry-Moist Old Field Meadow	**Emergent Trees/Shrubs**: includes eastern red cedar, Siberian elm (*Ulmus pumila*), common buckthorn, and staghorn sumac. **Ground Cover:** includes Cananda goldenrod, wild carrot (*Daucus carota*), awnless brome (*Bromus inermis* ssp. *inermis*), Kentucky blue grass, Canada thistle (*Cirsium arvense*), and Kentucky blue grass.	• Cultural communities (CU). • Tree cover and shrub cover < 25 % (M). • This community can occur on a wide range of soil moisture regimes (Dry-Moist) (-1).
CUP3	Coniferous Plantation		
CUP3	Coniferous Plantation	**Canopy:** includes Scotch pine (*Pinus sylvestris*), white spruce (*Picea glauca*), and eastern white pine.	• Cultural communities (CU). • Planted trees (P). • Coniferous tree species >75% of canopy cover (3).
CUP3-1	Red Pine Coniferous Plantation	**Canopy:** includes red pine (*Pinus resinosa*), eastern white cedar, white ash and eastern white pine. **Understory:** includes red pine, common buckthorn, and eastern white cedar. **Ground cover:** includes yellow avens, Canada goldenrod, bitter nightshade (*Solanum dulcamara*), thimble-berry (*Rubus occidentalis*), garlic mustard, and celandine (*Chelidonium majus*).	• Cultural communities (CU). • Planted trees (P). • Coniferous tree species >75% of canopy cover (3). • Red pine dominant (-1).
CUP3-2	White Pine Coniferous Plantation	**Canopy:** includes eastern white pine, white spruce, and Norway spruce (*Picea abies*). **Understory:** includes white pine, eastern white cedar, common buckthorn and glossy buckthorn. **Ground Cover:** includes garlic mustard, bitter nightshade, and creeping Charlie (*Glechoma hederacea*).	• Cultural communities (CU). • Planted trees (P). • Coniferous tree species >75% of canopy cover (3). • White pine dominant (-2).

TABLE 2.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES

ELC Code	Vegetation Type	Species Association	Community Characteristics
CUP3-3	Scotch Pine Coniferous Plantation	**Canopy:** includes Scotch pine. **Understory:** includes Scotch pine and common buckthorn. **Ground Cover:** includes western poison-ivy, bitter nightshade and Canada goldenrod.	• Cultural communities (CU). • Planted trees (P). • Coniferous tree species >75% of canopy cover (3). • Scotch pine dominant (-3).
CUS1	Cultural Savannah		
CUS1	Mineral Cultural Savannah	**Canopy:** includes Scotch pine, Siberian elm, and Norway maple (*Acer platanoides*). **Understory:** includes common buckthorn, white mulberry, riverbank grape, and Scotch pine. **Ground Cover:** includes Canada goldenrod, awnless brome, and wild carrot.	• Cultural communities (CU). • Tree cover <25% shrub cover >25% (S). • Mineral soil (1).
CUT1	Cultural Thicket		
CUT1	Mineral Cultural Thicket	**Canopy:** includes Scotch pine, eastern white pine, sugar maple, and Russian olive (*Elaeagnus angustifolia*). **Understory:** includes common buckthorn, staghorn sumac, white mulberry, and common pear (*Pyrus communis*). **Ground Cover:** includes wild red raspberry, Canada thistle, Canada goldenrod, and multiflora rose (*Rosa multiflora*).	• Cultural community (CU). • Tree cover <25 %; shrub cover >25% (T). • Mineral soil (1).
CUW	Cultural Woodland		
CUW1	Mineral Cultural Woodland	**Canopy:** includes trembling aspen, eastern white cedar, black walnut, Norway spruce, and Manitoba maple. **Understory:** includes common buckthorn, choke cherry (*Prunus virginiana* ssp. *virginiana*), white ash and white mulberry. **Ground Cover:** includes western poison-ivy, riverbank grape, wild red raspberry, European stinging-nettle (*Urtica diocia* ssp. *diocia*).	• Cultural communities (CU). • 25 % < tree cover < 35 % • Mineral Soil (1).
WETLAND			
SWD	Deciduous Swamp		
SWD2-2	Green Ash Mineral Deciduous Swamp	**Canopy:** includes red ash, black ash (*Fraxinus nigra*), and red maple (*Acer rubrum*). **Understory:** includes red ash, balsam poplar, and red-osier dogwood. **Ground Cover:** includes marsh-marigold (*Caltha palustris*), purple loosestrife (*Lythrum salicara*), reed canary grass (*Phalaris arundinacea*), and fox sedge (*Carex vulpinoidea*).	• Tree or shrub cover >25% and dominated by hydrophytic shrub and tree species (SW). • Deciduous tree cover >75% of canopy cover. • Ash dominant swamp (2). • Green ash dominant (-2).

TABLE 2.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES

ELC Code	Vegetation Type	Species Association	Community Characteristics
SWC	Coniferous Swamp		
SWC3-1	White Cedar Organic Coniferous Swamp	**Canopy:** includes eastern white cedar, trembling aspen and red ash. **Understory:** includes eastern white cedar, trembling aspen and common buckthorn. **Ground Cover:** includes sensitive fern and spotted touch-me-not.	• Tree or shrub cover >25% and dominated by hydrophytic shrub and tree species (SW). • Organic soil (3). • Almost entire dominated by white cedar (-1).
SWM1-1	Mixed Swamp		
White cedar-Hardwood Mixed Mineral Swamp		**Canopy:** includes tamarack (*Larix laricinia*), eastern white cedar, red ash, and black ash. **Understory:** includes round-leaved dogwood (*Cornus rugosa*), yellow birch, balsam poplar and eastern white cedar. **Ground cover:** includes sensitive fern, spotted joe-pye weed (*Eupatorium maculatum* ssp. *maculatum*), fox sedge, awl-fruited sedge (*Carex stipata*), and multi-coloured blue-flag (*Iris versicolor*).	• Tree or shrub cover >25% and dominated by hydrophytic shrub and tree species (SW). • Deciduous trees >25% and coniferous tree species >25% of canopy cover (M). • White cedar (1). • Hardwood mixture (-1).
SWT	Swamp Thicket		
SWT2-2	Willow Mineral Thicket Swamp	**Canopy:** includes crack willow. **Understory:** includes red-osier dogwood, common buckthorn and glossy buckthorin. **Ground Cover:** includes reed canary grass, spotted-touch-me-not and common water-plantain (*Alisma plantago-aquatica*)	• Tree or shrub cover >25% and dominated by hydrophytic shrub and tree species (SW). • Tree cover <25% hydrophytic shurbs >25% (T). • Mineral soil (2). • Willow dominant (-2).
MAS	Shallow Marsh		
MAS2	Shallow Marsh	**Emergent Trees/Shrubs:** includes red-osier dogwood. **Ground Cover:** includes purple loosestrife, spotted joe-pye weed, reed canary grass and spotted touch-me-not.	• Tree and shrub cover <25% with variable flooding regimes (water depth <2m) (MA). • Water up to 2 m deep (MAS). • Mineral soil (2).

TABLE 2.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES

ELC Code	Vegetation Type	Species Association	Community Characteristics
MAS2-1	Cattail Mineral Shallow Marsh	**Emergent Trees/Shrubs:** includes tamarack, eastern white cedar and trembling aspen. **Ground Cover:** includes board leaved cattail (*Typha latifolia*), narrow leaved cattail (*Tpyha angustifolia*), porcupine sedge (*Carex hystericina*), purple loosestrife and spotted touch-me-not.	• Tree and shrub cover <25% with variable flooding regimes (water depth <2m) (MA). • Water up to 2 m deep (MAS). • Mineral soil (2). • Cattails are dominant (-1).
MAM	Meadow Marsh		
MAM2	Mineral Meadow Marsh	**Ground Cover:** includes reed canary grass, sensitive fern, common reed (*Phragmites australis*), European stinging-nettle, and spotted joe-pye-weed.	• Tree and shrub cover <25% with variable flooding regimes (water depth <2m) (MA). • Species less tolerant of prolonged flooding (MAM). • Mineral soil (2).
MAM2-2	Reed-canary Grass Mineral Meadow Marsh	**Emergent Trees/Shrubs:** includes reddish willow (*Salix X rubens*). **Ground Cover:** includes reed canary grass, porcupine sedge, purple-stemmed aster (*Aster puniceus* var. *puniceus*), swamp milkweed (*Ascelpias incarnata* ssp. *incaranata*), purple loosestrife, and yellow sedge (*Carex flava*), spotted joe-pye weed.	• Tree and shrub cover <25% with variable flooding regimes (water depth <2m) (MA). • Species less tolerant of prolonged flooding (MAM). • Mineral soil (2). • Reed-canary grass dominant (2).
MAM2-5	Narrow-leaved Sedge Mineral Meadow Marsh	**Emergent Trees/Shrubs:** includes reddish willow (*Salix X rubens*), slender willow, Tartarian honeysuckle, and balsam poplar. **Ground Cover:** includes porcupine sedge, tussock sedge (*Carex stricta*), dark-green bulrush (*Scirpus atrovirens*), common reed, board leaved cattail, and fox sedge.	• Tree and shrub cover <25% with variable flooding regimes (water depth <2m) (MA). • Species less tolerant of prolonged flooding (MAM). • Mineral soil (2). • Narrow-leaved sedges dominant (-5).
OTHER**	Manicured and Hedgerow		
M and H	Manicured grasses and planted shrubs and/or trees	Areas where large expanses of grass/shrubs/trees are maintained and/or planted. **Trees/shrubs:** includes black walnut, white elm, red-osier dogwood, chokecherry, Manitoba maple and red ash.	

TABLE 3.
SUMMARY OF REGIONALLY RARE SPECIES IDENTIFIED WITHIN THE STUDY AREA

Scientific Name	Common Name	Waterloo	CUM1-1d	CUW1b	FOD5a	FOD7-3b	MAM2-2a	MAM2-2b	MAM2-2c	MAM2-5	MAM2a	MAM2b	MAS2-1b	MAS2-1c	MAS2a	SWM1-1
Pastinaca sativa	Wild Parsnip	R	X					X				X				
Lycopus uniflorus	Northern Bugleweed	R					X		X	X	X	X		X	X	X
Agastache foeniculum	Giant Hyssop	R	X					X					X			
Aster umbellatus var. umbellatus	Flat-topped White Aster	R		X												
Helianthus tuberosus	Jerusalem Artichoke	R				X										
Carex rosea	Rosy Sedge	R			X											

3.4 Wildlife and Wildlife Habitat

3.4.1 Purpose

A secondary source investigation and field surveys were carried out to characterize wildlife and wildlife habitat within the study area.

3.4.2 Data Sources

Information regarding wildlife and wildlife habitat within the study area was obtained through:

- The Natural Heritage Information Centre data available through *Make a Map* (MNRF 2019);
- Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature. Editors: Michael D. Cadman, Donald A. Sutherland, Gregor G. Beck, Denis Lepage, and Andrew R. Couturier. Ontario Breeding Bird Atlas. 2001 – 2005;
- Couturier, A. 1999. Conservation Priorities for the Birds of Southern Ontario. Bird Studies Canada;
- Ministry of Natural Resources and Forestry (MNRF). 2015. Species at risk in the Waterloo region accessed at: https://www.ontario.ca/environment-and-energy/species-risk-region?name=Waterloo;

- Ministry of Natural Resources and Forestry (MNRF). 2000. *Significant Wildlife Habitat Technical Guide*. Fish and Wildlife Branch – Wildlife Section; and,
- Dobbyn, J.S. 1994. *Atlas of the Mammals of Ontario*. Federation of Ontario Naturalists. Toronto.

In addition, correspondence with the MNRF Guelph District Office and GRCA was carried out.

Fieldwork was undertaken during June and July 2014, April through July 2015, April through June 2019, and May through June 2020. Specific surveys were conducted for anurans (frogs and toads) and breeding birds, and observations of all wildlife species were recorded during each survey. No specialized surveys for mammals were undertaken.

The entire corridor of the proposed LRT route was covered, from the Fairview Park Mall area along Fairway Road South at the northern end to downtown Cambridge. However, detailed wildlife fieldwork was conducted only in areas with natural heritage features (e.g., fields, woods, rivers) and not in areas that were predominantly developed (e.g., the strip malls along Hespeler Road). With changes to the alignment of the proposed LRT route, some of the surveys done in 2014 and 2015 are no longer along the technically preferred route. Only those surveys done along the current proposed LRT route are included in this report, except where otherwise noted.

Anuran Surveys

The purpose of these surveys was to document the occurrence of frog and toad species, identify potential breeding areas, and estimate breeding population levels. Anuran surveys were conducted between April 1 and July 5, and each evening's survey began one half hour after sunset and ended prior to midnight. Methodologies outlined in the Great Lakes Marsh Monitoring Program (https://www.birdscanada.org/volunteer/glmmp/index.jsp?targetpg=glmmpfrog) were used including calling index codes to estimate the abundance of frogs and toads at each station. We also estimated the number of calling individuals if possible. Call level index codes were assigned to all calling frog and toad species at each survey location as follows:

- Code 1: individual calls do not overlap and calling individuals can be discretely counted;
- Code 2: calls of individuals sometimes overlap, but numbers of individuals can still be estimated; and,

- Code 3: overlap among calls seems continuous (full chorus), and a count estimate is impossible.

In 2015, anuran surveys were done at two stations in the Dumfries Conservation Area (**Table 1**). These two stations in the Dumfries CA were surveyed again in 2019, as well as six other stations along the proposed LRT route: three along the Speed River and three along smaller creeks (**Table 4**; **Figure 2**). Three survey dates were selected in each year to coincide with the peak periods of breeding and vocalizing activity for different species of anurans (**Table 5**) following methodology in the Great Lakes Marsh Monitoring Program. Survey dates were spaced at least 15 days apart during evenings with little wind and minimum night air temperatures of 5°C for the first visit, 10°C for the second visit, and 17°C for the third visit.

Breeding Bird Surveys

Breeding bird surveys were conducted during June and early July in 2014 and 2015, and in late May and mid June in 2020, as follows:

- June 20, 23, 26 and 30, 2014;
- July 3, 8 and 9, 2014;
- June 23 and 24, 2015;
- July 2 and 3, 2015;
- May 27, 28 and 29, 2020; and,
- June 16, 18, and 19, 2020.

Surveys for breeding birds followed the Ontario Breeding Bird Atlas protocol (Cadman *et al.* 2007). Details regarding species, location, number of individuals, and behaviour (especially behaviour related to breeding activities) were recorded. Additional general wildlife surveys were undertaken on July 11, 14 and 16 in 2014. Incidental wildlife observations were recorded during breeding surveys in 2015 and 2020. Breeding bird surveys were done in 2020 along the current proposed LRT alignment.

Requests for data, in particular regarding species at risk, were made to MNRF Guelph District and the GRCA. Information concerning species at risk that had been previously recorded in the vicinity of the study area was obtained from the NHIC. The designation of regionally significant species is based on the Region of Waterloo list. We also checked eBird (https://ebird.org/home) for any recent bird species sightings in the vicinity of the study area. Very little information regarding wildlife occurrence that was specific to the study area, or immediately adjacent to it, was found. Most secondary-source data was collected outside of the LRT study area, or applied to a larger area, such as an atlas square, and could not be assigned specifically to the study area.

TABLE 4.
ANURAN SURVEY STATIONS

Station	Location	Stream/wetland	UTM Easting	UTM Northing
1	Galt Arena gardens	Mill Creek	556214	4801507
2	Dumfries CA south	Marsh in Dumfries CA	554907	4804122
3	Dumfries CA north	Marsh in Dumfries CA	554797	4804279
4	Footbridge near Russ St	Speed River	552300	4806219
5	MMP office on Eagle St	Speed River	551886	4805724
6	**A.** Canadian tire gas station	Speed River	551022	4805178
	B. Linear trail off Moore St	Speed River	551128	4805118
7	Hidden Valley Rd East	North Creek in Hidden Valley	546752	4807844
8	Hidden Valley Rd West	North Creek in Hidden Valley	546286	4807989

TABLE 5.
ANURAN SURVEY EFFORT AND CONDITIONS

Station	Survey time periods (start time - end time)					
	15-Apr-15	**27-May-15**	**29-Jun-15**	**24-Apr-19**	**16-May-19**	**18-Jun-19**
	9°C, overcast, wind 5-8km/hr	20°C, partly cloudy, winds light	18°C, partly cloudy, no wind	10°C, clear, wind 11 km/hr	13°C, clear, wind 5 km/hr	21°C, overcast, no wind
1	Not surveyed	Not surveyed	Not surveyed	20:57-21:00	22:07-22:10	21:35-21:38
2	22:59-23:02	22:15 – 22:18	22:12 – 22:15	21:18-21:21	22:27-22:30	21:53-21:56
3	22:48-22:51	22:09 – 22:12	22:20 – 22:23	21:33-21:36	22:38-22:41	21:58-22:01
4	Not surveyed	Not surveyed	Not surveyed	22:02-22:05	21:10-21:13	22:21-22:24
5	Not surveyed	Not surveyed	Not surveyed	22:18-22:21	21:26-21:29	22:33-22:36
6	Not surveyed	Not surveyed	Not surveyed	22:35-22:38	21:42-21:45	22:50-22:53
7	Not surveyed	Not surveyed	Not surveyed	23:06-23:09	23:20-23:23	23:22-23:25
8	Not surveyed	Not surveyed	Not surveyed	Not surveyed	23:30-23:33	23:15-23:18

3.4.3 Results

A list of the 93 wildlife species recorded within the study corridor during LGL surveys, and immediately adjacent to it, is presented in **Table 6**. That table also summarizes the federal (*Species At Risk Act, Migratory Birds Convention Act*), provincial (*Endangered Species Act, Fish and Wildlife Conservation Act*), and local status of each species. The scientific names of those species are included in **Table 3** and not repeated below.

3.4.4 Wildlife Habitat

The study area is a long, narrow corridor that mostly follows an existing railroad line and roads. There are a variety of vegetation communities, from cultural meadows and cultural woodlands, forests and marsh, to cropland and heavily developed commercial and residential areas. The study corridor also crosses both the Grand River and Speed River. The predominant ELC units, in terms of geographic area, are cultural meadow, cultural woodland, and manicured vegetation communities. The portion of the proposed corridor from the Fairview Park Mall area southeast to the Speed River crossing contains wildlife habitat with higher capability. Where the proposed route follows Eagle Street North and Hespeler Road, the wildlife habitat has lower capabililty. The only notable patch of comparatively high capability habitat for wildlife along this southern segment is Dumfries Conservation Area. There is also a vacant field (cultural meadow) along the west side of Hespeler Road just south of Langs Drive.

The study area is long and narrow, thus the area of wildlife habitat within the study corridor in any one location is small. However, at several locations, the Stage 2 ION LRT runs adjacent to forests or cultural meadows that are part of much larger ELC units, most of which lie outside of the narrow right-of-way. Along the corridor from west of Sportsworld Drive/Maple Grove Road to the Speed River are several deciduous forest woodlots. The corridor also connects to cultural meadow habitats along Fairway Road South, and between Riverbank Drive and Hwy 401. These larger parcels of habitat support more diverse and abundant wildlife populations that likely use the narrow study corridor for foraging and travel.

TABLE 6.
WILDLIFE SPECIES DOCUMENTED WITHIN OR ADJACENT TO THE STUDY AREA BY LGL BIOLOGISTS

Wildlife	Scientific Name	Common Name	SARA[1]	ESA[1]	Legal Status[1]	Local Status[2]
Amphibians and Reptiles	*Ambystoma laterale*	Blue-spotted Salamander			FWCA	
	Anaxyrus americanus	American Toad				
	Hyla versicolor	Gray Treefrog			FWCA	
	Pseudacris crucifer	Spring Peeper				
	Lithobates sylvaticus	Wood Frog				
	Lithobates pipiens	Northern Leopard Frog				
	Lithobates clamitans	Green Frog				
	Chelydra serpentina	Snapping Turtle	Special Concern	Special Concern	FWCA	
	Chrysemys picta marginata	Midland Painted Turtle	Special Concern	Special Concern	FWCA	
	Thamnophis sirtalis	Common Gartersnake				
	Storeria dekayi	Dekay's Brownsnake				
Birds	*Branta canadensis*	Canada Goose			MBCA	
	Anas platyrhynchos	Mallard			MBCA	
	Meleagris gallopavo	Wild Turkey			FWCA	
	Ardea herodias	Great Blue Heron			MBCA	RS
	Phalacrocorax auratus	Double-crested Cormorant				
	Cathartes aura	Turkey Vulture			FWCA	RS
	Accipiter cooperii	Cooper's Hawk			FWCA	RS
	Pandion haliaetus	Osprey			FWCA	RS
	Buteo jamaicensis	Red-tailed Hawk			FWCA	
	Charadrius vociferus	Killdeer			MBCA	
	Actitis macularius	Spotted Sandpiper			MBCA	
	Larus delawarensis	Ring-billed Gull			MBCA	
	Columba livia	Rock Pigeon				

TABLE 6.
WILDLIFE SPECIES DOCUMENTED WITHIN OR ADJACENT TO THE STUDY AREA BY LGL BIOLOGISTS

Wildlife	Scientific Name	Common Name	SARA[1]	ESA[1]	Legal Status[1]	Local Status[2]
	Zenaida macroura	Mourning Dove			MBCA	
	Coccyzus americanus	Yellow-billed Cuckoo			MBCA	
	Coccyzus erythropthalmus	Black-billed Cuckoo			MBCA	RS
	Chaetura pelagica	Chimney Swift	Threatened	Threatened	MBCA	
	Megaceryle alcyon	Belted Kingfisher			FWCA	RS
	Melanerpes carolinus	Red-bellied Woodpecker			MBCA	RS
	Picoides pubescens	Downy Woodpecker			MBCA	
	Leuconotopicus villosus	Hairy Woodpecker			MBCA	
	Colaptes auratus	Northern Flicker			MBCA	
	Contopus virens	Eastern Wood-Pewee	Special Concern	Special Concern	MBCA	
	Empidonax minimus	Least Flycatcher			MBCA	RS
	Empidonax traillii	Willow Flycatcher			MBCA	RS
	Sayornis phoebe	Eastern Phoebe			MBCA	
	Myiarchus crinitus	Great Crested Flycatcher			MBCA	
	Tyrannus tyrannus	Eastern Kingbird			MBCA	
	Vireo gilvus	Warbling Vireo			MBCA	RS
	Vireo olivaceus	Red-eyed Vireo			MBCA	
	Cyanocitta cristata	Blue Jay			FWCA	
	Corvus brachyrhynchos	American Crow				
	Eremophila alpestris	Horned Lark			MBCA	
	Tachycineta bicolor	Tree Swallow			MBCA	
	Stelgidopteryx serripennis	Northern Rough-winged Swallow			MBCA	
	Hirundo rustica	Barn Swallow	Threatened	Threatened	MBCA	
	Riparia riparia	Bank Swallow	Threatened	Threatened	MBCA	
	Poecile atricapillus	Black-capped Chickadee			MBCA	

TABLE 6.
WILDLIFE SPECIES DOCUMENTED WITHIN OR ADJACENT TO THE STUDY AREA BY LGL BIOLOGISTS

Wildlife	Scientific Name	Common Name	SARA[1]	ESA[1]	Legal Status[1]	Local Status[2]
	Sitta canadensis	Red-breasted Nuthatch			MBCA	RS
	Sitta carolinensis	White-breasted Nuthatch			MBCA	
	Troglodytes aedon	House Wren			MBCA	
	Hylocichla mustelina	Wood Thrush	Threatened	Special Concern	MBCA	
	Turdus migratorius	American Robin			MBCA	
	Dumetella carolinensis	Gray Catbird			MBCA	
	Toxostoma rufum	Brown Thrasher			MBCA	RS
	Sturnus vulgaris	European Starling				
	Bombycilla cedrorum	Cedar Waxwing			MBCA	
	Mniotilta varia	Black-and-white Warbler			MBCA	RS
	Oreothlypis ruficapilla	Nashville Warbler			MBCA	RS
	Geothlypis trichas	Common Yellowthroat			MBCA	
	Setophaga ruticilla	American Redstart			MBCA	RS
	Setophaga petechia	Yellow Warbler			MBCA	
	Setophaga pinus	Pine Warbler			MBCA	RS
	Spizella passerina	Chipping Sparrow			MBCA	
	Spizella pusilla	Field Sparrow			MBCA	
	Passerculus sandwichensis	Savannah Sparrow			MBCA	
	Melospiza melodia	Song Sparrow			MBCA	
	Melospiza georgiana	Swamp Sparrow			MBCA	RS
	Cardinalis cardinalis	Northern Cardinal			MBCA	
	Pheucticus ludovicianus	Rose-breasted Grosbeak			MBCA	
	Passerina cyanea	Indigo Bunting			MBCA	
	Agelaius phoeniceus	Red-winged Blackbird				
	Quiscalus quiscula	Common Grackle				
	Molothrus ater	Brown-headed Cowbird				

TABLE 6.
WILDLIFE SPECIES DOCUMENTED WITHIN OR ADJACENT TO THE STUDY AREA BY LGL BIOLOGISTS

Wildlife	Scientific Name	Common Name	SARA[1]	ESA[1]	Legal Status[1]	Local Status[2]
	Icterus galbula	Baltimore Oriole			MBCA	
	Haemorhous mexicanus	House Finch			MBCA	
	Spinus tristis	American Goldfinch			MBCA	
	Passer domesticus	House Sparrow				
Mammals	*Marmota monax*	Woodchuck				
	Sciurus carolinensis	Eastern Grey Squirrel			FWCA	
	Tamias striatus	Eastern Chipmunk			FWCA	
	Tamiasciurus hudsonicus	Red Squirrel			FWCA	
	Microtus pennsylvanicus	Meadow Vole				
	Peromyscus sp.	Deer/White-footed Mouse				
	Sylvilagus floridanus	Eastern Cottontail			FWCA	
	Blarina brevicauda	Northern Short-tailed Shrew			FWCA	
	Canis latrans	Coyote			FWCA	
	Vulpes vulpes	Red Fox			FWCA	
	Neovison vison	American Mink			FWCA	
	Mustela erminea	Ermine			FWCA	
	Mephitis mephitis	Striped Skunk			FWCA	
	Procyon lotor	Northern Raccoon			FWCA	
	Odocoileus virgianus	White-tailed Deer			FWCA	

[1]Federal and Provincial Legislation:
SARA: *Species at Risk Act* (Federal)
ESA: *Endangered Species Act* (Ontario)
MBCA: *Migratory Birds Convention Act* (Federal)
FWCA: *Fish and Wildlife Conservation Act* (Ontario)
[2]Local Status:
RS = Regionally Significant in the Region of Waterloo, based on Region of Waterloo status list 27 February 2009.

