




ECOLOGICAL STUDY REPORT
LYONS CREEK EAST

Areas A, B, and C

City of Welland

28 November 2024

TERRASTORY
environmental consulting inc.

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1 INTRODUCTION

1.1 Study Background

Terrastory Environmental Consulting Inc. (hereinafter "Terrastory") was retained by the Niagara Peninsula Conservation Authority (NPCA) to prepare this Ecological Study Report (ESR) as a means to characterize baseline ecological conditions and natural heritage features within sections of Lyons Creek East (hereinafter "Study Area") affected by legacy sediment contamination. The Study Area centres on an approximately 2.2 kilometre (km) long stretch of Lyons Creek extending between the Welland By-pass (i.e., Welland Ship Canal) and Buchner Road within the City of Welland. Zones of sediment contamination have been classified as three discrete Sediment Management Areas (A, B, and C) with contamination severity being greatest upstream (Area A) and decreasing downstream (Areas B and C). The locations of the Study Area and associated Sediment Management Areas are shown in **Figure 1**.

The section of Lyons Creek investigated herein represents the upstream limit of the Lyons Creek East subwatershed, which covers approximately 4,507 hectares (ha) or 11,137 acres (ac) of land and extends downstream to its confluence with the Welland River near Chippawa (City of Niagara Falls). Lyons Creek is one of the largest tributaries of the Welland River and is also fed by Tee Creek (sometimes "Tea" Creek), itself having a watershed of 3,218 ha (7,952 ac). Tee Creek empties into Lyons Creek just east of the Queen Elizabeth Way (QEW) approximately 15 km (as the fish swims) downstream of the Study Area.

The local landscape surrounding the Study Area historically acted as an important corridor for the movement of goods between the United States and Upper Canada, particularly following construction of the First Welland Canal in the 1820s/1830s (Chapman and Putnam 1984). The overwhelmingly clay soils proved restrictive to agriculture, leading to an emphasis on livestock and a distinctly heterogenous pattern of land use (Chapman and Putnam 1984). While the prevailing historical context is subject to greater scrutiny later in this ESR (see **Section 3**), suffice it to say that construction of the Welland By-pass in the early 1970s markedly altered the Study Area and Lyons Creek itself by severing the upper watershed, necessitating permanent augmentation of flows from the canal to the creek via pumping. The adjacent tablelands above Lyons Creek abutting the Welland By-pass were extensively filled with spoils (dredgings). Presently, land cover within the Study Area is characterized by a matrix of regenerating natural areas, industrial lands, and low-density residential uses.

Flowing northeastward through the Study Area, Lyons Creek is set within a modest but distinguishable valleyland which serves to define the area of assessment. An assemblage of thicket swamp, shallow marshes with stands of cattail (*Typha* spp.) and Broad-fruited Burreed (*Sparganium eurycarpum*), submerged and fixed-floating aquatic communities, and open water typify the Study Area and comprise the Provincially Significant Lyons Creek Wetland Complex ("PSW"). These wetlands continue to support a variety of regionally, provincially, and nationally rare flora despite historical sediment contamination and 250 years of settlement and industrialization. Other vegetation types and habitats within the tablelands of the Study Area predominantly consist of successional communities (e.g., meadows, thickets), with smaller proportions of treed areas.

Polychlorinated biphenyl (PCB) sediment contamination in Lyons Creek was initially discovered in the early 1990s; the Study Area represents the last of 14 contaminated sites identified through the

Niagara River Remedial Action Plan (RAP) program. Possible sediment remediation options were studied extensively through the mid- and late-2000s, culminating in several technical reports produced by various government agencies and external partners. This includes the Lyons Creek East Wetland Inventory and Monitoring Study (Dougan & Associates 2007) which this ESR builds upon. There was optimism that Lyons Creek would recover through natural deposition of sediment load which would act to isolate, and form a cap over, the contaminated sediment. Unfortunately, sediment monitoring over time has revealed that natural recovery (i.e., burial of the contaminated sediments) is not sufficiently occurring within the Study Area, spurring interest in revisiting options for sediment management once more.

On account of the above, the objectives of this ESR are to:

- characterize and delineate the ecological conditions, natural heritage features, and significant habitats present within the Study Area;
- provide information about potential adverse ecological impacts associated with various possible Sediment Management Options (SMOs) under consideration (based on information available at this time); and
- outline relevant natural heritage legislation and regulatory requirements associated with sediment management (e.g., provincial *Endangered Species Act* and federal *Fisheries Act* and *Species at Risk Act*).

1.2 Study Area Delineation

The Study Area (wherein fieldwork and analysis are concentrated) is defined to include lands within 15 metres of the top of bank/slope of Lyons Creek where it passes through Sediment Management Areas A, B, and C. In establishing and refining the Study Area, Terrastory proceeded by:

- Mapping the approximate top of bank (and/or top of slope) associated with Lyons Creek as indicated by LiDAR contained in the 2013 Southwestern Ontario Orthophotography Project (SWOOP) Digital Terrain Model (DTM).
- Including all marshy areas along the margins of Lyons Creek as being topographically below the top of bank/slope, while excluding apparent areas of fill (i.e., which do not reflect a fluvial geomorphologic landform).
- Trimming the Study Area where lands within 15 m of the top of bank/slope overlapped with built structures and/or infrastructure (e.g., Highway 140 and associated road allowance).
- Extending the Study Area beyond the 15 m top of bank/slope to include contiguous physiographic features, including a remnant narrow valleyland on the south side of Lyons Creek (at 192 Ridge Road).

The Study Area (as defined above) is indicated on **Figure 1** and shown consistently on the figure package appended to this ESR.

2 APPROACH AND METHODS

2.1 Background Biophysical Information Assessment

This ESR is supported by background biophysical information and mapping acquired and reviewed from a variety of sources which are listed below in **Table 1**.

Table 1. Background Biophysical Information Acquired and Reviewed.

Type of Information Acquired	Description
Ortho-rectified Aerial Photographs	• 1934, 1948, 1954, 1965, 1968, 2000, 2002 to 2003, 2006, 2009, 2013, 2015 to 2023.
Pre-settlement and Early Settlement Biophysical Conditions	• Illustrated Historical Atlas of the Counties of Lincoln and Welland (Page 1876). • History of the County of Welland, Ontario: Its Past and Present (Langs et al. 1887). • The Province of Ontario – A History (Middleton and Landon 1927). • Crowland (Duff 1928). • Report on the Welland and Feeder Canals (McGeorge 1947). • Niagara's Changing Landscapes (H. Gayler 1994). • The Mighty Niagara: One River – Two Frontiers (Jackson 2003).
Natural Feature Mapping	• City of Welland Official Plan (November 2016) (Revised 20 June 2017) Schedules C (Core Natural Heritage System), C1 (Components of the Core Natural Heritage System), and C2 (Flood Hazards. • Regional Municipality of Niagara Official Plan (November 2022) Schedules C1 (Natural Environment System Overlay and Provincial Natural Heritage Systems), C2 (Natural Environment System - Individual Components and Features), and C3 (Key Hydrologic Areas Overlay). • Land Information Ontario (LIO) accessed via the "Make a Map: Natural Heritage Areas" web-based platform. • NPCA regulated areas, natural feature, and ELC mapping.
Physiographic Resource Mapping and Datasets	• Ontario Base Mapping produced by MNR (1:10,000) with 5 m contours. • Provincial Digital Terrain Model (LiDAR-derived). • Ontario Well Records (publicly-available). • Soils Survey Map of Welland County – Report No. 5 (Ontario Agricultural College 1935). • The Soils of the Regional Municipality of Niagara (Kingston and Presant 1989a). • Agricultural Information Atlas. • Bedrock Topography and Overburden Thickness Mapping (Gao et al. 2006). • Quaternary Geology and Industrial Minerals of the Niagara-Welland Area, Southern Ontario (Feenstra 1984). • Paleozoic Geology of Southern Ontario (Armstrong and Dodge 2007). • Surficial Geology of Southern Ontario (Ontario Geological Survey 2010). • Physiography of Southern Ontario (Chapman and Putnam 1984).
Ecological Resource Mapping and Datasets	• Natural Heritage Information Centre (NHIC) database accessed via the "Make a Map: Natural Heritage Areas" web-based platform. • Critical Habitat for SAR National Dataset. • iNaturalist "(NHIC) Rare species of Ontario" project.

Type of Information Acquired	Description
	• Ontario Breeding Bird Atlas (OBBA) database and the Atlas of the Breeding Birds of Ontario, 2001–2005 (Cadman et al. 2007), along with OBBA 3 (2021-2023) existing data from the Birds Canada-NatureCounts database. • eBird. • iNaturalist "Herps of Ontario" project and Ontario Reptile & Amphibian Atlas. • Ontario Butterfly Atlas database. • iNaturalist "Ontario Odonata" project. • Bumble Bee species distributions maps from iNaturalist and Bumble Bee Watch. • Aquatic Species at Risk Maps produced by Fisheries and Oceans Canada. • Atlas of the Mammals of Ontario (Dobbyn 2005). • MNRF Fish ON-line database maintained by MNRF. • Flowing Waters Information System (FWIS) Database.
Previous Studies of Lyons Creek East supporting the Remedial Action Program	• Lyons Creek East Wetland Inventory and Monitoring Study (Dougan & Associates 2007). • Biomonitoring Study of Lyons Creek East, Welland, Ontario (MOE 2005). • The Assessment of Sediment PCB Contamination and Biological Impacts in Lyons Creek East (Niagara River Area of Concern) (Environment Canada, n.d.). • Benthic Conditions in Lyons Creek East (Niagara River Area of Concern) 2002 – 2010 (Environment Canada 2014). • Lyons Creek East Long-term Monitoring Plan to Assess Monitored Natural Recovery as an Effective Remediation Strategy: 2015 Survey (MECP 2018). • Niagara River AOC Phase IV: Sediment Management Options for Lyon's Creek East and West (Golder Associates 2008).
Other Natural Heritage and Biophysical Studies	• NPCA Natural Areas Inventory Volumes 1 and 2, particularly Study Site WE-06 (Highway 140/Netherby Slough Forest) and WE-07 (Canal Lands) (NPCA 2010a, 2010b). • South Niagara Falls Watershed Report (NPCA 2008). • Wetland Evaluation Record for the Provincially Significant Lyons Creek Wetland Complex (MNR 2009). • Life Science Features of the Haldimand Clay Plain Physiographic Region (MacDonald 1980). • The Niagara River Mussel Biomonitoring Program (*Elliptio complanta*): An Update in Long-term Water Quality trends using Passive Samplers (2012-2018) (MECP 2022). • Niagara River Watershed Fish Community Assessment (1997 to 2011) (Yagi and Blott 2012). • Targeted sampling of fish species at risk in Lyons and Tea Creeks (Marson et al. 2009). • Freshwater Mussel Surveys of the Welland River watershed: 2014-16 (Wright et al. 2017). • An Environmental Evaluation of the Lower Welland River (MOEE 1993). • Biological Survey of the Welland River (MECP 2022). • A Preliminary Survey of the freshwater mussels of the Welland River watershed in 2008 (Morris et al. 2012).

2.2 Site Assessment and Surveys

The acquired background information per **Table 1** above helped direct an extensive, four-season fieldwork program carried out by Terrastory staff from July 2023 to July 2024. **Table 2** below indicates the primary assessments/surveys performed during each site visit, weather conditions, and time on-site. A total of twenty (20) separate site visits were undertaken.

Table 2. Site Assessments and Ecological Surveys performed within the Study Area.

Date of Site Assessment	Assessments/Surveys Performed	Terrastory Staff	Weather Conditions	Time On-site
27 July 2023	Site reconnaissance; summer terrestrial insect survey; summer vascular plant inventory; preliminary vegetation mapping (ELC); incidental wildlife observations.	T. Knight	Air temperature: 22 to 27°C; Beaufort Wind Scale 2; cloud cover 50 to 100%; short duration rainfall during the survey but otherwise dry.	9:40 to 16:05
17 August 2023	Early fall terrestrial insect survey; late summer vascular plant inventory; preliminary vegetation mapping (ELC); incidental wildlife observations.	T. Knight	Air temperature: 24 to 26°C; Beaufort Wind Scale 1; cloud cover 75 to 100%; no precipitation.	9:00 to 16:10
24 August 2023	Aquatic vegetation assessment; vegetation mapping (ELC); late summer vascular plant inventory; snake survey #1; incidental wildlife observations.	T. Knight, J. Consiglio	Air temperature: 19 to 26°C; Beaufort Wind Scale 1; cloud cover 75 to 100%; no precipitation.	8:25 to 15:15
22 September 2023	Aquatic vegetation assessment; vegetation mapping (ELC); fall vascular plant inventory; fall migratory bird survey; snake survey #2; incidental wildlife observations.	J. Consiglio, C. Wegenschimmel	Air temperature: 19 to 26°C; Beaufort Wind Scale 1; cloud cover 75 to 100%; no precipitation.	10:00 to 14:25
06 February 2024	Overwintering bird survey; incidental wildlife observations.	C. Wegenschimmel	Air temperature: 0 to 4°C; Beaufort Wind Scale 0; cloud cover 0%; no precipitation.	10:00 to 13:15
09 April 2024	Anuran calling survey #1; incidental wildlife observations.	T. Knight, J. Consiglio	Air temperature 9 to 16°C; Beaufort Wind Scale 0; cloud cover 0 to 25%; no precipitation.	20:20 to 22:15
16 April 2024	Migratory bird survey #1; snake survey #3, turtle survey #1; incidental wildlife observations.	T. Knight	Air temperature 16 to 18°C; Beaufort Wind Scale 0 to 2; cloud cover 0 to 25%; no precipitation.	11:00 to 14:30
26 April 2024	Migratory bird survey #2; snake survey #4; turtle survey #2; incidental wildlife observations.	T. Knight	Air temperature 10 to 17°C; Beaufort Wind Scale 0 to 2; cloud cover 0 to 25%; no precipitation.	09:28 to 13:30
07 May 2024	Migratory bird survey #2; snake survey #5, turtle survey #3; incidental wildlife observations.	C. Wegenschimmel	Air temperature 16 to 22°C; Beaufort Wind Scale 0 to 1; cloud cover 0%; no precipitation.	10:39 to 14:58

Date of Site Assessment	Assessments/Surveys Performed	Terrastory Staff	Weather Conditions	Time On-site
07 May 2024	Anuran calling survey #2; incidental wildlife observations.	J. Consiglio, C. Wegenschimmel	Air temperature 17 to 20°C; water temperature: 21°C; Beaufort Wind Scale 0; cloud cover 50 to 75%; intermittent light rain throughout survey.	20:55 to 22:50
16 May 2024	Migratory bird survey #3; snake survey #6; turtle survey #4; incidental wildlife observations.	C. Wegenschimmel	Air temperature 19 to 26°C; Beaufort Wind Scale 0 to 1; cloud cover 50 to 75%; no precipitation.	10:05 to 13:31
21 May 2024	Nightjar survey #1, incidental wildlife observations.	C. Wegenschimmel	Air temperature 18 to 20°C; Beaufort Wind Scale 0; cloud cover 0%; no precipitation.	20:30 to 21:47
05 June 2024	Breeding bird survey #1; Least Bittern and marsh bird survey #1; snake survey #7; turtle survey #5; incidental wildlife observations.	T. Knight, C. Wegenschimmel	Air temperature 18 to 24°C; Beaufort Wind Scale 0 to 2; cloud cover 0 to 75%%; no precipitation.	05:35 to 11:00
06 June 2024	Turtle nesting survey #1; anuran calling survey #3; incidental wildlife observations.	J. Consiglio, C. Wegenschimmel	Air temperature 18 to 21°C; Beaufort Wind Scale 0 to 1; cloud cover 25 to 75%; no precipitation.	19:49 to 23:10 Anuran surveys began at 21:33.
13 June 2024	Spring vascular plant inventory; snake survey #8; turtle survey #6; incidental wildlife observations.	J. Consiglio	Air temperature 26 to 30°C; Beaufort Wind Scale 2 to 3; cloud cover 0 to 25%; no precipitation.	10:40 to 14:35
21 June 2024	Nightjar survey #2; incidental wildlife observations.	C. Wegenschimmel	Air temperature 23 to 26°C; Beaufort Wind Scale 0 to 1; cloud cover 0 to 25%; no precipitation.	21:05 to 22:00
25 June 2024	Turtle nesting survey #2; incidental wildlife observations.	T. Knight	Air temperature 24°C; Beaufort Wind Scale 2 to 3; cloud cover 75 to 100%; no precipitation.	19:25 to 20:50
03 July 2024	Breeding bird survey #2; Least Bittern and marsh bird survey #2; snake survey #9; incidental wildlife observations.	T. Knight, C. Wegenschimmel	Air temperature 21 to 28°C; Beaufort Wind Scale 1 to 3; cloud cover 0 to 50%; no precipitation.	05:40 to 11:15
15 July 2024	Least Bittern survey #3; snake survey #10; vegetation community delineation (ELC); incidental wildlife observations.	J. Consiglio, C. Wegenschimmel	Air temperature 21 to 24°C; Beaufort Wind Scale 2; cloud cover 75 to 100%; no precipitation.	07:00 to 15:00
18 July 2024	Site walk with Geosyntec and project team; assessment of new property in which permission to enter was recently granted.	T. Knight	Air temperature 18 to 22°C; Beaufort Wind Scale 0 to 1; cloud cover 50 to 100%; no precipitation.	09:00 to 13:15

The site assessments and surveys centred on characterizing the land use (e.g., historical development patterns, existing built features, land maintenance), physiographic (e.g., topography, drainage, surface water features), and ecological (e.g., vegetation, wildlife, habitats) conditions and features of the Study Area. All land-use, physiographic, and ecological information described for Adjacent Lands was collected from either current aerial photographs or observations from inside the Study Area and/or publicly-accessible areas (e.g., rights-of-way, etc.). The locations and boundaries of significant natural features and/or habitats were recorded on-site with a high-accuracy GPS supported by representative photographs.

In addition to collecting general biophysical information, the following targeted assessments (i.e., feature- or species-specific surveys) were undertaken:

- **Vegetation Mapping according to Ecological Land Classification (ELC):** Vegetation communities on the Study Area were characterized and mapped according to Ecological Land Classification (Lee et al. 1998) and the 2008 update to the Vegetation Type List (Lee 2008). Vegetation communities were initially identified based on current aerial photographs and then verified and refined (as necessary) on-site. ELC mapping was scaled to the finest level of resolution deemed appropriate (i.e., either Ecosite or Vegetation Type).
- **Wetland Boundaries:** Where wetlands were identified via ELC, their boundaries were delineated consistent with the "50% wetland vegetation rule" and presence of hydric soils per the procedures of the Ontario Wetland Evaluation System (OWES) (OMNRF 2014).
- **Vascular Plant Survey:** Vascular plants were recorded based on a comprehensive area search ("wandering transects") within naturally-occurring (i.e., non-planted) or naturalizing areas of vegetation. Aquatic vascular plants were recorded from a watercraft (i.e., canoe) based on a comprehensive area search where feasible. Particular effort was paid to areas with the greatest potential to support significant vascular plants (i.e., designated Species at Risk, Provincially Rare, etc.) and areas with the greatest potential for impact based on the proposed management options. Nomenclature and common names for the recorded vascular plant species are generally consistent with the Southern Ontario Vascular Plant Species List (Bradley 2013) except where a name change has more recently been adopted by NHIC.
- **Anuran Calling Surveys according to the Marsh Monitoring Protocol:** Three rounds of Anuran calling surveys were conducted in accordance with the Marsh Monitoring Protocol (Bird Studies Canada et al. 2008). Surveys occurred within the appropriate season (April to June), time of day (between 30 minutes after sunset and 12:00am), and weather conditions (minimal to no rain, wind speed ≤3 on the Beaufort Wind Scale).
- **Breeding Bird Surveys according to the Ontario Breeding Bird Atlas Protocol:** Two rounds of breeding bird surveys were conducted in accordance with the Ontario Breeding Bird Atlas (OBBA) protocol (Bird Studies Canada et al. 2001). Surveys occurred within the appropriate season (May 24 to July 10), time of day (between dawn and approximately 5 hours after dawn), and weather conditions (no rain, wind speed ≤3 on the Beaufort Wind Scale). While the OBBA protocol recommends that stations be situated at least 300 m apart (to avoid double counting), the stations established herein were often closer together to ensure more comprehensive survey coverage. Surveys occurred for a minimum duration of 10 minutes at each station. Species were also recorded during comprehensive area searches ("wandering transects") that were completed while traveling between each station. Both rounds of breeding bird surveys were completed via canoe.

- **Marsh Bird Surveys according to the Marsh Monitoring Protocol:** Two (2) rounds of tape playback surveys were conducted in accordance with the Marsh Monitoring Protocol (Bird Studies Canada 2008). Surveys occurred within the appropriate season (May 20 to July 5), time of day (between dawn and no later than 10:00), and weather conditions (no rain, wind speed ≤3 on the Beaufort Wind Scale). Each survey lasts fifteen (15) minutes and consists of five (5) minutes of passive listening, five (5) minutes of broadcasted calls for Least Bittern (*Ixobrychus exilis*), Sora (*Porzana carolina*), Virginia Rail (*Rallus limicola*), Common Gallinule (*Gallinula galeata*)/American Coot (*Fulica americana*), and Pied-billed Grebe (*Podilymbus podiceps*). The broadcasted calls are followed by a second five (5) minutes of passive listening. Marsh bird vocalizations were broadcast via Bluetooth speaker (iHome). A third round of surveys were undertaken on 15 July 2024 targeting Least Bittern as is recommended by the National Least Bittern Survey Protocol (Jobin et al. 2011).
- **Nightjar Surveys according to the Survey Protocol for Eastern Whip-poor-will (*Caprimulgus vociferous*) and Common Nighthawk (*Chordeiles minor*):** this survey protocol (MNR 2016) could be considered superior to other provincial (e.g.,Hannah 2021) and federal (e.g., Bird Studies Canada 2018) nightjar survey protocols where confirmation of presence/absence is critical as it mandates the completion of two (rather than one) evening surveys and recommends that the surveys be spread across lunar cycles. Surveys are completed 30 minutes after sunset until moonset during periods when the moon is at least 90% illuminated. Each station was surveyed for at least three minutes and only under appropriate weather conditions (i.e., temperature >10°C, no precipitation, little to no cloud cover, wind speed ≤3 on the Beaufort wind scale, visible moon). Note that the lunar calendar for 2024 indicates full moons on May 23 and June 21; surveys are best undertaken within a seven-day evening period in which the full moon occurs on the third or fourth evening.
- **Overwintering Bird Survey**: An overwintering bird survey was conducted at seven (7) stations (B-1 to B-7) on 06 February 2024.
- **Turtle Visual Encounter Surveys according to the MNRF Survey Protocol for Blanding's Turtle:** Five visual encounter surveys were undertaken in accordance with the Survey Protocol for Blanding's Turtle (*Emydoidea blandingii*) in Ontario (MNRF 2015b). Five surveys were spread out over a minimum three-week period between ice-out (April) and June 15 under appropriate weather conditions (e.g., air temperatures ≥5°C when sunny or ≥15°C when overcast, no rain) between 8:00 and 17:00. Where possible, surveys were timed to target warm days following cool or inclement weather (conditions which promote turtle basking). Vegetation communities and surface water features with a potential to function as turtle habitat (particularly for overwintering, basking, and feeding) were surveyed.
- **Snake Visual Encounter and Active Hand Surveys according to the MNRF Survey Protocol for Species at Risk Snakes:** Ten (10) visual encounter and active hand searches for snakes occurred in accordance with the MNRF Survey Protocol for Species at Risk Snakes (MNRF 2016). Surveys occurred within the appropriate season (April 1-October 15), time of day, and weather conditions (air temperature between 8ºC and 25ºC when sunny, >15 ºC when overcast, no rain, wind speed ≤3 on the Beaufort Wind Scale). Two surveys were scheduled early in the season (i.e., April) with the intent of detecting recent snake emergence from hibernacula. Where present, cover objects (e.g., rocks, debris, etc.) were overturned to detect individuals beneath.
- **Odonate and Butterfly Surveys:** Surveys targeting odonates and butterflies were undertaken using a wandering transect/area search methodology paired with canoe-based transect surveys. Surveys were conducted within areas of suitable habitat for target taxa (i.e., odonates and lepidopterans) on multiple occasions across the active season.

3 HISTORICAL CONTEXT

A broad array of historical maps and aerial photographs are available for Niagara Region which are useful in revealing landscape condition and patterning which was present during early settlement, in part a testament to the economic and strategic importance of both the Welland Canal and Niagara River. Many of these maps and airphotos have been graciously digitized and made available to the public (including in a georeferenced format) by scholars at Brock University. Upon review of this mapping chronology, widespread changes to the Lyons Creek East Study Area (and indeed the creek itself) become evident. To adequately trace the evolution of Lyons Creek over the past 250 years also demands allocating equal attention to the treatment of Wainfleet Bog, construction of the Welland Canal, and overall industrialization of southern Niagara.

The transformation of Lyons Creek and surrounding countryside is explored in the sections that follow. A series of historical maps are presented at the culmination of this section to assist the reader with interpreting the text herein.

3.1 Between the Lakes Treaty No. 3

The Lyons Creek East Study Area is situated on Treaty land with a rich and varied cultural history, both known and unreported.

The lands and waters forming a peninsular link between southwestern Lake Ontario and northeastern Lake Erie (i.e., Niagara), further bordered on the east by a mighty river (i.e., Niagara River), represent the traditional territories of several First Nations. This includes (amongst others) the Attawandaron (Neutrals), Haudenosaunee (Six Nations Confederacy), and Anishinaabe (including the Mississauga) peoples. Indigenous villages appear widespread across Niagara Region around initial contact (i.e., early 1600s) based on the writings of Recollet missionary Joseph de La Roche Daillon, who spent three months amongst the Neutral Nation over the fall and winter of 1626/1627 (Niagara Region 2023). Centred further east among the finger lakes of upstate New York, the Haudenosaunee were also known to have gathered food and hunted in Niagara at least seasonally (Hill 2017). The Mississaugas are said to have been the primary Indigenous people occurring in Niagara from the late-1600s to 1763, when the colony of New France was transferred to Great Britain via the Treaty of Paris.

The Royal Proclamation of 1763 established First Nations rights and title to lands and ushered in the era of Treaty-making. Much of Niagara forms part of Treaty #3 (i.e., "Between the Lakes Purchase") signed by Sir Frederick Haldimand (Governor of Quebec) and the Mississaugas in 1784. Treaty #3 totaled over one million acres and stretched from the north shore of Lake Erie in Norfolk County to what would become the City of Guelph. The entire Niagara peninsula was included with the exception of lands abutting the Niagara River, which were subject to an earlier Treaty with the Mississaugas signed in 1781. When the agreed-upon northern limit of Treaty #3 was deemed incorrect, the Treaty area was clarified in 1792 and signed by Lieutenant Governor Sir John Graves Simcoe on behalf of the British Crown and Mississaugas as represented by Chiefs and Principal Women.

