

Northgate & Erbsville Kartway Subdivisions
Beaver Creek Meadows District
Waterloo

Environmental Impact Study

Prepared for:
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NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Northgate & Erbsville Kartway Subdivisions
Beaver Creek Meadows District, Waterloo

Environmental Impact Study

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1.0 Introduction

Natural Resource Solutions Inc. (NRSI) was retained as part of a team by Northgate Land Corporation and Erbsville Kartway to prepare an Environmental Impact Study (EIS) for the proposed combined development of the above noted subject properties located on Conservation Drive in north Waterloo, Ontario.

The total subject property is approximately 55.746ha in area and is bounded to the north by Conservation Drive, Beaver Creek Road to the east, and natural features to the south and west (Map 1). The majority of the lands are owned by Northgate Land Corp. (49.29ha) with Erbsville Kartway being 6.456ha in area. Habitats within the subject property are comprised of agricultural fields, with wetlands and woodlands associated with Laurel and Beaver Creeks within the central and west portions of the property.

The City of Waterloo formally refers to this area as the Beaver Creek Meadows District. The woodland/wetland complex is part of Environmentally Sensitive Policy Area (ESPA) 80 known as Laurel Creek Forest (Region of Waterloo 2015) and is a Core Natural Feature in the City of Waterloo's Official Plan (2016), while Beaver Creek is identified as a Supporting Natural Feature. Wetlands are part of the Laurel Creek-Sunfish Lake Provincially Significant Wetland (PSW). The low-lying habitats along Laurel and Beaver Creeks are floodplain. The PSW, watercourses and their associated floodplain are regulated by the Grand River Conservation Authority (GRCA) and are subject to Ontario Regulation 150/06. The presence of these natural features, in addition to lands containing known and potential habitat for Species At Risk (SAR) that are afforded protection under the *Endangered Species Act* (ESA) (2007), have triggered the requirement for an EIS.

Technical studies, relevant to other aspects of the project such as planning, stormwater management, engineering, etc., have been prepared by the study team and have been used to supplement the natural feature characterization and assess potential impacts to the natural features. The study team includes:

- MHBC (Planning and Urban Design)
- MTE Consulting Inc. (Servicing, Stormwater Management, Hydrogeology, Noise)
- Natural Resource Solutions Inc. (Terrestrial, Wetland and Aquatic Biology).

The natural features in the area have been well studied through the North Waterloo Scoped Subwatershed Study (NWSSS, Ecoplans et al. 2013), 6 years (2014-2019) of pre-construction biological monitoring by NRSI (NRSI 2016, 2017a, 2018 and 2019), and 5 years of pre-construction surface water and groundwater monitoring by MTE (2015-2020). Pre-construction monitoring was completed as per the City of Waterloo's Development Monitoring Protocol (1999).

This report is the second submission of the EIS and is the result of an iterative process amongst the study team to revise the draft plan of subdivision, taking into account the comment received from City of Waterloo, the Region of Waterloo and the Grand River Conservation Authority on the first EIS report (NRSI 2017), and the recommendations of NRSI to protect natural features. This revised EIS contains an updated detailed characterization of existing natural features based on the results of a background review, as well as extensive original field surveys from the annual monitoring reports. Field survey data presented in this report is current up to and including the 2019 monitoring year. In 2019, the boundaries of the woodland and the wetland were re-flagged, reviewed and surveyed to update the mapping to current conditions. The report identifies natural feature boundaries and constraints in association with the land use policy designations, assesses potential impacts and provides mitigation measures to ensure that the proposed development will have no negative impacts on the features or their ecological functions. This EIS has been prepared in accordance with the City of Waterloo's OP (2016), Region of Waterloo's OP (2015), Greenlands Network Implementation Guidelines (2016), Section 15 – 17 of the NWSSS (Ecoplans et al. 2013), and the GRCA's EIS Guidelines and Submission Standards for Wetlands (2005). This revision has been prepared as part of a complete resubmission in support of a revised draft plan of subdivision. A comment-response document was prepared and submitted under separate cover to agency staff for their review.

For the purposes of this report, the term 'subject property' refers to the lands owned by the clients, including the area where the development is proposed to occur. The term 'study area' refers to the subject property plus the surrounding area up to 1km, for which additional information was collected and reviewed (as could be gathered without direct

access to these areas). Legacy data collected from agencies and wildlife atlases was gathered for the study area to ensure that all natural features were considered.

1.1 Proposed Development

The proposed development includes an internal road network, a mixture of residential density types, stormwater management facilities and pumping stations (2), trails and parkland as shown on the consolidated plan with the Draft Plans of Subdivision and Draft Plans of Vacant Land Condominium prepared by MHBC Planning (2020); Map 2. The development plan corresponds to the land use structure of the Beaver Creek Meadows District Plan (TPP 2016). The draft plan has been revised from the original submission in 2017 based on the comments provided by the agencies and through subsequent team meetings and discussions. A summary of the notable changes was provided in a letter to the City prepared by MHBC (April 16, 2020). Of note, the development plan reflects the updated wetland and dripline boundaries identified by NRSI July 15, 2019 and confirmed by the City, Region and GRCA August 27, 2019. Block boundaries have been adjusted to maintain the natural heritage feature buffers and includes new Open Space Blocks.

1.2 Project Scoping

In order to determine a study approach for this EIS, existing natural heritage information was gathered and reviewed to identify key natural heritage features and species that are known or have the potential to occur within the study area. Background information on the natural heritage features within the study area was gathered from the NWSSS (Ecoplans et al. 2013) and the pre-construction biological monitoring reports prepared by NRSI (NRSI 2016, 2017a).

For the purposes of this report, SAR are those listed on the Species at Risk in Ontario List (MECP 2019). These include species identified by the Committee on the Status of Species at Risk in Ontario (COSSARO) as provincially Endangered, Threatened, or Special Concern. Species listed by COSSARO as Endangered or Threatened are protected by the *Endangered Species Act* (*ESA)*, 2007, which includes protection to their habitat, and are referred to herein as regulated SAR.

Species considered Special Concern are included in the definition of Species of Conservation Concern (SCC), which includes the following:

- Species designated provincially as Special Concern,
- Species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by the NHIC, and
- Species that are designated federally as Threatened or Endangered by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC) but not provincially by the COSSARO. If these species are listed under the *Species at Risk Act* (SARA) under Schedule 1 they are protected by the federal Act but not provincially by the ESA.

NRSI completed a preliminary screening of SAR and SCC for the subject property based on the known available habitats. The following information sources were referenced to develop the list of SAR and SCC known and having the potential to be present in the subject property:

- Aerial photography of the site (2012),
- Species lists, vegetation community mapping, study methods and management recommendations contained in the NWSSS (Ecoplans et al. 2013), and
- Correspondence received from the GRCA, Region of Waterloo, City of Waterloo and the Ministry of Natural Resources and Forestry (MNRF)

The SAR/SCC screening was completed by comparing the habitat requirements for significant species that are known from the vicinity of the study area against the ELC communities and habitats known to occur within and adjacent to the subject property. This comparison determined which species have potential to occur within habitats in the subject property, and identify those species with potential to be impacted by the proposed development. Those species identified and an appropriate survey methodology was provided to the MNRF for review and approval.

Based on the findings of the background review and pre-construction monitoring surveys, including the SAR/SCC screening, a Terms of Reference (TOR) for the EIS was prepared by NRSI and submitted on January 15, 2016 to the City of Waterloo, and distributed to the Region of Waterloo, GRCA, and the Ministry of Natural Resources and

Forestry (MNRF). The TOR was edited based on the comments received from reviewers and finalized on January 19, 2017. A copy of the final TOR for the EIS is appended to this report (Appendix I).

1.3 Relevant Policies, Legislation, and Planning Studies

Information on the natural heritage features within the subject property was collected and assessed for significance by evaluating them against relevant policies, legislation, and planning studies as outlined in Table 1. Features which are significant or sensitive were identified to the study team to help inform suitable land-use concepts, guide the layout of development, and identify areas to be protected. Table 1 provides an overview of the policy legislation and planning studies that were considered and which informed the field program and analysis.

Table 1. Relevant Policies, Legislation and Planning Studies

Policy/Legislation	Description	Project Relevance
City of Waterloo Official Plan (2016)	• Commits to maintain, enhance, and restore the City's Natural System through land-use planning policies, restoration initiatives, sound management, stewardship, education, and acquisition. • The City's Natural System consists of Landscape Level Systems, Core Natural Features, Supporting Natural Features, Fish Habitat, Restoration Areas, and Linkages. The Natural System forms part of the broader Greenlands Network identified through the Region of Waterloo Official Plan. • As outlined in Section 8.2 of the OP, development or site alteration may occur on lands contiguous to the Natural System if it is demonstrated through an EIS that there will be no adverse impacts on the feature or its ecological functions. • It should be noted that portions of the Official Plan related to the Natural System are under appeal as it relates to the Northgate lands.	• The subject property is primarily designated as Low Density Residential. • The natural features within the central and west portions of the property are designated as Open Space, containing both Core Natural Feature and Supporting Natural Feature which are afforded protection under the City's OP.
Endangered Species Act (OMNR 2007)	• The original ESA, written in 1971, underwent a year-long review which resulted in a number of changes which came into force in 2007. • The ESA prohibits killing, harming, harassing, or capturing SAR and protects their habitats from damage and destruction.	• Based on information available through background documents and field surveys, including the SAR/SCC screening, several SAR and SCC were identified as having suitable habitat within the study area.
Fish and Wildlife Conservation Act (OMNR 1997)	• The FWCA provides protection for certain bird species, not protected under the MBCA (e.g., raptors), as well as furbearing mammals and their dens or habitual dwellings, asides from the Red Fox (*Vulpes vulpes*) and Striped Skunk (*Mephitis mephitis*).	• The timing of construction activities, especially vegetation clearing and site grading must have consideration for bird nesting and den sites for fur-bearing mammals.
GRCA Ontario Regulation 150/06 (2013)	• Regulation issued under *Conservation Authorities Act,* R.S.O. 1990.	• The proposed development footprint location is adjacent to the GRCA regulated Sunfish Lake – Laurel Creek PSW Complex (Map 1).

Policy/Legislation	Description	Project Relevance
	• Through this regulation, the GRCA has the responsibility to regulate activities in natural and hazardous areas (i.e. areas in and near rivers, streams, floodplains, wetlands, and slopes). • GRCA requires that an EIS be undertaken in accordance with their *EIS Guidelines and Submission Standards for Wetlands* where development is proposed within 120m of PSW or 30m of non-PSW (GRCA 2005). • Section 7.0 of the Regulation identifies the general policies associated with the CA's 'Regulation Area'. • The Regulation identifies that Development, interference or alteration within a Regulated Area may be permitted, where it can demonstrated, through an EIS that "*there are no negative or adverse hydrological or ecological impacts on the wetland."*	• A regulation limit of 120m from the GRCA confirmed wetland boundaries applies. • In accordance with this policy, the proposed development must demonstrate no negative impacts to the regulated natural features or their ecological functions.
Migratory Birds Convention Act (CWS 2013)	• The MBCA protects migratory game birds, insectivorous birds, and several other migratory non-game birds from persecution in the form of harassment. • The schedule of on-site work must consider MBCA windows, with timing of breeding bird season typically occurring between April 1 and August 31; however, this is a guideline, since the MBCA applies to nesting bird species. • "Incidental take" is considered illegal, with the exception of a permit obtained by the Canadian Wildlife Service (CWS).	• The timing of construction activities, especially vegetation clearing and site grading must have consideration for the MBCA timing windows.
Provincial Policy Statement (OMMAH 2020)	• Issued under the authority of Section 3 of the Planning Act and came into effect on April 30, 2020, replacing the 2014 PPS (OMMAH 2020). • One of the key goals of the PPS is the *"effective use of land and resources, with development primarily focused in settlement areas."*	• Based on the background review and detailed information from the NWSSS, pre-construction monitoring reports and SAR/SCC screening, several natural features afforded consideration within the PPS have been identified in the study area, including: o Significant Wetland,

Policy/Legislation	Description	Project Relevance
	• Section 2.1 of the PPS – Natural Heritage establishes clear direction on the adoption of an ecosystem approach and the protection of resources that have been identified as 'significant'. This section also identifies that natural features are to be protected for the long term. • Section 2.1.5 of the PPS identifies that development and site alteration shall not be permitted within the area outlined in sub-sections a) – f) *"unless it has been demonstrated that there will be no negative impacts on the natural features or their functions."* • The Natural Heritage Reference Manual (OMNR 2010) and the Significant Wildlife Habitat Technical Guide (OMNR 2000, MNRF 2015a) were prepared by the MNRF to provide guidance on identifying natural features and in interpreting the Natural Heritage sections of the PPS.	○ Significant Woodland, ○ Significant Wildlife Habitats, and ○ Habitat for endangered and threatened species
Regional Municipality of Waterloo Tree By-Law Number 08-026	• The by-law regulates the destruction or injuring of trees within woodlands, • Enactment of this by-law is aimed at sustaining a healthy natural environment within the Region, while also having regard for good forestry practices, • Statutes of protection aims that no person shall destroy or injure a tree, or cause another person to destroy or injure a tree, of a protected species that is located in a woodland	• The proposed development area contains only planted isolated trees, therefore, trees within development envelope are not protected under the Regions By-Law, • The development proposal will be maintained outside of the adjacent natural feature containing any woodland habitat.
Regional Municipality of Waterloo Official Plan (2015)	• The updated Regional Official Plan (ROP) includes policies related to the natural environment. • It provides a much more detailed policy framework than the previous ROPP that protects environmental features; therefore, the ROP 2015 is referred to throughout this report as the most current guidance for delineating and protecting Core Environmental Features within the study area.	• The Regions OP identifies the natural features within the central and western portions of the subject property to be 'Core Environmental Features' • Beaver Creek (or its tributaries), which flow through the central and western portions of the subject property, is associated with the Core Environmental Features.

Policy/Legislation	Description	Project Relevance
		• The Region's OP permits infrastructure within and adjacent to 'Core Environmental Features". Infrastructures includes municipal services and private and public roads.
North Waterloo Scoped Subwatershed Study (Ecoplans et al. 2013)	• The Subwatershed Study provides recommendations on conservation, enhancement, mitigation measures, and management practices of natural features and functions that have the potential to be impacted by development. • Core Areas and Watercourses are to be retained in their entirety, with no alterations to watercourses. • Development setbacks and buffers are recommended, to be confirmed during the EIS phase.	• Core Natural Areas and Watercourses exist within the central and western portions of the subject property.

2.0 Field Methods

The pre-construction biological monitoring program that was undertaken by NRSI within the study area, including the Northgate and Erbsville Kartway subject property, encompassed a number of survey components which were detailed and agreed upon in a Terms of Reference (TOR) (Appendix I) at the outset of the study. The terrestrial and aquatic field surveys were undertaken to characterize the natural heritage features and identify significant and sensitive features and species that have potential to be adversely affected by the proposed development. The methods and dates of each monitoring program component are described in detail below and are summarized in Table 2. Vegetation communities identified in the subject property are shown on Map 3, with specific biological monitoring locations shown on Map 4.

During the field work program, all incidental observations of wildlife were documented, including actual direct observations, as well as signs (i.e. tracks, scat, dens, nests, etc.). In addition to NRSI's characterization of natural heritage features, pre-construction surface and groundwater monitoring in the subwatershed study area has also been completed by Stantec (2016a, ongoing) as well as site specific monitoring of groundwater by MTE (2020 ongoing).

Table 2. Field Survey Summary

Survey Type	Protocol	Date					
		2014	2015	2016	2017	2018	2019
American Badger Survey	NWSSS (Ecoplans et al. 2013)	N/A	October 23	N/A	N/A	N/A	N/A
Barn Swallow Habitat Investigation & Descriptions Surveys	MNRF Guelph District Guidance (G. Buck, pers. comm. 2012a)	N/A	July 2	June 23	June 27	June 26	June 28
Bat Habitat Assessments (cavity trees and structures)	MNRF 2015c	October 17	N/A	N/A	N/A	N/A	N/A
Benthic Sampling	Ontario Benthos Biomonitoring Network (OBBN) Protocol Manual (Jones et al. 2007)	May 22[1]	May 20	June 2	June 7	June 5	June 5
		October 9	September 30	October 24	October 24	October 26	October 23
Breeding Bird Surveys	OBBA 2001	June 12[1]	June 5	June 6	June 6/7	June 4	June 11
		June 26[1]	June 23	June 17	June 16	June 18	June 21
Ecological Land Classification (verification and refinement; documentation of significant species)	Lee et al. 1998	N/A	June 5	June 6	June 6	June 14	June 12
		September 29	September 28	September 12	September 13	September 20	October 8
Evening Calling Anuran Surveys	BSC 2009	April 21[1]	April 16	April 18	April 11	April 26	April 28
		May 12[1]	May 25	May 17	May 18	May 16	May 22
		June 10[1]	June 16	June 21	June 22	June 18	June 18
Nocturnal Bird Surveys	Common Nighthawk Survey Protocol (G. Buck, pers. comm. 2012b)	N/A	May 28	May 26	June 1	May 28	June 12
			June 4	June 23	June 8	June 5	June 17
			June 30	N/A	July 8	June 25	June 24

Survey Type	Protocol	Date					
		2014	2015	2016	2017	2018	2019
Pre-Construction Monitoring & Disturbance Data Sheet	City of Waterloo Pre-Construction Monitoring (City of Waterloo 1999)	N/A	June 5	June 6	June 6	June 14	June 12
		September 29	September 28	September 12	September 13	September 20	October 8
Road Crossing Mortality Surveys[1]	NWSSS (Ecoplans et al. 2013)	May 1	N/A	N/A	N/A	N/A	N/A
		May 13					
		May 27					
		June 3					
		June 12					
Turtle Nest and Nesting Surveys	MNRF 2015b; MNRF 2016	N/A	May 25	May 28	N/A	N/A	N/A
			June 16	May 30			
				June 2			
				June 4			
				June 7			
				June 9			
				June 11			
				June 13			
				June 16			
				June 18			
				June 20			
				June 22			
				June 23			
Turtle Emergence/ Overwintering Surveys	MNRF 2015d	N/A	N/A	N/A	March 29	N/A	N/A
					April 9		
					April 10		
					April 17		
					April 18		
Vegetation Plot Monitoring	NRSI Vegetation Plot Monitoring standardized methods (GRCA approved, K. Smith, pers. comm. 2014),	June 23/25[1]	July 17/23	July 28 / August 2	N/A	N/A	July 11/12

Survey Type	Protocol	Date					
		2014	2015	2016	2017	2018	2019
	adapted from Terrestrial Monitoring – Plot Establishment & Data Collection (City of Waterloo 2002)	August 7/8/11/14					
Wetland Boundary and Dripline Flagging	Ontario Wetland Evaluation System for Southern Ontario (MNRF 2014) Greenlands Network Implementation Guidelines (Region of Waterloo 2016)						July 15 NRSI flagged, August 27 reviewed with GRCA and Region
Winter Wildlife Surveys	Greenlands Network Implementation Guidelines (Region of Waterloo 2016)	N/A	N/A	N/A	N/A	January 18	January 22
						February 12	February 14

[1]Survey(s) completed by MMM Group prior to NRSI's involvement in the project; methods detailed in NWSSS (Ecoplans et al. 2013)

2.1 Aquatic Habitat Assessment

Two watercourses traverse the subject property; Beaver Creek and Laurel Creek. Both creeks have been characterized and documented as part of the NWSSS (Ecoplans et al. 2013) including targets and thresholds provided for protection and enhancement. Information provided within the NWSSS has been utilized to assist in characterizing the aquatic habitat, fish and benthic communities in the creek for this EIS. The characterization completed for the NWSSS was performed through a multi-season approach to assess the following parameters:

- Flow condition,
- Channel dimensions and general character,
- Morphology (e.g. riffles, pools),
- Instream and overhead cover opportunities (i.e. woody debris, undercut banks, boulders, aquatic vegetation),
- Substrate type,
- Bank height, character and stability/evidence of erosion,
- Riparian vegetation,
- Physical barriers to fish movement,
- Evidence of groundwater discharge, and
- Disturbances, habitat limitations and potential habitat enhancement opportunities.

Fish community sampling was performed as part of the NWSSS (Ecoplans et al. 2013) using a multi-pass sampling approach following the sampling protocols described by the Ministry of Transportation Environmental Guide for Fish and Fish Habitat (2009) and the fish community composition assessment protocol as described in the Ontario Stream Assessment Protocol (Stanfield 2013). The results of these fish sampling events have been incorporated into the assessment of the local fish community for the purposes of this EIS. The full list of fish species known from within Laurel Creek and Beaver Creek is provided in Appendix II.

Benthic macro-invertebrate monitoring was performed at three stations (BTH-001, BTH-002, and BTH-003) as part of the NWSSS (Ecoplans et al. 2013) (Map 4). These

stations have continued to be sampled annually by NRSI. Spring sampling for benthic invertebrate monitoring was performed by MMM Group on May 22, 2014 as part of the NWSSS and by NRSI in spring and fall in all subsequent years (2015-2019). Two stations (BTH-001 and BTH-003) exist along Beaver Creek and one station (BTH-002) exists on Laurel Creek. These stations were established in accordance with the *Ontario Benthos Biomonitoring Network Protocol Manual* (OBBN) protocol (Jones et al. 2007). Each station is comprised of 3 sub-stations: 2 from riffle habitat and 1 from pool habitat. For wadable streams, such as the areas of Beaver Creek and Laurel Creek, the OBBN protocol employs a "Travelling Transect Kick and Sweep" method, where each sub-sample is made up by sampling 10 linear meters of stream transect over a 3 minute period (Jones et al. 2007; EC 2011). A 500 µm mesh D-net is held downstream of the substation transect to capture invertebrates dislodged by vigorous kicking within the transect area. Samples were then preserved in a buffered 70% ethanol solution for identification. Benthic samples were then identified to the lowest practical taxonomic level. Each monitoring station sub-sample was identified and the results of this identification were pooled for analysis. For the identification of the benthic macro-invertebrates within each sub-station, small, randomly selected portions were taken as representative samples of the sub-station. Successive portions were removed and fully identified until a minimum of 100 organisms were collected as per the requirements of the OBBN protocol (Jones et al. 2007). After the collection of the 100th organism, the portion being sampled is completed in order to facilitate the measurement of the proportion of the total sample that was sub-sampled. The proportion of the total sample analyzed is determined by comparing the volume of sub-samples taken to the volume of the total sample, which is a then calculated as a percentage of the total sample (Environment Canada 2011).

Benthic organisms which do not fall within the 27 groups of benthic invertebrates outlined in the OBBN protocol were not included in the tally (Jones et al. 2007). The benthic invertebrate data was analyzed using a number of metrics in order to characterize the general condition of the watercourse. The metrics used for the assessment of watercourse condition were selected to reflect the metrics and indices used for the NWSSS (Ecoplans et al. 2013) and recommended by the OBBN Protocol.

A total of 11 metrics and indices were calculated in order to assess the water quality within each monitoring station. These metrics include:

- Taxa Richness – the number of taxa generally increases with habitat diversity and water quality (Jones et al. 2007),
- EPT Taxa Richness – the number of taxa from orders sensitive to pollution, specifically the orders Ephemeroptera, Plecoptera, and Tricoptera (Barbour et al. 1999; Weber 1973),
- Percent EPT – percent composition of a community by taxa from orders sensitive to pollution, specifically the orders Ephemeroptera, Plecoptera, and Tricoptera (Barbour et al. 1999; Weber 1973),
- Percent *Oligochaetes* – percent composition of a community by aquatic worms, a group tolerant to pollutants (Jones et al. 2007),
- Percent Diptera – percent composition of a community by fly larvae which provides a context for other analysis (Jones et al. 2007),
- Percent *Chironomidae* – percent composition of a community by larval midges, a highly tolerant family (Jones et al. 2007),
- Dominant/Subdominant Taxa – highest and second highest number of taxa sampled,
- Percent Functional Feeding Groups – the percent composition of a community by Collector-filterers, Collector-gatherers, Predators, Scrapers, and Shredders. Feeding groups can provide an indication of habitat conditions (Merritt et al. 2008),
- Shannon Wiener Index (H') – an index used to measure the diversity in categorical data, taking into account the number of species and evenness of the species. Calculated as:
    - $H' = -\sum(p_i)\,(lnp_i)$
    - Where "p_i "is the proportion of individuals in the ith taxon (EC 2011),
- BI – a measure of water quality based on the species-level "tolerance values" and the number of individuals of each species and the total number of individuals within the sample. Calculated as:
    - $BI = \sum \frac{x_i t_i}{n}$

- Where "x_i" is the number of individuals within the ith taxon, "t_i" is the tolerance value of the ith taxon, and n is the total number of individuals within the sample (Hilsenhoff 1987).

- FBI – a measure of water quality based on the family-level "tolerance values" and the number of individuals within each family and the total number of individuals within the sample. Calculated as:
  - $FBI = \sum \frac{x_i t_i}{n}$
- Where "x_i" is the number of individuals within the ith family, "t_i" is the tolerance value of the "ith" family, and n is the total number of individuals within the sample (Hilsenhoff 1988).

2.2 Vegetation

2.2.1 Vegetation Communities

Vegetation communities within and adjacent to the subject property were characterized as per the Ecological Land Classification System (ELC) for southern Ontario (Lee et al. 1998) and presented in the NWSSS (Ecoplans et al. 2013). Vegetation community boundaries were verified and refined during the pre-construction monitoring program conducted by NRSI (2014-2019). ELC mapping is shown on Map 3. Detailed descriptions of ELC vegetation communities are presented in Section 3.6.1 (Table 3).

2.2.2 Vascular Flora

Detailed vegetation inventories within the subject property were conducted during the NWSSS (Ecoplans et al. 2013). Comprehensive summer-season vegetation inventories were completed by NRSI biologists during the pre-construction biological monitoring, in Years 1-3 (2014-2016) (NRSI 2016, 2017a), and Year 6 (2019) within the 5 vegetation monitoring plots (Map 4). All significant vascular flora species (i.e. federally, provincially, regionally) observed during all visits to the property were documented. A complete list of plant species observations within the vegetation monitoring plots is appended to this report (Appendix III) while a full list of plants in the subwatershed study area can be found in the NWSSS, Appendix 2E (Ecoplans et al. 2013). Further discussion of additional plant survey efforts is discussed in the following sections, and results are discussed in Section 3.6.2.

2.2.3 Vegetation Monitoring Plots

The GRCA requested vegetation plot monitoring be implemented for the proposed development. Permanent plot vegetation monitoring was completed within the subject property during the summer season (2014-2016, 2019) following the methods for vegetation monitoring taken from the City of Waterloo's *Terrestrial Monitoring – Plot Establishment & Data Collection* (2002). Monitoring was carried out at 5 locations in a variety of habitats within the subject property as shown on Map 4. Data recorded included species, size, abundance, and health of canopy trees, and comprehensive documentation of understorey trees, shrubs, and herbaceous plants. NRSI had recommended in the 2016 pre-construction monitoring report that vegetation plot monitoring be discontinued until the construction period, or after a time of 3 years, in order to minimize impacts to the sensitive natural features and organic substrates and allow vegetation to recover (NRSI 2017a). GRCA staff concurred with NRSI's recommendation, and the vegetation plot monitoring was suspended in 2017 and 2018. GRCA further clarified that one year of vegetation plot monitoring is required in the year immediately prior to construction, and the other year of required pre-construction data can rely on the 2014-2016 monitoring events (C. Tinney, pers. comm. 2019). Accordingly, vegetation plot monitoring was reinstated in 2019. A complete list of plant species observations within the vegetation monitoring plots is appended to this report (Appendix III) and results are discussed in Section 3.6.3.

2.2.4 Vegetation Surveys for Enhancement / Management Needs

Wandering transects were established within and adjacent to the natural features on the subject property to assess enhancement and/or management needs as development proceeds. Transects surveys were conducted during spring and fall (2014-2019) to document the presence of litter, footpaths, and any other forms of disturbance (i.e. dumping of yard waste, forts, invasive species establishment, etc.) using a standardized form to collect data. This information will inform the baseline condition of the interior and buffering habitats of the natural features to be used as a comparative condition for future monitoring. It will also be used to identify areas for refuse removal and enhancement or enhancement activities. In addition, the vegetation surveys identified federally (Government of Canada 2018), provincially (MECP 2019, MNRF 2019) and regionally significant plant species (Richardson and Martin 1999).

The results of the vegetation surveys for enhancement/management needs are discussed in Section 3.6.4 in this report with significant species locations shown on Map 3.

2.2.5 Terrestrial Feature Monitoring

As outlined in the City of Waterloo's Development Monitoring Protocol document (1999) for pre-construction surveys, terrestrial feature monitoring was conducted within the subject property in spring and fall (2014-2019). NRSI biologists walked through the natural features within the subject property and documented the following using a standardized data form:

- General health of vegetation and trees,
- Evidence of soil movement,
- Evidence of human disturbance or encroachment,
- General fish and wildlife observations, and
- Overall conditions

The results of the terrestrial feature monitoring are discussed in conjunction with the vegetation surveys for enhancement/management needs (Section 3.6.4).

2.2.6 Fixed Photo Plot Monitoring

A total of 17 fixed photo monitoring plots were established throughout and adjacent to the natural features within the subject property (Map 4). Each plot was assessed by NRSI (2014-2019) during the spring and fall seasons through a qualitative photo inventory method. In order to facilitate comparison of baseline conditions with future conditions, the same orientation was used in each year of subsequent monitoring. The photo monitoring was conducted in accordance with the City of Waterloo's Development Monitoring Protocol guidance document for pre-construction monitoring of terrestrial features (1999). This guidance document specifies spring and fall photo plot monitoring.

Photos documented the current condition of the natural features and their edges to record the health and character of the vegetation, presence of any refuse, footpaths, erosion, or other forms of disturbance. These photos will help establish baseline

conditions and document future disturbances, planting success, or other changes over time.

2.2.7 Dripline and Wetland Boundary Flagging and Survey

Initial dripline flagging and surveying of the Core Environmental Feature (CEF) boundaries was done during the NWSSS in 2009. Due to the amount of time passed since the NWSSS boundary delineation, the CEF boundaries were flagged, reviewed and re-surveyed in 2019 to ensure the most accurate feature limits were being used in this EIS. The features were flagged by NRSI biologists on July 15, 2019, and reviewed in the field with GRCA ecologist T. Zammit, Region of Waterloo environmental planner A. Hovingh, and City of Waterloo environmental planner R. McMullen on August 27, 2019, and subsequently surveyed by MTE. The current boundaries have been used on all maps and development plans herein.

2.3 Avifauna

2.3.1 Breeding Birds

Breeding bird surveys were completed within the existing Wildlife Survey Units (WSUs) as defined in the NWSSS (Ecoplans et al. 2013) as well as within the agricultural and cultural areas on the subject property (Map 4). Surveys were conducted during the peak breeding bird season, consistent with the NWSSS (Ecoplans et al. 2013) methods, and the Ontario Breeding Bird Atlas (OBBA) Guide for Participants (OBBA 2001) standardized protocol.

Following the standardized protocol, point counts for breeding birds were completed twice each breeding season and timed at least 10 days apart in 2014-2019. Random wandering transect surveys were also completed in between point count stations to document incidental bird species in each habitat unit. Point counts were completed during the early morning between sunrise and 1000hrs, for a length of 10 minutes. Supplementary data was also recorded at each station, including the survey time, air temperature, wind speed (as per Beaufort Wind Scale), cloud cover, and precipitation.

Monitoring results from avifauna surveys, including incidental observations are provided in Appendix IV and are discussed in Section 3.7. The results have been presented in

two separate tables; cumulatively for all bird species documented during the breeding bird season, and those documented incidentally outside of the breeding bird season during all other visits to the subject property. This approach is consistent with the presentation of bird survey results in the NWSSS (Ecoplans et al. 2013).

2.3.2 Common Nighthawk

The potential presence of Common Nighthawk (*Chordeiles minor*), a SCC, within the study area was identified based on data obtained from the MNRF, and initially circulated to NRSI by GRCA reviewing staff. Suitable habitat for this species, albeit marginal, is present in the subject property; therefore, surveys were conducted in 2015-2019 according to MNRF guidance including up to 3 evening surveys, spaced 7 days apart, on evenings during the appropriate lunar phase, between late May and early July (G. Buck, pers. comm. 2012b). Monitoring locations are shown on Map 4.

2.3.3 Barn Swallow

Barn Swallow (*Hirundo rustica*), a provincially Threatened species, was noted as occurring within the study area in the NWSSS (Ecoplans et al. 2013). Barn swallow surveys were conducted in 2015-2019 according to the Guelph District MNRF Barn Swallow Survey Protocol (G. Buck, pers. comm. 2012a) which includes a third targeted survey during the breeding bird season. A third survey visit was conducted within the cultural areas of the subject property to determine if any Barn Swallows were nesting in the existing structures on-site. Structures proposed for removal within the proposed development scenario are limited to the Erbsville Kartway property. Specific Barn Swallow surveys were conducted within WSU-11 as shown on Map 4.

2.4 Amphibians

Evening amphibian call surveys were completed at the 5 permanent monitoring stations located at wetland units within the subject property (Map 4). Surveys were conducted on 3 separate dates during the amphibian breeding season, in April, May, and June (2014 - 2019), consistent with the Marsh Monitoring Program (MMP) amphibian monitoring standardized protocol (BSC 2009). A minimum of 15 days between visits was coordinated to correspond with peak vocalization periods for early, mid, and late-season breeding species. Surveys occurred between one half-hour after sunset and midnight,

on evenings with appropriate weather conditions, as specified in the protocol. Surveys were not conducted during rain events (light rain is acceptable) (BSC 2009).

Following this protocol, 3 minute point counts were conducted at each monitoring station to identify presence and relative abundance (based on calling intensity) of anuran (frog and toad) species within each wetland unit. A three-level calling code system was utilized to record relative levels of calling intensity for each identified species:

- Calling Code 1 is used when number of calling males can be estimated and calls do not overlap,
- Calling Code 2 is used when some calls overlap but number of calling males can still be estimated, and
- Calling Code 3 is used when males are calling at full chorus and it isn't possible to estimate the number of individuals.

Supplementary data was also recorded at each station, including the survey time, air and water temperature, pH, wind speed (as per Beaufort Wind Scale), cloud cover, direction surveyors were facing, and background noise levels.

The significant sub-population of Western Chorus Frog (*Pseudacris triseriata*), a federally Threatened species, was recorded within the study area during the NWSSS (Ecoplans et al. 2013). The anuran call surveys described above are adequate to monitor for the presence and abundance of Western Chorus Frog.

Anuran call count monitoring results are provided in Appendix V and discussed in Section 3.8.

2.5 Reptiles

Extensive surveys for snake species using cover boards were undertaken during the NWSSS (Ecoplans et al. 2013). No significant species were observed during these surveys; therefore, no further cover board surveys were conducted in 2014-2019.

Significant turtle species with the potential to be using the habitats within the study area include Snapping Turtle (*Chelydra serpentina*) (SCC) and Blanding's Turtle (*Emydoidea*

blandingii) (Threatened) as described in the NWSSS (Ecoplans et al. 2013). Numerous targeted visual surveys for turtle SAR and Significant Wildlife Habitat (SWH) related to turtles (potential turtle nesting and overwintering areas) were conducted by NRSI according to recent MNRF guidance for turtle nest and nesting surveys (MNRF 2015b; MNRF 2016), and overwintering/emergence surveys (MNRF 2015b) (NRSI 2018). Based on the results of the turtle survey efforts to-date, with no sightings, no further targeted turtle surveys have been recommended by the MNRF as confirmed during a consultation meeting held on March 19, 2018.

During all visits to the subject property, any incidental sightings of snake or turtle species were documented, as well as any evidence of hibernation, nesting, or basking areas that may qualify as SWH according to the Significant Wildlife Habitat Technical Guide (SWHTG, OMNR 2000) and criteria tables (MNRF 2015a).

2.6 Mammals and Other Wildlife

The isolated landscape trees and buildings within the subject property were considered for their suitability to provide roosting habitat for the following SAR bats: Little Brown Myotis (*Myotis lucifugus*), Northern Long-eared Bat (*Myotis septentrionalis*), Eastern Small-footed Myotis (*Myotis leibii*), and Tri-colored Bat (*Perimyotis subflavus*). Isolated trees and existing buildings on the Kartway property are proposed for removal according to the existing development concept shown in Map 2; tree and building removals are not applicable to the Northgate property. Accordingly, a detailed bat habitat assessment was conducted at the Kartway property on October 17, 2014.

American Badger (*Taxidea taxus jacksoni*) (Endangered) was surveyed for in the NWSSS (Ecoplans et al. 2013) with no sightings or evidence found. During the monitoring program, the MNRF requested targeted den surveys for American Badger, as time had passed since the NWSSS American Badger surveys were completed in 2010-2011, and the species has the potential to move into the site (D. Marriott, pers. comm. 2015). A targeted American Badger den survey was conducted by NRSI within the subject property on October 23, 2015 as per the NWSSS methods (Ecoplans et al. 2013), focusing on the edges of natural features abutting agricultural areas.

Winter wildlife surveys were completed by NRSI in 2018 and 2019 according to the Greenlands Network Implementation Guidelines (GNIG, Region of Waterloo 2016). These surveys consisted of two visits during between January 1 and February 29 with suitable weather conditions (within 24-72 hrs. of a snowfall of at least 2cm) to document overwintering use by resident wildlife.

Incidental observations of all mammals, insects, and any other wildlife species were recorded during all field visits. This included direct observations, as well as observations of tracks, scat, vocalizations, etc. Habitat features that may qualify as SWH according to the Significant Wildlife Habitat Technical Guide (SWHTG, OMNR 2000) and criteria tables (MNRF 2015a) were documented, evaluated and confirmed as SWH. Confirmed SWH are shown on Map 5.

2.7 Road Crossing Mortality Monitoring

Road crossing mortality monitoring was completed by MMM Group during spring 2014. Monitoring events occurred in May and June and generally focused on Conservation Drive from Beaver Creek Road to the property frontage at the Erbsville Kartway(Map 4). Methods implemented were consistent with the NWSSS (Ecoplans et al. 2013). Additionally, incidental road crossing mortality inspections were completed by NRSI during the annual spring and fall pre-construction monitoring events (2014-2019), focused on the Beaver Creek watercourse crossing of Conservation Drive.

3.0 Existing Conditions

3.1 Soils, Terrain and Drainage

The study area is located in the physiographic region known as the Waterloo Moraine or the Waterloo Sand Hills (Chapman and Putnam 1984). This region is characterized by irregular hummocky to steeply rolling land comprised of a number of layers of ice contact and glacial outwash sands and gravels, separated by layers of silt and clay rich tills. These soils were deposited over the course of numerous advances and retreats of glacial ice lobes during the Wisconsinian glacial period. As the glacial ice melted and retreated, melt water eroded and cut through the layers. Modern action and erosion by watercourses and the deposition of wetland organic soils further created a complex pattern of surficial soils in the study area.

The tills in the study area are dominated by silts and clays in variable compositions and also with sand. In general, the tills are described as hard and dense with low permeability and are known as aquitards, forming a barrier protecting the underlying aquifer layers of water bearing sand and gravel layers or bedrock. The deep aquifer layers of the Waterloo moraine are important in Waterloo Region as a water supply for the Cities of Kitchener and Waterloo.

The subject property soils and groundwater conditions were investigated by MTE and are described in their Hydrogeology Study (2017). The subject lands gradually increase in topography from west to east (elevation 350-358m above mean seal level (amsl)), with a relatively flat topography from north to south along the Beaver Creek corridor (elevation 346m amsl). The borehole drilling program identified the subsurface stratigraphy to be comprised of topsoil material consisting of some organics and silty sand up to 1m below ground surface (bgs). Fine sand with till and/or clay silt materials underlay the topsoil layer up to 17m bgs. Fine-textured glaciolacustrine sediments of primarily silty clay interpreted as the Lower Maryhill Till occur between 17-25m bgs. Refer to the Hydrogeological Study report for further details (MTE 2017).

3.2 Groundwater

Stantec Consulting carried out the pre-construction monitoring of groundwater and surface water across the North Waterloo study area (Stantec 2016a) while MTE

completed site specific groundwater monitoring and prepared the Hydrogeological Study (MTE 2020a). The results of the Stantec monitoring report conclude that in general, groundwater and surface water observations from 2011-2015 were consistent with the overall results and interpretations as presented in the NWSSS with respect to groundwater flow, levels, chemistry, and surface flow conditions (Stantec 2016a). Stantec found that groundwater levels at the monitoring wells vary seasonally and respond synchronously (all at once) across the site to precipitation events. The flow of groundwater is interpreted to be generally directed to and associated with Beaver Creek and Laurel Creek (Ecoplans et al. 2013). Based on the permeability of the surficial soils, the majority of the subject property is identified as a groundwater recharge area, where precipitation can infiltrate to the shallow groundwater layer, and potentially to the deeper aquifers where there is no intervening layer of impermeable till. Figure 5.8 of the NWSSS (Ecoplans et al. 2013) indicates that approximately the western half of the subject property is a Potential Groundwater Recharge Area, and approximately the eastern half of the subject property is a Significant Groundwater Recharge Area. As reported in the NWSSS, groundwater discharge occurs within the subject property in the lower reaches of Beaver Creek just above its confluence with Laurel Creek, as well as into Laurel Creek within the Erbsville Kartway property (Ecoplans et al. 2013). The NWSSS indicated variable hydraulic gradients along both Beaver Creek and Laurel Creek and did not consistently indicate areas of groundwater recharge or discharge. This observation was substantiated during the 2012 groundwater and surface water monitoring year, which was a below average precipitation year. In 2012, groundwater levels were lower than those previously measured and accompanied by a lack of groundwater discharge within Laurel and Beaver Creeks during that time of drought (Stantec 2016a).

MTE (2020a) determined that the regional groundwater flow direction is inferred to be from the topographical highs in the northwest and northeast towards Beaver Creek and Laurel Creek. Depth to water table is approximately 2m bgs to 7m bgs from west to east, but is close to the ground surface (1m bgs) along the Beaver Creek corridor from north to south. During on-site investigations, groundwater was identified at depths ranging from 0.3m to 7.4m bgs in the boreholes and at the installed standpipes. The greatest depth to groundwater occurs near the topographic high in the northeast,

whereas the shallowest depth occurs adjacent to Beaver Creek and the wetlands in the central portion of the subject property.

Downward vertical hydraulic gradients (groundwater recharge) are observed at the high points of the properties in the northeast and the northwest, with upward groundwater movement (discharge) at the low regions of the site, at the wetlands and creeks. The overall conclusions presented in the NWSSS suggest that groundwater discharge along Beaver Creek was at best minimal or negligible (Ecoplans et al. 2013). MTE's field monitoring of groundwater-surface water interactions in the wetlands between 2015 and 2020 showed that there is some groundwater supporting the wetland at certain times of the year. Further details are provided in the Hydrogeological Study report (MTE 2020a).

3.3 Aquatic Habitat

3.3.1 Beaver Creek

Beaver Creek is a headwater tributary to Laurel Creek, which crosses Conservation Drive along the north side of the subject property boundary upstream from BTH-003 and flows generally southeast across the subject property, exiting on the southeast side of the subject property near BTH-001, as shown on Map 3. Beaver Creek flows into Laurel Creek approximately 20m south of the subject property boundary.

Immediately downstream of Conservation Drive, Beaver Creek flows within a narrow riparian corridor through open agricultural fields. The channel appears to have been historically channelized where it flows adjacent to agricultural lands but exhibits a more natural, meandering form where it enters the wooded area south of the fields. Bankfull widths are in the range of 4.0m to 7.0m, and bank height is between 1.0m and 2.0m. The banks have mostly moderate slopes with some evidence of erosion. Wetted widths were noted to be in the range of 2.8m to 4.5m, and flows had a low velocity over a low gradient. Water depths ranged from 0.1m to 0.4m. Morphology is described as predominantly flats with some small pools and short riffles. Substrates comprise mostly sand and silt, with some coarser substrates in the riffles. Instream cover is provided mainly through woody debris and overhanging riparian vegetation (grasses and shrubs) with some cobble and pools providing additional cover. Filamentous algae has also been noted in the NWSSS (Ecoplans et al. 2013). During benthic invertebrate sampling

the substrates within this reach of Beaver Creek were found to be predominantly gravel, with patches of cobble and sand with traces of silt throughout.

The downstream portion of Beaver Creek (BTH-001) exits the subject property on the southeast side immediately upstream of the confluence of Beaver Creek and Laurel Creek. The creek flows through a mature cedar-hardwood mixed swamp. Bankfull widths within this reach range from 5.0m to 9.0m, and bank height is between 0.3m and 1.5m. Channel flows were observed to be high velocity flows with water depths ranging from 0.1m to 0.3m throughout this reach. Channel morphology throughout this reach is dominated by riffles with isolated pools and long flat sections. Instream fish habitat is provided by deposits of woody debris along banks and patches of cobble and boulder debris was documented in the NWSSS (Ecoplans et al. 2013). During benthic invertebrate sampling the substrates within this reach of Beaver Creek were identified as predominantly gravel, with patches of cobble and sand throughout.

3.3.2 Laurel Creek

Laurel Creek flows south along the south-west edge of the subject property and to the west of the Erbsville Kartway (BTH-002). This reach flows through a dense cedar-hardwood mixed swamp habitat, and during the NWSSS was affected by significant flooding resulting from beaver dam construction downstream (Ecoplans et al. 2013). This beaver dam remained in place through the 2014 monitoring period but was no longer in place during the 2015 benthic sampling. Once the beaver dam was no longer in place water levels were reduced and began to carve through the original creek channel. Wetted widths and maximum depths in the vicinity of BTH-002 were observed to be 2.85m and 0.18m on average prior to beaver dam construction, with sand and cobble substrates. After the beaver dam failed, the average wetted width was observed to have increased to 3.9m while the maximum water depth increased to 0.33m and substrates were observed to be sand and silt. Bankfull widths within this reach of Laurel Creek range from 0.7m to 12m, with bank heights ranging between 0.8m to 1.5m. The banks were observed to have a low to moderate slope with some traces of erosion. The channel morphology is predominantly a mix of deep flat and pool habitats with isolated portions of short riffles. Significant instream fish habitat is provided by dense woody debris and undercut banks throughout the cedar-hardwood mixed swamp as documented in the NWSSS (Ecoplans et al. 2013).