Several species of birds were widespread and recorded at most locations along the study area. Bird species that were recorded in all four sections of the study area (i.e. South Cambridge, Central Cambridge, Kitchener and North Cambridge, and Fairway) include Northern Cardinal, Blue Jay, Song Sparrow, American Goldfinch, Red-winged Balckbird, Black-capped Chickadee and American Robin. Other commonly encountered species include Rose-breasted Grosbeak, Mourning Dove, American Crow, Chipping Sparrow, Baltimore Oriole, Gray Catbird, Red-eyed Vireo, European Starling, Common Grackle, and House Sparrow. Species of birds and mammals that were encountered in cultural meadow, cultural thicket, and cultural woodland habitats included Killdeer, Mourning Dove, Eastern Kingbird, Warbling Vireo, House Wren, American Robin, Gray Catbird, European Starling, Cedar Waxwing, Yellow Warbler, Chipping Sparrow, Field Sparrow, Savannah Sparrow, Song Sparrow, Northern Cardinal, Indigo Bunting, Red-winged Blackbird, Common Grackle, Brown-headed Cowbird, American Goldfinch, Coyote, Northern Raccoon, and White-tailed Deer. Species recorded in forests include Northern Flicker, Eastern Wood-Pewee, Great Crested Flycatcher, Red-eyed Vireo, Blue Jay, Wood Thrush, Pine Warbler, and Rose-breasted Grosbeak.

Few species of reptiles were found, four in total including two species of turtles near the Speed River and two species of snakes found in drier areas (**Table 7**). Seven species of amphibians were found (Table 6), five of which were heard calling during anuran surveys (**Table 7**). The wetlands in Dumfries Conservation Area supported several species of amphibians, and locations along the Speed River also supported a few amphibian species (**Table 7**).

3.4.5 Fauna

A total of 93 species of wildlife (amphibians, reptiles, birds, and mammals) was recorded within, or immediately adjacent to, the study area during field surveys (**Table 6**). Some of those species are species at risk protected under federal and/or provincial legislation; those species are discussed in the following section. Several species that were recorded are considered regionally significant within the Region of Waterloo and are mentioned below. This is not considered a complete list of all species that breed, or otherwise occur in the study area. In particular, the list of reptiles and mammals should be considered incomplete as these groups are more difficult to survey and require specialized survey methods. Some other species likely occur, based on the habitat, and many other species of birds and some bats will occur during migration. Additional bird species will visit during the winter months as well.

Four species of reptiles were found (**Table 6**). Common Gartnersnake and Dekay's Brownsnake were seen in drier habitats; both are abundant and widespread species in southern Ontario. Queensnake (*Regina septemvittata*) was not recorded during our surveys but is known to occur locally along the Grand River within Waterloo Region

(Rowell 2012). It is ranked Endangered in Canada under Schedule 1 of the federal *Species At Risk Act*, and Endangered in Ontario under the provincial *Endangered Species Act*. Two turtle species were found along the Speed River, Midland Painted Turtle and Snapping Turtle, both are listed as species of special concern federally under COSEWIC and are protected under the *Fish and Wildlife Conservation Act* (FWCA). Three Snapping Turtle females were found digging nests on June 18, 2020 on the south side of the Speed River to the north of the proposed LRT route.

The amphibians were encountered primarily in wetland areas, as expected. During the anuran surveys four species of frogs (Gray Treefrog, Green Frog, Spring Peeper, and Wood Frog) and one toad species (American Toad) were heard calling (**Table 7**). Leopard Frog and Blue Spotted Salamander were encountered incidentally, so in total seven species of amphibians were encountered (**Table 6**). The wetlands within the Dumfries CA where two of the anuran survey stations were located (**Figure 2**), supported the highest number of amphibian species, and were the only locations with a high density of calling amphibians (calling index of 3), indicating that these areas support large numbers of breeding amphibians (**Table 7**).

The 68 species of birds recorded were likely breeding in the region, and many perhaps near to the study area; few are expected to have been nesting within the narrow study corridor itself though. Nevertheless, all species likely foraged within or adjacent to the study area. Bird surveys done in 2020 confirmed breeding evidence for three species (Canada Goose, Baltimore Oriole, and European Starling), found probable breeding evidence (e.g. building nests, defending breeding territories) for 14 species, and possible breeding evidence (e.g. male singing, species observed in suitable breeding habitat) for another 14 species. Many of these species are widespread and abundant in southern Ontario and the Region of Waterloo (Cadman *et al*. 2007). Seventeen species are ranked Regionally Significant within the Region of Waterloo; 53 are protected under the federal Migratory *Birds Convention Act* (MBCA), and an additional seven species are protected under Ontario's FWCA (**Table 6**).

Fifteen species of mammals were recorded through evidence (e.g., tracks, scat) or direct observation (**Table 6**). All are common and widespread species in southern Ontario (Naughton 2012; Dobbyn 1994). All but three of the species receive protection in Ontario under the FWCA (**Table 6**).

TABLE 7.
ANURAN SURVEY RESULTS

Station	Location	Survey Date	Calling Level Code[1] (estimated no. of individuals)				
			American Toad	Gray Treefrog	Green Frog	Spring Peeper	Wood Frog
1	Galt Arena gardens	24-Apr-19					
		16-May-19					
		18-Jun-19					
2	Dumfries CA south	15-Apr-15				1	
		27-May-15					
		29-Jun-15					
		24-Apr-19	1 (1)			3	1 (2)
		16-May-19	1 (2)			2 (6)	
		18-Jun-19		2 (8)			
3	Dumfries CA north	15-Apr-15				2	
		27-May-15		2			
		29-Jun-15		1	1		
		24-Apr-19				3	3
		16-May-19	1 (2)	1 (1)		3	
		18-Jun-19		3			
4	Footbridge near Russ St	24-Apr-19					
		16-May-19					
		18-Jun-19		1 (1)*			
5	MMP office on Eagle St	24-Apr-19					
		16-May-19					
		18-Jun-19	1 (1)				
6	A. Canadian Tire gas station	24-Apr-19					
	B. Linear trail off Moore St	16-May-19					
		18-Jun-19					
7	Hidden Valley Rd East	24-Apr-19				1 (1)	
		16-May-19					
		18-Jun-19					
8	Hidden Valley Rd West	24-Apr-19	Not surveyed				
		16-May-19					
		18-Jun-19					

[1] Calling Level Code 1 – Individual calls do not overlap and calling individuals can be discretely counted.
Calling Level Code 2 – Calls of individuals sometimes overlap but numbers can be estimated.
Calling Level Code 3 – Calls are continuous and overlapping; no accurate or even reasonable estimate of numbers is possible.
— No individuals detected.
*Very distant, >100m away

3.4.6 Species at Risk

A search of the NHIC database for records of wildlife species at risk within or near the study area resulted in records for ten species. The most recent records for five of those species — Acadian Flycatcher (*Empidonax virescens*, 1974), Loggerhead Shrike (*Lanius ludovicianus*, 1935), Cerulean Warbler (*Setophaga cerulea*, 1900), Louisiana Waterthrush (*Parkesia motacilla*, 1953), and Henslow's Sparrow (*Ammodramus henslowii*, 1948) — are considered historical and it is likely that these species no longer occur within the study area. There were also no eBird sightings for these five species within the past 10 years in the Cambridge and Kitchener area, and we did not detect them during breeding bird surveys. Details regarding the other five species — Jefferson's Salamander (*Ambystoma jeffersonianum*), Snapping Turtle, Eastern Ribbonsnake (*Thamnophis sauritus*), Queensnake, and Eastern Meadowlark (*Sturnella magna*) are listed below in **Table 8**. The MNRF, Guelph District has records of six wildlife species at risk found within or near the study area - Jefferson's Salamander, Snapping Turtle, Bald Eagle (*Haliaeetus leucocephalus*), Common Nighthawk (*Chordeiles minor*), Chimney Swift (*Chaetura pelagica*), and Eastern Meadowlark. The date of the most recent sightings of these species was not provided. Snapping Turtle and Chimney Swift were encountered during surveys done by LGL in 2020.

The NHIC and local MNRF sources list a combined total of eight species at risk with recent records of occurrence in or near the study area. Of these, only two were documented during our field surveys: Snapping Turtle and Chimney Swift. However, four additional species at risk were recorded during LGL fieldwork: Eastern Wood-Pewee, Barn Swallow, Bank Swallow and Wood Thrush (**Table 6**). Midland Painted Turtle was recently listed as a species of special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (COSEWIC 2018) and was encountered during field surveys. Thus, there are recent records for 12 wildlife species at risk in or near the study area. **Table 9** summarizes the federal and Ontario conservation status rankings of these 12 species.

Jefferson's Salamander

No suitable habitat (vernal pools) was found in the study area for this species; however, regulated Blue-spotted Salamander habitat occurs in the Hidden Valley Wetland. Blue-spotted Salamander, a closely related species that is known to hybridize with Jefferson's, was found at Dumfries Conservation Area in wetlands near the study corridor. The NHIC records date from 1981 and earlier. They are all located south of Hwy 401: in and around Riverside Park and the Speed River, around Dumfries Conservation Area, and near the Grand River in Galt.

TABLE 8.
RECENT RECORDS OF SPECIES AT RISK FROM THE NHIC DATABASE

	SPECIES AT RISK				
	Jefferson's Salamander	Snapping Turtle	Eastern Ribbonsnake	Queensnake	Eastern Meadowlark
Year of most recent record	1981	2010	1977	1979	2010
1-km Square					
17NJ4507			X		X
17NJ4508			X		
17NJ4608			X		
17NJ4708			X		
17NJ4806		X			
17NJ5105	X	X			
17NJ5106	X	X			
17NJ5205	X				
17NJ5206	X	X			
17NJ5305	X				
17NJ5306	X	X			
17NJ5403	X			X	
17NJ5404	X				
17NJ5405	X				
17NJ5406	X				
17NJ5500			X		
17NJ5501	X	X	X		
17NJ5502	X		X		
17NJ5503	X				
17NJ5504	X				

TABLE 9.
FEDERAL AND ONTARIO RANKINGS OF SPECIES AT RISK

Species	SARA[1]	COSEWIC[1]	ESA[1]
Jefferson's Salamander	END	END	END
Snapping Turtle	SC	SC	SC
Midland Painted Turtle	—	SC	SC
Eastern Ribbonsnake	SC	SC	SC
Queensnake	END	END	END
Bald Eagle	—	NAR	SC
Common Nighthawk	SC	SC	SC
Chimney Swift	THR	THR	THR
Eastern Wood-Pewee	SC	SC	SC
Bank Swallow	THR	THR	THR
Barn Swallow	THR	THR	THR
Wood Thrush	THR	THR	SC
Eastern Meadowlark	THR	THR	THR

[1]SARA = Federal *Species At Risk Act*
COSEWIC = Committee on the Status of Endangered Wildlife in Canada
ESA = Ontario *Endangered Species Act*
END = Endangered
THR = Threatened
SC = Special Concern
NAR = Not At Risk
— = Species not listed

Snapping Turtle

Snapping Turtles were seen on three occasions — 30 June 2014, 29 May 2015, and 18 June 2020 — during LGL field surveys, in the Speed River alongside Riverside Park in 2014 and 2015 and south of the Speed River in 2020. Note that the current Stage 2 ION LRT alignment no longer goes through Riverside Park, but since the LRT will cross the Speed River downstream of Riverside Park and will continue south of the Speed River, the potential occurrence of this species is likely. On 18 June 2020, of the four Snapping Turtles observed, three were females in the process of digging nests. These nest locations were south of the Speed River and north of the proposed LRT alignment. NHIC records list the following locations: near King Street East and Sportsworld Drive, near Riverside Park and the Speed River, and near the Grand River in Galt. The most recent NHIC record(s) is from 2010.

Eastern Ribbonsnake

The Eastern Ribbonsnake typically occurs in wetlands (e.g., marshes) and near permanent bodies of still or slow-moving water (e.g., ponds, streams, lakes) (Rowell 2012). There are a few such sites in or near the study area. Records from the NHIC database date from 1977 and earlier. Eastern Ribbonsnake may no longer occur in the region of the study corridor. The NHIC records come from the vicinity of Fairview Park Mall (Fairway Road South and Hwy 8), and at the southern end of the study corridor in and near Galt.

Queensnake

Queensnakes are highly aquatic, frequenting creeks, streams, and rivers; they specialize on eating crayfish (Rowell 2012). Areas of the Grand River are known to support local populations of this species. The NHIC database lists Queensnake from the area of Dumfries Conservation Area. The most recent record is from 1979.

Bald Eagle

The MNRF lists the Bald Eagle as occurring in the vicinity of the study corridor, and there have been several recent sightings of Bald Eagles on the Speed River and on the Grand River on eBird, including in 2020. Bald Eagles forage along the Grand and Speed Rivers and undoubtedly fly over the area during migration. Although no evidence of breeding was documented during the most recent atlas period (Cadman *et al*. 2007), in 2020 there was a confirmed nest of Bald Eagles with two young near the Grand River at Fountain St in north Cambridge.

Common Nighthawk

Common Nighthawk was listed by MNRF as occurring in or near the study area. Common Nighthawks nest on the ground in open natural areas, and on flat rooftops in urban areas. During the most recent breeding bird atlas period (2001-2005), possible

breeding evidence was recorded for 10-km square 17NJ40, and probable breeding evidence for 10-km square 17NJ50 (Cadman *et al*. 2007).

Chimney Swift

Chimney Swifts were heard calling and seen foraging over downtown Galt at two locations in the South Cambridge section of the study area along Mill Creek on May 27, 2020 and June 18, 2020. It is likely they are nesting in chimneys on old buildings in the downtown area of Galt. Chimney Swifts were also heard calling and seen foraging over the Speed River at Riverside Park during LGL surveys on 2 July 2015. They were not recorded during the 24 June 2015, or 2014, surveys. It is possible that these birds are nesting in chimneys on old buildings in the downtown area of Preson. Note that the current Stage 2 ION LRT alignment does run along Mill Creek but no longer goes through Riverside Park, although since the LRT will cross the Speed River downstream of Riverside Park and will go through parts of Preston, the occurrence of this species is likely. The MNRF also has records of Chimney Swift occurring in or near the study corridor. During the 2001-2005 breeding bird atlas surveys, a probable level of breeding evidence was obtained for 10-km square 17NJ40A, and breeding was confirmed in 10-km square 17NJ50 (Cadman *et al*. 2007). There have been multiple recent sightings in 2018, 2019 and 2020 of Chimney Swifts on eBird in Preston near the Speed River and over downtown Galt.

Eastern Wood-Pewee

Records for Eastern Wood-Pewee in the vicinity of the study area were not listed in either the NHIC database or the records of the MNRF. Bird surveys in 2020 found this species singing in deciduous woods south of the Speed River near the location where the LRT is proposed to cross the Speed River. This species was heard singing in deciduous woods during surveys in 2014 and 2015 at four locations that are now outside of the study area with the current proposed alignment of the LRT, though still in the vicinity:

- Schneider Park at the Grand River;
- Sportsworld Drive/Maple Grove Road and the RR tracks;
- South side of the RR tracks between Maple Grove Drive and Fountain Street; and
- West end of Riverside Park.

There have also been some recent records of Eastern Wood-Pewee on eBird in 2018 and 2019 in Riverside Park and along the Cambridge Linear Trail on the south side of the Speed River west of King St. Eastern Wood-Pewee was listed as a probable breeder in square 17NJ40, and a confirmed breeder in square 17NJ50 during the 2001-2005 breeding bird atlas (Cadman *et al*. 2007).

Bank Swallow

Bank Swallows were seen foraging over the Grand River on the west side of the Highway 8 bridge during bird surveys in 2020. No suitable nesting sites were found along the banks of the Grand River at this location, but it is possible there are nesting sites either upstream or downstream on the river. There are several sightings in 2020 on eBird of Bank Swallows foraging over the Grand River near Freeport Bridge (upstream of the current LRT alignment) and foraging over the Speed River to the east of the King Street Bridge. This species was confirmed nesting in both 10-km squares (17NJ40 and 17NJ50) during the most recent breeding bird atlas (Cadman *et al*. 2007).

Barn Swallow

Barn Swallows were seen foraging at six locations along the study corridor during 2014 fieldwork, one location during 2015 surveys, and one location during 2020 surveys. Three of these locations are within the study area of the current proposed LRT alignment:

- Fairview Park Mall area (2014);
- The NE corner of Hespeler Road and Can-Amera Parkway in Cambridge (2014); and,
- East of Speedsville Rd, south of the Speed River (2020).

Four locations are now outside of the study area with the current proposed alignment of the LRT, though still in the vicinity:

- In the vicinity of the Honda dealership, east of the Grand River (2014 and 2015);
- Sportsworld Drive/Maple Grove Road at the RR tracks (2014 and 2015);
- By the Blackberry building on Reuter Drive (2014); and,
- The baseball field at the west end of Riverside Park by the Speed River (2014).

This species was confirmed nesting in both 10-km squares (17NJ40 and 17NJ50) during the most recent breeding bird atlas (Cadman *et al*. 2007).

Wood Thrush

Wood Thrush was recorded once during the 2014 field surveys, in the woods at the west end of Riverside Park. This species was not recorded during 2020 field surveys. Note that the current LRT alignment no longer goes through Riverside Park, but we thought it important to note the presence of this species in the vicinity of the study area. There were no records in either the NHIC database or MNRF records, although Wood Thrush was documented at the Probable level of breeding evidence in both 10-km squares during the 2001-2005 breeding bird atlas (Cadman *et al*. 2007). Wood Thrush prefer woodlands during the nesting season.

Eastern Meadowlark

No Eastern Meadowlarks were recorded during field surveys, but there are records in the NHIC database and with the MNRF. The NHIC record(s) come from the area south of the Fairview Park mall (1-km square 17NJ4507). Records for Eastern Meadowlarks in eBird are in the vicinity but not within the study area and most are earlier than 2010. Eastern Meadowlarks prefer field habitats, including pasture and hay. Breeding was confirmed for Eastern Meadowlark in both 10-km squares that encompass the study area, 17NJ40 and 17NJ50, during the 2001-2005 breeding bird atlas (Cadman *et al*. 2007).

3.5 Designated Natural Areas

Designated natural areas include areas that have been identified for protection by the MNRF, GRCA, Region of Waterloo, City of Cambridge and the City of Kitchener. The limits of designated natural areas located within the study area are presented in **Figures 3a to 3d.**

3.5.1 Areas of Natural and Scientific Interest (ANSIs)

One regionally significant earth science Area of Natural and Scientific Interest (ANSI), the Freeport Esker, is located north of Highway 8 at Sportsworld Drive. The Freeport Esker is also identified as a Significant Landform in the City of Kitchener Official Plan.

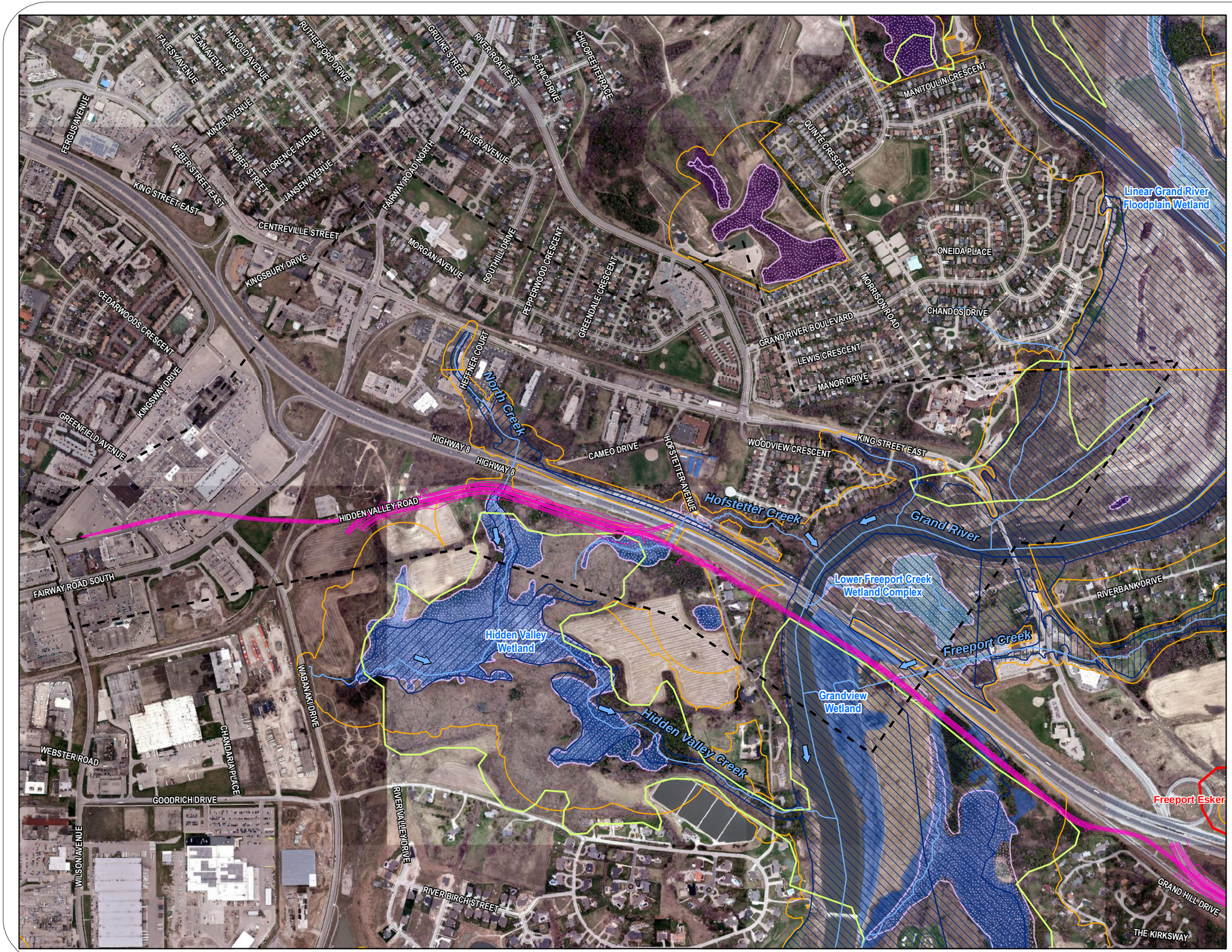
3.5.2 Provincially Significant Wetlands (PSWs)

There are three provincially significant wetlands (PSWs) located in the study area including:

- Hidden Valley Wetland;
- Grandview Wetland; and,
- Speed River Wetland.

Hidden Valley PSW is located south of Highway 8, west of the Grand River and north of Hidden Valley Road. The Grandview PSW is located south of Highway 8 and immediately east of the Grand River within the Grand River valleylands. Speed River PSW is located south of Highway 401 between Speedsville Road and Fountain Street North along the Speed River valleylands.

Several other wetland pockets that are non-provicially significant have been identified by the GRCA at the Dumfries Conservation Area. The Lower Freeport Creek Wetland Complex and West Freeport Esker ANSI Wetland are non-provincially significant wetlands located beyond the preferred LRT alignment.



LEGEND

- Preferred Alignment (August 2019)
- Study Area
- Area of Natural and Scientific Interest
- *Core Environmental Features
- Environmentally Significant Landscape
- Watercourse
- Watercourse Flow Direction

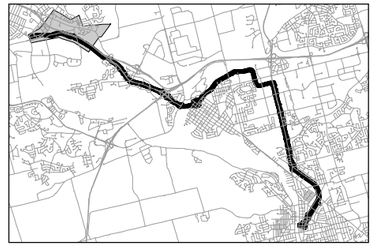
Wetlands (LIO)

- Evaluated-Provincial
- Evaluated-Other
- Not evaluated per OWES
- Wetland (GRCA)
- Regulation Limit (GRCA)

Regulatory Floodplain (GRCA)

- Engineered
- Estimated
- Approximate

* Core Environmental Features include: Environmentally Sensitive Policy Areas, Regional Forests, Forests greater than 4 ha, and Siginificant Valley Features.