3.2 Initial Settlement of Crowland Township

The Lyons Creek East Study Area is contained within the historical Geographic Township of Crowland (see **Figure 2**), which was originally conceived by proclamation of Governor Simcoe on 16 July 1792. Before then, Crowland was referred to as "Township No. 2 above Chippeway"

(Chippawa) in the Township papers ("Crowland Township Papers" n.d.) for the purposes of issuing land grants. Reference to the Township being "above" Chippawa (which grew up at the southern end of the portage around Niagara Falls) reflects an upstream (rather than northward) orientation. Crowland was bounded by the Townships of Willoughby (east), Humberstone (south), and Wainfleet (west), which have been variously lopped and split amongst the municipalities of Niagara Falls, Fort Erie, Port Colborne, and Welland (see **Figure 2**). Crowland was an "interior" township (i.e., lacked frontage on the Niagara River, Lake Ontario, and Lake Erie) and thus settlement commenced slightly later than some neighbouring townships.

Governor Simcoe named Crowland after a town of the same name in Lincolnshire, England (Middleton and Landon 1927) and similarly drew upon Lincolnshire as inspiration for multiple township names in Niagara (e.g., Caistor, Grantham Stamford, Willoughby) and Hamilton (e.g., Ancaster, Binbrook). Governor Simcoe also reassigned the name "Welland River" to Chippawa Creek in homage to a river of the same name which similarly skirted the northern margins of Crowland, England (Duff 1928). Despite this, references to "Chippawa Creek" remained commonplace (at least in written form) for many decades thereafter.

The Crowland township papers suggest that the first settlers arrived in the late 1780s ("Crowland Township Papers" n.d.) to commence the making of homesteads, including Peter and Henry Buchner (to which "Buchner Road" derives), William Cook ("Cook's Mills"), John Yokom ("Yokom Road"), and various members of the Doan family ("Doan's Ridge Road") (Page 1876; Langs et al. 1887). Other authors (e.g., Langs et al. 1887) have suggested that the earliest settlers actually arrived in 1770s. Many were United Empire Loyalists (Mika and Mika 1977).

Benjamin Lyons petitioned for two hundred acres of land in Township No. 2 above Chippewa ("Crowland Township Papers" n.d.); the land patent was granted covering all of Lots 1 and 2, Concession 3 in Crowland Township on 24 May 1798 ("Crowland Settlers 'L'" n.d.). We hazard to assume Lyons Creek is so named for Benjamin but no documentation asserting as such was found during research in support of this ESR. Benjamin Lyons is also said to have founded the settlement of Lyons Creek (more frequently known as White Pigeon) (Niagara Region 2021). Unimproved land could apparently be purchased at that time for "eighteen pence per acre" (Page 1876). Settlers that took up land prior to the formal Township survey would have possessed unclear title (at best), particularly in light of the Royal Proclamation which forbade settlement in the "hunting grounds" reserved for First Nations use (Hill 2017).

Crowland remained administratively part of Willoughby Township until 17 March 1803 when the first official meeting was held (Siebert 1915). The population at that time was 216 (Langs et al. 1887), increasing to about 600 by 1817, with one sawmill and one grist mill constructed at Cook's Mills less than 2 km downstream of the Study Area (Page 1876; Langs et al. 1887). Land values in the early 1800s had increased about ten times to twenty shillings per acre (Page 1876).

The many challenges of settlement in Crowland Township are encapsulated by the following passage (Langs et al. 1887, p. 2):

> *Even when the crop of grain had been raised by hard labor upon the partially cleared land the difficulty yet to be overcome before it was ready for culinary purposes would be considered by the young men of to-day insurmountable. After the building of the mill at the Falls* [Niagara Falls] *and the one in the Short Hills known as Beckett's the grain could be taken to one of those places and there converted into*

> *flour. The means of getting it there were to cross the Chippawa* [Welland River] *by means of rafts or canoes and carry the bag on the back through the woods those long weary miles, or to take it on horseback. In going to Street's mill at the Falls* [Niagara Falls]*, the usual way for the Crowland pioneer was to take his "grist" down the Chippawa* [Welland River] *in a boat; the latter he would leave opposite the mill and carry the grain the rest of the way on his back. By this route, the grain only had to be carried three miles, providing the owner was fortunate to live along the bank of the river. If he were one of the inland residents of the township he would, of course, have to get his "grist" from his home to the River and back again, in addition to his walk from the mouth of the Chippawa* [Welland River] *to the mill. Great as were the difficulties after the building of the two mills above mentioned, still greater were those of the few people who settled in the township before any mills existed in the county. Then the grain was got ready for baking purposes by hollowing out the end of a log, and pounding it in the cavity thus formed until it was reduced to a meal, out of which bread could be made.*

Like the Welland River, Lyons Creek was of great importance for the movement of goods and timber between homesteads in the Niagara interior and various mills and locations of export (Foley 1990, 1992).

3.3 Pre-settlement Vegetation, Topography, and Drainage

Depictions of the historical landscape assembled from original survey descriptions, hand-drawn maps, and related documentation can be telling and instructive, but also piecemeal and vague. Some effort is expended here to reveal what the ecological conditions of the Lyons Creek East Study Area and broader landscape may have looked like around the commencement of settlement.

Several researchers have painstakingly transcribed the dominant tree species encountered by surveyors along lot and concession boundaries throughout southern Ontario, and much of this information can be called upon for review as digital mapping products. Unfortunately, vegetation descriptions as transcribed by surveyors are unavailable for much of southern Niagara, including the Lyons Creek East Study Area. It has been suggested that this reflects the early settlement date of this region, whereas areas settled just a few years later possess a more fulsome record of surveyor notations (Moss 1994).

Thankfully, a remarkably detailed description of the "timber" resources of Crowland Township was provided by several town inhabitants (including Calvin Cook and Samuel and Richard Yokom) via letter dated 1817 upon the request of Sir Robert Gourlay to support his lofty *Statistical Account of Upper Canada*. They write (Gourlay 1822 p. 446):

> *The ground in its uncultivated state is timbered with white oak, swamp white oak, Spanish or red oak, sugar and red maple, bass or linden, beech, hickory, and iron wood, and in some places, heavy growths of white pine; in others, a species of sycamore, some butternut, black walnut, elm, and black and white ash.*

References to "Red Maple" probably reflect Freeman's Maple (*Acer* × *freemanii*) – a natural hybrid of Silver Maple (*Acer saccharinum*) and Red Maple – which occupies sloughs and wet forests across Niagara (whereas Red Maple *sensu stricto* is more often associated with sandy sites such as on the Fonthill Kame and Lake Erie/Lane Ontario shorelands). "[B]ass or linden" is assuredly American Basswood (*Tilia americana*) whereas "Spanish Oak" was probably Swamp Pin Oak (*Quercus palustris*), though the wording is ambiguous as to whether both Swamp Pin Oak and Red Oak (*Quercus rubra*)

were each encountered regularly. The possibility of Sycamore (*Platanus occidentalis*) being prevalent (at least in certain areas) is also of interest, as this species tends to be rare on the Haldimand Clay Plain (seeming to prefer sandy floodplains and riparian areas) though it is highly distinctive and not easily forgotten. "Lordly pines and giant oaks" (Langs et al. 1887 p. 390) are said to have been felled along the banks of the Welland River.

By the late 1800s, Crowland Township is said to have had at least 6,070 ha (15,000 ac) under cultivation with a further 1,619 ha (4,000 ac) of woodland being "distributed evenly over the whole of the township" (Langs et al. 1887, p. 239). Assuming that these numbers are reliable, about 75 to 80% of the original woodland must have been cleared for cultivation and settlement in only a century. An earlier 1862 map covering the "Niagara Frontier" and Welland Canal suggests that Crowland Township may have had upwards of about 50% woodland cover (see **Historical Map 1**) or double what was reported 25 years later by Langs et al. (1887), portraying the mid- to late-1880's as a period of rapid agricultural advancement. Tablelands bordering Lyons Creek are shown to have been generally devoid of woodland by that time.

Descriptions of Crowland Township as "rolling" can be found in several early treatments (Page 1876; Middleton and Landon 1927 p. 1232). The former township is in fact very flat with the exception of a few localized, sandy knolls (such as Doan's Ridge, approximately 2 km southeast of the Study Area) which trend in a northwest/southeast direction and stand above the broader clay plain, reflecting deposition of the Fort Erie Moraine (Feenstra 1984). The absence of a discernible topographic gradient impeded efforts to construct water-powered mills for fear of inundating great expanses of land with standing water (Langs et al. 1887). This gentle gradient has given rise to several unfortunate and pejorative descriptions of Lyons Creek as a "sluggish stream of brackish water" (Middleton and Landon 1927 p. 448) and having a "dull, sluggish current" (Langs et al. 1887 p. 381). Similar verbiage has been applied to the Welland River, which Elizabeth Simcoe described on 30 June 1792 as a "dull, muddy river running through a flat, swampy country" (Robertson 2001 p. 128). The following description of the Welland River from Gourlay's *Statistical Account* is illustrative (Gourlay 1822 p. 64):

> *The Chippawa* [Welland River] *having passed over a plain of 40 miles, and through a number of swamps and strata of discolouring earth, is a sluggish, dark water, not very fit for culinary uses, or even for washing, and as it meets the clear rapid stream of the Niagara, instead of intermixing with it, it pushes along near the shore, and forms a very visible contrast.*

It is probable that Lyons Creek also exhibited a dark, opaque colouration which is imparted by dissolved organic carbon (DOC), a by-product of arising from organic/peat deposits in Wainfleet Bog. The Biederman Drain (one of many drainage "improvements" to Wainfleet Bog) takes on a similar appearance today and follows a course quite similar to (though slightly south of) the historical upper reaches of Lyons Creek (see **Section 3.4**). One wonders whether the name Tee/"Tea" Creek (which emerged in the peatlands of Humberstone Marsh) was also assigned by early settlers in reference to its high concentration of DOC. The "sluggishness" of both Lyons Creek and the Welland River attested to by so many early observers reflects ongoing isostatic rebound (see **Section 4.2.3**).

3.4 Hydrological Changes to Lyons Creek

Interest in transforming the hydrologic capacity of Lyons Creek to promote transportation has been contemplated as far back as settlement extends, evidenced by the treatment of Willoughby

Township by settlers Thomas and James Cummings in Gourlay's *Statistical Account* (Gourlay 1822 p. 415):

> *Much might be done in the improvement of this township and the adjoining townships of Crowland and Wainfleet, by bringing the water of lake Erie into Lyons* [C]*reek, which empties into the Chippawa* [R]*iver, about a mile from the mouth, the distance from the head of Lyons* [C]*reek not being more than a mile from lake Erie, in digging which, eight feet would be the deepest to about three feet at the least; the soil of which, part sand and part clay; this improvement has been talked of, but from the want of means and inhabitants, has never been attempted.*

Settlers in Humberstone Township wrote similarly (Gourlay 1822 p. 408-409):

> *The roads are not good, but could be much improved. Water conveyances is by* [L]*ake Erie; and a canal could be very easily cut from this to Lyons'* [C]*reek, to communicate with Chippawa*.

It is well known that the headwaters of Lyons Creek originally emerged from peatlands on the eastern margins of Wainfleet Bog. The bog was naturally drained to the north by "Beaver Creek" (McGeorge 1947) whereas drainage southward was impeded by the Onondaga Escarpment, which (like the Niagara Escarpment) was formed by differential erosion, being capped by younger and more erosion-resistant limestones of the Bois Blanc Formation which overly older and softer shales of the Salina Formation. The original eastern margin of Wainfleet Bog is not well known as drainage efforts and other landform manipulations commenced soon after settlement. Much of this area has also been filled by spoils from various iterations of the Welland Canal and to support industrial development. Still, delimiting the uppermost, headwater extent of Lyons Creek requires ascertaining the eastern limits of Wainfleet Bog.

The entire alignment of the First Welland Canal is depicted with topographic and other notations on the 1837 "Baird and Killaly" maps, produced less than a decade following construction of the section between the Feeder Canal (north) and Port Colborne ("Gravelly Bay"). Baird and Killaly show the canal extending through a "Cranberry Marsh", which was the usual signifier for Wainfleet Bog in the first half of the 19th century. This suggests that the First Welland Canal was cut through the eastern limit of the bog itself (see **Historical Map 2**). There is no culvert indicated by Baird and Killaly which would assist with ascertaining the precise crossing of Lyons Creek, at least within some margin of error.

The original survey of Humberstone Township from 1811 shows "the Great Cranberry Swamp" (Wainfleet Bog) extending from at least Lot 23 (possibly including Lot 22) to Lot 27 across the southern half of Concession 4, which generally corroborates the 1837 Baird and Killaly map (see **Historical Map 3**). If in fact Wainfleet Bog extended eastward to Lot 23 (or possibly Lot 22), this suggests the eastern extremity would be reflected by Snider Road (or thereabouts) today, which is a great deal eastward (~3 km) of its current eastern limit around Highway 58. Even if the Humberstone Survey Map of 1811 was generous in its depiction of the bog area (which is likely the case), it is unquestioned that the bog extended meaningfully further eastward than it does currently. Like the Baird and Killaly map of 1837, Lyons Creek is not shown on the original Humberstone Township survey either.

Two maps from the second half of the 19th century reveal the original headwaters of Lyons Creek with greater certainty. Tremaine's *Map of the Counties of Lincoln and Welland, Canada West* from 1862

depicts Lyons Creek emerging in the "Great Cranberry Marsh" within the southern half of Concession 4, Lot 29, in the Township of Humberstone, mistakenly referencing "Lyon" Creek (see **Historical Map 4**). The *Illustrated Historical Atlas of Lincoln and Welland Counties* (Page 1876) similarly shows the same commencement point (see **Historical Map 5**). Both of these maps depict Lyons Creek being conveyed through the Welland Canal (which at that time was the Second Welland Canal), suggesting that a culvert was in place.

Such a culvert conveying Lyons Creek beneath the Second Welland Canal is depicted in Book Three (Port Robinson to Port Colborne) by the Welland Canal Company, which contained a series of maps dating to around 1845 to 1860 (see **Historical Map 6**). Several "back ditch" lines are shown on either side of the canal along with a "spoil bank". The Lyons Creek culvert beneath the Second Welland Canal (which was simply an enlarged version of the First Welland Canal at this location) was designed as an inverted syphon (forcing Lyons Creek to flow below the invert of the canal under pressure) and was made of block stone masonry, extending 8 feet wide and plunging 40 feet below the adjacent towing path (Langs et al. 1887).

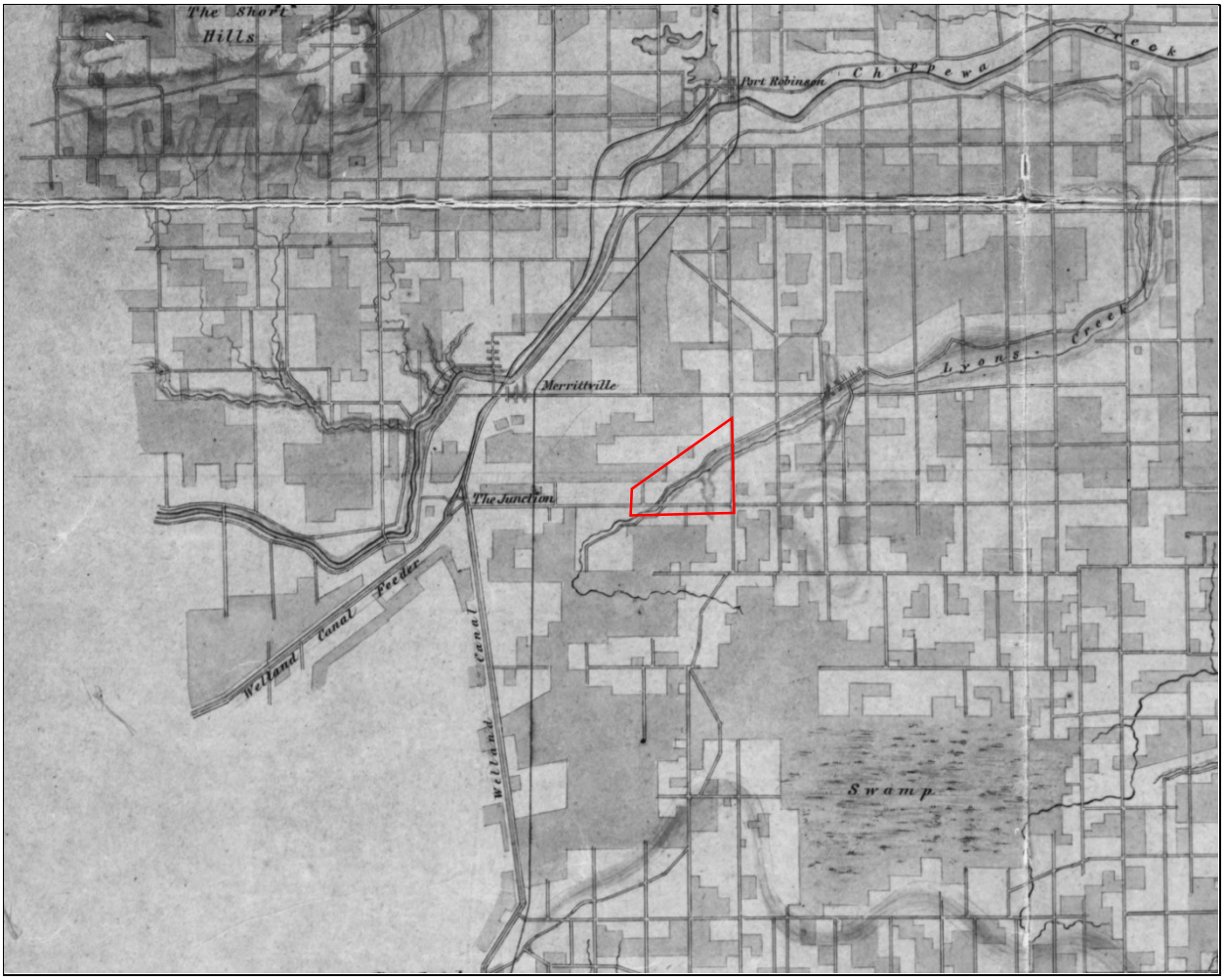
A culvert is also shown pursuant to a 1916 map (see **Historical Map 7**), around the time the Fourth Welland Canal was under construction. Excavation of the Fourth Welland Canal involved the placement of extensive spoils ("canal dump" as depicted on historical soils maps; Ontario Agricultural College 1935) in an area that would later become Mud Lake Conservation Area, which also overlapped with the original alignment of Lyons Creek. It can be expected that construction of the Fourth Welland Canal severed the uppermost watershed to the west, with any surface water being conveyed to Lyons Creek through constructed ditches. As the Fourth Welland Canal was lowered in elevation by several feet, this allowed Lyons Creek to outlet directly into the Welland Canal, with the culvert said to have been "abandoned" by or before 1940's (McGeorge 1947).

Further hydrological modifications to Lyons Creek came with the construction of the Welland By-pass (Welland Ship Canal) completed in 1973, which further severed the upper (Lyons Creek West) and lower (Lyons Creek East) watersheds. A 1971 aerial photograph shows a realigned Lyons Creek flowing through a constructed channel; thus, it was either 1972 or 1973 when the upper watershed was initially truncated. From then on, Lyons Creek West emptied directly into the Welland By-pass whereas flows within Lyons Creek East were augmented by pumping water from the by-pass directly into the channel, a practice that continues to this day.

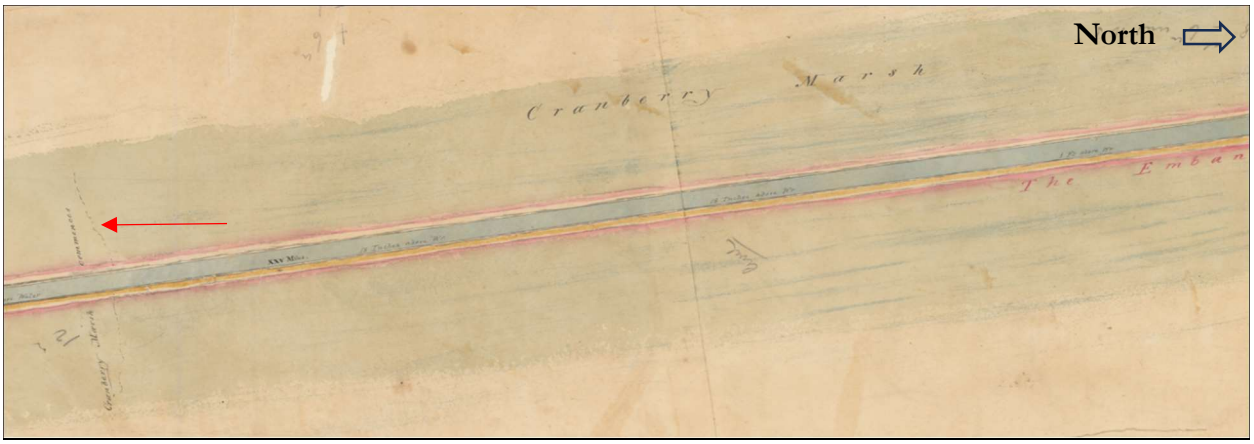
By this time, impairment of Lyons Creek was well known. A provincial report from the mid-1960s describes Lyons Creek as "grossly polluted in and below Welland" (Ontario Water Resources Commission 1964 p. 4). Fish kills occurred every few years through the 1970s and 1980s as a result of suspected chemical spills, at which time the water would sometimes turn pink (R. Brown pers. comm. 2024). Settling ponds near the banks of Lyons Creek (immediately southeast of the Ridge Road bridge) associated with the Welland Tubes Limited factory (later becoming Stelpipe) on Rusholme Avenue (formerly Little Road) would occasionally overflow into Lyons Creek (R. Brown pers. comm. 2024), offering one plausible source of chemical and sediment contamination. Contamination of the former channel of Lyons Creek West (north of Humberstone Road) by PCBs and metals is also known (Dillon Consulting Limited 2007), suggesting other possible industrial sources of sediment contamination further upstream in Welland. As early as the 1960s/1970s, locals knew not to swim in, or consume fish from, Lyons Creek (R. Brown pers. comm. 2024).

In 1992, drainage ditches which continued to flow through the relict channel of Lyons Creek West were re-routed by the City of Welland (Dillon Consulting Limited 2007). What remains of the Lyons Creek West subwatershed is restricted to lands north of Humberstone Road, with flows conveyed directly into the Welland By-pass east of Robert Street. Portions of the former channel through Dain City now flow southwestward (opposite to the historical flow direction) and outlet into what has become the Welland Recreational Waterway.

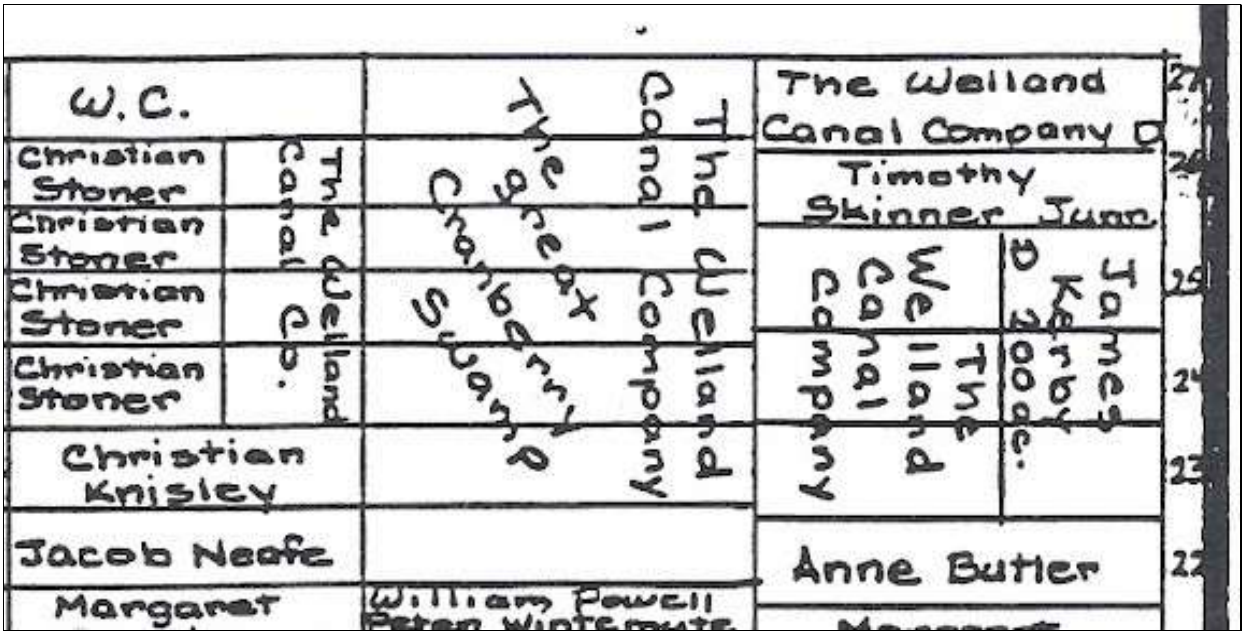
The approximate original alignment of Lyons Creek and eastern extent of Wainfleet Bog are shown in **Figure 3**.



Historical Map 1. Entitled "Plan No. 8: The Niagara Frontier and Welland Canal" and dated 1862 by Captain Stotherd and Lieutenant Price. The Study Area is outlined in red and can be inferred by the location of Ridge Road (extending westward to "The Junction"). Note that the alignment of Lyons Creek does not perfectly match its true orientation, likely owing to the immense complexity of field verifying and hand drawing maps at a regional scale in the mid-1800s without the aid of motorized vehicles, aerial photographs, or GPS equipment.