3.4 Fish Community

3.4.1 Beaver Creek

A collective total of 14 species of fish were captured in this reach of Beaver Creek during sampling in 2006 and 2009 for the NWSSS (Ecoplans et al. 2013). These species are listed in Appendix II. The species captured were all common and populations are considered secure in Ontario. Of the 14 species observed 12 can be considered habitat generalists. Rainbow darter (*Etheostoma caeruleum*) is considered a habitat specialist, preferring fast-flowing gravel and cobble riffles of creeks and small rivers with a preferred water temperature of 19.8°C (Eakins - OFFLHD as cited in Ecoplans et al. 2013). Longnose Dace (*Rhinichthys cataractae*) also prefers fast-flowing riffles. While some of the fish captured prefer cool water temperatures, none are indicative of coldwater habitat.

3.4.2 Laurel Creek

A collective total of 10 species of fish were captured from Laurel Creek in the vicinity of the subject property during sampling in 2006 and 2009 for the NWSSS (Ecoplans et al. 2013). These species are listed in Appendix II. The species captured were all common and secure in Ontario, and 8 of the 10 species can be considered habitat generalists. Similar to Beaver Creek, Rainbow Darter and Longnose Dace were noted within Laurel Creek. These two species are considered to be more specialized, requiring riffles and runs with higher water velocities and substrates of gravel and cobble. While some of the fish captured prefer cool water temperatures, none are indicative of coldwater habitat.

Brown Trout (*Salmo trutta*) spawning was previously documented from 1984 to 1994 by the MNRF and GRCA in the lower reaches of Laurel Creek and in Beaver Creek near the confluence immediately southeast of the subject property. Since that observation, there have only been observations of potential adult trout and ‘scrapes’ that may or may not be redds. The NWSSS (Ecoplans et al. 2013) indicates that there appears to be suitable habitat for Brown Trout and Brook Trout (*Salvelinus fontinalis*) in Beaver Creek. The lower reaches of Laurel Creek were also identified as potentially suitable based on instream temperatures, substrates of gravel that are suitable for spawning, and

observations of local groundwater discharge. No evidence of trout activity has been observed, and the fine substrates noted in Laurel Creek within the subject property are not suitable for trout spawning.

3.5 Benthic Invertebrate Community

Benthic invertebrate sampling results are provided in the annual pre-construction monitoring reports prepared by NRSI (2016-2020). The taxonomic richness of the benthic community remained relatively consistent between years and seasons within all three monitoring stations, ranging from 16-34 taxa within Laurel Creek (BTH-002), 18-31 taxa within the upper reaches of Beaver Creek (BTH-003) and 19-44 taxa immediately upstream of the confluence of Laurel and Beaver Creeks (BTH-001). The richness of sensitive taxa (EPT taxa richness) showed considerably more variation between each monitoring station and between seasons within each monitoring station. The proportion of sensitive Taxa within Laurel Creek was observed to be substantially lower (1-10) than the richness observed within Beaver Creek (2-11 and 5-14). This result corresponds generally to the trends observed in the richness of sensitive taxa in the NWSSS. The average proportion of sensitive taxa within Laurel Creek was observed to be 10.3% comprising a relatively small proportion of the overall community, the proportion of sensitive taxa within Beaver Creek ranged considerably from 35.2% at BTH-001 and 10.8% at BTH-003 across all years of monitoring.

The tolerant taxa were observed in much higher proportions in both Beaver and Laurel Creeks, with the Family Chironomidae observed to make up a large proportion of the benthic community ranging in composition from 36.7% and 88.6% within Laurel Creek and between 8.1% and 82.91% within Beaver Creek. This corresponds with the high proportions observed in the findings of the NWSSS (Ecoplans et al. 2013).

Various taxa belonging to the highly tolerant Order Diptera (True Flies) were dominant across all years of monitoring within both Laurel and Beaver Creeks, with few exceptions. Occasional fluctuations in dominant taxa were observed throughout the years and also included dominance by some sensitive and highly sensitive taxa such as from the Order Trichoptera and Ephemeroptera.

The Shannon Wiener Diversity Index falls within the typical range of values, 1.5-3.5 across all monitoring stations. The average index value within Laurel Creek was 2.66 while the average index values within Beaver Creek were 2.88 (BTH-001) and 2.76 (BTH-003) this result is generally consistent with the results of the NWSSS and indicates a moderately high diversity of benthic taxa with an abundance balanced between multiple taxa (Ecoplans et al. 2013).

The Family Biotic Index (FBI) results were on average *good* within both Laurel and Beaver Creeks. This shows a slight improvement in FBI water quality when compared to the FBI range observed during the NWSSS (Ecoplans et al. 2013). This slight improvement is similarly seen in the results of the Biotic Index (BI) which shows an average quality of *Fair* across all monitoring stations in both Laurel and Beaver Creeks.

3.6 Vegetation

3.6.1 Vegetation Communities

Existing ELC mapping was field verified by NRSI and refined during the 2014-2019 pre-construction monitoring program. ELC in the subject property is largely the same as reported in the NWSSS, with minor refinements as reported in the pre-construction monitoring reports (NRSI 2016, 2017a, 2018, 2019). A summary of ELC communities identified within the subject property is provided in Table 3 and shown on Map 3. Vegetation communities occurring off-property that were not specifically assessed by NRSI but were assessed within the NWSSS (Ecoplans et al. 2013) are noted on Map 3. Similarly, the SWM6-1 vegetation community occurring off-property to the south of the Northgate property was delineated based on observations from the property line and airphoto interpretation.

Table 3. Vegetation Communities Identified within the Study Area (adapted from Ecoplans et al. 2013)

ELC Ecosite Type	ELC Description	Environmental Characteristics
Wetland		
SWM4-1	White Cedar – Hardwood Organic Mixed Swamp	This mixed swamp community is associated with low-lying areas of Beaver and Laurel Creek, and occurs on both the Northgate and Kartway properties. The canopy is comprised of Eastern White Cedar (*Thuja occidentalis*), Black Ash (*Fraxinus nigra*), Trembling Aspen (*Populus tremuloides*), Yellow Birch (*Betula alleghaniensis*), and Eastern Hemlock (*Tsuga canadensis*). The sub-canopy and understorey layers consist of Eastern White Cedar, European Buckthorn (*Rhamnus cathartica*) and Glossy Buckthorn (*Frangula alnus*), Black Ash, and Common Elderberry (*Sambucus canadensis*). Groundcover flora is characterized by Spotted Jewelweed (*Impatiens capensis*), Sensitive Fern (*Onoclea sensibilis*), sedges (*Carex* spp.), Wild Black Currant (*Ribes americanum*), Dwarf Raspberry (*Rubus pubescens*), Bulblet Fern (*Cystopteris bulbifera*), Bitter Nightshade (*Solanum dulcamara*), Rough-leaved Goldenrod (*Solidago patula*), Woodbine (*Parthenocissus vitacea*), and Fowl Meadow Grass (*Glyceria striata*). Several regionally significant plant species were observed within this community: Rough Sedge (*Carex scabrata*), Golden Alexanders (*Zizia aurea*), Virginia Stickseed (*Hackelia virginiana*), Shining Ladies'-tresses (*Spiranthes lucida*), Smooth-sheated Sedge (*Carex laevivaginata*), and Soft-leaved Sedge (*Carex disperma*). As well, a single federally significant species, Black Ash, was documented within this community. A habitat inclusion was identified on the edge of this vegetation community on the Kartway property, Fresh-Moist Poplar Deciduous Forest (FOD8-1), and is dominated by Trembling Aspen, Manitoba Maple (*Acer negundo*), Green Ash (*Fraxinus pensylvanica*), and European Buckthorn.
SWM6-1	Birch – Conifer Organic Mixed Swamp	This mixed swamp community is dominated by Yellow Birch, Black Ash, Eastern Hemlock, White Elm (*Ulmus americana*), Red Maple (*Acer rubrum*), and Eastern White Cedar in the canopy. The sub-canopy and understorey are comprised of Eastern Hemlock, Eastern White Cedar, and Yellow Birch. Groundcover flora is characterized by sedges, Dwarf Raspberry, Northern Lady Fern (*Athyrium filix-femina var. angustum*), False Mitrewort (*Tiarella cordifolia*), Bulblet Fern, Bitter Nightshade, Spotted Jewelweed, Sensitive Fern, Coltsfoot (*Tussilago farfara*), and Wood Nettle (*Laportea canadensis*). Three regionally significant plant species were observed within this community, Northern Beech Fern (*Phegopteris connectilis*), Smooth-sheathed Sedge, and Rough Sedge. As well, a single federally significant species, Black Ash, was documented within this community.

ELC Ecosite Type	ELC Description	Environmental Characteristics
		A habitat inclusion was identified within this vegetation community, Mineral Meadow Marsh (MAM2), and is dominated by Phragmites (*Phragmites australis* ssp. *australis*) and Narrow-leaved Cattail (*Typha angustifolia*). The extent of this vegetation community occurring off-property to the south was delineated based on airphoto interpretation.
SWD7-1	White Birch – Poplar Organic Deciduous Swamp	This deciduous swamp community is associated with Beaver Creek, and is dominated by Balsam Poplar (*Populus balsamifera*), Green Ash, White Elm, and Trembling Aspen in the canopy. The sub-canopy and understorey are comprised of Balsam Poplar, European Buckthorn and Glossy Buckthorn, and Choke Cherry (*Prunus virginiana*). Groundcover flora is characterized by Lake-bank Sedge (*Carex lacustris*), Canada Goldenrod (*Solidago canadensis*), Wild Red Raspberry (*Rubus idaeus* ssp. *melanolasius*), Field Horsetail (*Equisetum arvense*), Ciliate Willow-herb (*Epilobium ciliatum*), Bitter Nightshade, Woodbine, Canada Anemone (*Anemone canadensis*), Spotted Jewelweed, and American Stinging Nettle (*Urtica dioica* ssp. *gracilis*). A single regionally significant species was observed within this community, Virginia Stickseed. Two habitat inclusions were identified adjacent to this vegetation community, Mineral Cultural Woodland (CUW1), and Fresh-Moist Poplar Deciduous Forest (FOD8-1). The CUW1 community is dominated by White Poplar (*Populus alba*); the FOD8-1 community is dominated by Balsam Poplar.
SWT2	Mineral Thicket Swamp	This thicket swamp community is associated with Beaver Creek and is dominated by willows (*Salix* spp.), Red-osier Dogwood (*Cornus stolonifera*), Silky Dogwood (*Cornus amomum* ssp. *obliqua*), Riverbank Grape (*Vitis riparia*), Narrow-leaved Meadowsweet (*Spiraea alba*), and Balsam Poplar. Groundcover flora is characterized by Spotted Jewelweed, Reed Canary Grass (*Phalaris arundinacea*), Canada Anemone, Hog Peanut (*Amphicarpaea bracteata*), Wild Red Raspberry, Canada Goldenrod, and Spotted Joe-pye-weed (*Eupatorium maculatum*).
Forest		
FOM6-1	Fresh – Moist Sugar Maple –	This mixed forest community occurs in 3 locations within the Northgate property. The canopy is dominated by Sugar Maple (*Acer saccharum* ssp. *saccharum*), Eastern Hemlock, White Ash (*Fraxinus americana*), Black Cherry (*Prunus serotina*), American Beech (*Fagus grandifolia*), American Basswood

ELC Ecosite Type	ELC Description	Environmental Characteristics
	Hemlock Mixed Forest	(*Tilia americana*), and Eastern White Pine (*Pinus strobus*). The sub-canopy and understorey layers consist of Sugar Maple, Bitternut Hickory (*Carya cordiformis*), White Ash, Eastern Hemlock, American Beech, and European Buckthorn. Groundcover flora is characterized by sedges, Evergreen Wood Fern (*Dryopteris intermedia*), Herb Robert (*Geranium robertianum*), Coltsfoot, Allegheny Blackberry (*Rubus allegheniensis*), Enchanter's Nightshade (*Circaea lutetiana* ssp. *canadensis*), Woodland Strawberry (*Fragaria vesca* ssp. *americana*), Spinulose Wood Fern (*Dryopteris carthusiana*), Lady Fern, Blue Cohosh (*Caulophyllum giganteum*), Zig-zag Goldenrod (*Solidago flexicaulis*), Wild Ginger (*Asarum canadense*), and Sugar Maple. A single regionally significant plant species was observed within this community, Virginia Stickseed. A habitat inclusion was identified within this vegetation community, White Cedar – Hardwood Organic Mixed Swamp (SWM4-1), and is dominated by Eastern White Cedar.
FOC4-1	Fresh – Moist White Cedar Coniferous Forest	This coniferous forest community is dominated largely by Eastern White Cedar, with lesser quantity of Green Ash, Trembling Aspen, Black Cherry, Sugar Maple, and American Basswood in the canopy. The sub-canopy and understorey are comprised of European Buckthorn and hawthorns (*Crataegus* spp.). Groundcover flora is characterized by Bitter Nightshade, European Buckthorn, sedges, Herb Robert, Common Speedwell (*Veronica officinalis*), Tall Hairy Agrimony (*Agrimonia gryposepala*), Spinulose Wood Fern, and Enchanter's Nightshade.
FOD3-1	Dry – Fresh Poplar Deciduous Forest	This deciduous forest community is dominated by Balsam Poplar, White Ash, Sugar Maple, and Black Cherry in the canopy. The sub-canopy and understorey layers consist of European Buckthorn and Choke Cherry. Groundcover flora is characterized by Wild Ginger, Herb Robert, Bitter Nightshade, Wild Red Raspberry, Tall Hairy Agrimony, Woodland Strawberry, and sedges. A single regionally significant plant species was observed within this community, Virginia Stickseed.
FOD7-2	Fresh – Moist Green Ash – Harwood Lowland Deciduous Forest	This deciduous forest community occurs on the Northgate property and extends off-property to the south, and is dominated by Green Ash, Trembling Aspen, Bitternut Hickory, and American Basswood in the canopy. The sub-canopy and understorey layers consist of Black Maple (*Acer saccharum* ssp. *nigrum*), European Buckthorn, Sugar Maple, Green Ash, Ironwood (*Ostrya virginiana*), and Choke Cherry. Groundcover flora is characterized by Zig-zag Goldenrod, sedges, Spotted Jewelweed, Woodbine, Riverbank Grape, European Buckthorn, Blue Cohosh, Herb Robert, False Solomon's Seal

ELC Ecosite Type	ELC Description	Environmental Characteristics
		(*Maianthemum racemosum*), Ostrich Fern (*Matteuccia struthiopteris var. pensylvanica*), Woodland Strawberry, and Panicled Aster (*Symphyotrichum lanceolatum*).
Plantation		
CUP3	Coniferous Plantation	This plantation community is dominated by Red Pine (*Pinus resinosa*), Norway Spruce (*Picea abies*), White Spruce (*Picea glauca*), and Eastern White Cedar. The sub-canopy and understorey layers consist of White Ash and European Buckthorn. Groundcover flora is characterized by European Buckthorn, Wild Red Raspberry, Bitter Nightshade, Herb Robert, Enchanter's Nightshade, Canada Goldenrod, Common Burdock (*Arctium minus*), Poison-ivy (*Toxicodendron rydbergii*), Black Raspberry (*Rubus occidentalis*), Upright Yellow Wood-sorrel (*Oxalis stricta*), sedges, and Prickly Cucumber (*Echinocystis lobata*). A single regionally significant species was observed within this community, White Spruce.
Hedgerow		
HR4	Deciduous Hedgerow	This deciduous hedgerow is dominated by White Ash, American Basswood, European Buckthorn, Manitoba Maple, and Sugar Maple in the canopy. The sub-canopy and understorey layers consist of Wild Red Raspberry and European Buckthorn. Groundcover flora is characterized by Garlic Mustard (*Alliaria petiolata*), Coltsfoot, Herb Robert, Field Horsetail, Canada Thistle (*Cirsium arvense*), New England Aster (*Symphyotrichum novae-angliae*), Daisy Fleabane (*Erigeron annuus*), and Common Helleborine (*Epipactis helleborine*).

3.6.2 Vascular Flora

A total of 168 vascular plant species were documented within the vegetation monitoring plots (Appendix III) during the pre-construction monitoring. Approximately 13% of the vascular plant species observed are non-native species.

NRSI biologists documented and mapped all regionally, provincially, and federally significant plant species observed during the pre-construction biological monitoring program in 2014-2019. Significant species observed within the subject property are shown on Map 3. Several regionally significant plants (Richardson and Martin 1999) were observed including: Black Walnut (*Juglans nigra*), White Spruce, American Plum (*Prunus americana*), Northern Beech Fern, Virginia Stickseed, Shining Ladies'-tresses, Rough Sedge, Smooth-sheathed Sedge, Soft-leaved Sedge, and Golden Alexanders. Of these, American Plum, Shining Ladies'-tresses, Rough Sedge, Smooth-sheathed Sedge, and Soft-leaved Sedge were not previously identified in the NWSSS (Ecoplans et al. 2013). Black Walnut was not mapped due to its prolific presence throughout suitable habitats within the subject lands. White Spruce individuals are likely planted specimens, or reproducing from the planted specimens, given the coniferous plantation context, as reported in the NWSSS (Ecoplans et al. 2013) and confirmed by NRSI biologists. In the context of this study, Black Walnut and White Spruce are not considered regionally significant due to the anthropogenic origin of their presence.

A single provincially and federally Endangered species, Butternut (*Juglans cinerea*), was observed previously within the Erbsville Kartway property. This species prefers rich-moist woodlands, stream banks and swamps, as well as upland beech-maple, oak-hickory, and mixed hardwood stands (Reznicek et al. 2011). Butternut was not identified in the NWSSS (Ecoplans et al. 2013). A genetic test was completed in 2017 by the Ontario Forest Research Institute (OFRI) to determine the hybridity status of the individual. The results showed that the tree was a hybrid and therefore not protected under the ESA. Due to the confirmed hybridity of the Butternut, this individual is not considered significant. Nevertheless, the location of the hybrid Butternut tree is within the limits of the Natural Heritage System as presented in the NWSSS (Ecoplans et al. 2013) and will be adequately protected and buffered from development.

Black Ash, a federally significant species, is known from the subject property from the NWSSS (Ecoplans et al. 2013) and NRSI observations throughout the pre-construction monitoring program. Recent up-listing of this species in November 2018 to 'Threatened' by COSEWIC renders this species a provincial SCC, thereby designating its habitat as significant. Habitats containing Black Ash are therefore treated as SWH under the Special Concern and Rare Wildlife Species category. Refer to Section 4.4 for further discussion.

3.6.3 Vegetation Monitoring Plots

A total of 5 vegetation monitoring plots were established within the core environmental feature wetlands and woodlands on the subject property. The plots were surveyed in summer 2014-2016, and 2019. The purpose of the monitoring was to establish baseline vegetation conditions, for comparison with subsequent monitoring events (i.e. during and post-construction monitoring). The plots are all located within protected features and will continue to be monitored during construction and after buildout. The pre-construction results among all monitoring events were found to be generally consistent with the detailed vegetation community characterization reported in the NWSSS (Ecoplans et al. 2013). Refer to the Pre-Construction Biological Monitoring Program reports (NRSI 2016, NRSI 2017a) for further details and discussion. As the vegetation monitoring plot surveys were suspended in 2017 and 2018 to avoid trampling disturbance to the sensitive natural features, the habitat conditions were confirmed to be unchanged upon reinstatement of these surveys in 2019.

Within Vegetation Monitoring Plot #3 (VEG-003), no significant plant species were observed. This monitoring plot was noted as having a relatively open canopy, supporting a variety of open habitat, edge, and closed canopy species, with noticeable iron staining in groundwater seepage areas.

Within Vegetation Monitoring Plot #4 (VEG-004), two single regionally significant plant species were observed, Rough Sedge, and Smooth-sheathed Sedge. No other significant plant species were observed within the monitoring plot. Black Ash, a federally significant species, was also observed within the monitoring plot. This monitoring plot

was noted as a mature organic swamp with hummocky microtopography and a relatively open understorey layer, and the water table just beneath the ground surface.

Within Vegetation Monitoring Plot #5 (VEG-005), no significant plant species were observed. This monitoring plot was noted as a mature forest dominated by Sugar Maple and Eastern Hemlock with a rolling micro-topography, and limited groundcover vegetation throughout most of the plot.

Within Vegetation Monitoring Plot #6 (VEG-006), no significant plant species were observed. This monitoring plot was noted as a mature forest dominated by Sugar Maple and Eastern Hemlock with notable regeneration of White Ash and Sugar Maple, and limited groundcover vegetation throughout most of the plot.

Within Vegetation Monitoring Plot #7 (VEG-007), no significant plant species were observed. This monitoring plot was noted as a mid-aged mixed cedar swamp dominated by Eastern White Cedar, with limited groundcover vegetation and gentle hummocky topography.

In order to evaluate the quality of the vegetation communities on-site, the Floristic Quality Index (FQI) was calculated for each vegetation plot and is shown in Table 4 below (NRSI results in bold font). These results have been aggregated for vegetation monitoring plot surveys completed by NRSI from 2014-2016, and 2019. The same analysis was completed in the NWSSS (Ecoplans et al. 2013) by entire ELC community and is shown for comparison.

Table 4. Floristic Quality Index by Vegetation Plot and Community

	VEG-003 (SWM4-1)	SWM4-1 (NWSSS)	**VEG-004 (SWM6-1)**	SWM6-1 (NWSSS)	**VEG-005 (FOM6-1)**	FOC3-1[1] (NWSSS)	**VEG-006 (FOM6-1)**	FOM6-1 (NWSSS)	**VEG-007 (SWM4-1)**	SWM4-1 (NWSSS)
Total species	**112**	101	**82**	89	**39**	66	**34**	65	**53**	75
FQI (native species)	**33.49**	38.29	**36.03**	38.64	**24.70**	37.29	**21.94**	30.59	**28.75**	35.34
FQI (incl. non-native)	**27.31**	31.94	**32.91**	36.04	**21.46**	32.50	**17.15**	26.92	**25.0**	31.87
Wetness index	**-0.79**	-0.67	**-0.63**	-0.39	**1.77**	2.71	**1.97**	1.75	**-0.83**	-1.12

[1]ELC vegetation community as reported in the NWSSS and later refined by NRSI

3.6.4 Vegetation Surveys for Enhancement / Management Needs and Terrestrial Feature Monitoring

Results of the vegetation surveys for enhancement and management needs are presented in the Pre-Construction Biological Monitoring Program reports (NRSI 2016, 2017a, 2018, 2019). Notable disturbances within the subject property include tree cutting, refuse dumping, erosion along the Beaver Creek corridor, and invasive species establishment. Refer to the above-referenced reports for further details, mapping and discussion. The following Table 5 provides a high-level summary of findings. Refer to Section 5.0 of this report for recommendations to address the identified disturbances.

Table 5. Disturbance Areas and Management/Enhancement Recommendations

Wildlife Survey Unit(s)	Disturbance Identified	Description of Disturbance	Management/Enhancement Recommendations
Erbsville Kartway Property			
11	Invasive species (European Buckthorn)	Dense thicket of European Buckthorn at far northeast corner of natural feature. This thicket exists predominantly off-property to the north.	This concentration area will be a challenge to control in the long-term unless a coordinated effort among landowners is initiated. Removal of European Buckthorn through cutting and herbicide application if possible. Edge management and buffer recommendations are included in this EIS. An invasive species management plan will be developed for the property.
11	Invasive species (Phragmites)	Stand of Phragmites at edge of natural feature and Northgate property line.	Removal of Phragmites through herbicide application if possible. Edge management and buffer recommendations are included in this EIS. An invasive species management plan will be developed for the property.
11	Invasive species (Autumn Olive (*Elaeagnus umbellata*))	Small thicket of Autumn Olive at edge of manicured area and Northgate property line.	Removal of Autumn Olive through herbicide application if possible. Edge management and buffer recommendations are included in this EIS. An invasive species management plan will be developed for the property.
11	Refuse dumping	Storage of old tires along edge, and old metal storage drum were found in watercourse.	Removal of refuse and proper disposal.
11	Land use encroachment	Steel drainage pipe (approximately 4” diameter) directing flows from low-lying area of the race track into adjacent treed area. A basin has been dug within the race track to collect surface water and is periodically drained by sump pump through the	Drainage will be rectified as development proceeds. It is recommended the drainage pipe be retrofitted with a spreader berm, spreader swale, and perforated pipe at the existing outlet in order to

Wildlife Survey Unit(s)	Disturbance Identified	Description of Disturbance	Management/Enhancement Recommendations
		steel drainage pipe outletting at the treed edge. It is resulting in erosion along the discharge flow route within the treed area due to lack of a controlled outlet structure.	mimic the natural flow of water before discharge into the natural feature. Refer to Appendix VII for the engineering design drawing.
11	Tree cutting	Cutting of trees along property line.	Avoid tree cutting along the edge unless necessary for safety concerns. Edge management, buffer, and tree protection recommendations are included in this EIS.
Northgate Property			
10, 12, 13, 15	Invasive species (European Buckthorn)	Although European Buckthorn is present throughout the subject lands, dense Concentration Areas have been identified.	Removal of European Buckthorn through cutting and herbicide application if possible. Edge management and buffer recommendations are included in this EIS. An invasive species management plan will be developed for the property.
12, 14, 15	Invasive species (Phragmites)	Stands of Phragmites exist in several locations in edge habitats.	Removal of Phragmites through herbicide application if possible.. It is anticipated that Phragmites invasion along Conservation Dr. will be removed by the scheduled road improvements. Edge management and buffer recommendations are included in this EIS. An invasive species management plan will be developed for the property.
12, 14	Invasive species (White Poplar)	An established stand of White Poplar exists adjacent to Conservation Drive. Stand consists of young-aged to mature individuals.	Removal of White Poplar through cutting and girdling (for large, mature trees), and herbicide application if possible.

Wildlife Survey Unit(s)	Disturbance Identified	Description of Disturbance	Management/Enhancement Recommendations
			It is anticipated that White Poplar invasion along Conservation Dr. will be removed by the scheduled road improvements. Replacement of White Poplar with suitable native species such as Trembling Aspen or Balsam Poplar. Edge management and buffer recommendations are included in this EIS. An invasive species management plan will be developed for the property.
14, 15	Soil erosion	Soil erosion along riparian area of Beaver Creek alignment (Wildlife Survey Unit 14). Mineral soils in these areas of the property are being deposited into the adjacent vegetated area and subsequently into Beaver Creek. Soil erosion along southwest edge of Wildlife Survey Unit 15. Surface water flows in this area are eroding mineral soils and depositing into the adjacent treed area. Native edge vegetation in this area is struggling to remain established, with invasion of Phragmites and Coltsfoot (*Tussilago farfara*).	Provide a buffer and plantings with native species in area experiencing erosion to stabilize soils. Drainage will be rectified as development proceeds.
13, 15	Tree cutting, vegetation grubbing	Tree cutting and pruning along the edges of the agricultural fields was carried out in 2014 under the approval of the Region of Waterloo Forester and Principal Planner (A. Hovingh, pers. comm. 2014). Vegetation management along the edges of Wildlife Survey Units 10, 13, and 15 observed occasionally since 2014. No further vegetation management observed in 2019. Brush piles of the slash have been deposited along the woodland edges in	Avoid tree cutting along the edge unless necessary for safety concerns or to facilitate regular farming practices. Edge management, buffer, and tree protection recommendations are included in this EIS.

Wildlife Survey Unit(s)	Disturbance Identified	Description of Disturbance	Management/Enhancement Recommendations
		several areas. Aggressive European Buckthorn growth has resulted in some of these areas.	
13, 15	Refuse dumping	Plastic and metal debris, old tires, old metal storage drums, and old overgrown passenger vehicle were found.	Removal of refuse and proper disposal.

3.6.5 Fixed Photo Plot Monitoring

No notable changes in the pre-construction conditions were documented during the fixed photo plot monitoring (2014-2019). Photographic documentation of the fixed photo plot monitoring on the subject property is provided in the Pre-Construction Biological Monitoring Program reports (NRSI 2016, 2017a, 2018, 2019). Refer to the above-referenced reports for further details and discussion.

3.7 Avifauna

A total of 74 bird species were documented during the pre-construction monitoring (2014-2019 combined), including incidental observations, within the subject property. Of the 74 documented bird species, 58 of these species exhibited signs of breeding, such as being in suitable breeding habitat, males singing, territories established, females carrying food or nest materials, and the presence of fledged young. Refer to Appendix IV for a list of bird species documented during the breeding bird season in 2014-2019; also included in Appendix IV is a separate list of bird species documented incidentally outside of the breeding bird season in 2014-2019 during all other visits to the subject property.

Of the documented bird species, several are designated as federally, provincially, or regionally significant. A total of 1 regulated bird SAR, 3 bird SCC, and 24 regionally significant bird species (Martin 1996) were observed within the subject property (2014-2019) and are discussed in further detail below.

Eastern Wood-pewee (*Contopus virens*)

Eastern Wood-pewee, a SCC, is listed as Special Concern both provincially and federally (MECP 2019, Government of Canada 2018). Breeding habitat for this species includes open, deciduous, mixed or coniferous forest predominated by oak with little understorey, forest clearings, edges, farm woodlots, and parks (OMNR 2000). Eastern Wood-pewee was documented displaying breeding evidence within 4 Wildlife Survey Units (WSU-11, WSU-13, WSU-14 and WSU-15) during 2014-2019. The highest breeding evidence was recorded as ‘T’ (permanent territory), suggesting a probable breeding status.

Wood Thrush (*Hylocichla mustelina*)

Wood Thrush, a SCC, is listed as Special Concern provincially, and Threatened federally (MECP 2019, Government of Canada 2018). Breeding habitat for this species includes Carolinian and Great Lakes-St. Lawrence forest zones; undisturbed moist mature deciduous or mixed forest with deciduous sapling growth; near pond or swamp; hardwood forest edges (OMNR 2000). A single Wood Thrush individual was heard on May 17, 2016 (i.e. outside of breeding bird survey period), within Wildlife Survey Unit 13. As it was not documented by NRSI on any subsequent visits to-date, it is likely that this observation was a migrant and not breeding within the subject property. Wood Thrush was not documented within the subject property in the NWSSS (Ecoplans et al. 2013), nor by NRSI prior to or since this observation. Suitable breeding habitat for this species is present within the subject property.

Common Nighthawk (*Chordeiles minor*)

Common Nighthawk, a SCC, is listed as Special Concern provincially (MECP 2019) and Threatened federally (Government of Canada 2018). This species' breeding habitat includes open ground, clearings in dense forests, ploughed fields, gravel beaches or barren areas with rocky soils, open woodlands, and flat gravel roofs (OMNR 2000). Common Nighthawk was documented as flyovers (i.e. no breeding evidence) at WSU-9, and WSU-12 during targeted surveys; aerial displays and flight patterns characteristic of territorial behavior were observed on adjacent lands only. This species was observed in 2015 and 2016 only, with the highest breeding evidence recorded as 'T' (permanent territory) documented on adjacent lands, suggesting a probable breeding status. Suitable nesting habitat for this species on-site is limited to forest edges, with other suitable preferred nesting habitat found off-site within the local area (i.e. flat gravel roof at Creekside Church to the north of the subject property). Any available nesting habitat for this species within the subject property is considered marginal and unfavorable and would likely be subjected to nest predation. It is expected that any local individuals are nesting on properties with permanent bare soil or flat roofs and not within the subject property. Further discussion relating to Common Nighthawk SWH is provided in Section 4.4 of this report.

Barn Swallow (*Hirundo rustica*)

Barn Swallow, a regulated SAR, is listed as Threatened provincially (MECP 2019), affording individuals and their habitat protection under the *Endangered Species Act* (2007). Barn Swallow can be found in farmlands or rural areas near bodies of water and nest in buildings or other man-made structures (OMNR 2000). Barn Swallow was documented foraging during breeding bird surveys at 3 Wildlife Survey Units (WSU-10, WSU-11, and WSU-12), over 2014-2019. Observations were predominantly incidental with no evidence of breeding. During breeding bird surveys conducted in 2017, one active nest and 3 adult individuals were documented within WSU-11, on the concession stand porch roof associated with the Erbsville Kartway. This observation is building on the probable evidence of active Barn Swallow breeding documented in 2016. All structures at Erbsville Kartway were inspected for Barn Swallow presence and nesting in 2018, including areas where past nesting was documented, however no evidence of Barn Swallow nesting was found at that time.

During targeted surveys in 2019, confirmed breeding activity (i.e. adult at occupied nest) was documented at 2 separate buildings on the Kartway property. Suitable nesting habitat in the subject property for this species is limited to buildings associated with the Kartway lands only, and is also present outside of the subject property. Foraging habitat for Barn Swallow exists throughout the majority of the subject property.

In addition to the species discussed above, a total of 24 regionally significant bird species have been observed to-date (Appendix IV). Of these 24 species observed, 17 species displayed evidence of breeding, as summarized in Table 6 below.

Table 6. Regionally Significant Breeding Bird Species Observations (2014-2019)

Scientific Name	Common Name	Location(s) Observed	Highest Breeding Evidence[1]
Aix sponsa	Wood Duck	WSU-11	Probable
Archilochus colubris	Ruby-throated Hummingbird	WSU-11	Possible
Ardea herodias	Great Blue Heron	WSU-11	Possible
Butorides virescens	Green Heron	WSU-11	Possible
Catharus fuscescens	Veery	WSU-15	Possible
Certhia americana	Brown Creeper	WSU-13, 15	Possible
Dryocopus pileatus	Pileated Woodpecker	WSU-13	Possible
Empidonax alnorum	Alder Flycatcher	WSU-11	Possible
Empidonax minimus	Least Flycatcher	WSU-11	Possible
Megaceryle alcyon	Belted Kingfisher	WSU-14	Possible
Melanerpes carolinus	Red-bellied Woodpecker	WSU-11, 13, 15	Probable
Pooecetes gramineus	Vesper Sparrow	WSU-12, 13	Possible
Setophaga pensylvanica	Chestnut-sided Warbler	WSU-11, 15	Possible
Setophaga pinus	Pine Warbler	WSU-11, 13, 15	Possible
Setophaga ruticilla	American Redstart	WSU-13, 15	Possible
Polioptila caerulea	Blue-gray Gnatcatcher	WSU-11	Possible
Toxostoma rufum	Brown Thrasher	WSU-11, 13	Probable

[1]OBBA 2001

3.8 Amphibians

Amphibian breeding activity documented within the subject property has been variable throughout the pre-construction monitoring (2014-2019). No federally, provincially, or regionally significant amphibian species have been documented to-date, and all amphibian species recorded were previously documented in the NWSSS (Ecoplans et al. 2013).

Appendix V summarizes the results of the evening amphibian call surveys within the subject property (2014-2019). Incidental amphibian observations made by NRSI biologists during all other field surveys conducted throughout the subject property during the pre-construction monitoring program (2014-2019) are listed in Table 7.

Table 7. Incidental Amphibian Observations (2014-2019)

Scientific Name	Common Name	Location(s) Observed
Anaxyrus americanus	American Toad	WSU-10, 11, 13, 14, 15
Hyla versicolor	Gray Treefrog	WSU-11, 12, 13, 14, 15
Lithobates clamitans melanota	Northern Green Frog	WSU-11, 13, 14
Lithobates pipiens	Northern Leopard Frog	WSU-9, 10, 11, 12, 13, 14, 15
Lithobates sylvatica	Wood Frog	WSU-11, 12, 13, 15
Plethodon cinereus	Eastern Red-backed Salamander	WSU-13
Pseudacris crucifer	Spring Peeper	WSU-11, 13, 14, 15

3.9 Reptiles

During the initial years of pre-construction monitoring surveys (i.e. 2014-2016), NRSI biologists did not observe or document habitat use by any turtle species within the subject property. As well, the NWSSS (Ecoplans et al. 2013) and roadside mortality surveys completed by others (MMM Group) did not document any turtle species within the subject property prior to 2014.

Turtle emergence/overwintering surveys were conducted in early spring 2017 to further assess the presence of any turtle species on-site. The intention of these surveys was to determine if Blanding's Turtle, known from the general area, were overwintering within the Erbsville Kartway property in Laurel Creek. In late winter of 2017, Beaver Creek and Laurel Creek were investigated to determine if either had suitable habitat conditions for Blanding's Turtle overwintering. Suitable overwintering habitat for Blanding's Turtle is defined in the General Habitat Description (OMNR 2013) for the species as permanent bogs, fens, marshes, ponds, channels or other habitats with free (unfrozen) shallow water depths ranging from 7-50cm. Blanding's Turtle may also hibernate within graminoid shallow marsh areas of larger marsh complexes by burying into substrates in areas of pooled water, or in seasonal pools or small excavated areas with standing water (OMNR 2013). It was found that Beaver Creek and Laurel Creek do have sufficient depth and substrate for Snapping Turtle overwintering, but Beaver Creek was too shallow and without suitable substrates for Blanding's Turtle overwintering. No other habitats within the subject property are suitable for Blanding's Turtle overwintering.

During the emergence/overwintering surveys carried out in early spring 2017, a single Snapping Turtle was observed within the Erbsville Kartway property in Laurel Creek (WSU-11). The sighting was at the appropriate time of year to indicate emergence from an overwintering site, thereby meeting the criteria to confirm a portion of Laurel Creek was turtle overwintering SWH.

Two incidental observations of Snapping Turtle were documented by NRSI in June 2017 associated with the Beaver Creek corridor (WSU-14) and adjacent agricultural fields, as reported in the 2017 pre-construction monitoring report (NRSI 2018). Similarly, during a June 2018 survey, an adult Snapping Turtle was observed in the agricultural field on the west edge of WSU-14 and is expected to be using the Beaver Creek corridor, similar to other incidental observations of this species to-date. No snapping turtle nests or nest predation evidence was detected for these incidental occurrences. Refer to Section 4.4.1 and 4.4.3 for further discussion of SWH relating to Snapping Turtle.

No other significant reptile species were documented within the subject property during the pre-construction monitoring (2014-2019). Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) has been occasionally documented incidentally during the Monitoring Program (2014-2019). Northern Brownsnake (*Storeria dekayi dekayi*) was newly documented for the subject property in 2019 in WSU-12.

Blanding's Turtle

The NWSSS (Ecoplans et al. 2013) reports that Blanding's Turtle was observed in the Laurel Creek Reservoir and to the west of the reservoir in 2009 and 2013 respectively. As well, Blanding's Turtle have been reported within the Laurel Creek Nature Centre property in 2013 and 2016. The reservoir is managed as a flood control reservoir, where water from the spring freshet is stored to reduce flood peaks. Water in the reservoir is drawn-down during the late fall to early spring, generally corresponding to the turtle overwintering period. As such, the reservoir is unsuitable for Blanding's Turtle overwintering.

Category 1 habitat is defined as any nest or overwintering sites and adjacent lands within 30m (OMNR 2013). Targeted nesting surveys and emergence/overwintering

surveys were completed as part of the pre-construction monitoring program, to determine the presence of Category 1 habitat. Potential Category 1 overwintering habitat includes off-site wetland habitats associated with Laurel Creek.. Potential overwintering sites for Blanding's Turtle within the subject property were surveyed and are limited to Laurel Creek on the Erbsville Kartway lands, where potential hibernation conditions exist. Beaver Creek within the subject property is not suitable for Blanding's Turtle overwintering due to its shallow depth and lack of organic substrates.

Category 2 habitat is defined as the wetland complex (i.e. all suitable wetlands or waterbodies within 500m of each other) extending up to 2km from an occurrence, and the area within 30m around those suitable wetlands or waterbodies. Category 2 habitats are present within the study area and include the wetlands plus 30m.

Category 3 habitat is defined as areas between 30m and 250m around suitable wetlands and waterbodies identified in Category 2, within 2km of an occurrence. Category 3 habitats provide movement corridors between wetlands essential for carrying out life processes within Category 1 and 2 habitats (OMNR 2013).

3.10 Mammals

According to the Mammal Atlas of Ontario (Dobbyn 1994), 40 mammal species are reported from within 10km of the study area. Direct or indirect evidence of 14 mammal species were observed during the field surveys. Three mammal occurrences as documented during the winter wildlife surveys could not be identified to species through print/track investigation. Refer to Appendix VI for a complete list of mammal species reported and observed from the subject property (2014-2019).

The detailed bat habitat assessment completed by NRSI in 2014 did not identify any habitat features or structures suitable for bat use at that time. During evening field surveys completed in 2016, bats were observed exiting one of the Erbsville Kartway buildings indicating potential roost or hibernation habitat. Refer to Section 5.6 for further discussion.

As a result of the targeted American Badger den survey completed by NRSI in 2015, no candidate dens were observed within the subject property.

During a June 2015 field survey, a Virginia Opossum was observed dead alongside Conservation Drive at the Beaver Creek crossing. Virginia Opossum is a regionally significant mammal species (RMOW 1985). Virginia Opossum was not documented elsewhere within the subject lands by NRSI during the pre-construction monitoring program. This species was documented within the Primary Study Area of the NWSSS (Ecoplans et al. 2013) during the road mortality surveys. This species prefers lowland to upland deciduous wooded areas, preferably near water and farmland (OMNR 2000); therefore, suitable habitat for this exists throughout the subject property.

3.11 Terrestrial Crayfish

During 2015 and 2016 field surveys, approximately 15 terrestrial crayfish chimneys were observed within an area of mown lawn in between the asphalt pavement of the go-cart track and the Fresh-Moist Poplar Deciduous Forest (FOD8-1) vegetation community located on the Erbsville Kartway property. This particular area is low-lying and appears to be inundated seasonally in the spring. As the terrestrial crayfish chimneys were observed outside of the natural feature in an area of mown lawn, these observations are not treated as SWH. In addition, during 2017 and 2019 field surveys, terrestrial crayfish chimneys were observed on the edge of the White Birch-Poplar Organic Deciduous Swamp (SWD7-1) vegetation community located along Beaver Creek in the Northgate property. These observations meet the criteria for Terrestrial Crayfish SWH and is discussed further in Section 4.4.

3.12 Insects

Monarch Butterfly was observed incidentally within the subject property in several WSUs during the pre-construction monitoring (2014-2019). Monarch Butterfly SWH (i.e. Special Concern and Rare Wildlife Species) has been considered for the subject property based on these observations. Milkweed (*Asclepias* spp.) species, namely Common Milkweed (*Asclepias syriaca*), is the host plant for Monarch and is present occasionally throughout the subject property, restricted to natural feature edges and weedy/early successional habitats such as along property boundaries or agricultural field

edges. Monarch is a SCC, however, due to lack of expansive habitats for Milkweed throughout the subject property, as well as abundance of nectaring sources and habitat availability throughout southern Ontario, SWH for Monarch has not been identified within the subject property.

Table 8 lists incidental insect species observations by NRSI biologists during all field surveys conducted during the pre-construction monitoring (2014-2019).

Table 8. Incidental Insect Observations (2014-2019)

Scientific Name	Common Name	Location(s) Observed
Calopteryx maculata	Ebony Jewelwing	WSU-11
Danaus plexippus	Monarch	WSU-11, 13, 14, 15
Limenitis archippus	Viceroy	WSU-10
Limenitis arthemis astyanax	Red-spotted Purple	WSU-10, 12
Phyciodes cocyta	Northern Crescent	WSU-12
Pieris rapae	Cabbage White	WSU-11, 14
Polygonia comma	Eastern Comma	WSU-11
Tramea lacerata	Black Saddlebags	WSU-14

3.13 Wildlife Road Crossing Mortality Monitoring

Road crossing mortality monitoring conducted by MMM Group in 2014 at Conservation Drive resulted in relatively few documented mortalities, consisting entirely of frogs. Non-identifiable frogs were the most abundant mortality observation (n=11), followed by Northern Leopard Frog (n=6). Non-identifiable frogs are individuals that could not be identified from mortality remains, or where an observation of a frog was made at a distance, but species could not be determined (i.e. existing roadway too far away to identify).

NRSI biologists regularly inspected the Beaver Creek Road crossing at Conservation Drive for any wildlife mortality during the annual spring and fall terrestrial feature monitoring surveys. Notable mortality events, such as significant species or a significant number of individuals of a common species, have not been documented to-date by NRSI (2014-2019) with the exception of the single Virginia Opossum as described above.

4.0 Functional Analysis

In this section the findings of the ecological, hydrological, hydrogeological studies are compiled to provide an understanding of the quality and sensitivity of the ecosystems present on the property and the interactions between the biological and physical environment. The physical processes contributing to the maintenance of the natural features and their functions are discussed at the subject property scale, with reference to the subwatershed study for landscape-level context. This description takes into account the current quality and condition of the natural features based on land management practices and existing impacts such as clearing, grading, tree cutting, trails, dumping, filling and invasive plant and insect species.

4.1 Quality and Sensitivity of Ecosystems

The study area landscape is typical of rural southern Ontario; dominated by agricultural lands with natural features, primarily watercourses and wetlands, retained in blocks where land was unsuitable for farming. On the subject property, natural features include woodlands, and wetlands in the low-lying parts of the site that were not cleared or drained historically for agriculture. This fragmented landscape pattern has remained relatively unchanged for over 80 years, as far back as aerial photographs could be obtained, and likely much longer. The wetlands in the west and central portions of the subject property are primarily forested with mixed swamp vegetation on organic soils. The upland woodlands adjacent to the wetlands are generally mixed upland communities that are comprised of Sugar Maple and Eastern Hemlock (and their common associates), which is representative of the dominant forest type in Waterloo Region pre-European settlement.