Data Sources: Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

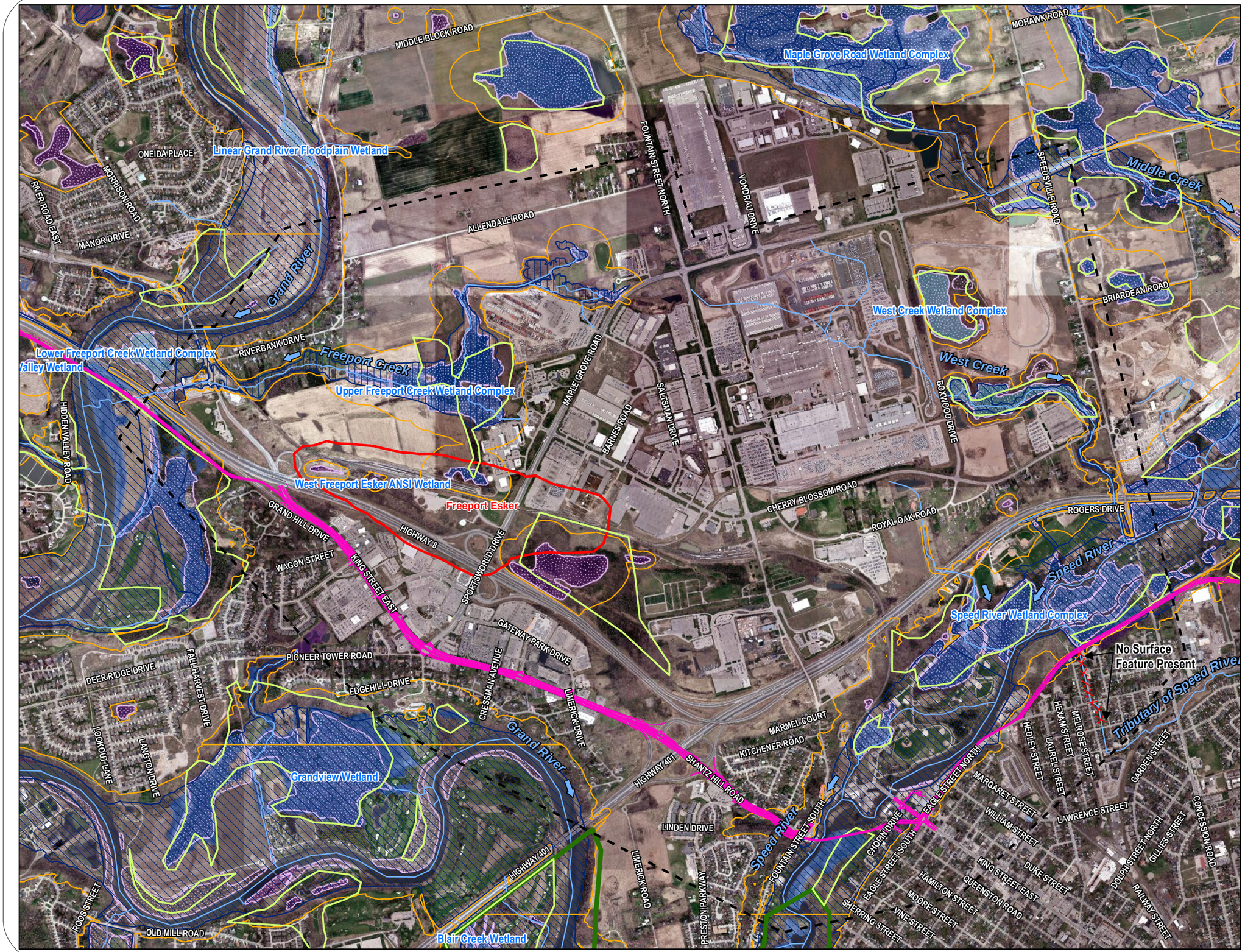
200 100 0 200 Metres

N

Designated Natural Areas Fairway Study Area

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	3a
Date	August, 2019	**Prepared By:**	KC
Scale	1:10,000	**Verified By:**	GNK



LEGEND

- Preferred Alignment (August 2019)
- Study Area
- Area of Natural and Scientific Interest
- *Core Environmental Features
- Environmentally Significant Landscape
- Watercourse
- Watercourse Flow Direction

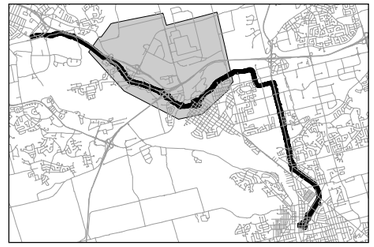
Wetlands (LIO)

- Evaluated-Provincial
- Evaluated-Other
- Not evaluated per OWES
- Wetland (GRCA)
- Regulation Limit (GRCA)

Regulatory Floodplain (GRCA)

- Engineered
- Estimated
- Approximate

* Core Environmental Features include: Environmentally Sensitive Policy Areas, Regional Forests, Forests greater than 4 ha, and Siginificant Valley Features.



Data Sources: Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

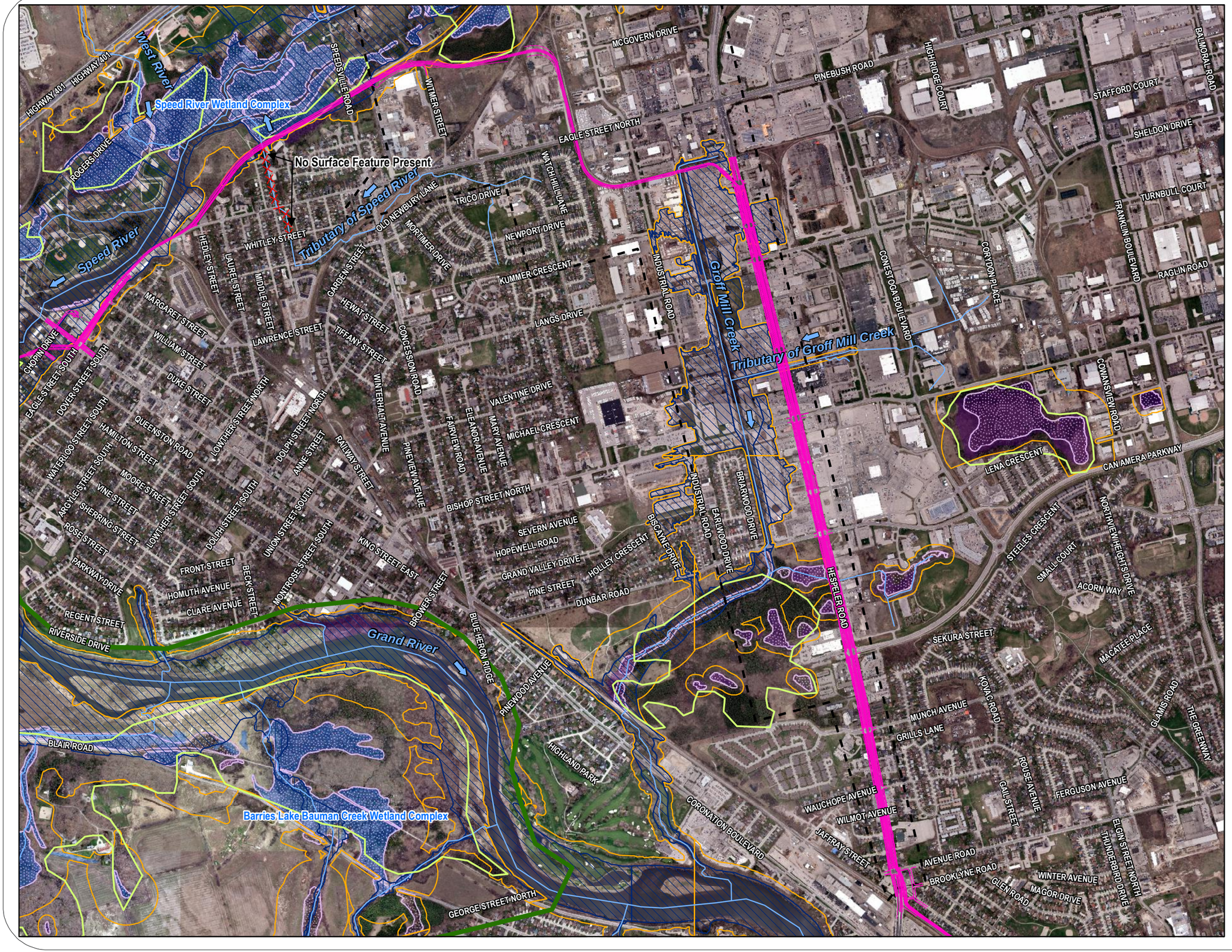
200 100 0 200 Metres

N

Designated Natural Areas Kitchener & North Cambridge Study Area

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	3b
Date	August, 2019	**Prepared By:**	KC
Scale	1:19,000	**Verified By:**	GNK



LEGEND

- Preferred Alignment (August 2019)
- Study Area
- Area of Natural and Scientific Interest
- *Core Environmental Features
- Environmentally Significant Landscape
- Watercourse
- Watercourse Flow Direction

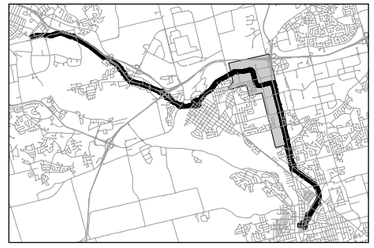
Wetlands (LIO)

- Evaluated-Provincial
- Evaluated-Other
- Not evaluated per OWES
- Wetland (GRCA)
- Regulation Limit (GRCA)

Regulatory Floodplain (GRCA)

- Engineered
- Estimated
- Approximate

* Core Environmental Features include: Environmentally Sensitive Policy Areas, Regional Forests, Forests greater than 4 ha, and Siginificant Valley Features.



Data Sources: Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

200 100 0 200 Metres

N

Designated Natural Areas Central Cambridge Study Area

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	3c
Date	August, 2019	**Prepared By:**	KC
Scale	1:16,000	**Verified By:**	GNK

LEGEND

- Preferred Alignment (August 2019)
- Study Area
- Area of Natural and Scientific Interest
- *Core Environmental Features
- Environmentally Significant Landscape
- Watercourse
- Watercourse Flow Direction

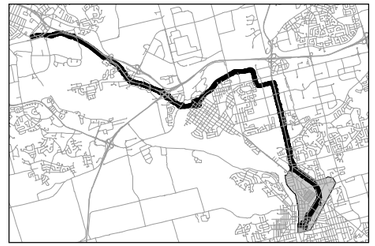
Wetlands (LIO)

- Evaluated-Provincial
- Evaluated-Other
- Not evaluated per OWES
- Wetland (GRCA)
- Regulation Limit (GRCA)

Regulatory Floodplain (GRCA)

- Engineered
- Estimated
- Approximate

* Core Environmental Features include: Environmentally Sensitive Policy Areas, Regional Forests, Forests greater than 4 ha, and Significant Valley Features.



Data Sources: Ministry of Natural Resources and Forestry, Region of Waterloo, Grand River Conservation Authority.

200 100 0 200 Metres

N

Designated Natural Areas South Cambridge Study Area

LGL LIMITED
environmental research associates

Project	TA8430	**Figure**	3d
Date	August, 2019	**Prepared By:**	KC
Scale	1:12,000	**Verified By:**	GNK

3.5.3 Environmentally Sensitive Policy Areas (ESPAs)

Two Environmentally Sensitive Policy Areas (ESPA) are identified by the Region of Waterloo and are located within the study area - ESPA # 27 Hidden Valley and ESPA #37 Grandview Woods. Hidden Valley is located south of Highway 8 between Wabanaki Drive and the Grand River. Grandview Woods is located south of Highway 8 and east of the Grand River. The boundaries of the Hidden Valley ESPA are being refined as part of the Region Official Plan review process to account for the EA-approved River Road Extension.

3.5.4 Conservation Areas

Dumfries Conservation Area, totaling approximately 75 ha, is located in the City of Cambridge between Highway 8 and Highway 24, south of Bishop Street North. Groff Mill Creek runs through the conservation area, eventually connecting to the Grand River.

3.5.5 Region of Waterloo Official Plan

A review of the Region of Waterloo Official Plan indicates that the Grand River and its major tributaries (including the Speed River) form a component of the Greenlands Network of the Region of Waterloo, along with significant valleys, wetlands and forests which contribute to the environmental health of the Grand River Watershed.

3.5.6 City of Kitchener Official Plan

The City of Kitchener Official Plan indicates that significant woodlands, wetlands and valleys of the Grand River and its tributaries form the Natural Heritage System of the City of Kitchener.

3.5.7 City of Cambridge Official Plan

A review of the City of Cambridge Official Plan indicates that the City's Natural Heritage System is made up of predominantly the Grand River and its tributaries, along with woodlands, wetlands, prairies and savannah habitat.

3.5.8 Region of Waterloo Conservation of Trees in Woodlands By-law 08-026

To sustain a healthy natural environment and have regards for good forestry practices, trees in woodlands, as identified by the Region of Waterloo, are prohibited from being destroyed or injured. However, 'activities or matters undertaken by the municipality or local board of municipality' are exempt from the provisions within the bylaw.

3.5.9 Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses (Ontario Regulation 150/06)

Valleylands associated with the Grand River and its tributaries, and all wetlands, are regulated areas under Ontario Regulation 150/06, Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses. A permit will be required from GRCA for development within these regulated areas.

4.0 PROJECT DESCRIPTION

The Stage 2 ION LRT will extend from the Fairview Park Mall in Kitchener to Downtown Cambridge. The Stage 2 ION LRT will consist of a mainly dedicated right-of-way following existing road and rail rights-of-way and new rights-of-way in several locations. A total of nine LRT stops are proposed from north to south including: Fairway; Sportsworld; Preston; Pinebush; Cambridge Centre Mall; Can-Amera; Delta; Main; and, Downtown Cambridge. Stops will consist of trackside platforms located within the right-of-way with covered shelters, ticket vending machines, bike racks and digital displays. The proposed route of the Stage 2 ION LRT is shown in **Figure 4**.

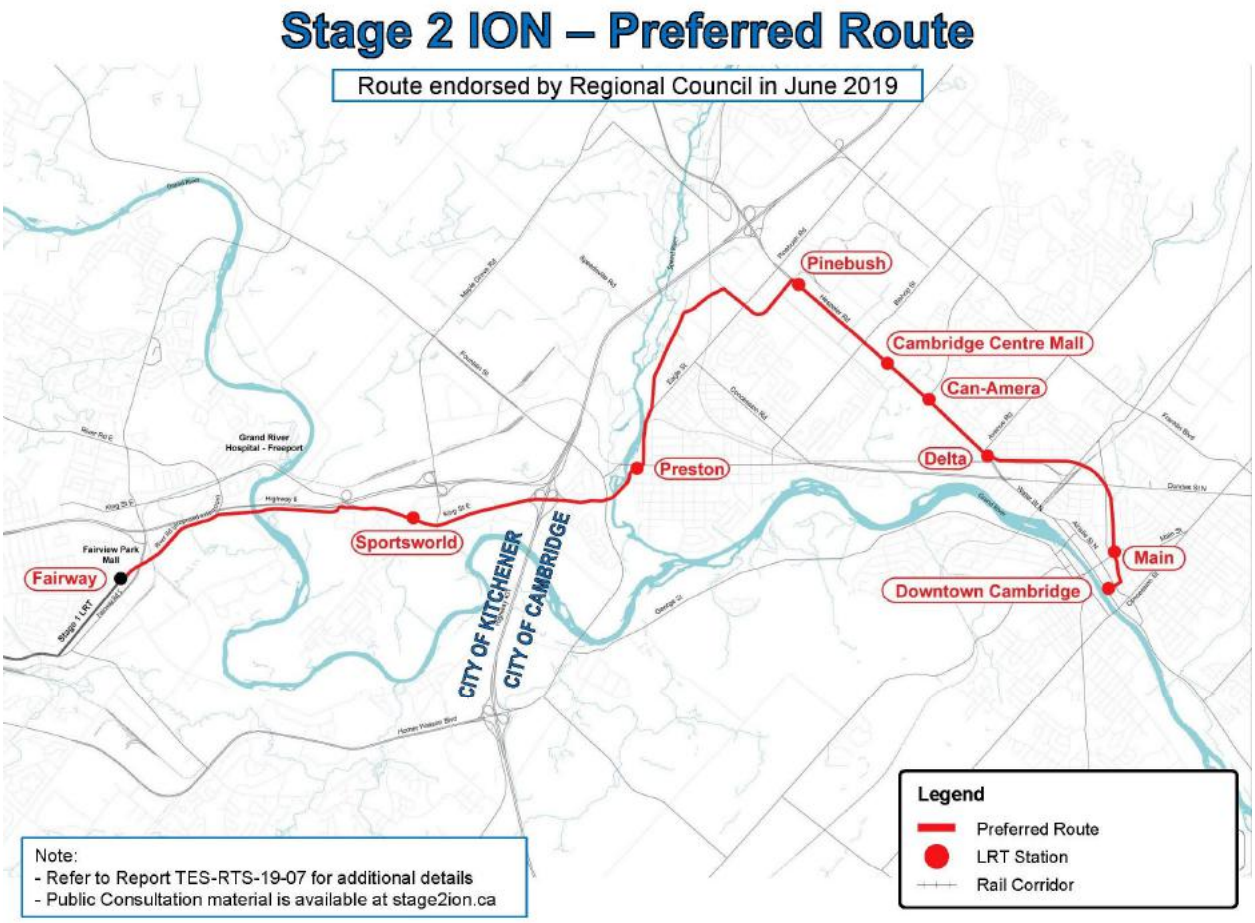


FIGURE 4. STAGE 2 ION LRT PREFERRED ROUTE (2019)

The Stage 2 ION LRT will include one northbound and one southbound lane located in a centre median, side running or in mixed traffic along existing roadways. The LRT will parallel railway tracks in active rail corridors or have a dedicated right-of-way where no existing right-of-way exists. The two-way runningway is typically 8.0 m wide; however, other amenities such as sidewalks, curbs, shoulders, multi-use trails, etc. will be built into the LRT design. Typical cross-sections for the LRT are shown in **Figure 5**.

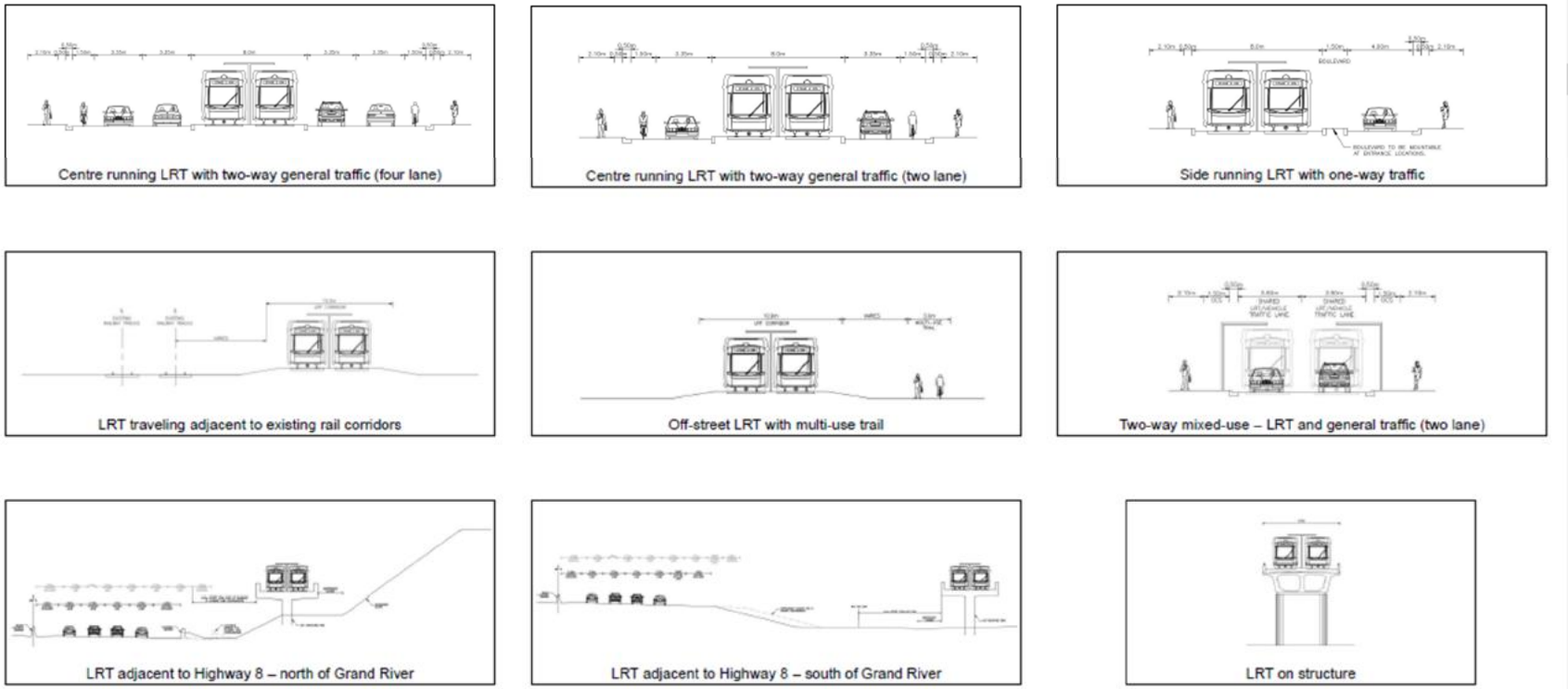


FIGURE 5. STAGE 2 ION LRT TYPICAL CROSS-SECTIONS

5.0 IMPACT ASSESSMENT AND MITIGATION

5.1 Soils

The soils located along the Stage 2 ION LRT facility are susceptible to erosion and will be impacted during construction as a result of clearing, excavation and grading. Consequently, soil disturbance associated with drainage improvements, grading revisions, culvert extension, etc. may result in erosion of, and sedimentation to, sensitive receiving watercourses. For this reason, standard erosion and sediment control measures will be followed during construction in accordance with Ontario Provincial Standard Specification (OPSS) 805 – Construction Specification for Temporary Erosion and Sediment Control Measures (2010) to minimize construction-related impacts on surface water quality and fish habitat. Site-specific erosion and sedimentation control measures to be implemented prior to construction will be identified during a later design stage following best management practices recommended in the following documents:

- Erosion and Sediment Control Guideline for Urban Construction (Greater Golden Horseshoe Area Conservation Authorities 2006);
- Best Management Practices Manual for Fisheries (MTO 2017); and,
- Environmental Guide for Erosion and Sediment Control during Construction of Highway Projects (MTO 2007).

These guidance documents will be used to prepare a detailed Erosion and Sediment Control Plan that will implement a multi-barrier solution that includes:

- placing straw bale/rock flow checks at regular intervals in ditches down-gradient from areas of soil disturbance in rural sections;
- protecting inlets to catch basins and maintenance holes in urban sections;
- placing silt fence along stream margins in areas of soil disturbance;
- managing stormwater during construction to prevent contact with exposed soils;
- implementing erosion control products within exposed areas such as erosion control blankets, coir logs, tackifyers and mulch, etc.;
- implementing temporary stormwater treatment measures during construction including sediment bags, sediment basins/ponds, diversion swales, pumping/drawdown of sediment basins/ponds, etc.
- limiting the extent and duration that soils are exposed to the elements to the minimum area and time necessary to perform the work;

- applying seed and mulch, tackifier and/or erosion control blanket in areas of soil disturbance to provide adequate slope protection and long-term slope stabilization; and,
- monitoring and maintenance of erosion and sedimentation control measures during construction to ensure their effectiveness.

Temporary erosion and sediment controls shall be inspected on a regular basis in accordance with the following documents:

- Erosion and Sediment Control Inspection Guide (TRCA 2008);
- Silt Smart: Erosion and Sediment Control Effectiveness Monitoring and Rapid Response Protocol for Large Urban Development Sites (CVC, MNRF, MECP and DFO 2012); and,
- Construction Administration and Inspection Task Manual (MTO 2007).

As a mimumum, erosion and sediment control measures shall be inspected on a daily basis during installation, prior to forecasted major storm events, during snowmelt and following significant storm events. Inspections for routine maintenance of erosion and sediment controls shall occur once per week, unless maintenance/repairs are required upon inspection and after significant storm events.

These environmental protection measures will greatly reduce the potential for soil erosion and impairment of surface water quality and fish habitat.

5.2 Fish and Fish Habitat

5.2.1 Impact Assessment

This section focuses on the potential direct and indirect environmental effects associated with the Stage 2 ION LRT project on fish and fish habitat. These effects can be mitigated through avoidance, design modifications, construction timing windows and best management practices to minimize disturbance to species and habitats. The mitigation measures outlined in this report will be refined in greater detail as the design is developed and assessed in the next phase of the project.

5.2.1.1 Aquatic Habitat and Communities

The Stage 2 ION LRT will require new crossings of watercourses or the extension or replacements of existing culverts. These works have the potential to result in impacts to aquatic habitats and communities. Effects on the aquatic features crossed or present within in the proximity of this new infrastructure, could include:

- Temporary disruption or permanent loss of site-specific aquatic habitat;

- Temporary changes to water quality;
- Changes in water temperature;
- Creating new barriers to fish passage;
- Indirect effects, including channel erosion; and
- Impacts to fish and mussel species at risk.

Projects undertaken near water must avoid causing serious harm to fish or impacting aquatic species at risk, unless exceptions are allowed (e.g. through a permit). The new *Fish and Fish Habitat Protection Provisions of the Fisheries Act* (2014*)* came into force on August 28, 2019. Under the new fish habitat protection provisions, there remains a proponent self-assessment process, for projects that qualify. Changes to the provisions include protecting all fish and fish habitats, restoring the acronym, HADD "harmful alteration, disruption or destruction of fish habitat," and restoring a prohibition against causing "the death of fish by means other than fishing." "Serious Harm to Fish", according to Fisheries and Oceans Canada, is considered to occur based on the following;

- the **death of fish**;
- a **permanent alteration** to fish habitat of a spatial scale, duration or intensity that limits or diminishes the ability of fish to use such habitats as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes; and
- the **destruction of fish habitat** of a spatial scale, duration, or intensity that fish can no longer rely upon such habitats for use as spawning grounds, or as nursery, rearing, or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes. (DFO 2015).

The self-assessment process shall be carried out durng a later design stage, once specific details related to each stream crossing have been determined.

5.2.1.2 Summary of Works and Site-Specific Habitat Impacts at Individual Crossings

The following provides a summary of the proposed works and high-level site-specific impacts at each watercourse crossing. Culvert sizing was not available during this design stage.

Tributary of the Grand River (North Creek)

There is an existing open footed culvert crossing under Highway 8 and the current alignment of River Road. A new (replacement) crossing of this watercourse will be required in order to accommodate the proposed River Road extension and the Stage 2 ION LRT alignment. The reach impacted is a high gradient channel supporting a 1.0 m

high perched culvert and severely eroding banks with little riparian cover. There is an opportunity to mitigate this barrier, to at least provide a stable channel reach at this location as well as span bankfull width. The potential impacts associated with this stream crossing will be assessed as part of the River Road Extension study.

Tributary of the Grand River (Hofstetter Creek)

As River Road will be realigned, the existing culvert and road base will be removed within the vicinity of this crossing. As such, a new culvert/structure will convey flow at the proposed River Road extension and the Stage 2 ION LRT crossing. Also, the local road will be realigned, removing a large portion of the upstream wetland. Additional habitat will be enclosed in the new culvert however this tributary does not support direct fish use. A culvert at this location will ensure that the function of this reach in contributing to downstream fish habitat, remains. The channel at the crossing location is not defined and direct fish use is not present. The potential impacts associated with this stream crossing will be assessed as part of the River Road Extension study.

Grand River

A new crossing of the Grand River will occur within a short distance downstream of the existing Highway 8 Northbound and Southbound structures. A new bridge will be constructed to accommodate the Stage 2 ION LRT crossing at this location. The new bridge has a span of 65 to 68 m and will span the River. The piers are shown in proximity of the bank edges, therefore temporary instream construction disturbance may be required in order to accommodate the pier installs. The installation of piers should occur during low water conditions to minimize the extent of in-water work that may be required. The preliminary design shows the bridge height ranging from 11 m to 13 m high. Although the bridge will be relatively high, vegetation growth on the south bank may suffer from reduced light and moisture. This observation was noted underneath the existing Highway 8 structures. Riparian vegetation impacted includes mainly grasses and herbaceous vegetation. With the direct/indirect removal of riparian vegetation, additional boulders and planting shade tolerant vegetation may mitigate these impacts.

Tributary of the Grand River (Freeport Creek)

This intermittent tributary will be crossed by the Stage 2 ION LRT within approximately 20 m downstream of the Highway 8 culvert crossing. A bridge structure will be constructed from the north bank of the Grand River a distance of 1.47 kilometers across the Grand River floodplain. As a result, Freeport Creek will be spanned by this approximately 3.0 m high bridge structure. No direct impacts are anticipated to occur at this watercourse, with the exception of removal of riparian vegetation within the footprint of the piers and likely reduced vegetation vigour underneath the 3.0 m high structure.