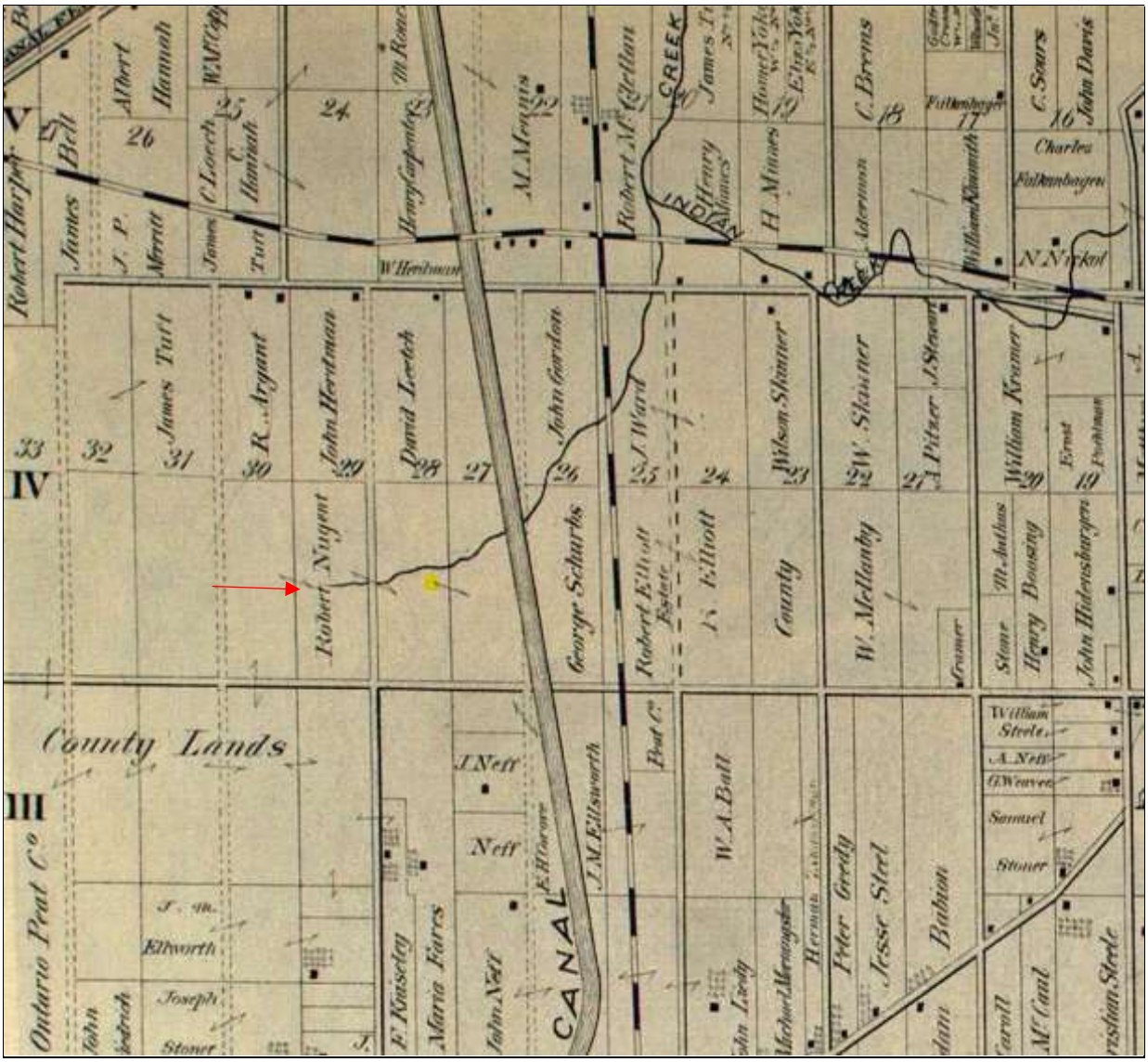


Historical Map 2. Baird and Killaly (1837) map of the First Welland Canal. The southern margin of the "Great Cranberry Marsh" (Wainfleet Bog) through which the First Welland Canal was excavated is emphasized (see red arrow).

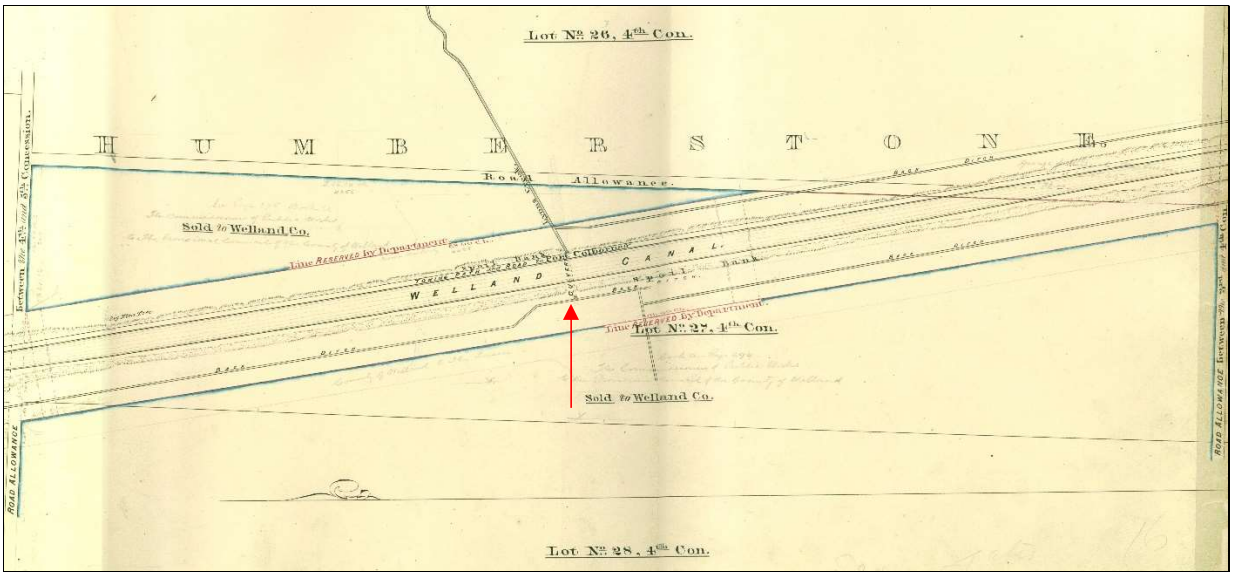


Historical Map 3. Humberstone Survey of 1811 showing the eastern extent Wainfleet Bog extending to at least Lot 23 in Concession 4.

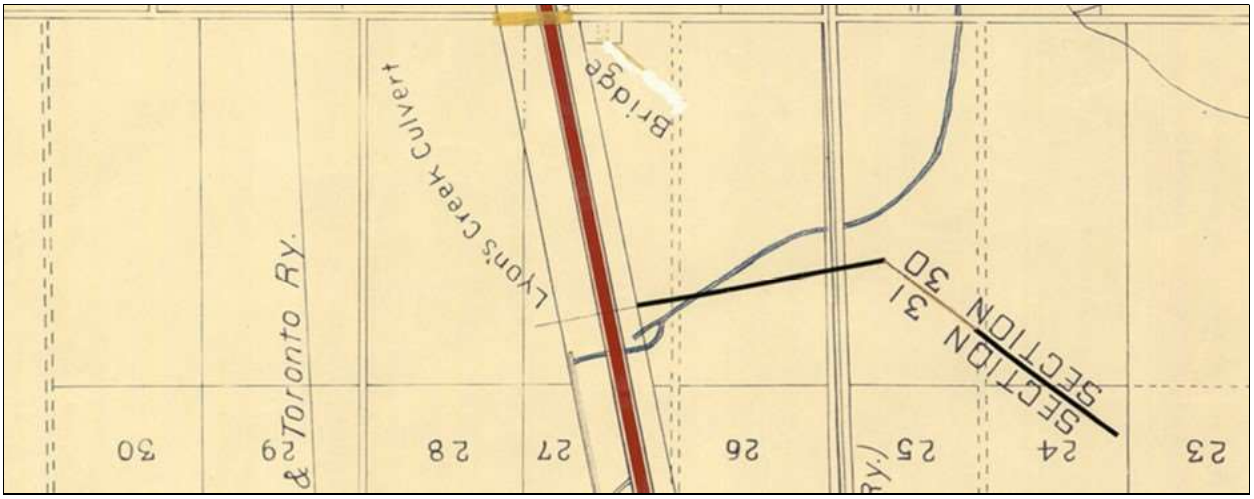
Historical Map 4. Headwaters of Lyons Creek within Concession 4, Lot 29 in Humberstone Township (see red arrow) per Tremaine (1862). Wainfleet Bog is shown as "Great Cranberry Marsh". The Lyons Creek East Study Area is also highlighted (see red polygon).



Historical Map 5. Headwaters of Lyons Creek on Concession 4, Lot 29 in Humberstone Township (see red arrow) per Page (1876). Wainfleet Bog is shown as "County Lands".



Historical Map 6. Survey Map (likely dating around 1845 to 1860) of the Second Welland Canal indicating the presence of a culvert (see red arrow) conveying Lyons Creek.



Historical Map 7. 1916 map of what would be the Third Welland Canal indicating the presence of a culvert at Lyons Creek.

4 EXISTING BIOPHYSICAL CONDITIONS

The following is a description of the biophysical features and conditions of the Lyons Creek East Study Area. Representative photographs are provided in **Appendix 1**. Mapping which presents physiographic conditions (**Figure 4**), fish and wildlife survey stations (see **Figure 5**), and biophysical features and conditions (see **Figure 6** and **Figure 7**) within the Study Area are also appended.

4.1 Land-use and Landscape Setting

The Study Area (as defined in **Section 1.2**) totals 20.37 ha (50.34 ac) in size, with 16.41 ha (40.55 ac) occurring upstream (west) of Highway 140 and the remaining 3.96 ha (9.79 ac) occurring between Highway 140 and Buchner Road. Whereas the Study Area occurs within the designated "Urban Area" of Welland pursuant to Schedule A (City Structure) of the City's Official Plan (OP), lands occurring east of the Welland By-pass possess a more rural character with a mixture of industrial and agricultural uses punctuated by wooded and swampy areas. The Welland By-pass acts as a physical barrier to the movement of people and goods for residents residing to the east, who generally access Welland via either the Main Street tunnel (to the north) or Townline tunnel (to the south).

Many of the parcels with frontage on Ridge Road and Buchner Road overlapping with the Study Area are zoned for industrial uses per the City of Welland's Comprehensive Zoning By-law 2017-117. West of Highway 140 many parcels contain residential uses, whereas there is a mixture of residential and warehouse/storage buildings east of Highway 140. Lyons Creek and associated wetlands and natural hazards form part of an Environmental Protection Area overlay.

The Study Area is also zoned as an Environmental Control Area owing to historical sediment contamination. Any development or site alteration in the Lyons Creek East Environmental Control Area is subject to the policies of Section 6.7.5 under the City of Welland's OP. Such activities cannot pose an impact on the existing contaminated sediments, particularly through stormwater flows/runoff, construction, and/or maintenance and operations.

The Lyons Creek East Study Area has undergone substantial transformations over the past few centuries of settlement (see **Section 3**). Perhaps the greatest changes were associated with construction of the Welland By-pass in the early 1970s, which resulted in:

- severance of the upper watershed (i.e., west of the Welland By-pass) from the lower watershed, becoming Lyons Creek West and Lyons Creek East, respectively;
- regular augmentation of flows from the Welland By-pass into Lyons Creek via a pumping station;
- dumping of excavated spoils across much of the northwest portion of the Study Area;
- excavation of a baseball-field shaped settling basin where water was pumped during construction of the Main Street tunnel about 1.8 km to the northwest (R. Brown pers. comm. 2024); and
- construction of Highway 140 (slightly east of the former Moore Road) and replacement of the small bridge over Lyons Creek with a CSP culvert (R. Brown pers. comm. 2024).

4.2 Physical Setting

4.2.1 Bedrock Geology

The bedrock underlying the Study Area is characterized as Silurian-aged (i.e., 419 to 444 million-year-old) dolostones, shales, and evaporites (i.e., gypsum) of the Salina Formation. In Ontario, the Salina Formation can be traced from Southampton on the shores of Lake Huron to the Niagara River north of Fort Erie (Armstrong and Dodge 2007). The Salina Formation rarely outcrops at the surface (due to the high erodibility of shale and solubility of evaporite minerals) and is mostly hidden beneath surficial deposits. Based on publicly-available well records, depth to bedrock in the local landscape appears to be greater than 10 m.

4.2.2 Surficial Geology and Soils

Much of the Study Area is comprised of glaciolacustrine deep water deposits represented by silts and clays (Ontario Geological Survey 2010). These soils were laid down during retreat of the Wisconsin ice sheet (circa 11,000 to 22,000 years ago). Glaciolacustrine silts and clays are widespread throughout central and southern Niagara (between the Niagara Escarpment and Onondaga Escarpment) and form part of the Haldimand Clay Plain (Chapman and Putnam 1984). The topography of the Haldimand Clay Plain is characterized by minimal changes in elevation, producing flat landscapes with low gradient and wide, meandering rivers (Chapman and Putnam 1984). Modern alluvium deposited during flood events has accumulated in the bottomlands beyond the flooded fringe of Lyons Creek (see **Figure 4**).

The most recent soils mapping for Niagara Region (Kingston and Presant 1989b) assigns Oneida series clay loam till to the Study Area, whereas the reddish-hued, lacustrine heavy clays of the Welland, Niagara, and Peel series extend outwards onto the tablelands. Areas subject to filling with dredged spoils are assigned "Not Mapped" (NM). Drainage within the Study Area is impeded by the heavy textured soils (Chapman and Putnam 1984).

A wide, plunging bend in Lyons Creek just west of Highway 140 exhibits coarser sandy silt materials along the southern valley slope. This small but distinctive part of the Study Area supports several uncommon and "conservative" vascular plant species (i.e., those with less tolerance to disturbance and found in more restricted areas) including White Oak (*Quercus alba*), Yellow Pimpernel (*Taenidia integerrima*), and White Goldenrod (*Solidago bicolor*). Such species are generally uncommon locally and are associated with dry, somewhat open environments, which are generally rare on the Haldimand Clay Plain (outside of the Fonthill Kame Moraine) and otherwise absent within the Study Area.

4.2.3 Topography and Drainage

The peaceful, meandering planform of both the Welland River and Lyons Creek reflects isostatic rebound, whereby downstream reaches are lifting more rapidly than upstream reaches and have been since glacial retreat (MacDonald 1980). The Welland River only falls 15 cm per km (NPCA 2010a) whereas the entirety of Lyons Creek from its upstream commencement point at the Welland Canal By-pass (174 masl) to its outlet at the Welland River (171 masl) sees only 3 m (9 ft) of relief over 19,300 m (19.3 km). This is also equivalent to about 15 cm of elevational gradient per km.

Lyons Creek is set within a well-defined valleyland with slopes ranging up to about 4 m in height. Some areas lack a discrete top of slope (possibly a result of previous earthworks or landscape modifications) and glide gently but consistently to the water's edge, which sits at approximately 174

masl within both the upstream and downstream extents of the Study Area. Above the top of bank/slope, the Study Area is nearly flat and generally sits between 176 to178 masl depending on location. The wetted width of Lyons Creek is about 10 to 15 m in Area A downstream of Ridge Road, widening quickly to about 50 to >60 m in Areas B and C. The short stretch of channel upstream of Ridge Road to the pumping station outlet is constructed and does not conform to the historical alignment of Lyons Creek, which was slightly westward (R. Brown pers. comm. 2024) and eliminated during construction of the Welland By-pass (see **Figure 3**).

The minimal gradient, clay-rich soils, and shallow surface depressions (i.e., sloughs) promote seasonal ponding and wetland conditions which have come to define much of Niagara's clay plains. Such physiographic conditions are often referred to as "Slough Forests", where a mosaic of vernal pools or shallow depressions ("sloughs") are surrounded by slightly elevated bottomlands, characterized by repeating patterns of hydrophytic and upland vegetation. Slough Forests reflect pre-settlement vegetation and topographic conditions in much of the local landscape and southern Niagara Region generally, along with other clay-plain regions of southern Ontario (e.g., parts of Lambton County).

The unmistakable, darkened, slightly elongated appearance of sloughs is easily observed on both current and historical aerial photographs where former sloughs were drained and farmed. Slough patterning has been referred to as "ripple-like" (Tinkler 1994) or having a "washboard" appearance (Feenstra 1984). It has been suggested that sloughs in Niagara formed as a result of relatively rapid, below-water glacial recession (Menzies 2001). At the glacial margin, materials were deposited and slumped as small, successive ridges, with residual hollows (sloughs) filling the gaps between them. It has also been suggested that the sloughs reflect wave-washing of surficial deposits in glacial Lake Warren, giving rise to a shallow, slightly undulating ground surface with depressional wetlands and intervening moist uplands (D. Webster pers. comm. 2020). Historical sloughs are evident throughout the landscape surrounding the Study Area on aerial photographs but have been eliminated from filled areas adjacent to the Welland By-pass and other areas of considerable soil disturbance.

4.3 **Ecological Setting**

4.3.1 Vegetation Communities

Commercial and Institutional (CVC)

Commercial and Institutional (CVC) properties within the central and western portions of the Study Area predominantly consist of small vehicle and shipping container storage areas associated with residential dwellings and/or small businesses. Larger expanses of CVC lands occur within the eastern portion of the Study Area, associated with automotive repair, delivery, and trailer repair businesses. Land cover within these areas is a mixture of paved impermeable surfaces and manicured lawn. Generally, Lyons Creek is buffered from these land uses by dense vegetation; however, they abut Lyons Creek immediately east and west of Highway 140.

Transportation and Utilities (CVI)

The easternmost tip of the Study Area abuts an active railway corridor currently operated by Canadian National (CN). This portion of the Study Area is characterized by coarse, bare mineral substrates (i.e., crushed stone) placed by CN along the railway tracks, and exposed sandy soils. While

this area does not support many vascular plants, the exposed mineral substrates and south- to southwest- facing slopes have created optimal nesting habitat for turtles, as discussed in greater detail below.

Low Density Residential (CVR_1)

Residential areas are predominantly restricted to the central and western portions of the Study Area. These spaces are typically comprised of one or more dwellings surrounded by manicured lawn, specimen trees (often native or naturalized species retained after vegetation clearing activities), and ornamental plantings.

Dry – Fresh Oak – Hardwood Deciduous Forest (FODM2-4)

Oak-hardwood deciduous forest (FODM2-4) occupies a southern bend of Lyons Creek within the centre of the Study Area west of Highway 140. The forest canopy is comprised of Red Oak (*Quercus rubra*), Sugar Maple (*Acer saccharum*), Bur Oak (*Quercus macrocarpa*), and Shagbark Hickory (*Carya ovata*), with Shagbark Hickory and Sugar Maple throughout the subcanopy. The sparse understory consists of Gray Dogwood (*Cornus racemosa*), Chokecherry (*Prunus virginiana*), American Witch-hazel (*Hamamelis virginiana*), and Maple-leaved Viburnum (*Viburnum acerifolium*). A mixture of regenerating Sugar Maple, young Shagbark Hickory, Large-leaved Aster (*Eurybia macrophylla*), White Goldenrod, Canada Bluegrass (*Poa compressa*), and Yellow Pimpernel comprise the ground layer.

Dry sandy/loamy slopes within the deciduous forest have produced a species assemblage more typically associated with dry and often open environments, which are generally considered rare on the Haldimand Clay Plain. Additionally, this vegetation community contains several plants which are considered uncommon in Niagara Region (per Oldham 2017), including Deceitful Pussytoes (*Antennaria parlinii* ssp. *fallax*), Pear Hawthorn (*Crataegus calpodendron*), White Goldenrod, and Yellow Pimpernel.

Dry – Fresh Sugar Maple – Oak Deciduous Forest (FODM5-3)

A linear remnant of Sugar Maple – Oak dominated deciduous forest (FODM5-3) occupies the eastern edge of the Study Area, abutting the banks of Lyons Creek. Sugar Maple comprises much of the forest canopy and subcanopy, with pockets of Red Oak scattered throughout. The dense understory vegetation is reflective of historical disturbance occurring within and adjacent to the forest, with Grey Dogwood, Glossy Buckthorn (*Frangula alnus*), and regenerating American Basswood throughout. Patches of Canada Bluegrass and regenerating Sugar Maple seedlings characterize the sparse ground layer.

Fresh – Moist White Elm Lowland Deciduous Forest (FODM7-1)

A narrow band of Fresh – Moist Lowland Deciduous Forest (FODM7-1) dominated by White Elm (*Ulmus americana*) spans the southern bank of Lyons Creek along the southwestern edge of the Study Area. The forest canopy predominantly consists of White Elm, with standing dead Green Ash (*Fraxinus pennsylvanica*) comprising the subcanopy. Pockets of Staghorn Sumac (*Rhus typhina*) and Common Apple (*Malus pumila*) occupy drier portions of the community, with European Buckthorn (*Rhamnus cathartica*), Silky Dogwood (*Cornus amomum*), and Sandbar Willow (*Salix interior*) occupying low lying areas. Owing to dense understory vegetation, Riverbank Grape (*Vitis riparia*) occupies

patches of exposed substrate in the ground layer, rambling over shrubs and climbing small trees (particularly dead Green Ash).

Fresh – Moist Green Ash – Hardwood Lowland Deciduous Forest (FODM7-2)

Spanning the southern bank of Lyons Creek, and encompassing two oxbows, is a lowland forest (FODM7-2) dominated by Green Ash. Scattered mature Eastern Cottonwood (*Populus deltoides* ssp. *deltoides*) and Pin Oak comprise the sparse canopy, with extensive living and dead Green Ash throughout the subcanopy. Rusty Willow (*Salix atrocinerea*), Glossy Buckthorn, and European Buckthorn characterize the understory, alongside regenerating Green Ash in the understory and ground layer.

Fresh – Moist Willow Lowland Deciduous Forest (FODM7-3)

Abutting the western edge of Highway 140 is a lowland forest dominated by Hybrid Crack Willow (*Salix* × *fragilis*). Portions of this community no longer exhibit understory vegetation owing to vegetation clearing and repeated mowing. Small patches of Spotted Joe-pye Weed (*Eutrochium maculatum* var. *maculatum*) and Soft-stemmed Bulrush (*Schoenoplectus tabernaemontani*) remain where the forest interfaces with Lyons Creek.

Fresh – Moist Norway Maple Lowland Deciduous Forest (FODM7-8)

Located in the westernmost portion of the Study Area, abutting the end of Ridge Road and informal ATV trails, is a lowland forest (FODM7-8) dominated by Norway Maple (*Acer platanoides*). Norway Maple, Green Ash, and Siberian Elm (*Ulmus pumila*) comprise the canopy and subcanopy. Dense growth of Glossy Buckthorn, Silky Dogwood, Highbush Cranberry (*Viburnum opulus* var. *opulus*), and Morrow's Honeysuckle (*Lonicera morrowii*) occurring throughout the understory reflect a legacy of anthropogenic disturbance (i.e., a residence formerly occurred in this area based on historical aerial photographs). The ground layer is comprised of Purple Loosestrife (*Lythrum salicaria*), Field Horsetail (*Equisetum arvense*), European Buckthorn seedlings, and Canada Bluegrass, forming a gradient along the sloping banks where species have been segregated based on differing moisture and microclimate requirements.

Common Reed Graminoid Mineral Meadow Marsh (MAMM1-12)

Two meadow marsh communities (MAMM1-12) dominated by European Reed (*Phragmites australis* ssp. *australis*) occur within the western tip of the Study Area. Both meadow marshes are comprised of a monotypic stand of European Reed. Sparse clumps of Yellow Iris (*Iris pseudacorus*), Hybrid Cattail (*Typha* × *glauca*), and Broad-fruited Burreed (*Sparganium eurycarpum*) occur at the edges. This vegetation community likely acts as a significant seed source of European Reed within the broader Study Area, given the plant's ability to disperse seeds by wind and water.

Cattail Mineral Shallow Marsh (MASM1-1)

Cattail-dominated shallow marsh (MASM1-1) comprises a significant portion of the emergent aquatic vegetation within the Study Area. Generally, these communities form linear edges, interfacing between terrestrial and open water systems; however, in several areas where oxbows or meander bends have formed (in the present day and/or historically), cattail dominated marshes are significantly wider. A mixture of Broad-leaved Cattail (*Typha latifolia*) and Narrow-leaved Cattail

(*Typha angustifolia*) characterize the vegetation composition within these communities, with occasional hybrids arising between the two species (i.e., *Typha* × *glauca*). Owing to the dense monocultures formed by cattails, little other vegetation grows within these communities, although patches of Broad-leaved Arrowhead (*Sagittaria latifolia*), Nodding Beggarticks (*Bidens cernua*), Swamp Loosestrife (*Decodon verticillatus*), and Water Smartweed (*Persicaria amphibia*) occur sporadically along the community margins. This vegetation community provides habitat for the Provincially Rare (S3) Nuttall's Waterweed (*Elodea nuttallii*).

Bulrush Mineral Shallow Marsh (MASM1-2)

A narrow band of shallow marsh dominated by bulrush (MASM1-2) runs along the northern shore of Lyons Creek within the central portion of the Study Area. This vegetation community appears to follow the extent of historical meander bends and/or oxbows, arising in areas with slower-flowing water. Soft-stemmed Bulrush comprises much of the emergent vegetation, with small patches of cattail, sedges (*C. hystericina*, *C. lupulina*), grasses (*Phalaris arundinacea*, *Poa palustris*), and Bulbous Water-hemlock (*Cucuta bulbifera*) scattered along the community margins.

Narrow-leaved Sedge Mineral Shallow Marsh (MASM1-4)

This vegetation community occurs in one location within the Study Area. Dominated by sedges (*C. hystericina*, *C. lurida*), and interspersed with Soft-stemmed Bulrush (*Juncus effusus* ssp. *effusus*), Common Woolly Bulrush (*Scirpus cyperinus*), Blunt Spikerush (*Eleocharis obtusa*), and Arrow-leaved Smartweed (*Persicaria sagittata*), this community provides habitat for the regionally uncommon Slender St. John's-wort (*Hypericum mutilum*) and Provincially Rare (S1) Smartweed Dodder (*Cuscuta polygonorum*).

Beggar-ticks Mineral Shallow Marsh (MASM2-2)

Two emergent aquatic vegetation communities dominated by Nodding Beggarticks occur within the eastern portion of the Study Area. Both communities are comprised of dense floating patches of Nodding Beggarticks, ringed with a narrow band of Water Smartweed.

Water Willow Organic Shallow Marsh (MASO2-3)

Three vegetation communities dominated by Water Willow (MASO2-3) occur within the central portion of the Study Area. These shallow marsh communities typically represent the interface between emergent aquatic vegetation (or terrestrial communities) and areas dominated by floating aquatic plants. Large swaths of Water Willow characterize these communities, with small pockets of Broad-leaved Burreed, Creeping Spikerush (*Eleocharis palustris*), and Broad-leaved Arrowhead.

Dry – Fresh Graminoid Meadow (MEGM3)

A small meadow community extends along the western edge of Highway 140, arising from a legacy of anthropogenic disturbance, and receiving salt-laden runoff from winter road maintenance. A monoculture dominated by European Reed, a known halophyte, has established within this narrow strip of disturbed ground. Queen Anne's Lace (*Daucus carota*) and Oxeye Daisy (*Leucanthemum vulgare*) are scattered along the community edges.

Dry – Fresh Mixed Meadow (MEMM3)

A linear mixed meadow (MEMM3) comprised of Queen Anne's Lace, Chicory (*Cichorium intybus*), Oxeye Daisy, and young patches of European Reed bounds the western edge of Highway 140. Several sections of this vegetation community appear to have been utilized for ATV trails and/or vehicle access.