ESPA 80 (WSU-11, WSU-13, WSU-15)

The large woodland and wetland complex in the central portion and along the western boundary of the subject property is a significant natural area and has been recognized as such through the designations of ESPA, PSW, and CEF, and as part of the larger natural heritage system in the NWSSS (Ecoplans et al. 2013) and the City of Waterloo Official Plan (2016). The boundary of this feature was delineated during this EIS through the flagging, review and surveying of the dripline and wetland boundary. This large forested block contributes a number of important ecological functions in the local

landscape. The NWSSS (Ecoplans et al. 2013) details the significance of this feature including its role in providing forest cover in the watershed and forest interior habitat for area-sensitive bird species. The woodlands on the subject property are approximately 16.3 ha in size and represent the majority of the forest cover in the urban portion of the NWSSS primary study area. The overall forest cover in the North Waterloo subwatershed is 21% which is higher than the forest cover in the Laurel Creek subwatershed (20%) and the Grand River watershed (19%) as a whole (Ecoplans et al. 2013). The on-site woodlands therefore are a significant contribution to forest cover locally and at the subwatershed scale.

The presence of forest interior habitat (forested area that is more than 100m from any edge) is one important ecosystem function of woodlands and is often used as a measure of woodland significance in a planning area. Forest interior habitat is important for certain bird and wildlife species that are sensitive to disturbances that are associated with the edges of woodlands. The central part of the woodland-wetland complex of ESPA 80 provides a very small area of forest interior habitat (0.27ha) and the woodland is not large enough to provide any deep forest interior habitat (more than 200m from any edge). It is the only woodland in the NWSSS primary study area that contains forest interior habitat. This woodland is a significant natural feature and will be protected within the development plan. The woodlands on-site are contiguous with the woodlands outside of the NWSSS, on GRCA owned lands to the south, which provides a significant local area of forest interior habitat (approx. 3.6ha).

A number of interior/edge bird species were documented within the habitats of ESPA 80 during the pre-construction biological monitoring program (2014-2019), as well as 9 species with area sensitivity or interior habitat requirements (Hairy Woodpecker, Pileated Woodpecker, Least Flycatcher, White-breasted Nuthatch, Brown Creeper, Blue-gray Gnatcatcher, Veery, American Redstart, Pine Warbler) (OMNR 2000). Note that these species (except Veery) are not indicator species for identifying Woodland Area-sensitive Bird Breeding SWH according to the SWHTG criteria tables (MNRF 2015a), but rather are considered generalist area-sensitive bird species according to Appendix C and G of the SWHTG (OMNR 2000). These sensitive species have been documented sporadically during the years of monitoring, in low numbers (1 or 2), and may or may not

have shown evidence of nesting. These species require woodlands 10-30ha in size (OMNR 2000) which is provided by the combined extent of woodland on the subject property as well as the off-site portion on GRCA land to the south.

The wetland and upland forest communities that make up the majority of ESPA 80 on the subject property include White Cedar Organic Mixed Swamp wetland (SWM4-1), Yellow Birch – Conifer Organic Mixed Swamp (SWM6-1), and Fresh – Moist Sugar Maple – Hemlock Mixed Forest (FOM6-1).Collectively these vegetation communities contain a relatively rich and diverse plant community, with a relatively high FQI, ranging from 30.59 to 38.64 for all native species as reported in the NWSSS (Ecoplans et al. 2013). Generally, an FQI of 20-35 indicates high vegetative quality and above 35 indicates "Natural Area" quality (Swink and Wilhelm 1994). In addition to their floristic quality, the central forested communities contain some old growth attributes as determined through an analysis of tree and forest stand age in the NWSSS (Ecoplans et al. 2013). Several trees over 100 years in age are found in the central woodlands, particularly the white pine, hemlock and sugar maple greater than 40cm in diameter, although these forests are for the most part regenerating from past disturbance and are much younger than can be considered old growth. The woodlands on the western side of the subject property are also of a younger age and are not expected to be considered old growth.

The southern portion of the central forest extending off-site to the south is relatively free of signs of recent disturbance. It consistently contains large tree specimens and had the greatest number of old growth trees, including the large trees along the edges of the linear cultivated strip accessing the southern agricultural field. This portion of the woodland is contiguous with a large tract of upland forest on the GRCA lands to the south of the Northgate property and also provides forest interior habitat.

The smaller vegetation communities and inclusions, primarily along the edges of the ESPA were of lower quality and diversity such as Dry – Fresh Poplar Deciduous Forest (FOD3-1), Fresh – Moist Green Ash – Hardwood Lowland Deciduous Forest (FOD7-2), Coniferous Plantation (CUP3), White Cedar Coniferous Forest (FOC4-1), and Mineral Thicket Swamp (SWT2). These communities contain a low diversity of plant species,

with low to moderate FQI values (ranging from 10.82 to 24.32 for all native species as reported in the NWSSS (Ecoplans et al. 2013)). It is likely that these communities have arisen following a disturbance and are a result of cultural influences which is reflected in their younger age and reduced quality and complexity.

Existing impacts within the interior of the central woodland/wetland were generally absent, although disturbances were found along the outer edges such as tree cutting, invasive species establishment and some brush pile and refuse dumping. Particularly, European Buckthorn and Phragmites concentration areas were identified as problematic in the pre-construction monitoring program (NRSI 2016, 2017a, 2018, 2019) along some of the natural feature edges. Tree cutting along the natural feature edges has temporarily grubbed some of the European Buckthorn, however the stumps were not treated with herbicide which will encourage aggressive re-growth (Anderson 2012). Agricultural tilling occurs up to the natural feature edges. Disturbance within the wooded wetland on the Erbsville Kartway property is low and is limited to invasive species establishment, minor historic refuse dumping, and minor land-use encroachment from the Erbsville Kartway facility to mitigate flooding on the go-cart track.

The woodland/wetlands of the ESPA function as habitat for a number of significant plant and wildlife species, as well as a variety of other common local plants and wildlife.

The central wetland communities within the ESPA are directly connected to Beaver Creek and function as an interface with the shallow groundwater table, as observed through evidence of groundwater discharge. This groundwater is a component in supporting the wetlands and providing cool, clear baseflow to the creek at least at certain times of the year. It would appear that there is some groundwater supporting the wetland and the creek at certain times of the year, although it is minimal in the overall water balance (MTE 2020a, b). The hummocky terrain functions to slow down and store surface and groundwater while the and overhead canopy shades the creek. Similarly, on the west side of the subject property, the mixed swamp wetland is directly adjacent to and connected to Laurel Creek as it flows south through the edge of the property. The deep organic soils here are saturated and very poorly drained. In contrast to Beaver Creek, groundwater seepage was consistently observed in the wetland and Laurel Creek

including a notable upwelling along the east side of the creek. Together the wetlands and the upland forest communities provide a wide and dense vegetated buffer to enhance the aquatic habitat. The lower reaches of Laurel Creek may be potentially suitable for trout species based on instream temperatures, substrates of gravel that are suitable for spawning, and observations of local groundwater discharge. However, no evidence of trout activity has been observed and the substrates within Laurel Creek on-site are too soft to be suitable for their spawning.

Beaver Creek Riparian Corridor (WSU-14)

The White Birch – Poplar Organic Deciduous Swamp (SWD7-1) along the northern portion of Beaver Creek contains a low diversity of plant species, with a corresponding moderate FQI (20.07 for all native species as reported in the NWSSS (Ecoplans et al. 2013)). A Mineral Cultural Woodland (CUW1) habitat inclusion occurs adjacent and to the north of SWD7-1. Disturbance within these communities includes invasive species establishment and soil erosion and sediment loading into Beaver Creek, which is associated with agricultural tilling up to the natural feature edge and close to Beaver Creek within the CUW1 community. As a relatively young community, poplars (*Populus* spp.), dogwoods (*Cornus* spp.), and willows (*Salix* spp.) are the dominant woody species. These communities form a vegetated riparian corridor along Beaver Creek, of varying width. Beaver Creek and its wooded corridor north of ESPA 80 were evaluated in the NWSSS (Ecoplans et al. 2013) to determine if it met the criteria to be included in the ESPA, and the analysis showed that the creek and associated habitats do not meet the criteria for designation as an ESPA. The corridor is identified in the NWSSS (Ecoplans et al. 2013) as the primary existing linkage between habitats north and south of Conservation Drive, but this is obstructed by the major barrier present at Conservation Drive.

4.2 Wetland Water Balance

Groundwater and surface water flow patterns are influenced by the local topography and soil conditions. The subject property surface drainage is divided into catchments based on topography by MTE in their Preliminary Stormwater Management Report (2020b). The majority of the site flows towards the central wetland and Beaver Creek, with the eastern portion flowing toward the Laurel Creek Reservoir Tributary, while the western

portion flows west into Laurel Creek. Groundwater flow direction was interpolated to flow from northwest to southeast beneath the site toward Beaver Creek and ultimately toward the Laurel Creek Reservoir.

The surface soils on-site are primarily sands and some clay/silt till, which have a high capability for infiltration of rainfall. The groundwater monitoring completed by MTE (2020a) showed that recharge and discharge of groundwater varied across the site depending on topography. The high regions of the site showed downward hydraulic gradients indicating recharge, while the low topographic areas showed upward hydraulic gradients, or discharge of groundwater, coinciding with the wetlands and Beaver Creek.

The NWSSS prepared a water balance for each of the catchments on the subject property under the existing condition, and are shown in Table 9 below.

Table 9. Existing Water Balance for On-Site Catchments (NWSSS)

Catchment	Area (ha)	Precipitation (mm)	ET (mm)	Runoff (mm)	Infiltration (mm)
3914	12.7	844.8	553.0	79.9	211.9
3915	4.2	844.8	551.9	69.9	222.9
3917	2.7	844.8	551.0	116.7	177

Under the current agricultural land use, the majority of precipitation which falls on the site during the growing season is taken up by evapotranspiration (64% on average), with a smaller component infiltrating into the soil (23% on average), and a relatively low amount of surface runoff (13% on average). The wetlands on-site are supported through a combination of groundwater discharge and surface water runoff as well as direct rainfall. Areas of groundwater seepage were observed within the swamp wetland communities during NRSI's pre-construction monitoring program surveys as was reported in the findings of the NWSSS (Ecoplans et al. 2013). While seepage was consistently noted throughout these wetlands, the NWSSS (Ecoplans et al. 2013) found that groundwater expression into Laurel Creek and Beaver Creek was occasional and minor, and that groundwater does not represent a significant portion of the flow volume within these watercourses. This was further substantiated by the pre-construction groundwater monitoring by Stantec (2016a) and the site specific monitoring completed by MTE (2020a). The mini-piezometers installed in the wetland by MTE in 2015 (MP1-15 and MP2-15) were used to observe groundwater-surface water interaction within the

PSW. The groundwater levels were measured manually between October 2015 and March 2020. Field measurements indicated that groundwater levels averaged 1.1m btoc at MP1-15 and approximately 0.97m btoc at MP2-15. The water levels outside of the mini-piezometers were dry (MTE 2020a). It would appear that there is some groundwater supporting the wetland at certain times of the year. It appears that the primary hydrologic function of these wetlands is the storage and evaporation of water with a moderate expression of groundwater into the creeks.

In the future development scenario, evapotranspiration will decrease significantly due to the change in ground cover, resulting in more water being available to the system in the form of runoff and/or infiltration. The NWSSS predicted future infiltration estimates that are above existing conditions (increase of 17%-87%), recognizing that the agricultural land use results in much of the water being lost to evapotranspiration. Increasing infiltration post-development will have benefits for the wetland and watercourse in improving groundwater discharge to these features, as well as to the deeper groundwater and Regional water supply. In considering the water balance to the wetland and watercourse, the NWSSS established that both infiltration and surface water inputs are to be maintained or enhanced in the post-development condition.

4.3 Species At Risk

Through the field surveys and analysis in the NWSSS (Ecoplans et al. 2013) and the pre-construction monitoring program (2014-2019) supporting this study, Barn Swallow was the only regulated SAR with confirmed presence within the subject property. The subject property also contains protected general habitat for Blanding's Turtle. Further discussion is provided below.

Barn Swallow

Barn swallow was confirmed nesting in one of the Erbsville Kartway buildings during the 2017 and 2019 monitoring years. NRSI understands that this facility will remain operational until the time when development proceeds. Barn Swallow monitoring will be continued for the duration of the pre-construction monitoring program and will continue to document presence and use by this species to further inform management considerations. At the time when building demolition is to occur, Barn Swallow nesting

will be considered according to the ESA, and in consultation with MECP, where appropriate.

Blanding's Turtle

NRSI has been, and continues to be involved in ongoing consultation and field data information sharing with MNRF/MECP relating to Blanding's Turtle throughout the pre-construction monitoring program (2014-2019) and this EIS in order to make a determination of protected general habitat presence and its extent within the subject property.

The most sensitive category of protected habitat for Blanding's Turtle is Category 1, which includes the nest or overwintering sites. Since Blanding's Turtle requires organic substrates and water depths of approximately 0.9m for overwintering sites (Ernst and Lovich 2009), suitable overwintering habitat for this species is limited within the subject lands. Wetlands within the subject lands do not contain sufficient permanent water for overwintering and depths within Beaver Creek are also too shallow. Findings from the Groundwater and Surface Water Monitoring Program report prepared by Stantec (2016a) indicate that surface water levels of 0.9m or greater are rare, but do occur occasionally during this species overwintering period (i.e. October to April) within Laurel Creek on the Erbsville Kartway property. Turtle emergence surveys were conducted by NRSI at this location during spring 2017 to document any overwintering habitat use of candidate habitat by turtles. No Blanding's Turtle were observed during the targeted turtle overwintering/emergence surveys (2018).

Category 2 habitat includes the wetland complex extending up to 2km from a known occurrence, and an area of 30m beyond those wetlands. The wetlands on-site, plus 30m are Category 2 habitat. Category 3 habitat is the area between 30m and 250m around suitable wetlands/waterbodies identified as Category 2 and provides movement corridors between wetlands.

No nesting by Blanding's Turtle or any other turtles has been documented within the subject property as confirmed through targeted turtle nest and nesting surveys completed in 2015 and 2016 according to MNRF protocol (MNRF 2015b, MNRF 2016).

In consultation with MNRF, nesting habitat was determined not to be present on the subject property (Marriot, D. pers. comm. 2017).

An Information Gathering Form (IGF) was initially prepared to be submitted to the MNRF in November 2017 addressing SAR on-site including Blanding's Turtle. In response to comments from MNRF, further information was provided in technical memorandums and a mitigation plan to MECP, addressing potential impacts to the species' protected habitat. At that point SAR responsibility was taken on by MECP. Upon review of the additional information and mitigation plan, MECP agreed that impacts to Blanding's Turtle habitat were not likely to occur subject to full implementation of the mitigation plan (Karam personal communication 2019). The Mitigation Plan (NRSI 2020) outlines a comprehensive approach to mitigating impacts to Blanding's turtle among the developer properties and is appended to this EIS (Appendix VIII).

Bats

At the time of the 2014 bat habitat survey no trees within the proposed development area were observed to have suitable bat roosting characteristics, and the buildings were thought to be unsuitable. Later in the field work program (2015), bats were observed exiting one of the buildings on the Erbsville Kartway property. Bat usage of the building can change over time, as can species status, monitoring techniques and approaches to mitigation. Therefore, NRSI will liaise with MECP closer to the time of demolition of the buildings to determine best practices for mitigation of impacts to bats, if required.

4.4 Significant Wildlife Habitat

Within the NWSSS (Ecoplans et al. 2013), confirmed and candidate SWH types were identified following guidance within the Natural Heritage Reference Manual (NHRM) (OMNR 2010), the SWHTG (OMNR 2000) and the SWH Ecoregion Criteria Schedules (MNRF 2015a). In the SWHTG, SWH is grouped into 5 broad categories:

- Seasonal concentration areas,
- Rare vegetation communities,
- Specialized wildlife habitat,
- Habitats of species of conservation concern, and
- Animal movement corridors.

The following 3 SWH types were confirmed within the NWSSS (Ecoplans et al. 2013) based on the site-specific field surveys for the subject property; i) specialized wildlife habitat (amphibian breeding habitat (woodland), ii) woodland area-sensitive bird breeding habitat), and iii) habitat for species of conservation concern (special concern and rare wildlife species). Bat maternity colonies, and turtle wintering areas were identified as candidate SWHs within the NWSSS (Ecoplans et al. 2013). A more fulsome assessment of confirmed SWH types within the subject property is provided in the following sections and discussed in each of the pre-construction monitoring reports (NRSI 2016, 2017a, 2018, 2019).

Findings from the detailed field surveys conducted in 2014-2019 were used to further identify confirmed and candidate SWH within the subject property. Confirmed SWH identified by NRSI within the subject property during 2014-2019 are shown on Map 5 and include:

- Seeps and Springs (not previously reported in the NWSSS),
- Special Concern and Rare Wildlife Species (Eastern Wood-pewee, Snapping Turtle, Black Ash),
- Turtle Wintering Area, and
- Terrestrial Crayfish

Woodland area-sensitive bird breeding habitat was identified in the study area during the NWSSS in WSU-13 and WSU-15. This type of SWH has not been confirmed during the 2014-2019 pre-construction monitoring due to the lack of woodland area-sensitive bird species found during breeding bird surveys. The criteria for this SWH type list a number of woodland area-sensitive bird species and abundance that are required to confirm this type of SWH. To be considered SWH, the presence of nesting or breeding pairs of 3 or more of the criterion species must be present, or any site with breeding Cerulean Warbler (*Setophaga cerulea*) or Canada Warbler (*Cardellina canadensis*) (MNRF 2015a). During the pre-construction monitoring program (2014-2019), a single woodland area-sensitive bird species was observed, Veery in WSU-15, with the highest breeding status documented as ‘Possible’. No other woodland area-sensitive bird species were

observed or documented within any other WSUs. Refer to Appendix IV for more detailed results of avifauna observed within the subject property.

Similarly, amphibian breeding habitat (woodland) SWH was identified in the subject property during the NWSSS in WSU-11 and WSU-15. This type of SWH has not been confirmed during the pre-construction monitoring (2014-2019) due to the lack of woodland breeding amphibians and their relative abundances as documented during amphibian call surveys. The criteria for this SWH type list a number of woodland breeding amphibian species and abundance that are required to confirm this type of SWH. To be considered SWH, 2 or more of the criterion frog species with Call Level Codes of 3 must be present (MNRF 2015a). During the pre-construction monitoring program (2014-2019), Spring Peeper was the only species documented with a Call Level Code 3. Refer to Appendix V for more detailed results of anuran monitoring data from within the subject property.

Candidate SWHs are not included in Map 5 of this report and are limited to bat maternity colonies. Bat maternity colonies candidate SWH occurs within the following vegetation communities (Map 3): SWM4-1, FOD8-1, SWM6-1, FOM6-1, FOD5-2, FOC4-1, SWD7-1, FOD3-1, and FOD7-2. Since all treed areas will be retained and buffered under the proposed development scenario, candidate SWH has been maintained for this SWH type and no specific field surveys were conducted. Similarly, turtle wintering areas SWH was confirmed in Laurel Creek, and is maintained as candidate for Beaver Creek.

4.4.1 Seasonal Concentration Areas

Turtle Wintering Area

Based on the results of the early spring 2017 turtle emergence/overwintering surveys, turtle wintering area SWH has been confirmed on Laurel Creek within the Erbsville Kartway portion of the subject property. A single juvenile/sub-adult Snapping Turtle was observed within Laurel Creek on the subject property on April 10, 2017 and was expected to have overwintered within the creek. One or more overwintering Snapping Turtle is considered SWH, and since the hibernation site appeared to be associated with the creek, the areas with deep-water pools have been identified as SWH (MNRF 2015a).

4.4.2 Specialized Wildlife Habitat

Seeps and Springs

Seeps and springs SWH has been confirmed within the subject property. Seepage areas were observed throughout the following vegetation communities: SWM4-1 and SWM6-1, and are associated with groundwater discharge in the wetlands. Seeps and springs occur regularly within low-lying wooded areas in the general study area.

4.4.3 Habitat for Species of Conservation Concern

Terrestrial Crayfish

Terrestrial crayfish chimneys were observed on the edge of the White Birch-Poplar Organic Deciduous Swamp (SWD7-1) vegetation community located along Beaver Creek in the Northgate property in 2017 and 2019 during the pre-construction monitoring. These observations meet the criteria for Terrestrial Crayfish SWH.

Special Concern and Rare Wildlife Species

Confirmed habitat for SCC may be considered Significant Wildlife Habitat (OMNR 2000). Based on the results of wildlife-specific field surveys during the pre-construction monitoring (2014-2019), habitat for 3 SCC (Eastern Wood-pewee, Snapping Turtle, and Black Ash), was confirmed within the subject property and therefore this type of SWH is confirmed. Refer to Sections 3.6.2 (Black Ash), 3.7 (Eastern Wood-pewee) and 3.9 (Snapping Turtle) for discussion on each of these significant species occurrences.

Common Nighthawk SWH has been considered for the subject property based on species observations in 2015 and 2016 as discussed in Section 3.7, however due to the presence of more suitable breeding habitat availability off-property and lack of breeding evidence display for habitats within the subject property, SWH for Common Nighthawk has not been identified within the subject property.

4.5 Key Wildlife Habitat Functions

Table 10 provides a summary of the key attributes and species notes for each of the WSUs within the subject property. For the purposes of this report, confirmed SWH types provided in Table 10 are based on NRSI field survey results during the pre-construction monitoring (2014-2019). Some additional wildlife attributes were identified in the NWSSS (Ecoplans et al. 2013), and those are indicated in the table with a reference to

that study but have not been confirmed otherwise by NRSI. The reader is referred to the NWSSS Table 4.20 (Ecoplans et al. 2013) for further details.

Table 10. Summary of Wildlife Habitat and Findings (2014–2019)

Wildlife Survey Unit (NRSI)	Wildlife Survey Unit (NWSSS)[1]	Habitat Description[1]	Species Notes
9	N/A	Agricultural field actively planted with row crops. Limited wildlife function. Notable wildlife habitat elements: • Common Nighthawk observed in general area, not nesting	Birds[2] • Low breeding bird diversity (14 species with breeding evidence) • 16 migrant/non-breeding species Amphibians • 1 common species: Northern Leopard Frog
10	N/A	Agricultural field actively planted with row crops, surrounded by woodland/wetland ESPA #80. Notable wildlife habitat elements: • None	Birds[2] • Low breeding bird diversity (9 species with breeding evidence) • 15 migrant/non-breeding species Amphibians • 2 common species: American Toad, Northern Leopard Frog Insects • 2 common species: Viceroy, Red-spotted Purple
11	10	Block of mixed swamp and thicket swamp, riparian habitat along unnamed tributary to Laurel Creek. Contiguous with and riparian linkage to Laurel Creek and ESPA 80 woodland to the southeast. Total unit size: 2.0ha Notable wildlife habitat elements: • SWH – Seeps and Springs • SWH – Special Concern and Rare Wildlife Species • SWH – Turtle Wintering Area (Laurel Creek) • Habitat/structural diversity • Riparian linkage to large ESPA woodland • Terrestrial crayfish burrows observed adjacent in mown lawn area, not SWH	Birds[2] • Moderate-high breeding bird diversity (45 species with breeding evidence) • 49 migrant/non-breeding species • 1 SCC: Eastern Wood-pewee • 1 Regulated SAR: Barn Swallow (associated with Erbsville Kartway operations buildings; nesting confirmed in 2017 and 2019) • 12 Regionally Significant (with breeding evidence): Wood Duck, Ruby-throated Hummingbird, Great Blue Heron, Green Heron, Red-bellied Woodpecker, Alder Flycatcher, Least Flycatcher, Alder Flycatcher, Blue-gray Gnatcatcher, Brown Thrasher, Pine Warbler, Chestnut-sided Warbler • Predominantly edge or interior/edge species

Wildlife Survey Unit (NRSI)	Wildlife Survey Unit (NWSSS)[1]	Habitat Description[1]	Species Notes
		• Cavity trees and downed woody debris	Amphibians • 6 common species: American Toad, Green Frog, Northern Leopard Frog, Spring Peeper, Wood Frog, Gray Treefrog Reptiles • 1 SCC: Snapping Turtle Plants • 2 Regionally Significant: Rough Sedge, Shining Ladies'-tresses Insects • 3 Common species: Ebony Jewelwing, Cabbage White, Eastern Comma • 1 SCC: Monarch Butterfly
12	N/A	Agricultural field actively planted with row crops. Limited wildlife function. Notable wildlife habitat elements: • Common Nighthawk observed in general area, not nesting	Birds[2] • Low breeding bird diversity (16 species with breeding evidence) • 21 migrant/non-breeding species • 1 Regionally Significant: Vesper Sparrow Amphibians • 3 common species: Northern Leopard Frog, Gray Treefrog, Wood Frog Reptiles • 2 common species: Eastern Gartersnake, Northern Brownsnake Plants • 1 Regionally Significant: American Plum Insects • 3 Common species: Red-spotted Purple, Northern Crescent
13	4	Mosaic of mixed swamp, mixed forest, deciduous forest and coniferous plantation. Beaver Creek flows through. Part of broader ESPA woodland.	Birds[2] • Moderate breeding bird diversity (36 species with breeding evidence)

Wildlife Survey Unit (NRSI)	Wildlife Survey Unit (NWSSS)[1]	Habitat Description[1]	Species Notes
		Total unit size: 8.63ha Notable wildlife habitat elements: • SWH – Seeps and Springs • SWH – Special Concern and Rare Wildlife Species • Habitat diversity and size • Very small forest 'interior' habitat component (0.27ha) (NWSSS) • Old growth forest attributes (NWSSS) • Cavity trees and downed woody debris	• 40 migrant/non-breeding species • 1 SCC: Eastern Wood-pewee • 7 Regionally Significant: Red-bellied Woodpecker, Pileated Woodpecker, Brown Creeper, Brown Thrasher, American Redstart, Pine Warbler, Vesper Sparrow • Predominantly edge or interior/edge species <u>Amphibians</u> • 7 common species: American Toad, Gray Treefrog, Northern Leopard Frog, Spring Peeper, Green Frog, Wood Frog, Eastern Red-backed Salamander <u>Plants</u> • 5 Regionally Significant: Virginia Stickseed, Golden Alexanders, Soft-leaved Sedge, Smooth-sheathed Sedge, White Spruce • 1 Federally Significant: Black Ash <u>Insects</u> • 1 SCC: Monarch Butterfly
14	5	Narrow deciduous swamp and thicket swamp along Beaver Creek with small inclusions of cultural woodland/meadow/thicket and marsh. Total unit size: 0.98ha Notable wildlife habitat elements: • SWH – Special Concern and Rare Wildlife Species • SWH – Terrestrial Crayfish • Riparian corridor along Beaver Creek • Some specialized habitat for Lepidoptera/Odonata (sedge meadow) (NWSSS)	<u>Birds[2]</u> • Moderate breeding bird diversity (30 species with breeding evidence) • 24 migrant/non-breeding species • 1 SCC: Eastern Wood-pewee • 1 Regionally Significant: Belted Kingfisher • Predominantly edge or interior/edge species <u>Amphibians</u> • 5 common species: American Toad, Spring Peeper, Gray Treefrog, Northern Green Frog, Northern Leopard Frog <u>Plants</u> • 1 Regionally Significant: Virginia Stickseed

Wildlife Survey Unit (NRSI)	Wildlife Survey Unit (NWSSS)[1]	Habitat Description[1]	Species Notes
		• Movement area for wildlife between ESPA 80 and natural areas to the north • Conservation Drive is a barrier/hazard to wildlife movement	Reptiles • 1 SCC: Snapping Turtle Insects • 2 Common species: Cabbage White, Black Saddlebags • 1 SCC: Monarch Butterfly
15	3	Mixed swamp, mixed forest and coniferous forest, with some thicket/marsh inclusions in gaps and at edges. Bisected by access lane/agricultural field (the 'gap'). Part of broader ESPA woodland. Total unit size: 6.54ha Notable wildlife habitat elements: • SWH – Seeps and Springs • SWH – Special Concern and Rare Wildlife Species • Forest 'interior' habitat component (NWSSS) • Cavity trees and downed woody debris	Birds[2] • Moderate breeding bird diversity (37 species with breeding evidence) • 29 migrant/non-breeding species • 1 SCC: Eastern Wood-pewee • 6 Regionally Significant: Red-bellied Woodpecker, Brown Creeper, Veery, Chestnut-sided Warbler, Pine Warbler, American Redstart • Predominantly edge or interior/edge species Amphibians • 5 common species: American Toad, Spring Peeper, Gray Treefrog, Northern Leopard Frog, Wood Frog Plants • 4 Regionally Significant: Rough Sedge, Smooth-sheathed Sedge, Northern Beech Fern, Virginia Stickseed • 1 Federally Significant: Black Ash Insects • 1 SCC: Monarch Butterfly

Source: [1]NWSSS (Ecoplans et al. 2013) where applicable

[2]Bird diversity is characterized by qualitative descriptors of richness (i.e. low/moderate/high), relative to other habitats in the NWSSS and relative to what would be expected in a habitat of similar size/composition within the Region; there are no numeric thresholds, rather these are qualitative rankings based on professional judgement and experience (J. Gross, pers. comm. 2017). For the purposes of this report, diversity thresholds are defined as follows: Low (0-20 species), Moderate (21-38 species), Moderate-High (39-49 species), High (50+ species) and is general consistent with thresholds as reported in the NWSSS.

4.6 Ecological Linkages

4.6.1 Beaver Creek Corridor

As part of identifying the Natural Heritage System in the study area, the NWSSS (Ecoplans et al. 2013) identifies the Beaver Creek corridor as the primary existing ecological linkage. The main function of this corridor is to provide wildlife movement opportunities along Beaver Creek between the wetland/woodlands north of Conservation Drive and the wetland/woodlands on the subject property, and beyond. The current vegetated zone along Beaver Creek is variable in width, being wide (up to 300m) and well-shaded with forest and wetland vegetation on-site, but with gaps in riparian vegetation and narrow disturbed sections (<20m and ploughed), notably at the north portion of the subject property near the Conservation Drive crossing.

Opportunities for linkage enhancement, namely along the north portion of Beaver Creek (i.e. WSU-14), exists within the context of improvements to Conservation Drive during its reconstruction and widening, and the management of the corridor through the development of the subject property. The Beaver Creek linkage corridor will be maintained and protected with a buffer as well as other management and enhancement actions which will retain and enhance its linkage function. Based on the Draft Plan (Map 2), ecological linkages within the subject property identified on Figure 14.4 of the NWSSS (Ecoplans et al. 2013) will be maintained, protected, and buffered appropriately. Refer to Section 6 of this report for further discussion of enhancement opportunities.

The Class EA for Beaver Creek Road and Conservation Drive Upgrades reported that although the NWSSS identified a high abundance of amphibian road mortality along Conservation Drive at the Beaver Creek crossing, this area was not considered to be a significant amphibian movement corridor since the Beaver Creek corridor is quite narrow and surrounded by agricultural lands (Stantec 2016b). The existing crossing structure at Conservation Drive is a large corrugated steel pipe encased in concrete (3.1m wide x 1.8m high) which conveys flows and provides aquatic connectivity but there is no terrestrial wildlife movement opportunity. The preferred design alternative for transportation improvements along Conservation Drive requires the installation of a longer and larger culvert structure at Beaver Creek to accommodate road widening and

regional flood levels, which will also provide an opportunity to include a terrestrial wildlife crossing including wildlife funnel walls, as recommended in the NWSSS (Stantec 2016b). It is recommended that the road construction, infrastructure and wildlife crossing improvements all be undertaken at one time, limiting the duration and extent of disturbance to the creek and corridor.

4.6.2 Deciduous Hedgerow (HR4)

The hedgerow along the southeast boundary of the Northgate property was identified as an existing but degraded ecological linkage in the NWSSS (Ecoplans et al. 2013). This hedgerow is approximately 150m in length consisting of a single row of deciduous trees such as White Ash, American Basswood, European Buckthorn, Manitoba Maple, and Sugar Maple with an understory of European Buckthorn and Wild Red Raspberry. It was identified as a linkage between the on-site woodland/wetland at the west end and the Laurel Creek Conservation Area to the east. Its function as a corridor is poor due to its narrow width, invasive species and the barrier presented by Beaver Creek Road. It was identified as a Low constraint in the NWSSS (Ecoplans et al. 2013) but was recommended as an area to be retained and enhanced as it provides a supporting linkage function in the Beaver Creek subwatershed.

4.7 Physical Constraints

The Regional floodline for Laurel Creek and Beaver Creek was provided in the NWSSS (Ecoplans et al. 2013) and is shown on the Draft Plan (Map 2). The floodline is mostly contained within the natural features and extends minimally into the agricultural fields on the Northgate property, and somewhat into the actively used area of the Erbsville Kartway property. There were no other physical constraints present on the subject property such as steep slopes or erosion prone areas.

4.8 Aquatic Habitat

Beaver Creek has been previously classified as a potential coldwater stream, although it has been degraded in a number of areas (Ecoplans et al. 2013). Through the subject property Beaver Creek provides habitat for a variety of fish species including eight minnow species, two darter species, two sunfish species, as well as Brook Stickleback (*Culaea inconstans*) and White Sucker (*Catosomus commersonii*). Most of these fish

species prefer a cool-water thermal regime, while the two sunfish and Fathead Minnow (*Pimephales promelas*) prefer warm water.

Only a small portion of Laurel Creek falls within the subject property; immediately to the west of the Erbsville Kartway. The lower reaches of Laurel Creek are considered to be impaired by the backwater and warming effect of the Laurel Creek Reservoir, but it is classified as a coldwater system with 9% relatively unimpaired coldwater habitat and 21% potential coldwater habitat. Fish community management objectives include extending and supporting coldwater fish habitat and important groundwater discharge sources as well as providing potential for Brown Trout spawning within Laurel Creek (Ecoplans et al. 2013; GRCA 1993; GRCA 2006). As direct fish habitat, both Beaver Creek and Laurel Creek are protected under Canada's *Fisheries Act*, and the *Planning Act* per the Provincial Policy Statement and the City of Waterloo Official Plan (2016).

Beaver Creek and Laurel Creek both provide a range of aquatic habitat functions making both creeks significant natural features. The majority of the length of Beaver Creek occurs within treed corridors and wetlands, with some encroachment by existing agricultural land use. Laurel Creek falls almost exclusively within heavily treed forest and wetland habitats. The NWSSS (Ecoplans et al. 2013) includes management objectives to protect and enhance the riparian attributes along Beaver and Laurel creeks, and to create a wider riparian corridor and linkage along Beaver Creek. Both creeks are sensitive to development and rely on an intact vegetated riparian corridor to provide shading and temperature mitigation, a source of large woody debris that adds complexity to the aquatic habitat, and is a source of allocthonous inputs (organic material such as leaves) that support the stream ecosystem. Although the creeks are primarily supported by surface water from the subject property, they will be sensitive to any activities which affect recharge of shallow groundwater that contributes to baseflow and water temperature mitigation. Maintaining a 30m buffer, as recommended in the subwatershed study, will largely avoid these impacts (Ecoplans et al. 2013).

Land use changes anywhere within the Laurel Creek and Beaver Creek subwatersheds can affect the hydrology of the creeks, and stormwater management measures must have regard for such potential impacts. The NWSSS provides recommendations for

maintaining and enhancing groundwater recharge and the control and treatment of surface water runoff for water quantity and quality. Beaver Creek is a small watercourse system and is sensitive to increased flows which can cause erosion and alter habitat. Implementation of best practices for construction is also key to avoiding impacts.

4.9 Buffers

Buffers are an important means to protect natural heritage features. The functioning of the buffer depends on the adjacent land use as well as the dimensions, characteristics and management of the buffer. Buffers are required for natural features such as woodlands, wetlands and watercourses to protect them from impacts during development. As described in Section 1.0, the natural features located on the subject property have a number of designations including PSW, ESPA, CEF, and Significant Woodland. These will be retained entirely and adequately buffered during development. NRSI identified several confirmed SWH types associated with these retained natural features as well. These features are afforded protection under the Provincial Policy Statement (2020), the Regional Official Plan (2015), the City of Waterloo Official Plan (2016), and are regulated by the GRCA under Ontario Regulation 150/06. Development or alteration of these areas is prohibited, unless otherwise provided for by the policies, such as the provision of infrastructure.

The NWSSS (Ecoplans et al. 2013) provides recommendations on development setbacks and buffer management measures for the natural features in the study area. The rationale for these measures is based on:

- Functional analysis of natural heritage features and functions, including considerations of the specific requirements and sensitivities of: vegetation communities and flora, wildlife breeding, foraging and movement habitat, and aquatic resources.
- Anticipated land uses in a future urban context, including roads, trails, development and required infrastructure.
- Relevant policy guideline documents (i.e. Natural Heritage Reference Manual (OMNR 2010); Greenlands Network Implementation Guideline. IV. Guideline for Determining Buffers around Environmental Features (Region of Waterloo 2016); How Much Habitat is Enough? (Environment Canada 2013)).

- Relevant scientific literature regarding potential impacts (i.e. abiotic and direct/indirect biological 'edge effects', occupancy related effects) and functional buffer widths.

The NWSSS (Ecoplans et al. 2013) recommended the following development setbacks for features present on the subject property:

- PSW wetland: 30m
- Upland Woodlands: 10m
- Beaver Creek and Laurel Creek: 30m
- Hedgerows: 5m

The future development setback is to be the greater of the combined recommended setbacks.

The NWSSS (Ecoplans et al. 2013) provides guidance on how and when reduced buffers may be considered, as described in Section 14.2.2 which states:

> *"There is potential for minor deviation in the recommended setbacks, where it is demonstrated through an EIS that: on average, the recommended setback width is met; and that the recommended setback/buffer in a proposed development or land use change will achieve the intended buffer objectives and appropriate level of environmental protection."*

This approach is supported in the Region of Waterloo Official Plan (2015) policy 7.C.10, which states:

> *"The location, width, composition and use of buffers will be in accordance with the approved EIS, with buffers being a minimum of 10 meters…"*

The final development setback (and buffer management recommendations) has been determined via site-specific work completed within the scope of this EIS, including field survey data collected during the pre-construction monitoring (2014-2019), with further consideration into the following:

- Species composition and diversity,

- Species sensitivity and requirements,
- Habitat sensitivity, including dependence on surface or groundwater inputs,
- Feature form and function, and
- Enhancement opportunities (i.e. corridor widening)

The following outlines how the proposed buffers are considered sufficient to protect species composition, diversity and sensitivity.

The natural features on the property are primarily PSW wetlands found in association with Beaver Creek and Laurel Creek, with adjacent areas of upland woodland. The PSW wetlands are primarily treed mixed swamp communities with small occurrences of thicket swamp, deciduous swamp, and meadow marsh. The large treed mixed swamp communities are the most significant and sensitive on the property. They have large old trees, moderate to high diversity of plant and wildlife species, highest floristic quality index in the study area (>30) and support a number of significant species of plants (as shown on Map 3 and wildlife including SCC Eastern Wood-peewee and other regionally significant birds. Shallow groundwater and seepage areas are evident throughout the PSW, supporting the wetland and contributing to flow in Beaver Creek. These features combine to qualify the PSW as one or more types of SWH (Map 5). The wetlands are also Category 2 habitat for the Threatened Blanding's Turtle. The adjacent upland woodlands are mature deciduous, mixed and coniferous forest communities which are significant and complement the PSW. Small areas of the upland woodland are younger as a result of disturbance/planting and are dominated by poplar or planted conifer trees. The edges of the PSW and the upland woodland show some impacts due to the adjacent agricultural land use such as tree removal, invasion of European Buckthorn and Phragmites as well as presence of urban tolerant wildlife such as Brown-headed Cowbird, Blue Jay, European Starling, Eastern Grey Squirrel (*Sciurus carolinensis*) and Northern Raccoon (*Procyon lotor*).

The 30m and 10m setbacks for the wetland and woodland recommended in the NWSSS (Ecoplans et al. 2013) are thought to be suitable to provide protection to the wetland/woodland on the subject property. The buffer for these features is addressed together since together they form large blocks of natural area and should be considered

a single unit. Wetland and woodland vegetation will be protected by the cessation of agriculture and tree removal along the edge. Annual plowing will end which will allow the root zones of trees to utilize the top layers of the soil. The width of the buffer is considered sufficient for planting and seeding with a mixture of native plants, shrubs and trees which will bolster and protect the existing edge from external effects of wind, sun and invasive species. A specific Rehabilitation and Enhancement Plan will be prepared for select areas where the treed edge is unstable and open due to tree removal, brush piles and decline/death of ash trees.

Buffer plantings will introduce diversity to the study area through the creation of meadow and thicket vegetation communities which are not common currently. These will provide new and additional habitat for insects including butterflies and dragonflies and can be used by mammals, birds, reptiles and amphibians for foraging, nesting, dispersal and travel.

The buffers will play a role in maintaining and enhancing the water balance of the creeks, wetland and woodlands. Measures will be implemented across the property to maintain and enhance infiltration within the development, which is key to sustaining the natural features. The recommended buffers will be important in maintaining the pattern of surface runoff and infiltration, such that water continues to be directed to the natural features in a diffuse way rather than as a point source. A 30m vegetated buffer to wetlands and watercourses is known to be effective for protecting water quality when implemented in conjunction with appropriate stormwater management and sediment and erosion control practices during construction, as discussed in the NWSSS (Ecoplans et al. 2013). The recommended buffers will be an improvement over the current condition where no buffer is present, allowing agricultural runoff to enter natural areas untreated and unabated, with minor erosion noted in a few locations.

The majority of Laurel Creek and Beaver Creek are buffered by wetland and woodland communities, providing extensive separation between the watercourses and the proposed development. These vegetated areas plus their buffers are substantial and will protect the majority of the length of the watercourses from potential impacts. The north portion of Beaver Creek is the one area where the existing buffer is absent or

reduced and an implemented watercourse buffer will be important. Both creeks have a warm/cool-water thermal regime and are small systems which are sensitive to changes in temperature and flow volume. A 30m buffer to the creeks is recommended in the NWSSS (Ecoplans et al. 2013) which is based on protecting the existing attributes of the creek and to provide an opportunity to provide a widened naturalized creek corridor. The 2019 updated wetland boundary delineation added a narrow strip of wetland along the northern portion of Beaver Creek that will increase the overall buffer width in this area. The creek/wetland buffer is of sufficient size to provide opportunities for plantings which will be beneficial in shading of the stream, increasing woody debris, and increasing diversity and richness of riparian habitat. The cessation of agriculture and implementing the buffer will remove the immediate impacts of bank erosion and runoff of sediment and pollutants into the creek.

The buffer distances are suitable to provide a physical separation distance to the development to minimize human occupancy effects, in combination with fencing and homeowner education brochure. The draft plan has been revised to include the buffers within the lands which will be transitioned to management by the City of Waterloo.

Section 14.2.2.1 of the NWSSS (Ecoplans et al. 2013) indicates that development and site alteration within buffer areas is to be limited and subject to detailed study in an EIS as follows:

- Part of SWM facilities and associated grading,
- Recreational trails and associated grading, and
- Site alteration associated with grading incursions to transition natural topography as required to achieve sound engineering practice and design

These are to be restricted to areas where the existing land use is active agriculture (i.e. crop lands). These recommended buffers and site-specific considerations were used to inform the limits of development as shown on Map 6 and are discussed further in the impact analysis section of this report.

5.0 Impact Analysis and Recommendations

5.1 Approach to Impact Analysis

The boundaries of significant natural features, sensitivities and buffer recommendations were provided to the study team to guide the development layout. This information was combined with other physical and planning considerations to come up with a suitable development plan for the property which respects the natural environment. The details of the development are shown on Map 2, Draft Plan of Subdivision prepared by MHBC Group (2020). Further details of the proposed development, including stormwater management, preliminary grading and servicing is provided by MTE (2020) under separate cover.

Potential impacts arising from the proposed undertaking are determined by comparing the layout and details of the proposed undertaking with the existing natural features, buffers and their ecological functions. Where the development proposal overlaps with the natural features or their buffers, impacts may arise. The following is a description of the types of impacts which will be discussed:

- Direct impacts to the natural features on the subject lands associated with disruption or displacement caused by the actual proposed 'footprint' of the undertaking.
- Indirect impacts associated with changes in site conditions such as drainage and water quantity/quality. Potential sources of indirect impacts associated with the proposed development include:
    - Encroachment into Buffers. The proposed development has regard for the recommended woodland dripline and wetland buffers throughout the entire Draft Plan (Map 2), with the exception of several small areas for trails, grading for SWM facilities and transitional grading, discussed below.
    - Changes to water balance. The SWM Report prepared by MTE provides an analysis of water balance to show how the site runoff will be managed to meet the objectives of the NWSSS.
    - Water quality. The SWM Report prepared by MTE describes the approach to protecting water quality.

- Erosion of Watercourses. The erosion thresholds for Beaver Creek were utilized in the design of the approach to SWM, as reported by MTE.
- Erosion and Sedimentation During Construction. An Erosion and Sediment Control (ESC) plan will be required at the Site Plan stage. Preliminary recommendations and measures are included in this EIS and MTE's SWM Report.
- Indirect impacts to wildlife habitat. The natural features will be retained in large blocks and buffered such that they will be protected from potential impacts of the new land uses, and opportunities for plantings and habitat enhancement are described.

- Induced impacts are those associated with post-development activities such as subsequent demand on the resources created by increased habitation/use of the area and vicinity.

The sections below describe the impact anticipated and the corresponding avoidance and mitigation measures.