Speed River

A new crossing of the Speed River will occur approximately 440 m downstream of the King Street East road/bridge crossing. This new crossing will cross the river on a skew, by a bridge structure with a 43 m span (approx.). This bridge width will completely span the channel, with the current plan showing the west pier within the proximity of the water's edge. Instream construction disturbance may be required in order to accommodate the pier installs. This work should be carried out during low flow conditions. The preliminary design shows the bridge height ranging from 6 m to 7 m high. The new bridge may inhibit water and light penetration under its footprint, likely impacting riparian vegetation vigour here. With the direct/indirect removal of riparian vegetation, additional boulders and planting shade tolerant vegetation may mitigate these impacts. Riparian vegetation impacted is mostly deciduous tree growth.

Speed River at Eagle Street

The Stage 2 ION LRT will extend within close proximity of the river for a distance of approximately 50 m, just north of the CPR and Eagle Street crossing. The Stage 2 ION LRT will be bridged in this section, measuring approximately 6 m to 7 m high. Some temporary instream work may be required in order to install at least one pier. Riparian vegetation within this reach is already fairly narrow and open, given the presence of the CPR line. Stringent erosion and sedimentation controls will be required along this reach, to ensure protection of the adjacent aquatic habitat.

Speed River Tributary (Russ Street)

The preliminary plan for this crossing is unknown, although a new culvert will likely be required. The gradient is very flat within this area; however, it is assumed that maintaining the storm outlet function will be required. Construction related impacts including sedimentation and dewatering impacts have the potential to impact water quality and habitat quality of the creek. Best management practices implemented during the construction phase, will help to mitigate these impacts.

Groff Mill Creek and Tributary of Groff Mill Creek

Crossing design has not yet been determined for these crossings. It is likely that culverts will be incorporated into the design at these crossings. The Stage 2 ION LRT will cross the channel where it bends south and runs adjacent to the south bank for approximately 125 m. This channel is fairly disturbed, is channelized and does not support direct fish use. It does not appear that existing riparian vegetation will be directly impacted at Groff Mill Creek; however, given the proximity of the creek, stringent erosion and sedimentation controls will be required along this reach during construction, to ensure protection of the adjacent aquatic habitat. The tributary of Groff Mill Creek, located north of Bishop Street, will be minimally impacted by the Stage 2 ION LRT, as the ION will travel in the middle of Hespeler Road in this area. It appears that the road

cross section will be widened here and a culvert extension may be required on this channelized feature (ditch). There are no impacts to direct fish habitat.

Mill Creek

Mill Creek will not be directly impacted by the Stage 2 ION LRT works. However, construction related impacts including sedimentation and dewatering impacts have the potential to impact water quality and habitat quality of the creek. Best management practices implemented during the construction phase, will help to mitigate these impacts.

5.2.2 Design Considerations

New culverts will be designed to allow for fish movement, where applicable. The following design measures will be considered during a later design stage to ensure fish and wildlife passage are maintained or enhanced. Many of these measures are taken from MTO's Highway Design Guide (2018).

- For culverts, ensuring the width of the culvert is 1.25 times the average bankfull width of the watercourse (DFO 2015; MTO 2008);
- For closed bottom designs, a low flow channel is created within stable substrate to promote fish passage as well as provide an overbank area for wildlife movement, where deemed applicable;
- No drops/perches will be present through the crossing;
- All in-water construction shall be performed in the dry using appropriate flow bypass/isolation systems;
- Culverts will be designed to ensure that culvert gradients do not impede fish passage; and,
- Minimal depth at the inlet, outlet and barrel should be 20 cm deep to allow for passage of all fish species/size.

There are existing fish barriers present at North Creek and Hoffstetter Creek, as well as along the greater Freeport Creek system. The barrier at North Creek in particular is present within the immediate impact area. However, as River Road will also be realigned in this area, it is understood that the design of this culvert will occur under a separate project. Removing perched culvert conditions will also benefit aquatic habitat by minimizing impacts caused by erosion and sedimentation in these systems. Additional consultation with agencies (GRCA, DFO) will be required as the design progresses.

As many of the large systems (in addition to Freeport Creek) will be crossed by bridges, it is important that the final width and span placements are assessed by a Fluvial Geomorphologist to ensure that channel-structure conflicts are avoided. Other considerations to the bridge design should include considerations with regards to vegetation loss or die-back and maintaining wildlife movement.

5.2.2.1 Maintenance of Riparian Vegetation

Maintaining riparian vegetation to the extent possible will help to stabilize the watercourse banks, provide shading/cover for the watercourse, filter contaminants, and improve wildlife habitat and aesthetics. The following measures are recommended:

- Prior to construction, trees/shrubs to be retained will be clearly identified in the field by the installation of tree/shrub protection barriers;
- In areas where riparian vegetation removal is necessary to accommodate construction, measures to protect the local fish communities shall include the following: no clearing of matures trees providing a bank stabilization function; no felling of trees into the watercourse; minimize the amount of debris produced from entering the watercourse; and only clear the vegetation required to complete the necessary works; and,
- Planting plans will be completed, that includes planting native trees, shrubs and native seeding at each watercourse crossing, to replace and enhance the riparian communities.

5.2.3 Soils, Erosion and Sediment Control, and Surface Water

The building of the Stage 2 ION LRT has the potential to suspend soil particles, which could result in eroded materials inadvertently affecting vegetation, wildlife habitat and could impair surface water quality. Furthermore, an increase in runoff may promote erosion downstream thus impairing water quality with sediments. There is also the potential for the contamination of surface water from sources other than sediments (i.e. spills). Water quality treatment must be provided to maintain the existing quality of surface water within the study limits.

An erosion and sedimentation control plan must be implemented during construction, using best practice erosion and sedimentation control measures to cover the installation, maintenance, and removal of the temporary erosion and sediment control measures and the removal of sediment accumulated by the control measures. This will minimize construction-related impacts on water quality and fish habitat.

Site-specific erosion and sedimentation control measures will be identified during a later design stage following best management practices. Erosion and sedimentation control measures may include:

- Placing flow checks at regular intervals in roadside ditches down-gradient from areas of soil disturbance to trap suspended sediments and reduce the erosive force of runoff;
- Placing silt fence along watercourses, ditches, wetlands and forest/woodland edges in areas of soil disturbance;
- Limiting the extent and duration that soils are exposed to the elements to the minimum area and time necessary to perform the work;
- Managing stormwater during construction to prevent contact with exposed soils;
- Applying seed and mulch, tackifier and/or erosion control blanket in areas of soil disturbance to provide adequate slope protection and long-term slope stabilization;
- Monitoring and maintenance of erosion and sedimentation control measures during construction to ensure their effectiveness; and,
- Any dewatering will have discharge directed to a sediment containment system (sediment basin, sediment bag, etc.) prior to release to the watercourse.

These environmental protection measures will be implemented prior to construction commencement and will remain in place until construction is complete and soils have been re-stabilized. This will greatly reduce the potential for soil erosion and impairment of surface water quality and fish habitat.

5.2.4 Contamination of Surface Water from Other Sources

There is also the potential for contamination of surface water from sources other than sediment (i.e. spills or other materials/equipment). Best management/construction practices and control of all construction operations will be implemented during construction to reduce the potential for spills or other materials/equipment from entering the watercourses and wetlands within the study area. The following measures will be employed:

- Storage, stockpiling and staging areas will be delineated prior to construction and inspected in accordance with the *Erosion and Sediment Control Guideline for Urban Construction* (GGHA 2006);
- Construction material, excess material, construction debris, and empty containers will be stored at least 30 m distance from watercourses and watercourse banks to prevent their entry into watercourses;
- Equipment refueling, maintenance and washing activities will be conducted at a pre-determined site located at an adequate distance (minimum 30 m) from the watercourses and their banks located within the study area to prevent the entry

of petroleum, oil or lubricants (POL) or other deleterious substances (including any debris, waste, rubble or concrete material) into watercourses within the study area, or their release to the environment. Any material which inadvertently enters the watercourses will be removed by the Contractor in a manner satisfactory to the Contract Administrator; and,

- All spills that could potentially cause damage to the environment shall be reported to the Spills Action Centre of the MECP. In the event of a spill, containment and clean-up will be completed quickly and effectively. In addition, an NSSP (Spill Prevention and Response Contingency Plan) must be included in the contract package to ensure a Spill Prevention and Response Contingency Plan and the appropriate contingency materials to absorb or contain any petroleum products/spills that may be accidentally discharged will be on site at all times.

These environmental protection measures will greatly reduce the potential for surface water contamination from spills and from other materials/equipment from entering the watercourses and wetlands within the study area, and will provide a contingency in the event of an unforeseen event.

5.2.5 Changes to Water Quality and Quantity

The construction associated with the proposed structures and culvert works has the potential to alter water quality through on-site erosion of exposed materials and the subsequent impairment of downstream water quality with sediments and other contaminants.

Changes to water quality during construction will be mitigated through the isolation of the work areas, the treatment of effluent from dewatering (if applicable) prior to its release back into the receiving watercourse, and the deployment and maintenance of erosion and sediment controls (silt fencing, flow checks, etc.) which will prevent sediments from reaching the watercourse from exposed soils upslope. In addition, all exposed areas should be vegetated as quickly as possible once the work is completed.

The long-term stormwater management strategy involves a treatment train approach as documented in the Preliminary Drainage and Stormwater Mangement Report (WSP 2019). To improve storm water quality, transitway runoff will be directed to storm water management (SWM) systems where technically feasible or additional options for on-site and linear treatment will be considered (enhanced swales, infiltration). Enhanced grassed swales will be constructed along most of the transitway, where technically feasible, to provide treatment prior to discharge to receiving watercourses. At the Grand and Speed rivers where the transitway is elevated and enhanced grassed swales cannot be accommodated, stormwater will be collected at low points and conveyed to oil/grit separators (OSG) prior to discharge to these two receiving rivers. No stormwater

will be discharged to the wetlands associated with these major valley systems. Additional water quality measures, such as OGS units at existing sewer outfalls, catchbasin inserts, low impact development BMPs such as permeable pavements, perforated pipe systems and bioretention areas will be further evaluated and considered at the next design phase

No quantity controls are required for the outlets that discharge directly to the Grand and Speed rivers. However, quantity controls will be required for the areas which discharge into an existing sewer with restricted capacity. Capacity assessment has not been conducted at this stage, and no quantity controls are proposed. This will require further review during the next design phase, and if required, quantity controls could be provided in the form of underground superpipes to provide peak flow attenuation.

The implementation of these mitigation measures should eliminate potential changes to water quality and quantity at the receiving watercourses and wetland communities.

5.2.6 In-water works

Where possible, structures shall be constructed outside of the watercourse banks, eliminating the need for in-water works. However, at some of the crossings in-water work may be necessary. At all locations where in-water work is proposed, cofferdams (pea gravel bags, sheet piles, jersey barriers, aquadams, etc.) will be used to isolate the work area from the watercourse to enable work to be done in-the-dry. Flow will be maintained through either damming and pumping or fluming. If possible, work shall be done during the driest part of the year when minimal flows are present. This will minimize disturbance to fish habitat at the site and downstream. To further reduce the potential for serious harm, the following environmental protection measures will be implemented:

- no in-water work (or work on watercourse banks) will be permitted from March 15 to June 30 to protect spawning warmwater fish, incubating eggs and fry emergence (constitutes most crossings in the study area);
- where cofferdams are to be employed, dewatering effluent will be treated prior to discharge to receiving watercourse;
- cofferdams will be constructed using pea gravel bags, sheet piling or other appropriate material to isolate the work area: flow will be maintained at all stations;
- only clean material free of particulate matter will be placed in the watercourse;
- fish isolated by construction activities (if present) will be captured by a qualified fisheries specialist and safely released to the watercourse; and,

- Where SAR mussels exist and instream works are deemed required, the construction instream timing window will correspond to the active season for the mussels (when stream temperatures reach 16 °C or above) (Mackie et al 2018), or as outlined in applicable permits.

5.2.7 Species at Risk

Impacts to aquatic species at risk include the:

- killing, harming, harassment, possession, capturing or taking of species listed as extirpated, endangered or threatened under the Species at Risk Act or Endangered Species Act;
- damage or destruction of a residence; and,
- destruction of any part of the species' critical habitat.

As noted, critical habitat for Rainbow Mussel is shown for the Grand River reach. Both the Speed River and Grand River supports two SAR fish species (Black Redhorse, Silver Shiner) and Wavy-rayed Lampmussel; the latter three species are protected under the *ESA.* Therefore, any work (temporary or permanent) within and adjacent to the watercourse banks will require further review with DFO and MNRF, to determine if further mitigation and protection measures are applicable to protect these species and habitat. Multiple regulatory permits may be required, under the provincial and/or federal acts (ESA, SARA, Fisheries Act).

To reduce the potential for serious harm to SAR mussel species and habitat, the following environmental protection measures will need to be considered as the crossing designs are refined:

- where SARA-listed shellfish occur (i.e. Grand River and Speed River), no scaffolding or support structures shall be placed directly on the bed of the watercourse;
- where critical habitat of endangered or threatened shellfish occur, no dredging or excavation of the waterbody shall take place except where exempted in the recovery strategy for that species; and,
- timing windows for instream or near stream works to be reviewed with agencies.

5.3 Vegetation Communities

Construction of the Stage 2 ION LRT has the potential to result in impacts to vegetation and vegetation communities. Effects on vegetation related to the construction of the LFT and associated facilities could include:

- Displacement of and/or disturbance to vegetation and vegetation communities; and,
- Displacement of and/or disturbance to Rare, Threatened or Endangered Vegetation and Vegetation Communities.

5.3.1 Displacement of and/or disturbance to vegetation and vegetation communities

Clearing of vegetation will be required to accommodate the proposed construction of the Stage 2 ION LRT. The proposed construction will result in the removal of approximately 21.53 ha of naturalized and/or planted areas. The largest area of impact will be to lands that have been anthropogenically influenced, including cultural vegetation communities, agricultural, hedgerows and manicured areas. A total of 17.41 ha of human influenced lands and cultural vegetation communities will be removed as a result of the proposed construction. In addition, a total of 3.19 ha and 0.93 ha of forest and wetland communities will be removed, respectively. **Table 10** provides a summary of the total area of vegetation communities that will be removed for the proposed construction of the Stage 2 ION LRT.

TABLE 10.
IMPACTS TO VEGETATION COMMUNITIES WITHIN THE STUDY AREA

Vegetation Community Type	Vegetation Community	Total Area (ha) to be Impacted
Cultural	Dry-Moist Old Field Meadow (CUM1-1)	5.69
	Coniferous Plantation (CUP3, CUP3-1, CUP3-2, CUP3-3)	1.14
	Mineral Cultural Woodland (CUW1)	0.47
	Mineral Cultural Thicket (CUT1)	1.64
	Sub-total	**9.04**
Forest	Coniferous Forest (FOC4-1)	0.01
	Deciduous Forest (FOD, FOD5, FOD7-3, FOD7, FOD3-1 and, FOD8-1)	3.18
	Sub-total	**3.19**
Wetland	Meadow Marsh (MAM2, MAM2-2, MAM2-5)	0.57
	Shallow Marsh (MAS2-1)	0.35
	Deciduous Swamp (SWD2-2)	0.01
	Sub-total	**0.93**
Human Influenced Lands	Arboretum	0.11
	Agricultural (Ag)	0.27
	Manicured (M)	7.95
	Hedgerow (H)	0.04
	Sub-total	**8.37**
	Total Area	**21.53**

Cultural Vegetation Communities

A total of 9.04 ha of cultural vegetation communities will be removed as a result of the proposed construction. The largest impact will be to cultural meadow communities (CUM1-1). Overall, impacts resulting in the loss of vegetation within these cultural

vegetation communities is considered to be minor. Cultural vegetation communities typically persist in areas that are regularly disturbed, and as a result, contain a high proportion of invasive and non-native plant species that are tolerant of these conditions.

It is expected that plant species displaced and/or disturbed within the cultural communities due to the proposed construction will re-colonize available lands adjacent to the new right-of-way post-construction. Disturbance activities often serve to promote the establishment and/or spread of certain plant species such as those disturbance tolerant species.

Forest Vegetation Communities

A total of 3.19 ha of forest vegetation communities will be removed as a result of the proposed construction. Impacts to the forest communities will generally result in the removal of a strip of the community adjacent to the proposed right-of-way. New forest edges are exposed to greater potential for non-native and invasive species infiltration further into the forest, and as such, forest edge management is recommended. Recommended forest edge management measures are outlined in **Section 5.3.3.2**.

All of the forest communities found within the study area are widespread throughout Ontario and the loss of a portion of these vegetation communities is not expected to have any significant negative impacts to the remaining portions of forest.

Wetland Vegetation Communities

A total of 0.93 ha of wetland vegetation communities will be removed as a result of the proposed construction. Impacts to the wetland communities will result in the removal of a small portion of the communities adjacent to the proposed right-of-way. Removal of a small portion of wetlands associated with the Hidden Valley, Grandview and Speed River PSW Complexes will occur. It is anticipated that these wetlands will continue to persist post-construction. Edge management techniques using suitable plant species should be employed to mitigate any negative impacts to these vegetation communities. During a later design stage, appropriate edge management measures will be developed. Overall, impacts resulting from the proposed Stage 2 ION LRT will have no significant effect on the remaining portions of wetland communities throughout the study area.

GRCA has noted a discrepancy between their wetland mapping and the wetland mapping prepared by LGL Limited within the Grandview PSW and Speed River PSW complexes based on Ecological Land Classification (ELC) methods. To resolve these apparent discrepencies, the Region will stake and survey the limits of wetland vegetation communities in association with GRCA and MNRF during later design stages. The results of the wetland delination and survey will be documented in scoped Environmental Impact Statements (EISs) and incorporated into future design drawings.

The potential impacts on provincially and non-provincially significant wetlands will be addressed in scoped EISs and permits will be obtained, as required, in accordance with O. Reg. 150/06.

Human Influenced Lands

As noted in **Table 10**, a total of 8.37 ha of human influenced vegetation will be removed as a result of the proposed construction of the Stage 2 ION LRT. Of the 8.37 ha to be removed, 7.95 ha of manicured lands will be removed. The overall significance of the impact to these lands is considered low.

5.3.2 Displacement of and/or Disturbance to Rare, Threatened or Endangered Vegetation and Vegetation Communities

All of the vegetation communities identified within the study area are considered to be widespread and common in Ontario and secure globally. As noted in **Section 3.3.4**, one butternut tree was identified during LGL's botanical survey. During a future design stage, a butternut health assessment should be undertaken to determine if the tree is a Category 1-3 tree. Since butternut is regulated as Endangered under the ESA, removal of any Category 2/3 butternut will require approval from MECP. In addition, a detailed butternut survey should be undertaken during a future design stage to confirm the absence of additional trees within 50 m of the proposed construction limits, in accordance with MECP guidelines.

As noted in **Section 3.3.4**, a total of six regionally rare plant species where identified within the study area. It is recommended that the regionally rare plant species be retained, to the extent possible. If impacts are unavoidable, it is recommended that these plant species, including individual shrub and trees that measure less than 10 cm DBH, be transplanted into suitable habitat conditions. Where possible, these plants should be transplanted into the newly created edges of those impacted communities, but outside of the limit of disturbance.

5.3.3 Mitigation

5.3.3.1 Avoidance

The Stage 2 ION LRT has been designed to avoid terrestrial ecosystems to the extent possible. Minor refinements to the current alignment may occur during later design stages on a site-specific basis to minimize footprint area and avoid natural heritage features, where practical. Where avoidance cannot be achieved, restoration and enhancement measures will be identified to replace vegetation communities lost as a result of the LRT following GRCA policies.

5.3.3.2 Restoration and Enhancement

Restoration and enhancement measures to mitigatethe removal of wetland and forest communities will be determined through consultation with agencies and the municipality

during a future design stage. Restoration and enhancement measures will be implemented in accordance with GRCA policies.

Impacts to wetland communities within the study area will primarily be to the edge of the communities, with the exception of the Grandview PSW and Speed River PSW, where the transitway will be elevated. It is anticipated that these impacts will have no significant effect the function of the remaining portion of the wetlands. It is expected that post-construction, new wetland areas will be created as a result of changes in drainage related to the construction of the Stage 2 ION LRT and its related components, that being said, restoration and enhancement measures will be identified during later design stages in consultation with MNRF and GRCA.

Impacts to forest communities within the study area will primarily result in the new creation of forest edges. Forest edge management should be implemented to protect the new community edge as numerous forests within the study area are component of larger valley systems.

5.3.3.3 Forest Edge Management

The removal of forest vegetation along existing forest edges or the removal of a portion of a forested feature that results in the exposure of a new forest edge will have several negative impacts along forest borders and within the forest interior. Some of the direct and indirect impacts as a result of newly exposed edges include:

- exposure of the retained vegetation to the effects of increased light, wind, and sun which results in decreased soil moisture;
- exposure to salt spray;
- reduced establishment of shade tolerant plant species and an overall reduction in plant species richness and abundance;
- increased invasion/spread of aggressive non-native plant species;
- loss of native seedbank;
- decreased presence of interior habitat;
- exposure of “edge” trees to windthrow;
- changes in wildlife diversity and abundances;
- destabilization of landforms composed of unconsolidated material and/or soil compaction;
- changes to hydrology; and,
- increased noise.

GRCA does not have forest edge management guidelines and as such, it is recommended that the TRCA *Forest Edge Management Plan Guidelines* (2004) be adhered to. Where new forest edges are exposed, forest management techniques will be implemented to mitigate the associated impacts to the forest communities. As part of the forest edge management, mitigation measures will include, but not be limited to the following:

- Planting of appropriate native trees, shrubs and ground flora which shall be undertaken as soon as possible following vegetation removals. Plantings along the disturbed forest edges will provide a protective buffer. Newly exposed forest edges become exposed to a greater potential for aggressive and invasive species infiltration further into the forest interior causing greater impacts. Micro-habitat conditions are also altered due to a greater incident of light penetrating further into the forest resulting in decreased soil moisture and increased windthrow. Plant species used within the buffer shall be somewhat similar to those in the adjacent habitat and be non-invasive in nature;
- Grading within areas where edges will be newly created shall be designed to meet existing grades a minimum of 3 m away from the tree drip-line;
- Compaction of soils on lands immediately adjacent to the newly exposed forest edge will be minimized to the extent possible. Construction activities can result in cut roots, and soil compaction due to re-grading and fill placement. Cut tree roots can reduce a tree's capacity to uptake and transfer water and nutrients, and soil compaction can result in a decrease in air spaces within the soil which can reduce the infiltration capacity of the soil, limits soil oxygen and limits root penetration. Decompaction efforts and methodology shall be site specific. Where decompaction is required, it shall extend to a minimum depth of approximately 25 cm;
- Drainage patterns adjacent to newly created edges shall be maintained to avoid changes in soil moisture, this is especially important around wetland areas and forest communities with substrates that maintain increased moisture capacity;
- A plan must be in place to immediately mitigate the spread/invasion of aggressive plant species; and,
- A monitoring plan must be developed to ensure that the newly planted material survives and fulfils the intended function and to ensure that the inadvertent spread of aggressive or non-native plant species is appropriately managed.

During a later design stage, a forest edge management plan shall be prepared for those communities where forest edge management is recommended.

5.3.3.4 Invasive Species Management

Efforts to control non-native and invasive plant species that have become established, as well as prevent the establishment of new non-native and invasive plant species at a minimum should include the following:

- where there are dense patches of common buckthorn, swallow-wort or garlic mustard, the appropriate removal and control of these species by a qualified specialist should be undertaken;
- minimize the exposure of bare soil, where bare soil must persist over a period of time these should be planted with a non-invasive annual cover crop for an interim period; and,
- no non-native and invasive ornamentals plants should be used for landscaping (e.g., Norway maple, purple loosestrife, Japanese knotweed, Japanese honeysuckle, etc.).

In addition, efforts should be made to prevent the spread of invasive plant species during construction both on and off site. Sanitation of construction equipment should be undertaken in accordance with the *Clean Equipment Protocol for Industry* (Halloran, Anderson and Tassie 2013) and at a minimum should include sanitation of construction vehicles and equipment prior to leaving and moving to the next site. A cleaning station should be set up, so vehicles and equipment can be inspected and cleaned regularly.

5.3.3.5 Planting Plans

A detailed planting plan should be developed during a later design stage once areas identified for restoration have been determined in consultation with the respective agencies. It is recommended that the planting of forest and wetland habitat be undertaken with the appropriate native and non-invasive plant species which will be presented on site-specific plans to be developed by an experienced landscaped architect.

At a minimum, planting plans will show the following:

- detailed maps of the planting locations along with the respective allocations of tree, shrub, herbaceous and grass species to be planted inclusive of species and ratio of plantings or abundances; and,
- a description of the best management practices that are to be followed in the planting and tending of these sites for a minimum of five years following the initial planting stage. In particular, management will need to be undertaken for those invasive/ aggressive plant species.

5.3.3.6 Construction Best Management Practices

At a minimum the following mitigation measures should be implemented during construction:

- vegetation cover will be used to protect any exposed surfaces in accordance with OPSS 804 -Construction Specification for Seed and Cover;
- topsoil from stockpiles to be in accordance with OPSS 802 - Construction Specification for Topsoil;
- old field seed mix and mulching or erosion control blanket (in accordance with NSSP-Erosion Control Blanket) will be placed in areas of soil disturbance to provide adequate slope protection and long-term slope stabilization; and,
- tree protection to be in accordance with OPSS 801 - Construction Specification for the Protection of Trees.

5.4 Wildlife and Wildlife Habitat

Implementation of the Stage 2 ION LRT has the potential to result in impacts to wildlife and wildlife habitat. Effects related to the construction of the Stage 2 ION LRT between Fairway Mall in Kitchener and downtown Cambridge and associated facilities could include:

- Displacement of wildlife and wildlife habitat;
- Barrier effects on wildlife passage;
- Wildlife/vehicle conflicts;
- Disturbance to wildlife from noise, light and visual intrusion;
- Potential impacts to migratory birds; and,
- Displacement of rare, threatened or endangered wildlife or significant wildlife habitat.

5.4.1 Runningway and Stop Impacts

The study area is a long, narrow corridor that follows an existing railroad line, roads, and a pedestrian trail and crosses both the Grand River and Speed River. The proposed Stage 2 ION LRT route extends from the existing Fairway station includes a runningway and eight stops. The proposed new stops are not expected to impact wildlife habitat as they are located either on street, or in existing industrial or residential areas. A discussion of the impacts along the runningway segments (Figure 1) is provided below.