Water Lily – Bullhead Lily Floating-leaved Shallow Aquatic (SAF1-1)

Six (6) aquatic vegetation communities dominated by Fragrant Water-lily (*Nymphaea odorata* ssp. *odorata*) occupy the majority of Lyons Creek within the Study Area. These communities are characterized by Fragrant Water-lily acting as a surrounding matrix for smaller pockets of American Eelgrass (*Vallisneria americana*) and Tuberous White Water-lily (*N. odorata* ssp. *tuberosa*).

Water-lily – Bullhead Lily Mixed Shallow Aquatic (SAM1-8)

This vegetation community encompasses the central portion of Lyons Creek within the Study Area. Fragrant Water-lily comprises a large proportion of floating vegetation, interspersed with expanses of submergent vegetation, including Brittle-leaved Naiad (*Najas minor*), Common Hornwort (*Ceratophyllum demersum*), and Water Stargrass (*Heteranthera dubia*). This vegetation community provides habitat for the Provincially Rare (S3) Floating Crystalwort (*Riccia fluitans*).

Water Milfoil Submerged Shallow Aquatic (SAS1-4)

The western tip of the Study Area contains a shallow aquatic vegetation community (SAS1-4) dominated by Eurasian Water-milfoil (*Myriophyllum spicatum*). Small pockets of Red-stemmed Spikerush (*Eleocharis erythropoda*) and Curly-leaved Pondweed (*Potamogeton crispus*) exist along the community edges.

Buttonbush Mineral Deciduous Thicket Swamp (SWTM5-1)

Mature Eastern Buttonbush (*Cephalanthus occidentalis*) comprise the thicket swamp subcanopy and understory. Small patches of White Meadowsweet (*Spiraea alba*) and Rusty Willow also occur towards the southern edge of this community. Broad-leaved Burreed, Broad-leaved Arrowhead, Straw-coloured Flatsedge (*Cyperus strigosus*), and sedges (*C. comosa*, *C. lurida*) characterize the ground layer vegetation.

This vegetation community is considered Provincially Rare (S3).

Dry – Fresh Deciduous Shrub Thicket (THDM2)

Two deciduous shrub thickets (THDM2) occur within the eastern and western ends of the Study Area. Both vegetation communities are comprised of standing dead Green Ash in the canopy, with sparse amounts of live Green Ash and Common Apple within the subcanopy. Glossy Buckthorn dominates the understory, with smaller proportions of European Buckthorn and Autumn Olive (*Elaeagnus umbellata*) throughout. Scattered Field Horsetail, Creeping Jennie (*Lysimachia nummularia*), Wild Strawberry (*Fragaria virginiana* ssp. *virginiana*), and Tall White Clover (*Melilotus albus*) comprise the sparse ground vegetation.

Apple Deciduous Shrub Thicket (THDM2-10)

Common Apple characterizes the subcanopy and understory of this linear shrub thicket (THDM2-10), with European Buckthorn and Gray Dogwood also present throughout the understory. The sparse ground layer is comprised of Riverbank Grape (which also rambles over the shrubs) and Calico Aster (*Symphyotrichum lateriflorum*).

Buckthorn Deciduous Shrub Thicket (THDM2-6)

Two shrub thickets dominated by European Buckthorn run along the northern edge of the Study Area, from east to west. Small portions of these communities contain remnant canopies of standing dead Green Ash. The understory is comprised of European Buckthorn, with young American Elm and Green Ash regeneration. In many areas, Riverbank Grape dominates the ground layer, rambling over shrubs and standing dead trees.

Native Deciduous Regeneration Thicket (THDM4-1)

Occupying the western tip of the Study Area, this thicket is comprised of standing dead Green Ash throughout the canopy, with Sandbar Willow, Rusty Willow, Silky Dogwood, and small pockets of Glossy Buckthorn throughout.

Fresh – Moist Manitoba Maple Deciduous Woodland (WODM5-3)

Two woodlands dominated by Manitoba Maple (*Acer negundo*) occur directly east of Highway 140 within the Study Area. These communities are characterized by Manitoba Maple, standing dead Green Ash, and Basswood throughout the canopy, with dense growth of Manitoba Maple, European Buckthorn, and Glossy Buckthorn throughout the understory impeding the growth of herbaceous plants.

4.3.2 Vascular Plants

A total of 277 vascular plant species were recorded within the Study Area (see **Appendix 2**). Key results of the vascular plant surveys are as follows:

- No Species at Risk vascular plants (or bryophytes) were recorded.
- Four (4) Provincially Rare vascular plant and liverwort species (S1 to S3) were recorded.
- Seventeen (17) regionally rare vascular plant species (per Oldham 2017) were recorded.

4.3.3 Breeding Anurans

Anuran calling surveys were undertaken at 11 stations on 09 April, 07 May, and 06 June 2024. The locations of each survey station are shown on **Figure 5** while the full survey results are provided in **Appendix 4**. A total of seven (7) Anuran species were documented during the calling surveys. A general description of Anuran communities present within the Study Area is provided below.

Green Frog (*Lithobates clamitans*) and Northern Leopard Frog (*Lithobates pipiens*) were detected in relatively low to moderate abundances within the narrow bands of cattail-dominated shallow marsh communities (MASM1-1) throughout the Study Area. Wider patches of cattail dominated shallow

marsh (MASM1-1) typically supported higher levels of Green Frog and Northern Leopard Frog calling activity (e.g., at AN-5), as well as Western Chorus Frog (*Pseudacris triseriata*).

Calling activity was generally sparse within the eastern portion of the Study Area, although abundant Western Chorus Frog activity was recorded within and/or adjacent to the beggarticks-dominated shallow marsh (MASM2-2) community located between AN-10 and AN-11. Similarly, minimal call activity was recorded within the westernmost portion of the Study Area.

American Bullfrog (*Lithobates catesbeianus*) was documented calling within the mixed shallow aquatic community (SAM1-8) between AN-7 and AN-10. While only one individual was recorded during formal surveys, individuals were also recorded in the same area incidentally during the day. The presence of vocalizing American Bullfrog suggests that significant Anuran breeding habitat may be present.

American Toad (*Anaxyrus americanus*), Gray Treefrog (*Dryophytes versicolor*), Spring Peeper (*Pseudacris crucifer*), and Western Chorus Frog were also detected calling from wet depressions located within treed and scrubby vegetation communities immediately north and south of the Study Area.

4.3.4 Breeding Birds

Breeding bird surveys were undertaken at 11 stations on 05 June and 03 July 2024. A total of 50 bird species were documented during the formal breeding bird surveys. The surveys were conducted mainly via canoe (stations BI-4 to BI-11) with the remaining stations situated near the waters edge (BI-1 to BI-3). The assemblage and abundance of birds recorded generally reflects the prevailing structure and composition of on-site vegetation communities and variable habitats of the Study Area (e.g., thicket, shallow marsh, open water). The locations of each survey station are shown on **Figure 5** while the full survey results indicating each species' breeding status by survey station can be found in **Appendix 5**. The locations of significant bird species recorded are shown on **Figure 8** and **Figure 9** (where present). A general summary of the breeding bird communities present within the Study Area is provided below.

The most common and abundant species detected during breeding bird surveys includes American Goldfinch (*Spinus tristis*), American Robin (*Turdus migratorius*), Cedar Waxwing (*Bombycilla cedrorum*), Common Grackle (*Quiscalus quiscula*), Common Yellowthroat (*Geothlypis trichas*), Gray Catbird (*Dumetella carolinensis*), Northern Cardinal (*Cardinalis cardinalis*), Red-winged Blackbird (*Agelaius phoeniceus*), Song Sparrow (*Melospiza melodia*) and Yellow Warbler (*Setophaga petechia*). These species are generally reflective of the marsh and thickety habitats found along Lyons Creek.

More infrequently recorded species included Cooper's Hawk (*Accipiter cooperii*), Eastern Bluebird (*Sialia sialis*), Green Heron (*Butorides virescens*), Indigo Bunting (*Passerina cyanea*), Marsh Wren (*Cistothorus palustris*), Purple Martin (*Progne subis*), Red-eyed Vireo (*Vireo olivaceus*), Rose-breasted Grosbeak (*Pheucticus ludovicianus*), and Wood Duck (*Aix sponsa*). Species like Cooper's Hawk, Red-eyed Vireo, and Rose-breasted Grosbeak are associated with forests and woodlands which are limited within the Study Area. Eastern Bluebird, Indigo Bunting, and Purple Martin are associated with meadow and open areas which are extensive north of Lyons Creek. Green Heron, Marsh Wren and Wood Duck are associated with the marsh and shallow aquatic habitat along Lyons Creek.

Two (2) bird species of conservation interest were recorded during the targeted breeding bird surveys:

- Barn Swallow (Provincially Special Concern, Federally Threatened); and
- Purple Martin (Provincially Rare, S3B).

The location of nesting Barn Swallows (observed in both 2023 and 2024) within an outbuilding is indicated on **Figure 9**, whereas observations of Purple Martin are considered to represent individuals in transit and/or temporarily foraging above the Study Area.

4.3.5 Marsh Bird and Least Bittern Survey

Marsh bird surveys were undertaken via canoe during the breeding bird surveys (i.e., during point counts) at all 11 breeding bird survey stations. No marsh bird species were recorded during the surveys or incidentally over the course of the 2023/2024 fieldwork program.

4.3.6 Nightjars

Nightjar surveys were undertaken on 21 May and 21 June 2024. Common Nighthawk (*Chordeiles minor*) was recorded to the east of the Study Area during the first (21 May 2024) nightjar survey as shown in **Figure 9**. The species is considered a "Rare Transient" per the Niagara NAI and is listed as Special Concern under O. Reg. 242/08 of the provincial *Endangered Species Act* (ESA) and Schedule 1 of the federal *Species at Risk Act* (SARA). The individual was observed flying high and did not appear to be circling or interacting with habitats within or adjacent to the Study Area. The individual may have represented a migrant (i.e., the OBBA safe breeding date for Common Nighthawk in southern Ontario is May 31st) or local breeder.

4.3.7 Overwintering Birds

An overwintering bird survey was undertaken on 06 February 2024. The full survey results indicating abundance counts of each overwintering bird species recorded can be found in **Appendix 6**. A general summary of the overwintering bird communities present within the Study Area is provided below.

A total of nineteen (19) bird species were recorded during the overwintering survey. Overall, birds were generally sparse throughout the Study Area, which is typical of winter bird surveys. One migratory species was observed – American Pipit (*Anthus rubescens*) – at station OB-1 (this species is listed as an "occasional straggler" during winter in the Niagara NAI). There were mixed species flocks noted at stations OB-1, OB-2, and OB-5 which included American Tree Sparrow (*Spizelloides arborea*), Black-capped Chickadee (*Poecile atricapillus*), Downy Woodpecker (*Dryobates pubescens*), and Golden-crowned Kinglet (*Regulus satrapa*). Waterfowl were infrequent as Lyons Creek was largely frozen over (as was the Welland By-pass); however, open water was present at stations OB-1, OB-6, and OB-7. A few small flocks of Canada Goose (*Branta canadensis*) and Mallard (*Anas platyrhynchos*) were observed in areas of open water. One raft of five American Black Ducks (*Anas rubripes*) was observed at station OB-7 along with a few individual Hooded Merganser (*Lophodytes cucullatus*) at stations OB-6 and OB-7. No overwintering raptors (e.g., eagles, hawks, owls, or falcons) were documented.

Of the 19 species of overwintering birds recorded, none are provincially or federally listed as species at risk. One species recorded – White-breasted Nuthatch (*Sitta carolinensis*) – is considered "area-sensitive" (MNR 2000). Area-sensitive species generally require larger areas of suitable habitat to carry out their life processes.

4.3.8 Turtles

Three (3) turtle species were detected during visual encounter and nesting surveys:

1. Midland Painted Turtle (*Chrysemys picta marginata*)
2. Red-eared Slider (*Trachemys scripta elegans*)
3. Snapping Turtle (*Chelydra serpentina*)

Midland Painted Turtle is listed as Special Concern under Schedule 1 of SARA but has no provincial status under the ESA. Snapping Turtle is also listed Special Concern under Schedule 1 of SARA and similarly under O. Reg. 230/08 under the ESA. Red-eared Slider is a non-native species and is not of conservation interest.

A daily high count of 40 Midland Painted Turtles was made on 16 April 2024, although true numbers likely greatly exceed this value. Observations of turtles in mid-April is suggestive of overwintering in Lyons Creek. Snapping Turtle was primarily documented during the nesting surveys but was also observed within Lyons Creek itself (typically aqua-basking) on a few occasions. Red-eared Slider was recorded twice. Areas of high turtle basking concentration (i.e., where a dozen or more individuals were recorded, sometimes on a single day) are presented in **Figure 8** and **Figure 9**.

Evidence of turtle nesting was also documented across the Study Area during nesting surveys, along with evidence of nest predation (likely by meso-predators). Snapping Turtle nesting was confirmed in several areas and locations are presented in **Figure 8** and **Figure 9**. The carcass of one female adult Snapping Turtle was observed on Highway 140 during the nesting surveys.

4.3.9 Snakes

Three (3) snake species were detected during visual encounter surveys:

- Dekay's Brownsnake (*Storeria dekayi*)
- Eastern Gartersnake (*Thamnophis sirtalis sirtalis*)
- Northern Watersnake (*Nerodia sipedon sipedon*)

Two (2) suspected snake hibernacula were identified within the Study Area, as shown on **Figure 8** and **Figure 9**. Carcasses (i.e., roadkill) of Eastern Gartersnake and Northern Watersnake were documented on Highway 140. No Species at Risk snakes were documented within the Study Area.

4.3.10 Odonates and Butterflies

Surveys for odonates (i.e., dragonflies, damselflies) and butterflies were conducted within areas of suitable habitat on multiple occasions across the active season. Non-target taxa were recorded incidentally when observed. Incidental observations of bumblebees (*Bombus* spp.) were also made during the butterfly and odonate surveys.

A total of 22 species of butterflies and 26 species of odonates were recorded. Three (3) odonate species listed as Rare in the Niagara NAI were recorded during surveys, as well as one (1) odonate species considered Historic, and two (2) odonates not previously reported in the Niagara NAI. One (1) butterfly listed as Rare in the Niagara NAI was recorded. These significant species are discussed in greater detail in **Section 5** below.

4.3.11 Fish / Mussel Records (Background Information Sources Only)

A minimum of 34 fish species have been captured within Lyons Creek East (i.e., from the Welland Canal to the Welland River) between 1976 and 2011 (Yagi and Blott 2012). The data presented by Yagi and Blott (2012) does not allow for discrimination between fish species captured within the Study Area itself (i.e., Sediment Management Areas A, B, or C) from those captured downstream (i.e., between Buchner Road and the confluence of Lyons Creek with the Welland River). Alternatively, a total of 15 fish species were captured at stations overlapping with the Study Area (i.e., #16 to #21) based on sampling conducted in 2004 (Marson et al. 2009). These fish records are provided below in **Table 3**.

Table 3. Fish species captured in 2004 from six separate stations (#16 to #21) overlapping with the Lyons Creek East Study Area as reported by Marson et al. (2009).

Common Name	Scientific Name	FI-16	FI-17	FI-18	FI-19	FI-20	FI-21	Total Captured
Bluegill	*Lepomis macrochirus*	2	3	1	2			8
Bluntnose Minnow	*Pimephales notatus*	5	13	3	8	2		31
Brown Bullhead	*Ameiurus nebulosus*	1						1
Central Mudminnow	*Umbra limi*		2		1	1		4
Emerald Shiner	*Notropis atherinoides*	1		1		1		3
Fathead Minnow	*Pimephales promelas*		1		4			5
Golden Shiner	*Notemigonus crysoleucas*	7	6		2	8		23
Goldfish	*Carassius auratus*	8	3	1	1	2		15
Grass Pickerel	***Esox americanus vermiculatus***	**2**	**1**	**3**		**1**		**7**
Green Sunfish	*Lepomis cyanellus*				1			1
Lake Chubsucker	***Erimyzon sucetta***	**1**	**1**	**1**	**1**	**1**		**5**
Largemouth Bass	*Micropterus salmoides*	2	2	1	1		1	7
Pumpkinseed	*Lepomis gibbosus*	11	8	3	2	3		27
White Sucker	*Catostomus commersonii*		1		1		1	3
Yellow Perch	*Perca flavescens*	1						1

Note also that Common Carp (*Cyprinus carpio*) were observed by Terrastory staff on numerous occasions throughout the Study Area, and apparently have been present within the Study Area since at least the 1970s (R. Brown pers. comm. 2024). Local anglers have also reported Bowfin (*Amia calva*) and Northern Pike (*Esox lucius*) at a frequented fishing spot just upstream (south) of Buchner Road in Area C, although the latter was only captured by Marson et al. (2009) a great distance downstream (i.e., at Montrose Road). It is possible that angler reports of Northern Pike could in some instances represent the remarkably similar Grass Pickerel (*Esox americanus vermiculatus*).

Two SAR fish species are known from the Study Area:

1. Lake Chubsucker (*Erimyzon sucetta*) – listed as "Endangered" per O. Reg. 230/08 of the ESA and "Endangered" per Schedule 1 of SARA.
2. Grass Pickerel (*Esox americanus vermiculatus*) – listed as "Special Concern" per O. Reg. 230/08 of the ESA and "Special Concern" per Schedule 1 of SARA.

There are records of Creek Heelsplitter (*Lasmigona compressa*) and Giant Floater (*Pyganodon grandis*) from the Montrose Road crossing of Lyons Creek which is approximately 6.7 km northeast (i.e., Euclidian distance) of the eastern limit of the Study Area (Area C) at Buchner Road (Wright et al. 2017). Giant Floater was also recorded from the Crowland Avenue crossing of Lyons Creek (~4.9 km Euclidian distance northeast of the Buchner Road crossing) in 2008 (Morris et al. 2012). DFO has confirmed there is an absence of mussel records for the Study Area (T. Morris pers. comm. 2024).

5 SIGNIFICANT SPECIES

Brief descriptions of eighteen (18) regionally, provincially, and/or nationally significant species of conservation interest which are known from the Study Area are offered in the sections that follow. Locations where each significant species was documented are presented in **Figure 8** and **Figure 9**.

Birds

1. **Common Nighthawk (*Chordeiles minor*)** was recorded in one location east of Area C (see **Section 4.3.6**). This individual was not interacting with habitats within or adjacent to the Study Area and may have represented a migrant.
2. **Barn Swallow (*Hirundo rustica*)** was recorded to be nesting within a wooden outbuilding (shop) at 327 Highway 140 in both 2023 and 2024.

Butterflies

3. **American Copper (*Lycaena phlaeas*)** was observed flying over Lyons Creek on 22 September 2024. This species is listed as Rare in the Niagara NAI.
4. **Monarch (*Danaus plexippus*)** caterpillars were documented in several locations throughout the Study Area, primarily on Swamp Milkweed (*Asclepias incarnata*). Monarch adults were also observed feeding and flying through the Study Area. This species is listed as Special Concern provincially (O. Reg. 230/08 of the ESA) and Endangered federally (Schedule 1 of SARA).

Fish

5. **Lake Chubsucker (*Erimyzon sucetta*)** was first captured in Lyons Creek in 2004 (Marson et al. 2009). This species is a bottom-feeder and is associated with well-vegetated wetland areas. The most recent record of this species within the Study Area appears to be from 2008 (Staton et al. 2010) although no surveys were conducted within Lyons Creek between 2016 to 2021 (DFO 2023). Mitochondrial barcoding has revealed that the Lyons Creek population of Lake Chubsucker is genetically distinct from other Ontario populations (Hauser et al. 2019). This species is listed as Endangered both provincially (O. Reg. 230/08 of the ESA) and federally (Schedule 1 of SARA).
6. **Grass Pickerel (*Esox americanus vermiculatus*)** was captured within the Study Area in 2012 and 2013 and is also known from downstream reaches of Lyons Creek extending to the Welland River (DFO 2022, 2024). This species occupies wetlands, ponds, slow-moving streams, and shallow bays of larger lakes with warm, shallow, clear water and an abundance of aquatic plants. It is not known if targeted survey effort within the Study Area has occurred since 2013 and (if so) whether this resulted in a lack of detections. This species is listed as Special Concern both provincially (O. Reg. 230/08 under the ESA) and federally (Schedule 1 of SARA).

Odonates

7. **Prince Baskettail (*Epitheca princeps*)** was observed cruising above Lyons Creek near the upstream side of the culvert at Highway 140 in Area B. Prince Baskettail was also observed at three (3) additional locations within the western portion of the Study Area during the 2024 fieldwork program. This species is listed as Rare (one station, and one historical station) in the Niagara NAI.
8. **Canada Darner (*Aeshna canadensis*)** was observed on 22 September 2023 flying above Lyons Creek downstream of the culvert at Highway 140 in Area C. This species is neither listed from the Niagara NAI nor are there any confirmed records from Niagara on iNaturalist at present. Canada Darner is known to migrate (based on a recent study in Minnesota) so it is unknown if this species is breeding locally (i.e., in Lyons Creek). This species was not recorded during the 2024 fieldwork program.
9. **Cyrano Darner (*Nasiaeschna pentacantha*)** was observed on 05 June 2024 along the southern edge of Lyons Creek in Area B. This species is listed as Historical (known from two stations) in the Niagara NAI.
10. **Elegant Spreadwing (*Lestes inaequalis*)** was observed on 05 June 2024 along the southern edge of Lyons Creek. This species is listed as Rare (known from one station) in the Niagara NAI.
11. **Slender Spreadwing (*Lestes rectangularis*)** was observed on 17 August 2024 along the northern edge of Lyons Creek. This species is listed as Rare (known from one station) in the Niagara NAI.
12. **Vesper Bluet (*Enallagma vesperum*)** was observed on 06 June 2024 flying above Lyons Creek. This species is not known from Niagara according to the Niagara NAI.

Plants and Liverworts

13. **Yellow-fruited Sedge (*Carex annectens*)** was documented approximately 40 m north of Lyons Creek in an open field surrounded by thicket. This population appears to be one of the largest known in southern Ontario. Yellow-fruited Sedge is considered Provincially Rare (S2) by the Natural Heritage Information Centre (NHIC). During 2024 vascular plant surveys, a smaller second patch of Yellow-fruited Sedge was documented approximately 50 m west of the termination of Ridge Road.
14. **Nuttall's Waterweed (*Elodea nuttallii*)** was documented in two (2) locations in Lyons Creek. This species is a submerged aquatic and looks similar to the more common Canada Waterweed (Elodea canadensis) which also occurs within the Study Area. Nuttall's Waterweed is considered Provincially Rare (S3) by NHIC.
15. **Floating Crystalwort (*Riccia fluitans*)** was documented in one (1) location in Lyons Creek (western portion of the Study Area). This floating bryophyte is considered Provincially Rare (S3) by NHIC. An NHIC status review would likely conclude that this species is more common in southern Ontario than existing records suggest and may not in fact by Provincially Rare.
16. **Smartweed Dodder (*Cuscuta polygonorum*)** was documented along the southern margin of Lyons Creek parasitizing and twining upon Dotted Smartweed (Persicaria punctata). The first observation of this species in Niagara Region was recorded by Dougan and Associates during 2006 fieldwork in support of the Lyons Creek East Wetland Monitoring Study further downstream; that individual was also found parasitizing the same host plant (Dotted Smartweed) on the north side of Lyons Creek in Zone 5. This species is considered Provincially Rare (S1) by NHIC.

Reptiles

17. **Midland Painted Turtle (*Chrysemys picta marginata*)** was documented in many locations throughout the Study Area. Certain areas with a high concentration of basking individuals (particularly in early spring) are indicated on **Figure 8** and **Figure 9**. In general, Midland Painted Turtle basking activity is concentrated in the eastern half of the Study Area (i.e., Areas B and C). Very few Midland Painted Turtles were documented basking in Area A, as Lyons Creek through much of this area is significantly narrowed (~10 to 15 m) and lacks marshy margins with aquatic vegetation.
18. **Snapping Turtle (*Chelydra serpentina*)** was documented in several locations within Lyons Creek, with additional observations of nesting individuals (particularly near the Welland By-pass and Buchner Road railway crossing).

6 DATA GAPS

Certain data limitations and gaps associated with the completion of this ESR bear highlighting to support data interpretation.

Throughout the course of the study, property accesses were only granted for two (2) abutting parcels on the north side of Lyons Creek in Areas A and B (west of Highway 140). This includes lands owned by the St. Lawrence Seaway Management Corporation (SLSMC) which abut the Welland By-pass along with 327 Highway 140. Permission to access a third parcel at 144 Ridge Road was granted late during the investigation, permitting a single, reconnaissance-level site visit in July 2024. Targeted wildlife surveys were often conducted via canoe. Should any sediment remediation activities be proposed on lands which were not ecologically surveyed through this ESR, further screening for potential natural heritage impacts and regulatory implications will be necessary.

The following additional data gaps which may have bearing on selection of the preferred SMO alternative and the final design of the undertaking are highlighted as follows:

- Targeted surveys for fish and mussels were beyond the scope of this ESR. The fish community has been inferred based on existing data from six (6) stations sampled in 2004 (Marson et al. 2009) which are summarized in **Table 3**. DFO does not possess any mussel survey data for the Study Area (T. Morris pers. comm. 2024). **DFO may request the completion of fish and/or mussel surveys (which may involve eDNA) to support regulatory review of the sediment remediation works pursuant to the *Fisheries Act*.**
- Targeted surveys for Endangered bats were beyond the scope of this ESR, as was completion of targeted, playback surveys for Red-headed Woodpecker (*Melanerpes erythrocephalus*). Bats and Red-headed Woodpecker both occupy wooded and other treed areas. **Should the sediment remediation works require encroachment into any wooded areas (see Figure 8 and Figure 9) particularly to support handling/stockpiling and/or machinery accesses, surveys for such species (and/or further engagement with MECP) may be required.**
- While turtles were observed to be abundant and concentrated in certain areas of high basking activity (see **Figure 8** and **Figure 9**), and multiple nesting sites were documented, turtle overwintering locations are unknown. If any sediment remediation works occur during turtle overwintering (generally November 1 to March 30 in southern Ontario), potentially severe impacts would be expected if the works envelope overlaps with a hibernation site (which may be attended by many individuals). **Timing the sediment removal activities**

outside of the turtle overwintering period may be advisable, otherwise radio telemetry could be undertaken to clarify at least some areas of overwintering.