5.2 Description of the Proposed Development

The development of the subject property was guided by a number of planning and engineering studies over the past many years. The Beaver Creek Meadows District Plan (TPP 2016) informed land use and community design at a block plan level including transportation network, servicing and institutional uses. The Class Environmental Assessment for Conservation Drive and Beaver Creek Road (Stantec 2016b) provides planned upgrades to the major roads in the study area as well as a preferred option for servicing and stormwater management. The NWSSS (Ecoplans et al. 2013) established the natural environment existing conditions and sensitivities and recommended buffers, environmental targets and land management activities to protect and enhance the natural heritage system in the study area. Within the framework of these overarching studies, the details of the development proposed on the subject property were designed. This second submission provides an updated Draft Plan which takes into account the comments received from the review agencies and has been refined and focused by the study team through a number of iterations.

The study team worked together to design the layout of the proposed development within the complexity of the physical, natural and servicing constraints of the subject lands and taking into account connections to the adjacent lands. The resulting proposal has been designed to avoid any direct impacts to natural environment features. The developed areas of the subdivisions have been placed in the actively farmed portions of the properties, outside of the ESPA, wetlands, woodlands, creeks and their buffers.

The proposed development includes a variety of residential densities, internal road network, parks, trails, open space and stormwater management facilities as shown on the Draft Plan (Map 2). Access to the site will be from several entrances along Conservation Drive and Beaver Creek Road, with a roundabout planned at the intersection of these two roads. The construction of the proposed development will occur in phases as shown on the Draft Plans (Map 2). The Erbsville Kartway lands will be developed in combination with the western portion of the Northgate lands and will proceed from north to south. The timing of the phasing is dependent upon the installation of roads, water and wastewater services.

Details of lots, road layout, stormwater management, grading and servicing have been prepared for the Erbsville Kartway and Northgate Subdivision. The development is to be staged through the Plans of Subdivision and Plans of Condominium. There are areas within the Plans of Subdivision that are shown as blocks and will be developed through a Site Plan Approval process including detailed stormwater management plan to show how the NWSSS criteria are being adhered to and implemented.

Water and wastewater servicing will be through connections to approved infrastructure in Conservation Drive and Beaver Creek Road. This infrastructure was assessed through the Class Environmental Assessment process prepared by Stantec (2016b). Two wastewater pumping stations are required on the subject lands, as shown on the Draft Plan; one adjacent to Beaver Creek at Conservation Drive and one at the southeast corner of the property adjacent to Beaver Creek Road. Details of servicing are provided in the Functional Servicing Report prepared by MTE (2020c).

The natural features and their buffers have been retained in large blocks, identified as Open Space on the Draft Plan, or as additional lands owned by the applicant and to be retained in private ownership by the applicant. Other open space land uses include stormwater management, community trail and parks as shown on Map 2. Natural features on Erbsville Kartway property and their buffers are included in the Draft Plan and will be conveyed to the City of Waterloo. On Northgate, buffers are included in the Draft Plan with the intent to convey to the City, but natural features are proposed to remain in private ownership and form part of the common area for the Plan of Condominium. The natural features will be maintained by the condominium corporation. However, a Conservation Easement in favour of a public authority is proposed, to ensure the ongoing protection of natural features into the future.

Three stormwater management facilities are proposed on-site, all draining to Beaver Creek; the main facility is a traditional detention pond on the west side of Beaver Creek, to service the western portions of the property. Smaller dry pond facilities are proposed on the east side of Beaver Creek and within the condominium block in the southern agricultural field. These facilities will service smaller specific catchment areas (see Map 2). Amended topsoil and infiltration measure will be used throughout the site wherever possible, to enhance and maintain the natural water balance. A fourth SWM facility known as the Beaver Creek Meadows District Communal SWM facility (BCMD CSWMF) is proposed off-site to the east, at the southwest corner of the Green Acres RV Park property (Mar-View Farms). This facility will be built to receive flows from the eastern portion of the Northgate development as well as flows from other properties to the north and east in that local catchment area. This communal stormwater management facility will outlet to the Laurel Creek Reservoir Tributary and is being designed and assessed under a separate study process. See the BCMD Communal SWMF Report prepared by MTE (2020b) for details. This strategy and SWM facility locations are consistent with those presented in the NWSSS (Ecoplans et al. 2013) and the Beaver Creek Meadows District Plan (BCMDP) (TPP 2016).

Buffers have been provided from the wetland and woodland boundary to the limits of the development including the stormwater management facilities. Small modifications to the buffer have been made based on line smoothing, as well as the need for transitional

grading, resulting in small buffer additions and removals in various areas of the plan. These can be seen on Maps 6 and 10. General areas for enhancement are shown on Map 10 Stewardship Plan, but details will be provided in a future Rehabilitation and Enhancement Plan.

An impact analysis has been prepared for the proposed development, broken down according to the stages of development, as shown on the Draft Plan. Stages are grouped together where the impact analysis is similar, as follows:

- Stages 1, 2 and 3 (East of Beaver Creek),
- Stages 4, 5, 6 and 7 (West of Beaver Creek),
- Stage 8 (southern agricultural field and access road), and,
- Erbsville Kartway Property (Stages 1 and 2).

5.3 Stages 1, 2 and 3 (East of Beaver Creek)

Stages 1, 2 and 3 of the development includes blocks for single residential, multiple residential blocks, a multiple residential/mixed use block, park, walkways and SWM facility 5915 on the east side of Beaver Creek, with a pumping station at the southeast corner of the property. This part of the development has been designed to the block level including preliminary servicing, grading and stormwater analysis to ensure that all targets are being met and the development is feasible. Details will be determined at a future Site Plan Approval process for these blocks.

5.3.1 Direct Impacts and Mitigation Measures

The development has been located entirely within the active agricultural lands and there are no direct impacts to natural features in Stages 1, 2 and 3.

5.3.2 Indirect Impacts and Mitigation Measures

<u>Encroachment into Buffers</u>

- Grading at rear of Block 3 in Stage 1 adjacent to the buffer of the Core Environmental Feature. Due to a natural steep hill in this area, grading will extend into the 10m dripline buffer a varying distance from 0 to 5m, but averaging 2.9m over a length of 63m. Grading has been minimized as much as possible through the use of a single tier of armour stone, but is required to provide a level

surface for the recreational trail and to match existing grades through sound engineering practice and design. At this location, the adjacent woodland is comprised of coniferous plantation which was given a low-moderate quality and sensitivity rating in the NWSSS due to is anthropogenic origin and presence of non-native species. This encroachment into the buffer is entirely within currently tilled agricultural land and will result in a slight filling of an area of 185m^2 ha.

- There are no encroachments into Blanding's turtle Category 2 habitat in Stages 1, 2 and 3.

Mitigation: Clearly demarcate the limits of grading in the field and install heavy-duty ESC/ tree protection fence. A rehabilitation and enhancement plan for the buffer will be prepared as a condition of draft plan of subdivision approval.

Additions to Buffers/Reforestation

At the rear of lots where Block 1 meets Block 2 in Stage 3, there is a small area at the tip of the wetland/woodland where additional lands will be added to the buffer, totaling 135m^2.

Due to the topography in Block 2 in the northwest part of Stage 3, adjacent to Beaver Creek, an embankment will be created to provide a level surface for the placement of the SWM facility 5915, and residential lots. This bank is agricultural field, outside of the proposed buffer, but will be vegetated and will add another 16-20m to the buffer separation distance from the wetland/Beaver Creek/dripline in this area. It will result in approximately 6000m^2 of land being reforested, bulking up the creek riparian corridor and natural heritage system. This reforestation in conjunction with the buffer and reforestation in Stage 8 will enhance forest habitat in ESPA 80. See Section 6.10 for more details.

Water Quality

Most of the land area in Stages 1, 2 and 3 is within catchment 310, which drains to the LCRT. These lands will continue to flow towards the LCRT and will utilize the BCMD communal SWM facility on Mar-View Farms property. This facility will provide an

Enhanced level of water quality control to the LCRT including TSS, thermal regulation and a winter bypass to avoid potential chloride impacts to the LCRT.

The small portion of Stage 3 that drains to Beaver Creek will be treated through a proposed SWM facility 5915. A detailed SWM plan will be prepared at the Site Plan Approval stage for this Block showing how the proposed facility will adhere to the NWSSS criteria and be implemented. Enhanced level of quality control is to be achieved using an oil-grit separator, thermal regulation will be provided by a subterranean cooling trench, and chloride impacts will be mitigated by a winter by-pass which avoids infiltration of salt-laden runoff during the months of December to March.

Mitigation: Determine details of SWM at Site Plan stage. Monitor Beaver Creek for chlorides.

Changes to Water Balance

One of the potential sources of impact to natural features as a result of development is the increase in impervious cover in the catchment which can alter the pattern, volume and flow of groundwater and surface water to natural features. The increase in impervious cover prevents water from soaking into the ground, or being taken up by plants and can speed up the rate at which surface runoff flows across the site.

Most of the land area in Stages 1, 2 and 3 is within catchment 310, which drains to the LCRT. These lands will continue to flow towards the LCRT and will utilize the communal SWM facility on Mar-View Farms property. As per the NWSSS quantity control is not required for catchment 310, but this was taken into account in the BCMD Communal SWM study to ensure no negative impacts to the LCRT and its habitat due to erosion or due to changes in water balance. Some of the lots which back onto the woodland and wetlands of Beaver Creek will have split lot drainage such that clean water from roofs and the rear of the lots will continue to drain by overland flow to the natural feature.

In the event that the BCM communal SWM facility is not ready in time to service this portion of the Northgate development, the proponent will construct a temporary SWM facility in the southeast corner of the subject property, as shown on Map 2. MTE's

BCMD Communal SWMF report (2020) details this approach and the facility in Appendix 10. The temporary SWM facility has been designed as a wet pond with a permanent pool depth of 1.5m to achieve an Enhanced level of water quality control. An oil-grit separator will be provided upstream of the facility instead of a sediment forebay. Quantity control is not required for this catchment. Flows from the temporary facility will be directed into the existing ditch of Beaver Creek Road and into Laurel Creek.

A portion of Stage 3 is within catchment 391 which flows west to Beaver Creek and adjacent wetlands. Stormwater management facility 5915 is proposed on the east side of Beaver Creek (see Map 2) to service the development of this area. Due to the natural features and slopes a bank must be constructed to create a level area for the proposed multi-residential Block and the SWM facility. The facility will handle runoff from the multi-residential Block totaling a drainage area of 0.89ha. The SWM facilty 5915 has been placed to capture and treat flows from this area prior to outletting to a subterranean infiltration gallery. A detailed SWM plan will be prepared at the Site Plan Approval stage showing how the proposed strategy and facility will adhere to the NWSSS criteria and be implemented. MTE's Preliminary SWM Report provides a summary of how this facility is to be designed to meet the requirements, which includes:

- Water quantity control is expected to be achieved via a dry pond, with a multi-stage outlet structure.
- End of pipe infiltration galleries sized for 30mm rainfall are to be provided for all the roof area, except for those assigned to contribute surface water to the wetland.
- An end of pipe infiltration facility is proposed such that no runoff is produced under a 4 hour, 25mm storm event.

MTE conducted a water balance analysis in their report (see section 5.6). For Stages 1, 2 and 3, the surface water balance to the eastern portion of the on-site wetland is predicted to be maintained in the post-development condition (1.9% increase in flow annually). This was accomplished by maintaining runoff to the wetland from the buffers and the open space areas adjacent to the wetland buffers as well as directing roof and rear yard runoff from adjacent lots. The embankment in Stage 3 is a 0.67ha area that will be naturalized with plantings and will drain directly to the Beaver Creek corridor.

Infiltration in this catchment will be maintained or enhanced resulting in enhanced infiltration rates above the pre-development condition (33.9-63.8% increase above existing) and closely matching the NWSSS predicted value (6-11% increase above predicted).

A comparison of infiltration values for this portion of the development is shown in Table 11 below.

Table 11. Infiltration in Catchments 3102 (LCRT) and 3915 (Beaver Creek)

Catchment	Precipitation (mm/yr)	Existing Condition (mm/yr)	NWSSS Predicted Infiltration (mm/yr)	Proposed Infiltration (mm/yr)
3102	844.8	183.4	281.6	300.4
3915	844.8	222.9	266.7	298.4

The comparison in Table 11 indicates that the infiltration strategy for the development of Stages 1, 2 and 3 will result in an enhancement of infiltration over the existing condition and the predicted rate from the NWSSS. The enhanced infiltration is not expected to cause any groundwater mounding impacts, as was calculated in the Hydrogeological Report by MTE (2020a).

Mitigation: Implement recommendations from MTE's BCMD Communal SWMF report and Preliminary SWM report. Details of SWM for Catchment 3915 to be determined at the Site Plan Approval stage.

Thermal Impacts to Beaver Creek

In Stages 1, 2 and 3, no surface runoff is outlet to Beaver Creek directly. The majority of this development is within the subcatchment of the LCRT, and thermal mitigation is provided by the BCMD Communal SWM facility for that watercourse. The remainder of the development will flow to SWM facility 5915 which will be a dry pond with an infiltration gallery as its outlet, capable of infiltrating all runoff up to a 4hr-25mm event, thus avoiding any thermal impacts to Beaver Creek. If this method changes during the detailed design, then additional cooling measures may be required.

Mitigation: Review the need for cooling measures at the detailed design stage, implement and monitor temperature in Beaver Creek to determine their functioning and success.

Erosion Exceedance

The majority of runoff from this part of the development will be directed to the LCRT, via the BCMD Communal SWM facility which has been designed with a controlled outlet to avoid any erosion to the LCRT, as described in the BCMD Communal SWMF report (MTE 2020). The outlet has been designed such that the predicted erosion exceedance duration will be significantly reduced from current conditions which will be a benefit to the LCRT and reduce the risk of erosion of its banks.

In Stages 1, 2 and 3, no surface runoff is outlet to Beaver Creek directly. The on-site SWM facility 5915 will be a dry pond with an infiltration gallery as its outlet, capable of infiltrating all runoff up to a 4hr-25mm event. Post-development peak flows to Beaver Creek will be controlled to the required unit flow rates for the 2yr, 5yr and 100yr storm events.

Mitigation: Monitor LCRT in accordance with the BCMD Communal SWMF report. Monitor SWM Facility 5915 outflows and Beaver Creek bed and bank to evaluate condition and determine if erosion thresholds are being exceeded.

5.4 Stages 4, 5, 6 and 7 (West of Beaver Creek)

These stages of the development consist of single and multiple residential lots, an internal road network with entrances from Conservation Drive, parks, a pumping station and stormwater management facility located adjacent to Beaver Creek. These stages are coordinated with the Erbsville Kartway property (discussed further in Section 5.6) to create an integrated development.

5.4.1 Direct Impacts and Mitigation Measures

The development has been located entirely within the active agricultural lands and there are no direct impacts to natural features in Stages 4, 5, 6 and 7.

5.4.2 Indirect Impacts and Mitigation Measures

Encroachment into Buffers

Stages 5, 6 and 7 of the proposed development have respected the recommended woodland dripline and wetland setbacks/buffers. In Stage 4 there are a few exceptions of small areas of encroachment where topography is challenging:

- Stormwater management facility 5914 Block 25 in Stage 4. All of the open water pond, berms and cooling trench for the facility will be outside of the natural feature buffers. The outlet pipe from the facility will extend into the buffer in order to meet grades. Flows from the pond will be discharged into the buffer and will infiltrate or surface flow to the creek, or be taken up by plants. This is not considered a significant impact.
- Rear of Block 14 in Stage 4. Minor encroachment into the 30m wetland buffer for transitional grading is required at the rear of Block 14. The intrusion will be 52.5m long x 5m wide, resulting in an area of 263m^2.
- Rear of Blocks 12 and 13 in Stage 4. Due to a bulge of Phragmites extending from the wooded wetland into the agricultural field, the wetland boundary was modified during re-marking in 2019 to include this area of poor drainage. This resulted in a pinch point for the development layout. In order to maintain a usable lot depth in Block 12 and 13, a portion of the wetland buffer is reduced to a minimum of approximately 20.7m in width in this location which is an encroachment of 332m^2. A corresponding addition to the buffer is required in the rear of Block 13 for an area of 69m^2. The recreational trail has been re-routed in this area to avoid any additional infringements into the buffer. The buffer will be planted and wetland rehabilitation activities are proposed to bolster the ecosystem function in this location.

These encroachments into the outer fringe of the buffer have been limited as much as possible in the proposed development layout and are only located in areas where it is necessary to achieve appropriate land use as well as sound engineering practice and design. This will result in a slight filling of a net total area of 0.0434ha of current tilled agricultural land. The NWSSS indicates the main potential impacts to wetlands in a development scenario to be addressed by buffers are protection of vegetation, wildlife habitat, occupancy related effects, water balance and water quality.

These encroachments are considered minor in area and in level of disturbance. The encroachment areas are currently tilled agricultural land which will receive fill and then be naturalized along with the rest of the buffers, such that the functional buffer width is 30m.

The encroachment by Block 12 and 13 is necessary to provide lots that meet minimum depth requirements to build medium density housing as well as to form a safe stable slope to transition from the developed portion to the vegetated/naturalized buffer at existing grades. Recognizing the slight reduction in buffer width, a detailed buffer planting plan has been created in order to bolster its function and to rehabilitate the wetland ecosystem (see Map 7). The native vegetation will be preserved while the non-native Phragmites will be removed. The water quality improvement and infiltration functions of the buffer are expected to be sufficient at this location while the habitat and riparian protection value of the buffer will be improved through Phragmites management and plantings to create permanent vegetated cover.

In all other areas of the proposed development the separation distance between the wetland and residential lots will be 30m, or greater in areas where additions have been made to the buffer width or where open space land uses are adjacent. Permanent fencing will be installed at the rear of the lots and around the SWM facility to demarcate the limit of development and to prevent any encroachment by residents into the buffer and the natural features.

The proposed reduced buffer is considered adequate to protect the form and function of the adjacent wetland community based on the following factors:

- The vegetation form of the wetland and the woodland will be directly protected. The buffer provided always meets or exceeds the minimum Region of Waterloo recommended buffer of 10m from dripline for Core Environmental Features,
- Buffer width overall across the properties is sufficient to increase natural cover area through the cessation of agriculture and proposed buffer plantings,
- Naturalization of the buffer will improve the riparian corridor of Beaver Creek by increasing its width and filling in gaps in the vegetation of an area that is currently tilled,

- Naturalization of the buffer provides an opportunity to create adjacent upland habitat for wildlife such as foraging and nesting habitat for turtles, snakes, mammals, insects and birds,
- Stormwater management plan will provide surface water treatment to address potential for water quality impacts and will maintain and improve the existing water balance through LID measures such as amended topsoil which will increase infiltration,
- Erosion and Sediment Control plan will be prepared to prevent impacts to the natural features and buffers,
- Rear yard fencing along the development limit will minimize and prevent human encroachment.

Based on the analysis provided above for the proposed minor encroachments into the recommended 30m wetland buffer, the following criteria are satisfied which meets the City of Waterloo OP policy 8.2.4(9) regarding encroachment into buffer zones for Core Natural Features:

- The adjacent Core Natural Feature is enhanced above the existing condition,
- No other alternative location is feasible (Draft Plan adheres to recommended layout and SWM facility locations, as shown in Figure 16.1 Implementation Plan of the NWSSS),
- Low Impact Development (LID) measures are implemented to the extent feasible outside of the buffer,
- Root zones of adjacent natural features are not impacted, and,
- The SWM facility replicates or compliments an existing function of the buffer lands.

Mitigation: Implement stormwater management plan to address water quality and quantity and erosion potential impacts. Clearly demarcate the limits of grading in the field and install sediment barrier/protection fence. Enhance the function of the buffer through fencing, an invasive species management plan and planting plan.

Water Quality

Stormwater from the developed portions of Stages 4, 5, 6 and 7 will be directed to SWM facility 5914 located in Stage 4, Block 25, adjacent to the wetland and Beaver Creek buffer. Water will be conveyed to the facility via the storm sewer network and overland flow route using the road surfaces. The facility has been designed to achieve Enhanced water quality protection and will be a wet pond with a permanent pool depth of 1.0m and a sediment forebay with a depth of 1.5m. The forebay will function to trap sediment and dilute incoming water, and is designed specifically targeting the most frequent type of rainfall events (25mm or less). Larger storms will enter the main pond directly without going through the forebay. The facility will outlet to the buffer to the wetlands and Beaver Creek. To avoid impacts of infiltrating winter salt-laden runoff, outflows will be directed to Beaver Creek from December to March, avoiding the infiltration gallery. MTE has provided details of the facility design in the Preliminary SWM Report (MTE 2020b). *Mitigation: Monitor Beaver Creek for chlorides.*

Thermal Impacts to Beaver Creek

A number of stormwater management measures are provided in the SWM report to avoid and mitigate the potential for thermal impacts to Beaver Creek which could arise as a result of the introduction of warmed stormwater runoff. Thermal impacts are primarily avoided by infiltrating all runoff from rain events up to a 30mm storm at the lot level using amended topsoil and infiltration galleries as shown on Figure 5.5 in MTE's report. In addition, the outlet pipe from SWM pond 5914 is a bottom draw pipe, accessing cooler waters from the bottom of the pond. This water will flow to a subsurface cooling trench constructed in the shallow groundwater table which will allow the treated storm water to be effectively cooled before being discharged to the wetland/watercourse buffer. MTE's heat transfer modelling predicts that outflow from the cooling trench will average 21.9ºC with a maximum of 23.1ºC. It is important to note the discharge point will be into the buffer, approximately 15m from the wetland and further from the creek. Discharge water will flow through naturalized and vegetated area in a diffuse pattern before reaching the natural features. It is expected that water will evaporate, be taken up by plants or infiltrate across this flow route, further minimizing the chance for any thermal or other impacts to the receiving watercourse and wetlands. SWM facility plantings will be important for shading of the pond to further reduce thermal

impacts. The NWSSS recommends in-stream target temperatures for Beaver Creek of less than 22°C from April 1 to October 31, and between 4°C and 14°C from November 1 to March 31.

Mitigation: Implement infiltration measures and outlet cooling measures and monitor temperature in Beaver Creek to determine their functioning and success.

Erosion Exceedance

According to the fluvial geomorphology assessment in the NWSSS, the banks of Beaver Creek are more sensitive to erosion than the creek bed. In designing the SWM facility 5914 and its outlet structure, MTE used the threshold for bank destabilization as a target for flow volume, rather than the creek bed threshold, as this was a more conservative and sensitive approach. A multi-stage control outlet has been designed to meet quantity targets and erosion thresholds to avoid any impacts to Beaver Creek. Based on their modelling this will result in slight lowering of the erosion exceedance duration as predicted and accepted in the NWSSS.

Mitigation: Monitor creek bed and bank to determine if the erosion thresholds are being exceeded.

Changes to Water Balance

In order to manage water quantity and to control erosion in the post-development scenario, MTE designed the stormwater management strategy following the target unit flow rate approach (as documented in the NWSSS) for catchment 391 which covers the majority of the site and contributes to Beaver Creek (Subwatershed 391 in MTE's report). The intent of this approach is to manage development within the subwatershed in a manner that does not cause an increase to surface flows in Beaver Creek. This approach was used in the NWSSS as it was found that the typical post-to-pre SWM strategy would increase the magnitude of flows in the lower reaches of Beaver Creek. Beaver Creek is a small watercourse system and is sensitive to increased flows which can cause erosion and alter habitat. Surface runoff needs to be controlled and infiltrated to the extent possible to maintain and enhance existing water balance conditions which are important for sustaining the wetlands and the creek. This method aligns with the

thresholds for erosion and duration of flows for the sensitive reaches of the creek as determined in the NWSSS.

In order to gain an understanding of potential water balance impacts it is important to understand more detail on how and where water will be delivered to the wetland and watercourses in the post-development scenario. MTE conducted a water balance analysis in their report (see section 5.6). In the analysis, they delineated in greater detail the existing surface water catchments that contribute to the central wetland and compared that to the proposed condition. Under the existing condition, the catchment area of the western portion of the central wetland is 20.3ha generating an annual runoff volume of 16,914m^3. The proposed grading of the site and the stormwater management strategy were reviewed and refined to create a plan which allows the surface water contribution to the wetland to be matched in the post-development scenario. Surface runoff to the wetland will increase to 17,099m^3 annually (an increase of 1.1%). This was accomplished by maintaining runoff to the wetland from the woodland/wetland areas, their buffers and the open space areas adjacent to the buffers such as the pumping station and park as well as clean runoff from roof (or half roof) and rear yards of adjacent lots.

To ensure there is no reduction in base flow to Beaver Creek and wetlands, no change in existing aquifer recharge, and no disruption in the pattern of groundwater recharge, infiltration measures are proposed which will result in increased rates infiltration above the existing condition. MTE's analysis indicates that the infiltration strategy for the subject development is an enhancement over the current average annual volumes and roughly matches the predicted value in the NWSSS for the respective catchments.

This increase in infiltration will be achieved through a number of SWM practices at the lot level and end-of-pipe controls. Lot level enhancements include amended topsoil (450mm depth proposed) over all of the single family lots and the park. Roof leaders from either the full roof or half roof will be connected to infiltration galleries on the single lots and multi-residential blocks. The predicted infiltration value for this portion of the development is shown in the Table 12 below.

Table 12. Infiltration in Catchment 3914

Catchment	Precipitation (mm/yr)	Existing Condition (mm/yr)	NWSSS Predicted Infiltration (mm/yr)	Proposed Infiltration (mm/yr)
3914	844.8	211.9	262.2	268.3

Mitigation Measures: Implement the SWM strategy and design from MTE's report for Stages 4, 5, 6 and 7. Measures are recommended to promote infiltration in order to enhance groundwater recharge above the existing condition and to meet the objectives of the NWSSS.

Species At Risk

Blanding's Turtle

The wetlands on-site plus the adjacent 30m lands are Category 2 habitat for Blanding's Turtle. This category of habitat is considered to have a moderate level of tolerance to alteration before its function is compromised (OMNR 2013). The details of the SWM pond design prepared by MTE (2020) show that the open water portion of the pond itself is well outside of the 30m buffer as well as the outer bank and the underground cooling trench. The outlet pipe extends into the outer portion of the wetland buffer in order to meet grades (see MTE SWM report Figure 5.1).

Correspondence with MNRF regarding potential impacts to Blanding's turtle and its habitat indicate that their main concern is related to maintaining the water balance to the wetland such that the habitat for Blanding's turtle is not negatively impacted. The placement and construction of the forebay and permanent pool of the stormwater management pond adjacent to the wetland buffer is not anticipated to impact Blanding's Turtle as it is outside of the Category 2 habitat, and the placement of the outlet pipe within the habitat is not anticipated to be a negative impact. This has been confirmed with MECP through the submission of an Information Gathering Form (IGF), accompanying reports and a Blanding's Turtle mitigation plan (NRSI 2020) prepared as a separate document which is appended to this report.

Mitigation: maintain the water balance to the wetland such that the habitat for Blanding's turtle is not negatively impacted. Implement details of Blanding's Turtle Mitigation Plan as prepared by NRSI.

5.5 Stage 8 (Southern Agricultural Field and Access Roadway)

Stage 8 includes the development of a 14 unit vacant land condominium in the southern agricultural field with access by a private road as well as provision of municipal services and stormwater management measures.

5.5.1 Direct Impacts and Mitigation Measures

There are no direct impacts to natural features in Stage 8 as the access road and the condominium development have been located entirely within the active agricultural lands outside of the ESPA and natural features and buffers.

5.5.2 Indirect Impacts and Mitigation Measures

Access Road

The development of Stage 8 includes the construction of an access road and provision of underground services (water, sewer). This road and servicing will be located within the agricultural lands as they provide access to the southern field. This access is approximately 35m in width from dripline to dripline and accommodates large farming equipment. The area is actively cultivated and has recently been planted in corn or soybeans.

The woodland edge has been disturbed over the years through tree removal for agricultural purposes, removal of trees damaged by ice, wind and damage by Emerald Ash Borer (EAB). A 10m buffer to the ESPA woodland dripline has been applied on both sides at this location which provides an opportunity to rehabilitate the edge of the woodland through tree management and tree and shrub plantings. Woodland enhancement is further discussed in Section 6. The access road will be constructed as a private road which allows a narrower cross-section, using a minimum width of 7.3m. The road footprint and detailed grading analysis allow the road and grading to be constructed outside of the woodland buffers. Detailed grading analysis by MTE shows how the road can be

constructed without need for encroachment into buffers. Road surface runoff will be managed within Stage 8. The need for grading has been minimized through road design and the use of a low retaining wall. MTE has prepared a preliminary design sketch and cross sections of the access road as shown on Map 8.

The proposed design will result in the road being elevated above the existing topography. This is necessary for a number of reasons, including the need for separation of underground services from the groundwater table and to control road runoff such that it can be accommodated by the stormwater management strategy for Stage 8. The retaining wall is also provided as a mitigation measure in terms of preventing small wildlife and reptiles from entering the road surface. The retaining wall is of sufficient height (0.85m) to function as funnel fencing and will direct wildlife to culverts for passage under the road. Two culverts are provided; one for wildlife passage and one for combined drainage and wildlife passage function. Wildlife passage is further discussed below in Section 6.7.

Mitigation: minimize road footprint and grading as much as possible, maintain 10m dripline buffer, buffers to be naturalized, woodland edge to be managed and planted with trees to stabilize and create additional forest habitat. Install retaining wall as wildlife barrier and culverts as shown by MTE for proper drainage and to ensure safe wildlife passage.

Provided these mitigation measures are implemented, no negative impacts to natural features and ecological functions of the ESPA are anticipated to occur as a result of the access road and servicing.

Water Quality

A SWM facility 5917 is located within the island of the internal road, servicing a catchment area of approximately 1.27ha which includes runoff from the road surface and the front yards of the proposed lots. The SWM plan has been conceptually designed at this point and a detailed SWM plan will be prepared at the Site Plan Approval stage showing how the proposed facility will adhere to the NWSSS criteria and be implemented. Enhanced level of quality control is to be achieved using an oil-grit

separator, thermal regulation will be provided by infiltrating all rainfall up to the 4 hour, 25mm storm event, and chloride impacts will be mitigated by a winter by-pass which avoids infiltration of salt-laden runoff during the months of December to March.

Mitigation: Determine details of SWM at Site Plan stage. Monitor Beaver Creek for chlorides.

Changes to Water Balance

All of Stage 8 is within the catchment of Beaver Creek. A detailed SWM plan will be prepared at the Site Plan Approval stage. MTE's Preliminary SWM Report provides a summary of how this facility is to be designed to meet the requirements, which includes:

- Water quantity control is expected to be achieved via a dry pond, with a multi-stage outlet structure.
- The lot level infiltration galleries are to be sized for 30mm rainfall from roofs, except for those assigned to contribute surface water to the wetland.
- An end of pipe infiltration facility is proposed such that no runoff is produced under a 4 hour, 25mm storm event.

The large lots of the condominium development will primarily infiltrate runoff in the rear yards or flow overland to the buffer and adjacent natural features. The proportion of infiltration and surface flow has been calculated for achieving optimal water balance targets.

Based on these measures, infiltration in Stage 8 is expected to be above current (73% increase) and the predicted infiltration rate from the NWSSS (27% increase). See Table 13.

Table 13. Infiltration in Catchment 3917

Catchment	Precipitation (mm/yr)	Existing Condition (mm/yr)	NWSSS Predicted Infiltration (mm/yr)	Proposed Infiltration (mm/yr)
3917	844.8	177.0	240.8	306.6

This increase in infiltration will be achieved through a number of LID practices at the lot level and end-of-pipe controls which will be detailed at the Site Plan Approval step for

Stage 8. The enhanced infiltration is not expected to cause any groundwater mounding impacts, as was calculated in the Hydrogeological Report by MTE (2020a).

Mitigation: Implement recommendations from MTE's SWM report in the detailed design of the SWM strategy for Stage 8.

Thermal or Erosion Impacts to Beaver Creek

There will be no impact to the thermal regime or erosion sensitive banks of Beaver Creek as rainfall will be infiltrated. The SWM outlet will be located approximately 30m from the creek, allowing flows to dissipate and infiltrate along a lengthy flow route through the woodland wetland.

Mitigation: Implement recommendations from MTE's SWM report in the detailed design of the SWM strategy for Stage 8.

Field Restoration and ESPA 80

The Region of Waterloo's Ecological and Environmental Advisory Committee (EEAC) scoped the TOR for this EIS and asked that it include "*consideration of the ecological implications of ecologically restoring the agricultural field inside the northern lobe of ESPA 80 as an alternative to residential development*."

The study team considered several options for development of Stage 8. The proposed plan was created with several environmental considerations:

- Condominium development. The condominium approach allows unique standards to be applied to all lots that will restrict activities in order to protect and enhance the natural area. The natural areas will be governed by the condominium corporation and will have a Conservation Easement in place to provide protection and management.
- Large lots – A total of 14 lots are proposed, ranging in size from approximately 0.07ha to 0.1ha with about 20m in frontage. Large size lots will provide space for infiltration and vegetation cover in addition to the buffer lands.
- Central island – The access road will circle a central island which has been proposed to perform several functions, both aesthetic and ecological. The island

will be landscaped and planted with native trees, shrubs and herbaceous plants to provide some privacy screening between lots, but will also increase tree cover, vegetation and provide some wildlife habitat.

  - SWMF 5917 – The SWM facility located within the central island will receive, treat and infiltrate precipitation and runoff from the local lots and access road. An overflow path is provided to the north and into the open space area in the event of a major storm and for winter drainage.
  - Buffers – will be naturalized to protect and enhance forest edge. The rear of lots adjacent to the buffer will be fenced to mitigate potential induced impacts by residents and to maintain habitat connectivity for Blanding's turtle.
- Restoration area – A portion of the field has been identified as additional Open Space (1850m^2) and will be planted with trees providing an ecological enhancement. This block is a natural low point on the property and will continue to receive surface runoff from the adjacent lots as well as be part of the flow path from the SWM facility. See section 6.10 for further details.

The proposed development of Stage 8, including the access road, have been carefully planned to ensure that the development will have no negative impact on the ESPA 80 woodland/wetland or its ecological function. Forest interior habitat and other significant wildlife habitat functions within ESPA 80 will be maintained and protected.

5.6 Erbsville Kartway Property (Stages 1 and 2)

The Erbsville Kartway property is in separate ownership from the Northgate Lands and the parcels are subject to separate planning applications, although the Erbsville Kartway and Northgate applications are being coordinated from the perspective of supporting studies and processing. Accordingly, the Erbsville Kartway and the Northgate lands have been studied together throughout the pre-construction monitoring program and characterization report. The draft plan, servicing and stormwater management planning and reports incorporated both parcels for an efficient planning approach. It is expected that these lands will be developed at a later stage, as development progresses from east to west. A large part of the Erbsville Kartway property consists of provincially significant wetlands, a portion of Laurel Creek, natural feature buffers and floodplain, with residential development and vacant land condominium proposed outside of those

constraints. The property is actively used as a go-cart facility and contains a paved track, buildings and mown lawn as well as the owner's private residence. The business will continue to operate until development begins. The impact analysis is included in this combined report.

5.6.1 Direct Impacts and Mitigation Measures

Vegetation Removal

The only direct impacts will be the removal of vegetation associated with the existing residence, the go-kart facility and outbuildings. Limited landscape plantings and ornamental trees in and around these buildings and facilities will be removed at the time of development as these are demolished. These trees and plantings surrounding the existing residence are not significant and no significant species use this area.

Bird Nest Destruction

The *Migratory Birds Convention Act* (MBCA) protects migratory birds, their eggs and nests from being harmed or destroyed. Since the habitat to be removed is entirely landscape trees and shrubs around the existing buildings, a reduced window of nest protection from May 1 to July 31 has been proposed based on the guidance of CWS (2016a).

Mitigation: During the time period from May 1 to July 31 it is recommended that no clearing of vegetation occur within the Erbsville Kartway property. The Canadian Wildlife Service (CWS) advises that, nest searches, as a means of mitigating nest destruction during the core breeding period, may be undertaken in "simple" habitats such as isolated landscape trees, bridges, or other constructed features where the potential to observe all active nests is relatively high (CWS 2016b). If required at the time of development, nest searches by a qualified biologist are a feasible strategy on this property due to the simplicity of the habitats to be removed.

Species At Risk

Barn Swallow

Barn swallow was confirmed nesting in one of the Erbsville Kartway buildings during the 2017 and 2019 spring monitoring. Barn swallows and their nests are protected under the ESA (2007). These buildings will require removal at the time of development. A

replacement nesting structure and nest cups may be required by the MECP, the details of which will be determined at the time of demolition of the buildings. The replacement structure needs to be installed before the active nesting season (generally May-August) in the year that the existing nest structure is removed.

Mitigation: Barn swallow nesting will be monitored during future years of the pre-construction monitoring program and will be addressed according to the ESA at the time when building demolition is proposed, and in consultation with MECP, as appropriate.

Bats

During field surveys, bats were observed exiting one of the Erbsville Kartway buildings. Guidance from MNRF recommends that the buildings proposed for removal be surveyed visually for bats, as per standardized protocol (D. Marriott, pers. comm. 2015b). Since it will be several years before the development of this subject property, these buildings will be re-assessed at that time to ensure compliance with the *Endangered Species Act* (2007) and any updated guidance on SAR bats.

Mitigation: SAR Bat use of the buildings will be monitored and will be addressed according to the ESA at the time when building demolition is proposed, and in consultation with MECP, as appropriate.

5.6.2 Indirect Impacts and Mitigation Measures

Encroachment into Buffers

No encroachment into natural feature buffers is proposed in this portion of the development.

Changes to Water Balance

All of the Erbsville Kartway property currently drains to Laurel Creek, as shown on Figure 2.0 of MTE's report. As indicated in their report (MTE 2020b) and approved in the NWSSS, some of the land which currently drains to Laurel Creek will be redirected to Beaver Creek during development in order to consolidate the number of stormwater management facilities required and to limit the number of outlets to watercourses (NWSSS). A total of 4.7ha additional hectares are proposed to be redirected to Beaver Creek in the post-development drainage analysis. The remainder of the Erbsville

Kartway property will continue to discharge surface runoff overland through rear yards towards Laurel Creek and the wetlands. Details are described in Section 4.2 in MTE's report. No impacts to Laurel Creek are anticipated as a result of this minor change.

5.7 Erosion and Sedimentation During Construction

During construction, areas of bare soil will be exposed which have the potential to erode during rainfall events and impact adjacent natural features. In the event of a heavy rain, sediment laden runoff can enter adjacent natural areas by way of overland flow. In order to protect on-site and off-site natural features from potential impacts due to sediment, a Erosion and Sediment Control plan should be developed. MTE provides a number of recommendations regarding construction staging and site erosion and sedimentation control in their report (2020). The details of the ESC plan will follow the Erosion and Sediment Control Guidelines for Urban Construction which will be provided during final design. The recommendations include consideration of best management practices listed in the NWSSS such as sequencing of works, rock check dams, heavy-duty ESC fencing, sediment basins, management of topsoil or fill storage piles and regular monitoring and inspection of these measures, as well as reporting to the City of Waterloo and the GRCA.

Mitigation – An Erosion and Sediment Control Plan should be prepared and implemented taking into account the best management practices recommended in the NWSSS and the details provided by MTE.

5.8 Trails

An Active Transportation Master Plan has been prepared for the Northgate and Erbsville Kartway properties by MHBC as shown on Map 9. This plan was created using the guidance of the NWSSS and BCMDP, but with some refinements specific to the subject properties and natural features. The NWSSS provides guidance as to locating trails to avoid impacts to natural features while allowing a recreational and nature viewing experience. The BCMDP provided a general layout for a community trail system (TPP 2016) which has been adopted in this proposal.

This study has located the trail system within the outer 5m of the buffer to wetlands and forests. The general trail alignment respects natural features by avoiding sensitive core

areas (Provincially Significant Wetlands, woodlands, groundwater seepage areas, significant species locations, etc.) and locates the trail in what is currently agricultural field. The existing topography along buffers, specifically on the east side, is rolling with existing slopes being approximately between 10-15% in some sections. Type 1 trail standard requires slopes less than 5%. To avoid excessive grading and filling in the buffers, a Type 2 standard trail is proposed where the trails are adjacent to natural features. The Type 2 trail will be linked to the active transportation network within development, which provides a Type 1 trail including parks, paved pathways and sidewalks and on-street pedestrian travel routes.

The trail circumnavigates the property, following the outer edge of natural areas, and provides an east-west connection for residents by a crossing of Beaver Creek without having to enter Conservation Drive. The creek crossing has been placed at the narrowest portion of the creek corridor to minimize removal of wetlands and treed areas to the extent possible. The crossing is placed in a location that appears to have been used historically as a tractor crossing, lacking vegetation, and with undercut banks. Through the pre-construction monitoring program, it has been identified as an area for bank restoration. The details of the creek crossing structure will be determined at a more detailed stage, but it is expected that the bridge will be a clear span structure with piers located outside of the top of bank. The design will ensure that there are no impacts to the fish habitat and hydrology of the creek and will incorporate restoration measures.

In the area of Block 12-13 (Stage 4), the trail will shift onto the sidewalk through Block 23. The area at the rear of Block 13 has a reduced wetland buffer and therefore it is recommended that the trail not be included in the buffer in this location. The trail will then reconnect with the natural area trail system through the walkway at Block 22.

One departure from the BCMDP trail alignment is the lack of a connection across Laurel Creek, off-site to the southwest. It is recommended that this connection be removed as the natural area to be crossed is highly sensitive provincially significant wetland with deep organic soils and is significant wildlife habitat for turtle overwintering. A trail crossing here is inappropriate.

Signage identifying sensitive natural areas is recommended at regular intervals along the natural area buffer portion of the trail system.

5.9 Indirect Impacts to Wildlife

Potential indirect impacts to wildlife may arise from noise and dust associated with construction activities as well as unnatural lighting associated with the development. During construction activities such as tree clearing and grubbing, dust can be created which can have a harmful effect on wildlife and vegetation, while excessive noise and human activity can cause wildlife to temporarily avoid the area.

Mitigation: Dust and noise associated with construction is anticipated to be temporary. Best management practices for limiting dust should be employed, such as seeding areas of bare soil within 30 days of being inactive. Construction activity should be limited on a daily basis to daytime hours. Significant effects on wildlife and vegetation from dust and noise are not expected. Lighting designs should include shielding and directional lighting on roads and buildings to avoid lightwash impacts on wildlife and their habitats.

Maintenance of the stormwater management ponds has the potential to impact wildlife such as amphibians and turtles which may take up residence in the pond. It is well documented that Painted Turtles (*Chrysemys picta marginata*) and Snapping Turtles move into man-made ponds after construction, and it is possible that the pond may attract Blanding's Turtles as well. The wet cells of the pond have been placed outside of the Category 2 habitat of Blanding's Turtle which will avoid the need for registering any maintenance works for an exemption under the ESA, but best management practices should be employed when planning pond clean out. Timing windows to avoid the active turtle season as well as wildlife salvage prior to activities will help avoid impacts to wildlife.

Mitigation: Install permanent fencing (such as chain link plus a wildlife barrier) around the SWM pond to effectively exclude turtles (including juveniles) from the infrastructure. Assess wildlife use of the pond prior to clean-out. Avoid in-water maintenance of SWM pond during the summer season when turtles may be using the pond (i.e. avoid work

during May 1 to August 31). Implement wildlife and fish salvage immediately prior to maintenance work, as required.

5.10 Induced Impacts and Mitigation Measures

Induced impacts are described as those that are not directly related to the construction or operation of the facilities in question, but rather arise from the increased use of the natural areas by humans as a result of the development. The simplest example is occupancy effects such as increased use of a natural area by residents and their pets resulting in impacts such as unauthorized trail construction, garbage dumping and wildlife disturbance and mortality. Once the development is completed, subsequent use of the natural areas by residents is difficult to control.

A number of options are available to help mitigate potential impacts of human occupancy as discussed in the NWSSS. These include permanent fencing at the development/natural area interface to prevent uncontrolled access and rear lot encroachment into buffer and sensitive areas. It is a requirement of the City of Waterloo that standard chain-link fencing be installed along the private-public interface to prevent encroachment. Fencing is to be located at the limit of the buffer, or allowed encroachment such as for public trails or SWM facility. A permanent chain link fence is also recommended along the property boundary with the GRCA owned lands to the south, to prevent trespassing. GRCA property fencing is to be 1.2m high with details provided in OPSS-541 and OPSD-900.01 specifications using Class A fencing fabric with no gates permitted (NWSSS). The design of this fencing should be determined in consultation with GRCA and take into account wildlife passage including movement of Blanding's turtle.

The provision of a formal trail system will be important to focus residents' access along the outer limits of the natural heritage system. The trail system provides an opportunity for educational signage regarding important aspects of the NHS.

Education with respect to the values and appropriate stewardship of the neighbouring natural areas should be promoted through signage and environmental brochures. The City of Waterloo has a brochure entitled "Naturally Your Waterloo" that can be purchased and provided to homeowners.

Mitigation: Rear lot fencing and fencing at the development/natural area interface will be constructed including along the GRCA property boundary. Fencing is to take into account wildlife passage considerations. Further details of the trail design, creek crossing, location and educational signage are to be determined at the Site Plan Approval stage. Provision of homeowner brochure.

6.0 Enhancement of Natural Features

A basis for ecological enhancements in the study area is provided in the NWSSS in Section 14.4. This section indicates that the primary ecological enhancements in the study area include linkages, buffer management (including habitat creation – general and specialized) and specific wildlife passage measures to reduce road mortality at the Conservation Drive crossing of Beaver Creek. Recommendations for restoration and enhancement measures on-site are provided in this section using the general objectives provided in the NWSSS but tailored to the site conditions, species and habitats present, and opportunities within the development plan. A Rehabilitation and Naturalization Plan will be prepared as a condition of draft plan approval which will include details of these enhancements and will prescribe specific approaches for particular areas and needs. The combined general enhancement opportunities are shown on a Stewardship Management Plan (Map 10). This plan shows how open space land uses have been placed adjacent to the natural features and their buffers which provide enhancement of the contiguous green space area and connectivity between naturalized and natural features.