Fairway

This section extends from the existing station at Fairview Mall to the Grand River. Wildlife habitat in this section includes the wetlands adjacent to Hidden Valley Road that form part of the Hidden Valley Wetland and the Grandview Wetland on the east side of the Grand River (Figure 3a). Two amphibian survey stations were located along Hidden Valley Road, station 7 was situated on the edge of a cattail marsh (Figure 2b) and station 8 was situated on the bank of North Creek (Figure 2a); only a single amphibian species was heard calling, though the traffic noise from Highway 8 was very loud in these two locations. The parts of the wetlands close to Hidden Valley Road do not appear to be good breeding habitat for anuran amphibians (i.e. frogs and toads), possibly due to noise pollution from Highway 8. Jefferson's Salamander presence was not confirmed during field surveys; however, they breed in ponds in deciduous forest and this habitat is regulated. There are extensive wetlands in the central portion of Hidden Valley (Figure 3a) that provide habitat for Jefferson's Salamander, and the runningway borders on some wetlands next to Hidden Valley Road and also comes in close proximity to the edge of the Core Environmental Feature in Hidden Valley (Figure 3a). During a future design stage, additional discussions with MECP and GRCA will be carried out to determine permitting requirements, if any, for Jefferson Salamander.

Kitchener and North Cambridge

This section extends from the Grand River to Speedsville Road in North Cambridge and includes the Speed River crossing. This section will impact some woodland habitat on the east side of the Grand River south of Highway 8. The crossing over the Speed River does not use an existing crossing structure and thus this new crossing will result in disturbing part of the riparian zone that was previously undisturbed. The crossing over the Speed River will also impact a core environmental feature on the southeast side of the Speed River (Figure 3b) where there is deciduous forest habitat (Figure 2e) and this could impact deciduous forest-dwelling birds including species at risk such as the Wood Thrush and Eastern Wood-Pewee. Snapping turtles and Midland Painted Turtles are species at risk that were found in this area along the banks of the Speed River in Riverside Park and on the south side of the Speed River during field surveys. After crossing the Speed River where the Stage 2 ION LRT runningway impacts a core environmental feature, the runningway is proposed to be elevated along this stretch which will help to reduce impacts on wildlife. After crossing King Street in Preston, the Stage 2 ION LRT runningway is proposed to be elevated along a stretch close to the south bank of the Speed River which will also help to reduce impacts on wildlife that may be using this riparian corridor.

Central Cambridge

This section extends from Speedsville Road in North Cambridge to the intersection of Hespeler Road and Avenue Road. Most of this section is highly developed and

industrialized. The best wildlife habitat in this section is the Dumfries Conservation Area. Wetlands within the Conservation Area support large numbers of breeding amphibians; five amphibian species were heard calling during surveys here (Figure 2j) and Blue Spotted Salamander was found within the Conservation Area. Dumfries CA also supports a variety of bird species and this was the only location where Wild Turkey was observed; however, no SAR bird species were observed in this area.

South Cambridge

This section extends from the intersection of Hespeler Road and Avenue Road to the Stage 2 ION LRT terminus on Bruce Street before Water Street. This section extends along roads, a railway corridor, and a pedestrian path that runs parallel to Mill Creek. The section along the pedestrian pathway is the only area here that is likely to impact wildlife habitat. No amphibians were heard calling alongside the creek (Figure 2l), and the banks of the creek are well defined with no wetland habitat in between the water and the lip of the bank (Figure 3d). Bird species encountered in this area were species that are typically found in urban environments. The only SAR species were Chimney Swifts observed foraging over downtown Galt.

5.4.2 Displacement of Rare, Threatened or Endangered Wildlife or Significant Wildlife Habitat

Out of the 89 species of wildlife (amphibians, reptiles, birds, and mammals) recorded within, or immediately adjacent to, the study area during field surveys, six of these were species at risk. These include Snapping Turtle, Midland Painted Turtle, Chimney Swift, Eastern Wood-Pewee, Barn Swallow, and Wood Thrush. In addition, the NHIC and local MNRF sources list six species at risk with recent records of occurrence in or near the study area that were not detected during field surveys. These include Jefferson's Salamander, Eastern Ribbonsnake, Queensnake, Bald Eagle, and Common Nighthawk. The following sections provide a brief review of each species' status, the results of field surveys carried out, and the potential impacts to those species at risk and their populations within the vicinity of the study area.

Jefferson's Salamander

Jefferson's Salamander is currently listed as 'Endangered' and is provincially regulated as 'Endangered' under the *Endangered Species Act* 2007 (ESA). Individuals of the species are protected under Section 9 of the ESA, and their habitat is protected under Section 10. Jefferson's Salamander habitat is regulated under Ontario Regulation 242/08 and their habitat includes wetlands, ponds, and vernal pools. The NHIC records for Jefferson's Salamander date from 1981 and earlier. The NHIC records are all located south of Highway 401, in and around Riverside Park and the Speed River, around Dumfries Conservation Area, and near the Grand River in Galt. Jefferson's Salamander was not found during field surveys conducted by LGL; however, Blue-spotted Salamander, a closely related species that is known to hybridize with

Jefferson's, was found at Dumfries Conservation Area in wetlands near the study corridor during field surveys in April 2015.

There are extensive wetlands in the central portion of Hidden Valley (Figure 3a) that provide breeding habitat for Jefferson's Salamander and areas found within approximately 300 m of the breeding habitat are designated as Regulated Habitat under Section 55(1)(a) of the *Endangered Species Act, 2007*. The potential for impacts to Regulated Habitat for Jefferson Salamander within Hidden Valley were assessed during preparation of the River Road Extension from King Street to Manitou Drive Schedule "C" Municipal Class Environmental Assessment (Region of Waterloo 2014), which was approved by the MECP. The Class EA determined that the River Road Extension could be constructed without significant adverse effects to Jefferson Salamander or their habitat. Since the Stage 2 ION LRT will be constructed within the EA-approved River Road Extension right-of-way, and the right-of-way is located beyond the Regulated Habitat for Jefferson Salamander, the Stage 2 ION LRT will have no significant effects on Jefferson Salamander or their habitat. During a future design stage, additional discussions with MECP and GRCA will be carried out to determine the requirements, if any, for permits under the *Endangered Species Act 2007*.

Snapping Turtle

Snapping Turtle is currently listed as 'Special Concern' and is provincially regulated as 'Special Concern' under the ESA. Snapping Turtles were seen on three occasions — 30 June 2014, 29 May 2015, and 18 June 2020 — during LGL field surveys, in the Speed River alongside Riverside Park in 2014 and 2015 and south of the Speed River in 2020. NHIC records list the following locations: near King Street East and Sportsworld Drive, near Riverside Park and the Speed River, and near the Grand River in Galt. The most recent NHIC record(s) is from 2010. The current Stage 2 ION LRT alignment no longer goes through Riverside Park, but since the LRT will cross the Speed River downstream of Riverside Park and will continue south of the Speed River, the potential occurrence of this species is likely. On 18 June 2020, of the four Snapping Turtles observed, three were females in the process of digging nests. These nest locations were south of the Speed River and north of the proposed LRT alignment. Further field investigations, undertaken during the appropriate season using MNRF protocols for surveying for this species, should be conducted to establish their presence or absence and to locate potential nests.

Eastern Ribbonsnake

Eastern Ribbonsnake is currently listed as 'Special Concern' and is provincially regulated as 'Special Concern' under the ESA. The Eastern Ribbonsnake typically occurs in wetlands (e.g., marshes) and near permanent bodies of still or slow-moving water (e.g., ponds, streams, lakes) (Rowell 2012). There are a few such sites in or near

the study area, however this species was not detected during field surveys. Records from the NHIC database date from 1977 and earlier. Eastern Ribbonsnake may no longer occur in the region of the study corridor. The NHIC records come from the vicinity of Fairview Park Mall (Fairway Road South and Hwy 8), and at the southern end of the study corridor in and near Galt. It is unlikely that this species still occurs in the study area, and thus impacts to this species are expected to be minimal.

Queensnake

Queensnake is currently listed as 'Endangered' and is provincially regulated as 'Endangered' under the ESA. Queensnakes are highly aquatic, frequenting creeks, streams, and rivers; they specialize on eating crayfish (Rowell 2012). Areas of the Grand River are known to support local populations of this species. The NHIC database lists Queensnake from the area of Dumfries Conservation Area, the most recent record is from 1979, and this species was not detected during field surveys. It is unlikely that this species still occurs in the study area, and thus impacts to this species are expected to be minimal.

Bald Eagle

Bald Eagle is not listed federally but is provincially regulated as 'Special Concern' under the ESA. The MNRF lists the Bald Eagle as occurring in the vicinity of the study corridor, and there have been some recent sightings of Bald Eagles flying over the Speed River and a recent nest near the Grand River at Fountain Street according to eBird. While Bald Eagles forage along the Grand and Speed rivers, and undoubtedly fly over the area during migration. While no evidence of breeding was documented during the most recent atlas period (Cadman *et al.* 2007), recent reports of a Bald Eagle nest with young in 2020 indicates that this species does occasionally breed in the vicinity of study area. Nests and eggs of Bald Eagle are protected under the Fish and Wildlife Conservation Act, 1997. Since this nest is outside of the LRT alignment and habitat loss is not generally seen as a major threat for Bald Eagles (Grier and Guinn 2003), impacts to this species are expected to be minimal.

Common Nighthawk

Common Nighthawk is listed as 'Threatened' and is provincially regulated as 'Special Concern' under the ESA. This species was listed by MNRF as occurring in or near the study area but was not detected during field surveys. However, given its nocturnal foraging habits, it's unlikely to be detected during breeding bird surveys conducted in the hours after dawn. Common Nighthawks nest on the ground in open natural areas, and on flat rooftops in urban areas. During the most recent breeding bird atlas period (2001-2005), possible breeding evidence was recorded for 10-km square 17NJ40, and probable breeding evidence for 10-km square 17NJ50 (Cadman *et al.* 2007). Further field investigations, undertaken during the appropriate season and time of day using

MNRF protocols for surveying for this species, should be conducted to establish their presence or absence, and, thus, the appropriate steps for protection and permitting.

Chimney Swift

Chimney Swift is currently listed as 'Threatened' and is provincially regulated as 'Threatened' under the ESA. A group of six Chimney Swifts were calling and seen foraging over the Speed River at Riverside Park during LGL surveys on 2 July 2015. However, it is not clear whether these birds were local nesters. They were not recorded during the 24 June 2015, or 2014, surveys. Note that the current Stage 2 ION LRT alignment no longer goes through Riverside Park, but since the Stage 2 ION LRT will cross the Speed River we thought it important to note the presence of this species in the vicinity of the study area. The MNRF also has records of Chimney Swift occurring in or near the Stage 2 ION LRT corridor. During the 2001-2005 breeding bird atlas a probable level of breeding evidence was obtained for 10-km square 17NJ40A, and breeding was confirmed in 10-km square 17NJ50 (Cadman *et al.* 2007). There have been multiple recent sightings in 2018 and 2019 of Chimney Swifts according to eBird in Preston near the Speed River. Further field investigations, undertaken during the appropriate season and time of day using MNRF protocols for surveying for this species, should be conducted to establish their presence or absence, and, thus, the appropriate steps for protection and permitting.

Eastern Wood-Pewee

Eastern Wood-Pewee is currently listed as 'Special Concern' and is provincially regulated as 'Special Concern' under the ESA. Records for Eastern Wood-Pewee in the vicinity of the study area were not listed in either the NHIC database or the records of the MNRF. This species was heard singing in deciduous woods during surveys in 2014 and 2015 at four locations that are now outside of the study area with the current proposed alignment of the Stage 2 ION LRT, though still in the vicinity of the study area. There have also been some recent records of Eastern Wood-Pewee according to eBird in 2018 and 2019 in Riverside Park and along the Cambridge Linear Trail on the south side of the Speed River west of King Street. Eastern Wood-Pewee was listed as a probable breeder in square 17NJ40, and a confirmed breeder in square 17NJ50 during the 2001-2005 breeding bird atlas (Cadman *et al.* 2007). Eastern Wood-Pewee inhabit wooded areas and nest in trees, so to minimize potential impacts to this species tree removals during construction should occur outside the breeding window, before April 1 or after August 15. In the event that these activities must be undertaken from April 1 to August 15, a nest survey will be conducted by a qualified avian biologist to identify and locate active nests of this species, as well as other bird species covered by MCBA.

Barn Swallow

Barn Swallow is currently listed as 'Threatened' and is provincially regulated as 'Threatened' under the ESA. Barn Swallows were seen foraging at several locations along the study corridor during 2014 and 2015 fieldwork, a few locations are within study area of the current proposed Stage 2 ION LRT alignment, and other locations are in the nearby vicinity. This species was confirmed nesting in both 10-km squares (17NJ40 and 17NJ50) during the most recent breeding bird atlas (Cadman *et al.* 2007). However, it is likely that the individual birds observed foraging are not dependent upon these specific foraging areas as many similar habitats exist in surrounding areas. Furthermore, no structures suitable for Barn Swallow nesting will be affected by the construction of the runningway and stops. As such, impacts to this species are expected to be minimal.

Wood Thrush

Wood Thrush is currently listed as 'Threatened' and is provincially regulated as 'Special Concern' under the ESA. Wood Thrush was recorded once during the 2014 field surveys, in the woods at the west end of Riverside Park, it was not recorded during 2015 or 2020 field surveys. There are also recent records from eBird for Wood Thrush in Riverside Park. While the current Stage 2 ION LRT alignment no longer goes through Riverside Park, these occurrence records indicate the presence of this species in the vicinity of the study area. Wood Thrush inhabit mature deciduous and mixed forests and nest in trees, so to minimize potential impacts to this species tree removals during construction should occur outside the breeding window, before April 1 or after August 15. In the event that these activities must be undertaken from April 1 to August 15, a nest survey will be conducted by a qualified avian biologist to identify and locate active nests of this species, as well as other bird species covered by MCBA.

Eastern Meadowlark

Eastern Meadowlark is currently listed as 'Threatened' and is provincially regulated as 'Threatened' under the ESA. No Eastern Meadowlarks were recorded during field surveys, but there are records in the NHIC database and with the MNRF. The NHIC record(s) come from the area south of the Fairview Park Mall (1-km square 17NJ4507). Records for Eastern Meadowlarks in eBird are in the vicinity but not within the study area and most are earlier than 2010. Breeding was confirmed for Eastern Meadowlark in both 10-km squares that encompass the study area, 17NJ40 and 17NJ50, during the 2001-2005 breeding bird atlas (Cadman *et al.* 2007). Eastern Meadowlarks prefer field habitats, including pasture and hay. There are no field habitats that fall within the study area or along the runningway, so the impacts to this species are expected to be minimal.

5.4.3 Barrier Effects on Wildlife Passage

No new barriers to wildlife passage are expected to occur as a result of the construction of the Stage 2 ION LRT. Major river crossings, including the Grand and Speed rivers, will be elevated, so wildlife corridors associated with these valleylands, will be maintained.

5.4.4 Wildlife/Vehicle Conflicts

Wildlife/vehicle conflicts appear to be very minor at present within the Stage 2 ION LRT corridor as it mostly follows existing roads, a railway line, and a pedestrian pathway. River crossings will be elevated, which should minimize wildlife/vehicle conflicts.

5.4.5 Disturbance to Wildlife from Noise, Light and Visual Intrusion

Noise, light and visual intrusion may alter wildlife activities and patterns. In the area of the proposed Stage 2 ION LRT, wildlife has likely become acclimatized to the noise, light and visual conditions associated with roads, railways, and pedestrian trails present within and in the vicinity of the study area. Only those fauna that are tolerant of human activities tend to persist. Given that wildlife found within the study area are acclimatized to the presence of road infrastructure, disturbance to wildlife from any increase in noise, light and visual intrusion potentially caused by the operation of the Stage 2 ION LRT are not expected to have any significant adverse effects.

Potential disturbance caused by light pollution from the Stage 2 ION LRT runningway and stops can be mitigated by using reflectors to focus light beams onto the facilities and away from natural heritage features adjacent to the Stage 2 ION LRT.

5.4.6 Potential Impacts to Migratory Birds

Several bird species listed under the *Migratory Birds Convention Act* (MBCA) are located within the study area. The MBCA prohibits the killing, capturing, injuring, taking or disturbing of migratory birds (including eggs) or the damaging, destroying, removing or disturbing of nests. While migratory insectivorous and non-game birds are protected year-round, migratory game birds are only protected from March 10 to September 1. To comply with the requirements of the MBCA, disturbance, clearing or disruption of vegetation where birds may be nesting should be completed outside the window of April 1 to August 15. In the event that these activities must be undertaken from April 1 to August 15, a nest survey will be conducted by a qualified avian biologist to identify and locate active nests of species covered by the MBCA.

5.5 Impacts to Designated Natural Areas

As noted in **Section 3.5**, the Freeport Esker ANSI is located within 120 m of the study area. However, no impacts are anticipated to the ANSI as a result of the proposed construction of the Stage 2 ION LRT.

It is anticipated the proposed construction will remove a narrow strip of wetland communities located along the existing edge of a portion of the Hidden Valley, Grandview, and Speed River PSW. Edge management is recommended at the PSW, where new edges are exposed. Edge management techniques (**Section 5.3.3.2)** should be implemented to mitigate associated impacts to the wetland communities. Overall, the removal of a narrow strip of the wetland communities adjacent to the proposed right-of-way is unlikely to negatively impact the function of the remaining portions of the PSW complex. During a later design stage, opportunities for ecological restoration/ enhancement will be investigated to ensure no net loss of wetland area or function.

Much of the Stage 2 ION LRT corridor is regulated under Ontario Regulation 150/06. As a result, a permit will be required from the GRCA prior to construction. Applications for permits will be prepared during a later design stage once the design has been advanced to an appropriate level of detail.

The Region of Waterloo Official Plan, Chapter 7 – The Greenlands System and Map 4 - Greenlands Network, identify several Core Environmental Features located along the Stage 2 ION LRT alignment including the Hidden Valley ESPA, the Grand River Valley, the Speed River Valley and the Dumfries Conservation Area. In addition, the Grand River Valley and the Speed River Valley are identified as Significant Valleys within Landscape Level Systems. These Core Environmental Features and Landscape Level Systems represent elements of the Regional Greenlands System that are covered by policies designed to maintain, enhance, or wherever feasible restore, these natural heritage areas/features.

The Stage 2 ION LRT has been aligned to avoid the Region of Waterloo Greenlands System to the extent possible. The LRT will skirt the Hidden Valley ESPA by being built within the EA-approved River Road Extension right-of-way and skirt the Dumfries Conservation Area within the Hespeler Road right-of-way. The crossing of the Grand River Valley and the Speed River Valley are unavoidable; however, site-specific mitigation such as elevating the LRT tracks through these floodplain areas, have been incorporated into the design to reduce the impacts of the Stage 2 ION LRT on the Greenlands System. In accordance with Chapter 7 of the Region of Waterloo Official Plan, site-specific, scoped Environmental Impact Studies (EISs) will be prepared during a future design stage to identify avoidance, mitigation, restoration and enhancement measures to maintain area and function of Greenlands System elements to the extent possible.

6.0 CONCLUSION AND RECOMMENDATIONS

Much of the Stage 2 ION LRT will be constructed along roadways, former railways and trail systems which have been disturbed in the past. There are several areas that exist in a natural/semi-natural state that will require site-specific environmental management measures including the Hidden Valley Wetland, Grandview Wetland and Speed River Wetland. Within the Grandview Wetland and Speed River Wetland, the Stage 2 ION LRT will be elevated to reduce potential impacts on the wetland system. In other areas, the Stage 2 ION LRT has been aligned to skirt along woodland edges to the extent possible, to avoid significant encroachment into the woodlands.

The following tasks shall be carried out in greater detail during future design phases including:

- Preparation of the following environmental management plans: Edge Management Plan; Restoration and Enhancement Plans; Erosion and Sediment Control Plan; and, Environmental Inspection and Monitoring Plan. Further correspondence with regulatory agencies and municipal planning staff shall take place during the preparation of these plans;
- Further correspondence shall take place with MECP to discuss species at risk that have been identified or have the potential to be located in the vicinity of the study area, and any requirements under the Ontario ESA;
- Site-specific, scoped Environmental Impact Statements (EISs) in areas identified by GRCA and the Region will be carried out in accordance with the Region of Waterloo Greenlands Network Implementation Guidelines (Region of Waterloo 2016) and the Environmental Impact Study Guidelines and Submission Standards for Wetlands (GRCA 2005);
- Further field investigations will be undertaken during the appropriate seasons using MNRF protocols. Surveying for species at risk should be conducted to confirm their presence or absence, and thus, the appropriate steps for protection and permitting;
- Further correspondence shall take place with GRCA to determine application requirements for permits under Ontario Regulation 150/06 and to stake the boundaries of wetlands located in proximity of the Stage 2 ION LRT; and,
- A self-assessment shall be carried out in accordance with DFO procedures to determine the potential for “HADD” once culvert and bridge designs have been advanced. Further correspondence with DFO shall take place to discuss species at risk and *Fisheries Act* requirements.

7.0 REFERENCES

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier (eds.). 2007. *Atlas of the Breeding Birds of Ontario, 2001-2005*. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706 pp.

Chapman. L.J. and D.F. Putnam. 1984. *The Physiography of Southern Ontario, 3rd Edition.* Ontario Geological Survey Special Volume 2.

City of Cambridge. 2003. Hespeler West Subwatersheds Study.

City of Cambridge. 2012. 2012 Cambridge Official Plan.

City of Kitchener. 2014. City of Kitchener Official Plan.

City of Kitchener. 2014. City of Kitchener Natural Heritage System Technical Background Report.

Committee on the Status of Endangered Wildlife in Canada. 2002. *Species at Risk*. Ottawa.

Couturier, A. 1999. *Conservation Priorities for the Birds of Southern Ontario*. Bird Studies Canada.

Dobbyn, J.S. 1994. *Atlas of the Mammals of Ontario*. Federation of Ontario Naturalists. Toronto.

Eakins, R. J. 2012. Ontario Freshwater Fishes Life History Database. Version 4.24. On-line database (http://www.ontariofishes.ca).

Fisheries and Oceans Canada (DFO). 2019. Aquatic Species at Risk Maps. https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html

Grand River Conservation Authority. 2004. Dumfries Conservation Area Master Plan. Section 3.3.2. Fauna.

Grand River Conservation Authority. 2005. A Community-Based Approach to Fisheries Management in the Grand River Watershed. Part A: Grand River Fisheries Management Plan.

Grand River Conservation Authority. 2014. Personal Correspondence with Tony Zammit Grand River Conservation Authority. April 28, 2014.

Grand River Conservation Authority. 2001. Technical Background Report for the Grand River Fisheries Management Plan. Draft Report.

Grand River Conservation Authority. 2003. Wetlands Policy.

Grand River Conservation Authority. 2005. Environmental Impact Study Guidelines and Submission Standards for Wetlands.

Grand River Conservation Authority. 2004. A Watershed Forest Plan for the Grand River.

Grand River Conservation Authority. 2004. Dumfries Conservation Area Master Plan.

Grand River Conservation Authority. 2008. Forest Zones of the Grand River Watershed [map].

Grand River Conservation Authority. 2010. Fishing the Grand River brochure. Available at: https://www.grandriver.ca/en/outdoor-recreation/resources/Documents/Fishing_brochure_FishingTheGrand.pdf

Grand River Conservation Authority. 2015. Policies for the Administration of the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation, Ontario Regulation 150/06.

Grier, J. W., and J. E Guinn. 2003. Bald Eagle habitats and responses to human disturbance in Minnesota. Final Report to Minnesota Department of Natural Resources. North Dakota State University, Fargo ND. 44 pp.

Government of Canada. 2002. *Official List of Wildlife Species at Risk*. Species at Risk Act. Available at: http://www.sararegistry.gc.ca/sar/index/default_e.cfm

Harding, J. H. 1997. *Amphibians and Reptiles of the Great Lakes Region*. The University of Michigan Press, Michigan. 378pp.

Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray. 1998. Ecological Land Classification for Southern Ontario: First Approximation and Its Application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Department and Transfer Branch. SCSS Field Guide FG-02 North Bay, Ontario. 225 pp.

LGL Limited. 2014. *River Road Extension Class Environmental Assessment, Natural Heritage Study Existing Conditions Update*. Produced for the Region of Waterloo.

LGL Limited. 2013. *Surface Water Quality Monitoring Program for the Grand River: 2012 End of Year Report.* Produced for the Region of Waterloo.

LGL Limited. 2010. *Surface Water Quality Monitoring Program for the Grand River: 2009 End of Year Report*. Produced for the Region of Waterloo.

Mackie, G, T.J Morris, D. Ming. 2008. Protocol for the detection and relocation of freshwater mussel species at risk in Ontario-Great Lakes Area (OGLA).Metcalfe-Smith, J, A. MacKenzie, I. Carmichael, D. McGoldrick. 2005. Photo Field Guide to the Freshwater Mussels of Ontario.

Ministry of Natural Resources and Forestry. 2019. *Natural Heritage Information Centre information Data available through Make a Natural Heritage Map.* Website available online. https://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-USMinistry of Natural Resources and Forestry. 2015. Personal Correspondence with Art Timmerman Ministry of Natural Resources and Forestry Guelph District Office. March 20, 2015

Ministry of Natural Resources and Forestry. 2016. Personal Correspondence with Jamie Hagman Ministry of Natural Resources and Forestry Guelph District Office. December 12, 2016.

Ministry of Natural Resources and Forestry. 2014. Personal Correspondence with Anne Marie Laurence Ministry of Natural Resources and Forestry Guelph District Office. July 9, 2014.

Ministry of Transportation. 2008*. Highway Design Standards.*

Ministry of Natural Resources, Natural Heritage Information Centre website (http://www.mnr.gov.on.ca/MNR/nhic/nhic.cfm). Ministry of Natural Resources. Peterborough, Ontario.

Ministry of Natural Resources and Forestry (MNRF). 2015. Species at risk in the Waterloo region accessed at: https://www.ontario.ca/environment-and-energy/species-risk-region?name=Waterloo

Ministry of Natural Resources and Forestry (MNRF). 2000. *Significant Wildlife Habitat Technical Guide*. Fish and Wildlife Branch – Wildlife Section. 151p.