- Green Heron was documented on several occasions (either a single individual or perhaps separate individuals) by Terrastory staff during the 2024 fieldwork program, along with Great Blue Heron (*Ardea herodias*) and Great Egret (*Ardea alba*). While no nests or nesting individuals were documented, Green Heron, Great Blue Heron, and Great Egret nests receive permanent, year-round protection under the 2022 Migratory Birds Regulations pursuant to the *Migratory Birds Convention Act* (see **Section 7.8**). Buffers around nesting waterbirds are context specific but can range up to several hundred metres or more. **Targeted surveys for Green Heron nests or nesting individuals (or that of other waterbirds) may be required to confirm regulatory implications pursuant to the *Migratory Birds Convention Act* and *Fish and Wildlife Conservation Act*.**
- While complete avoidance of impacts to aquatic vegetation cannot be achieved during sediment removal activities, certain aquatic plant species are less sensitive to disturbance than others. Sediment removal in areas with dense coverage by fixed-floating species such as White Water-lily and/or broad-leaved emergent species such as Water Smartweed should be avoided to the extent possible, whereas free-floating and/or submerged aquatic vegetation which dominates open water areas are less likely to be impacted (and can be successfully relocated following site isolation). The scale of vegetation community mapping (per **Figure 6** and **Figure 7**) does not typically permit small patches of vegetation to be delineated. **Highly-refined aquatic vegetation mapping could be undertaken once the preferred areas of sediment removal are specified to assist with the impact assessment.**
- Several aggressive, invasive vascular plant species were documented within or along the wetted margins of Lyons Creek within the Study Area, particularly European Reed, Purple Loosestrife, Curly-leaved Pondweed, Eurasian Water-milfoil, and Brittle-leaved Naiad. Many other invasive plant species were also documented which are either less established, restricted to the valley slope/tablelands, or only marginally outcompete more desirable native species for resources and space. No efforts to map the spatial configuration of invasive plant species colonization were expended during this study. **A list of priority invasive plant species could be prepared for the Study Area supported by a mapping exercise which spatially articulates their current distribution.** Such efforts could help clarify the risks of facilitating their spread during or post completion of the sediment remediation works and guide the determination of treatment options (if deemed warranted).

7 REGULATORY CONSIDERATIONS

There are several legislative and regulatory requirements that must be addressed prior to undertaking the sediment remediation works. Once a remedial solution(s) is selected, an impact assessment / environmental assessment process will be completed to address relevant provincial *Environmental Assessment Act* and federal *Impact Assessment Act* requirements. Below is a list of some relevant regulations; however, the list may not be comprehensive.

7.1 O. Reg. 41/24, pursuant to the *Conservation Authorities Act*, R.S.O. 1990, c. C.27

NPCAs regulatory jurisdiction includes areas within and adjacent to valley and stream corridors, the Lake Erie shoreline, hazard lands (e.g., floodplains, steep slopes), watercourses, and wetlands as provided under O. Reg. 41/24 of the *Conservation Authorities Act*. NPCA's Policy Document provides guidance for the administration of O. Reg. 41/24.

NPCA regulates development and site alteration (including fill placement and grade changes) within 15 m of the stable top of bank/slope associated with a confined valleyland and within 30 m of all wetlands. Permission to "develop" within a regulated area must establish how the five tests of development within or adjacent to "hazardous land" have been met. More specifically, development is only permitted if (in the opinion of the Authority) the control of 1) flooding, 2) erosion, 3) dynamic beaches, 4) unstable soil, or 5) bedrock will not be affected.

Permission from NPCA under O. Reg. 41/24 is expected to be required to facilitate implementation of the sediment remediation works.

7.2 Provincial *Endangered Species Act*, S.O. 2007, c. 6

The provincial *Endangered Species Act* (ESA) is administered by MECP and protects designated Endangered and Threatened species in Ontario from being killed, harmed, or harassed (s. 9) or having their habitat damaged or destroyed (s. 10). The protection afforded to Endangered and Threatened species "habitat" is either prescribed by O. Reg. 832/21, or (for those species that lack regulated habitat) is defined as *an area on which the species depends, directly or indirectly, to carry on its life processes, including life processes such as reproduction, rearing, hibernation, migration or feeding.* Development activities that constitute habitat damage and/or destruction typically require permitting under section 17 of the ESA, or proceed through registration of the activity as a conditional exemption under O. Reg. 242/08 or O. Reg. 830/21 (where applicable).

Lake Chubsucker is known from the Study Area (see **Section 5**) and receives "general" habitat protection under the ESA. The provincial Lake Chubsucker Recovery Strategy (MNR 2012) recommends that areas of "critical habitat" identified in Section 2.7.1 of the federal Recovery Strategy for the Lake Chubsucker in Canada (Staton et al. 2010) be applied to delimit the spatial extent of "habitat". The federal Recovery Strategy recommended that "all contiguous waters and wetlands located upstream of Montrose Rd. to the Welland Canal" be considered "critical habitat", including all contiguous segments/reaches "from the uppermost stream segment with the species present to the lowermost stream segment with the species present". This section of Lyons Creek was considered reasonably homogeneous such that the species was assumed to likely be present throughout; however, distinct changes in habitat occur downstream of Montrose Road (where the creek is channelized). A Critical Habitat Order was published in the Canada Gazette in 2018 (Vol. 152, No. 15) providing greater certainty in relation to "critical habitat" of Lake Chubsucker in the context of SARA. Clause 2(1)(e) of the Critical Habitat Order is reproduced as follows:

> *(e) all contiguous waters and wetlands of Lyons Creek, Ontario, from the Welland Canal (latitude 42°58'29.038"N, longitude 79°13'12.175" W) to Montrose Road (latitude 43°00'19.797" N, longitude 79°07'25.073" W), as illustrated in Map 5 of the schedule.*

Mapping which accompanies the Critical Habitat Order indicates that Lake Chubsucker has been captured in several locations spanning each Sediment Management Area (A, B, and C) based on sampling in 2004 (summarized in **Table 3** herein) and 2008.

It can be safely assumed that the sedimentation remediation works overlap with habitat for Lake Chubsucker as defined under the provincial ESA (and federal SARA). Once sufficient details pertaining to the works are available, it is recommended that the project team formally engage with MECP staff in relation to potential regulatory requirements related to undertaking works within Lake Chubsucker habitat. Engagement with MECP staff in the Permissions Division of SAR Branch

typically commences with the circulation of an Information Gathering Form (IGF). In addition to Lake Chubsucker, other Endangered/Threatened species which may occur within the Study Area (e.g., bats, Red-headed Woodpecker) have some potential to be impacted, depending on the selected SMO alternative and overall design (see also **Section 6**).

7.3 Provincial *Public Lands Act*, R.S.O. 1990, c. P.43

The *Public Lands Act* (PLA) is administered by MNR and governs activities on both public land (including the beds of certain waterbodies) and "shore lands" (any lands covered or seasonally inundated by water). A work permit under O. Reg. 239/13 pursuant to the PLA is typically required whenever filling or dredging of shorelands is proposed, or removal of aquatic vegetation.

Further engagement with MNR is recommended to clarify any regulatory implications of the works in the context of the provincial PLA.

7.4 Provincial *Ontario Water Resources Act*, R.S.O., c. O.40

The *Ontario Water Resources Act* regulates use of and discharge to surface and groundwater resources in the province. This includes sewage disposal and sewage works, discharge of polluting materials that may impair water quality, and administration of permits to take water (PTTW).

Dewatering may be required to support the future works. A PTTW must be secured for any water diversions greater than 50,000 L/day.

7.5 Provincial *Environmental Protection Act*, R.S.O., c. E.19

The *Environmental Protection Act* requires securement of an Environmental Compliance Approval (ECA) for any wastewater and waste treatment works installed at the site to manage (i.e., treat and dispose of) wastewater and/or sediment (if required).

7.6 Federal *Fisheries Act*, R.S.C. 1985, c. F-14

The amended federal *Fisheries Act* (Bill C-68) received Royal Assent in June 2019 while the updated fish and fish habitat protection provisions came into force in August 2019. Subsection 34.4(1) of the amended *Fisheries Act* prohibits all work, undertaking, or activity from causing the death of fish (other than fishing). Subsection 35(1) requires that project activities not result in the "*harmful alteration, disruption or destruction of fish habitat*" (HADD) unless undertaken in accordance with the requirements of a statutory exemption per subsection 35(2). Based on the Fish and Fish Habitat Protection Policy Statement (August 2019), HADD is interpreted by DFO to include "*any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes of fish*".

Once sufficient details pertaining to the undertaking are available, it is recommended that the project team formally engage with DFO to clarify regulatory requirements under the *Fisheries Act* through submission of a Request for Review (RfR). The sediment remediation works must follow a set of minimum standards including avoidance of in-water works during the restricted activity period and adherence to relevant DFO Standards and Codes of Practice.

7.7 Federal *Species at Risk Act*, S.C. 2002, C. 29

The *Species at Risk Act* (SARA) was enacted to prevent wildlife and plant species in Canada from disappearing, and to enable legislative provisions intended to recover and/or manage listed species.

Section 32 of SARA protects extirpated, endangered, or threatened species listed on Schedule 1 from being killed, harmed, harassed, captured, or taken, while section 33 prohibits damage or destruction of their "residence" (where applicable). Subsection 58(1) prohibits the destruction of "Critical Habitat" as described in the relevant recovery strategy or action plan.

While COSEWIC is the independent, scientific body responsible for assessing a species' status in Canada, the decision to proceed with listing such species under Schedule 1 of SARA is made by the Governor in Council per subsection 27(1.1). Further, protection of a species' Critical Habitat can only occur once the federal Recovery Strategy has been finalized and a Critical Habitat Order is issued. Finally, protections afforded to listed species (s. 32), their Residence (s. 33), and their Critical Habitat (s. 58) generally only apply to federal lands excepting aquatic species and migratory birds (or where a Ministerial order has been issued).

The federal Recovery Strategy for the Lake Chubsucker in Canada was finalized in 2010 (Staton et al. 2010) with a Critical Habitat Order published in 2018. Under SARA, Critical Habitat protection takes regulatory effect via a Ministerial Order issued within 180 days of being identified. Once sufficient details pertaining to the undertaking are available, further discussions with DFO (who administers SARA in respect of "aquatic species") are recommended to clarify regulatory requirements under SARA. Such discussions should occur jointly with MECP to ensure consistency in approach and mitigation.

7.8 Federal *Migratory Birds Convention Act*, S.C. 1994, c. 22

Subsection 5(1) of the Migratory Birds Regulations (2022) under the *Migratory Birds Convention Act, 1994* (MBCA) prohibits the disturbance or destruction of nests, eggs, or nest shelters of a migratory bird without authorization. Subsection 5(2) of the Migratory Birds Regulations allows for damage or destruction of nests which lack a live bird or viable egg with the exception of inactive nests associated with species listed under Schedule 1. In Ontario, the nests of Schedule 1 species are afforded year-round protection (i.e., regardless of the presence or absence of a live bird or viable egg), inclusive of the following species:

- Black-crowned Night Heron (*Nycticorax nycticorax*)
- Cattle Egret (*Bubulcus ibis*)
- Great Blue Heron (*Ardea herodias*)
- Great Egret (*Ardea alba)*
- Green Heron (*Butorides virescens*)
- Pileated Woodpecker (*Dryocopus pileatus*)
- Snowy Egret (*Egretta thula*)

The provincial *Fish and Wildlife Conservation Act, 1997* (FWCA) extends the protection of bird nests and eggs to certain non-migratory species not listed under the Migratory Birds Regulations (e.g., Corvids, Strigids, Accipitrids). Section 7(1) of the FWCA prohibits a person from destroying, taking, or possessing the nest or eggs of a bird that belongs to a species that is wild by nature. Section 7(3) identifies that section 7(1) of the FWCA does not apply to a person who destroys, takes, or possesses the nest or eggs of a bird described in subsection (a) in accordance with the authorization of the Minister, or subsection (b) in the circumstances prescribed by the regulations. The nests of certain non-migratory bird species are not protected under the FWCA (e.g., Red-winged Blackbird).

It is expected that some degree of woody and emergent vegetation clearance and disturbance will be required to support the sediment removal efforts. Such activities will be subject to a timing restriction to protect nesting birds and bird nests (i.e., vegetation removals to occur between September 1 and March 31).

Green Heron was documented on several occasions (either a single individual or perhaps separate individuals) by Terrastory staff during the 2024 fieldwork program, along with Great Blue Heron and Great Egret. The nests of Green Heron, Great Blue Heron, and Great Egret receive year-round protection. It may be necessary to perform additional, targeted surveys for nesting waterbirds in advance of the sediment remediation works, though this will depend on the spatial configuration of the works and any associated access or staging areas.

8 CONCLUSIONS

The preceding Ecological Study Report provides an overall characterization of the natural environment occurring within and adjacent to a contaminated section of Lyons Creek stretching between the Welland By-pass and Buchner Road in Welland, Ontario. Included herein is a comprehensive biophysical analysis of the Study Area with reference to its historical context, existing ecological setting, and identified significant species and habitats. Data gaps have been identified where relevant to support regulatory considerations and selection of the preferred Sediment Management Option(s).

This Ecological Study Report has revealed the presence of the following significant natural features:

- Various wetland communities associated with the Provincially Significant Lyons Creek Wetland Complex, extending through the eastern section of Area A and much of the remaining Study Area.
- Habitat for two Species at Risk fishes, including the Endangered Lake Chubsucker and Special Concern Grass Pickerel.
- Direct warmwater fish habitat (and probable mussel habitat).
- Significant wildlife habitats beyond the waters edge, such as overwintering habitat for snakes and other habitats for species of conservation interest (Yellow-fruited Sedge, Smartweed Dodder).
- Woodlands and other treed areas which may provide roosting habitat for Endangered bats.

Selection of a preferred SMO(s), being undertaken through a separate project, will take into consideration the results of this ecological study as well as several other technical studies and factors (natural heritage, geotechnical, cost, etc.). From a natural heritage perspective, it is noted that managing the PCB-contaminated sediments will involve significantly altering the existing bed of Lyons Creek (which forms part of a PSW). There are regulatory implications related to the placement or removal of materials within a fish-bearing waterbody (Lyons Creek) containing habitat for a provincially and federally designated Endangered species (Lake Chubsucker). Additional biophysical surveys and/or analyses may be required (see **Section 6**) to close data gaps and clarify relevant regulatory implications once sufficient details pertaining to the preferred SMO(s) become available.

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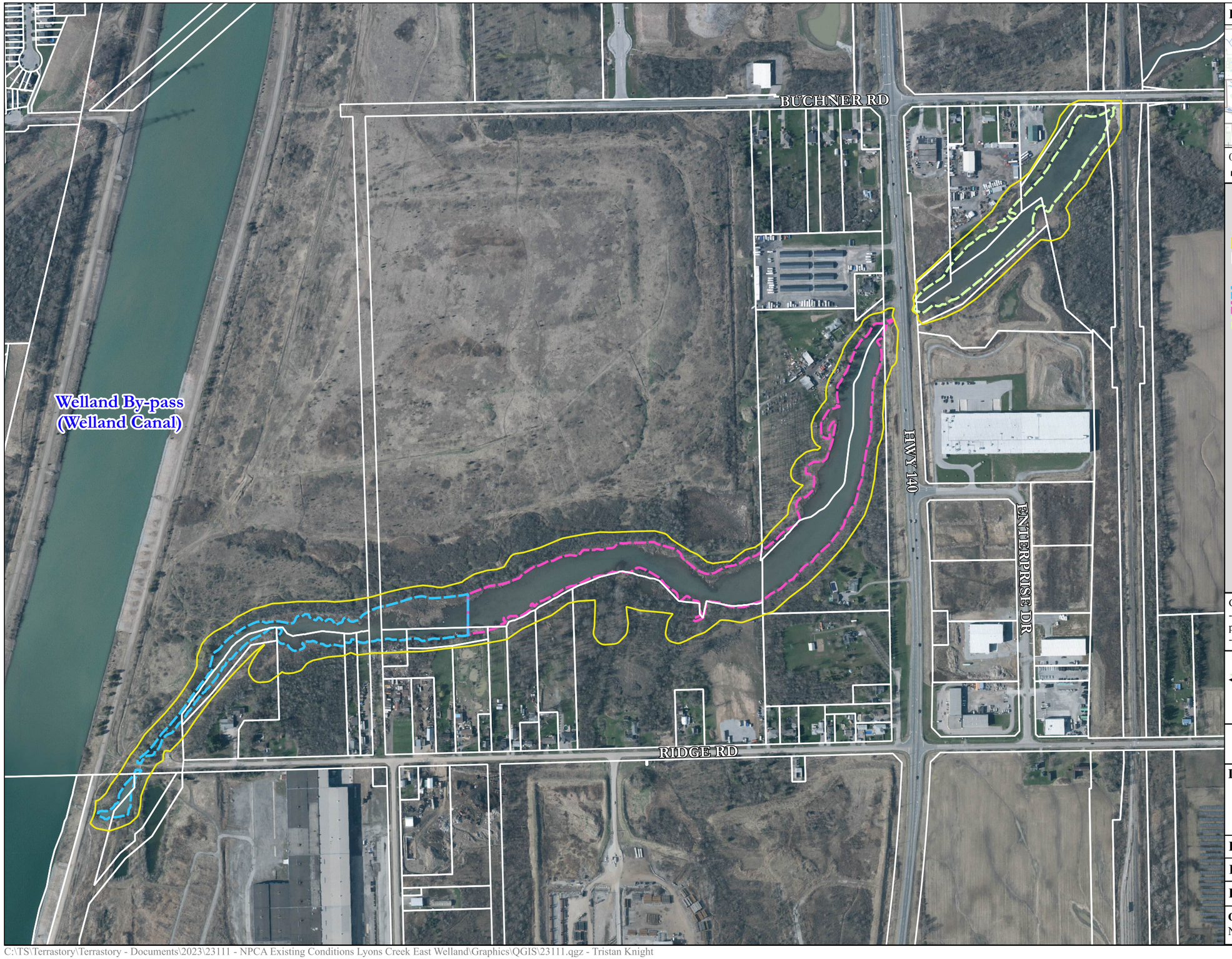

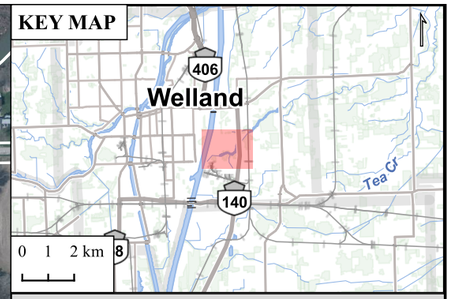

Legend

Area of Assessment

- Study Area (Lyons Creek Top of Bank + 15 m)
- Assessment Parcels

Sediment Management Areas

- Area A
- Area B
- Area C

GENERAL NOTES:
-Features depicted herein should not be used in place of a professional survey.
-Numeric scale is for a 11x17 inch print.

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Location:
Lyons Creek East Study Area,
City of Welland

Project No.: 23111
Date: 2024-10-31
By: JC **Checked:**TK
Orthophotograph Date: Niagara Region, 2020.

Figure 1:
Location of the Study Area and Sediment Management Areas

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PELHAM

THOROLD

CITY OF WELLAND

CROWLAND

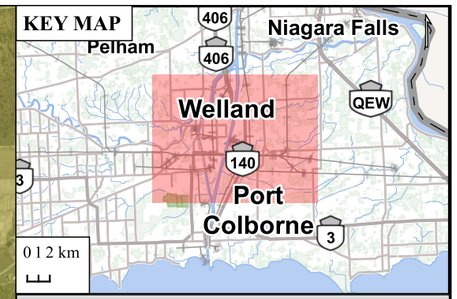
CITY OF NIAGARA FALLS

WAINFLEET

HUMBERSTONE

CITY OF PORT COLBORNE

KEY MAP



Legend

Area of Assessment

- Study Area (Lyons Creek Top of Bank + 15 m)
- Historical Geographic Townships
- Lower-tier Municipalities
- Lyons Creek Subwatershed

GENERAL NOTES:
-Features depicted herein should not be used in place of a professional survey.
-Numeric scale is for a 11x17 inch print.

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Location:

Lyons Creek East Study Area,
City of Welland

Project No.: 23111

Date: 2024-10-31

By: JC **Checked:**TK

Orthophotograph Date:
Niagara Region, 2020.

Figure 2:

Location of the Study Area with Municipalities and Geographic Townships

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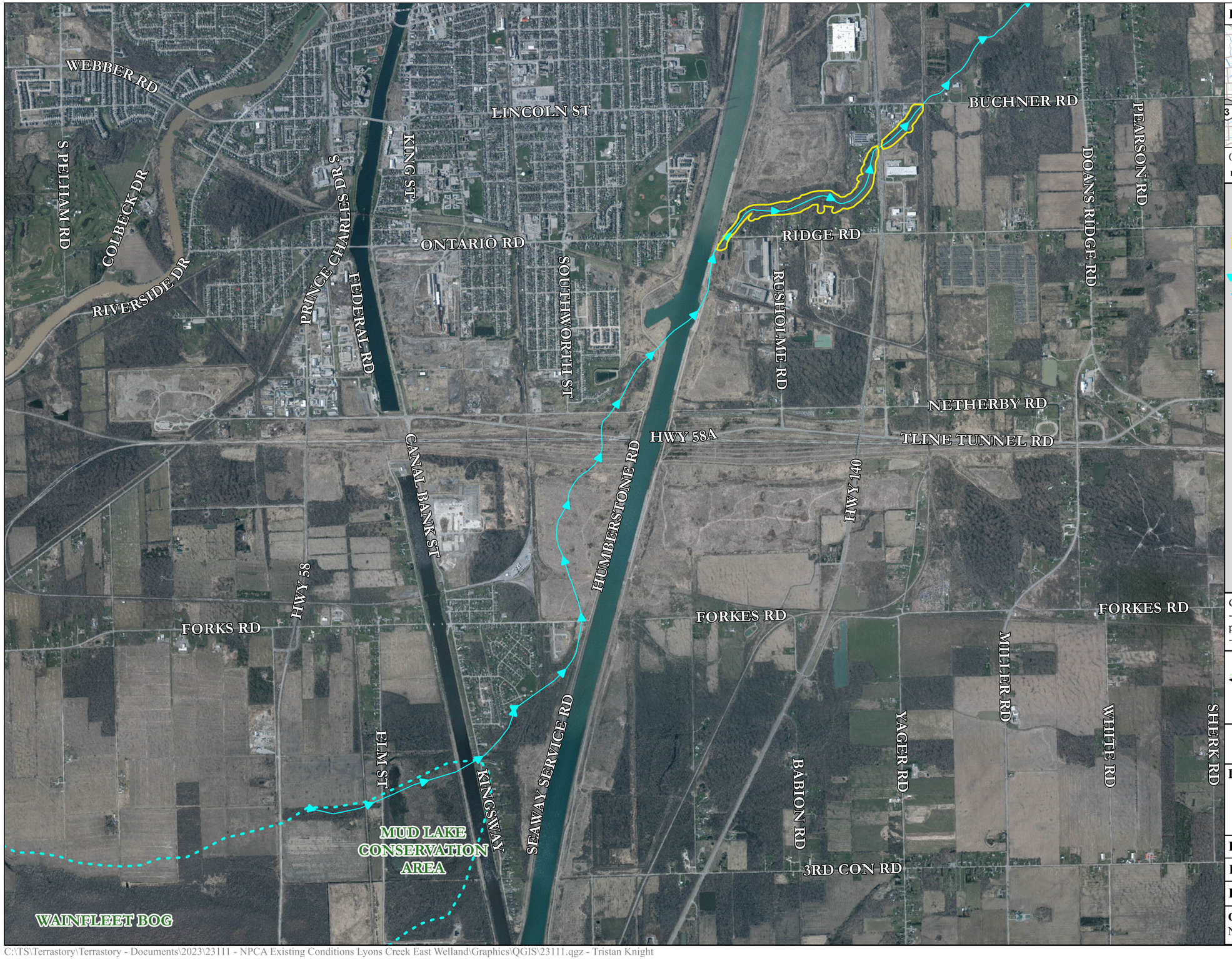

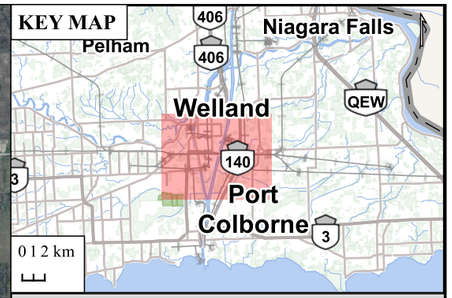

Legend

Area of Assessment

Study Area (Lyons Creek Top of Bank + 15 m)

Historical Conditions

Original Alignment of Lyons Creek (approx.)

Original Margin of Wainfleet Bog (approx.)

GENERAL NOTES:
-Features depicted herein should not be used in place of a professional survey.
-Numeric scale is for a 11x17 inch print.

TERRASTORY
environmental consulting inc.
info@terrastoryenviro.com 905.745.5398

N | 1:30,000 | 0 250 500 750 1,000 m

Location:
Lyons Creek East Study Area,
City of Welland

Project No.: 23111

Date: 2024-10-31

By: JC **Checked:**TK

Orthophotograph Date: Niagara Region, 2020.