6.1 Wetland/Woodland Edge and Buffer Enhancement

Pre-development monitoring of the wetlands/woodlands showed that these are generally in good condition with light to moderate disturbances or damage to the edges noted within Erbsville Kartway and the Northgate property. The go-kart facility is immediately adjacent to the natural features on that property, while agricultural tilling, tree removal and brush cutting have occurred along the woodland edges of the Northgate property. Cutting activities have resulted in these edges being fairly open and susceptible to impacts of erosion, sun, invasive species and windthrow. Emerald ash borer (*Agrilus planipennis*) (EAB) has damaged areas of ash (*Fraxinus sp.)* trees with several stands of dead trees being obvious along the woodland edges. Phragmites has invaded several areas along the wetland edges. A few locations of erosion from runoff from the fields were observed with sandy soils being deposited into the adjacent natural features. Recently, vandalism and occupancy by homeless persons has been noted in the woodlands on Northgate property. Measures have been taken to curtail these activities

by the landowner. Disturbances are detailed in the 2015-2019 annual pre-construction monitoring reports prepared by NRSI.

Through the proposed development, the natural features and their edges will be stabilized and protected through the implementation of buffers. Buffers are an opportunity to enhance the wetland/woodland features and provide a transition zone between the natural communities and the development, thereby protecting them from the influences of the built-up areas.

Buffer enhancement may include the planting of native larger caliper trees or smaller tree 'whips', shrub plantings and native herbaceous seed mixes, all of which will serve to expand the size of the existing woodland and create more closed and stable/resilient edges. The selection of species for edge plantings should reflect the native species composition of adjacent natural areas. The natural regeneration that currently occurs at woodlot edges should be considered as well; left alone, the natural succession of trees and shrubs will lend itself to the buffering effect. Due to the presence of Emerald Ash Borer, within southern Ontario, the use of ash trees for plantings are not recommended. Dead and declining ash trees may be recommended for removal prior to development taking place. Stumps and root systems can be left in place for habitat and soil stabilization.

As the majority of the buffer areas are disturbed or currently tilled, all of these areas will require some level of planting or seeding. This is consistent with the buffer management recommendations of the NWSSS related to native species plantings and habitat creation. Tree planting is particularly recommended for select areas such as small areas of erosion along Beaver Creek, the buffer behind Block 13, the buffer along the access road in Stage 8 and the areas proposed for re-forestation adjacent to ESPA 80 . Other areas can be planted with a mixture of trees, shrubs, herbaceous seed mix as well as take advantage of natural regeneration.

Buffer enhancement on the Erbsville Kartway property will need to be coordinated with the demolition and removal of those facilities. At the time when development proceeds on that property, the asphalt go-kart track, parking areas and buildings will be removed,

the drainage repaired, the area re-graded, soils replaced and cleaned up, etc. It is recommended that buffer plantings be designed to the rehabilitated site conditions.

Where the buffer is adjacent to a wetland boundary, the focus should be on restoring desirable native facultative wetland species which are complementary to the wetland and provide transition from upland to wetland habitat. The moisture regime of these areas requires careful selection of appropriate species of trees, shrubs and herbaceous vegetation, with a mixture of all three vegetation types being desirable. It is noted that tree cover may not be necessary for buffering all of the wetland areas. Restoring open meadow on the buffer lands is also important for wildlife species such as snakes, birds, small mammals, insects (Lepidoptera and Odonata), bees and other edge species which are known to use open areas in conjunction with wooded and thicket habitats. In these situations, node plantings of shrubs or trees, in addition to herbaceous ground cover will be the best approach. The establishment of dense shrub areas around the wetland edge will provide refuge for wildlife and is generally an aesthetically appealing approach to enhancement plantings, as well as deterring human encroachment through a 'living fence' approach.

Some minor refuse dumping has been noted within the wetlands/woodlands throughout the subject property, having been discarded there in the past. To improve conditions in these areas, it is recommended that removal of refuse by hand is undertaken throughout the subject property prior to habitat enhancement plantings being implemented.

6.2 Aquatic Habitat Enhancement

The primary management recommendation for the watercourses in the study area in the NWSSS is to retain in full, with no alterations, all watercourses on the subject property. In addition, two opportunities for improvement are mentioned which include; 1) the removal of a "knick-point" on Laurel Creek, created by a large woody debris jam on the City-owned property, downstream of the subject lands; and 2) consider removing the beaver dam on Laurel Creek at the downstream end of the Kartway property. The proposed development will retain the watercourses in full and no alterations to any parts of the watercourses are proposed. The recommended buffer widths have been applied and will be planted and naturalized which will be an improvement in riparian cover for both Beaver and Laurel Creeks.

During NRSI's pre-construction monitoring on Laurel Creek, the beaver dam was found to have been removed through natural processes of flooding and storm flow, so no longer creates a backwater effect. The channel is currently in a transitional stage and is in the process of re-aligning itself through natural stream processes. The knick-point (abrupt drop/pool) is located off-site, on City-owned lands and is an opportunity to improve channel connectivity with the upstream reaches.

Small areas of erosion noted along Beaver Creek in the pre-construction monitoring will be addressed through a Rehabilitation and Enhancement Plan with detailed recommendations for bank and creek bed stabilization as well as plantings where necessary. When the trail crossing of Beaver Creek is designed, site specific recommendations will be included as part of the detailed design.

6.3 Naturalization of Stormwater Management Areas

The effective naturalization of stormwater ponds can hold value in providing native vegetation in proximity to natural areas, while connecting and enhancing ecological linkages. The naturalization approach should reflect the native species composition of nearby natural areas. Native species present at wetland edges will serve as good indicators for what species would naturalize well in stormwater management ponds.

A diverse mix of native trees, shrubs and herbaceous species with appropriate tolerances for hydrologic regime, will enhance the aesthetics of these features, in addition to providing wildlife cover and reducing slope erosion. Woody plant material should be planted in a manner that provides at least a 3.0m clearance on either side of access roads for maintenance purposes.

As a mitigative measure to enhance water temperature conditions at the stormwater ponds, where feasible, tree, shrub and herbaceous plantings are recommended to provide shading to the ponds and along the outlet ditch and cooling trench.

6.4 Invasive Species Removal

Stands of White Poplar (*Populus alba*) and nodes of Phragmites were identified during the pre-construction monitoring (NRSI 2016, NRSI 2017a, 2019), namely along the

natural feature edges. Well established groupings of white Poplar trees are found adjacent to Conservation Drive on both the north and south sides of the road. White Poplar is a non-native tree species that is particularly aggressive and spreads by root suckers. Dense thickets can form along roadsides, fields, forest edges, and other disturbed habitats (Reznicek et al. 2011). The proposed improvements to Conservation Drive are an appropriate opportunity to control the roadside stands of White Poplar. As shown in the Environmental Assessment for the proposed infrastructure improvements to Conservation Drive, the proposed road right-of-way will widen into existing roadside areas where White Poplar has been identified (Stantec 2016b), providing an opportunity to remove this species and control any remaining individuals.

Phragmites exists throughout the subject property and is generally characterized as an early establishment species. Phragmites is found in disturbed habitats, such as roadside ditches, and edges, preferring mesic to hydric soils, and is salt tolerant. Dense stands form through aggressively spreading rhizomes, out-competing native wetland vegetation. Several nodes of Phragmites have been mapped on the properties in the pre-construction monitoring program including stands that extend along the Conservation Drive ditch, out from wetlands into the agricultural field as well as off-site to the south onto the Laurel Creek Nature Centre lands. Nodes that extend off-site will be a challenge to control in the long-term unless a coordinated effort among landowners is initiated. Given the early onset of establishment, opportunities are present to remove this species and enhance habitats before it becomes fully established. Removal of Phragmites through herbicide application should be considered, if possible.

Invasive species, such as Garlic Mustard (*Alliaria petiolata*) and Glossy Buckthorn (*Frangula alnus*) exist occasionally throughout the subject property and are not identified as problematic at this time.

It is recommended that an invasive species management plan be prepared during detailed design as a Condition of Approval and implemented at an appropriate project development phase.

6.5 Parks and Trails

Open and “green” land uses such as parks and stormwater management ponds have been placed adjacent to the natural features and provide an opportunity for open space in conjunction with the identified significant natural features. The Draft Plan (Map 2) shows a park block (Block 1, Stage 5) located adjacent to the 30m setback to the wetland and Beaver Creek. One additional park in Block 1, Stage 2 has been integrated into the residential area to provide amenities for future neighborhood residents, such as recreation and nature appreciation, within short distances for the majority of residents, which is a guiding principle of the Beaver Creek Meadows District Plan (TPP 2016).

The proposed active transportation plan provides a variety of trail types including those located within the outer 5m of the buffer and connecting links to multi-use trails. The buffers are currently open agricultural land and together with the large park blocks and connections provide opportunities for ecological enhancements such as plantings, water retention and infiltration. The trail placement follows the guidance of the NWSSS in that trails provide access for nature viewing and connect back into the developed on-street/park trail network. An east-west trail connection across Beaver Creek is located outside of the wetland, and takes advantage of the narrowest point along the Beaver Creek riparian corridor.

6.6 Wildlife Passage at Conservation Drive and Beaver Creek Road

As described in the EA for the improvements to Conservation Drive prepared by Stantec (2016b) for the City of Waterloo, the crossing of Beaver Creek requires the construction of a larger culvert structure to accommodate regional flood levels. This is an opportunity to enhance the connectivity for wildlife along the Beaver Creek corridor and may include a terrestrial wildlife crossing and barriers to prevent road mortality such as wildlife funnel walls, as recommended in the NWSSS (Ecoplans et al. 2013). It is recommended that the road construction, infrastructure and wildlife crossing improvements all be undertaken at one time, limiting the duration and extent of disturbance to the creek and corridor.

Similarly, the hedgerow at the east side of the Northgate property has been identified as a linkage in the NWSSS (Ecoplans et al 2013). The provision of a linkage function must

be taken into account in the design of the improvements for Beaver Creek Road, being undertaken by Stantec and the City of Waterloo.

6.7 Access Road to Southern Agricultural Field

Although there was no evidence of any significant wildlife crossing at this location, the placement of a road through this section between two woodland areas is seen as an opportunity to provide measures for safe wildlife passage. Given the low number of lots in Stage 8 (14), the volume of traffic travelling the access road will be quite low, and so too is the risk to wildlife.

In the current condition, wildlife moves diffusely through the landscape and across the open fields, but tends to follow the edges of the woodland/wetland. When constructed, the access road will be setback from the current dripline of the woods by a 10m buffer or more as shown in Map 8 prepared by MTE. However, in the future scenario, the surrounding open agricultural fields will be developed which are expected to result in focusing wildlife movement within and along natural feature edges and buffers and toward this crossing. This area may become more frequently used for passage by wildlife. The enhancement of the woodland edge and buffers along the access road will make this a very narrow crossing (approximately 15m in width) and it will likely not be seen as a gap to wildlife moving through the area.

As the road will be elevated through this section, and includes a wrought iron fence on the south side, it may pose a barrier to wildlife travelling from one side to the other. Map 8 shows schematically how the road can be constructed successfully for wildlife passage, but further details will be determined at the Site Plan approval stage. This elevated design is proposed to accomplish multiple objectives including installation of underground services, minimizing grading and as a mitigation measure in terms of preventing small wildlife and reptiles from entering the road surface. The retaining wall will function as a funnel fencing and will direct small wildlife to two box culverts under the road; one 1.5m wide x 0.9m high (0.3m embedded), 8.5m long, and a second; 1.8m wide x 1.2m high (0.3m embedded), 15m long. The culverts are to be embedded 0.3m to provide natural substrate within the culverts to encourage wildlife passage. The dimensions and installation method of these culverts are recommended based on best

practices for wildlife ecopassage developed by the MNRF (2016). and will provide an openness ratio of 0.1, which is conducive to use by small wildlife.

6.8 Ecological Linkages

The NWSSS identifies the Beaver Creek corridor as an existing movement and connection within or between natural areas in the local landscape. The woodland and wetland Core Environmental Features on the subject lands are also identified as linkages with connections to off-site natural areas and are to be enhanced. The hedgerow along the southeast boundary of the Northgate property was also identified as an existing but degraded ecological linkage.

Measures to enhance the quality of existing linkages include the provision of buffer zones to increase the size and width of natural areas, provide additional habitat diversity, visual screening and protection from edge effects. The control of invasive vegetation, infilling of gaps, and maintenance of vegetation structure in combination with buffer plantings/natural regeneration will assist in improving the quality and function of the existing linkage areas.

6.8.1 Beaver Creek Riparian Corridor

The length of Beaver Creek from Conservation Drive to ESPA 80 is the main ecological linkage and primary focal area to establish a broader, enhanced ecological corridor, to improve connectivity to ESPA 80 and lands to the north. The main strategies to achieve this goal are widening of the corridor and improving wildlife passage at Conservation Drive (see Section 6.6 above).

The NWSSS identifies herpetofauna as the group of wildlife to use as a target when considering options for improvements to the riparian corridor. Based on this wildlife group, the following design considerations are provided for improvements to the corridor:

- Increase to a minimum width of 60m,
- Native species plantings which are low maintenance, provide shading, cover and refuge from predators,
- Improve soil moisture, but avoid creation of ponded areas that could become breeding sinks,
- Provide hard cover elements such as rootwads, woody debris and stone piles,

- Manage construction timing to protect wildlife,
- Provide signage and homeowner education, and,
- Exclude humans through fencing, and avoid or minimize and separate any trails.

Given the open “green” space associated with park and stormwater management blocks on the west side of Beaver Creek, opportunities are provided for enhancement of the riparian corridor according to the recommendations of the NWSSS. The placement of the Pumping Station, SWM Block and Park Block all along the narrowest part of the Beaver Creek corridor, in addition to implementing the 30m buffer is an opportunity to improve the width and quality of this riparian area and to enhance its function as a linkage. The SWM Block on the eastern side of Beaver Creek will require an embankment of approximately 16-20m in width, which will be vegetated and re-forested. Naturalization of part or all of these blocks will result in an increase in corridor width to a range of between 125m and 250m. A planting plan, detailing enhancements to this area is recommended to be a condition of approval.

6.8.2 Deciduous Hedgerow (HR4)

The east hedgerow is approximately 150m in length consisting of a single row of deciduous trees. It was identified as a linkage between the on-site woodland/wetland at the west end and the Laurel Creek Conservation Area to the east across Beaver Creek Road. Its function as a corridor is poor due to its narrow width, invasive species and the barrier presented by Beaver Creek Road. This hedgerow will be enhanced by the provision of the 5m buffer from the dripline which is sufficient to retain the existing trees and to expand the width of this feature. The buffer provides room for plantings, which in combination with invasive species control and naturalization will enhance the buffer and its limited linkage function. The provision of a linkage function must be taken into account in the design of the improvements for Beaver Creek Road, being undertaken by Stantec and the City of Waterloo. The details of enhancements on the Northgate property will be provided in a Rehabilitation and Naturalization Plan.

6.9 Forest Interior

As described in the NWSSS (Ecoplans et al. 2013), a component and indicator of significant habitat within overall forest cover targets is the presence of ‘interior’ forest habitat (i.e. forested habitat >100m from forest edge), and ‘deep interior’ forest habitat

(i.e. >200m from forest edge, as per OMNR 2010). Forest interior habitat has been identified as an enhancement objective in the NWSSS (Ecoplans et al. 2013) through the establishment of appropriate setbacks and buffers. Interior forest habitats are important to the integrity of biodiversity at the landscape scale, particularly for area-sensitive species such as Wood Thrush, which was documented incidentally within the subject property with no breeding evidence. The current size and shape of the forested areas on the subject lands provides a very small amount of forest interior habitat, as described in Table 8 for WSU-13 and WSU-15.

During the pre-construction monitoring, only a few bird species with forest interior habitat affinities were documented sporadically over the years. Protecting and enhancing forest interior habitat may benefit area sensitive breeding bird species. Increased forest interior habitat will benefit area-sensitive breeding bird species, for example, in an increasingly urbanized landscape.

Proposed tree planting within the recommended buffers as well as strategic re-forestation areas (a portion of the southern agricultural field and an area along the northern woodland edge), have been proposed to enhance the woodland with the benefit of protecting forest interior habitat function of the ESPA. These areas of reforestation will enhance forest shape by filling in “bays” and decreasing edge.

7.0 Monitoring Plan

Pre-construction monitoring in the study area is ongoing and will continue through the construction and post-construction stages at two levels of study; the system-wide subwatershed level monitoring and the site level monitoring. The pre-construction monitoring program was described in a Terms of Reference (TOR) dated January 21, 2015 (NRSI 2016) and includes biological, surface water and groundwater components. The details of each stage of monitoring will be determined at the transition point between stages and will be informed by the results of the monitoring work that have been completed up to that point. A TOR for during and post-construction monitoring stages will be prepared and submitted for agency review at the time of transition to those stages. A table summarizing the monitoring recommendations at each stage is provided below.

7.1 Pre-Construction Monitoring (Stage I)

Substantial pre-construction monitoring program has been carried out for the past 6 years (2014-2019) and includes biological, surface water and groundwater components across the subwatershed and at specific sites. The monitoring program methods were developed according to the City of Waterloo Development Monitoring Protocol (1999), Sections 14 to 17 of the NWSSS (Volume 1, November 2013) and was revised and updated based on comments received from the City of Waterloo, Grand River Conservation Authority (GRCA), and the Region of Waterloo as well as results of the Species At Risk (SAR) screening, prepared separately, which was reviewed and approved by MNRF on December 15, 2014 (G. Buck, pers. comm. 2014). The monitoring program has been sufficient in characterizing the existing condition and sensitivities of the natural features, species and ecological functions.

The pre-construction monitoring program results have been provided to the City of Waterloo, GRCA and the Region of Waterloo annually in the *North Waterloo Subwatershed Lands Pre-Construction Biological Monitoring Program r*eports prepared by NRSI (2016, 2017a, 2018, 2019). Pre-construction monitoring is continuing in 2020. Surface water and groundwater monitoring programs for the subwatershed study area and the subject properties are continuing to be carried out by Stantec and MTE. These

programs will continue to be carried out until the start of site grading which is the first activity in preparing the site for development and is anticipated to be in 2021.

7.2 During Construction Monitoring (Stage II)

The works associated with construction such as vegetation removal and earth grading have the potential to result in impacts to adjacent natural features. Prior to the onset of area grading, site specific measures will be put in place to control runoff, limit the work zone and ensure that equipment is operated and maintained in an environmentally safe manner. During construction monitoring is anticipated to focus on implementing and monitoring the controls to protect surface water and groundwater as well as buffers to the adjacent woodland/wetland and will include erosion and sediment control measures as well as water quality in Beaver Creek and functioning of the stormwater management facilities.

The during-construction biological monitoring program is modelled after the pre-construction monitoring program and includes the same biological, hydrological and hydrogeological monitoring conducted previously as well as compliance monitoring. The details of during construction biological monitoring program will be refined following the outcome of this EIS, but are anticipated to follow the same general intent and methods as the pre-construction monitoring. In addition, monitoring of enhancement and rehabilitation activities is recommended during the construction phase. Invasive species control, edge management and plantings of native species should all be monitored and assessed for success throughout the process. It is anticipated that these activities will begin to be implemented once approval of the application is received. It is also recommended that the during-construction monitoring include road mortality surveys focusing on the crossing of the Beaver Creek corridor by Conservation Drive. Road mortality surveys should follow the methods implemented in the NWSSS, and be completed in conjunction with the road improvement works for Conservation Drive.

Stormwater management, erosion and sediment control and groundwater monitoring recommendations during construction are provided by MTE in their reports. The results of the monitoring will be reported annually to the City and GRCA.

7.3 Post Construction Monitoring (Stage III)

Post-construction monitoring begins once the site development is mostly completed and the site is generally stable. The City of Waterloo Development Protocol indicates this should start once the project reaches 90% buildout. Monitoring frequency is reduced to reflect the stability and maturity of the site. The purpose of this stage of the monitoring is to ensure that the watershed targets are being met with respect to ecological health of the natural features. Areas where it may be necessary to provide any additional mitigation measures will be identified and also the effectiveness of the controls put in place for the operational phase of the development will be monitored.

At this point the natural features will have been well-documented by the monitoring program over many years. The original surface water, groundwater and biological monitoring programs will be continued at the subwatershed scale and the site scale, but the frequency will be decreased for each component:

- Surface water: subwatershed scale,
- Groundwater: subwatershed scale and site specific,
- Erosion: site specific scale,
- Aquatic habitat: one benthic invertebrate sample during the year (fall), every three years.
- Terrestrial habitat: confirmation of vegetation community condition twice per year, every three years.
- Rehabilitation measures: Success of plantings, enhancement measures and invasive species control twice per year, every three years.
- Road mortality: completed every three years
- Stormwater Management Facilities: monitoring of SWM facilities as recommended by MTE.
- Erosion and sedimentation control measures: inspections of control measures are to continue quarterly and at the time of removal.

The results of the post-construction monitoring programs will be reported to the City and the GRCA, being submitted on their own schedules which range from annually to every three years.

Table 14. Pre-Construction Monitoring Summary

	Monitoring Completed – Northgate/ Erbsville Kartway		
	Component	Frequency	Location
Aquatic Biology	Benthic sampling	Annually, spring and fall	Beaver Creek, Laurel Creek
Terrestrial Biology	Amphibian surveys	Annually, April, May, June	Established stations
	Breeding Bird surveys	Annually, twice in late May – early July	Established wildlife survey units
	ELC and Vegetation Plots	Every 3 years, summer	Established stations
	Terrestrial feature and photographic monitoring	Annually, spring and fall	Established stations

Table 15. During-Construction Monitoring Summary

	NWSSS and NRSI Recommended Monitoring Program		
	Component	Frequency	Location
Aquatic Biology	Benthic Sampling	Annually, fall	Beaver Creek, Laurel Creek
	Fish Community	Once, summer	Beaver Creek, Laurel Creek
Terrestrial Biology	Amphibian surveys	Annually, April, May, June	Established stations
	Breeding Bird surveys	Annually, twice in late May – early July	Established wildlife survey units
	ELC and Vegetation Plots	Every 3 years, summer	Established stations
	Rehabilitation measures	At installation, 1 year and 3 years, spring/summer	Specified locations – buffers, treed edges, Phragmites stands
	Road mortality	Every 3 years, spring and fall	Beaver Creek corridor crossing at Conservation Drive and private access road
Compliance	Buffer limit fencing	Upon installation, and twice annually following	Natural feature buffer limits
	Blanding's turtle fencing	Upon installation, and twice annually following	Natural feature buffer limits and SWMF property limits

Table 16. Post-Construction Monitoring Summary

	NWSSS and NRSI Recommended Monitoring Program		
	Component	Frequency	Location
Aquatic Biology	Benthic Sampling	Every 3 years, spring and fall	Beaver Creek, Laurel Creek
	Fish Community	Once, third year, summer	Beaver Creek, Laurel Creek
Terrestrial Biology	Amphibian surveys	Third year, April, May, June	Established stations
	Breeding Bird surveys	Third year, twice in late May – early July	Established wildlife survey units
	ELC and Vegetation Plots	Every 3 years, spring and fall	Established stations
	Rehabilitation measures	Every 3 years, spring/summer	Specified locations – buffers, treed edges, Phragmites stands
	Road mortality	Every 3 years, spring and fall	Beaver Creek corridor crossing at Conservation Drive and private access road
Compliance	Buffer limit fencing	At removal	Natural feature buffer limits
	Blanding's turtle fencing	Once annually	Natural feature buffer limits and SWMF property limits

8.0 Summary and Recommendations

This EIS builds on the characterization of natural features presented in the NWSSS (Ecoplans et al. 2013), and incorporates the findings of the 6 years of pre-construction biological and water monitoring that has been completed specifically on the subject property. This report has been updated and edited based on the comments provided by the City of Waterloo, Region of Waterloo and the GRCA on the first submission in July 2017. The analysis of natural feature significance and ecological functions in the NWSSS is further substantiated by these years of more recent work.

Barn Swallow, a Species at Risk, was observed within the subject property and will be addressed according to the ESA. Bat species were also observed within the Erbsville Kartway property and appropriate mitigation measures will be developed through consultation with MECP staff to ensure protection of any SAR. Wetland features on-site plus 30m is Category 2 protected general habitat for Blanding's Turtle, a provincially Threatened species. Eastern Wood-pewee, Snapping Turtle and Common Nighthawk, all Species of Conservation Concern were documented within the property, and their habitats have been retained and protected. Regionally significant birds and plant species have been documented in the woodlands and wetlands as well.

Woodlands and wetlands within the subject property are significant natural features and have a number of designations such as ESPA, PSW, Significant Woodland, SWH, and are part of ecological linkages providing travel routes for wildlife along the Laurel Creek and Beaver Creek corridors to off-site habitats to the north and south. Conservation Drive is a barrier to wildlife movement which is being addressed through road improvements which are being undertaken in accordance with a Municipal Class EA process. The woodlands and wetlands on the subject property contain good quality habitats with some areas of rich and diverse species communities. There are areas which have experienced impacts but these are relatively minor or can be addressed through a rehabilitation and enhancement plan.

Laurel Creek is classified as an existing coldwater system that flows through the west portion of the Erbsville Kartway property and is a headwater tributary of the Grand River.

Beaver Creek is a coolwater/warmwater stream that flows through the central portion of the property and drains into Laurel Creek, the Laurel Creek Reservoir, and eventually into the Grand River. Watercourses will be protected though buffers, transition of land use away from agriculture, a stormwater management plan with an emphasis on infiltration as well as enhancement of the buffers and creek corridors.

The NWSSS provides recommendations on management, development setbacks and buffers and these were relied upon to design the layout of the proposed development in addition to other physical constraints as well as planning, transportation, grading and servicing considerations. The development layout adheres to the natural feature buffers recommended in the NWSSS (Ecoplans et al. 2013), with the exception of minor encroachment into the outer 15m of the wetland buffer, or the outer 5m of the woodland buffer for stormwater management, transition grading at the rear of Blocks and trails. Total encroachment into buffers is 0.067ha. This encroachment is considered minor and is not anticipated to be a negative impact to the wetland/woodland and creeks, their functions or wildlife species. There are additional lands to be added to the buffers that more than off-set this encroachment totaling approximately 0.805ha. Buffers will be allowed to naturalize and will be supplemented with native plantings in areas where re-planting is required, where buffer width has been reduced adjacent to residential lots, as well as along the access road in Stage 8. Rear lot fencing, a designated trail system and homeowner education are further methods of mitigating the potential for impacts due to residents.

A stormwater management report has been prepared by MTE that shows how the design meets the criteria of provincial and local policies (MOE, GRCA, City of Waterloo) and the NWSSS for quantity, quality, erosion control, infiltration and thermal mitigation. The forebay and wetland of the primary SWM facility are outside of the protected general habitat for Blanding's Turtle. Infiltration is a key part of the stormwater management design which incorporates a mix of lot-level and end of pipe techniques and facilities to maintain and enhance infiltration occurring on-site. Post-development infiltration is expected to exceed pre-development infiltration which will be a benefit and enhance groundwater contribution to the wetlands, Laurel Creek and Beaver Creek and their habitats.

Mitigation and compliance monitoring measures are provided by the team of MTE and NRSI to avoid, minimize and alleviate any potential impacts during construction and occupancy. An outline of a during and post-construction monitoring program has been provided in the team's various reports which includes biological, surface water and groundwater monitoring as well as performance monitoring of the stormwater management facilities. This program will aim to track and compare the environmental conditions during and post-development and compare those to the pre-development monitoring results and the targets set in the NWSSS to identify any changes that may be related to the development and are not due to weather patterns or other natural cycles.

A comprehensive mitigation plan has been prepared separately to show how Blanding's turtle habitat will be protected throughout development of these lands and the surrounding BCMDP area. The plan requires a coordinated approach by multiple landowners and proponents. It has been reviewed by MNRF and MECP to ensure that turtles are protected and that the connectivity of their habitat is maintained and enhanced.

The Stewardship Plan as described in Section 6.0 and shown on Map 10 demonstrates the commitment of the applicants to protecting natural areas, and enhancing and restoring ecological functions on the subject property to the benefit of the subwatershed study area. The plan shows how the development will provide a buffer between natural features and the development and places open space land uses such as stormwater management and parks adjacent to the natural areas. The riparian corridor of Beaver Creek will effectively be widened to over 125m. Taking into account the layout of the development, the stormwater management plan, the monitoring program and the stewardship plan, and assuming the recommendations in this EIS and the reports of the study team are implemented no negative impacts to natural features or their ecological functions are anticipated as a result of the proposed development.

9.0 References

Anderson, Hayley. 2012. Invasive Common (European) Buckthorn (*Rhamnus cathartica*): Best Management Practices in Ontario. Ontario Invasive Plant Council, Peterborough, ON.

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadable rivers: periphyton, benthic macroinvertebrates and fish, second edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Bird Studies Canada (BSC). 2009. Marsh Monitoring Program Participant's Handbook for Surveying Amphibians. 2009 Edition. Published by Bird Studies Canada in Cooperation with Environment Canada and the U.S. Environmental Protection Agency. February 2009.

Bouchard, Jr. R.W. 2004. Guide to aquatic invertebrates of the Upper Midwest. Water Resources Center, University of Minnesota, St. Paul, MN. 208 pp.

Brigham, R. M., Janet Ng, R. G. Poulin and S. D. Grindal. 2011. Common Nighthawk (*Chordeiles minor*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/213 doi:10.2173/bna.213

Canadian Wildlife Service (CWS). 2016a. Core Nesting Periods of Migratory Birds in Canada. Last updated May 19, 2016. https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1#_fig04_1

Canadian Wildlife Service (CWS). 2016b. Migratory Birds Convention Act (MBCA) and Regulations. Last updated March 14, 2016. http://www.ec.gc.ca/nature/default.asp?lang=En&n=7CEBB77D-1

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

City of Waterloo. 2016. City of Waterloo Official Plan. Office Consolidation November 2016.

City of Waterloo. 2002. Terrestrial Monitoring - Plot Establishment & Data Collection.

City of Waterloo. 1999. City of Waterloo Development Monitoring Protocol. Development Services Department. July 16, 1999.

Dobbyn, J.S. 1994. Atlas of the Mammals of Ontario. Don Mills, Federation of Ontario Naturalists.

Eakins, R. J. 2013. Ontario Freshwater Fishes Life History Database. Version 4.68. Online database. (http://www.ontariofishes.ca).

Ecoplans, MHBC, and Stantec. 2013. North Waterloo Scoped Subwatershed Study. Volume 1. November 2013.

Environment Canada. 2013. How Much Habitat is Enough? Third Edition. Environment Canada, Toronto, Ontario.

Environment Canada. 2011. 2011 Metal mining environmental effects monitoring (EEM) technical guidance document. Chapter 4; pp. 29 – 53.

Ernst, C.H., and J.E Lovich. 2009. Turtles of the United States and Canada, Second Edition. The John Hopkins University Press, Baltimore, Maryland.

Federation of Ontario Naturalists. 1999. Woodland Heritage of Southern Ontario. A Study of Ecological Change, Distribution and Significance.

Government of Canada. 2018. Species at Risk Public Registry: Species Index. Last updated November 29, 2018. https://wildlife-species.canada.ca/species-risk-registry/sar/index/default_e.cfm (Accessed November 2019)

Grand River Conservation Authority (GRCA). 1993. The Laurel Creek Watershed Study. Waterloo, Ontario: City of Waterloo.

Grand River Conservation Authority (GRCA). 2005. GRCA's EIS Guidelines and Submissions Standards for Wetlands. August 26, 2005.

Grand River Conservation Authority (GRCA), 2006. Grand River Fisheries Management Plan. Waterloo, Ontario: City of Waterloo.

Grand River Conservation Authority (GRCA). 2013. Policies for the Administration for the Development Interference with Wetlands and Alterations of Shorelines and Watercourses Regulation: Ontario Regulation 150/06. January 25, 2013.

Hilsenhoff, W.L. 1987. An improved biotic index of organic stream pollution. The Great Lakes Entomologist. Vol. 20, No. 1. Pg 31 – 39.

Hilsenhoff, W.L. 1988. Rapid field assessment of organic pollution with a family-level biotic index. J. N. Am. Benthol. Soc. 7(1):65-68.

Jones, C., K.M. Somers, B. Craig and T. Reynoldson. 2007. Ontario Benthos Biomonitoring Network Protocol Manual. Ontario Ministry of the Environment, Environment Canada, National Water Research Institute.

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

MacNaughton, A., R. Layberry, C. Jones and B. Edwards. 2016. Ontario Butterfly Atlas Online. http://www.ontarioinsects.org/atlas_online.htm (Accessed January 2017).

Martin, V. 1996. Revisions to Waterloo Region's Significant Species List: Breeding Birds Component. Report to the Regional Municipality of Waterloo, April 16, 1996.

Merritt, R.W., K.W. Cummins, and M.B. Berg. 2008. An introduction to the aquatic insects of North America – fourth edition. Kendall Hunt Publishing Company. Dubuque, IA.

Ministry of Environment, Conservation and Parks (MECP). 2019. Species at Risk in Ontario (SARO) List. Last updated July 9, 2019. https://www.ontario.ca/page/species-risk-ontario (Accessed November 2019)

Ministry of Natural Resources and Forestry (MNRF). 2019. Natural Heritage Information Centre Species Lists. Last updated October 16, 2019. https://www.ontario.ca/page/get-natural-heritage-information (Accessed November 2019)

Ministry of Natural Resources and Forestry (MNRF). 2017. Natural Heritage Information Centre (NHIC): Biodiversity Explorer, Land Information Ontario: http://www.giscoeapp.lrc.gov.on.ca/web/MNR/NHLUPS/NaturalHeritage/Viewer/Viewer.html (Accessed January 2017).

Ministry of Natural Resources and Forestry (MNRF). 2016. Blanding's Turtle Nest and Nesting Survey Guidelines. Guelph District MNRF. May 2016, Version 1.

Ministry of Natural Resources and Forestry. 2016. Best Management Practices for Mitigating the Effects of Roads on Amphibian and Reptile Species at Risk in Ontario. April 2016. Queen's Printer for Ontario, 112 pp.

Ministry of Natural Resources and Forestry (MNRF). 2015a. Significant Wildlife Habitat Ecoregion 6E Criterion Schedule: Addendum to Significant Wildlife Habitat Technical Guide. MNRF, January 2015.

Ministry of Natural Resources and Forestry (MNRF). 2015b. Survey Protocol for Blanding's Turtle (*Emydoidea blandingii*) in Ontario. Species Conservation Policy Branch. Peterborough, Ontario. ii + 16 pp.

Ministry of Natural Resources and Forestry (MNRF). 2015c. Technical Note: Species At Risk Bats. Regional Operations Division. MNRF, June 2015.

MTE Consultants Inc. 2020a. Northgate and Erbsville Kartway Subdivisions, Beaver Creek Meadows District, Waterloo: Hydrogeology Study. Prepared for 1017081 Ontario Limited and Gabriella Elizabeth Groff (Northgate Subdivision), 1455136 Ontario Inc (Erbsville Kartway Subdivisions) c/o Mr. Paul Grespan, 675 Riverbend Drive, Kitchener, ON N2K 3S3. May 27, 2020.

MTE Consultants Inc. 2020b. Northgate and Erbsville Kartway Subdivisions, Beaver Creek Meadows District, Waterloo: Preliminary Stormwater Management Report. Prepared for 1017081 Ontario Limited and Gabriella Elizabeth Groff (Northgate Subdivision), 1455136 Ontario Inc (Erbsville Kartway Subdivision) c/o Mr. Paul Grespan, 675 Riverbend Drive, Kitchener, ON N2K 3S3. June 4, 2020.

Ministry of Transportation (MTO). 2009. Environmental Guide for Fish and Fish Habitat. Provincial and Environmental Planning Office. June 2009.

Natural Resource Solutions Inc. (NRSI). 2016. North Waterloo Subwatershed Lands: Pre-Construction Biological Monitoring Program (2014-2015). Prepared for Northgate Land Corporation, 2115881 Ontario Ltd., and Erbsville Kartway. April 22, 2016.

Natural Resource Solutions Inc. (NRSI). 2017a. North Waterloo Subwatershed Lands: Pre-Construction Biological Monitoring Program (2016). Prepared for Northgate Land Corporation, 2115881 Ontario Ltd., and Erbsville Kartway. March 7, 2017.

Natural Resource Solutions Inc. (NRSI). 2017b. Northgate and Erbsville Kartway Subdivisions, Beaver Creek Meadows District, Waterloo. Environmental Impact Study. Prepared for 1017081 Ontario Limited and Gabriella Elizabeth Groff, and 1455136 Ontario Inc. July 5, 2017.

Natural Resource Solutions Inc. (NRSI). 2018. North Waterloo Subwatershed Lands: Pre-Construction Biological Monitoring Program (2017). Prepared for Northgate Land Corporation, 2115881 Ontario Ltd., and Erbsville Kartway. May 29, 2018.

Natural Resource Solutions Inc. (NRSI). 2019. North Waterloo Subwatershed Lands: Pre-Construction Biological Monitoring Program (2018). Prepared for Northgate Land Corporation, 2115881 Ontario Ltd., and Erbsville Kartway. April 3, 2019.

Oldham, M.J., W.D. Bakowsky and D.A. Sutherland. 1995. Floristic quality assessment for southern Ontario. OMNR, Natural Heritage Information Centre, Peterborough. 68 pp.

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

Ontario Ministry of Municipal Affairs and Housing (OMMAH). 2020. Provincial Policy Statement.

Ontario Ministry of Natural Resources (OMNR). 1997. Fish and Wildlife Conservation Act.

Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide. October 2000.

Ontario Ministry of Natural Resources (OMNR). 2007. Endangered Species Act, 2007, S.O. 2007, CHAPTER 6.

Ontario Ministry of Natural Resources (OMNR). 2010. Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005. Second Edition. Toronto: Queen's Printer for Ontario. 248 pp. March 2010.

Ontario Ministry of Natural Resources (OMNR). 2013. General Habitat Description for the Blanding's Turtle (*Emydoidea blandingii*). July 2, 2013. http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_ghd_bln_trtl_en.pdf

Peck, G.K., and R.D. James. 1983. Breeding birds of Ontario: Nidiology and distribution, Vol.1: Non-passerines. Life. Sci. Misc. Publ., R. Ont. Mus., Toronto.

Regional Municipality of Waterloo (RMOW). 1985. Appendix 4: Mammals in Environmentally Sensitive Policy Areas Technical Appendix. Approved by Council: 1986.

Region of Waterloo. 2015. Regional Official Plan 2031. As approved with modifications by the Ontario Municipal Board on June 18, 2015.

Region of Waterloo. 2016. Greenlands Network Implementation Guideline. May 16, 2016, final draft.

Reznicek, A.A., E.G. Voss, and B.S. Walters. 2011. Michigan Flora Online. University of Michigan, February 2011. Accessed January 2017. http://www.michiganflora.net/home.aspx

Richardson, W. and V. Martin. 1999. Regional Municipality of Waterloo. Revisions to Waterloo Region's Significant Species List: Native Vascular Plant Component.

Sandilands, A. 2007. Common Nighthawk, pp. 308-309 in Cadman, M.D., D. A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier, eds. Atlas of the Ontario Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706pp.

Stantec. 2016a. North Waterloo, Phase 1 Groundwater and Surface Water Monitoring Program. Prepared for Northgate Corporation, 2115881 Ontario Ltd., Activa Holdings and Erbsville Kartway. April 15, 2016.

Stantec. 2016b. Beaver Creek Road and Conservation Dr. Upgrades and Extension of Municipal Services Class Environmental Assessment. Final Report. Prepared for City of Waterloo. Dated May 2, 2016.

The Planning Partnership (TPP). 2016. City of Waterloo Beaver Creek Meadows District Plan, Final Report. January 8, 2016. Approved by City Council January 25, 2016.

Stanfield L. 2013. Ontario Stream Assessment Protocol. Version 9.0, Fisheries Policy Section. Ontario Ministry of Natural Resources. Peterborough, Ontario. 505 pages.

Swink, F., & Wilhelm, G. (1994). Plants of the Chicago region: Indiana Academy of Science.

Weber, C.I. 1973. Biological field and laboratory methods for measuring the quality of surface waters and effluents. Cincinnati, Ohio, U.S. Environmental Protection Agency. EPA-670/4-73-001.WESA. 2010. Surface Water Quality Monitoring Program Serpent (McCarthy) Ontario. February 2011.

Wedgwood, J. 1992. Common nighthawks in Saskatoon. Blue Jay, 50, pp.211-217.

Authorities Consulted

Buck, Graham. 2012a. Management Biologist, Ontario Ministry of Natural Resources and Forestry, Guelph District. Personal Communication (email correspondence regarding Barn Swallow monitoring guidelines), June 29, 2012.

Buck, Graham. 2012b. Management Biologist, Ontario Ministry of Natural Resources and Forestry, Guelph District. Personal Communication (email correspondence regarding Common Nighthawk survey protocol), May 23, 2012.

Buck, Graham. 2014. Management Biologist, Ontario Ministry of Natural Resources and Forestry, Guelph District. Personal Communication (email correspondence regarding 2115881 Ontario Ltd. property, SAR Screening memo approval), December 15, 2014.

Gross, Jeff. 2017. Senior Ecologist, MMM Group. Personal Communication (email correspondence regarding bird species diversity thresholds), January 4, 2017.

Karam, Michelle. 2019. Management Biologist, Species At Risk Branch, Ministry of Environment, Conservation and Parks. Personal Communication (email correspondence regarding Blanding's Turtle mitigation plan), July 11, 2019.

Marriott, David. 2017. District Planner, Ontario Ministry of Natural Resources and Forestry, Guelph District. Personal Communication (email correspondence regarding Blanding's Turtle nesting surveys for the Northgate/Kartway EIS), April 10, 2017.

Marriott, David. 2015. District Planner, Ontario Ministry of Natural Resources and Forestry, Guelph District. Personal Communication (email correspondence regarding EIS Terms of Reference for the 2115881 Ontario Ltd. property, American Badger), October 13, 2015.

Smith, Kaitlyn. 2014. Resource Planner, Grand River Conservation Authority. Personal Communication (email correspondence regarding vegetation plot monitoring), July 29, 2014.

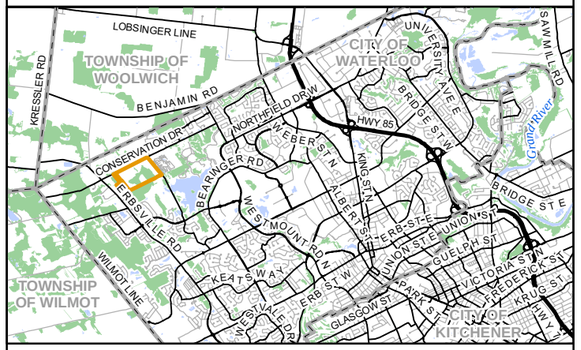
Tinney, Christian. 2019. Resource Planner, Grand River Conservation Authority. Personal Communication (email correspondence regarding vegetation plot monitoring), March 6, 2019.