Ministry of Natural Resources and Forestry (MNRF). 2013. Ontario Wetland Evaluation System. Southern Manual 3rd Edition, Version 3.2. Available at: http://apps.mnr.gov.on.ca/public/files/er/stdprod_103924.pdf

Newcomb, L. 1977. Newcomb's Wildflower Guide. Little, Brown and Company. Toronto, Ontario.

Newmaster, S.G. and S. Ragupathy. 2005. *Flora Ontario – Integrated Botanical Information System* (FOIBIS) 2007 species scientific names obtained March 2007 from the University of Guelph.

Newmaster, S.G., A. Lehela, P.W.C. Uhlig, S. McMurray and M.J. Oldham. 1998. Ontario Plant List. Ontario Ministry of Natural Resources, Ontario Forest Research Institute, Sault Ste. Marie, Ontario, Forest Research Information Paper No. 123, 550 pp. + appendices.

Ontario Geological Survey and Planning and Engineering Initiatives Limited. 1998. Aggregate Resources Inventory of the Regional Municipality of Waterloo. Aggregate Resources Inventory Paper 161

Oldham, M.J. and S.R. Brinker. 2009. Rare Vascular Plants of Ontario. Fourth Edition. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. Peterborough, Ontario. 188 pp.

Ontario Ministry of Natural Resources. 2001. *Index List of Vulnerable, Threatened, Endangered, Extirpated or Extinct Species of Ontario*. Wildlife Section, Peterborough.

Ontario Ministry of Natural Resources. 2000. *Significant Wildlife Habitat Technical Guide.* Fish and Wildlife Branch, Wildlife Section, Peterborough.

Ontario Breeding Bird Atlas. 2001. *Guide for Participants*. Atlas Management Board, Federation of Naturalists. Don Mills.

Presant, E.W. and Wicklund, R.E. 1971. The Soils of Waterloo County. Research Branch Canada Department of Agriculture. Accompanied by Soil Associations Map (colour), Soil Survey Report, No 44, scale 1:100,000.

Region of Waterloo. 2015. Regional Official Plan.

Region of Waterloo. 2016. Greenlands Network Implementation Guideline.

Region of Waterloo, City of Cambridge and Grand River Conservation Authority. 2013. East Side Lands (Stage 1), Master Environmental Servicing Plan and Community Plan.

Region of Waterloo. 2007. Rapid Transit Individual Environmental Assessment, Phase 2, Step 2, Evaluation of Route Sections and Technology Alternatives, Ecological Impact Assessment Report.

Riley, J.L., W.D. Backowksy, P.W. Ball, D.M. Britton, P.M. Catling, C.A. Campbell, W.J. Crins, K.L. McIntosh, S.M. Mckay-Kuja, M.J. Oldham, A.A. Reznicek, D.A. Sutherland, and S. Varga. 1989. *Niagara-Haldimand. Distribution and Status of the Vascular Plants of Central Region*, Ontario Ministry of Natural Resources, Parks and Recreational Areas Section. Central Region. Richmond Hill, Ontario 100pp.

WSP. 2019. Stage 2 ION LRT: Transit Project Assessment – Preliminary Drainage and Stormwater Management Report.

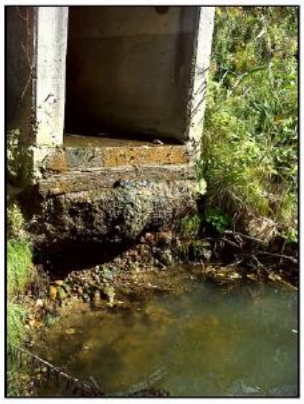
APPENDIX A
PHOTOGRAPHIC RECORD OF WATERCOURSE CROSSINGS

PROJECT #TA8430

PHOTO APPENDIX
Waterloo ION Stage 2 LRT

LGL LIMITED
environmental research associates

Tributary of the Grand River (North Creek): View downstream of Hidden Valley Road, Fall 2018.



Tributary of the Grand River (North Creek): Perched culvert outlet at Hidden Valley Road, Fall 2018.

Tributary of the Grand River (North Creek): Downstream channel, flowing into wetland habitat, Fall 2018.

Hofstetter Creek outlet to the Grand River (Fall 2018).

Hofstetter Creek culvert outlet (perched).

Origin of Hofstetter Creek (wetland pocket upstream of Hidden Valley Road), Fall 2018.

PROJECT #TA8430

PHOTO APPENDIX
Waterloo ION Stage 2 LRT

LGL LIMITED
environmental research associates

Grand River: View of proposed LRT crossing location from the south bank.

Grand River: Similar view, showing the north valley slope.

Grand River: View from the north valley slope showing Highway 8 and proposed LRT crossing area.

Grand River: Substrates along the north bank, on downstream side of Highway 8 (Fall 2018).

Grand River: North bank of the Grand River, immediately downstream of Highway 8.

Grand River: Substrates along the south bank, immediately downstream of Highway 8.

PROJECT #TA8430

PHOTO APPENDIX
Waterloo ION Stage 2 LRT

LGL LIMITED
environmental research associates

Freeport Creek: Location of Freeport Creek outlet to the Grand River.

Freeport Creek: Dry open channel located approximately 45m downstream of Highway 8 (Fall 2018).

Freeport Creek: Highway 8 culvert outlet.

Freeport Creek: Reach immediately downstream of Highway 8 culvert (Fall 2018).

Speed River: West bank showing existing fill (at proposed LRT crossing area).

Speed River: West bank, downstream view from the proposed LRT crossing area (Fall 2018).

PROJECT #TA8430

PHOTO APPENDIX
Waterloo ION Stage 2 LRT

LGL LIMITED
environmental research associates

Speed River: View of reach upstream of the proposed LRT crossing.

Speed River: East bank near the proposed LRT crossing.

Speed River: Wide river reach located downstream of King Street E.

Speed River: Open reach parallel to the railway tracks and Eagle Street (May 2015).

Groff Mill Creek at the Hespeler Road outlet (post rainstorm- May 2015).

Groff Mill Creek at Langs Road (post rainstorm- May 2015).

PROJECT #TA8430

PHOTO APPENDIX
Waterloo ION Stage 2 LRT

LGL LIMITED
environmental research associates

Tributary of Groff Mill Creek: Looking west (downstream) from Hespeler Road (May 2015).

Mill Creek: Natural reach near the Galt Gardens Arena (Fall 2018).

Mill Creek: Upstream view from Kerr Street.

Mill Creek: Upstream view from near Main Street (concrete trapezoidal channel).

Mill Creek: Hardened bank adjacent to pedestrian trail (proposed LRT), in between Kerr Street and Main Street.

APPENDIX B
VASCULAR PLANT LIST

Appendix B.
Forest Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	FOC3-1	FOC4-1	FOD3	FOD5a	FOD5b	FOD7-3a	FOD7-3b	FOD7a	FOD8-1	FODa	FODb	FODc	FODd
	EQUISETACEAE	**HORSETAIL FAMILY**																		
	Equisetum arvense	field horsetail	G5	S5			X	X	X		X		X	X		X				
	DENNSTAEDTIACEAE	**BRACKEN FERN FAMILY**																		
	Pteridium aquilinum var. latiusculum	eastern bracken-fern	G5T	S5			X				X					X				
	DRYOPTERIDACEAE	**WOOD FERN FAMILY**																		
	Cystopteris bulbifera	bulbet bladder fern	G5	S5			X		X											
	Polystichum acrostichoides	Christmas fern	G5	S5			X		X											
	Onoclea sensibilis	sensitive fern	G5	S5			X			X	X					X				
	Matteuccia struthiopteris var. pensylvanica	ostrich fern	G5	S5			X						X	X						X
	Dryopteris carthusiana	spinulose wood fern	G5	S5			X			X										
	Athyrium filix-femina var. angustum	northern lady fern	G5T5	S5			X				X									
	PINACEAE	**PINE FAMILY**																		
*	*Pinus sylvestris*	scotch pine	G?	SE5			X											X		
	Picea glauca	white spruce	G5	S5			X				X									
	Pinus strobus	eastern white pine	G5	S5			X		X	X							X			
	Tsuga canadensis	eastern hemlock	G5	S5			X	X	X											
	CUPRESSACEAE	**CEDAR FAMILY**																		
	Juniperus virginiana	eastern red cedar	G5	S5				X												
	Thuja occidentalis	eastern white cedar	G5	S5			X		X		X	X	X	X			X			X
	ARISTOLOCHIACEAE	**DUCHMAN'S-PIPE FAMILY**																		
	Asarum canadense	wild ginger	G5	S5			X				X									
	RANUNCULACEAE	**BUTTERCUP FAMILY**																		
	Thalictrum pubescens	tall meadow-rue	G5	S5			X						X	X						X
*	*Ranunculus acris*	tall buttercup	G5	SE5			X			X	X				X	X				X
	Ranunculus recurvatus var. recurvatus	hooked buttercup	G5	S5			X						X	X						
	Thalictrum dioicum	early meadow-rue	G5	S5			X				X									
	Anemone canadensis	Canada anemone	G5	S5			X											X		
	Clematis virginiana	virgin's-bower	G5	S5			X						X	X						X
	Actaea rubra	red baneberry	G5	S5			X				X									
	Anemone quinquefolia var. quinquefolia	wood anemone	G5	S5			X			X										
	BERBERIDACEAE	**BARBERRY FAMILY**																		
	Caulophyllum thalictroides	blue cohosh	G	S5			X				X									
	Podophyllum peltatum	may-apple	G5	S5			X				X							X		
	PAPAVERACEAE	**POPPY FAMILY**																		
	Sanguinaria canadensis	bloodroot	G5	S5			X				X									
*	*Chelidonium majus*	celandine	G?	SE5			X				X									
	ULMACEAE	**ELM FAMILY**																		

Appendix B.
Forest Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	FOC3-1	FOC4-1	FOD3	FOD5a	FOD5b	FOD7-3a	FOD7-3b	FOD7a	FOD8-1	FODa	FODb	FODc	FODd
*	*Ulmus pumila*	Siberian elm	G?	SE3								X							X	
	Celtis occidentalis	common hackberry	G5	S4			X					X		X						
	Ulmus americana	white elm	G5?	S5			X			X	X	X								X
	MORACEAE	**MULBERRY FAMILY**																		
*	*Morus alba*	white mulberry	G?	SE5			X	X					X	X	X				X	X
	URTICACEAE	**NETTLE FAMILY**																		
*	*Urtica dioica ssp. dioica*	European stinging nettle	G5T?	SE2			X						X	X						
	Laportea canadensis	wood nettle	G5	S5			X						X	X	X					
	Boehmeria cylindrica	false nettle	G5	S5			X				X									
	JUGLANDACEAE	**WALNUT FAMILY**																		
	Juglans nigra	black walnut	G5	S4			X Nat					X	X	X	X		X	X	X	X
	Carya cordiformis	bitternut hickory	G5	S5			X				X									
	Juglans cinerea	butternut	G3G4	S3?	END	END	X					X								
	FAGACEAE	**BEECH FAMILY**																		
	Fagus grandifolia	American beech	G5	S5			X			X	X									
	Quercus macrocarpa	bur oak	G5	S5			X					X							X	
	Quercus rubra	red oak	G5	S5			X			X	X									
	BETULACEAE	**BIRCH FAMILY**																		
	Carpinus caroliniana ssp. virginiana	blue beech	G5T	S5			X					X								
	Betula papyrifera	white birch	G5	S5			X				X	X							X	
	Betula alleghaniensis	yellow birch	G5	S5			X		X		X									
	Ostrya virginiana	ironwood	G5	S5			X			X	X									
	CARYOPHYLLACEAE	**PINK FAMILY**																		
*	*Dianthus armeria*	deptford pink	G?	SE5			X				X									
	POLYGONACEAE	**SMARTWEED FAMILY**																		
*	*Rumex obtusifolius ssp. obtusifolius*	bitter dock	G5	SE5			X													X
	GUTTIFERAE	**ST. JOHN'S-WORT FAMILY**																		
*	*Hypericum perforatum*	common St. John's-wort	G?	SE5			X			X	X									
	TILIACEAE	**LINDEN FAMILY**																		
	Tilia americana	basswood	G5	S5			X				X	X					X	X	X	
	VIOLACEAE	**VIOLET FAMILY**																		
	Viola sp.	violet							X	X	X	X								
	Viola pubescens	downy yellow violet	G5	S5			X											X		
	SALICACEAE	**WILLOW FAMILY**																		
	Populus tremuloides	trembling aspen	G5	S5			X	X		X	X						X		X	X
	Populus grandidentata	large-tooth aspen	G5	S5			X	X		X	X						X			

Appendix B.
Forest Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	FOC3-1	FOC4-1	FOD3	FOD5a	FOD5b	FOD7-3a	FOD7-3b	FOD7a	FOD8-1	FODa	FODb	FODc	FODd
	Salix sp.	willow		?											X					X
	Salix petiolaris	slender willow	G4	S5			X	X					X	X						
*	*Salix fragilis*	crack willow	G?	SE5			X						X	X						X
	Populus balsamifera ssp. balsamifera	balsam poplar	G5T?	S5			X	X								X		X		
	Populus deltoides ssp. deltoides	eastern cottonwood	G5T?	SU			X Nat					X	X	X	X				X	
	Salix discolor	pussy willow	G5	S5			X						X	X						
	BRASSICACEAE	**MUSTARD FAMILY**																		
*	*Alliaria petiolata*	garlic mustard	G5	SE5			X			X	X	X	X	X	X		X	X	X	X
*	*Hesperis matronalis*	dame's rocket	G4G5	SE5			X				X		X	X						X
	PRIMULACEAE	**PRIMROSE FAMILY**																		
	Lysimachia ciliata	fringed loosestrife	G5	S5			X						X	X						
	GROSSULARIACEAE	**GOOSEBERRY FAMILY**																		
	Ribes americanum	wild black currant	G5	S5			X				X									
	ROSACEAE	**ROSE FAMILY**																		
*	*Potentilla recta*	rough-fruited cinquefoil	G?	SE5			X			X										
	Agrimonia gryposepala	tall hairy agrimony	G5	S5			X		X		X									
*	*Prunus avium*	sweet cherry	G?	SE4			X	X												
	Rubus occidentalis	thimble-berry	G5	S5			X						X	X			X			X
	Rubus idaeus ssp. melanolasius	wild red raspberry	G5T	S5			X			X	X	X		X						X
*	*Rubus idaeus ssp. idaeus*	red raspberry	G5T5	SE1									X						X	
	Rubus allegheniensis	alleghany blackberry	G5	S5			X											X		
	Fragaria virginiana ssp. virginiana	scarlet strawberry	G5T?	SU			X				X							X		
	Geum aleppicum	yellow avens	G5	S5			X			X	X		X		X			X		X
	Prunus virginiana ssp. virginiana	choke cherry	G5T?	S5			X	X			X	X	X	X		X	X	X		
	Prunus serotina	black cherry	G5	S5			X		X	X	X	X						X		
	Physocarpus opulifolius	ninebark	G5	S5			X			X										
*	*Malus pumila*	common apple	G5	SE5			X					X		X						
	Crataegus sp.	hawthorn								X										
	FABACEAE	**PEA FAMILY**																		
*	*Coronilla varia*	variable crown-vetch	G?	SE5			X													X
*	*Vicia cracca*	tufted vetch	G?	SE5			X	X												
	Amphicarpaea bracteata	hog peanut	G5	S5			X				X									
*	*Robinia pseudo-acacia*	black locust	G5	SE5			X					X	X	X	X				X	
	ELAEAGNACEAE	**OLEASTER FAMILY**																		
*	*Elaeagnus angustifolia*	Russian olive	G?	SE3				X												

Appendix B.
Forest Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	FOC3-1	FOC4-1	FOD3	FOD5a	FOD5b	FOD7-3a	FOD7-3b	FOD7a	FOD8-1	FODa	FODb	FODc	FODd
	ONAGRACEAE	**EVENING-PRIMROSE FAMILY**																		
	Circaea lutetiana ssp. canadensis	yellowish enchanter's nightshade	G5T5	S5			X			X	X							X		
	CORNACEAE	**DOGWOOD FAMILY**																		
	Cornus alternifolia	alternate-leaved dogwood	G5	S5			X				X									
	Cornus foemina ssp. racemosa	red panicled dogwood	G5?	S5			X			X								X		
	Cornus stolonifera	red-osier dogwood	G5	S5			X	X										X		
	RHAMNACEAE	**BUCKTHORN FAMILY**																		
*	*Rhamnus cathartica*	common buckthorn	G?	SE5			X	X	X	X	X	3	X	X	X	X	X	X	X	X
*	*Rhamnus frangula*	glossy buckthorn	G?	SE5			X			X	X									X
	VITACEAE	**GRAPE FAMILY**																		
	Vitis riparia	riverbank grape	G5	S5			X	X		X	X	X	X	X	X		X	X	X	X
	Parthenocissus quinquefolia	five-leaved Virginia-creeper	G5	S4?			X?						X				X			X
	Parthenocissus inserta	inserted Virginia-creeper	G5	S5			X			X	X	X		X	X			X	X	
	ACERACEAE	**MAPLE FAMILY**																		
	Acer saccharum ssp. saccharum	sugar maple	G5T?	S5			X	X	X		X	X								
	Acer rubrum	red maple	G5	S5			X			X										
*	*Acer platanoides*	norway maple	G?	SE5			X					X							X	X
	Acer negundo	manitoba maple	G5	S5			X			X		3	X	X	X		X		X	X
	Acer saccharinum	silver maple	G5	S5			X						X	X			X			X
	ANACARDIACEAE	**SUMAC FAMILY**																		
	Rhus rydbergii	western poison-ivy	G5T	S5			X			X						X		X		X
	Rhus typhina	staghorn sumac	G5	S5			X		X			X	X	X	X		X	X	X	X
	OXALIDACEAE	**WOOD SORREL FAMILY**																		
	Oxalis stricta	upright yellow wood-sorrel	G5	S5			X											X		X
	GERANIACEAE	**GERANIUM FAMILY**																		
	Geranium maculatum	spotted crane's-bill	G5	S5			X			X								X		
*	*Geranium robertianum*	herb-robert	G5	SE5			X													X
	BALSAMINACEAE	**TOUCH-ME-NOT FAMILY**																		
	Impatiens capensis	spotted touch-me-not	G5	S5			X						X	X	X	X				X
	ARALIACEAE	**GINSENG FAMILY**																		
	Aralia nudicaulis	wild sarsaparilla	G5	S5			X				X							X		
	APIACEAE	**PARSLEY FAMILY**																		
*	*Aegopodium podagraria*	goutweed	G?	SE5			X						X							
*	*Daucus carota*	wild carrot	G?	SE5			X													X
	Cryptotaenia canadensis	honewort	G5	S5			X						X	X						

Appendix B.
Forest Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	FOC3-1	FOC4-1	FOD3	FOD5a	FOD5b	FOD7-3a	FOD7-3b	FOD7a	FOD8-1	FODa	FODb	FODc	FODd
	SOLANACEAE	**POTATO FAMILY**																		
*	*Solanum dulcamara*	bitter nightshade	G?	SE5			X				X		X			X				X
	HYDROPHYLLACEAE	**WATER-LEAF FAMILY**																		
	Hydrophyllum virginianum	Virginia water-leaf	G5	S5			X				X							X		
	BORAGINACEAE	**BORAGE FAMILY**																		
	Hackelia virginiana	Virginia stickweed	G5	S5			X						X	X			X			X
	VERBENACEAE	**VERVAIN FAMILY**																		
	Verbena urticifolia	white vervain	G5	S5			X						X	X			X			X
	LAMIACEAE	**MINT FAMILY**																		
*	*Leonurus cardiaca ssp. cardiaca*	common motherwort	G?T?	SE5			X			X							X			X
	PLANTAGINACEAE	**PLANTAIN FAMILY**																		
*	*Plantago major*	common plantain	G5	SE5			X				X		X	X						X
	OLEACEAE	**OLIVE FAMILY**																		
	Fraxinus pennsylvanica	red ash	G5	S5			X		X			X	X	X	X		X	X	X	X
	Fraxinus americana	white ash	G5	S5			X			X	X	X				X	X		X	X
*	*Ligustrum vulgare*	common privet	G?	SE5						X										
*	*Syringa vulgaris*	common lilac	G?	SE5			X					X	X	X					X	
	SCROPHULARIACEAE	**FIGWORT FAMILY**																		
*	*Linaria vulgaris*	butter-and-eggs	G?	SE5			X	X												
	RUBIACEAE	**MADDER FAMILY**																		
	Mitchella repens	creeping partridge-berry	G5	S5			X			X										
*	*Galium mollugo*	white bedstraw	G?	SE5			X													X
	Galium sp.	bedstraw						X												
	CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**																		
*	*Viburnum lantana*	bending wayfaring-tree	G?	SE2			X											X		
	Viburnum lentago	nannyberry	G5	S5			X			X										X
*	*Lonicera tatarica*	tartarian honeysuckle	G?	SE5			X	X	X	X	X	X	X	X	X			X	X	X
	Sambucus racemosa ssp. pubens	red-berried elderberry	G5T4T5	S5			X			X	X					X				
*	*Viburnum opulus*	guelder rose	G5	SE4			X			X	X							X		
	ASTERACEAE	**ASTER FAMILY**																		
*	*Cirsium vulgare*	bull thistle	G5	SE5			X													X
*	*Arctium minus ssp. minus*	common burdock	G?T?	SE5									X	X						
	Aster macrophyllus	large-leaved aster	G5	S5			X				X									
	Aster novae-angliae	New England aster	G5	S5			X	X										X		
	Aster cordifolius	heart-leaved aster	G5	S5			X				X									
*	*Cichorium intybus*	chicory	G?	SE5			X													X
	Ambrosia trifida	giant ragweed	G5	S5			X						X	X	X					X

Appendix B.
Forest Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	FOC3-1	FOC4-1	FOD3	FOD5a	FOD5b	FOD7-3a	FOD7-3b	FOD7a	FOD8-1	FODa	FODb	FODc	FODd
	Aster lanceolatus ssp. lanceolatus	tall white aster	G5T?	S5			X			X			X	X						
*	*Chrysanthemum leucanthemum*	ox-eye daisy	G?	SE5			X													X
	Aster ericoides ssp. ericoides	white heath aster	G5T?	S5			X	X												
*	*Tanacetum vulgare*	common tansy	G?	SE5			X				X									
	Solidago rugosa ssp. rugosa	rough goldenrod	G5T?	S5			X			X										
	Solidago gigantea	giant goldenrod	G5	S5			X			X										
	Solidago flexicaulis	zig-zag goldenrod	G5	S5			X				X									
	Solidago canadensis	Canada blue grass	G5	S5			X	X				X	X	X	X			X	X	
	Solidago caesia	blue-stem goldenrod	G5	S5			X				X									X
	Erigeron philadelphicus ssp. philadelphicus	Philadelphia fleabane	G5T?	S5			X			X										
*	*Helianthus tuberosus*	Jerusalem artichoke	G5	SE5			R							X						
	Euthamia graminifolia	flat-topped bushy goldenrod	G5	S5				X										X		
	ARACEAE	**ARUM FAMILY**																		
	Symplocarpus foetidus	skunk-cabbage	G5	S5			X						X	X						
	Arisaema triphyllum ssp. triphyllum	small jack-in-the-pulpit	G5T5	S5			X			X		X						X		X
	CYPERACEAE	**SEDGE FAMILY**																		
	Carex pensylvanica	Pennsylvania sedge	G5	S5			X			X	X									
	Carex sp.	sedge																X		
	Carex rosea	stellate sedge	G5	S5			R				X									
	POACEAE	**GRASS FAMILY**																		
*	*Bromus inermis ssp. inermis*	awnless brome	G4G5T?	SE5			X	X			X				X					
	Poa compressa	Canada blue grass	G?	S5			X	X				X							X	
	Poa pratensis ssp. pratensis	Kentucky bluegrass	G5T	S5			X	X					X	X						
*	*Elymus repens*	quack grass	G?	SE5			X	X					X	X						
*	*Dactylis glomerata*	orchard grass	G?	SE5			X						X	X						
*	*Phleum pratense*	timothy	G?	SE5			X						X	X	X					
	LILIACEAE	**LILY FAMILY**																		
	Maianthemum stellatum	star-flowered Solomon’s seal	G5	S5			X			X										
	Erythronium americanum ssp. americanum	yellow dog's-tooth violet	G5T5	S5			X				X									
*	*Convallaria majalis*	lily-of-the-valley	G5	SE5			X				X	X								
	Trillium grandiflorum	white trillium	G5	S5			X				X							X		
	ORCHIDACEAE	**ORCHID FAMILY**																		
*	*Epipactis helleborine*	common helleborine	G?	SE5			X			X	X							X		

*-introduced species / X – species present

Appendix B.
Vegetation Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	CUM/CUW	CUM1-1a	CUM1-1b	CUM1-1c	CUM1-1d	CUM1-1e	CUM1-1f	CUM1-1g	CUM1-1h	CUM1-1i	CUM1-1k	CUM1-1l	CUM1-1m	CUM1-1n	CUM1-1o	CUM1-1p	CUM1-1r	CUM1-1s	CUP3-1	CUP3-2	CUP3-3	CUP3a	CUP3c	CUS1	CUT1a	CUT1b	CUT1c	CUT1d	CUT1e	CUW1/CUT1	CUW1a	CUW1b	CUW1c	CUW1d	H
	EQUISETACEAE	**HORSETAIL FAMILY**																																							
	Equisetum sylvaticum	wood horsetail	G5	S5			X																																	X	
	Equisetum arvense	field horsetail	G5	S5			X		X				X	X		X		X			X					X						X					X				X	
	DRYOPTERIDACEAE	**WOOD FERN FAMILY**																																							
	Matteuccia struthiopteris var. pensylvanica	ostrich fern	G5	S5			X																					X													
	GINKGOACEAE	**GINKGO FAMILY**																																							
*	*Ginkgo biloba*	maiden-hair tree																						X																	
	PINACEAE	**PINE FAMILY**																																							
	Larix laricina	tamarack	G5	S5			X																			X															
*	*Pinus sylvestris*	scotch pine	G?	SE5			X																			X		X		X	X	X							X	X	X
*	*Larix decidua*	European larch	G?	SE2																						X						X								X	
*	*Picea abies*	Norway spruce	G?	SE3			X																				X										X				X	
	Picea glauca	white spruce	G5	S5			X																			X	X		X	X							X				X	
*	*Picea pungens*	Colorado spruce	G5	SE1					X																				X													
*	*Pinus nigra*	Austrian pine	G?	SE2																										X								X				
	Pinus resinosa	red pine	G5	S5			X Int																			X																
	Pinus strobus	eastern white pine	G5	S5			X																			X	X		X	X		X					X				X	
	CUPRESSACEAE	**CEDAR FAMILY**																																							
	Juniperus virginiana	eastern red cedar	G5	S5					X																															X	
	Thuja occidentalis	eastern white cedar	G5	S5			X											X								X	X					X				X	X			X	X	
	RANUNCULACEAE	**BUTTERCUP FAMILY**																																							
*	*Ranunculus acris*	tall buttercup	G5	SE5			X																																	X	
	Anemone virginiana var. virginiana	thimbleweed	G5T	S5			X																																	X	
	Ranunculus abortivus	kidney-leaf buttercup	G5	S5			X																			X						X									
	Anemone cylindrica	thimbleweed	G5	S4			X																														X				
	PAPAVERACEAE	**POPPY FAMILY**																																							
*	*Chelidonium majus*	celandine	G?	SE5			X																			X															X	
	ULMACEAE	**ELM FAMILY**																																							
*	*Ulmus pumila*	Siberian elm	G?	SE3					X						X								X		X						X	X				X			X	X	
	Celtis occidentalis	common hackberry	G5	S4			X																	X																	
	Ulmus americana	white elm	G5?	S5			X										X									X						X					X				X	X
	MORACEAE	**MULBERRY FAMILY**																																							
*	*Morus alba*	white mulberry	G?	SE5			X							X									X		X						X	X				X			X	X	
	URTICACEAE	**NETTLE FAMILY**																																							