Figure 3:
Historical Alignment of Lyons Creek

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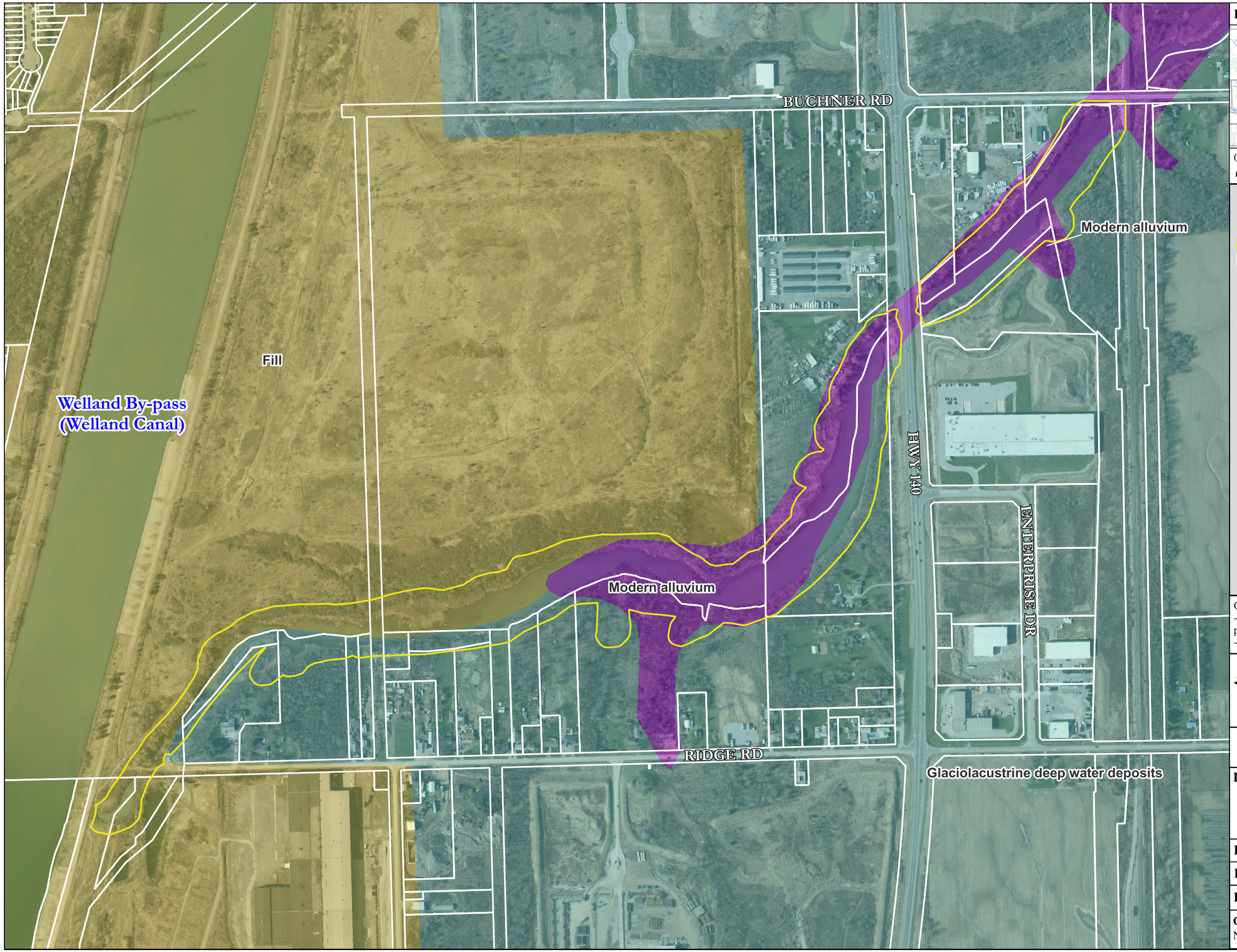
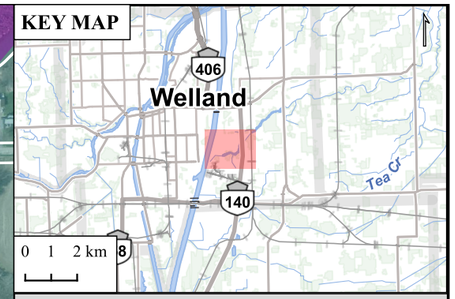


KEY MAP



Legend

Area of Assessment
- Study Area (Lyons Creek Top of Bank + 15 m)
- Assessment Parcels

Surficial Geology
- Fill (Spoils from Welland By-pass Excavation)
- Glaciolacustrine Deep Water Deposits
- Modern Alluvium

GENERAL NOTES:
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-Numeric scale is for a 11x17 inch print.

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N | 1:6,000 | 0 50 100 150 200 m

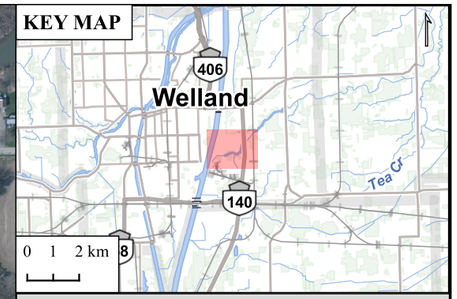
Location:
Lyons Creek East Study Area,
City of Welland

Project No.: 23111
Date: 2024-10-31
By: JC **Checked:**TK
Orthophotograph Date: Niagara Region, 2020.

Figure 4:
Physiography

C:\TS\Terrastory\Terrastory - Documents\2023\23111 - NPCA Existing Conditions Lyons Creek East Welland\Graphics\QGIS\23111.qgz - Tristan Knight

KEY MAP



Legend

Area of Assessment

- Study Area (Lyons Creek Top of Bank + 15 m)

Survey Stations - Terrastory

- Anuran Calling Stations
- Breeding Bird and Marsh Bird Survey Stations
- Nightjar Survey Stations
- Overwintering Bird Survey Stations

Survey Stations - DFO

- Fish Sampling Stations

GENERAL NOTES:
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N | 1:6,000 | 0 50 100 150 200 m

Location:
Lyons Creek East Study Area,
City of Welland

Project No.: 23111
Date: 2024-10-31
By: JC **Checked:**TK
Orthophotograph Date: Niagara Region, 2020.

Figure 5:
Fish and Wildlife Survey Stations

C:\TS\Terrastory\Terrastory - Documents\2023\23111 - NPCA Existing Conditions Lyons Creek East Welland\Graphics\QGIS\23111.qgz - Tristan Knight

ELC Vegetation Community Codes:
CVC - Commercial and Institutional
CVR_1 - Low Density Residential
FODM2-4 - Dry – Fresh Oak – Hardwood Deciduous Forest
FODM7-1 - Fresh – Moist White Elm Lowland Deciduous Forest
FODM7-2 - Fresh – Moist Green Ash - Hardwood Lowland Deciduous Forest
FODM7-8 - Fresh - Moist Norway Maple Lowland Deciduous Forest
MAMM1-12 - Common Reed Graminoid Mineral Meadow Marsh
MASM1-1 - Cattail Mineral Shallow Marsh
MASM1-4 - Narrow-leaved Sedge Mineral Shallow Marsh
MASO2-3 - Water Willow Organic Shallow Marsh
SAF1-1 - Water Lily - Bullhead Lily Floating-leaved Shallow Aquatic
SAM1-8 - Water Lily – Bullhead Lily Mixed Shallow Aquatic
SAS1-4 - Water Milfoil Submerged Shallow Aquatic
SWTM5-1 - Buttonbush Mineral Deciduous Thicket Swamp
THDM2 - Dry - Fresh Deciduous Shrub Thicket
THDM2-6 - Buckthorn Deciduous Shrub Thicket
THDM4-1 - Native Deciduous Regeneration Thicket

Welland By-pass
(Welland Canal)

THDM2-6
MASO2-3
MASM1-1
SAM1-8
SAF1-1
FODM7-2
MASM1-4
SWTM5-1
FODM2-4
MASM1-1
MASM1-1
SAF1-1
THDM2
MASM1-1
CVR_1
CVC
FODM7-1
CVR_1
CVR_1
MASO2-3
MAMM1-12
MASM1-1
MAMM1-12
FODM7-8
THDM4-1
SAS1-4
RIDGE RD
RUSHOLME RD

Legend

Area of Assessment
- Study Area (Lyons Creek Top of Bank + 15 m)

Sediment Management Areas
- Area A
- Area B

Built Structures and Infrastructure

Watercourse Crossing Structures
- Ridge Road Bridge

Biophysical Features and Conditions

Terrain
- Topographic Contours (1 m; SWOOP DTM)

Vegetation Communities
- Forest
- Thicket
- Swamp
- Marsh
- Shallow Water
- Constructed

Surface Water Features
- Lyons Creek
- Open Water

GENERAL NOTES:
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info@terrastoryenviro.com 905.745.5398

N | 1:3,500 | 0 25 50 75 100 125 m

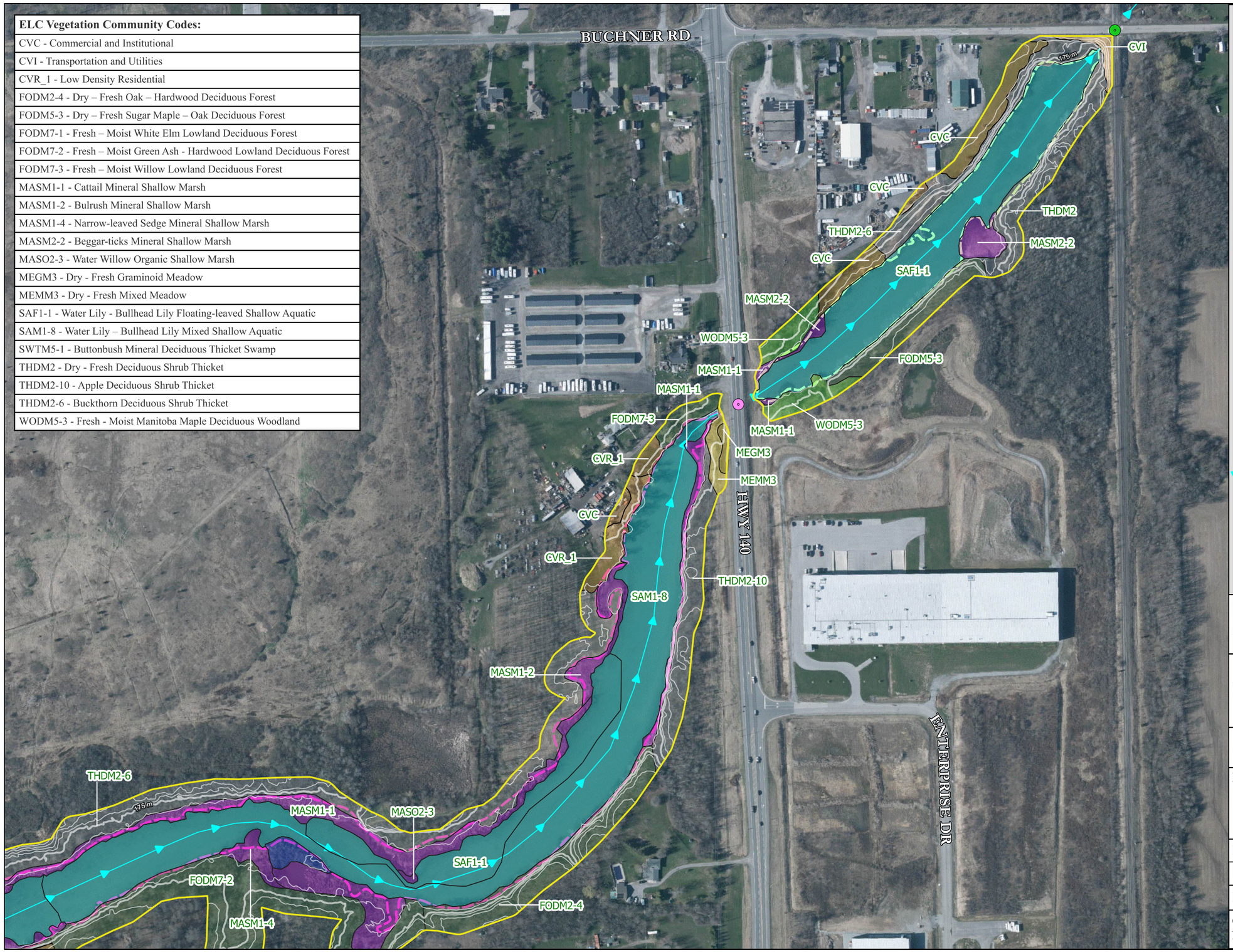
Location:
Lyons Creek East Study Area,
City of Welland

Project No.: 23111
Date: 2024-10-31
By: JC **Checked:**TK
Orthophotograph Date: Niagara Region, 2020.

Figure 6:
Biophysical Features and Conditions (West)

C:\TS\Terrastory\Terrastory - Documents\2023\23111 - NPCA Existing Conditions Lyons Creek East Welland\Graphics\QGIS\23111.qgz - Tristan Knight

ELC Vegetation Community Codes:
CVC - Commercial and Institutional
CVI - Transportation and Utilities
CVR_1 - Low Density Residential
FODM2-4 - Dry – Fresh Oak – Hardwood Deciduous Forest
FODM5-3 - Dry – Fresh Sugar Maple – Oak Deciduous Forest
FODM7-1 - Fresh – Moist White Elm Lowland Deciduous Forest
FODM7-2 - Fresh – Moist Green Ash - Hardwood Lowland Deciduous Forest
FODM7-3 - Fresh – Moist Willow Lowland Deciduous Forest
MASM1-1 - Cattail Mineral Shallow Marsh
MASM1-2 - Bulrush Mineral Shallow Marsh
MASM1-4 - Narrow-leaved Sedge Mineral Shallow Marsh
MASM2-2 - Beggar-ticks Mineral Shallow Marsh
MASO2-3 - Water Willow Organic Shallow Marsh
MEGM3 - Dry - Fresh Graminoid Meadow
MEMM3 - Dry - Fresh Mixed Meadow
SAF1-1 - Water Lily - Bullhead Lily Floating-leaved Shallow Aquatic
SAM1-8 - Water Lily – Bullhead Lily Mixed Shallow Aquatic
SWTM5-1 - Buttonbush Mineral Deciduous Thicket Swamp
THDM2 - Dry - Fresh Deciduous Shrub Thicket
THDM2-10 - Apple Deciduous Shrub Thicket
THDM2-6 - Buckthorn Deciduous Shrub Thicket
WODM5-3 - Fresh - Moist Manitoba Maple Deciduous Woodland



Legend

Area of Assessment
- Study Area (Lyons Creek Top of Bank + 15 m)

Sediment Management Areas
- Area B
- Area C

Built Structures and Infrastructure

Watercourse Crossing Structures
- Highway 140 CSP Arch Culvert
- Buchner Road CSP Arch Culvert

Biophysical Features and Conditions

Terrain
- Topographic Contours (1 m; SWOOP DTM)

Vegetation Communities
- Forest
- Woodland
- Thicket
- Meadow
- Swamp
- Marsh
- Shallow Water
- Constructed

Surface Water Features
- Lyons Creek

GENERAL NOTES:
-Features depicted herein should not be used in place of a professional survey.
-Numeric scale is for a 11x17 inch print.

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1:3,500

0 25 50 75 100 125 m

Location:
Lyons Creek East Study Area,
City of Welland

Project No.: 23111

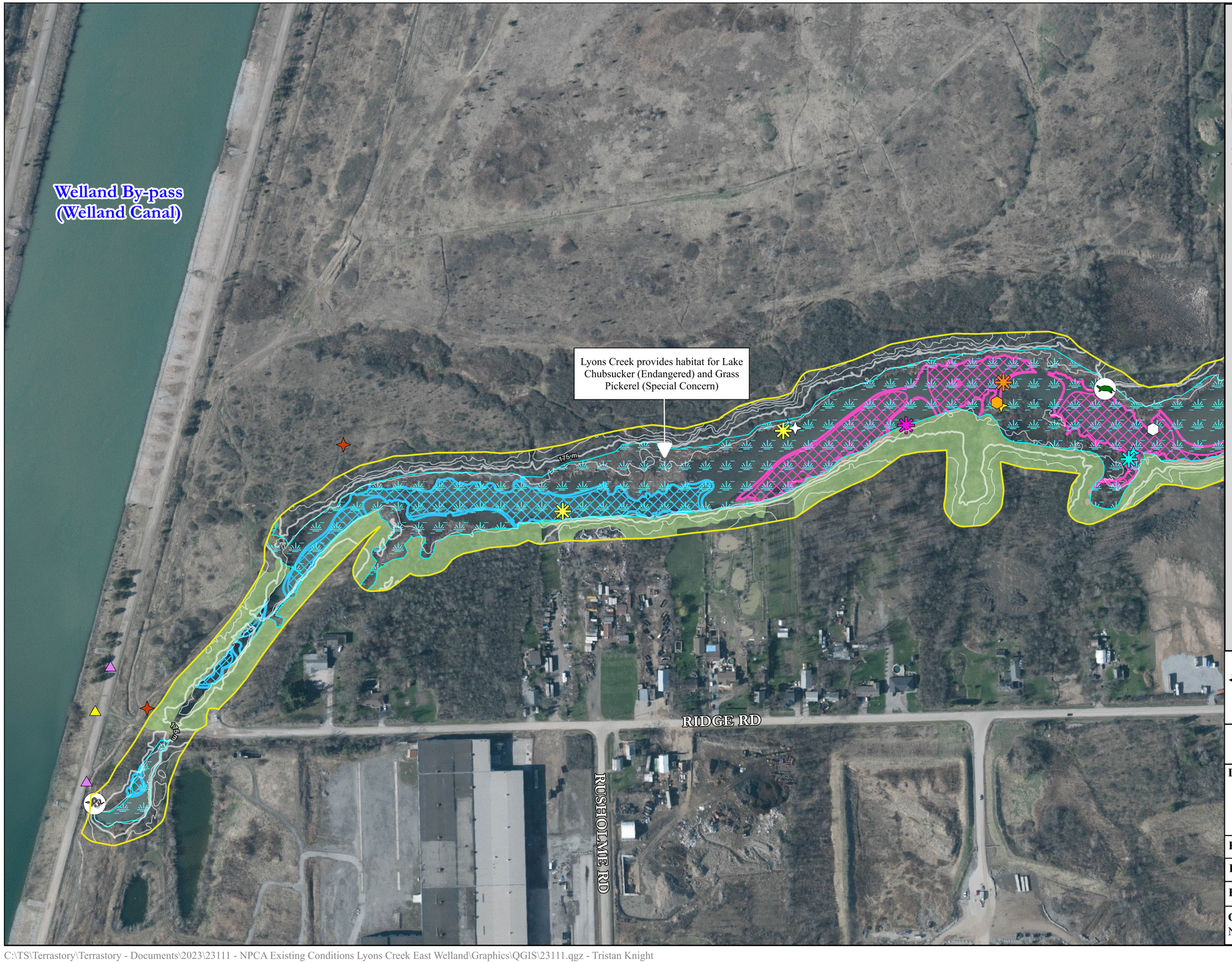
Date: 2024-10-31

By: JC **Checked:**TK

Orthophotograph Date:
Niagara Region, 2020.

Figure 7:
Biophysical Features and Conditions (East)

C:\TS\Terrastory\Terrastory - Documents\2023\23111 - NPCA Existing Conditions Lyons Creek East Welland\Graphics\QGIS\23111.qgz - Tristan Knight



Legend

Area of Assessment
- Study Area (Lyons Creek Top of Bank + 15 m)

PCB Sediment Concentrations > 50 ppm
- Area A
- Area B

PCB Sediment Concentrations > 40 ppm
- Area A
- Area B

Biophysical Features and Conditions

Terrain
- Topographic Contours (1 m; SWOOP DTM)

Significant Natural Features - Terrastory

Significant Species
- Yellow Fruited Sedge (Carex annectens var. xanthocarpa)
- Smartweed Dodder (Cuscuta polygonorum)
- Nuttall's Waterweed (Elodea nuttallii)
- Floating Crystalwort (Riccia fluitans)
- Monarch (Danaus plexippus) - Caterpillar
- American Copper (Lycaena phlaes)
- Prince Baskettail (Epitheca princeps)
- Cyrano Darner (Nasiaeschna pentacantha)
- Elegant Spreadwing (Lestes inaequalis)
- Vesper Bluet (Enallagma vesperum)
- Suspected Snake Overwintering Area
- High Concentration Turtle Basking Area
- Turtle Nesting - Snapping Turtle
- Turtle Nesting - Species Unknown

Significant Natural Features
- Provincially Significant Lyons Creek Wetland Complex
- Woodlands

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N | 1:3,500 | 0 25 50 75 100 125 m

Location:
Lyons Creek East Study Area,
City of Welland

Project No.: 23111

Date: 2024-10-31

By: JC **Checked:** TK

Orthophotograph Date: Niagara Region, 2020.

Figure 8:
Significant Species and Natural Feature Mapping (West)

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BUCHNER RD

HWY 140

ENTERPRISE DR

175 m

Lyons Creek provides habitat for Lake Chubsucker (Endangered) and Grass Pickerel (Special Concern)

Legend

Area of Assessment
- Study Area (Lyons Creek Top of Bank + 15 m)

PCB Sediment Concentrations > 50 ppm
- Area B
- Area C

PCB Sediment Concentrations > 40 ppm
- Area B
- Area C

Biophysical Features and Conditions

Terrain
- Topographic Contours (1 m; SWOOP DTM)

Significant Natural Features - Terrastory

Significant Species
- Smartweed Dodder (Cuscuta polygonorum)
- Nuttall's Waterweed (Elodea nuttallii)
- Floating Crystalwort (Riccia fluitans)
- Common Nighthawk (Chordeiles minor)
- Monarch (Danaus plexippus) - Caterpillar
- American Copper (Lycaena phlaes)
- Canada Darner (Aeshna canadensis)
- Prince Baskettail (Epitheca princeps)
- Cyrano Darner (Nasiaeschna pentacantha)
- Elegant Spreadwing (Lestes inaequalis)
- Slender Spreadwing (Lestes rectangularis)
- Vesper Bluet (Enallagma vesperum)
- Suspected Snake Overwintering Area
- High Concentration Turtle Basking Area
- Turtle Nesting - Snapping Turtle
- Turtle Nesting - Species Unknown
- Barn Swallow (Hirundo rustica) - Nest Location

Significant Natural Features
- Provincially Significant Lyons Creek Wetland Complex
- Woodlands

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info@terrastoryenviro.com 905.745.5398

N

1:3,500

0 25 50 75 100 125 m

Location:

Lyons Creek East Study Area,
City of Welland

Project No.: 23111

Date: 2024-10-31

By: JC **Checked:** TK

Orthophotograph Date: Niagara Region, 2020.

Figure 9:

Significant Species and Natural Feature Mapping (East)

C:\TS\Terrastory\Terrastory - Documents\2023\23111 - NPCA Existing Conditions Lyons Creek East Welland\Graphics\QGIS\23111.qgz - Tristan Knight

Appendix 1. Representative Photographs

Photo 1. Monarch (*Danaus plexippus*) caterpillar feeding on Swamp Milkweed (*Asclepias incarnata*) (27 July 2023).

Photo 2. Dense monoculture of European Reed (*Phragmites australis* ssp. *australis*) (17 August 2023).

Photo 3. Fragrant Water-lily (*Nymphaea odorata* ssp. *odorata*) and Water Stargrass (*Heteranthera dubia*) in floating aquatic vegetation community (24 August 2023).

Photo 4. Water Smartweed (*Persicaria amphibia* var. *stipulacea*) bounding the edge of shallow mash (24 August 2023).

Photo 5. Manicured grass associated with a residential area bordering Lyons Creek (24 August 2023).

Photo 6. Typical interface between floating-leaved aquatic community (SAF1-1) and cattail dominated shallow marsh (MASM1-1) (24 August 2023).

Photo 7. Sedge dominated mineral shallow marsh (MASM1-4) (24 August 2023).

Photo 8. Female Snapping Turtle (*Chelydra serpentina*) moving away from freshly dug nest (06 June 2024).

Photo 9. Lyons Creek facing downstream in Area A (13 June 2024).

Photo 10. Lyons Creek facing upstream in Area A (13 June 2024).

Photo 11. Northern Leopard Frog (*Lithobates pipiens*)(13 June 2024).

Photo 12. Regenerating areas on the tablelands near Area A at the western edge of the Study Area (13 June 2024).

Appendix 2. Vascular Plant List

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Acer negundo	Manitoba Maple	Aceraceae	S5	X	0	0
Acer platanoides	Norway Maple	Aceraceae	SNA	IX	0	5
Acer saccharum	Sugar Maple	Aceraceae	S5	X	4	3
Acer x freemanii	Freeman's Maple	Aceraceae	SNA	hybrid	6	-5
Achillea millefolium	Common Yarrow	Asteraceae	SNA	N/A	0	3
Agrostis gigantea	Redtop	Poaceae	SNA	IC	0	-3
Agrostis stolonifera	Creeping Bentgrass	Poaceae	SNA	IC	0	-3
Alisma subcordatum	Southern Water-plantain	Alismataceae	S4?	X	1	-5
Alisma triviale	Northern Water-plantain	Alismataceae	S5	X	1	-5
Alliaria petiolata	Garlic Mustard	Brassicaceae	SNA	IC	0	0
Alopecurus pratensis	Meadow Foxtail	Poaceae	SNA	IR	0	-3
Ambrosia artemisiifolia	Common Ragweed	Asteraceae	S5	C	0	3
Ambrosia trifida	Great Ragweed	Asteraceae	S5	C	0	0
Amelanchier laevis	Smooth Serviceberry	Rosaceae	S5	U	5	5
Antennaria neglecta	Field Pussytoes	Asteraceae	S5	C	3	5
Antennaria parlinii ssp. fallax	Deceitful Pussytoes	Asteraceae	S5	U	2	5
Anthoxanthum odoratum	Sweet Vernalgrass	Poaceae	SNA	IR	0	3
Apocynum androsaemifolium	Spreading Dogbane	Apocynaceae	S5	C	3	5
Apocynum cannabinum	Hemp Dogbane	Apocynaceae	S5	C	3	0
Arctium lappa	Great Burdock	Asteraceae	SNA	IU	0	3
Arctium minus	Common Burdock	Asteraceae	SNA	IC	0	3
Arenaria serpyllifolia	Thyme-leaved Sandwort	Caryophyllaceae	SNA	IU	0	0
Asclepias incarnata	Swamp Milkweed	Asclepiadaceae	S5	C	6	-5
Asclepias syriaca	Common Milkweed	Asclepiadaceae	S5	C	0	5
Bidens cernua	Nodding Beggarticks	Asteraceae	S5	C	2	-5
Bidens vulgata	Tall Beggarticks	Asteraceae	S5	U	5	0
Bromus inermis	Smooth Brome	Poaceae	SNA	IC	0	5
Bromus japonicus	Japanese Brome	Poaceae	SNA	IR	0	3
Carduus acanthoides	Spiny Plumeless Thistle	Asteraceae	SNA	IR	0	5
Carex annectens var. xanthocarpa	Yellow-fruited Sedge	Cyperaceae	S2	R	6	-3
Carex comosa	Bristly Sedge	Cyperaceae	S5	U	5	-5
Carex crinita	Fringed Sedge	Cyperaceae	S5	U	6	-5
Carex gracilescens	Slender Loose-flowered Sedge	Cyperaceae	S4	U	7	5
Carex granularis	Limestone Meadow Sedge	Cyperaceae	S5	C	3	-3
Carex hystericina	Porcupine Sedge	Cyperaceae	S5	C	5	-5
Carex lupulina	Hop Sedge	Cyperaceae	S5	C	6	-5
Carex lurida	Sallow Sedge	Cyperaceae	S4S5	U	6	-5
Carex molesta	Troublesome Sedge	Cyperaceae	S4S5	C	5	0
Carex pseudocyperus	Cyperus-like Sedge	Cyperaceae	S5	U	6	-5
Carex scoparia	Pointed Broom Sedge	Cyperaceae	S5	U	5	-3
Carex stipata	Awl-fruited Sedge	Cyperaceae	S5	C	3	-5
Carex tribuloides	Blunt Broom Sedge	Cyperaceae	S4	U	5	-3