MAPS

Map 1

Northgate and Erbsville Kartway Subdivisions EIS

Study Area and Natural Features





Legend

- Subject Property
- Future Study Area (from NWSSS 2013)
- ESPA #80 (Region of Waterloo, 2015)
- Natural Heritage System (from NWSSS 2013, updated 2016)
- Primary Road
- Secondary Road
- Permanent Watercourse
- Provincially Significant Wetland (PSW)

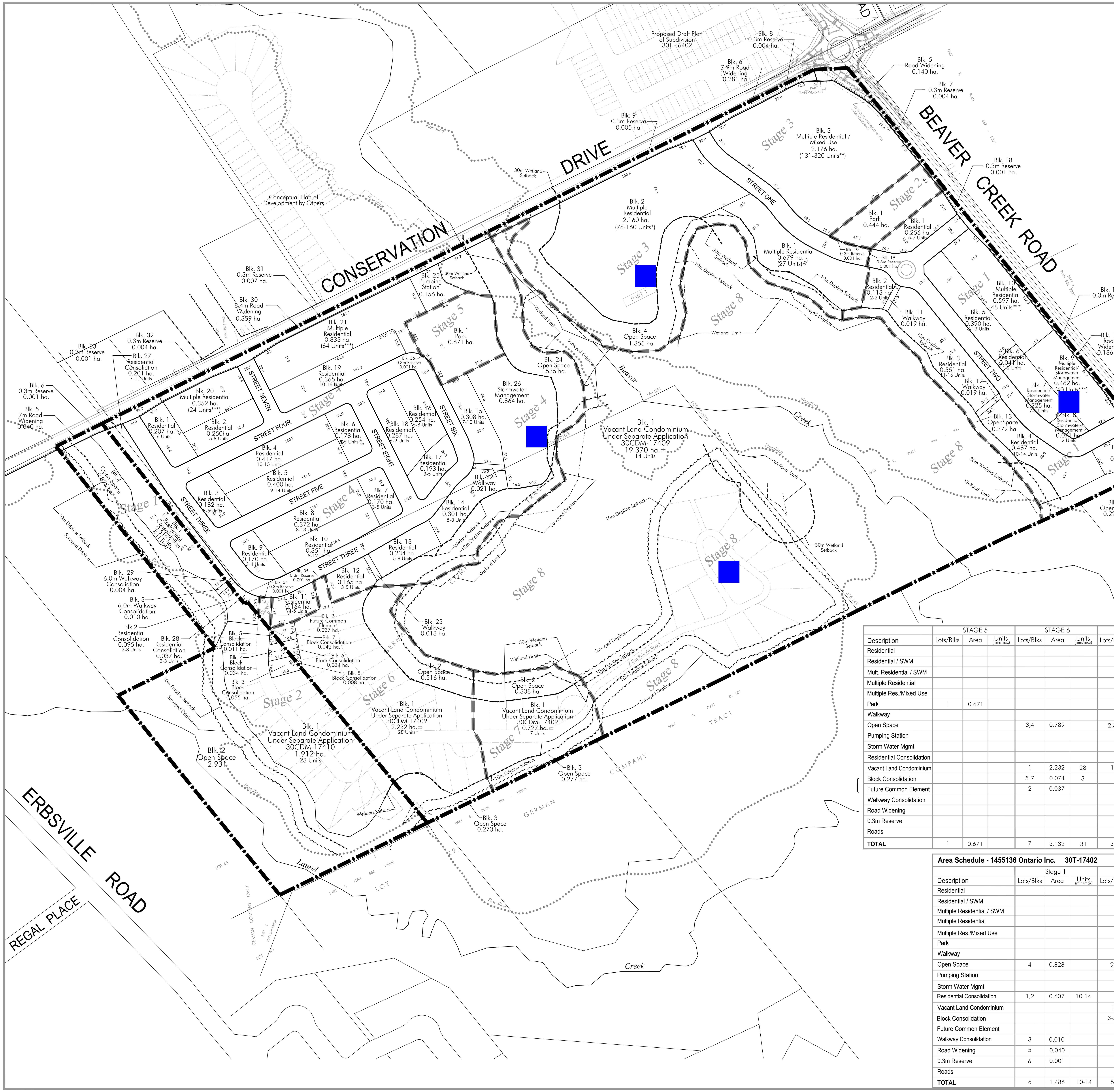
NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

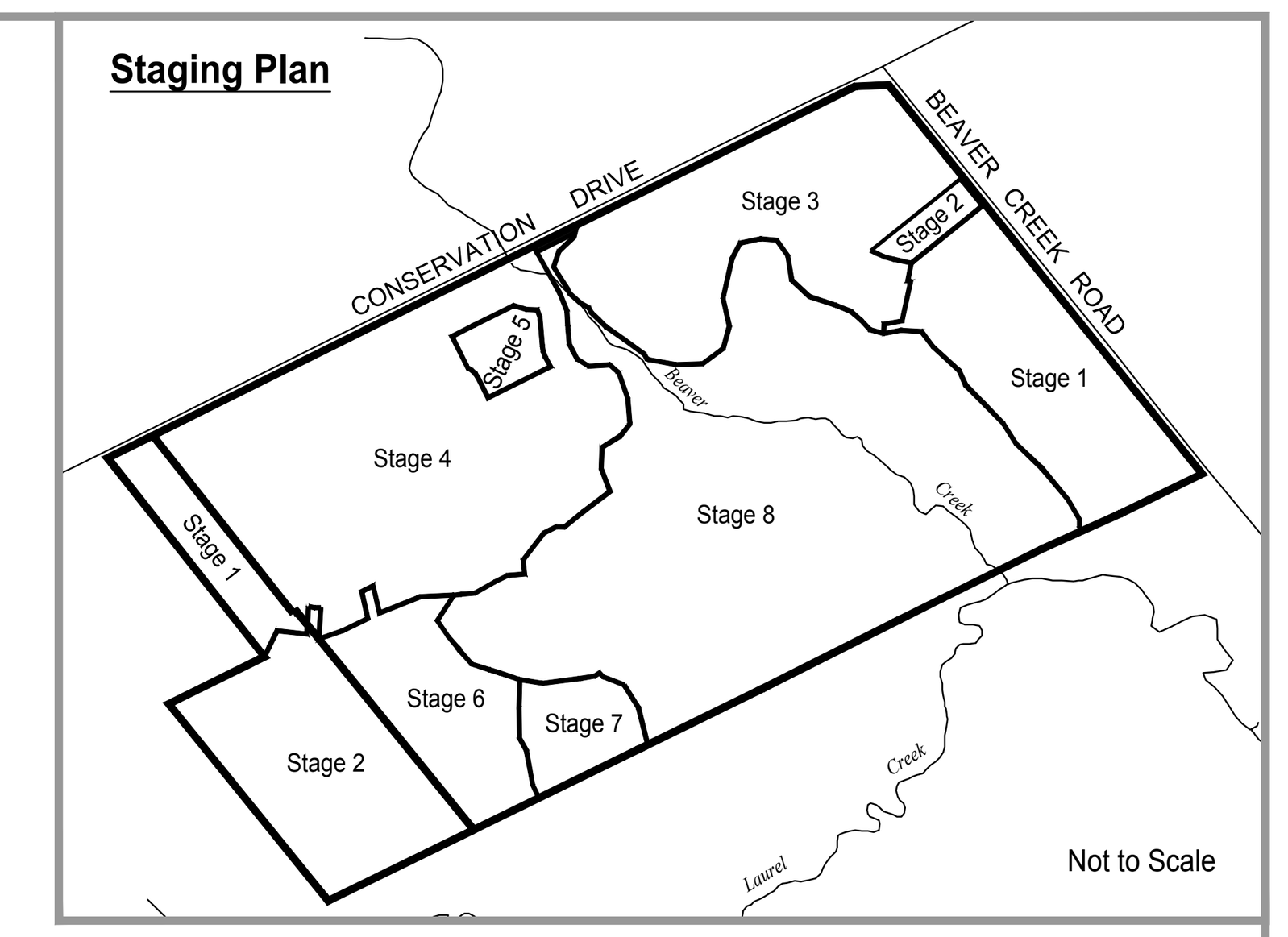
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Imagery: First Base Imagery (2019).

Project: 1531B Date: June 8, 2020	NAD83 - UTM Zone 17 Size: 11x17" **1:4,000**

0 50 100 150 200 Metres

Path: X:\1531B_NorthGate_and_KartwayLands\NRSI_1531B_Map1_StudyArea_NaturalFeatures_5K_2020_06_08_GCS.mxd

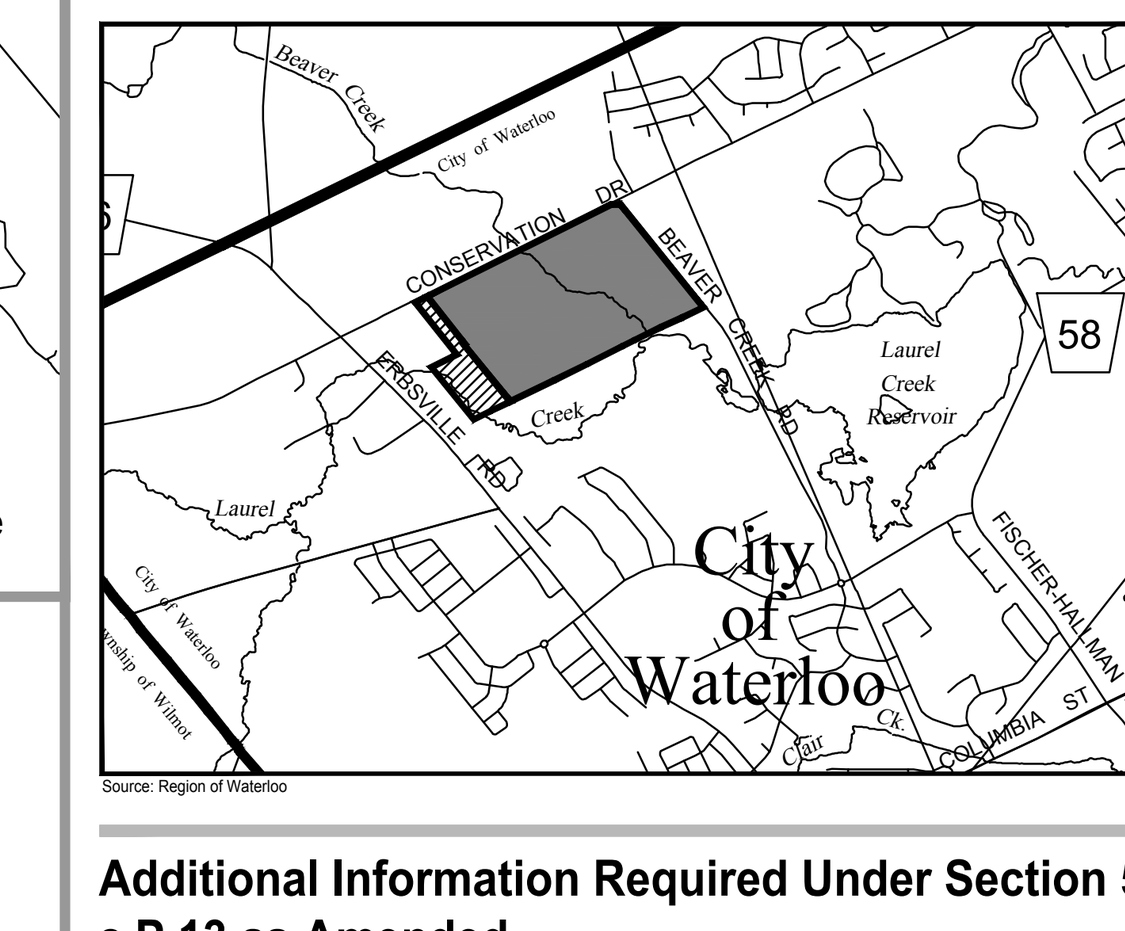




Legal Description

PART OF LOT 28, GERMAN COMPANY TRACT,
(GEOGRAPHIC TOWNSHIP OF WATERLOO),
CITY OF WATERLOO,
REGIONAL MUNICIPALITY OF WATERLOO

Key Plan



1017081 Ontario Limited & Gabriella Groff

1455136 Ontario Inc

north

Not to Scale

Additional Information Required Under Section 51(17) of the Planning Act R.S.O. 1990, c.P.13 as Amended

A. As Shown B. As Shown C. As Shown
D. Residential, Park, Open Space, Stormwater Management
E. As Shown F. As Shown
G. As Shown H. Municipal Water Supply I. Sandy Loam
J. As Shown K. All Services As Required L. As Shown

Area Schedule 30T - 17401

Description	STAGE 1 Lots/Blks	Area	Units (min/max)	STAGE 2 Lots/Blks	Area	Units (min/max)
Residential	1-6	1.838	37-54			
Residential / SWM	7,8	0.296	9-11			
Mult. Residential / SWM	9	0.462	40			
Multiple Residential	10	0.597	48			
Multiple Res./Mixed Use						
Park				1	0.444	
Walkway	11,12	0.038				
Open Space	13,14	0.594				
Pumping Station	15	0.170				
Storm Water Mgmt						
Residential Consolidation						
Walkway Consolidation						
Road Widening	16	0.186				
0.3m Reserve	17-19	0.010				
Roads		0.886				
TOTAL	19	5.077	134-153	1	0.444	

Description	STAGE 3 Lots/Blks	Area	Units	STAGE 4 Lots/Blks	Area	Units (min/max)
Residential				1-19	4.919	104-161
Residential / SWM						
Multiple Residential	1,2	2.839	103-187	20,21	1.185	88
Mult. Residential / SWM						
Multiple Res./Mixed Use	3	2.176	131-320			
Walkway				22,23	0.039	
Open Space	4	1.355		24	1.565	
Pumping Station				25	0.156	
Storm Water Mgmt				26	0.864	9-14
Residential Consolidation				27,28	0.238	
Walkway Consolidation				29	0.004	
Road Widening	5,6	0.421		30	0.359	
0.3m Reserve	7-10	0.014		31-36	0.008	
Roads		0.463			2.649	
TOTAL	10	7.268	234-507	36	11.986	201-263

Description	STAGE 5 Lots/Blks	Area	Units (min/max)	STAGE 6 Lots/Blks	Area	Units (min/max)	STAGE 7 Lots/Blks	Area	Units (min/max)	STAGE 8 Lots/Blks	Area	Units (min/max)	TOTAL Lots/Blks	Area	Units (min/max)
Residential													25	6.757	141-215
Residential / SWM													2	0.296	9-11
Mult. Residential / SWM													1	0.462	40
Multiple Residential													5	4.621	239-323
Multiple Res./Mixed Use													1	2.176	131-320
Park	1	0.671											2	1.115	
Walkway													4	0.077	
Open Space				3,4	0.789		2,3	0.615					8	4.918	
Pumping Station													2	0.326	
Storm Water Mgmt													1	0.864	
Residential Consolidation													2	0.238	9-14
Vacant Land Condominium				1	2.232	28	1	0.727	7	1	19.370	14	3	22.329	49
Block Consolidation				5-7	0.074	3							3	0.074	3
Future Common Element				2	0.037								1	0.037	
Walkway Consolidation													1	0.004	
Road Widening													4	0.966	
0.3m Reserve													13	0.032	
Roads														3.998	
TOTAL	1	0.671		7	3.132	31	3	1.342	7	1	4.164	14	78	49.290	621-975

Area Schedule - 1455136 Ontario Inc. 30T-17402

Description	Stage 1 Lots/Blks	Area	Units (min/max)	Stage 2 Lots/Blks	Area	Units (min/max)	TOTAL Lots/Blks	Area	Units (min/max)	1017081 Ontario Limited, Gabriella Groff & 1455136 Ontario Inc. Lots/Blks	Area	Units (min/max)
Residential										25	6.757	141-215
Residential / SWM										2	0.296	9-11
Multiple Residential / SWM										1	0.462	40
Multiple Residential										5	4.621	239-323
Multiple Res./Mixed Use										1	2.176	131-320
Park										2	1.115	
Walkway										4	0.077	
Open Space	4	0.828		2	2.931		2	3.759		10	8.677	
Pumping Station										2	0.326	
Storm Water Mgmt										1	0.864	
Residential Consolidation	1,2	0.607	10-14				2	0.607	10-14	4	0.845	19-28
Vacant Land Condominium				1	1.912	23	1	1.912	23	4	9.035	72
Block Consolidation				3-5	0.100	3	3	0.100	3	6	0.174	6
Future Common Element										1	0.037	
Walkway Consolidation	3	0.010					1	0.010		2	0.014	
Road Widening	5	0.040					1	0.040		5	1.006	
0.3m Reserve	6	0.001					1	0.001		14	0.033	
Roads											3.998	
TOTAL	6	1.486	10-14	5	4.943	26	11	6.429	36-40	89	55.719	657-1,015

SWM Facility

Date	Issued / Revision	By
July 14,2020	Input Stormwater Management Block in Stage 1. Stage 8 Expanded. Revise Area Schedule.	LHB
June 15,2020	Input Conceptual & Proposed Developments North of Conservation Drive.	LHB
May 28,2020	Walkway Added in Stage 4. Revise Private Road in Stage 7.	LHB
April 15,2020	Kartway Block Consolidations added to Plan. Area Schedules Edits.	LHB
April 9,2020	Plan Revised per City and Regional Comments.	LHB
October 24,2019	Updated Contours, Wetland Limits, Driplines,Topographic Features and Plan Revisions.	LHB
August 28,2019	Frontages and Additional Dimensioning Added to All Blocks.	LHB
July 31,2019	Revise Road Widening at Beaver Creek Road & Conservation Drive. Revise Area Schedule.	LHB
Mar. 11,2019	Revise Walkway-Stage 1, Pumping Station-Stage 3, Park-Stage 4, Adjust Limits of Plan & Revise Area Schedule.	LHB
Feb. 26,2019	Revise Stages 3 & 4 Lotting, Park and SWM Areas. Revise Area Schedule.	LHB
Dec. 20,2018	Revise Stage 4 Park, Add Residential Unit Yields per Block, Revise Area Schedule.	LHB
Nov. 14,2018	Edits to Street One, Stage 2 & Stage 5 Lotting, Stage 3 SWM Pond, Parks & Area Schedule.	LHB
Oct. 24,2018	Streets 1 & 2, Park and Multiple Blocks Redesigned. Area Schedule Revised.	LHB
Oct. 18,2018	Stages 3 & 4 Redesigned. Area Schedule Revised.	LHB
Oct. 10,2018	West Area Revised to Align Main Access with Church Access	LHB

- Boundary information provided by MacDonald Tamblyn Surveying Ltd., February 5,2008, Plan 58R-16404.
- Topographic information provided by MTE Engineering, September-October 2019. Contour Interval - 0.5m.
*- BCM District Plan, Low Density Residential 2 calculated at 35-60 Units per Hectare
**- BCM District Plan, Mixed Use Medium Density Residential calculated at 60-100 Units per Hectare
***- Multiple Block Unit Yield based on Conceptual Site Plan prepared by MHBC Planning.
VLC - denotes Vacant Land Condominium.
- Floodline mapping obtained from North Waterloo Scoped Subwatershed Study, November 2012 and GRCA Developement Resource On-Line Mapping, January 23,2017.
- Single Family Residential Lots based on: min. @ 13.7m, max. @ 9.0m wide lots.

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Approval Stamp

Date: July 14,2020

File No.: 14148A

Plan Scale: 1:2,000

Drawn By: L.H.B.

Checked By: P.B. / T.H.

Project: **1017081 Ontario Limited, Gabriella Groff & 1455136 Ontario Inc.**
Conservation Drive
Waterloo, Ontario

north

File Name: **DRAFT PLAN CONSOLIDATION**

K:\14148A-NORTHGATE-WATERLOO\DRAFT PLAN\DRAFT PLAN CONSILIDATION JULY 14 2020.DWG

Map 3

Northgate and Erbsville Kartway Subdivision EIS

Vegetation Communities and Significant Plant Species



Legend

- Subject Properties
- Woodland Dripline Boundary, Surveyed (Region Confirmed August 2019)
- Wetland Boundary, Surveyed (GRCA Confirmed August 2019)
- Watercourse

Regionally Significant Plant Species

- 3 Northern Beech Fern (*Phegopteris connectilis*)
- 5 Virginia Stickseed (*Hackelia virginiana*)
- 6 White Spruce (*Picea glauca*)
- 7 Rough Sedge (*Carex scabrata*)
- 8 Soft-Leaved Sedge (*Carex disperma*)
- 9 Golden Alexanders (*Zizia aurea*)
- 10 Shining Ladies'-tresses (*Spiranthes lucida*)
- 12 American Plum (*Prunus americana*)
- 13 Smooth-sheathed Sedge (*Carex laevivaginata*)

Federally Significant Plant Species

- 15 Black Ash (*Fraxinus nigra*)

Ecological Land Classification (ELC)

(CUP3) Coniferous Plantation
(CUW1) Mineral Cultural Woodland Ecosite
(FOC4-1) Fresh - Moist White Cedar Coniferous Forest
(FOD3-1) Dry - Fresh Poplar Deciduous Forest
(FOD5-2) Dry - Fresh Sugar Maple-Beech Deciduous Forest
(FOD7-2) Fresh - Moist Green Ash-Hardwood Lowland Deciduous Forest
(FOD8-1) Fresh - Moist Poplar Deciduous Forest
(FOM6-1) Fresh - Moist Sugar Maple-Hemlock Mixed Forest
(HR) Hedgerow
(MAM2) Mineral Meadow Marsh Ecosite
(SWD7-1) White Birch-Poplar Organic Deciduous Swamp
(SWDO3) Organic Deciduous Swamp Ecosite
(SWM4-1) White Cedar Organic Mixed Swamp
(SWM6-1) Birch-Conifer Organic Mixed Swamp
(SWT2) Mineral Thicket Swamp
(SWT3) Organic Thicket Swamp

* As per NWSSS (Ecoplans et al. 2013)
^ Estimated ELC Boundary

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Project: 1531B
Date: June 8, 2020

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Map 4

Northgate and Erbsville Kartway Subdivision EIS

Biological Monitoring Locations

Legend

- Subject Property
- Photo Vegetation Plot Station Location
- Permanent Watercourse

Biological Monitoring (NRSI)

- Vegetation Station (VEG)
- Common Nighthawk Station (CNH)
- Benthic Sampling Station (BTH)
- Anuran Call Station (ANR)
- Wildlife Survey Unit (Approx)
- Road Mortality Monitoring (MMM Group)

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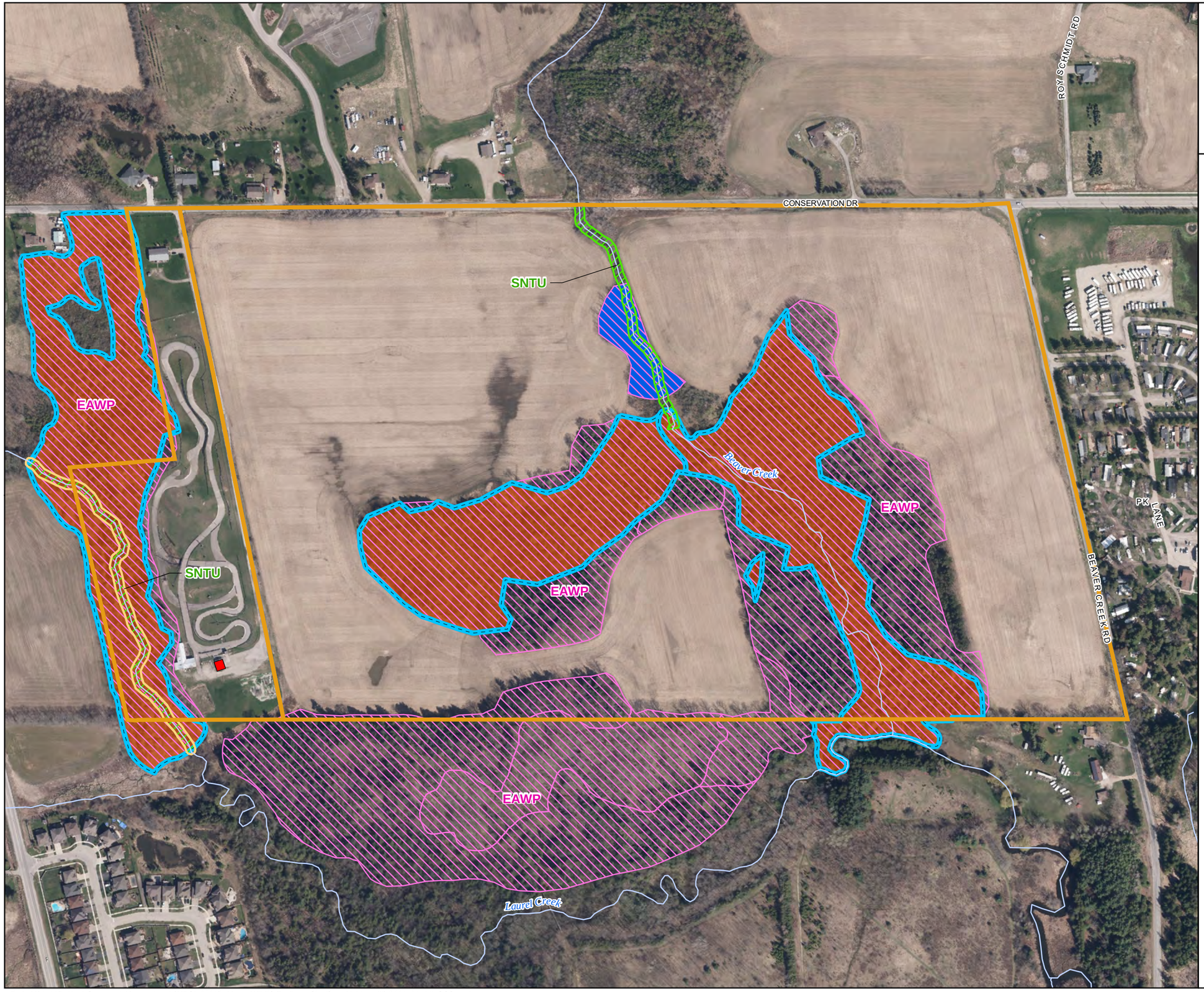
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Map 5

Northgate and Erbsville Kartway Subdivisions EIS

Wildlife Findings and Significant Habitats



Legend

- Subject Properties
- Permanent Watercourse

Species at Risk

- Barn Swallow (Nesting Confirmed in 2017, 2019)

Significant Wildlife Habitat

- Seeps and Springs
- Terrestrial Crayfish
- Turtle Wintering Area

Special Concern and Rare Wildlife Species

- Eastern Wood-pewee (EAWP)
- Snapping Turtle (SNTU)
- Black Ash (*Fraxinus nigra*)

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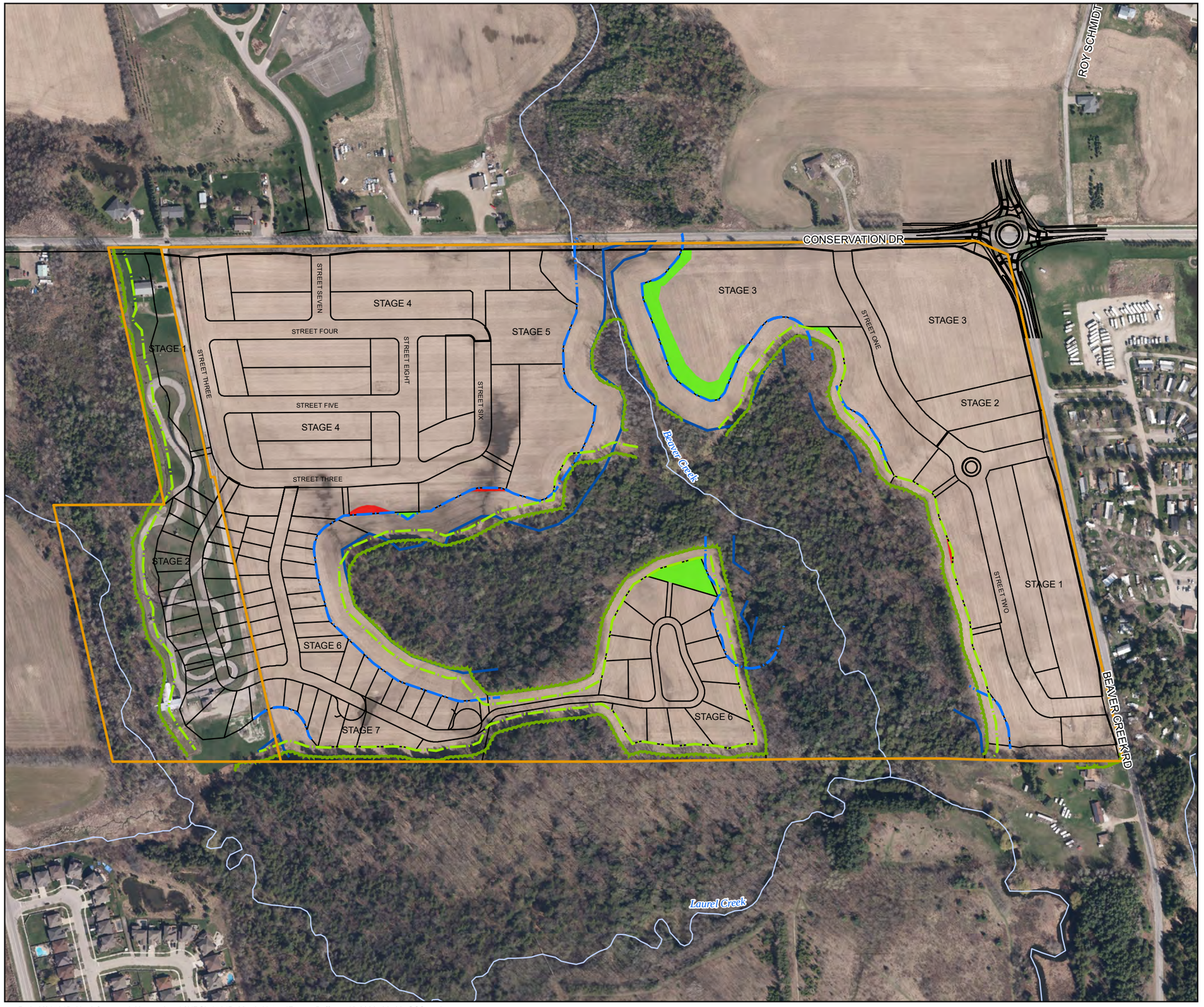
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Map 6

Northgate and Erbsville Kartway Subdivisions EIS

Natural Feature Buffers



Legend

- Subject Property
- Proposed Draft Plan
- Surveyed Woodland Dripline Boundary (Flagged by NRSI July 15, 2019 and approved by Region of Waterloo August 27, 2019)
- Surveyed Dripline Buffer (10m)
- Surveyed Wetland Boundary (Flagged by NRSI July 15, 2019 and approved by GRCA August 27, 2019)
- Surveyed Wetland Buffer (30m)
- Permanent Watercourse
- Buffer Addition
- Buffer Encroachment

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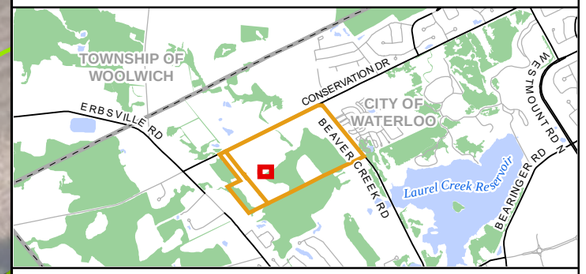
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Map 1A

Northgate South Lands

Buffer Planting Plan (Block 12/Block 13)



Legend

- Proposed Lot Line
- Surveyed Dripline
- Surveyed Dripline Buffer (10m)
- Surveyed Wetland
- Surveyed Wetland Buffer (30m)
- Existing Contour (0.5m interval)
- Common Reed Management
- Buffer Planting Area (0.30ha)
- Xx Proposed Deciduous Tree Planting
- Xx Proposed Coniferous Tree Planting
- Proposed Shrub Planting



View to West



View to East

See planting notes and specs on Map 1B

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Date: April 15, 2020

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Planting Table

Type	Common Name	Scientific Name	Code	Quantity	Size	Planting Notes
Trees	Red Maple	*Acer rubrum*	Ar	30	1 gallon potted	Adjust location as warranted on site.
	Yellow Birch	*Betula alleghaniensis*	Ba	10	1 gallon potted	
	White Pine	*Pinus strobus*	Pst	30	1 gallon potted	
	Trembling Aspen	*Popoulus tremuloides*	Pt	30	1 gallon potted	
	Black Cherry	*Prunus serotina*	Ps	10	1 gallon potted	
	White Cedar	*Thuja occidentalis*	To	50	1 gallon potted	
	White Cedar	*Thuja occidentalis*	Throughout	72	Plug	Plugs to be planted throughout the entire area (not indicated on drawing).
	Trembling Aspen	*Popoulus tremuloides*		36		
Shrubs	Grey Dogwood	*Cornus racemosa*	cr	10	1 gallon potted	Adjust location as warranted on site.
	Red Osier Dogwood	*Cornus sericea*	cs	30	1 gallon potted	
	Alternate-leaved Dogwood	*Cornus alternifolia*	ca	10	1 gallon potted	
	Pussy Willow	*Salix discolor*	sd	20	1 gallon potted	
	Nannyberry	*Viburnum lentago*	vl	10	1 gallon potted	
Nurse Crop Seed	White Millet	*Panicum millaceum*	Throughout	4.5 kg	Pure live seed	Applied at 15 kg/ha to area of 0.30 ha
	White Clover	*Trifolium hybridum*		1.5 kg		Applied at 5 kg/ha to area of 0.30 ha
Native Seed Mixture	Awl Sedge	*Carex stipata*	Throughout	1.2 kg	Pure live seed	Applied at 4 kg/ha to area of 0.30 ha (OSC Mixture 8180 or equivalent as approved by NRSI)
	Boneset	*Eupatorium perfoliatum*				
	Fox Sedge	*Carex vulpinoidea*				
	Fringed Sedge	*Carex crinata*				
	Green Bulrush	*Scirpus atrovirens*				
	Hard Stemmed Bulrush	*Scirpus acutus*				
	Lurid Sedge	*Carex lurida*				
	Nodding Bur Marigold	*Bidens ceruna*				
	Purple Stemmed Aster	*Aster puniceus*				
	Rice Cutgrass	*Leersia oryzoides*				
	Soft Rush	*Juncus effusus*				
	Spotted Joe Pye Weed	*Eupatorium maculatum*				
	Swamp Milkweed	*Asclepias incarnata*				
	Tall Mannagrass	*Glyceria grandis*				
	Virginia Wild Rye	*Elymus virginicus*				

Total Trees	**268**
Total Shrubs	**80**

Planting Notes

1. All plant materials will be true to species. No garden cultivars will be accepted.

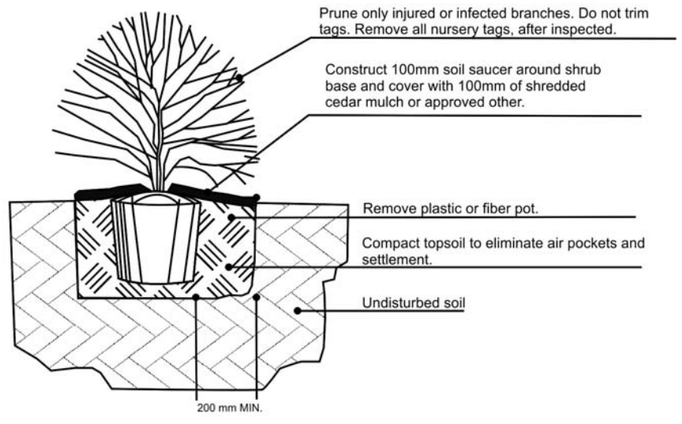
2. Seed mixes to be hand-broadcast.

3. Planting to be installed by hand (no machinery) outside of June 1 through September 30.

4. All deciduous trees and shrub stems to be coated with Skoot at time of planting.

5.Refer to accompanying memo for further planting details.

POTTED TREE OR SHRUB PLANTING



Notes:

1. Saucer shall be soaked with water and mulched immediately following planting.
2. All dimensions are in mm.
3. In poorly drained soils plant shrubs slightly higher than adjacent grade.
4. All plants to be straight and planted vertically regardless of slope.

Map 1B

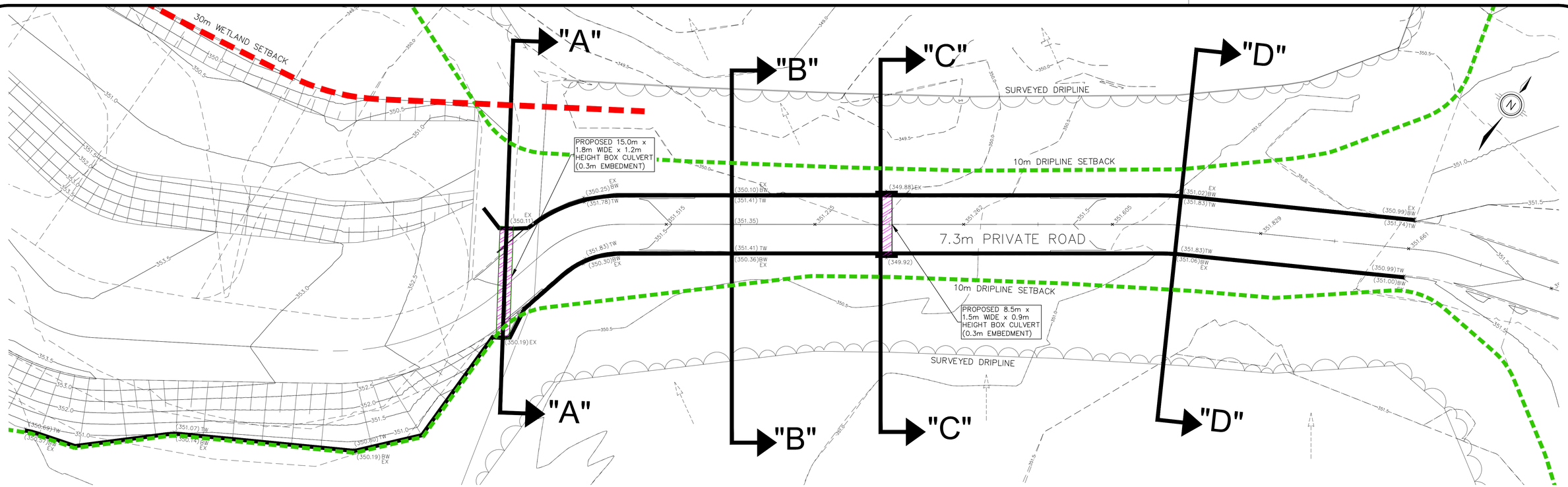
Northgate South Lands

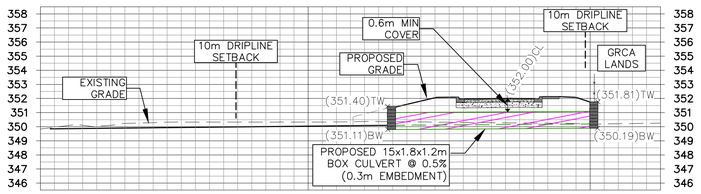
Buffer Planting Plan (Block 12/Block 13)

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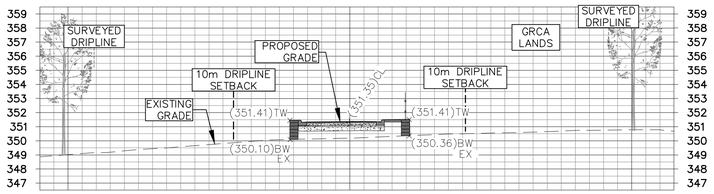
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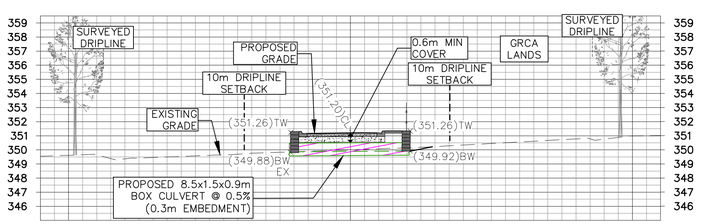


BOX CULVERT
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0.3m EMBEDMENT

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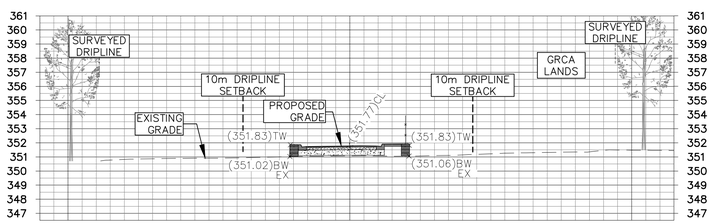


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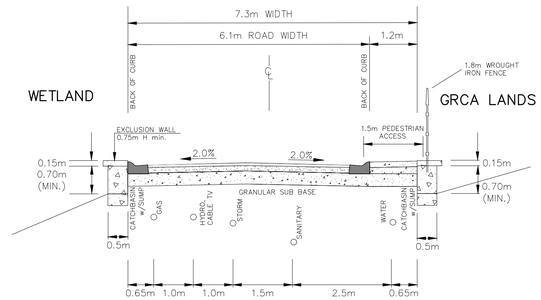


BOX CULVERT
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0.3m EMBEDMENT

SECTION C-C



SECTION D-D



7.3m PRIVATE ROAD CROSS-SECTION

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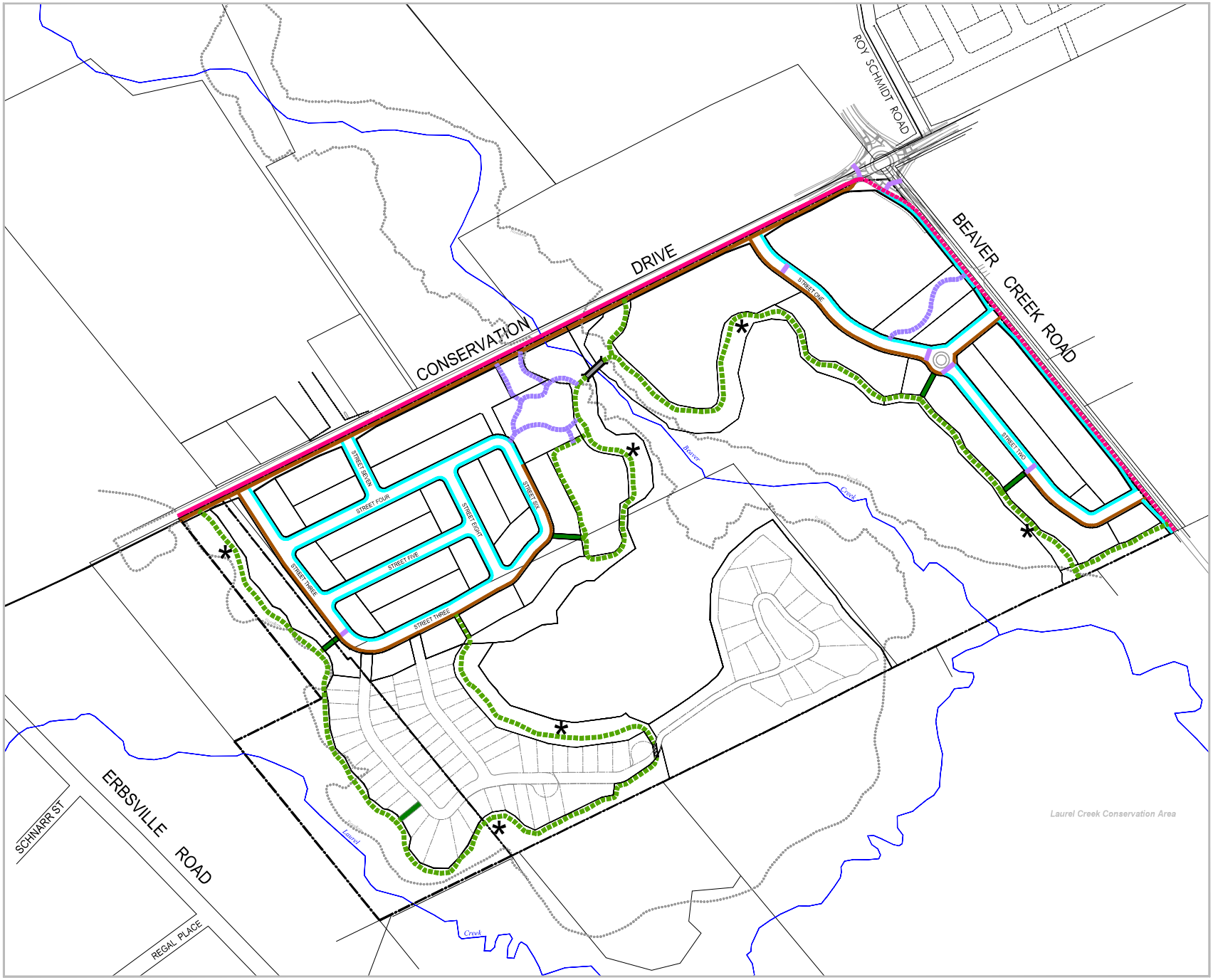
NORTHGATE AND ERBSVILLE KARTWAY SUBDIVISIONS

PRIVATE ROAD CROSS SECTIONS

MTE Engineers, Scientists, Surveyors

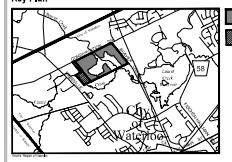
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Northgate Active Transportation Master Plan

Key Plan



LEGEND

- MULTI-USE TRAIL
- SIDEWALK
- BIKE LANE - RAISED
- BIKE LANE - BUFFERED
- TRAIL
- TRAIL THRU PARK / PUMPING STATION
- WALKWAY
- PEDESTRIAN CROSSING
- PEDESTRIAN CROSSING EASEMENT
- PROPOSED BRIDGE
- * TRAILS CONCEPTUALLY SHOWN. (EXACT LOCATION DEPENDANT UPON SITE SPECIFIC LOCATION, FINAL DESIGN AND GRADING.)

No.	Date	Issued / Revision	By

Notes:

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Approval Stamp

Date: May 28,2020
File No.: 14148A
Plan Scale: 1:2,000
Drawn By: L.H.B.
Checked By: P.B. / T.H.