Appendix B.
Vegetation Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	CUM/CUW	CUM1-1a	CUM1-1b	CUM1-1c	CUM1-1d	CUM1-1e	CUM1-1f	CUM1-1g	CUM1-1h	CUM1-1i	CUM1-1k	CUM1-1l	CUM1-1m	CUM1-1n	CUM1-1o	CUM1-1p	CUM1-1r	CUM1-1s	CUP3-1	CUP3-2	CUP3-3	CUP3a	CUP3c	CUS1	CUT1a	CUT1b	CUT1c	CUT1d	CUT1e	CUW1/CUT1	CUW1a	CUW1b	CUW1c	CUW1d	H
*	*Urtica dioica ssp. dioica*	European stinging nettle	G5 T?	SE2			X		X	X						X			X							X						X									X	
	JUGLANDACEAE	**WALNUT FAMILY**																																								
	Juglans nigra	black walnut	G5	S4			X N at		X					X	X		X			X			X		X	X										X			X	X	
	FAGACEAE	**BEECH FAMILY**																																								
	Quercus macrocarpa	bur oak	G5	S5			X																	X																		
*	*Quercus robur*	English oak	G?	SE1																																		X				
	BETULACEAE	**BIRCH FAMILY**																																								
	Betula papyrifera	white birch	G5	S5			X																																	X		
*	*Alnus glutinosa*	European black alder	G?	SE4			X																													X	X					
	CHENOPODIACEAE	**GOOSEFOOT FAMILY**																																								
*	*Chenopodium album var. album*	lamb's quarters	G5 T5	SE5			X		X	X									X				X		X																	
	CARYOPHYLLACEAE	**PINK FAMILY**																																								
*	*Silene vulgaris*	catchfly	G?	SE5			X	X	X					X			X					X	X														X	X			X	
	POLYGONACEAE	**SMARTWEED FAMILY**																																								
*	*Polygonum cuspidatum*	Japanese knotweed	G?	SE4			X																X																			
*	*Polygonum persicaria*	lady's-thumb	G?	SE5			X							X		X																										
*	*Rumex crispus*	curly-leaf dock	G?	SE5			X	X	X					X	X	X	X	X	X	X		X		X	X						X					X	X					
	GUTTIFERAE	**ST. JOHN'S-WORT FAMILY**																																								
*	*Hypericum perforatum*	common St. John's-wort	G?	SE5			X		X								X	X			X											X				X	X	X	X		X	
	TILIACEAE	**LINDEN FAMILY**																																								
	Tilia americana	basswood	G5	S5			X											X																		X					X	
	VIOLACEAE	**VIOLET FAMILY**																																								
	Viola sororia	woolly blue violet	G5	S5			X																													X					
	Viola pubescens	downy yellow violet	G5	S5			X																		X		X															
	CUCURBITACEAE	**GOURD FAMILY**																																								
	Echinocystis lobata	prickly cucumber	G5	S5			X			X			X			X																										
	SALICACEAE	**WILLOW FAMILY**																																								
	Populus tremuloides	trembling aspen	G5	S5			X											X																		X	X	X		X	X	X	X
	Populus grandidentata	large-tooth aspen	G5	S5			X																														X					
	Salix bebbiana	long-beaked willow	G5	S5			X																													X	X					
	Salix sp.	willow		?					X																						X											
	Salix petiolaris	slender willow	G4	S5			X																													X	X			X		
	Populus balsamifera ssp. balsamifera	balsam poplar	G5 T?	S5			X							X																							X				X	

Appendix B.
Vegetation Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	CUM/CUW	CUM1-1a	CUM1-1b	CUM1-1c	CUM1-1d	CUM1-1e	CUM1-1f	CUM1-1g	CUM1-1h	CUM1-1i	CUM1-1k	CUM1-1l	CUM1-1m	CUM1-1n	CUM1-1o	CUM1-1p	CUM1-1r	CUM1-1s	CUP3-1	CUP3-2	CUP3-3	CUP3a	CUP3c	CUS1	CUT1a	CUT1b	CUT1c	CUT1d	CUT1e	CUW1/CUT1	CUW1a	CUW1b	CUW1c	CUW1d	H
	Populus deltoides ssp. deltoides	eastern cottonwood	G5 T?	SU			X N at		X									X								X												X	X			
	Salix discolor	pussy willow	G5	S5			X																												X	X				X		
	BRASSICACEAE	**MUSTARD FAMILY**																																								
*	*Rorippa sylvestris*	creeping yellow-cress	G5	SE5			X		X																																	
*	*Brassica rapa*	wild turnip	G?	SE5											X		X														X											
*	*Thlaspi arvense*	field penny-cress	G?	SE5			X						X			X	X						X		X														X			
*	*Alliaria petiolata*	garlic mustard	G5	SE5			X							X	X											X	X		X							X	X	X	X			
*	*Barbarea vulgaris*	yellow rocket	G?	SE5			X		X																												X					
*	*Hesperis matronalis*	dame's rocket	G4 G5	SE5			X					X	X	X		X	X										X				X					X	X	X			
*	*Sisymbrium officinale*	hedge mustard	G?	SE5			X																													X					
*	*Brassica juncea*	Indian mustard	G?	SE5			X						X			X																									
	PRIMULACEAE	**PRIMROSE FAMILY**																																							
	Lysimachia ciliata	fringed loosestrife	G5	S5			X						X			X																									
	ROSACEAE	**ROSE FAMILY**																																								
*	*Potentilla recta*	rough-fruited cinquefoil	G?	SE5			X										X								X							X								X	
	Agrimonia gryposepala	tall hairy agrimony	G5	S5			X																					X													
*	*Prunus avium*	sweet cherry	G?	SE4			X																																	X	
	Rubus occidentalis	thimble-berry	G5	S5			X	X																		X														X	
	Rubus idaeus ssp. melanolasius	wild red raspberry	G5 T	S5			X							X																		X				X		X		X	
*	*Rubus idaeus ssp. idaeus*	red raspberry	G5 T5	SE1					X	X																												X				
*	*Rosa multiflora*	multiflora rose	G?	SE4			X	X																								X								X	
	Fragaria virginiana ssp. virginiana	scarlet strawberry	G5 T?	SU			X																			X						X				X	X			X	
	Geum aleppicum	yellow avens	G5	S5			X																			X						X				X				X	
*	*Pyrus communis*	common pear	G5	SE4			X																									X									
	Prunus virginiana ssp. virginiana	choke cherry	G5 T?	S5			X																			X			X			X								X	X
	Prunus serotina	black cherry	G5	S5			X																			X			X												
	Physocarpus opulifolius	ninebark	G5	S5			X																													X					
	Malus sp.	apple																														X	X								X
*	*Sorbus aucuparia*	European mountain-ash	G5	SE4			X																													X					
	Geum canadense	white avens	G5	S5			X																														X				
	Prunus sp.	cherry																							X												X				
	Crataegus sp.	hawthorn																														X									X

Appendix B.
Vegetation Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	CUM/CUW	CUM1-1a	CUM1-1b	CUM1-1c	CUM1-1d	CUM1-1e	CUM1-1f	CUM1-1g	CUM1-1h	CUM1-1i	CUM1-1k	CUM1-1l	CUM1-1m	CUM1-1n	CUM1-1o	CUM1-1p	CUM1-1r	CUM1-1s	CUP3-1	CUP3-2	CUP3-3	CUP3a	CUP3c	CUS1	CUT1a	CUT1b	CUT1c	CUT1d	CUT1e	CUW1/CUT1	CUW1a	CUW1b	CUW1c	CUW1d	H
	FABACEAE	**PEA FAMILY**																																							
*	*Coronilla varia*	variable crown-vetch	G?	SE5			X	X	X	X	X	X			X		X				X	X									X				X	X	X	X			
*	*Medicago sativa ssp. sativa*	alfalfa	G? T?	SE5			X																		X																
*	*Vicia cracca*	tufted vetch	G?	SE5			X	X			X	X									X	X									X	X			X	X				X	
*	*Medicago lupulina*	black medick	G?	SE5			X			X							X						X		X													X		X	
*	*Lotus corniculatus*	bird's-foot trefoil	G?	SE5			X		X			X					X		X				X	X	X																
*	*Trifolium repens*	white clover	G?	SE5			X											X					X	X																	
*	*Trifolium pratense*	red clover	G?	SE5			X	X	X								X		X				X		X							X								X	
*	*Melilotus alba*	white sweet-clover	G?	SE5			X	X			X	X		X	X			X	X				X		X							X								X	
*	*Robinia pseudo-acacia*	black locust	G5	SE5			X																		X											X		X	X	X	
	ELAEAGNACEAE	**OLEASTER FAMILY**																																						
*	*Elaeagnus angustifolia*	Russian olive	G?	SE3																		X									X				X		X		X	X	X
	LYTHRACEAE	**LOOSESTRIFE FAMILY**																																						
*	*Lythrum salicaria*	purple loosestrife	G5	SE5			X	X			X	X		X	X				X																X						
	ONAGRACEAE	**EVENING-PRIMROSE FAMILY**																																						
	Oenothera fruticosa ssp. glauca	common sundrops	G5 T5	SX					X																															
	Oenothera biennis	common evening-primrose	G5	S5			X	X	X										X		X				X										X					
	Circaea lutetiana ssp. canadensis	yellowish enchanter's nightshade	G5 T5	S5			X															X					X													
	CORNACEAE	**DOGWOOD FAMILY**																																						
	Cornus rugosa	round-leaved dogwood	G5	S5			X																														X			
	Cornus stolonifera	red-osier dogwood	G5	S5			X	X									X																		X	X			X	X	X
	EUPHORBIACEAE	**SPURGE FAMILY**																																						
*	*Euphorbia esula*	leafy spurge	G5	SE5			X					X																													
	RHAMNACEAE	**BUCKTHORN FAMILY**																																						
*	*Rhamnus cathartica*	common buckthorn	G?	SE5			X	X		X	X	X	X	X		X		X				X				X	X	X	X		X	X	X		X	X		X	X	X		X
*	*Rhamnus frangula*	glossy buckthorn	G?	SE5			X		X													X					X								X						
	VITACEAE	**GRAPE FAMILY**																																						
	Vitis riparia	riverbank grape	G5	S5			X		X	X		X	X	X	X	X	X					X	X		X	X	X	X			X	X			X	X	X	X	X	X	
	Parthenocissus inserta	inserted Virginia-creeper	G5	S5			X		X					X								X			X	X		X				X		X	X	X	X			X	
	Vitis aestivalis	summer grape	G5	S4			X																				X														
	ACERACEAE	**MAPLE FAMILY**																																						
	Acer saccharum ssp. saccharum	sugar maple	G5 T?	S5			X																								X								X	
*	*Acer platanoides*	norway maple	G?	SE5			X		X	X				X									X	X	X						X				X	X		X		X	

Appendix B.
Vegetation Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	CUM/CUW	CUM1-1a	CUM1-1b	CUM1-1c	CUM1-1d	CUM1-1e	CUM1-1f	CUM1-1g	CUM1-1h	CUM1-1i	CUM1-1k	CUM1-1l	CUM1-1m	CUM1-1n	CUM1-1o	CUM1-1p	CUM1-1r	CUM1-1s	CUP3-1	CUP3-2	CUP3-3	CUP3a	CUP3c	CUS1	CUT1a	CUT1b	CUT1c	CUT1d	CUT1e	CUW1/CUT1	CUW1a	CUW1b	CUW1c	CUW1d	H
	Acer negundo	manitoba maple	G5	S5			X	X	X			X		X		X		X		X		X			X										X	X	X	X	X	X	X	X
	Acer saccharinum	silver maple	G5	S5			X																	X														X	X			
	ANACARDIACEAE	**SUMAC FAMILY**																																							
	Rhus rydbergii	western poison-ivy	G5 T	S5			X					X														X		X														X	
	Rhus typhina	staghorn sumac	G5	S5			X		X			X	X	X	X	X	X	X	X		X	X	X		X	X		X				X										X
	GERANIACEAE	**GERANIUM FAMILY**																																							
*	*Geranium robertianum*	herb-robert	G5	SE5			X																				X		X												X	
	BALSAMINACEAE	**TOUCH-ME-NOT FAMILY**																																							
	Impatiens capensis	spotted touch-me-not	G5	S5			X			X			X			X																										
	APIACEAE	**PARSLEY FAMILY**																																							
*	*Daucus carota*	wild carrot	G?	SE5			X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X						X				X	X	X			X	X
	Angelica atropurpurea	dark-purple alexanders	G5	S5			X					X																													
*	*Pastinaca sativa*	wild parsnip	G?	SE5			R					X																														
	Cryptotaenia canadensis	honewort	G5	S5			X									X																										
	ASCLEPIADACEAE	**MILKWEED FAMILY**																																							
	Asclepias syriaca	common milkweed	G5	S5			X	X	X	X	X	X	X	X	X	X	X	X			X	X		X							X	X			X	X					X
	SOLANACEAE	**POTATO FAMILY**																																							
*	*Solanum dulcamara*	bitter nightshade	G?	SE5			X							X		X										X	X	X	X			X						X	X		X	
	CONVOLVULACEAE	**MORNING-GLORY FAMILY**																																							
*	*Convolvulus arvensis*	field bindweed	G?	SE5								X	X			X		X																								
	BORAGINACEAE	**BORAGE FAMILY**																																							
	Hackelia virginiana	Virginia stickweed	G5	S5			X																			X																
*	*Echium vulgare*	blueweed	G?	SE5			X		X						X		X		X				X	X	X						X	X						X		X	X
	VERBENACEAE	**VERVAIN FAMILY**																																							
	Verbena urticifolia	white vervain	G5	S5			X						X			X																										
	Verbena hastata	blue vervain	G5	S5			X					X																														
	LAMIACEAE	**MINT FAMILY**																																							
*	*Leonurus cardiaca ssp. cardiaca*	common motherwort	G? T?	SE5			X					X	X			X			X					X	X															X		X	
*	*Nepeta cataria*	catnip	G?	SE5			X														X																					
	Agastache foeniculum	blue giant-hyssop	G4 G5	S4			R					X																														
	Mentha arvensis ssp. borealis	American wild mint	G5 T5	S5					X	X																																
*	*Prunella vulgaris ssp. vulgaris*	common heal-all	G5 T?	SE3			X																								X								X		

Appendix B.
Vegetation Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	CUM/CUW	CUM1-1a	CUM1-1b	CUM1-1c	CUM1-1d	CUM1-1e	CUM1-1f	CUM1-1g	CUM1-1h	CUM1-1i	CUM1-1k	CUM1-1l	CUM1-1m	CUM1-1n	CUM1-1o	CUM1-1p	CUM1-1r	CUM1-1s	CUP3-1	CUP3-2	CUP3-3	CUP3a	CUP3c	CUS1	CUT1a	CUT1b	CUT1c	CUT1d	CUT1e	CUW1/CUT1	CUW1a	CUW1b	CUW1c	CUW1d	H
*	*Glechoma hederacea*	creeping Charlie	G?	SE5			X		X															X	X		X											X		X	
	PLANTAGINACEAE	**PLANTAIN FAMILY**																																							
*	*Plantago lanceolata*	ribgrass	G5	SE5			X		X		X			X									X	X	X							X					X				
*	*Plantago major*	common plantain	G5	SE5			X	X		X			X	X		X	X	X	X	X			X	X	X															X	
	OLEACEAE	**OLIVE FAMILY**																																							
	Fraxinus pennsylvanica	red ash	G5	S5			X	X	X							X	X			X							X									X		X	X			
	Fraxinus americana	white ash	G5	S5			X							X												X										X				X	
*	*Syringa reticulata*	japanese tree lilac																							X																
	SCROPHULARIACEAE	**FIGWORT FAMILY**																																							
*	*Verbascum blattaria*	moth mullein	G?	SE5			X													X																					
*	*Linaria vulgaris*	butter-and-eggs	G?	SE5			X		X	X	X			X			X		X		X				X											X				X	
	Linaria canadensis	blue toadflax	G4 G5	S1																		X																			
*	*Verbascum thapsus*	common mullein	G?	SE5			X	X	X					X	X		X	X	X		X			X	X											X	X			X	
	CAMPANULACEAE	**BLUEBELL FAMILY**																																							
*	*Campanula rapunculoides*	creeping bellflower	G?	SE5			X																	X																	
	RUBIACEAE	**MADDER FAMILY**																																							
	Galium triflorum	sweet-scented bedstraw	G5	S5			X																														X				
*	*Galium mollugo*	white bedstraw	G?	SE5			X					X						X																			X	X		X	
	Galium aparine	cleavers	G5	S5			X	X	X																										X						
	CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**																																							
	Viburnum lentago	nannyberry	G5	S5			X																													X				
*	*Lonicera tatarica*	tartarian honeysuckle	G?	SE5			X		X			X	X			X						X	X		X	X									X	X		X		X	X	
	Sambucus racemosa ssp. pubens	red-berried elderberry	G5 T4T 5	S5			X																				X														
	Lonicera canadensis	american fly honeysuckle	G5	S5			X																															X			
*	*Viburnum opulus*	guelder rose	G5	SE4			X		X																											X	X				
	Sambucus canadensis	common elderberry	G5	S5			X																														X	X			
	DIPSACACEAE	**TEASEL FAMILY**																																							
*	*Dipsacus fullonum ssp. sylvestris*	wild teasel	G? T?	SE5			X		X	X		X	X	X	X	X	X	X				X		X							X					X	X		X			
	ASTERACEAE	**ASTER FAMILY**																																							
*	*Cirsium vulgare*	bull thistle	G5	SE5			X	X		X	X	X				X	X																			X		X				X
*	*Cirsium arvense*	Canada thistle	G?	SE5			X		X	X		X		X				X		X	X	X									X				X					X	
	Conyza canadensis	horseweed	G5	S5			X		X	X				X																										X		
*	*Arctium minus ssp. minus*	common burdock	G? T?	SE5						X			X			X		X																		X		X			X	

Appendix B.
Vegetation Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	CUM/CUW	CUM1-1a	CUM1-1b	CUM1-1c	CUM1-1d	CUM1-1e	CUM1-1f	CUM1-1g	CUM1-1h	CUM1-1i	CUM1-1k	CUM1-1l	CUM1-1m	CUM1-1n	CUM1-1o	CUM1-1p	CUM1-1r	CUM1-1s	CUP3-1	CUP3-2	CUP3-3	CUP3a	CUP3c	CUS1	CUT1a	CUT1b	CUT1c	CUT1d	CUT1e	CUW1/CUT1	CUW1a	CUW1b	CUW1c	CUW1d	H
	Aster novae-angliae	New England aster	G5	S5			X		X	X	X			X			X	X	X	X	X										X	X					X	X		X	X	X
	Aster umbellatus var. umbellatus	flat-top white aster	G5 T?	S5			R																															X				
	Aster lateriflorus var. lateriflorus	calico aster	G5 T5	S5													X															X										
	Bidens frondosa	devil's beggar-ticks	G5	S5			X		X							X																										
*	*Centaurea maculosa*	spotted knapweed	G?	SE5			X		X			X																															
*	*Cichorium intybus*	chicory	G?	SE5			X	X	X			X		X	X		X	X	X			X	X	X	X						X					X						
*	*Carduus acanthoides*	plumeless thistle	G?	SE5			X		X																																	
*	*Arctium lappa*	great burdock	G?	SE5			X														X																					
	Ambrosia trifida	giant ragweed	G5	S5			X					X	X			X		X																			X					
	Ambrosia artemisiifolia	common ragweed	G5	S5			X	X									X			X																		X				
*	*Achillea millefolium ssp. millefolium*	common yarrow	G5 T?	SE?			X		X			X	X	X		X	X	X		X			X														X					
	Aster lanceolatus ssp. lanceolatus	tall white aster	G5 T?	S5			X	X			X				X	X																				X		X			X
*	*Centaurea jacea*	brown knapweed	G?	SE5			X																								X										
*	*Chrysanthemum leucanthemum*	ox-eye daisy	G?	SE5			X		X										X				X	X												X				X	
	Aster ericoides ssp. ericoides	white heath aster	G5 T?	S5			X				X				X	X			X																	X				X	
*	*Tanacetum vulgare*	common tansy	G?	SE5			X		X	X		X												X												X	X	X			
	Solidago altissima var. altissima	tall goldenrod		S5			X					X					X														X						X	X			
*	*Taraxacum officinale*	common dandelion	G5	SE5			X	X	X				X	X	X	X	X	X	X				X	X	X											X	X	X		X	
*	*Tussilago farfara*	coltsfoot	G?	SE5			X							X				X																						X	
*	*Sonchus arvensis ssp. arvensis*	field sow-thistle	G? T?	SE5			X							X							X															X					
	Solidago sp.	goldenrod											X																												
	Solidago nemoralis ssp. nemoralis	gray goldenrod	G5 T?	S5			X		X																																
	Solidago juncea	early goldenrod	G5	S5			X		X																																
	Solidago gigantea	giant goldenrod	G5	S5			X												X																						
	Solidago canadensis	canada goldenrod	G5	S5			X	X	X	X	X			X	X	X		X	X	X	X	X		X	X	X		X			X	X			X	X	X	X	X	X	X
*	*Senecio jacobaea*	tansy grounsel	G?	SE1			X																	X																	
	Rudbeckia hirta	black-eyed Susan	G5	S5			X					X																												X		
	Erigeron philadelphicus ssp. philadelphicus	Philadelphia fleabane	G5 T?	S5			X							X	X		X		X						X																
*	*Matricaria matricarioides*	pineapple-weed	G5	SE5			X											X																							
*	*Matricaria maritima ssp. maritima*	seaside camomile	G5 T?	SE?													X			X		X																			

Appendix B.
Vegetation Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	CUM/CUW	CUM1-1a	CUM1-1b	CUM1-1c	CUM1-1d	CUM1-1e	CUM1-1f	CUM1-1g	CUM1-1h	CUM1-1i	CUM1-1k	CUM1-1l	CUM1-1m	CUM1-1n	CUM1-1o	CUM1-1p	CUM1-1r	CUM1-1s	CUP3-1	CUP3-2	CUP3-3	CUP3a	CUP3c	CUS1	CUT1a	CUT1b	CUT1c	CUT1d	CUT1e	CUW1/CUT1	CUW1a	CUW1b	CUW1c	CUW1d	H
*	*Tragopogon dubius*	doubtful goat's-beard	G?	SE5			X		X																X											X						
	Erigeron annuus	daisy fleabane	G5	S5			X		X			X												X								X				X					X	
*	*Hieracium caespitosum ssp. caespitosum*	field hawkweed		SE5			X																									X						X			
	Euthamia graminifolia	flat-topped bushy goldenrod	G5	S5				X	X	X	X										X																	X			X
	POACEAE	**GRASS FAMILY**																																							
*	*Bromus inermis ssp. inermis*	awnless brome	G4 G5 T?	SE5			X	X	X	X	X	X	X	3		X	X	X	X	X		X		X	X						X				X	X					
	Phragmites australis	common reed	G5	S5			X	X			X								X			X															X				
	Poa compressa	Canada blue grass	G?	S5			X								X				X			X									X				X						
	Poa pratensis ssp. pratensis	Kentucky bluegrass	G5 T	S5			X		X					X				X		X	X		X	X	X							X					X	X				
*	*Setaria faberi*	giant foxtail	G?	SE4						X							X		X				X		X																	
*	*Setaria viridis*	green foxtail	G?	SE5			X			X							X		X				X		X																	
*	*Elymus repens*	quack grass	G?	SE5			X		X		X	X	X	X		X	X	X		X	X	X	X	X	X	X						X									
	Phalaris arundinacea	reed canary grass	G5	S5			X			X		X	X		X	X	X		X	X	X	X													X		X				
*	*Dactylis glomerata*	orchard grass	G?	SE5			X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X							X									
*	*Phleum pratense*	timothy	G?	SE5			X				X		X			X		X		X																					
	Panicum capillare	witch grass	G5	S5			X		X		X										X																	X			
*	*Echinochloa crusgalli*	common barnyard grass	G?	SE5			X		X	X																	X														
	TYPHACEAE	**CATTAIL FAMILY**																																							
	Typha angustifolia	narrow-leaved cattail	G5	S5			X		X																																
	LILIACEAE	**LILY FAMILY**																																							
*	*Asparagus officinalis*	garden asparagus	G5?	SE5			X	X			X																														
*	*Convallaria majalis*	lily-of-the-valley	G5	SE5			X									X																									