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Carex vulpinoidea	Fox Sedge	Cyperaceae	S5	C	3	-5
Carpinus caroliniana	Blue-beech	Betulaceae	S5	C	6	0
Carya ovata	Shagbark Hickory	Juglandaceae	S5	C	6	3
Centaurea nigrescens	Short-fringed Knapweed	Asteraceae	SNA	IX	0	5
Centaurea stoebe	Spotted Knapweed	Asteraceae	SNA	IX	0	5
Centaurea x moncktonii	(Centaurea jacea X Centaurea nigra)	Asteraceae	SNA	hybrid	0	5
Cephalanthus occidentalis	Eastern Buttonbush	Rubiaceae	S5	C	7	-5
Ceratophyllum demersum	Common Hornwort	Ceratophyllaceae	S5	R	4	-5
Cichorium intybus	Chicory	Asteraceae	SNA	IC	0	5
Cicuta bulbifera	Bulb-bearing Water-hemlock	Apiaceae	S5	C	5	-5
Circaea canadensis	Broad-leaved Enchanter's Nightshade	Onagraceae	S5	C	2	3
Cirsium arvense	Canada Thistle	Asteraceae	SNA	IC	0	3
Cirsium vulgare	Bull Thistle	Asteraceae	SNA	IC	0	3
Convolvulus arvensis	Field Bindweed	Convolvulaceae	SNA	IC	0	5
Cornus alternifolia	Alternate-leaved Dogwood	Cornaceae	S5	C	6	3
Cornus obliqua	Pale Dogwood	Cornaceae	S5	C	2	-3
Cornus racemosa	Gray Dogwood	Cornaceae	S5	C	2	0
Cornus stolonifera	Red-osier Dogwood	Cornaceae	S5	U	2	-3
Crataegus calpodendron	Pear Hawthorn	Rosaceae	S4	U	4	5
Crataegus coccinea var. coccinea	Scarlet Hawthorn	Rosaceae	S4	R	4	5
Crataegus holmesiana	Holmes' Hawthorn	Rosaceae	S4S5	R	4	5
Crataegus pruinosa var. pruinosa	Frosted Hawthorn	Rosaceae	S4S5	U	4	5
Crataegus punctata	Dotted Hawthorn	Rosaceae	S5	C	4	5
Crepis tectorum	Narrow-leaved Hawksbeard	Asteraceae	SNA	N/A	0	5
Cuscuta gronovii var. gronovii	Swamp Dodder	Cuscutaceae	S5?	C	4	-3
Cuscuta polygonorum	Smartweed Dodder	Cuscutaceae	S1	R	7	0
Cyperus strigosus	Straw-colored Flatsedge	Cyperaceae	S5	U	5	-3
Dactylis glomerata	Orchard Grass	Poaceae	SNA	IC	0	3
Danthonia spicata	Poverty Oatgrass	Poaceae	S5	C	5	5
Daucus carota	Wild Carrot	Apiaceae	SNA	IC	0	5
Decodon verticillatus	Hairy Swamp Loosestrife	Lythraceae	S5	R	7	-5
Dianthus armeria	Deptford Pink	Caryophyllaceae	SNA	IC	0	5
Dichanthelium implicatum	Slender-stemmed Panicgrass	Poaceae	S5	C	3	0
Diplotaxis muralis	Stinking Wallrocket	Brassicaceae	SNA	IR	0	5
Dipsacus fullonum	Common Teasel	Dipsacaceae	SNA	IC	0	3
Echinochloa crus-galli	Large Barnyard Grass	Poaceae	SNA	IC	0	-3
Echinochloa muricata ssp. muricata	Rough Barnyard Grass	Poaceae	S5	R	4	-5
Elaeagnus angustifolia	Russian Olive	Elaeagnaceae	SNA	IR	0	3
Elaeagnus umbellata	Autumn Olive	Elaeagnaceae	SNA	IU	0	3
Eleocharis erythropoda	Red-stemmed Spikerush	Cyperaceae	S5	U	4	-5
Eleocharis obtusa	Blunt Spikerush	Cyperaceae	S5	C	5	-5
Elodea canadensis	Canada Waterweed	Hydrocharitaceae	S5	U	4	-5

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Elodea nuttallii	Nuttall's Waterweed	Hydrocharitaceae	S3	H	8	-5
Elymus repens	Creeping Wildrye	Poaceae	SNA	IC	0	3
Elymus virginicus var. virginicus	Virginia Wildrye	Poaceae	S5	C	5	-3
Epilobium ciliatum	Northern Willowherb	Onagraceae	S5	C	3	-3
Epilobium hirsutum	Hairy Willowherb	Onagraceae	SNA	IC	0	-3
Epilobium parviflorum	Small-flowered Willowherb	Onagraceae	SNA	IU	0	3
Eragrostis minor	Little Lovegrass	Poaceae	SNA	IU	0	5
Eragrostis pectinacea var. pectinacea	Tufted Lovegrass	Poaceae	S5	U	0	0
Erechtites hieraciifolius	Eastern Burnweed	Asteraceae	S5	C	2	3
Erigeron annuus	Annual Fleabane	Asteraceae	S5	C	0	3
Erigeron strigosus	Rough Fleabane	Asteraceae	S5	R	4	3
Eurybia macrophylla	Large-leaved Aster	Asteraceae	S5	C	5	5
Euthamia graminifolia	Grass-leaved Goldenrod	Asteraceae	S5	C	2	0
Fragaria vesca	Woodland Strawberry	Rosaceae	S5	C	4	3
Fragaria virginiana ssp. virginiana	Wild Strawberry	Rosaceae	S5	C	2	3
Frangula alnus	Glossy Buckthorn	Rhamnaceae	SNA	IC	0	0
Fraxinus americana	White Ash	Oleaceae	S4	C	4	3
Fraxinus excelsior	European Ash	Oleaceae	SNA	IR	0	3
Fraxinus pennsylvanica	Green Ash	Oleaceae	S4	C	3	-3
Galinsoga quadriradiata	Hairy Galinsoga	Asteraceae	SNA	IR	0	3
Galium palustre	Marsh Bedstraw	Rubiaceae	S5	C	5	-5
Galium tinctorium	Stiff Marsh Bedstraw	Rubiaceae	S5	R	5	-5
Geum canadense	White Avens	Rosaceae	S5	C	3	0
Geum laciniatum	Rough Avens	Rosaceae	S4	C	4	-3
Glechoma hederacea	Ground Ivy	Lamiaceae	SNA	IC	0	3
Hamamelis virginiana	American Witch-hazel	Hamamelidaceae	S4S5	C	6	3
Hemerocallis fulva	Orange Daylily	Liliaceae	SNA	IX	0	5
Hesperis matronalis	Dame's Rocket	Brassicaceae	SNA	IX	0	3
Heteranthera dubia	Water Stargrass	Pontederiaceae	S5	R	7	-5
Hypericum mutilum ssp. mutilum	Dwarf St. John's-wort	Clusiaceae	S4?	U	6	-3
Hypericum perforatum	Common St. John's-wort	Clusiaceae	SNA	IC	0	5
Ilex verticillata	Black Holly	Aquifoliaceae	S5	C	5	-3
Impatiens capensis	Spotted Jewelweed	Balsaminaceae	S5	C	4	-3
Iris pseudacorus	Yellow Iris	Iridaceae	SNA	IU	0	-5
Iris versicolor	Harlequin Blue Flag	Iridaceae	S5	C	5	-5
Juncus articulatus	Jointed Rush	Juncaceae	S5	U	5	-5
Juncus dudleyi	Dudley's Rush	Juncaceae	S5	C	1	-3
Juncus effusus ssp. effusus	Soft Rush	Juncaceae	SNA	C	0	-5
Juncus torreyi	Torrey's Rush	Juncaceae	S5	U	3	-3
Juniperus virginiana	Eastern Red Cedar	Cupressaceae	S5	C	4	3
Lapsana communis	Common Nipplewort	Asteraceae	SNA	IC	0	3
Lathyrus tuberosus	Tuberous Vetchling	Fabaceae	SNA	IR	0	5

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Leersia oryzoides	Rice Cutgrass	Poaceae	S5	C	3	-5
Lemna minor	Lesser Duckweed	Lemnaceae	S5?	C	5	-5
Lemna trisulca	Star Duckweed	Lemnaceae	S5	U	6	-5
Lepidium campestre	Field Peppergrass	Brassicaceae	SNA	IC	0	5
Leucanthemum vulgare	Oxeye Daisy	Asteraceae	SNA	IC	0	5
Ligustrum vulgare	European Privet	Oleaceae	SNA	IC	0	3
Lolium arundinaceum	Tall Fescue	Poaceae	SNA	IC	0	3
Lolium perenne	Perennial Ryegrass	Poaceae	SNA	IU	0	3
Lonicera morrowii	Morrow's Honeysuckle	Caprifoliaceae	SNA	IU	0	3
Lonicera tatarica	Tartarian Honeysuckle	Caprifoliaceae	SNA	IC	0	3
Lotus corniculatus	Garden Bird's-foot Trefoil	Fabaceae	SNA	IC	0	3
Ludwigia palustris	Marsh Seedbox	Onagraceae	S5	C	5	-5
Lycopus americanus	American Water-horehound	Lamiaceae	S5	C	4	-5
Lycopus europaeus	European Water-horehound	Lamiaceae	SNA	IU	0	-5
Lycopus uniflorus	Northern Water-horehound	Lamiaceae	S5	C	5	-5
Lysimachia nummularia	Creeping Jennie	Primulaceae	SNA	IC	0	-3
Lythrum salicaria	Purple Loosestrife	Lythraceae	SNA	IC	0	-5
Malus coronaria	Sweet Crabapple	Rosaceae	S4	U	5	5
Malus prunifolia	Pear-leaved Crabapple	Rosaceae	SNA	N/A	0	5
Malus pumila	Common Apple	Rosaceae	SNA	IC	0	5
Medicago lupulina	Black Medic	Fabaceae	SNA	IC	0	3
Melilotus albus	Tall White Sweet-clover	Fabaceae	SNA	IC	0	5
Melilotus altissimus	Tall Yellow Sweet-clover	Fabaceae	SNA	IH	0	5
Melilotus officinalis	Yellow Sweet-clover	Fabaceae	SNA	IC	0	3
Mentha canadensis	Canada Mint	Lamiaceae	S5	C	3	-3
Myosotis scorpioides	True Forget-me-not	Boraginaceae	SNA	IU	0	-5
Myriophyllum spicatum	Eurasian Water-milfoil	Haloragaceae	SNA	IR	0	-5
Najas flexilis	Slender Naiad	Najadaceae	S4S5	R	5	-5
Najas minor	Brittle-leaved Naiad	Najadaceae	SNA	IR	0	-5
Nuphar variegata	Variegated Pond-lily	Nymphaeaceae	S5	U	7	-5
Nymphaea odorata ssp. tuberosa	Tuberous White Water-lily	Nymphaeaceae	SU	U	5	-5
Oenothera biennis	Common Evening Primrose	Onagraceae	S5	C	0	3
Oenothera parviflora	Small-flowered Evening Primrose	Onagraceae	S5	X	1	3
Onoclea sensibilis	Sensitive Fern	Dryopteridaceae	S5	C	4	-3
Ostrya virginiana	Eastern Hop-hornbeam	Betulaceae	S5	C	4	3
Oxalis stricta	Upright Yellow Wood-sorrel	Oxalidaceae	S5	C	0	3
Parthenocissus quinquefolia	Virginia Creeper	Vitaceae	S4?	U	6	3
Penstemon digitalis	Foxglove Beardtongue	Scrophulariaceae	S4	U	6	0
Penthorum sedoides	Ditch-stonecrop	Crassulaceae	S5	C	4	-5
Persicaria amphibia var. stipulacea	Flanged Smartweed	Polygonaceae	S5?	U	5	-5
Persicaria hydropiper	Marshpepper Smartweed	Polygonaceae	SNA	IC	0	-5
Persicaria maculosa	Spotted Lady's-thumb	Polygonaceae	SNA	IC	0	-3

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Persicaria pennsylvanica	Oriental Smartweed	Polygonaceae	SNA	C	0	5
Persicaria punctata	Dotted Smartweed	Polygonaceae	S5	C	4	-5
Persicaria sagittata	Arrow-leaved Smartweed	Polygonaceae	S4S5	C	5	-5
Persicaria virginiana	Virginia Smartweed	Polygonaceae	S4	C	6	0
Phalaris arundinacea	Reed Canary Grass	Poaceae	S5	C	0	-3
Phleum pratense	Common Timothy	Poaceae	SNA	IC	0	3
Phragmites australis ssp. australis	European Reed	Poaceae	SNA	X	0	-3
Pilea pumila	Dwarf Clearweed	Urticaceae	S5	C	5	-3
Pinus nigra	Black Pine	Pinaceae	SNA	IR	0	5
Plantago lanceolata	English Plantain	Plantaginaceae	SNA	IC	0	3
Plantago major	Common Plantain	Plantaginaceae	SNA	IC	0	3
Plantago rugelii	Rugel's Plantain	Plantaginaceae	S5	C	1	0
Platanus × hispida	London Plane Tree	Platanaceae	n/a	n/a	n/a	n/a
Poa compressa	Canada Bluegrass	Poaceae	SNA	IC	0	3
Poa palustris	Fowl Bluegrass	Poaceae	S5	C	5	-3
Poa pratensis ssp. pratensis	Kentucky Bluegrass	Poaceae	SNA	IC	0	3
Polygonum aviculare	Prostrate Knotweed	Polygonaceae	S4?	N/A	0	3
Populus alba	White Poplar	Salicaceae	SNA	IU	0	5
Populus deltoides ssp. deltoides	Eastern Cottonwood	Salicaceae	S5	C	4	0
Populus tremuloides	Trembling Aspen	Salicaceae	S5	C	2	0
Potamogeton crispus	Curly-leaved Pondweed	Potamogetonaceae	SNA	IC	0	-5
Potamogeton foliosus	Leafy Pondweed	Potamogetonaceae	S5	R	4	-5
Potentilla recta	Sulphur Cinquefoil	Rosaceae	SNA	IC	0	5
Prunella vulgaris	Heal-all	Lamiaceae	S5	C	0	0
Prunus avium	Sweet Cherry	Rosaceae	SNA	IC	0	5
Prunus serotina	Black Cherry	Rosaceae	S5	C	3	3
Prunus virginiana	Choke Cherry	Rosaceae	S5	C	2	3
Pyrus communis	Common Pear	Rosaceae	SNA	IC	0	5
Quercus alba	White Oak	Fagaceae	S5	C	6	3
Quercus bicolor	Swamp White Oak	Fagaceae	S4	C	8	-3
Quercus macrocarpa	Bur Oak	Fagaceae	S5	U	5	3
Quercus palustris	Pin Oak	Fagaceae	S4	C	9	-3
Quercus rubra	Northern Red Oak	Fagaceae	S5	C	6	3
Ranunculus caricetorum	Northern Swamp Buttercup	Ranunculaceae	S5	U	5	-5
Ranunculus sceleratus	Cursed Buttercup	Ranunculaceae	S5	C	2	-5
Rhamnus cathartica	Common Buckthorn	Rhamnaceae	SNA	IC	0	0
Rhus typhina	Staghorn Sumac	Anacardiaceae	S5	C	1	3
Riccia fluitans	Floating Crystalwort	Ricciaceae	S3	N/A	0	0
Ricciocarpos natans	Purple-fringed Heartwort	Ricciaceae	S4	N/A	0	0
Rorippa palustris	Marsh Yellowcress	Brassicaceae	S5	U	3	-5
Rosa canina	Dog Rose	Rosaceae	SNA	IR	0	5
Rosa multiflora	Multiflora Rose	Rosaceae	SNA	IC	0	3

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Rubus allegheniensis	Allegheny Blackberry	Rosaceae	S5	C	2	3
Rubus flagellaris	Northern Dewberry	Rosaceae	S4	U	4	3
Rubus occidentalis	Black Raspberry	Rosaceae	S5	C	2	5
Rubus odoratus	Purple-flowering Raspberry	Rosaceae	S5	C	3	5
Rumex crispus	Curly Dock	Polygonaceae	SNA	IC	0	0
Sagittaria latifolia	Broad-leaved Arrowhead	Alismataceae	S5	C	4	-5
Salix alba	White Willow	Salicaceae	SNA	I	0	-3
Salix amygdaloides	Peach-leaved Willow	Salicaceae	S5	C	6	-3
Salix atrocinerea	Rusty Willow	Salicaceae	SNA	IR	0	-3
Salix interior	Sandbar Willow	Salicaceae	S5	C	1	-3
Salix x fragilis	(Salix alba X Salix euxina)	Salicaceae	SNA	hybrid	0	0
Salix x sepulcralis	(Salix alba X Salix babylonica)	Salicaceae	SNA	hybrid	0	0
Sanicula canadensis var. canadensis	Short-styled Canada Sanicle	Apiaceae	S4	R	7	3
Scandosorbus intermedia	Swedish Whitebeam	Rosaceae	SE1	N/A	0	0
Schoenoplectus tabernaemontani	Soft-stemmed Bulrush	Cyperaceae	S5	C	5	-5
Scirpus atrovirens	Dark-green Bulrush	Cyperaceae	S5	C	3	-5
Scirpus cyperinus	Cottongrass Bulrush	Cyperaceae	S5	C	4	-5
Scutellaria lateriflora	Mad Dog Skullcap	Lamiaceae	S5	C	5	-5
Securigera varia	Common Crown-vetch	Fabaceae	SNA	IU	0	5
Sisyrinchium montanum	Strict Blue-eyed-grass	Iridaceae	S5	C	4	0
Solanum dulcamara	Bittersweet Nightshade	Solanaceae	SNA	IC	0	0
Solidago altissima var. altissima	Eastern Tall Goldenrod	Asteraceae	S5	C	1	3
Solidago bicolor	White Goldenrod	Asteraceae	S4?	U	8	5
Solidago canadensis var. canadensis	Canada Goldenrod	Asteraceae	S5	C	1	3
Solidago gigantea	Giant Goldenrod	Asteraceae	S5	C	4	-3
Solidago juncea	Early Goldenrod	Asteraceae	S5	C	3	5
Solidago nemoralis	Gray-stemmed Goldenrod	Asteraceae	S5	C	2	5
Solidago rugosa ssp. rugosa	Northern Rough-stemmed Goldenrod	Asteraceae	S5	C	4	0
Sonchus arvensis ssp. uliginosus	Smooth Sow-thistle	Asteraceae	SNA	IC	0	3
Sonchus oleraceus	Common Sow-thistle	Asteraceae	SNA	IU	0	3
Sparganium eurycarpum	Broad-fruited Burreed	Sparganiaceae	S5	C	3	-5
Spiraea alba	White Meadowsweet	Rosaceae	S5	C	3	-3
Spirodela polyrhiza	Great Duckweed	Lemnaceae	S5	R	4	-5
Stuckenia pectinata	Sago Pondweed	Potamogetonaceae	S5	R	4	-5
Symphyotrichum ericoides	White Heath Aster	Asteraceae	S5	C	4	3
Symphyotrichum lanceolatum	Panicled Aster	Asteraceae	S5	C	3	-3
Symphyotrichum lateriflorum	Calico Aster	Asteraceae	S5	C	3	0
Symphyotrichum novae-angliae	New England Aster	Asteraceae	S5	C	2	-3
Symphyotrichum pilosum var. pilosum	Old Field Aster	Asteraceae	S5	C	1	3
Syringa vulgaris	Common Lilac	Oleaceae	SNA	IC	0	5
Taenidia integerrima	Yellow Pimpernel	Apiaceae	S4	R	9	5
Taraxacum officinale	Common Dandelion	Asteraceae	SNA	IC	0	3

Scientific Name	Common Name	Family	S-Rank (per NHIC)	Local Rank (per Oldham 2017)	Coefficient of Conservatism	Coefficient of Wetness
Thuja occidentalis	Eastern White Cedar	Cupressaceae	S5	U	4	-3
Tilia americana	American Basswood	Tiliaceae	S5	C	4	3
Toxicodendron radicans var. rydbergii	Western Poison Ivy	Anacardiaceae	S5	C	2	0
Trifolium hybridum	Alsike Clover	Fabaceae	SNA	IC	0	3
Trifolium pratense	Red Clover	Fabaceae	SNA	IX	0	3
Trifolium repens	White Clover	Fabaceae	SNA	IX	0	3
Tussilago farfara	Colt's-foot	Asteraceae	SNA	IC	0	3
Typha angustifolia	Narrow-leaved Cattail	Typhaceae	SNA	IC	0	-5
Typha latifolia	Broad-leaved Cattail	Typhaceae	S5	C	1	-5
Typha x glauca	(Typha angustifolia X Typha latifolia)	Typhaceae	SNA	hybrid	0	-5
Ulmus americana	American Elm	Ulmaceae	S5	C	3	-3
Ulmus pumila	Siberian Elm	Ulmaceae	SNA	IU	0	3
Utricularia vulgaris ssp. macrorhiza	Greater Bladderwort	Lentibulariaceae	S5	U	4	-5
Vallisneria americana	Eel-grass	Hydrocharitaceae	S5	U	6	-5
Verbena hastata	Blue Vervain	Verbenaceae	S5	C	4	-3
Viburnum acerifolium	Maple-leaved Viburnum	Caprifoliaceae	S5	C	6	5
Viburnum lentago	Nannyberry	Caprifoliaceae	S5	C	4	0
Viburnum opulus ssp. trilobum	Highbush Cranberry	Caprifoliaceae	S5	C	5	-3
Viburnum opulus var. opulus	Highbush Cranberry	Caprifoliaceae	S5	IC	5	-3
Viburnum recognitum	Smooth Arrowwood	Caprifoliaceae	S4	C	7	0
Vicia cracca	Tufted Vetch	Fabaceae	SNA	IC	0	5
Vicia tetrasperma	Four-seeded Vetch	Fabaceae	SNA	IU	0	5
Vitis riparia	Riverbank Grape	Vitaceae	S5	C	0	0
Wolffia columbiana	Columbia Watermeal	Lemnaceae	S4S5	R	4	-5
Xanthium strumarium	Rough Cocklebur	Asteraceae	S5	C	2	0

Appendix 3. Wildlife List

Common Name	Scientific Name	Observation/Survey Type	Local Status per Niagara NAI
Amphibians			
American Bullfrog	*Lithobates catesbeianus*	Anuran calling survey	Widespread
American Toad	*Anaxyrus americanus*	Anuran calling survey	Widespread
Green Frog	*Lithobates clamitans*	Anuran calling survey	Widespread
Gray Treefrog	*Dryophytes versicolor*	Anuran calling survey	Widespread
Northern Leopard Frog	*Lithobates pipiens*	Anuran calling survey	Widespread
Spring Peeper	*Pseudacris crucifer*	Anuran calling survey	Widespread
Western Chorus Frog	*Pseudacris triseriata*	Anuran calling survey	Widespread
Birds			
American Black Duck	*Anas rubripes*	Overwintering bird survey	Uncommon resident (winter)
American Goldfinch	*Spinus tristis*	Breeding bird survey, overwintering bird survey	Common resident (summer), uncommon resident (winter)
American Pipit	*Anthus rubescens*	overwintering bird survey	Occasional straggler (winter)
American Redstart	*Setophaga ruticilla*	Migratory bird survey	Common transient (spring)
American Robin	*Turdus migratorius*	Breeding bird survey, migratory bird survey, overwintering bird survey	Transient (spring) very common resident (summer), uncommon resident (winter)
American Tree Sparrow	*Spizelloides arborea*	Overwintering bird survey	Occasional straggler (winter)
Baltimore Oriole	*Icterus galbula*	Breeding bird survey, migratory bird survey	Common transient (spring), common resident (summer)
Barn Swallow	*Hirundo rustica*	Breeding bird survey, migratory bird survey	Transient (spring), very common resident (summer)
Bay-breasted Warbler	*Setophaga castanea*	Migratory bird survey	Common transient (spring)

Common Name	Scientific Name	Observation/Survey Type	Local Status per Niagara NAI
Belted Kingfisher	*Megaceryle alcyon*	Breeding bird survey	Uncommon resident (summer)
Blackburnian Warbler	*Setophaga fusca*	Migratory bird survey	Uncommon transient (spring)
Black-capped Chickadee	*Poecile atricapillus*	Breeding bird survey, migratory bird survey, overwintering bird survey	Common permanent resident (all seasons)
Black-throated Blue Warbler	*Setophaga caerulescens*	Migratory bird survey	Common transient (spring)
Black-throated Green Warbler	*Setophaga virens*	Migratory bird survey	Common transient (spring)
Blue Jay	*Cyanocitta cristata*	Breeding bird survey, migratory bird survey, overwintering bird survey	Very common permanent resident (all seasons), a few spring transients
Blue-headed Vireo	*Vireo solitarius*	Migratory bird survey	Uncommon transient (spring)
Brown Thrasher	*Toxostoma rufum*	Migratory bird survey	Transient (spring)
Brown-headed Cowbird	*Molothrus ater*	Breeding bird survey, migratory bird survey	Transient (spring), very common resident (summer)
Canada Goose	*Branta canadensis*	Breeding bird survey, migratory bird survey, overwintering bird survey	Very common permanent resident (all seasons), a few spring transients
Carolina Wren	*Thryothorus ludovicianus*	Breeding bird survey, migratory bird survey, overwintering bird survey	Uncommon permanent resident (all seasons)
Caspian Tern	*Hydroprogne caspia*	Breeding bird survey, migratory bird survey	N/A (spring), uncommon resident (summer)
Cedar Waxwing	*Bombycilla cedrorum*	Breeding bird survey, migratory bird survey	Transient (spring), common resident (summer)
Chestnut-sided Warbler	*Setophaga pensylvanica*	Migratory bird survey	Common transient (spring)
Chipping Sparrow	*Spizella passerina*	Breeding bird survey, migratory bird survey	Transient (spring), common resident (summer)
Cliff Swallow	*Petrochelidon pyrrhonota*	Migratory bird survey	Transient (spring)
Common Grackle	*Quiscalus quiscula*	Breeding bird survey	Very common resident (summer)

Common Name	Scientific Name	Observation/Survey Type	Local Status per Niagara NAI
Common Nighthawk	*Chordeiles minor*	Nightjar survey	Rare transient (spring)
Common Yellowthroat	*Geothlypis trichas*	Breeding bird survey, migratory bird survey	Common transient (spring), common resident (summer)
Cooper's Hawk	*Accipiter cooperii*	Breeding bird survey	Uncommon resident (summer)
Dark-eyed Junco	*Junco hyemalis*	Overwintering bird survey	Common resident (winter)
Double-crested Cormorant	*Phalacrocorax auritus*	Incidental during turtle survey	N/A (spring)
Downy Woodpecker	*Dryobates pubescens*	Breeding bird survey, winter bird survey	Common permanent resident (all seasons)
Eastern Bluebird	*Sialia sialis*	Breeding bird survey	Uncommon resident (summer)
Eastern Kingbird	*Tyrannus tyrannus*	Breeding bird survey, migratory bird survey	Transient (spring), common resident (summer)
Eastern Wood-pewee	*Contopus virens*	Migratory bird survey	Transient (spring)
European Starling	*Sturnus vulgaris*	Breeding bird survey	Very common permanent resident (all seasons)
Field Sparrow	*Spizella pusilla*	Breeding bird survey, migratory bird survey	Transient (spring), uncommon resident (summer)
Golden-crowned Kinglet	*Regulus satrapa*	Overwintering bird survey	Uncommon resident (winter)
Grasshopper Sparrow	*Ammodramus savannarum*	Migratory bird survey	Occasional transient (spring)
Gray Catbird	*Dumetella carolinensis*	Breeding bird survey, migratory bird survey	Transient (spring), common resident (summer)
Great Blue Heron	*Ardea herodias*	Breeding bird survey, migratory bird survey	N/A (spring), uncommon resident (summer)
Great Egret	*Ardea alba*	Breeding bird survey, migratory bird survey	N/A (spring), rare resident (summer)
Green Heron	*Butorides virescens*	Breeding bird survey	Uncommon resident (summer)
Herring Gull	*Larus argentatus*	Overwintering bird survey	Very common resident (winter)