Project: 1017081 Ontario Limited, Gabriella Groff & 1455136 Ontario Inc.
Conservation Drive
Waterloo, Ontario

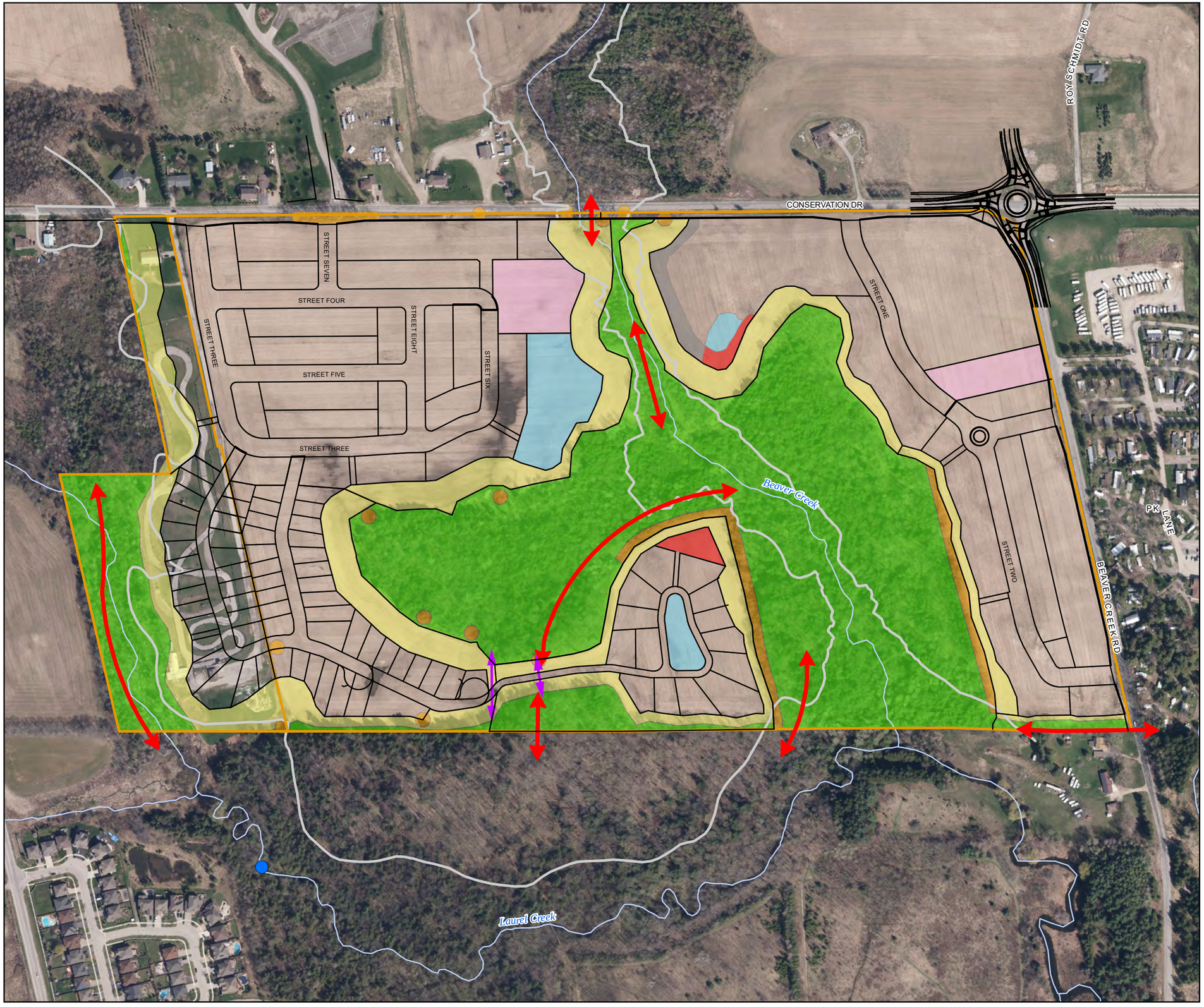
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Map 10

Northgate and Erbsville Kartway Subdivisions EIS

Stewardship Plan



Legend

- Subject Property
- Proposed Draft Plan
- Knickpoint
- Watercourse
- Floodplain
- Ecological Linkage
- Wildlife Passage Culvert
- Existing Natural Features
- Buffers to be Naturalized
- Additional Areas to be Naturalized
- SWM to be Naturalized
- Reforestation Area
- Invasive Species Management
- Park

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APPENDIX I

Terms of Reference

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

January 19, 2017 Project No. 1531B

Robyn McMullen
Environmental Policy Planner, City of Waterloo
100 Regina Street South
PO Box 337, Station Waterloo
Waterloo, ON, N2J 4A8

Dear Ms. McMullen,

Re: Northgate South, and Erbsville Kartway Lands, North Waterloo
Environmental Impact Study - Terms of Reference

Natural Resource Solutions Inc. (NRSI) has been retained as part of a team by Northgate Land Corporation and Erbsville Kartway to prepare an Environmental Impact Study (EIS) for the proposed development of the above noted property located on Conservation Drive in north Waterloo, Ontario. The City of Waterloo formally refers to this area as the Beaver Creek Meadows District. An EIS is required as the lands contain woodlands, watercourses and provincially significant wetlands which are designated and protected as:

- Core Environmental Features in the Region of Waterloo's Official Plan (2015),
- Core Natural Features, and Supporting Natural Features in the City of Waterloo's Official Plan (2014),
- Wetlands and watercourses in GRCA's Policies (2013).

In addition, the lands contain known and potential habitat for Species At Risk (SAR). These species and their habitat are protected under the Endangered Species Act through the Ministry of Natural Resources and Forestry (MNRF).

The EIS will be prepared in collaboration with the study team which includes NRSI (biology), MTE (engineering, stormwater management, surface and groundwater monitoring), and MHBC (planning). The natural features have been well studied through the North Waterloo Scoped Subwatershed Study (Ecoplans et al. 2013) and two years of pre-construction biological monitoring completed by MMM Group (formerly Ecoplans), and NRSI as per the City of Waterloo's Development Monitoring Protocol (1999). Pre-construction surface water and groundwater monitoring has been completed by Stantec.

This Terms of Reference (TOR) has been prepared in accordance with the City of Waterloo Official Plan, Region of Waterloo Official Plan, Greenlands Network Implementation Guidelines, Sections 15 to 17 of the North Waterloo Scoped Subwatershed Study (Ecoplans et al. 2013), GRCA EIS Guidelines (2005) and consultation with the MNRF. The details of the TOR are attached for your review and comment. Please feel free to contact me if you have any questions or comments.

Sincerely,
Natural Resource Solutions Inc.

Elaine Gosnell

M. Elaine Gosnell, B.Sc.
Senior Terrestrial and Wetland Biologist

Northgate South, and Erbsville Kartway Lands, North Waterloo
Environmental Impact Study Terms of Reference
January 19, 2017

Introduction

The subject property is approximately 54ha in area and is bounded to the north by Conservation Drive, Beaver Creek Road to the east, and natural features to the south and west (Map 1). Habitat within the subject property is comprised of agricultural fields, with wetlands and woodlands associated with Beaver Creek within the central and west portions of the property. The woodland/wetland complex on-site is part of Environmentally Sensitive Policy Area (ESPA) 80 known as Laurel Creek Forest (Region of Waterloo 2015) and is a Core Natural Feature in the City of Waterloo's Official Plan (2014), while Beaver Creek is identified as a Supporting Natural Feature. Wetlands are part of the Laurel Creek-Sunfish Lake provincially significant wetland.

Proposed Undertaking

The proposed development is a mixed use neighbourhood including an internal road network, a mixture of residential density types, stormwater management, trails and parkland. The development plan will follow the land use structure of the Beaver Creek Meadows District Plan (TPP 2016, approved by City Council January 25, 2016) (Map 2).

Characterization of Natural Features

The natural features have been well studied through the North Waterloo Scoped Subwatershed Study (NWSSS) (Ecoplans et al. 2013) and two years of pre-construction biological monitoring completed by MMM Group and NRSI as per the City of Waterloo's Development Monitoring Protocol (1999). Two years of pre-construction surface and groundwater monitoring has been completed by Stantec. For details of the pre-construction monitoring programs please refer to the Terms of Reference prepared for that study (NRSI 2015).

The natural features on the subject property will be characterized based on the background information in the NWSSS and the pre-construction monitoring reports. The EIS will refer to the data in the existing reports but will provide a summary of site conditions. The following key components will be included in the site characterization:

- Summary of and mapping of vegetation communities using the Ecological Land Classification system for southern Ontario,
- Plant and wildlife species diversity and habitats,
- There have been no significant changes to any of the wetland boundaries and Core Environmental Feature boundaries as identified in the NWSSS on the subject property. These boundaries will continue to be used and will be shown on all maps,
- Summary of wildlife species known to use the site including birds, mammals, reptiles and amphibians,
- Ecological function of agricultural area intersecting wooded habitat of ESPA 80 in the south-central portion of the subject property (referred to herein as the 'gap'),
- Description of aquatic habitat, fish and benthic communities in Beaver Creek,
- Key findings of the surface water and groundwater monitoring.

Species At Risk (SAR) and Species of Conservation Concern (SCC) Screening
A SAR and SCC screening was completed by comparing the habitat requirements for significant species that are known from the vicinity of the study area (i.e. within Waterloo Region) against the ELC communities and habitats within the subject property. This comparison allowed it to be determined which species have potential to occur within the subject property, and identify those species with potential to be impacted by the proposed undertaking.

Species which could be present within the immediate vicinity of the proposed development and are thought to have potential to be impacted by the proposed undertaking were surveyed for including American badger (*Taxidea taxus jacksoni*), butternut (*Juglans cinerea*), barn swallow (*Hirundo rustica*), common nighthawk (*Chordeiles minor*), wood thrush (*Hylocichla mustelina*), Eastern wood-pewee (*Contopus virens*), Western chorus frog (*Pseudacris triseriata*), Blanding's turtle (*Emydoidea blandingii*), snapping turtle (*Chelydra serpentina*), as well as potential roosting sites for SAR bats. Surveys were carried out according to MNRF guidance. This screening was originally provided to MNRF in July 2014 and was agreed to at that time (G. Buck, pers. comm. 2014). The SAR/SCC screening was updated for the submission of this TOR, and is appended (Appendix I).

The following surveys related to SAR/SCC and SWH have been conducted:

- Breeding bird surveys within existing wildlife survey units as well as additional surveys in the agricultural and cultural areas of the properties, consistent with the NWSSS methods and standardized Ontario Breeding Bird Atlas protocol (OBBA 2001). Surveys included random (wandering) transects and 10 minute point counts. Surveys were conducted three times during peak breeding bird season (May 15 to July 31) to account for barn swallow (see below).
- Breeding bird monitoring with targeted surveys for barn swallow according to the MNRF protocol for barn swallow surveys (OMNR 2012), which included a third visit during breeding season,
- GRCA correspondence indicated that common nighthawk has been observed in the local Waterloo area (K. Smith, pers. comm. 2014). As habitat for this species may be present in the study area, surveys were conducted according to MNRF guidance (G. Buck, pers. comm. 2012) including 3 evening surveys, 7 days apart, depending on the lunar cycle, between late May and early July.
- Marsh Monitoring Program (BSC 2009) anuran call surveys to monitor Western chorus frog and to identify amphibian SWH,
- Targeted visual surveys for turtle SAR/SCC and SWH related to Blanding's turtle and snapping turtle including potential turtle nesting and overwintering areas (to confirm that the habitat conditions for this species is unchanged). Surveys were conducted as per standardized protocol (OMNR 2013).
- Bat habitat assessments at buildings proposed for removal. Surveys were conducted as per MNRF guidance document (MNRF 2015c). There are no trees proposed for removal within the subject property. Compliance with the *Endangered Species Act (2007)* as it applies to SAR bats will be ensured at the time of the removal of buildings within the subject property.
- Any butternut observed within the proposed construction footprint and adjacent lands will be assessed by a certified butternut health assessor, and,
- Targeted den surveys for American badger were completed on October 23, 2015. American badger was surveyed for in the NWSSS with no sightings or evidence found. Recently MNRF requested targeted den surveys on-site, as time had passed since the

NWSSS American badger surveys (2010-2011) and this species has potential to move into the site.

Functional Analysis

The findings of the ecological, hydrological, hydrogeological studies will be compiled to provide an understanding of the interactions between the biological and physical environment. The processes contributing to the maintenance of the natural features and their functions will be discussed at the subject property scale, referring to the subwatershed study for landscape level context. This description will take into account the current quality and condition of the natural features based on land management practices and existing impacts such as clearing, grading, tree cutting, trails, dumping, filling and invasive plant and insect species. As provided in Section 17.0 of the NWSSS, this analysis will include the discussion of the following:

- Quality and sensitivity of terrestrial, aquatic and wetland ecosystems,
- Species at Risk and other significant species at the local, provincial and national level. The subject property includes known Category 2 and Category 3 habitats for Blanding's turtle, which are afforded protection under the *Endangered Species Act* (2007). An Information Gathering Form (IGF) for Blanding's turtle will be completed and submitted to the MNRF for review when more information on the proposed development becomes available.
- Significant wildlife habitat according to the MNRF's Significant Wildlife Habitat Technical Guide (MNRF 2000) and Ecoregion 6E criteria (MNRF 2015b),
- Ecological linkage associated with the Conservation Drive crossing of Beaver Creek. Any linkage enhancements will be recommended in corroboration with the detailed design of eco-passage features in the Class Environmental Assessment for Conservation Drive (Stantec 2016; approved by City Council January 25, 2016).
- Stormwater impacts on wetland water balance will be assessed,
- Physical constraints i.e. floodplain, top of bank, etc.,
- Ecological enhancements will be recommended, such as the Beaver Creek riparian corridor south of Conservation Drive. This area has been identified as an ecological linkage within the NWSSS due to its relatively narrow width (Ecoplans et al. 2013). Recommendations in the NWSSS are to provide for a future restored/naturalized corridor width ranging from 80m to over 100m (Ecoplans et al. 2013). In order to achieve this, it is anticipated that the development scenario will include stormwater management facilities within the 80-100m corridor.
- Setbacks and buffer management. Minimum development setbacks are recommended in the subwatershed study (Section 14.2), to be confirmed or adjusted as may be appropriate through the EIS. Avoidance of the Core Natural Features and recommended setbacks is recommended wherever possible, and options to minimize encroachment into these areas will be discussed with the landowner and study team. Additional guidance for development setbacks adjacent to Core Natural Features and Supporting Natural Features is provided in Section 8.2.4(9) and 8.2.5 in the City of Waterloo's Official Plan (2014). Setbacks will take into account the potential for "averaging" (minor deviations from the recommended minimum distance), specific site conditions, the type of adjacent development, and the need for infrastructure, trails, SWM facilities and grading within the buffer. The management approach for the buffer lands will be finalized considering fencing or other barriers/boundary treatment, signage location and details, planting plans/vegetation management (i.e. invasive species control); and target habitat creation.

In addition to the above listed items, an analysis of Special Policy Area 2 (TPP 2016) will be provided for the agricultural area that is surrounded by wooded habitat within the subject property. Access to SPA 2 is by way of a 'gap' (roughly 30-35m width) of agricultural land. The woodland dripline of the 'gap' was flagged by NRSI biologists on December 9, 2014, and subsequently surveyed by MTE Inc. on January 14, 2015, as this dripline was not delineated during the NWSSS. The surveyed dripline of the 'gap' will be shown on the EIS mapping. The NWSSS identifies the 'gap' as a 'Future Study Area' which will be addressed in this EIS.

Assessment of Potential Impacts

The analysis of impacts will be divided into:

- Direct impacts associated with disruption or displacement caused by the actual proposed 'footprint' of the undertaking.
- Indirect impacts associated with changes in site conditions such as drainage.
- Induced impacts associated with impacts after the development is constructed such as subsequent demand on the resources created by habitation/use of the area and vicinity.

The EIS will make recommendations to avoid, change, minimize and mitigate potential impacts.

Direct Impacts

The identification and delineation of core natural features will be used to avoid direct impacts from the development on important natural features. No direct impacts to significant natural features are anticipated and therefore the EIS will focus on analysing and avoiding indirect and induced impacts.

Indirect Impacts

The analysis of potential indirect impacts is anticipated to include the following:

Encroachment into Buffers

It is recognized in the NWSSS that there may be areas where encroachment into the recommended buffer width occurs. These will be identified and mitigation measures including buffer management (i.e. fencing, planting) will be determined.

Changes to groundwater and surface water flow patterns

This section of the impact analysis will focus on the potential changes to the flow patterns, quality and quantity of groundwater and surface water flows that currently supply wetlands and Beaver Creek. This section will include information from the Stormwater Management Strategy and a wetland water balance analysis. The development is anticipated to be designed in a manner using storm water management and Low Impact Development (LID) measures such that pre-development surface and groundwater patterns will be maintained in the post-development scenario. The maintenance of pre-development surface water and groundwater infiltration pattern and rates will be key to maintaining the water balance in the on-site wetlands. During and post-development monitoring data will be analyzed on a monthly or seasonal basis.

Sedimentation and erosion

During construction, areas of bare soil will be exposed which have the potential to erode during rainfall events and impact adjacent natural features. In the event of a heavy rain, sediment laden runoff can enter adjacent natural areas by way of overland flow. In order

to protect on-site and off-site natural features from potential impacts due to sediment, a sediment and erosion control plan will be developed.

Indirect impacts to wildlife habitat

Indirect impacts to wildlife can occur during construction due to the increased noise, dust and human activity on the site, but are generally temporary in duration.

Induced Impacts

Induced impacts are described as those that are not directly related to the construction of the proposed development, but rather arise as a result of the use of the natural areas or pressure on them following the development. In this case, potential induced impacts could include increased use of the natural features and buffers by residents, both authorized use (i.e. trails) and unauthorized (i.e. dumping).

Recommendations for Restoration and Enhancement

A basis for ecological enhancements in the study area is provided in the NWSSS in Section 14.4. This section indicates that the primary ecological enhancements in the study area include linkages, buffer management (including habitat creation – general and specialized) and specific wildlife passage measures to reduce roadkill at the Conservation Drive crossing of Beaver Creek. Recommendations for restoration and enhancement measures on-site will be provided using the general objectives provided in the NWSSS but tailored to the site conditions, species and habitats present and opportunities within the development plan and will be shown on a Stewardship Management Plan. Any linkage enhancements will be recommended in corroboration with the detailed design of eco-passage features in the Class Environmental Assessment for Conservation Drive (Stantec 2016, approved by City Council January 25, 2016).

Monitoring

Pre-construction monitoring will continue until the start of construction (i.e. site grading) as per the City of Waterloo Development Monitoring Protocol (1999). Recommendations will be provided in the EIS for during- and post-construction monitoring of biological features, surface water and groundwater, mitigation measures and compliance, as per the City's protocol. The basics of the during- and post-construction monitoring plan will be prepared during the EIS and may include the installation of piezometers to assist in the monitoring of wetland water balance. During and post-construction monitoring data related to wetland water balance will be analyzed on a monthly/seasonal basis.. Prior to the initiation of the during-construction phase, the pre-construction monitoring methods will be revised to incorporate the recommendations of the EIS and new components related to stormwater management and erosion and sediment control. The study design of the pre-construction monitoring plan will be replicated to provide consistency between the pre-, during- and post-construction monitoring plan. Further details of the monitoring program will be refined at the detailed design stage and will be provided in a TOR for agency review and approval at that time.

Recommendations and Conclusions

A summary of the findings, conclusions and recommendations in the EIS will be provided.

Reporting

The EIS report will be prepared in digital and hard copy format including appropriate mapping (study area, existing conditions, monitoring locations, development plan and stewardship plan) and appendices (final TOR, species lists, pertinent agency correspondence, analysis tables, etc.).

References

Bird Studies Canada (BSC). 2009. Marsh Monitoring Program Participant's Handbook for Surveying Amphibians. 2009 Edition. Published by Bird Studies Canada in Cooperation with Environment Canada and the U.S. Environmental Protection Agency. February 2009.

City of Waterloo. 2014. Official Plan. City of Waterloo Office Consolidation October 2014.

City of Waterloo. 1999. City of Waterloo Development Monitoring Protocol. Development Services Department. July 16, 1999.

Government of Canada. 2015. Species at Risk Public Registry: Species Index. Last updated December 30, 2015. http://www.sararegistry.gc.ca/sar/index/default_e.cfm (Accessed 2015)

Grand River Conservation Authority (GRCA). 2013. Policies for the Administration for the Development Interference with Wetlands and Alterations of Shorelines and Watercourses Regulation: Ontario Regulation 150/06. January 25, 2013.

Grand River Conservation Authority (GRCA). 2005. GRCA's EIS Guidelines and Submissions Standards for Wetlands. August 26, 2005.

Ecoplans, MHBC, and Stantec. 2013. North Waterloo Scoped Subwatershed Study. Volume 1. November 2013.

Layberry, R.A., P.W. Hall, and J.D. Lafontaine. 1998. The Butterflies of Canada. University of Toronto Press, Toronto, Canada.

Ministry of Natural Resources and Forestry (MNRF). 2014. Waterloo Region Species At Risk List. September 25, 2014.

Ministry of Natural Resources and Forestry (MNRF). 2015a. Species at Risk in Ontario (SARO) List. Accessed December 2015. http://www.ontario.ca/environment-and-energy/species-risk-ontario-list

Ministry of Natural Resources and Forestry (MNRF). 2015b. Significant Wildlife Habitat Ecoregion 6E Criterion Schedule: Addendum to Significant Wildlife Habitat Technical Guide. January 2015.

Ministry of Natural Resources and Forestry (MNRF). 2015c. Technical Note: Species at Risk Bats. Regional Operations Division. June 2015.

Natural Resource Solutions Inc. 2015. North Waterloo Subwatershed Lands Pre-Construction Monitoring Program - Terms of Reference. January 21, 2015.

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

Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide. October 2000.

Ontario Ministry of Natural Resources (OMNR). 2012. Guelph District Barn Swallow Survey Protocol. July 2012.

Ontario Ministry of Natural Resources (OMNR). 2013. Draft Occurrence Survey Protocol for Blanding's Turtle (*Emydoidea blandingii*) in Ontario. Ontario Ministry of Natural Resources, Species at Risk Branch. Peterborough, Ontario. ii + 17 pp.

Region of Waterloo. 2015. Regional Official Plan 2031. As approved with modifications by the Ontario Municipal Board on June 18, 2015.

Region of Waterloo. 2010. Region of Waterloo Greenlands Network Implementation Guideline. January 26, 2010.

Reznicek, A.A., E.G. Voss, and B.S. Walters. 2011. Michigan Flora Online. University of Michigan, February 2011. Accessed December 2015. http://www.michiganflora.net/home.aspx

Stantec Consulting Ltd. 2015. Beaver Creek Road and Conservation Dr. Upgrades and Extension of Municipal Services Class Environmental Assessment. Prepared for the City of Waterloo. December 14, 2015.

The Planning Partnership (TPP). 2016. City of Waterloo Beaver Creek Meadows District Plan, Final Report. January 8, 2016. Approved by City Council January 25, 2016.

Authorities Consulted

Buck, Graham. 2012. Management Biologist, Ontario Ministry of Natural Resources and Forestry, Guelph District. Personal Communication (email correspondence to Jessica Linton regarding Common Nighthawk survey protocol), May 23, 2012.

Buck, Graham. 2014. Management Biologist, Ontario Ministry of Natural Resources & Forestry, Guelph District. Personal Communication (e-mail correspondence to Andrew Dean regarding Pre-construction Ecological Monitoring Program), December 15, 2014.

Smith, Kaitlyn. 2014. Resource Planner, Grand River Conservation Authority. Personal Communication (e-mail correspondence to Elaine Gosnell regarding recommended crepuscular bird surveys), July 2, 2014.

MAPS



Map 1

Northgate and Kartway Lands

Environmental Impact Study - Study Area

Legend

- Subject Property
- Future Study Area (from NWSSS 2013)
- Natural Heritage System (from NWSSS 2013, updated 2016)
- Primary Road
- Secondary Road
- Permanent Watercourse

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Map Produced by Natural Resource Solutions Inc. This map is proprietary and confidential and must not be duplicated or distributed by any means without express written permission of NRSI. Data provided by MNR© Copyright: Queen's Printer Ontario. Imagery: City of Waterloo, 2010.

Project: 1531B
Date: February 25, 2016

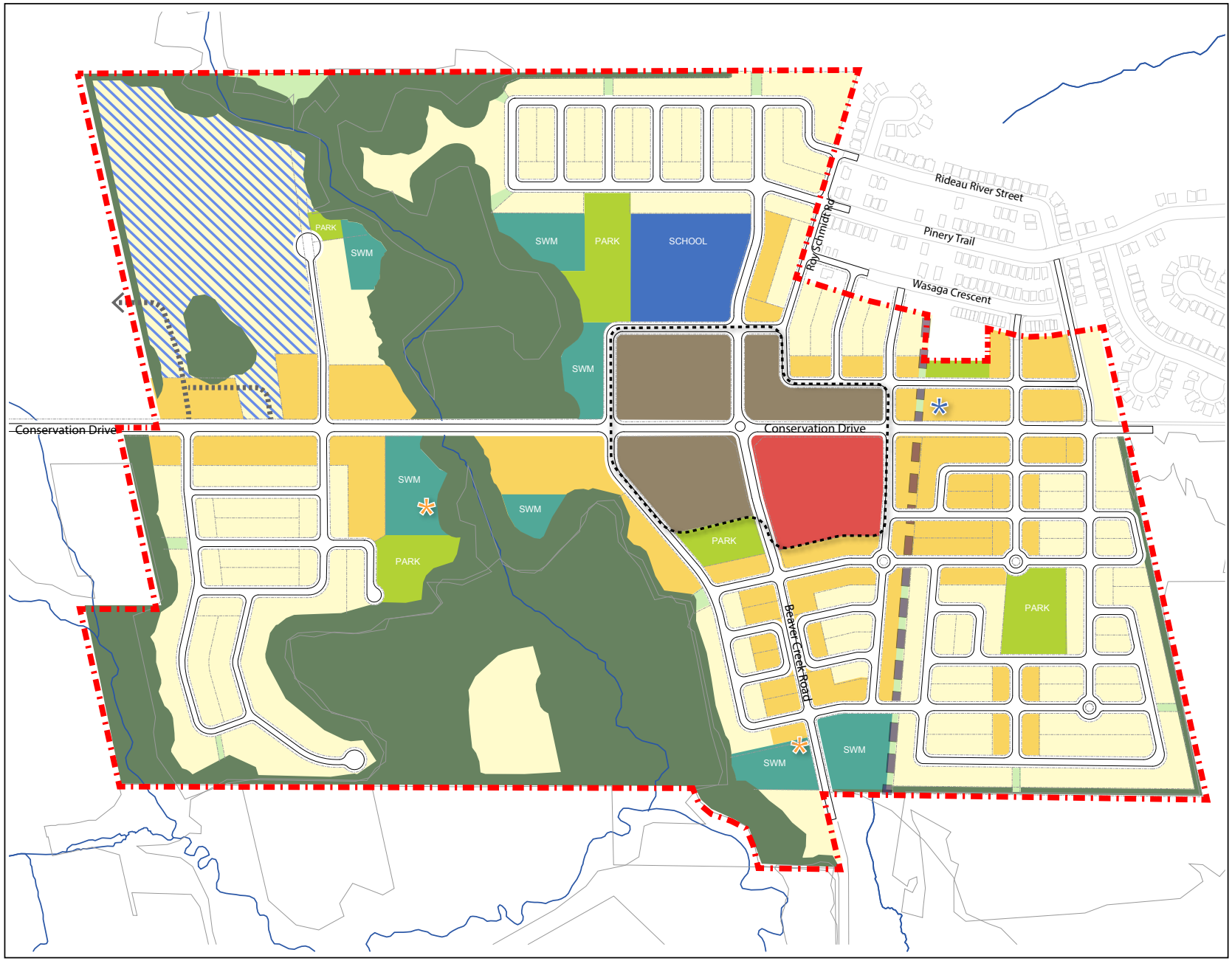
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BEAVER CREEK MEADOWS DISTRICT PLAN

MAP 3
LAND USES



LEGEND

- District Plan Boundary
- Mixed Use Node

Residential Designations

- Low Density Residential 1
- Low Density Residential 2
- Mixed Use Medium Density Residential

Commercial Designations

- Mixed-Use Neighbourhood Commercial

Open Space Designations

- Open Space Land Uses - Park
- Other Green Spaces
- Natural System (includes buffers)

Other Lands and Features

- SWM Stormwater Management Facility
- Temporary Stormwater Management Facility
- Spiritual Use
- Elementary School
- Potential New Road Connection
- Hydro Corridor
- Pumping Station

0 50 100 200 300 metres

Last Updated: January 6, 2016

APPENDIX I

Species at Risk and Species of Conservation Concern Habitat Screening Results

Species at Risk and Species of Conservation Concern Habitat Screening Results

Scientific Name	Common Name	SRANK[1]	COSEWIC[2]	COSSARO[3]	SARA Schedule[4]	Background Source	Habitat Preference[5,6,7,8]	Suitable Habitats within Subject Property (within 120m)	Potential to be Impacted by Project	Observed by NRSI
Vascular Plants & Mosses										
Arisaema dracontium	Green Dragon	S3	SC	SC	Schedule 3	MNRF 2014	Wet bottomlands along rivers and creeks.	Yes. Bottomlands along creeks exist within the subject properties.	Yes	No
Castanea dentata	American Chestnut	S2	E	END	Schedule 1	MNRF 2014	Moist to well drained forests on sand, occasionally heavy soils.	Yes. Suitable forest habitat exists within the subject properties.	Yes	No
Cornus florida	Eastern Flowering Dogwood	S2?	E	END	Schedule 1	MNRF 2014	Dry (usually oak) to rich deciduous forests, especially on hillsides and river banks.	No. The native range for this species is restricted to Ecoregion 7E.	No	No
Fissidens exilis	Pygmy Pocket Moss	S1	SC	SC	-	MNRF 2014	Moist, barren soil, typicaly clay, often asscoiated with forests.	No. Subject properties located within the Waterloo Sand Hills physiographic region, dominated by sandy loams.	No	No
Gymnocladus dioicus	Kentucky Coffee-tree	S2	T	THR	Schedule 1	MNRF 2014	Floodplains, edges of marshes and shallow soil over limestone.	No. The native range for this species is restricted to Ecoregion 7E.	No	No
Juglans cinerea	Butternut	S3?	E	END	Schedule 1	MNRF 2014	Rich woods of river terraces and valleys, also dry rocky slopes.	Yes. Suitable habitat for this species exists within the subject properties.	Yes	Yes
Panax quinquefolius	American Ginseng	S3	E	END	Schedule 1	MNRF 2014	Deep leaf litter in rich, moist deciduous woods, especially on rocky, shaded cool slopes in sweet soil.	Yes. Rich, moist deciduous woods exists within the subject proeprties.	Yes	No
Birds										
Ammodramus henslowii	Henslow's Sparrow	SHB	E	END	Schedule 1	MNRF 2014	Large, fallow, grassy area with ground mat of dead vegetation, dense herbaceous vegetation, ground litter and some song perches; neglected weedy fields; wet meadows; cultivated uplands; a moderate amount of moisture needed; requires a minimum tract of grassland of 40 ha, but usually in areas >100 ha.	No. Suitable grassland habitat does not exist within the subject properties.	No	No
Ammodramus savannarum	Grasshopper Sparrow	S4B	SC	--	--	MNRF 2014	Well-drained grassland or prairie with low cover of grasses, taller weeds on sandy soil; hayfields or weedy fallow fields; uplands with ground vegetation of various densities; perches for singing; requires tracts of grassland > 10 ha.	No. Suitable grassland habitat does not exist within the subject properties.	No	No
Asio flammeus	Short-eared Owl	S2N, S4B	SC	SC	Schedule 3	MNRF 2014	Grasslands, open areas or meadows that are grassy or bushy; marshes, bogs or tundra; both diurnal and nocturnal habits; ground nester; destruction of wetlands by drainage for agriculture is an important factor in the decline of this species; home range 25 -125 ha; requires 75-100 ha of contiguous open habitat.	No. Suitable grassland habitat does not exist within the subject properties.	No	No
Caprimlugus vociferus	Eastern Whip-poor-will	S4B	T	THR	Schedule 1	MNRF 2014	Dry, open, deciduous woodlands of small to medium trees; oak or beech with lots of clearings and shaded leaflitter; wooded edges, forest clearings with little herbaceous growth; pine plantations; associated with >100 ha forests; may require 500 to 1000 ha to maintain population.	No. Habitats within the subject properties do not meet the size requirements for this species.	No	No
Cardellina canadensis	Canada Warbler	S4B	T	SC	Schedule 1	MNRF 2014	An interior forest species; dense, mixed coniferous, deciduous forests with closed canopy, wet bottomlands of cedar or alder; shrubby undergrowth in cool moist mature woodlands; riparian habitat; usually requires at least 30 ha.	No. Forested habitat within the subject properties is not large enough to support this species.	No	No
Chaetura pelagica	Chimney Swift	S4B, S4N	T	THR	Schedule 1	MNRF 2014	Commonly found in urban areas near buildings; nests in hollow trees, crevices of rock cliffs, chimneys; highly gregarious; feeds over open water.	Yes. Buildings, hollow trees, and chimneys within the subject properties may provide habitat for this species.	Yes	No

Scientific Name	Common Name	SRANK[1]	COSEWIC[2]	COSSARO[3]	SARA Schedule[4]	Background Source	Habitat Preference[5,6,7,8]	Suitable Habitats within Subject Property (within 120m)	Potential to be Impacted by Project	Observed by NRSI
Childonias niger	Black Tern	S3B	NAR	SC	--	MNRF 2014	Wetlands, coastal or inland marshes; large cattail marshes, marshy edges of rivers, lakes or ponds, wet open fens, wet meadows; returns to same area to nest each year in loose colonies; must have shallow (0.5 to 1m deep) water and areas of open water near nests; requires marshes >20 ha in size; feeds over adjacent grasslands for insects; also feeds on fish, crayfish and frogs.	No. Wetlands within the subject properties are not large enough to support this species.	No	No
Chordeiles minor	Common Nighthawk	S4B	T	SC	Schedule 1	MNRF 2014	Generally prefer open, vegetation-free habitats, including dunes, beaches, recently harvested forests, burnt-over areas, logged areas, rocky outcrops, rocky barrens, grasslands, pastures, peat bogs, marshes, lakeshores, and river banks. This species also inhabits mixed and coniferous forests. Can also be found in urban areas (nest on flat roof-tops).	Yes. Clearings and ploughed fields exist within the subject properties.	Yes	Yes
Colinus virginianus	Northern Bobwhite	S1	E	END	Schedule 1	MNRF 2014	Generally inhabits a variety of edge and grassland type habitats including non-intensively farmed agricultural lands.	No. Suitable grassland habitat does not exist within the subject properties.	No	No
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC	-	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Open, deciduous, mixed or coniferous forest; predominated by oak with little understory; forest clearings, edges; farm woodlots, parks.	Yes. Forested habitat, forest clearings and edges exist within the subject properties.	Yes	Yes
Dolichonyx oryzivorus	Bobolink	S4B	T	THR	-	MNRF 2014	Large, open expansive grasslands with dense ground cover; hayfields, meadows or fallow fields; marshes; requires tracts of grassland >50 ha.	No. Suitable habitat not present within the subject properties.	No	No
Empidonax virescens	Acadian Flycatcher	S2S3B	E	END	Schedule 1	MNRF 2014	Mature, shady, deciduous forests; heavily wooded ravines; creek bottoms or river swamps; availability of good quality habitat is limiting factor; needs at least 30 ha of forest.	No. Forested habitat within the subject properties is not large enough to support this species.	No	No
Falco peregrinus	Peregrine Falcon	S3B	SC	SC	Schedule 1	MNRF 2014	Rock cliffs, crags, especially situated near water; tall buildings in urban centres.	No. Suitable topographic and anthropogenic features not present within the subject properties.	No	No
Haliaeetus leucocephalus	Bald Eagle	S2N, S4B	NAR	SC	-	MNRF 2014	Require large continuous area of deciduous or mixed woods around large lakes, rivers; require area of 255 ha for nesting, shelter, feeding, roosting; prefer open woods with 30 to 50% canopy cover; nest in tall trees 50 to 200 m from shore; require tall, dead, partially dead trees within 400 m of nest for perching.	No. Suitable aquatic features are not present within the subject properties.	No	No
Hirundo rustica	Barn Swallow	S4B	T	THR	-	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Farmlands or rural areas; cliffs, caves, rock niches; buildings or other man-made structures for nesting; open country near body of water.	Yes. Creek and open fields, and man-made structures are within the subject properties.	Yes	Yes
Hylocichla mustelina	Wood Thrush	S4B	T	SC	-	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Carolinian and Great Lakes-St. Lawrence forest zones; undisturbed moist mature deciduous or mixed forest with deciduous sapling growth; near pond or swamp; hardwood forest edges; must have some trees higher than 12 m.	Yes. Forested habitat exists within the subject properties.	Yes	Yes
Icteria virens	Yellow-breasted Chat	S2B	E	END	Schedule 1	MNRF 2014	Generally prefer dense thickets around wood edges, riparian areas, and in overgrown clearings.	Yes. Suitable thicket habitat exists within the subject properties.	Yes	No
Ixobrychus exilis	Least Bittern	S4B	T	THR	-	MNRF 2014	Deep marshes, swamps, bogs; marshy borders of lakes, ponds, streams, ditches; dense emergent vegetation of cattail, bulrush, sedge; nests in cattails; intolerant of loss of habitat and human disturbance.	No. Subject properties are too fragmented and encroached upon to provide suitable habitat for this species.	No	No
Melanerpes erythrocephalus	Red-headed Woodpecker	S4B	T	SC	Schedule 1	MNRF 2014	Open, deciduous forest with little understory; fields or pasture lands with scattered large trees; wooded swamps; orchards, small woodlots or forest edges; groves of dead or dying trees; feeds on insects and stores nuts or acorns for winter; loss of habitat is limiting factor; requires cavity trees with at least 40 cm dbh; require about 4 ha for a territory.	Yes. Deciduous forest and swamp habitats within the subject properties may provide habitat for this species.	Yes	No

Scientific Name	Common Name	SRANK[1]	COSEWIC[2]	COSSARO[3]	SARA Schedule[4]	Background Source	Habitat Preference[5,6,7,8]	Suitable Habitats within Subject Property (within 120m)	Potential to be Impacted by Project	Observed by NRSI
Parkesia motacilla	Louisiana Waterthrush	S3B	SC	SC	Schedule 1	MNRF 2014	Generally inhabits mature forests along steeply sloped ravines adjacent to running water. It prefers clear, cold streams and densely wooded swamps.	Yes. Swamp and creek habitats exist within the subject properties.	Yes	No
Riparia riparia	Bank Swallow	S4B	T	THR	-	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Sand, clay or gravel river banks or steep riverbank cliffs; lakeshore bluffs of easily crumbled sand or gravel; gravel pits, road-cuts, grassland or cultivated fields that are close to water; nesting sites are limiting factor for species presence.	No. Suitable nesting habitat does not exist within the subject properties.	No	No
Setophaga cerulea	Cerulean Warbler	S3B	E	THR	Schedule 1	MNRF 2014	Mature deciduous woodland of Great Lakes- St. Lawrence and Carolinian forests, sometimes coniferous; swamps or bottomlands with large trees; area sensitive species needing extensive areas of forest (>100 ha).	No. Forested habitat within the subject properties is not large enough to support this species.	No	No
Sturnella magna	Eastern Meadowlark	S4B	T	THR	-	MNRF 2014	Open, grassy meadows, farmland, pastures, hayfields or grasslands with elevated singing perches; cultivated land and weedy areas with trees; old orchards with adjacent, open grassy areas >10 ha in size.	No. Suitable grassland habitat does not exist within the subject properties.	No	No
Vermivora chrysoptera	Golden-winged Warbler	S4B	T	SC	Schedule 1	MNRF 2014	Generally prefer areas of early successional vegetation, found primarily on field edges, hydro or utility right-of-ways, or recently logged areas.	No. Suitable thicket habitat does not exist within the subject properties.	No	No
Herpetofauna										
Ambystoma jeffersonianum	Jefferson Salamander	S2	E	END	Schedule 1	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Inhabit deciduous and mixed deciduous forests with suitable breeding areas which generally consist of ephemeral (temporary) bodies of water that are fed by spring runoff, groundwater, or springs.	No. There is no suitable breeding habitat (i.e. vernal pools) within the subject properties. Ambystomid salamander habitat suitability assessments conducted in the NWSSS. No suitable breeding ponds identified within the NWSSS primary study area. No additional surveys undertaken, in consultation with MNRF (Ecoplans et al. 2013).	No	No
Chelydra serpentina serpentina	Snapping Turtle	S3	SC	SC	Schedule 1	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Permanent or semi-permanent fresh water; marshes, swamps or bogs; rivers and streams with soft muddybanks or bottoms. The species often uses soft soil or clean dry sand on south-facing slopes for nest sites and may nest at some distance from water.	Yes. Swamp, and stream habitat identified within the subject properties. As well, suitable basking and/or nesting habitat may exist within the subject properties. Targeted turtle nesting surveys conducted by NRSI in 2015 confirmed no evidence of turtle nesting.	Yes	No
Emydoidea blandingii	Blanding's Turtle (*Great Lakes/St Lawrence population*)	S3	T	THR	Schedule 1	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Shallow water marshes, bogs, ponds or swamps, or coves in larger lakes with soft muddy bottoms and aquatic vegetation; basks on logs, stumps, or banks; surrounding natural habitat is important in summer as they frequently move from aquatic habitat to terrestrial habitats; hibernates in bogs; not readily observed.	Yes. Wetland habitat identified, and suitable basking and/or nesting habitat may exist within the subject properties. Targeted turtle nesting surveys conducted by NRSI in 2015 confirmed no evidence of turtle nesting.	Yes	No
Glyptemys insculpta	Wood Turtle	S2	T	END	Schedule 1	MNRF 2014	Slow-moving streams with sandy bottoms and woody edges; ponds, marshes, swamps; woodlands in floodplains; lives within 150 m of stream shores; home range may be 5 to 25 ha, sometimes as much as 115 ha; riparian corridors important since this species is quite terrestrial.	No. This species no longer occurs within Waterloo Region.	No	No

Scientific Name	Common Name	SRANK[1]	COSEWIC[2]	COSSARO[3]	SARA Schedule[4]	Background Source	Habitat Preference[5,6,7,8]	Suitable Habitats within Subject Property (within 120m)	Potential to be Impacted by Project	Observed by NRSI
Graptemys geographica	Northern Map Turtle	S3	SC	SC	Schedule 1	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Large bodies of water with soft bottoms, and aquatic vegetation; basks on logs or rocks or on beaches and grassy edges, will bask in groups; uses soft soil or clean dry sand for nest sites; may nest at some distance from water; home range size is larger for females (about 70 ha) than males (about 30 ha) and includes hibernation, basking, nesting and feeding areas; aquatic corridors (e.g. stream) are required for movement; not readily observed.	No. Large bodies of water not present within subject properties. No suitable habitat observed within the NWSSS primary study area (Ecoplans et al. 2013).	No	No
Pseudacris triseriata	Western Chorus Frog	S3	T	NAR	Schedule 1	NWSSS (Ecoplans et al. 2013)	Roadside ditches or temporary ponds in fields; swamps or wet meadows; woodland or open country with cover and moisture; small ponds and temporary pools.	Yes. Swamps and suitable wet habitats exist within the subject area.	Yes	No
Regina septemvittata	Queensnake	S2	E	END	Schedule 1	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Margins of streams with slow currents and gravel bottoms; shorelines with rocks and debris; old quarries; canals; aquatic habitat with overhanging trees, particularly willows.	No. Watercourse features within the subject properties not suitable habitat for this species (Ecoplans et al. 2013).	No	No
Thamnophis sauritus septentrionalis	Northern Ribbonsnake	S3	SC	SC	Schedule 1	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Sunny grassy areas with low dense vegetation near bodies of shallow permanent quiet water; wet meadows, grassy marshes or sphagnum bogs; borders of ponds, lakes or streams; hibernates in groups.	Yes. Wet meadows, grassy marshes, and stream edges exist within the subject properties.	No. Considered to be absent.	No
Mammals										
Myotis leibii	Eastern Small-footed Bat	S2S3	-	END	-	MNRF 2014	Overwintering habitat: Caves and mines that remain above 0. Maternal Roosts: primarily under loose rocks on exposed rock outcrops, crevices and cliffs, and occasionally in buildings, under bridges and highway overpasses and under tree bark.	No. Bat habitat assessment conducted by NRSI in 2014 confirmed no use by bats within buildings that are to be demolished.	No	No
Myotis lucifugus	Little Brown Myotis	S4	E	END	-	MNRF 2014	Uses caves, quarries, tunnels, hollow trees or buildings for roosting; winters in humid caves; maternity sites in dark warm areas such as attics and barns; feeds primarily in wetlands, forest edges.	No. Bat habitat assessment conducted by NRSI in 2014 confirmed no use by bats within buildings that are to be demolished. No tree removal proposed.	No	No
Myotis septentrionalis	Northern Myotis	S3	E	END	-	MNRF 2014	Hibernates in mines or caves; during summer males roost alone and females form maternity colonies of up to 60 adults; roosts in houses, man-made structures but prefers hollow trees or under loose bark; hunts within forests, below canopy.	No. Bat habitat assessment conducted by NRSI in 2014 confirmed no use by bats within buildings that are to be demolished. No tree removal proposed.	No	No
Perimyotis subflavus	Tri-colored Bat	S3?	E	--	Schedule 1	MNRF 2014	Open woods near water; roosts in trees, cliff crevices, buildings or caves; hibernates in damp, draft-free, warm caves, mines or rock crevices.	No. Bat habitat assessment conducted by NRSI in 2014 confirmed no use by bats within buildings that are to be demolished. No tree removal proposed.	No	No
Taxidea taxus jacksoni	American Badger	S2	E	END	Schedule 1	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Generally prefer open habitats, whether natural (grasslands) or man-made (road right-of-ways, golf courses). Potential habitat also includes agricultural fields consisting of cereal crops, hay, and pasture and along the edges of corn and soybean fields.	Yes. Open habitats exist within the subject properties. Targetted surveys conducted in 2010 and 2011 within potential suitable habitats, in consultation with MNR. Field studies concluded no evidence of American Badger use within the NWSSS primary study area (Ecoplans et al. 2013). Targeted habitat assessment conducted by NRSI in 2015 confirmed the habitat conditions are unchanged; no candidate badger dens were observed.	No	No

Scientific Name	Common Name	SRANK[1]	COSEWIC[2]	COSSARO[3]	SARA Schedule[4]	Background Source	Habitat Preference[5,6,7,8]	Suitable Habitats within Subject Property (within 120m)	Potential to be Impacted by Project	Observed by NRSI
Insects										
Bombus affinis	Rusty-patched Bumble Bee	S1	E	END	-	MNRF 2014	Generally inhabits a range of diverse habitats including mixed farmland, sand dunes, marshes, urban and wooded areas. It usually nests underground in abandoned rodent burrows. Currently, the only known population occurs in a managed oak savanna remnant.	No. Known species range is within Lambton County, Ontario.	No	No
Danaus plexippus	Monarch	S2N, S4B	SC	SC	Schedule 1	MNRF 2014; NWSSS (Ecoplans et al. 2013)	Open areas with milkweed species (*Asclepias* spp.).	Yes. Milkweed is present within the subject properties.	Yes	Yes
Epiaeschna heros	Swamp Darner	S2S3	-	-	-	NWSSS (Ecoplans et al. 2013)	Shallow, shaded woodland ponds, including those that are sometimes temporary; also some swamps and slow streams.	Yes. Woodlands along Beaver Creek.	Yes	No
Pieris virginiensis	West Virginia White	S3	SC	-	-	MNRF 2014	Generally prefer moist, deciduous woodlands. The larvae feed only on the leaves of the two-leaved toothwort (*Cardamine diphylla*), which is a small, spring-blooming plant of the forest floor.	Yes. Suitable deciduous woodland habitat exists within the subject properties. Host plant observed in primary study area during NWSSS (Ecoplans et al. 2013).	Yes	No

[1,3]MNRF 2015a, [2,4]Government of Canada 2015, [5]MNRF 2000, [6]Layberry et al. 1998, [7]MNRF 2014, [8]Reznicek et al. 2011

Legend	COSEWIC/COSSARO
S1 Critically Imperiled	E/END Endangered
S2 Imperiled	T/THR Threatened
S3 Vulnerable	SC Special Concern
S4 Apparently Secure	NAR Not at Risk
B Breeding	
N Non-breeding	

Region of Waterloo

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Chris Gosselin 519-575-4501

May 3, 2016

Ms. Elaine Gosnell,
Natural Resource Solutions Inc.,
225 Labrador Drive, Unit 1,
Waterloo, Ontario, N2K 4M8.