*-introduced species / X – species present

Appendix B.
Wetland Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	MAM2-2a	MAM2-2b	MAM2-2c	MAM2-2d	MAM2-5	MAM2a	MAM2b	MAS2-1a	MAS2-1b	MAS2-1c	MAS2-1d	MAS2a	SWC3-1	SWD2-2	SWM1-1	SWT2-2
	EQUISETACEAE	**HORSETAIL FAMILY**																					
	Equisetum arvense	field horsetail	G5	S5			X	X													X	X	
	OSMUNDACEAE	**ROYAL FERN FAMILY**																					
	Osmunda cinnamomea	cinnamon fern	G5	S5			X	X															
	THELYPTERIDACEAE	**MARSH FERN**																					
	Thelypteris palustris var. pubescens	marsh fern	G5T?	S5			X	X			X		X		X							X	
	DRYOPTERIDACEAE	**WOOD FERN FAMILY**																					
	Onoclea sensibilis	sensitive fern	G5	S5			X					X	X		X		X			X		X	
	Matteuccia struthiopteris var. pensylvanica	ostrich fern	G5	S5			X	X				X											
	PINACEAE	**PINE FAMILY**																					
	Larix laricina	tamarack	G5	S5			X					X			X							X	
	CUPRESSACEAE	**CEDAR FAMILY**																					
	Thuja occidentalis	eastern white cedar	G5	S5			X					X			X					X		X	
	RANUNCULACEAE	**BUTTERCUP FAMILY**																					
	Caltha palustris	marsh-marigold	G5	S5			X	X				X			X						X	X	
	ULMACEAE	**ELM FAMILY**																					
	Ulmus Americana	white elm	G5?	S5			X															X	
	URTICACEAE	**NETTLE FAMILY**																					
*	*Urtica dioica ssp. dioica*	European stinging nettle	G5T?	SE2			X	X	X	X			X	X		X			X				
	Laportea Canadensis	wood nettle	G5	S5			X					X											
	Boehmeria cylindrical	false nettle	G5	S5			X				X												
	BETULACEAE	**BIRCH FAMILY**																					
	Betula papyrifera	white birch	G5	S5			X															X	
	Betula alleghaniensis	yellow birch	G5	S5			X															X	
	POLYGONACEAE	**SMARTWEED FAMILY**																					
*	*Polygonum persicaria*	lady's-thumb	G?	SE5			X	X															
	VIOLACEAE	**VIOLET FAMILY**																					
	Viola sp.	violet																				X	
	SALICACEAE	**WILLOW FAMILY**																					
	Populus tremuloides	trembling aspen	G5	S5			X								X					X			
	Salix eriocephala	Missouri willow	G5	S5			X								X								
	Salix sp.	willow		?													X						X
*	*Salix X rubens*	reddish willow	HYB	SE4				X				X											
	Salix petiolaris	slender willow	G4	S5			X				X	X			X								
*	*Salix fragilis*	crack willow	G?	SE5			X		X														X

Appendix B.
Wetland Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	MAM2-2a	MAM2-2b	MAM2-2c	MAM2-2d	MAM2-5	MAM2a	MAM2b	MAS2-1a	MAS2-1b	MAS2-1c	MAS2-1d	MAS2a	SWC3-1	SWD2-2	SWM1-1	SWT2-2
	Populus balsamifera ssp. balsamifera	balsam poplar	G5T?	S5			X					X			X						X	X	
	BRASSICACEAE	**MUSTARD FAMILY**																					
*	*Nasturtium officinale*	water-cress	G?	SE?													X						
	PRIMULACEAE	**PRIMROSE FAMILY**																					
	Lysimachia ciliate	fringed loosestrife	G5	S5			X					X		X	X				X				
	GROSSULARIACEAE	**GOOSEBERRY FAMILY**																					
	Ribes americanum	wild black currant	G5	S5			X															X	
	ROSACEAE	**ROSE FAMILY**																					
	Prunus sp.	cherry																		X			
	FABACEAE	**PEA FAMILY**																					
*	*Lotus corniculatus*	bird's-foot trefoil	G?	SE5			X										X						
	LYTHRACEAE	**LOOSESTRIFE FAMILY**																					
*	*Lythrum salicaria*	purple loosestrife	G5	SE5			X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	
	ONAGRACEAE	**EVENING-PRIMROSE FAMILY**																					
	Circaea lutetiana ssp. Canadensis	yellowish enchanter's nightshade	G5T5	S5			X														X		
	Epilobium palustre	marsh willow-herb	G5	S5			R?										X						
*	*Epilobium hirsutum*	great hairy willow-herb	G?	SE5			X	X															
	CORNACEAE	**DOGWOOD FAMILY**																					
	Cornus alternifolia	alternate-leaved dogwood	G5	S5			X					X											
	Cornus rugose	round-leaved dogwood	G5	S5			X															X	
	Cornus stolonifera	red-osier dogwood	G5	S5			X	X			X	X		X	X		X		X		X		X
	RHAMNACEAE	**BUCKTHORN FAMILY**																					
*	*Rhamnus cathartica*	common buckthorn	G?	SE5			X		X			X								X			X
*	*Rhamnus frangula*	glossy buckthorn	G?	SE5			X				X						X				X		X
	VITACEAE	**GRAPE FAMILY**																					
	Parthenocissus quinquefolia	five-leaved Virginia-creeper	G5	S4?			X?													X			
	ACERACEAE	**MAPLE FAMILY**																					
	Acer X freemanii	freeman's maple																				X	
	Acer rubrum	red maple	G5	S5			X														X		
	BALSAMINACEAE	**TOUCH-ME-NOT FAMILY**																					
	Impatiens capensis	spotted touch-me-not	G5	S5			X	X			X	X	X	X	X				X	X	X	X	X
	APIACEAE	**PARSLEY FAMILY**																					
	Angelica atropurpurea	dark-purple alexanders	G5	S5			X		X														

Appendix B.
Wetland Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	MAM2-2a	MAM2-2b	MAM2-2c	MAM2-2d	MAM2-5	MAM2a	MAM2b	MAS2-1a	MAS2-1b	MAS2-1c	MAS2-1d	MAS2a	SWC3-1	SWD2-2	SWM1-1	SWT2-2
	Cicuta maculate	spotted water-hemlock	G5	S5			X						X										
*	*Pastinaca sativa*	wild parsnip	G?	SE5			R		X					X									
	Sium suave	hemlock water-parsnip	G5	S5			X				X												
	ASCLEPIADACEAE	**MILKWEED FAMILY**																					
	Asclepias incarnata ssp. incarnate	swamp milkweed	G5T5	S5			X	X	X			X											
	SOLANACEAE	**POTATO FAMILY**																					
*	*Solanum dulcamara*	bitter nightshade	G?	SE5			X	X			X	X			X						X	X	
	HYDROPHYLLACEAE	**WATER-LEAF FAMILY**																					
	Hydrophyllum virginianum	Virginia water-leaf	G5	S5			X										X			X			
	BORAGINACEAE	**BORAGE FAMILY**																					
*	*Myosotis scorpioides*	mouse-ear scorpion-grass	G5	SE5													X						
	VERBENACEAE	**VERVAIN FAMILY**																					
	Verbena hastate	blue vervain	G5	S5			X			X		X					X						
	LAMIACEAE	**MINT FAMILY**																					
	Lycopus uniflorus	northern water-horehound	G5	S5			R	X		X		X	X	X			X		X			X	
	Agastache foeniculum	blue giant-hyssop	G4G5	S4			R		X							X							
	Mentha arvensis ssp. borealis	American wild mint	G5T5	S5				X	X	X			X	X		X	X		X			X	
*	*Prunella vulgaris ssp. vulgaris*	common heal-all	G5T?	SE3			X	X				X											
	Scutellaria galericulata	hooded skullcap	G5	S5			X				X												
	OLEACEAE	**OLIVE FAMILY**																					
	Fraxinus pennsylvanica	red ash	G5	S5			X													X	X	X	
	Fraxinus nigra	black ash	G5	S5			X														X	X	
	RUBIACEAE	**MADDER FAMILY**																					
	Galium trifidum ssp. trifidum	small bedstraw	G5T?	S5			X	X															
	Galium palustre	marsh bedstraw	G5	S5			X					X									X		
	CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**																					
*	*Lonicera tatarica*	tartarian honeysuckle	G?	SE5			X					X											
	Sambucus Canadensis	common elderberry	G5	S5			X														X		
	Viburnum trilobum	high bush cranberry	G5T5	S5			X					X											
	DIPSACACEAE	**TEASEL FAMILY**																					
*	*Dipsacus fullonum ssp. sylvestris*	wild teasel	G?T?	SE5			X					X		X									
	ASTERACEAE	**ASTER FAMILY**																					
*	*Cirsium arvense*	Canada thistle	G?	SE5			X					X											
	Aster puniceus var. puniceus	purple-stemmed aster	G5T?	S5			X	X				X			X						X	X	
	Aster lateriflorus var. lateriflorus	calico aster	G5T5	S5												X							

Appendix B.
Wetland Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	MAM2-2a	MAM2-2b	MAM2-2c	MAM2-2d	MAM2-5	MAM2a	MAM2b	MAS2-1a	MAS2-1b	MAS2-1c	MAS2-1d	MAS2a	SWC3-1	SWD2-2	SWM1-1	SWT2-2
	Bidens cernua	stick-tight	G5	S5			X	X															
	Bidens frondosa	devil's beggar-ticks	G5	S5			X				X	X		X							X		
	Aster lanceolatus ssp. lanceolatus	tall white aster	G5T?	S5			X	X				X		X	X								
	Solidago sp.	goldenrod																	X				
	Solidago gigantean	giant goldenrod	G5	S5			X					X											
	Solidago Canadensis	canada goldenrod	G5	S5			X			X				X		X							
*	*Tragopogon dubius*	doubtful goat's-beard	G?	SE5			X					X											
	Prenanthes alba	white rattlesnake-root	G5	S5			X					X											
*	*Hieracium caespitosum ssp. caespitosum*	field hawkweed		SE5			X					X											
	Euthamia graminifolia	flat-topped bushy goldenrod	G5	S5				X															
	Eupatorium perfoliatum	perfoliate thoroughwort	G5	S5			X					X					X					X	
	Eupatorium maculatum ssp. maculatum	spotted joe-pye-weed	G5T5	S5			X	X		X		X	X	X	X		X					X	
	Eupatorium maculatum ssp. bruneri	spotted joe-pye-weed	G5TU	S2?															X				
	ALISMATACEAE	**WATER-PLANTAIN FAMILY**																					
	Sagittaria latifolia	broad-leaved arrowhead	G5	S5			X										X						
	Alisma plantago-aquatica	common water-plantain	G5	S5			X				X										X		X
	ARACEAE	**ARUM FAMILY**																					
	Symplocarpus foetidus	skunk-cabbage	G5	S5			X													X			
	JUNCACEAE	**RUSH FAMILY**																					
	Juncus sp.	rush																					X
	Juncus dudleyi	Dudley's rush	G5	S5			X					X											
	CYPERACEAE	**SEDGE FAMILY**																					
	Carex pensylvanica	Pennsylvania sedge	G5	S5			X					X									X		
	Carex vulpinoidea	fox sedge	G5	S5			X					X			X						X	X	
	Carex stricta	tussock sedge	G5	S5			X					X											
	Scirpus cyperinus	wool-grass	G5	S5			X	X															
	Scirpus pungens	common three-square	G5	S5			X						X										
	Carex stipata	awl-fruited sedge	G5	S5			X	X														X	
	Scirpus validus	American great bulrush	G?	S5			X	X				X											
	Carex sp.	sedge															X						X
	Scirpus atrovirens	dark-green bulrush	G5?	S5			X					X			X		X					X	
	Carex granularis	meadow sedge	G5	S5			X	X							X								
	Carex flava	yellow sedge	G5	S5			X	X															
	Carex communis	fibrous rooted sedge	G5	S5			X														X		
	Carex hystericina	porcupine sedge	G5	S5			X	X							X								

Appendix B.
Wetland Communities Vascular Plant List

	Scientific Name	Common Name	GRank	SRank	MNR	COSEWIC	Waterloo	MAM2-2a	MAM2-2b	MAM2-2c	MAM2-2d	MAM2-5	MAM2a	MAM2b	MAS2-1a	MAS2-1b	MAS2-1c	MAS2-1d	MAS2a	SWC3-1	SWD2-2	SWM1-1	SWT2-2
	POACEAE	**GRASS FAMILY**																					
	Phragmites australis	common reed	G5	S5			X	X		X		X	X			X	X	X					
*	*Agrostis stolonifera*	redtop	G5	S5								X										X	
	Phalaris arundinacea	reed canary grass	G5	S5			X	X	X	X	X	X	X	X	X		X	X	X		X	X	X
	Glyceria striata	fowl meadow grass	G5	S5			X	X				X			X						X	X	
	Leersia oryzoides	rice cut grass	G5	S5			X					X									X		
	TYPHACEAE	**CATTAIL FAMILY**																					
	Typha latifolia	broad-leaved cattail	G5	S5			X					X			X			X			X	X	
	Typha angustifolia	narrow-leaved cattail	G5	S5			X	X	X			X			X	X	X	X					
	IRIDACEAE	**IRIS FAMILY**																					
	Iris versicolor	multi-coloured blue-flag	G5	S5			X				X						X					X	

*-introduced species / X – species present

APPENDIX C
ACRONYMS AND DEFINITIONS USED IN SPECIES LISTS

ACRONYMS AND DEFINITIONS USED IN SPECIES LISTS

G-Rank Global Rank

Global ranks are assigned by a consensus of the network of Conservation Data Centres, scientific experts, and the Nature Conservatory to designate a rarity rank based on the range-wide status of a species, subspecies or variety.

The most important factors considered in assigning global ranks are the total number of known, extant sites world-wide, and the degree to which they are potentially or actively threatened with destruction. Other criteria the number of known populations considered to be securely protected, the size of the various populations, and the ability of the taxon to persist at its known sites. The taxonomic distinctness of each taxon has also been considered. Hybrids, introduced species, and taxonomically dubious species, subspecies and varieties have not been included.

G1=	Extremely rare; usually 5 or fewer occurrences in the overall range or very few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction.
G2 =	Very rare; usually between 5 and 20 occurrences in the overall range or with many individuals in fewer occurrences; or because of some factor(s) making it vulnerable to extinction.
G3 =	Rare to uncommon; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
G4 =	Common; usually more than 100 occurrences; usually not susceptible to immediate threats.
G5 =	Very common; demonstrably secure under present conditions.
GH =	Historic, no records in the past 20 years.
GU =	Status uncertain, often because of low search effort or cryptic nature of the species; more data needed.
GX =	Globally extinct. No recent records despite specific searches.
? =	Denotes inexact numeric rank (i.e. G4?).
G" " =	A "G" (or "T") followed by a blank space means that the NHIC has not yet obtained the Global Rank from The Nature Conservancy.
G? =	Unranked, or, if following a ranking, rank tentatively assigned (e.g. G3?).
Q =	Denotes that the taxonomic status of the species, subspecies, or variety is questionable.
T =	Denotes that the rank applies to a subspecies or variety.

S-Rank Provincial Rank

Provincial (or Sub-national) ranks are used by the Ontario Ministry of Natural Resources 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 the global ranks, but consider only those factors within the political boundaries of Ontario. By comparing the global and provincial ranks, the status, rarity, and the urgency of conservation needs can be ascertained. The NHIC evaluates provincial ranks on a continual basis and produces updated list at least annually.

S1 =	Critically imperiled in Ontario 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.
S2 =	Imperiled in Ontario because of rarity due to very restricted range, very few populations (often 20 or fewer occurrences) steep declines or other factors making it very vulnerable to extirpation.
S3 =	Vulnerable in Ontario 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 Ontario.
SX =	Presumed Extirpated - specie or community is believed to be extirpated from Ontario.
SNR =	Unranked - conservation status in Ontario not yet assessed
SU =	Unrankable - currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA =	Not applicable - a conservation status rank is not applicable because the species is not a suitable target for conservation activities.
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 that S1S4).

COSEWIC Committee On The Status Of Endangered Wildlife in Canada

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species that are considered to be at risk in Canada.

Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)	A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.

COSSARO/OMNR Committee On The Status Of Species At Risk In Ontario/Ontario Ministry Of Natural Resources

The Committee on the Status of Species at Risk in Ontario (COSSARO)/Ontario Ministry of Natural Resources (OMNR) assess the provincial status of wild species that are considered to be at risk in Ontario.

Extinct (EXT)	A species that no longer exists anywhere.
Extirpated (EXP)	A species that no longer exist in the wild in Ontario but still occurs elsewhere.
Endangered (Regulated) (END-R)	A species facing imminent extinction or extirpation in Ontario which has been regulated under Ontario's *Endangered Species Act*.
Endangered (END)	A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's Endangered Species Act.
Threatened (THR)	A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
Special Concern (SC)	A species with characteristics that make it sensitive to human activities or natural events.
Not at Risk (NAR)	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)	A species for which there is insufficient information for a provincial status recommendations.

Local Status **Niagara Haldimand** (Riley 1989)

Species status within the Durham Region was used to determine local vascular plant status for the study area.

R-# = R- Native species present and rare; # - number of stations at which the species has been identified.

U = Uncommon

X = Not classified as rare or uncommon within Niagara Haldimand

APPENDIX D
REVIEW AGENCY COMMENTS

APPENDIX D: REVIEW AGENCY COMMENTS

ITEM	GRCA COMMENTS (FEBRUARY 21, 2020)	PROPONENT/CONSULTANT RESPONSES
Natural Heritage Review Comments		
1.	The Draft Natural Heritage Report prepared by LGL Limited contains some mapping discrepancies. Wetland areas mapped in accordance with ELC methods do not align well with the GRCA's wetland mapping in two main areas. Specifically, LGL has mapped more wetland within the floodplain area immediately downstream of the Highway 8 crossing. LGL has mapped less wetland within the Speed River floodplain in the Preston area. The ELC mapping also does not align well with the evaluated and unevaluated wetland boundary mapping obtained from the province. It is typically preferred that such mapping discrepancies be resolved as part of a Class EA. If feasible, site visits may be scheduled with the GRCA prior to finalization of the NHR to verify the accuracy of the ELC mapping.	The Natural Heritage Report mapping will be updated, per information available from GRCA. Site visits with GRCA to confirm wetland boundaries will be carried out during a future design stage.
2.	Wetland boundaries within close proximity of the preferred LRT Line will need to be flagged or staked in the field by a certified wetland ecologist and subsequently verified by the GRCA. The surveyed wetland boundaries shall be plotted on detailed site and grading plans.	Wetland boundaries will be staked and surveyed during a future design phase and added to the design plates.
3.	A scoped EIS will be required by the GRCA at the detailed design stage. The EIS will provide maps showing surveyed wetland boundaries and a clearer understanding of direct and indirect impacts to wetlands, in accordance with GRCA policies.	The Region of Waterloo commits to preparing a scoped EIS during a future design stage.
4.	We request that wetland losses be quantified more explicitly, where practicable. The Provincially Significant Wetlands and other wetlands and community type directly impacted should be disclosed in future EIS reports.	The Region of Waterloo commits to preparing a scoped EIS during a future design stage.
5.	Please note that GRCA's wetland policies do not currently address "compensation" or "offsetting." Avoidance of wetlands is always preferred. Where avoidance is not practicable, onsite restoration and enhancement of wetlands and their buffer areas will be required in accordance with current policies. Section 5.3.3.1 of the NHR should be revised accordingly.	Section 5.3.3.1 of the Natural Heritage Report will be revised to reflect GRCA policies related to avoidance, restoration and enhancement of wetlands.
6.	We suggest that potential or anticipated stormwater impacts within receiving wetlands and watercourses should be assessed in the final NHR.	The Natural Heritage Report has been updated to address stormwater management criteria at wetlands and watercourses.
7.	We note that potential impacts associated with the crossing of North Creek (aka Hidden Valley Creek) and Hofstetter Creek will be assessed as part of the River Road Extension Study. We support the removal of perched culverts to improve flows and aquatic habitat connectivity.	Comment noted.
8.	We agree that water quality treatment must be provided to maintain the existing quality of surface water within the study limits. We would therefore suggest that peak flows should be	Section 5.2.5 of the Natural Heritage Report will be revised to ensure that water

	mitigated as necessary to mitigate existing and future erosion potential along smaller watercourses, particularly North Creek, Hostetter Creek, Freeport Creek and Mill Creek. Section 5.2.5 of the report should be revised to ensure that water quantity is addressed at detailed design.	quantity is addressed during a future design stage.
Advisory Comments		
9.	Please be advised that Silver Shiner and Black Redhorse were recently listed on Schedule 1 and are legally protected under the Federal Species at Risk Act. Both fish species and their habitat are also protected under Ontario's Endangered Species Act (ESA). Wavy-rayed lampmussel is legally protected under the ESA only. It is further recommended that the Federal Department of Fisheries and Oceans (DFO) and the Ministry of the Environment, Conservation and Parks (MECP) be consulted at the detailed design stage to ensure compliance with applicable legislation.	Comment noted. The Region of Waterloo commits to carry out further discussions with MECP and DFO during a future design stage to ensure compliance with applicable legislation.
10.	According to information available from the Natural Heritage Information Centre (NHIC), Jefferson Salamander was last documented by LGL in 2008 within the Hidden Valley area. We recommend that the NHR be revised to include an assessment of impacts on this species and its habitat. The need for additional surveys and additional protection measures should be discussed with MECP.	The Natural Heritage Report will be revised to address Jefferson salamander at Hidden Valley in greater detail. The Region of Waterloo commits to carry out further discussions with MECP and DFO during a future design stage to ensure compliance with applicable legislation.
11.	According to records available from eBird, there are records of Bank Swallow in the Hidden Valley area. The steep slopes along the Grand River represent potentially suitable nesting habitat for this species. We recommend that the NHR be revised to include an assessment of the impacts on this species and its habitat. The need for additional targeted surveys and protection measures should be discussed with MECP.	The presence of Bank Swallow in the Hidden Valley area will be confirmed during breeding bird surveys to be carried out during the 2020 nesting season.
ITEM	**CITY OF CAMBRIDGE COMMENTS (JANUARY 17, 2020)**	**PROPONENT/CONSULTANT RESPONSES**
1.	I've had a chance to review the report and have no major comments. I recognize this is still early stages and that a lot more work will be completed in future design phases (additional field work, permitting requirements, preparation of environmental management plans, etc.), which were clearly identified in the report.	Comment noted.
2.	I noticed a few grammatical things that I thought I would pass along. Page 21 – 5th paragraph – 3rd last line – "fow" should read "flow" Page 22 – 5th paragraph – 2nd line – close bracket Page 24 – 3rd paragraph – 2nd line – grammar error "Two and to" Page 58 – 1st paragraph – 2nd line – "strom" should read "storm"	Edits will be reflected in the final Natural Heritage Report.
ITEM	**CITY OF KITCHENER COMMENTS (JANUARY 28, 2020)**	**PROPONENT/CONSULTANT RESPONSES**
1.	Overall, the report provides a complete summary of the features/functions and species along the preferred route including anticipated impacts and mitigation.	Comment noted.

2.	As noted in the report much of the Stage 2 ION LRT will be constructed along roadways, railways and trail systems which have been disturbed in the past. But there are several areas that exist in a natural/semi-natural state that will require site-specific environmental management measures including Hidden Valley Wetland, Grandview Wetland and Speed River Wetland. Additionally, new water crossing will be needed including a new crossing over the Grand River and Speed River.	Comment noted.
3.	During future design phases when meetings with approval agencies such as the GRCA, MECP and DFO are needed, additional field investigations undertaken and detailed plans such as edge management, compensation/restoration, and monitoring developed it is requested that municipal environmental planning staff be involved.	The City of Kitchener will continue to be consulted during future design stages.
ITEM	**REGION OF WATERLOO COMMENTS (APRIL 14, 2020)**	**PROPONENT/CONSULTANT RESPONSES**
1.	Generally the Stage 2 ION LRT Natural Heritage Report for the Kitchener to Cambridge Transit Project Assessment Process prepared by LGL (December 2019), provides an appropriate assessment programme for Regionally-designated features within and adjacent to the proposed rail alignment, including the scope of work required to be undertaken at various stages through the associated permitting process.	Comment noted.
2.	The Stage 2 ION TPAP will include new light rail track, nine light rail stations, and associated amenities. Regionally-designated environmental features of note that are within or adjacent to the proposed alignment identified in the Natural Heritage Report include: • Significant Valleys • Core Environmental Features including: • Provincially Significant Wetlands (PSW's; Hidden Valley Wetland, Grandview Wetland, Speed Wetlands) • Environmentally Sensitive Policy Areas (ESPA's; #27 Hidden Valley, #37 Grandview Woods) • Significant Woodlands • Significant Habitat of Endangered or Threatened Species • Areas of Natural and Scientific Interest Much of the proposed alignment is within disturbed and/or developed areas which are not anticipated to have any direct environmental impacts to features designated by the Region. There will, however, be discrete areas that will require additional assessment and mitigation within the Stage 2 alignment, including river crossing/bridging areas, areas within PSW's, ESPA's, and areas adjacent to Habitat of Endangered or Threatened Species. Detailed design components are identified to include edge management, compensation/restoration, erosion sediment control, environmental inspection and monitoring plans.	Comment noted. The Region of Waterloo has committed to carry out these detailed studies during a future design stage.
3.	Additional clarification is the applicability of permits issued under the River Road extension EA to the Stage 2 ION TPAP specifically in the area of Hidden Valley where there was previously Jefferson Salamander habitat identified is requested. This information may be in	The Natural Heritage Report will be revised to address Jefferson Salamander at Hidden Valley in greater detail. The Region of

	the form of legislative reference or correspondence with the MECP to verify that the previous work and permits continue to apply to the current process. We understand that the work is within the limits of the right-of-way identified for the River Road extension, but would like verification that the additional use and the timing of the previous assessment does not impact the continued applicability of the River Road EA.	Waterloo commits to carry out further discussions with MECP and DFO during a future design stage to ensure compliance with applicable legislation.
4.	Please be advised that the proposed revision to the Hidden Valley ESPA based on River Road EA, is anticipated to be included in the Regional Official Plan (ROP) through the ongoing ROP Review process. If any modifications to the proposed ESPA boundary are anticipated to result from the current work, please contact the undersigned to discuss.	Comment noted.
5.	Any correspondence with MECP related to Species at Risk, within the Hidden Valley area and elsewhere along the alignment, should be provided as an appendix in future submissions.	Correspondence with MECP and other regulatory agencies will be included in the final Natural Heritage Report.
6.	All areas that are identified as Species at Risk habitat are considered to be a Core Environmental Feature through the ROP.	Comment noted.
7.	It is suggested that additional discussion be provided either in the current Natural Heritage Report, or a future report or appendix, that identifies how ROP policies of Chapter 7 (The Greenlands Network) are being addressed.	The Natural Heritage Report has been updated to address the ROP policies of Chapter 7 (The Greenlands Network).
8.	Site-specific, scoped Environmental Impact Statements, where required by the GRCA and/or Region, should be undertaken in accordance with the Region's Greenlands Network Implementation Guideline.	The Region of Waterloo commits to prepare a scoped EIS during a future design stage.
9.	In summary, we are of the opinion that the programme outlined in the Natural Heritage Report for the Kitchener to Cambridge Transit Project Assessment Process prepared by LGL (December 2019) is generally appropriate and identifies the appropriate studies and assessments to be undertaken through the future stages of the TPAP and design work.	Comment noted.