Common Name	Scientific Name	Observation/Survey Type	Local Status per Niagara NAI
Hooded Merganser	*Lophodytes cucullatus*	Overwintering bird survey	Uncommon resident (winter)
House Finch	*Haemorhous mexicanus*	Breeding bird survey, migratory bird survey	Common permanent resident (all seasons), a few spring transients
House Sparrow	*Passer domesticus*	Breeding bird survey	Very common permanent resident (all seasons)
House Wren	*Troglodytes aedon*	Breeding bird survey, migratory bird survey	Transient (spring), common resident (summer)
Indigo Bunting	*Passerina cyanea*	Breeding bird survey, migratory bird survey	Transient (spring), common resident (summer)
Killdeer	*Charadrius vociferus*	Breeding bird survey	Common resident (summer)
Least Flycatcher	*Empidonax minimus*	Migratory bird survey	Uncommon transient (spring)
Mallard	*Anas platyrhynchos*	Breeding bird survey, overwintering bird survey	Common resident (summer), uncommon resident (winter)
Marsh Wren	*Cistothorus palustris*	Breeding bird survey	Uncommon resident (summer)
Mourning Dove	*Zenaida macroura*	Migratory bird survey	N/A (spring)
Nashville Warbler	*Leiothlypis ruficapilla*	Migratory bird survey	Common transient (spring)
Northern Cardinal	*Cardinalis cardinalis*	Breeding bird survey, migratory bird survey, overwintering bird survey	Common permanent resident (all seasons)
Northern Flicker	*Colaptes auratus*	Breeding bird survey, migratory bird survey	Common transient (spring), common resident (summer)
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	Breeding bird survey, migratory bird survey	Transient (spring), common resident (summer)
Palm Warbler	*Setophaga palmarum*	Migratory bird survey	Common Transient (Spring)
Purple Martin	*Progne subis*	Breeding bird survey, migratory bird survey	Transient (spring), very common resident (summer)

Common Name	Scientific Name	Observation/Survey Type	Local Status per Niagara NAI
Red-bellied Woodpecker	*Melanerpes carolinus*	Migratory bird survey, overwintering bird survey	Uncommon Permanent resident (all seasons)
Red-eyed Vireo	*Vireo olivaceus*	Breeding bird survey	Common resident (summer)
Red-tailed Hawk	*Buteo jamaicensis*	migratory bird survey	Common transient (spring)
Red-winged Blackbird	*Agelaius phoeniceus*	Breeding bird survey, migratory bird survey	Transient (spring), very common resident (summer)
Ring-billed Gull	*Larus delawarensis*	Breeding bird survey	Very common resident (summer)
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Breeding bird survey, migratory bird survey	Transient (spring), common resident (summer)
Ruby-crowned Kinglet	*Corthylio calendula*	Migratory bird survey	Common transient (spring)
Sandhill Crane	*Antigone canadensis*	Incidental during snake survey	Rare transient (spring)
Solitary Sandpiper	*Tringa solitaria*	Incidental during anuran calling survey	Transient (spring)
Song Sparrow	*Melospiza melodia*	Breeding bird survey, migratory bird survey, overwintering bird survey	Transient (spring), very common resident (summer), uncommon resident (winter)
Spotted Sandpiper	*Actitis macularius*	Breeding bird survey, migratory bird survey	N/A (spring), common resident (summer)
Swamp Sparrow	*Melospiza georgiana*	Breeding bird survey, migratory bird survey	Transient (spring), uncommon resident (summer)
Tree Swallow	*Tachycineta bicolor*	Breeding bird survey, migratory bird survey	Transient (spring), very common resident (summer)
Turkey Vulture	*Cathartes aura*	Breeding bird survey, migratory bird survey	Common transient (spring), uncommon resident (summer)
Trumpeter Swan	*Cygnus buccinator*	Incidental during turtle survey	N/A (spring)
Warbling Vireo	*Vireo gilvus*	Breeding bird survey, migratory bird survey	Common transient (spring), common resident (summer)

Common Name	Scientific Name	Observation/Survey Type	Local Status per Niagara NAI
White-breasted Nuthatch	*Sitta carolinensis*	Overwintering bird survey	Common resident (winter)
White-crowned Sparrow	*Zonotrichia leucophrys*	Migratory bird survey	Common transient (spring)
White-throated Sparrow	*Zonotrichia albicollis*	Migratory bird survey	Very common transient (spring)
Willow Flycatcher	*Empidonax traillii*	Breeding bird survey, migratory bird survey	Transient (spring), uncommon resident (summer)
Wood Duck	*Aix sponsa*	Breeding bird survey	Uncommon resident (summer)
Yellow Warbler	*Setophaga petechia*	Breeding bird survey, migratory bird survey	Transient (spring), common resident (summer)
Yellow-billed Cuckoo	*Coccyzus americanus*	Migratory bird survey	N/A (spring)
Yellow-rumped Warbler	*Setophaga coronata*	Migratory bird survey	Very common transient (spring)
Bumble Bees			
Common Eastern Bumble Bee	*Bombus impatiens*	Terrestrial insect survey	N/A
Crayfish			
Northern Clearwater Crayfish	*Faxonius propinquus*	Incidental during migratory bird survey	N/A
Gastropods			
Chinese Mystery Snail	*Cipangopaludina chinensis*	Incidental during aquatic vegetation survey	N/A
Lepidopterans			
American Copper	*Lycaena phlaeas*	Terrestrial insect survey	**Rare**
American Lady	*Vanessa virginiensis*	Incidental during turtle survey	Uncommon
Cabbage White	*Pieris rapae*	Terrestrial insect survey	Common (introduced)
Common Ringlet	*Coenonympha tullia*	Terrestrial insect survey	Common

Common Name	Scientific Name	Observation/Survey Type	Local Status per Niagara NAI
Clouded Sulphur	*Colias philodice*	Terrestrial insect survey	Common
Common Wood-nymph	*Cercyonis pegala*	Terrestrial insect survey	Common
Eastern Comma	*Polygonia comma*	Terrestrial insect survey	Common
Eastern Tailed-blue	*Cupido comyntas*	Terrestrial insect survey	**Not previously recorded**
Eastern Tiger Swallowtail	*Papilio glaucus*	Terrestrial insect survey	Common
Essex Skipper	*Thymelicus lineola*	Terrestrial insect survey	Common (introduced)
Hummingbird Clearwing	*Hemaris thysbe*	Incidental during migratory bird survey	n/a
Least Skipper	*Ancyloxypha numitor*	Terrestrial insect survey	Common
Monarch	*Danaus plexippus*	Terrestrial insect survey	Common
Mourning Cloak	*Nymphalis antiopa*	Terrestrial insect survey	Common
Northern Broken Dash	*Wallengrenia egeremet*	Terrestrial insect survey	Common
Pearl Crescent	*Phyciodes tharos*	Terrestrial insect survey	Common
Question Mark	*Polygonia interrogationis*	Terrestrial insect survey	Common
Red Admiral	*Vanessa atalanta*	Terrestrial insect survey	Common
Red-spotted Purple	*Limenitis arthemis astyanax*	Terrestrial insect survey	Common
Spring Azure	*Celastrina ladon*	Incidental during migratory bird survey	Common
Tiger Swallowtail	*Papilio glaucus*	Terrestrial insect survey	Common
Wild Indigo Duskywing	*Erynnis baptisiae*	Terrestrial insect survey	Common
Mammals			
Beaver	*Castor canadensis*	Incidental during summer vascular plant survey	N/A

Common Name	Scientific Name	Observation/Survey Type	Local Status per Niagara NAI
Big Brown Bat	*Eptesicus fuscus*	Incidental during anuran call survey	N/A
Eastern Cottontail	*Sylvilagus floridanus*	Incidental during summer vascular plant survey	N/A
Eastern Grey Squirrel	*Sciurus carolinensis*	Incidental during summer vascular plant survey	N/A
Groundhog	*Marmota monax*	Incidental during summer vascular plant survey	N/A
Hoary Bat	*Lasiurus cinereus*	Incidental during anuran call survey	N/A
Muskrat	*Ondatra zibethicus*	Incidental during summer vascular plant survey	N/A
Opossum	*Didelphis virginiana*	Incidental during anuran call survey	N/A
Raccoon	*Procyon lotor*	Incidental during summer vascular plant survey	N/A
Red Squirrel	*Sciurus vulgaris*	Incidental during summer vascular plant survey	N/A
Silver-haired Bat	*Lasionycteris noctivagans*	Incidental during anuran calling survey	N/A
White-tailed Deer	*Odocoileus virginianus*	Incidental during spring vascular plant survey	N/A
Odonates			
Autumn Meadowhawk	*Sympetrum vicinum*	Terrestrial insect survey	Common
Black Saddlebag	*Tramea lacerata*	Terrestrial insect survey	Common
Blue Dasher	*Pachydiplax longipennis*	Terrestrial insect survey	Common
Canada Darner	*Aeshna canadensis*	Terrestrial insect survey	**Not previously recorded**
Clubtail Species	*Arigomphus sp.*	Terrestrial insect survey	N/A

Common Name	Scientific Name	Observation/Survey Type	Local Status per Niagara NAI
Common Baskettail	*Epitheca cynosura*	Terrestrial insect survey	Common
Common Green Darner	*Anax junius*	Terrestrial insect survey	Common
Common Whitetail	*Plathemis lydia*	Terrestrial insect survey	Common
Cyrano Darner	*Nasiaeschna pentacantha*	Terrestrial insect survey	**Historical**
Dot-tailed Whiteface	*Leucorrhinia intacta*	Terrestrial insect survey	Uncommon
Eastern Amberwing	*Perithemis tenera*	Terrestrial insect survey	Common
Eastern Forktail	*Ischnura verticalis*	Terrestrial insect survey	Common
Eastern Pondhawk	*Erythemis simplicicollis*	Terrestrial insect survey	Common
Elegant Spreadwing	*Lestes inaequalis*	Terrestrial insect survey	**Rare**
Familiar Bluet	*Enallagma civile*	Terrestrial insect survey	Common
Fragile Forktail	*Ischnura posita*	Incidental during migratory bird survey	Common
Orange Bluet	*Enallagma signatum*	Terrestrial insect survey	Common
Prince Baskettail	*Epitheca princeps*	Terrestrial insect survey	**Rare**
Slender Spreadwing	*Lestes rectangularis*	Terrestrial insect survey	**Rare**
Stream Bluet	*Enallagma exsulans*	Terrestrial insect survey	Common
Twelve-spotted Skimmer	*Libellula pulchella*	Terrestrial insect survey	Common
Vesper Bluet	*Enallagma vesperum*	Incidental during anuran calling survey	**Not previously recorded**
Violet Dancer	*Argia fumipennis*	Terrestrial insect survey	Common
Wandering Glider	*Pantala flavescens*	Terrestrial insect survey	Uncommon
White-faced Meadowhawk	*Sympetrum obtrusum*	Terrestrial insect survey	Uncommon to common
Widow Skimmer	*Libellula luctuosa*	Terrestrial insect survey	Common

Common Name	Scientific Name	Observation/Survey Type	Local Status per Niagara NAI
Orthopterans			
Black-legged Meadow Katydid	*Orchelimum nigripes*	Terrestrial insect survey	N/A
Greater Anglewing	*Microcentrum rhombifolium*	Terrestrial insect survey	N/A
Reptiles			
Eastern Gartersnake	*Thamnophis sirtalis sirtalis*	Snake visual encounter survey	Widespread
Dekay's Brown Snake	*Storeria dekayi*	Snake visual encounter survey	Widespread
Midland Painted Turtle	*Chrysemys picta marginata*	Turtle visual encounter survey	Widespread
Northern Watersnake	*Nerodia sipedon sipedon*	Snake visual encounter survey	Widespread
Red-eared Slider	*Trachemys scripta elegans*	Turtle visual encounter survey	Introduced
Snapping Turtle	*Chelydra serpentina*	Turtle visual encounter survey, turtle nesting survey	Widespread

Appendix 4. Anuran Calling Survey Results

1 ANURAN CALLING SURVEY METHODOLOGY

Calling anuran surveys were conducted in accordance with the *Marsh Monitoring Program for Surveying Amphibians* (Bird Studies Canada et al. 2008). This protocol involves the completion of three (3) rounds of surveys once per month between April and June from 30 minutes after sunset until approximately midnight. Appropriate weather conditions include no or very light precipitation and wind speed ≤3 on the Beaufort wind scale. As the Study Area is located within the southern region (i.e., south of the 43rd parallel), all three (3) rounds of surveys should occur during the first half of the month (i.e., April 1-15, May 1-15, and June 1-15).

A total of 11 anuran calling stations were established and situated systematically to cover potentially significant anuran breeding habitats. Each station was surveyed for a minimum duration of three (3) minutes. Anurans and evidence of anuran breeding (i.e., vocalizations, tadpoles, etc.) were also recorded incidentally during other field activities on-site.

2 RESULTS

Table 1. Results of Anuran Calling Surveys.

Station ID[1]	**Feature or ELC Community Surveyed**	**Bearing (°)**	**Survey #1 –** 09 April 2024	**Survey #2 –** 07 May 2024	**Survey #3 –** 06 June 2024	**Comments**[2]
AN-1	FODM7-8 MAMM1-12 SAF1-1 THDM2	9	Northern Leopard Frog (1-1) Western Chorus Frog (3)	No calling anurans	Green Frog (1-4)	**Survey #1:** N/A. **Survey #2:** N/A. **Survey #3:** N/A.
AN-2	FODM7-1 MAMM1-12 MASM1-1	107	Northern Leopard Frog (1-2) Western Chorus Frog (3)	Green Frog (1-1) Spring Peeper (1-3)	Green Frog (1-3)	**Survey #1:** Northern Leopard Frog heard calling from emergent vegetation along Lyons Creek. **Survey #2:** N/A. **Survey #3:** Three individuals heard calling on each side of Lyons Creek.
AN-3	FODM7-1 MASM1-1 MASO2-3 SAF1-1 THDM2-6	87	Northern Leopard Frog (2-5)	Spring Peeper (1-3)	Green Frog (1-6)	**Survey #1:** Northern Leopard Frog heard calling from emergent vegetation along Lyons Creek. **Survey #2:** N/A. **Survey #3:** One Green Frog calling from the south side of Lyons Creek.
AN-4	FODM7-1 FODM7-2 MASM1-1 MASO2-3 SAF1-1 SAM1-8 THDM2-6	86	Northern Leopard Frog (2-4) Western Chorus Frog (1-3)	Green Frog (1-1) Spring Peeper (1-3) Western Chorus Frog (1-1)	Green Frog (1-4) Bullfrog (1-1)	**Survey #1:** Northern Leopard Frog heard calling from emergent vegetation along Lyons Creek. Western Chorus Frogs calling from distant features. **Survey #2:** Light rain starts. **Survey #3:** One Green Frog calling from the south side of Lyons Creek.
AN-5	FODM7-2 MASM1-1 MASM1-4 SAF1-1 SAM1-8 SWTM5-1 THDM2-6	85	Northern Leopard Frog (3) Western Chorus Frog (2-5)	Green Frog (1-1) Gray Treefrog (1-1) Spring Peeper (1-3)	Green Frog (2-6)	**Survey #1:** N/A **Survey #2:** Pause in light rain. **Survey #3:** Additional Green Frog (1-3) calling from the south side of Lyons Creek.

Station ID[1]	Feature or ELC Community Surveyed	Bearing (°)	Survey #1 – 09 April 2024	Survey #2 – 07 May 2024	Survey #3 – 06 June 2024	Comments[2]
AN-6	FODM2-4 MASM1-1 SAF1-1 SAM1-8 THDM2-6	63	Northern Leopard Frog (1-2) Spring Peeper (3)	No calling anurans	Green Frog (1-6)	**Survey #1:** Northern Leopard Frog heard calling from emergent vegetation along Lyons Creek. Spring Peepers calling from large pond. **Survey #2:** N/A. **Survey #3:** N/A.
AN-7	MASM1-1 MASM1-2 SAF1-1 SAM1-8 THDM2-6 THDM2-10	29	Northern Leopard Frog (1-3) Western Chorus Frog (1-2)	No calling anurans	Green Frog (1-5)	**Survey #1:** Northern Leopard Frog heard calling from emergent vegetation along Lyons Creek. Western Chorus Frogs calling from linear feature adjacent Highway 140. **Survey #2:** Significant noise from Highway 140 and train. Extended station survey by several minutes after train had passed. **Survey #3:** Additional Green Frog (1-3) calling ~30 m upstream of station 7.
AN-8	SAS1-4 THDM4-1	200	American Toad (1-2) Western Chorus Frog (3)	No calling anurans	No calling anurans	**Survey #1:** Western Chorus Frogs calling from outside of station. **Survey #2:** Light rain. **Survey #3:** N/A.
AN-9	FODM7-8	37	Western Chorus Frog (1-1)	No calling anurans	Green Frog (1-1)	**Survey #1:** N/A. **Survey #2:** N/A. **Survey #3:** N/A.
AN-10	CVC FODM5-3 MASM1-1 MASM2-2 WODM5-3	50	No amphibians calling	No calling anurans	Bullfrog (1-1) Green Frog (1-4)	**Survey #1:** N/A. **Survey #2:** Light rain ends. **Survey #3:** N/A.
AN-11	CVC CVI SAF1-1	210	Western Chorus Frog (1-1)	No calling anurans	Bullfrog (1-1) Green Frog (1-3)	**Survey #1:** Western Chorus Frog calling from edge of Lyons Creek. Spring Peepers calling outside of station from old oxbow.

Station ID[1]	Feature or ELC Community Surveyed	Bearing (°)	Survey #1 – 09 April 2024	Survey #2 – 07 May 2024	Survey #3 – 06 June 2024	Comments[2]
	THDM2 THDM2-6					**Survey #2:** Spring Peeper (3) and Gray Treefrog (1-1) calling outside of Study Area to northeast. **Survey #3:** N/A.

[1] Locations of Anuran Calling Stations are shown in **Figure 5**.

[2] **Call Code 1** = Individuals can be counted; calls not simultaneous; **Call Code 2** = Calls distinguishable; some simultaneous calling; **Call Code 3** = Full chorus; calls continuous and overlapping. Second number after the call code indicates the estimated number of individuals calling; no estimate of individuals is provided for Call Code 3.

Appendix 5. Breeding Bird Survey Results

Common Name	Scientific Name	Srank	SARO Status	SARA Status	Area Sensitive[1]	Breeding Bird Stations[2] and Breeding Status[3]										
						BI-1	BI-2	BI-3	BI-4	BI-5	BI-6	BI-7	BI-8	BI-9	BI-10	BI-11
American Goldfinch	*Spinus tristis*	S5				Pr	Po	Po	Pr	Pr	Po	Po	Pr	Pr	Po	Pr
American Robin	*Turdus migratorius*	S5				Co	Po	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Po
Baltimore Oriole	*Icterus galbula*	S4B						Po		Po		Po	Po	Pr		Po
Barn Swallow	*Hirundo rustica*	S4B	SC	THR		O	O	Co	O	O	O	O	O		O	
Belted Kingfisher	*Megaceryle alcyon*	S5B, S4N				Po			Po					Po		Po
Black-capped Chickadee	*Poecile atricapillus*	S5							Pr		Pr	Po	Pr			
Blue Jay	*Cyanocitta cristata*	S5				Po			Po		Po	Po	Po			
Brown-headed Cowbird	*Molothrus ater*	S5				Po	Po	Po	Po		Po				Po	Po
Canada Goose	*Branta canadensis*	S5				Po			Po			Po	Po			
Carolina Wren	*Thryothorus ludovicianus*	S4											Po			
Caspian Tern	*Hydroprogne caspia*	S3B, S5M	NAR				O		O							
Cedar Waxwing	*Bombycilla cedrorum*	S5				Po		Po		Pr	Po	Pr	Pr		Po	Pr
Chipping Sparrow	*Spizella passerina*	S5B, S3N						Po								
Common Grackle	*Quiscalus quiscula*	S5				Po	Po	Po	Po	Po	Pr	Po	Pr		Po	Po
Common Yellowthroat	*Geothlypis trichas*	S5B, S3N				Po	Pr			Pr	Po	Po	Po			Po
Cooper's Hawk	*Accipiter cooperii*	S4	NAR		x										Po	
Downy Woodpecker	*Dryobates pubescens*	S5						Po		Po	Po	Po	Pr			
Eastern Bluebird	*Sialia sialis*	S5B, S4N	NAR									Po		Po		Po
Eastern Kingbird	*Tyrannus tyrannus*	S4B				Pr		Po	Pr	Po				Pr	Pr	Po
Eastern Phoebe	*Sayornis phoebe*	S5B							Po					Po	Po	
European Starling	*Sturnus vulgaris*	SNA					Po	Pr				Po				
Field Sparrow	*Spizella pusilla*	S4B, S3N												Po	Po	Po
Gray Catbird	*Dumetella carolinensis*	S5B, S3N				Pr		Pr	Pr	Pr	Po	Pr		Pr	Pr	Pr
Great Blue Heron	*Ardea herodias*	S4				O			O		O		O			
Great Egret	*Ardea alba*	S2B, S3M				O	O				O					
Green Heron	*Butorides virescens*	S4B										Po		Po		
House Finch	*Haemorhous mexicanus*	SNA				Po							Po			
House Sparrow	*Passer domesticus*	SNA										Po				
House Wren	*Troglodytes aedon*	S5B				Pr		Pr	Pr				Po		Po	Po
Indigo Bunting	*Passerina cyanea*	S5B														Po
Killdeer	*Charadrius vociferus*	S4B					O		Po	O				O		
Mallard	*Anas platyrhynchos*	S5							Po				Po	Pr		Po
Marsh Wren	*Cistothorus palustris*	S4B, S3N												Po		
Northern Cardinal	*Cardinalis cardinalis*	S5				Pr	Po	Pr		Po	Pr	Pr	Pr	Pr	Po	Pr
Northern Flicker	*Colaptes auratus*	S5				Po		Po				Po	Po			
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	S4B						Po			Pr	Po	Pr			
Purple Martin	*Progne subis*	S3B								O						
Red-eyed Vireo	*Vireo olivaceus*	S5B								Pr						
Red-winged Blackbird	*Agelaius phoeniceus*	S5				Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Po	Po
Ring-billed Gull	*Larus delawarensis*	S5											O			
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S5B									Pr					
Song Sparrow	*Melospiza melodia*	S5				Po	Pr	Pr	Pr	Po	Po	Pr	Pr	Po	Pr	Pr

Spotted Sandpiper	*Actitis macularius*	S5B							Po		Po	Po		
Swamp Sparrow	*Melospiza georgiana*	S5B, S4N			Po	Pr	Pr	Pr	Po	Po	Po			
Tree Swallow	*Tachycineta bicolor*	S4S5B	Po	Po		Po	Po				Pr	Po	Po	
Turkey Vulture	*Cathartes aura*	S5B, S3N			O									
Warbling Vireo	*Vireo gilvus*	S5B	Pr		Po	Po								Po
Willow Flycatcher	*Empidonax traillii*	S4B	Po	Po		Po				Po				Po
Wood Duck	*Aix sponsa*	S5B, S3N							Po					
Yellow Warbler	Setophaga petechia	S5B	Po	Po	Po	Po	Po		Po	Pr	Pr	Pr	Pr	

1 - x = species considered to be Area Sensitive by the MNRF per Appendix G - Table G-4 of the SWH Techincal Guide

2 - Locations of breeding bird survey stations are indicated on **Figure 5**.

3 - Co = Confirmed Breeder; Pr = Probable Breeder; Po = Possible Breeder; O = Observed (no evidence of breeding). Breeding status determined based on the results of the formal breeding bird surveys; where a higher level of breeding status was documented incidentally (i.e., during other field surveys), this is noted in within the main body of the report (where applicable).

Appendix 6. Overwintering Bird Survey Results

Appendix 6. Overwintering Bird Survey Results.

Common Name	Scientific Name	S-Rank	SARO Status	SARA Status	Area Sensitive[1]	Overwintering Bird Stations[2] and Abundance[3]							Niagara NAI Winter Status
						OB-1	OB-2	OB-3	OB-4	OB-5	OB-6	OB-7	
American Black Duck	*Anas rubripes*	S4										5	Uncommon resident
American Goldfinch	*Spinus tristis*	S5					1			1			Uncommon resident
American Pipit	*Anthus rubescens*	S4B					1						Occasional straggler
American Robin	*Turdus migratorius*	S5					1			1			Uncommon resident
American Tree Sparrow	*Spizella arborea*	S5					3			2	3		Common resident
Black-capped Chickadee	*Poecile atricapillus*	S5					5			2		1	Common permanent resident
Blue Jay	*Cyanocitta cristata*	S5				1	2			1			Very common permanent resident
Canada Goose	*Branta canadensis*	S5				2		5	14		8	4	Very common permanent resident
Carolina Wren	*Thryothorus ludovicianus*	S4						1		2			Uncommon permanent resident
Dark-eyed Junco	*Junco hyemalis*	S5								1			Common resident
Downy Woodpecker	*Dryobates pubescens*	S5						1		1			Common permanent resident
Golden-crowned Kinglet	*Regulus satrapa*	S5								1			Uncommon resident
Herring Gull	*Larus argentatus*	S4B, S5N				1							Very common resident
Hooded Merganser	*Lophodytes cucullatus*	S5									1	2	Uncommon resident
Mallard	*Anas platyrhynchos*	S5				4					18	1	Uncommon resident
Northern Cardinal	*Cardinalis cardinalis*	S5					1						Uncommon permanent resident
Red-bellied Woodpecker	*Melanerpes carolinus*	S5						1					Uncommon permanent resident
Song Sparrow	*Melospiza melodia*	S5				1	1						Uncommon resident
White-breasted Nuthatch	*Sitta carolinensis*	S5			x					1			Common resident

[1] per the Significant Wildlife Habitat Technical Guide (MNR 2000).
[2] Locations of overwintering bird survey stations are indicated in **Figure 5**.
[3] Abundance reflects counts of individuals by species at each station.