RE: Proposed Residential Subdivision, Northgate South and Erbsville Kartway Lands, City of Waterloo - Laurel Creek Forest

Dear Ms. Gosnell;

At their February 29, 2016 meeting, the Ecological and Environmental Advisory Committee considered Report EEAC-16-01, and passed the following motion:

That the Ecological and Environmental Advisory Committee take the following actions with respect to the proposed Northgate South residential subdivision in Waterloo, on lands within and contiguous to the Laurel Creek Forest Environmentally Sensitive Policy Area (ESPA 80):

1. Advise Planning, Development and Legislative Services staff that the Terms of Reference (Natural Resource Solutions Inc., January 15, 2016) for the Environmental Impact Statement required in support of the proposed development application, as per Policy 7.C.10 of the Regional Official Plan, is acceptable as it addresses the following:

    a. confirmation of an ecologically appropriate boundary of ESPA 80 within the subject lands;

    b. delineation and design of suitable buffers between ESPA 80 and the proposed development on the subject lands;

    c. a biophysical survey to identify natural habitats and/or populations of Regionally significant plant and animal species on the subject lands that might be adversely affected by the proposed development;

    d. maintaining quantitative and qualitative aspects of the hydrological and hydrogeological regimes sustaining wetland features within ESPA 80 through design,

e. construction, and operation of a stormwater management system required to support the proposed development;

f. identification of ecological enhancement, restoration and long-term stewardship opportunities for ESPA 80 on the subject lands;

g. identification of items covered in the North Waterloo Sub-watershed Study and pre-development monitoring that may require special attention during site alteration and development; and

h. content of a during-development and post-development monitoring program.

At the same time, a sub-committee was struck to review the scoped Environmental Impact Statement when it is submitted. As six members volunteered to serve on the sub-committee, please ensure that there are eight copies of Environmental Impact Statement when the complete application package is submitted to the Region.

Yours sincerely,

Christopher Gosselin, M.A., B.Sc.(Agr.), M.A., M.C.I.P., R.P.P.
Manager of Environmental Planning,
CGosselin@regionofwaterloo.ca

c.c. Dave Aston, MHBC
Robyn McMullen, City of Waterloo
Beth Brown, Grand River Conservation Authority
Shilling Yip, Community Planning

Regional Municipality of Waterloo

Ecological and Environmental Advisory Committee

Minutes

Monday, February 29, 2016

6:30 p.m.

Room 110

150 Frederick Street, Kitchener, Ontario

Present were: W. Caston, E. Cejudo, A. Dean, R. Donaldson, L. Ehnes, A. Featherstone, J. Kingsbury, G. Michalenko, C. Priddle, N. Semper, and A. Woroch

Members absent: J. Ehgoetz, J. Kimantas, J. Nowak and C. Weatherall

Election of Chair and Vice Chair for 2016

Erin Flewwelling, Committee Clerk, called the meeting to order and explained the election process. A call was made for nominations for Chair. A. Featherstone was nominated and accepted the nomination.

Moved by R. Donaldson

Seconded by G. Michalenko

That the nominations for Chair of the Ecological and Environmental Advisory Committee be closed.

Carried

A. Featherstone was acclaimed as Chair.

A call was made for nominations for Vice-Chair. W. Caston was nominated and accepted the nomination.

Moved by G. Michalenko

Seconded by A. Dean

That the nominations for Vice-Chair of the Ecological and Environmental Advisory Committee be closed.

Carried

W. Caston was acclaimed as Vice-Chair.

A. Featherstone assumed the Chair.

Introduction of New Members

Members introduced themselves.

Declarations of Pecuniary Interest Under The Municipal Conflict of Interest Act

A. Dean declared a pecuniary interest to items 5.1 and 6.1 on the agenda due to his employment.

A. Featherstone declared a pecuniary interest to item 5.4 on the agenda due to her employment.

Minutes

Moved by W. Caston

Seconded by E. Cejudo

That the minutes of the Ecological and Environmental Advisory Committee of December 14, 2015 be approved.

Carried

Delegations

a) Ms. Elaine Gosnell, Natural Resource Solutions Inc. and Mr. Dave Aston, MHBC Planning, appeared before Committee regarding EEAC-16-01, Proposed Residential Subdivision, Northgate South and Erbsville Kartway Lands, City of Waterloo, ESPA 80 - Laurel Creek Forest. D. Aston provided background information on the site highlighting this is the next step in the planning process. E. Gosnell highlighted that the terms of reference attached to the report and builds off of the 2 year preconstruction monitoring that has already occurred.

A Committee member asked that the environmental impact study include the possibility of ecological restoration of the agricultural land in the large clearing within the ESPA. Chris Gosselin, Manager, Environmental Planning and Stewardship advised that it might be premature to make that recommendation explaining that this particular property was appealed as part of the ROP appeals back in 2011. It was agreed at that time by Community Planning staff and representatives of the landowners that the future

land use of and access to the area would be determined through the review of an EIS for the future development of the subject property, and not through the North Waterloo Sub-watershed Study which was then under way.

D. Aston highlighted that there was no illegal activity on the site with respect to recent tree removal explaining that the trees were removed after the ice storm.

D. Aston provided background information on the site explaining the process that has already occurred through the North Waterloo Sub-watershed study and the Conservation Meadows district plan.

E. Gosnell highlighted that the agricultural field went through an OMB appeal in the 90's and at that point it was designated residential. As such, a decision has been made and the EIS must reflect that decision. She realizes that access to the clearing will be the biggest area of interest. She also highlighted that field only has one access so the number of units will be limited and there is potential for that field to have multiple uses.

C. Gosselin noted that the West Side OMB hearing occurred in 1992-93. The Laurel Creek Forest ESPA was designated as part of the approval of the Regional Official Policies Plan in 1995. He also noted that an Official Plan residential designation, as opposed to zoning, can include more land uses than housing such as parkland.

G. Michalenko asked that an amendment be made to 1. d) stating climate change makes storm events more uncertain and difficult to predict but the magnitude of storm events is likely to be significantly higher than long term averages. Thus the design of the stormwater management system should be made in light of such changes and not just reflect calculations made using past conditions as the "norm".

A Committee member expressed concerns with the Committee questioning the expertise of stormwater professionals. It was stated that the Region doesn't have the authority to weigh in on the basic assumptions underlying stormwater management, and that professional engineers are grappling with the implications of climate change.

It was suggested that G. Michalenko's comments about stormwater management be made as a friendly advisement.

E. Gosnell stated that is unfair for the developer to reconsider the residential development but if consideration to different types of development be more reasonable.

G. Michalenko brought forward an additional recommendation (h) to consider restoring the land as an alternate to residential development. Committee members asked that the additional recommendation be taken separately.

Moved by R. Donaldson

2081655

Seconded by W. Caston

That the Ecological and Environmental Advisory Committee advise Community Planning staff as follows:

That the Ecological and Environmental Advisory Committee take the following actions with respect to the proposed Northgate South residential subdivision in Waterloo, on lands within and contiguous to the Laurel Creek Forest Environmentally Sensitive Policy Area (ESPA 80):

1. Advise Planning, Development and Legislative Services staff that the Terms of Reference (Natural Resource Solutions Inc., January 15, 2016) for the Environmental Impact Statement required in support of the proposed development application, as per Policy 7.C.10 of the Regional Official Plan, is acceptable as it addresses the following:

    a. confirmation of an ecologically appropriate boundary of ESPA 80 within the subject lands;

    b. delineation and design of suitable buffers between ESPA 80 and the proposed development on the subject lands;

    c. a biophysical survey to identify natural habitats and/or populations of Regionally significant plant and animal species on the subject lands that might be adversely affected by the proposed development;

    d. maintaining quantitative and qualitative aspects of the hydrological and hydrogeological regimes sustaining wetland features within ESPA 80 through design, construction, and operation of a stormwater management system required to support the proposed development;

    e. identification of ecological enhancement, restoration and long-term stewardship opportunities for ESPA 80 on the subject lands;

    f. identification of items covered in the North Waterloo Sub-watershed Study and pre-development monitoring that may require special attention during site alteration and development; and

    g. content of a during-development and post-development monitoring program.

2. Strike a sub-committee to review the scoped Environmental Impact Statement for the proposed development when it is submitted.

Carried

Moved by G. Michalenko

Seconded by C. Priddle

h. Consideration of the ecological implications of ecologically restoring the agricultural field inside the northern lobe of ESPA 80 as an alternative to residential development.

Carried

R. Donaldson, opposed.

W. Caston C. Priddle, G. Michalenko, R. Donaldson and A. Featherstone and N. Semper volunteered to be on the sub-committee.

Committee members asked that the sub-watershed report be circulated to them.

b) Mr. Jeff Gross, WSP/MMM Group and Ms. Amanda Kosloski, Armstrong Hunter Associates appeared before Committee regarding EEAC-16-02, Proposed Residential Subdivision, Empire Communities, Township of Woolwich, Breslau Core Environmental Feature and provided background information on the eco passage.

G. Michalenko introduced the report and highlighted the recommendation. He stated there was some difficulty setting the boundaries of the southern end of the Breslau Riverland Core Environmental Feature, and he briefly highlighted the eco-passage.

J. Gross asked if recommendation c) complies with ROP policy 7.C.11. C. Gosselin said that as a representative portion of the thickets outside the dripline of the woodland is being incorporated into the Core Environmental Feature and maintained as habitat for the Regionally significant breeding birds, Regional staff would not require an additional ten metre buffer between the thickets and the area to be developed.

J. Gross asked for clarification on the specific area where the 10 metre buffer wouldn't be required. C. Gosselin explained that this applied only in relation to the lands subject to this particular subdivision application. Determination of the boundary and buffer on additional lands to the south would be done through a future application following clarification of the Official Plan designation of the lands.

J. Gross asked that this recommendation could be included in future plans.

The Committee took a recess at 7:35 p.m.

The meeting resumed at 7:45 p.m.

The sub-committee left the meeting to meet with the delegations to discuss the recommendations further to include future draft plans.

Information/Correspondence

a) Region of Waterloo Wastewater Treatment Master Plan Update

Dave Arsenault appeared before the Committee to provide a presentation on the Region of Waterloo Wastewater Treatment Master Plan (WWTMP) Update. The presentation highlighted the wastewater infrastructure, what is the WWTMP, 2016: What's different, reduced flow forecast, project governance, technical goals (1), technical goals (2), and public consultation. A copy of the presentation is appended to the original minutes.

D. Arsenault provided clarification on handling emerging contaminates and asked if a member from EEAC could sit on the project team that meets 3 to 4 times a year.

Committee members asked if two people could sit on the project, one as an alternate. A. Featherstone and E. Cejudo volunteered.

Moved by R. Donaldson

Seconded by A. Dean

That the Ecological and Environmental Advisory Committee nominate both E. Cejudo and A. Featherstone to sit on the Wastewater Master Plan project team.

Carried

The sub-committee members and the delegations returned to the meeting.

Sylvia Rafalski-Misch, Planner, stated that recommendation a) stayed the same, recommendation b) to include the eco-passage on the additional lands and the changes to recommendation c) to include Blocks 71 and 72 and 96 and 97 to address additional lands and the draft plan lands.

J. Gross asked for clarification and the objective of recommendation d) explaining a lot of the trees would be left. He stated that the cottonwoods on the site are widely distributed.

Committee members highlighted their concerns stating that the sub-committee dealt with an application about 1.8 kilometres to the south of the subject property where there is a stand of poplars initially considered to be a hybrid but genetic testing proved them to be native Cottonwoods. The boundary of ESPA 25 was interpreted to retain some on site and that they are of the opinion that the same approach should be taken to the poplars on this site.

A Committee member stated that if a representative population of the trees are going to be conserved within the enhancement area, the removal of recommendation d) would be appropriate.

Moved by R. Donaldson

Seconded by G. Michalenko

That the Ecological and Environmental Advisory Committee advise Community Planning staff with respect to the proposed Empire Riverland (Area 2) Plan of Subdivision as follows:

a. That the proposed 1.58 hectare "Additional Open Space Ecological Enhancement Areas" and the 3.79 hectare "Ecological Retention/Enhancement Area" serve to conserve native biodiversity in this locality and should therefore be supported;

b. That the developer install an eco-passage on the additional lands, to the satisfaction of the Township of Woolwich, Grand River Conservation Authority, and Region beneath Street A to link the 3.79 hectare "Ecological Retention/Enhancement Area" with the "Additional Open Space Ecological Enhancement Area";

c. That the southern boundary of the Breslau Riverbank Core Environmental Feature be interpreted as the outer eastern limits of blocks 71, 72, 96, and 97 on the additional plans on February 23, in that it has been documented to provide breeding habitat for several species of Regionally significant breeding birds, as well as rare Lepidopterans and Odonates; and that no additional buffer be required between the these blocks and the adjoining land to be developed.

Carried, as amended

b) Monitoring the Central Transit Corridor: Environment Thematic Report

Alexander Wray, Student Planner, appeared before Committee and provided a presentation that highlighted: what is the CTC; Introduction; Monitoring program; baseline indicators; selecting indicators; and Environment Report 2016.

He stated the purpose is to track new development because of the LRT and provided clarification on the monitoring and indicators.

It was suggested that A. Wray could come back to the April meeting with more information.

c) Greenlands Network Implementation Guideline

C. Gosselin provided an update on the Greenlands Network Implementation Guideline. The draft was circulated for final comments in the fall of 2015, and many valuable

comments were received, including from Committee members. The final draft is now being readied for Council's consideration. He will provide members with a copy once it has been adopted.

Other Business

Chair A. Featherstone mentioned the recent passing of former Regional Councillor and past EEAC member Claudette Millar. The Committee members shared stories and memories of C. Millar's efforts on the Committee.

It was also pointed out that Younus Muhammad, Ted Creese, and Alge Merry's memberships have expired and that a letter will be sent to them thanking them for their hard work.

A Committee member asked if a list of the members' expertise could be circulated.

Chair A. Featherstone inquired about starting the meetings earlier and noted that an e-mail poll will be sent out to members about timing.

C. Gosselin asked if any member was interested in receiving a parking pass to park underground to be used only on EEAC meeting nights. W. Caston, A. Dean and L. Ehnes asked for parking passes.

Active EEAC Subcommittees

C. Gosselin asked for volunteers to sit on the Ripplewood subcommittee which has now bee depleted. A. Dean volunteered.

A Committee member asked about the Cambridge Golf Club application. C. Gosselin noted he isn't sure where that application stands.

Next Meeting- April 25, 2016

Adjourn

Moved by W. Caston

Seconded by A. Dean

That the meeting adjourn at 8:55 p.m.

Carried

Committee Chair, A. Featherstone

Committee Clerk, E. Flewwelling

APPENDIX II

Fish Species Known from the Study Area

Fish Species Reported from the Study Area

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	Thermal Regime	Spawn Time	Beaver Creek[4]	Laurel Creek[4]
Cyprinidae	**Carps and Minnows**							
Campostoma anomalum	Central Stoneroller	S4		NAR (April 1998)	warm	may-july		X
Chrosomus eos	Northern Redbelly Dace	S5			cool	may-july	X	X
Luxilus cornutus	Common Shiner	S5			cool	may-june	X	X
Nocomis biguttatus	Hornyhead Chub	S4	NAR	NAR (April 1988)	cool	may-july	X	
Notropis heterodon	Blackchin Shiner	S4	NAR	NAR (April 1994)	cool	jun-aug	X	
Pimephales promelas	Fathead Minnow	S5			warm	may-aug	X	X
Rhinichthys cataractae	Longnose Dace	S5			cool	may-june	X	X
Rihinchthys obtusus	Western Blacknose Dace	S5			cool	may-june	X	X
Semotilus atromaculatus	Creek Chub	S5			cool	may-june	X	X
Catostomidae	**Suckers**							
Catostomus commersonii	White Sucker	S5			cool	apr-june	X	X
Gasterosteidae	**Sticklebacks**							
Culaea inconstans	Brook Stickleback	S5			cool	may-july	X	
Centrarchidae	**Sunfishes and Basses**							
Lepomis gibbosus	Pumpkinseed	S5			warm	may-aug	X	
Lepomis macrochirus	Bluegill	S5			warm	jun-aug	X	
Percidae	**Perches and Darters**							
Etheostoma caeruleum	Rainbow Darter	S4			cool	apr-june	X	X
Etheostoma nigrum	Johnny Darter	S5			cool	may-june	X	X
						Total	**14**	**10**

[1]MNRF 2019; [2]MECP 2019, [3]Government of Canada 2018, [4]Ecoplans et al. 2013

Legend
SRANK
S4 Apparently Secure
S5 Secure
COSSARO/COSEWIC
NAR Not at Risk

APPENDIX III

Vegetation Species Observed by Monitoring Plot (2014 – 2019)

Vegetation Species Observed by Monitoring Plot (2014-2016, 2019)

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRANK[2]	COSSARO[3]	COSEWIC[4]	SARA Schedule[4]	Waterloo Region[5]	NRSI Observed				
										VEG-003 SWM4-1	VEG-004 SWM6-1	VEG-005 FOM6-1	VEG-006 FOM6-1	VEG-007 SWM4-1
Pteridophytes	**Ferns & Allies**													
Dryopteridaceae	**Wood Fern Family**													
Athyrium filix-femina var. angustum	Northern Lady Fern	4	0		S5						X	X	X	X
Cystopteris bulbifera	Bulblet Fern	5	-2		S5					X	X			X
Dryopteris carthusiana	Spinulose Wood Fern	5	-2		S5						X	X	X	X
Dryopteris cristata	Crested Wood Fern	7	-5		S5						X			X
Dryopteris intermedia	Evergreen Wood Fern	5	0		S5					X	X	X	X	X
Dryopteris marginalis	Marginal Wood Fern	5	3		S5						X			X
Onoclea sensibilis	Sensitive Fern	4	-3		S5					X	X		X	X
Equisetaceae	**Horsetail Family**													
Equisetum arvense	Field Horsetail	0	0		S5					X	X			X
Thelypteridaceae	**Beech Fern Family**													
Thelypteris palustris var. pubescens	Marsh Fern	5	-4		S5						X			
Gymnosperms	**Conifers**													
Cupressaceae	**Cypress Family**													
Thuja occidentalis	White Cedar	4	-3		S5					X	X		X	X
Pinaceae	**Pine Family**													
Pinus strobus	Eastern White Pine	4	3		S5					X				
Tsuga canadensis	Eastern Hemlock	7	3		S5						X	X	X	X
Dicotyledons	**Dicots**													
Aceraceae	**Maple Family**													
Acer negundo	Manitoba Maple	0	-2		S5					X				
Acer platanoides	Norway Maple		5	-3	SE5					X				
Acer rubrum	Red Maple	4	0		S5						X			
Acer saccharum ssp. saccharum	Sugar Maple	4	3		S5						X	X	X	X
Apiaceae	**Carrot or Parsley Family**													
Cicuta maculata	Spotted Water-hemlock	6	-5		S5					X				X
Daucus carota	Wild Carrot		5	-2	SE5					X				
Hydrocotyle americana	American Marsh-pennywort	7	-5		S5									X
Araliaceae	**Ginseng Family**													
Aralia nudicaulis	Wild Sarsaparilla	4	3		S5						X			
Asclepiadaceae	**Milkweed Family**													
Asclepias incarnata ssp. incarnata	Swamp Milkweed	6	-5		S5					X				
Asclepias syriaca	Common Milkweed	0	5		S5					X				
Asteraceae	**Composite or Aster Family**													
Ambrosia artemisiifolia	Common Ragweed	0	3		S5					X				
Arctium minus ssp. minus	Common Burdock		5	-2	SE5					X				
Bidens frondosa	Devil's Beggar-ticks	3	-3		S5					X	X			X
Cirsium arvense	Canada Thistle		3	-1	SE5					X				
Cirsium vulgare	Bull Thistle		4	-1	SE5					X				
Erigeron annuus	Daisy Fleabane	0	1		S5					X				
Erigeron philadelphicus ssp. philadelphicus	Philadelphia Fleabane	1	-3		S5					X				
Eupatorium perfoliatum	Perfoliate Thoroughwort	2	-4		S5					X				
Eupatorium maculatum ssp. maculatum	Spotted Joe-pye-weed	3	-5		S5					X	X			X
Euthamia graminifolia	Flat-topped Bushy Goldenrod	2	-2		S5					X				
Solidago altissima var. altissima	Tall Goldenrod	1	3		S5					X				
Solidago canadensis	Canada Goldenrod	1	3		S5					X	X			
Solidago patula	Rough-leaved Goldenrod	8	-5		S5					X				
Solidago rugosa ssp. rugosa	Rough Goldenrod	4	-1		S5					X	X			

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRANK[2]	COSSARO[3]	COSEWIC[4]	SARA Schedule[4]	Waterloo Region[5]	NRSI Observed				
										VEG-003 SWM4-1	VEG-004 SWM6-1	VEG-005 FOM6-1	VEG-006 FOM6-1	VEG-007 SWM4-1
Symphyotrichum lanceolatum var. lanceolatum	Tall White Aster	3	-3		S5					X				
Symphyotrichum lateriflorum var. lateriflorum	Calico Aster	3	-2		S5					X		X		X
Symphyotrichum novae-angliae	New England Aster	2	-3		S5					X				
Symphyotrichum puniceum var. puniceum	Purple-stemmed Aster				S5					X	X			
Taraxacum officinale	Common Dandelion		3	-2	SE5					X	X			X
Tussilago farfara	Coltsfoot		3	-2	SE5					X	X			X
Balsaminaceae	**Touch-me-not Family**													
Impatiens capensis	Spotted Touch-me-not	4	-3		S5					X	X			X
Berberidaceae	**Barberry Family**													
Caulophyllum giganteum	Blue Cohosh				S5					X		X		
Betulaceae	**Birch Family**													
Betula alleghaniensis	Yellow Birch	6	0		S5					X	X	X	X	X
Ostrya virginiana	Hop Hornbeam	4	4		S5							X	X	
Boraginaceae	**Borage Family**													
Myosotis laxa	Smaller Forget-me-not	6	-5		S5						X			X
Brassicaceae	**Mustard Family**													
Cardamine diphylla	Two-leaved Toothwort	7	5		S5						X			X
Campanulaceae	**Bellflower Family**													
Lobelia siphilitica	Great Lobelia	6	-4		S5					X				X
Caprifoliaceae	**Honeysuckle Family**													
Sambucus canadensis	Common Elderberry	5	-2		S5					X	X			X
Sambucus racemosa ssp. pubens	Red-berried Elderberry	5	2		S5							X		
Viburnum lentago	Nannyberry	4	-1		S5					X				
Viburnum opulus	Guelder Rose		0	-1	SE4					X		X	X	X
Viburnum trilobum	High Bush Cranberry	5	-3		S5					X				
Cornaceae	**Dogwood Family**													
Cornus alternifolia	Alternate-leaved Dogwood	6	5		S5					X	X	X	X	
Cornus amomum ssp. obliqua	Silky Dogwood	5	-4		S5					X				
Cornus stolonifera	Red-osier Dogwood	2	-3		S5					X	X			
Fabaceae	**Pea Family**													
Trifolium pratense	Red Clover		2	-2	SE5					X				
Fagaceae	**Beech Family**													
Fagus grandifolia	American Beech	6	3		S5							X		
Quercus macrocarpa	Bur Oak	5	1		S5					X				
Geraniaceae	**Geranium Family**													
Geranium maculatum	Spotted Crane's-bill	6	3		S5					X				
Geranium robertianum	Herb Robert		5	-2	SE5						X	X	X	X
Grossulariaceae	**Currant Family**													
Ribes americanum	Wild Black Currant	4	-3		S5						X			
Ribes cynosbati	Prickly Gooseberry	4	5		S5						X	X		
Juglandaceae	**Walnut Family**													
Carya cordiformis	Bitternut Hickory	6	0		S5							X	X	
Juglans nigra	Black Walnut	5	3		S4				R+*	X		X		
Lamiaceae	**Mint Family**													
Lycopus americanus	Cut-leaved Water-horehound	4	-5		S5					X	X			
Lycopus uniflorus	Northern Water-horehound	5	-5		S5					X	X			

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRANK[2]	COSSARO[3]	COSEWIC[4]	SARA Schedule[4]	Waterloo Region[5]	NRSI Observed				
										VEG-003 SWM4-1	VEG-004 SWM6-1	VEG-005 FOM6-1	VEG-006 FOM6-1	VEG-007 SWM4-1
Mentha arvensis ssp. borealis	American Wild Mint	3	-3		S5					X				
Prunella vulgaris ssp. lanceolata	Heal-all	5	5		S5					X			X	X
Scutellaria lateriflora	Mad-dog Skullcap	5	-5		S5					X				X
Oleaceae	**Olive Family**													
Fraxinus americana	White Ash	4	3		S5							X	X	
Fraxinus nigra	Black Ash	7	-4		S5		T				X			X
Fraxinus pennsylvanica	Green Ash	3	-3		S5					X	X			X
Onagraceae	**Evening-primrose Family**													
Circaea alpina	Smaller Enchanter's Nightshade	6	-3		S5						X			
Circaea lutetiana ssp. canadensis	Yellowish Enchanter's Nightshade	3	3		S5					X	X	X	X	X
Epilobium coloratum	Purple-veined Willow-herb	3	-5		S5					X	X			
Epilobium parviflorum	Sparse-flowered Willow-herb		3	-1	SE4					X				
Oenothera biennis	Common Evening-primrose	0	3		S5					X				
Oxalidaceae	**Wood Sorrel Family**													
Oxalis stricta	Upright Yellow Wood-sorrel	0	3		S5									X
Papaveraceae	**Poppy Family**													
Sanguinaria canadensis	Bloodroot	5	4		S5							X		
Plantaginaceae	**Plantain Family**													
Plantago major	Common Plantain		-1	-1	SE5					X				
Primulaceae	**Primrose Family**													
Lysimachia ciliata	Fringed Loosestrife	4	-3		S5					X				X
Lysimachia thyrsiflora	Tufted Loosestrife	7	-5		S5					X				
Ranunculaceae	**Buttercup Family**													
Actaea rubra	Red Baneberry	5	5		S5						X			
Anemone canadensis	Canada Anemone	3	-3		S5					X				
Caltha palustris	Marsh-marigold	5	-5		S5						X			
Ranunculus abortivus	Kidney-leaf Buttercup	2	-2		S5						X			
Ranunculus acris	Tall Buttercup		-2	-2	SE5					X				X
Ranunculus hispidus var. caricetorum	Swamp Buttercup	5	-5		S5						X			
Ranunculus recurvatus var. recurvatus	Hooked Buttercup	4	-3		S5					X	X			
Rhamnaceae	**Buckthorn Family**													
Rhamnus cathartica	European Buckthorn		3	-3	SE5					X	X	X	X	
Frangula alnus	Glossy Buckthorn		-1	-3	SE5					X				
Rosaceae	**Rose Family**													
Agrimonia gryposepala	Tall Hairy Agrimony	2	2		S5					X	X			
Fragaria vesca ssp. americana	Woodland Strawberry	4	4		S5						X			X
Fragaria virginiana	Wild Strawberry				S5					X	X		X	X
Geum aleppicum	Yellow Avens	2	-1		S5						X			
Geum canadense	White Avens	3	0		S5						X	X	X	
Geum urbanum	Wood Avens		5	-1	SE2						X			
Malus domestica	Apple									X				
Prunus pensylvanica	Pin Cherry	3	4		S5					X				
Prunus serotina	Black Cherry	3	3		S5					X	X	X	X	X
Prunus virginiana ssp. virginiana	Choke Cherry	2	1		S5					X	X	X		
Rubus allegheniensis	Alleghany Blackberry	2	2		S5						X	X	X	
Rubus idaeus ssp. melanolasius	Wild Red Raspberry	0	-2		S5					X	X	X		
Rubus pubescens	Dwarf Raspberry	4	-4		S5						X			X
Sorbus aucuparia	European Mountain-ash		5	-2	SE4								X	
Rubiaceae	**Madder Family**													
Galium aparine	Cleavers	4	3		S5						X			

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										VEG-003 SWM4-1	VEG-004 SWM6-1	VEG-005 FOM6-1	VEG-006 FOM6-1	VEG-007 SWM4-1
Galium asprellum	Rough Bedstraw	6	-5		S5						X			
Galium triflorum	Sweet-scented Bedstraw	4	2		S5						X			
Salicaceae	**Willow Family**													
Populus balsamifera ssp. balsamifera	Balsam Poplar	4	-3		S5					X				
Populus tremuloides	Trembling Aspen	2	0		S5					X				X
Salix bebbiana	Long-beaked Willow	4	-4		S5					X				
Salix purpurea	Basket Willow		-3	-1	SE4					X				
Saxifragaceae	**Saxifrage Family**													
Mitella diphylla	Two-leaved Bishop's Cap	5	2		S5						X			
Mitella nuda	Naked Mitrewort	6	-3		S5						X			
Tiarella cordifolia	False Mitrewort	6	1		S5						X			
Scrophulariaceae	**Figwort Family**													
Chelone glabra	Turtlehead	7	-5		S5					X	X			X
Veronica americana	American Speedwell	6	-5		S5									X
Veronica officinalis	Common Speedwell		5	-2	SE5					X			X	
Solanaceae	**Nightshade Family**													
Solanum dulcamara	Bitter Nightshade		0	-2	SE5					X	X	X	X	X
Tiliaceae	**Linden Family**													
Tilia americana	American Basswood	4	3		S5					X	X	X	X	
Ulmaceae	**Elm Family**													
Ulmus americana	White Elm	3	-2		S5									X
Urticaceae	**Nettle Family**													
Boehmeria cylindrica	False Nettle	4	-5		S5						X			
Laportea canadensis	Wood Nettle	6	-3		S5						X			
Pilea pumila	Dwarf Clearweed	5	-3		S5						X			X
Urtica dioica ssp. gracilis	American Stinging Nettle	2	-1		S5						X			
Verbenaceae	**Vervain Family**													
Verbena urticifolia	White Vervain	4	-1		S5					X				
Vitaceae	**Grape Family**													
Parthenocissus vitacea	Woodbine	3	3		S5					X	X	X	X	X
Vitis riparia	Riverbank Grape	0	-2		S5					X	X		X	X
Monocotyledons	**Monocots**													
Araceae	**Arum Family**													
Arisaema triphyllum	Jack-in-the-pulpit	5	-2		S5					X	X	X	X	X
Cyperaceae	**Sedge Family**													
Carex albursina	White Bear Sedge	7	5		S5					X				
Carex arctata	Drooping Wood Sedge	5	5		S5								X	
Carex bebbii	Bebb's Sedge	3	-5		S5					X				
Carex comosa	Bristly Sedge	5	-5		S5					X				
Carex flava	Yellow Sedge	5	-5		S5					X				
Carex gracillima	Graceful Sedge	4	3		S5					X		X	X	X
Carex granularis	Meadow Sedge	3	-4		S5					X				
Carex hitchcockiana	Hitchcock's Sedge	6	5		S5							X	X	
Carex hystericina	Porcupine Sedge	5	-5		S5					X				
Carex interior	Inland Sedge	6	-5		S5					X				
Carex lacustris	Lake-bank Sedge	5	-5		S5						X			
Carex laevivaginata	Smooth-sheathed Sedge	8	-5		S4				R		X			
Carex pedunculata	Long-stalked Sedge	5	5		S5					X	X	X	X	X
Carex radiata	Radiate Sedge	4	5		S5					X	X			

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRANK[2]	COSSARO[3]	COSEWIC[4]	SARA Schedule[4]	Waterloo Region[5]	NRSI Observed				
										VEG-003 SWM4-1	VEG-004 SWM6-1	VEG-005 FOM6-1	VEG-006 FOM6-1	VEG-007 SWM4-1
Carex retrorsa	Retrorse Sedge	5	-5		S5					X				
Carex scabrata	Rough Sedge	8	-5		S5				R		X			
Carex stipata	Awl-fruited Sedge	3	-5		S5						X			X
Carex vulpinoidea	Fox Sedge	3	-5		S5					X				
Eleocharis erythropoda	Red-footed Spike-rush	4	-5		S5					X				
Scirpus atrovirens	Dark-green Bulrush	3	-5		S5					X				
Iridaceae	**Iris Family**													
Sisyrinchium montanum	Montane Blue-eyed-grass		-1		S5					X				
Juncaceae	**Rush Family**													
Juncus effusus var. solutus	Soft Rush	4	-5		S5					X				
Juncus tenuis	Path Rush	0	0		S5					X				
Liliaceae	**Lily Family**													
Allium tricoccum	Wild Leek	7	2		S5							X		
Maianthemum canadense	Wild Lily-of-the-valley	5	0		S5						X	X	X	
Maianthemum racemosum ssp. racemosum	False Solomon's Seal	4	3		S5					X		X		
Maianthemum stellatum	Star-flowered Solomon's Seal	6	1		S5					X		X		
Orchidaceae	**Orchid Family**													
Epipactis helleborine	Common Helleborine		5	-2	SE5					X	X	X	X	X
Poaceae	**Grass Family**													
Dactylis glomerata	Orchard Grass		3	-1	SE5					X				
Elymus virginicus var. virginicus	Virginia Wild Rye	5	-2		S5						X			
Glyceria striata	Fowl Meadow Grass	3	-5		S5					X	X	X		X
Leersia oryzoides	Rice Cut Grass	3	-5		S5					X				X
Leersia virginica	White Cut Grass	6	-3		S4					X				
Muhlenbergia mexicana var. mexicana	Mexican Satin Grass	1	-3		S5					X				
Poa palustris	Fowl Meadow Grass	5	-4		S5					X	X			
Sphenopholis intermedia	Slender Wedge Grass	6	0		S4S5					X				
Typhaceae	**Cattail Family**													
Typha latifolia	Broad-leaved Cattail	3	-5		S5					X				
									Total	**112**	**82**	**39**	**34**	**53**

[1]Oldham et al., 1995, [2]MNRF 2019, [3]MECP 2019, [4]Government of Canada 2018, [5]Richardson and Martin 1999

LEGEND
SRANK
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SE# Introduced
COSEWIC
T Threatened
Region of Waterloo
R Native, Present, Rare
+ Significant only if demonstrably indigenous
* Significant, but additional research may prove otherwise

APPENDIX IV

Avifauna Observed within the Subject Property (2014 – 2019)

Avifauna Observed within Subject Property (2014-2019)

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Breeding Evidence (Br.Ev.) and Abundance (#)													
							Kartway Property		Northgate Property											
							WSU-11		WSU-9		WSU-10		WSU-12		WSU-13		WSU-14		WSU-15	
							Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#
Anatidae	**Ducks, Geese & Swans**																			
Branta canadensis	Canada Goose	S5					X	3	X	1	X	10	X	6	X	12			X	4
Aix sponsa	Wood Duck	S5				√*	P	2												
Anas platyrhynchos	Mallard	S5					H	4	X	2	X	3	P	24			P	3	P	2
Phasianidae	**Partridges, Grouse & Turkeys**																			
Meleagris gallopavo	Wild Turkey	S5					H	6	S	5			X	1	T	8			H	2
Columbidae	**Pigeons & Doves**																			
Zenaida macroura	Mourning Dove	S5					P	2			S	1					S	1	S	1
Caprimulgidae	**Goatsuckers**																			
Chordeiles minor	Common Nighthawk	S4B	SC	SC	Schedule 1	√*			X	1			X	2						
Trochilidae	**Hummingbirds**																			
Archilochus colubris	Ruby-throated Hummingbird	S5B				√	H	1												
Charadriidae	**Plovers**																			
Charadrius vociferus	Killdeer	S5B, S5N							A	1			D	3	H	1	H	1	H	1
Scolopacidae	**Waders**																			
Scolopax minor	American Woodcock	S4B					H	1					S	1	H	1				
Actitis macularia	Spotted Sandpiper	S5											P	2						
Laridae	**Gulls, Terns & Skimmers**																			
Larus delawarensis	Ring-billed Gull	S5B, S4N					X	1	X	1	X	1								
Ardeidae	**Herons & Bitterns**																			
Ardea herodias	Great Blue Heron	S4B				√	H	2					X	1					X	1
Butorides virescens	Green Heron	S4B				√	S	1												
Cathartidae	**Vultures**																			
Cathartes aura	Turkey Vulture	S5B				√	X	2												
Strigidae	**Typical Owls**																			
Bubo virgianus	Great Horned Owl	S4													FY	1				
Alcedinidae	**Kingfishers**																			
Megaceryle alcyon	Belted Kingfisher	S4B				√											H	1		
Picidae	**Woodpeckers**																			
Melanerpes carolinus	Red-bellied Woodpecker	S4				√	T	1							S	1			S	2
Picoides pubescens	Downy Woodpecker	S5					S	1					X	1	P	2	H	1	S	1
Picoides villosus	Hairy Woodpecker	S5													NY	2				
Colaptes auratus	Northern Flicker	S4B					P	2			S	1			H	1	H	1	S	1
Dryocopus pileatus	Pileated Woodpecker	S5				√									H	1				
Tyrannidae	**Tyrant Flycatchers**																			
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC			S	1							T	1	S	1	T	4
Empidonax alnorum	Alder Flycatcher	S5B				√	S	1												
Empidonax traillii	Willow Flycatcher	S5B					S	2												
Empidonax minimus	Least Flycatcher	S4B				√	S	1												
Myiarchus crinitus	Great Crested Flycatcher	S4B					T	1			S	1	S	2	S	2	A	1	A	3

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Breeding Evidence (Br.Ev.) and Abundance (#)											
							Kartway Property		Northgate Property									
							WSU-11		WSU-9		WSU-10		WSU-12		WSU-13		WSU-14		WSU-15	
							Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#
Tyrannus tyrannus	Eastern Kingbird	S4B							S	1							S	1	S	1
Vireonidae	**Vireos**																			
Vireo gilvis	Warbling Vireo	S5B															S	1		
Vireo olivaceus	Red-eyed Vireo	S5B					S	2							S	2			P	3
Corvidae	**Crows & Jays**																			
Cyanocitta cristata	Blue Jay	S5					S	1			S	3			S	3			A	4
Corvus brachyrhynchos	American Crow	S5B					H	2	X	1			X	1	H	10	H	2	A	8
Alaudidae	**Larks**																			
Eremophila alpestris	Horned Lark	S5B							S	2	S	1	T	6	S	2	S	2	S	1
Hirundinidae	**Swallows**																			
Tachycineta bicolor	Tree Swallow	S4B					H	1												
Hirundo rustica	Barn Swallow	S4B	THR	T			AE	6					X	2						
Paridae	**Chickadees & Titmice**																			
Poecile atricapillus	Black-capped Chickadee	S5					S	3			S	2	H	1	P	3	P	3	P	2
Sittidae	**Nuthatches**																			
Sitta carolinensis	White-breasted Nuthatch	S5					S	1							S	1			H	1
Certhiidae	**Creepers**																			
Certhia americana	Brown Creeper	S5B				√									S	1			S	1
Troglodytidae	**Wrens**																			
Troglodytes aedon	House Wren	S5B					T	3	S	1			S	1	S	1	T	1	NY	3
Polioptilidae	**Gnatcatchers**																			
Polioptila caerulea	Blue-gray Gnatcatcher	S4B				√	S	1												
Turdidae	**Thrushes**																			
Catharus fuscescens	Veery	S4B				√													S	1
Turdus migratorius	American Robin	S5B					CF	3	S	2	P	2	P	2	N	4	FY	2	FY	3
Mimidae	**Mockingbirds, Thrashers & Allies**																			
Dumetella carolinensis	Gray Catbird	S4B					S	2							S	1	S	1	S	1
Toxostoma rufum	Brown Thrasher	S4B				√	H	1							P	2				
Sturnidae	**Starlings**																			
Sturnus vulgaris	European Starling	SNA					AE	3	S	12			H	1			H	2		
Bombycillidae	**Waxwings**																			
Bombycilla cedrorum	Cedar Waxwing	S5B					S	2					X	2	P	3	H	1	S	2
Fringillidae	**Finches & Allies**																			
Spinus tristis	American Goldfinch	S5B					S	4	S	3	H	2	S	4	P	5	T	2	S	2
Parulidae	**Wood Warblers**																			
Geothylpis trichas	Common Yellowthroat	S5B					S	2							P	2	S	2	T	1
Setophaga ruticilla	American Redstart	S5B				√									S	1			S	1
Setophaga petechia	Yellow Warbler	S5B					S	1									H	1	S	1
Setophaga pensylvanica	Chestnut-sided Warbler	S5B				√	S	1											S	1
Setophaga pinus	Pine Warbler	S5B				√	S	2							S	2			S	1

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Breeding Evidence (Br.Ev.) and Abundance (#)											
							Kartway Property		Northgate Property									
							WSU-11		WSU-9		WSU-10		WSU-12		WSU-13		WSU-14		WSU-15	
							Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#
Emberizidae	**New World Sparrows & Allies**																			
Spizella passerina	Chipping Sparrow	S5B					T	2					N	4	S	1	S	2	S	2
Pooecetes gramineus	Vesper Sparrow	S4B				√							S	1	S	1				
Melospiza melodia	Song Sparrow	S5B					A	3	S	1			S	2	S	1	A	2	T	2
Melospiza georgiana	Swamp Sparrow	S5B					S	1												
Cardinalidae	**Cardinals, Grosbeaks & Allies**																			
Cardinalis cardinalis	Northern Cardinal	S5					T	2	S	1			S	1	S	2	P	2	S	2
Pheucticus ludovicianus	Rose-breasted Grosbeak	S4B					T	1							S	1	S	1	S	2
Passerina cyanea	Indigo Bunting	S4B					S	1	S	2	S	1			S	1	S	1	S	2
Icteridae	**Blackbirds**																			
Agelaius phoeniceus	Red-winged Blackbird	S4					T	2	S	1			X	2	H	1	A	9	D	5
Quiscalus quiscula	Common Grackle	S5B					CF	2	H	3					CF	2	H	1	CF	1
Molothrus ater	Brown-headed Cowbird	S4B					S	2	S	1			P	4	S	1	T	2	P	2
Icterus galbula	Baltimore Oriole	S4B					P	2									S	1	S	1
						Total	**48**		**19**		**12**		**25**		**37**		**30**		**39**	

[1]MNRF 2019, [2]MECP 2019, [3]Government of Canada 2018, [4]Martin 1996

LEGEND
SRANK
S4 Apparently Secure
S5 Secure
SNA Unranked
COSSARO/COSEWIC
NAR Not at Risk
SC Special Concern
THR/T Threatened
SARA Schedule
Schedule 1 Officially Protected under SARA
Waterloo Region
√ Regionally Significant
√* Significant when nesting in natural circumstances

Avifauna Observed within Subject Lands (Incidental Observations) (2014-2019)

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Abundance (#)						
							Kartway Property	Northgate Property					
							WSU-11	WSU-9	WSU-10	WSU-12	WSU-13	WSU-14	WSU-15
Anatidae	**Ducks, Geese & Swans**												
Branta canadensis	Canada Goose	S5					1	20	1	35	1	1	15
Aix sponsa	Wood Duck	S5				√*	2						
Anas platyrhynchos	Mallard	S5					2	1		1	1	1	
Phasianidae	**Partridges, Grouse & Turkeys**												
Meleagris gallopavo	Wild Turkey	S5					1	1	12	7	1	1	8
Columbidae	**Pigeons & Doves**												
Zenaida macroura	Mourning Dove	S5					1				1		1
Caprimulgidae	**Goatsuckers**												
Chordeiles minor	Common Nighthawk	S4B	SC	SC	Schedule 1	√*		1					
Trochilidae	**Hummingbirds**												
Archilochus colubris	Ruby-throated Hummingbird	S5B				√	1						
Charadriidae	**Plovers**												
Charadrius vociferus	Killdeer	S5B, S5N					2	1		1	1	1	1
Scolopacidae	**Waders**												
Scolopax minor	American Woodcock	S4B					1			1	1		
Actitis macularia	Spotted Sandpiper	S5								1			
Tringa solitaria	Solitary Sandpiper	S4B											1
Laridae	**Gulls, Terns & Skimmers**												
Larus delawarensis	Ring-billed Gull	S5B, S4N					1			2			
Ardeidae	**Herons & Bitterns**												
Ardea herodias	Great Blue Heron	S4B				√	1					3	
Cathartidae	**Vultures**												
Cathartes aura	Turkey Vulture	S5B				√	1				1		1
Accipitridae	**Hawks, Kites, Eagles & Allies**												
Buteo jamaicensis	Red-tailed Hawk	S5	NAR	NAR			1			1			
Strigidae	**Typical Owls**												
Bubo virgianus	Great Horned Owl	S4									1		
Alcedinidae	**Kingfishers**												
Megaceryle alcyon	Belted Kingfisher	S4B				√	1						
Picidae	**Woodpeckers**												
Melanerpes carolinus	Red-bellied Woodpecker	S4				√	1				1		1
Picoides pubescens	Downy Woodpecker	S5					1				1	1	1
Picoides villosus	Hairy Woodpecker	S5									1		
Colaptes auratus	Northern Flicker	S4B					1		1	1	1		5

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Abundance (#)						
							Kartway Property	Northgate Property					
							WSU-11	WSU-9	WSU-10	WSU-12	WSU-13	WSU-14	WSU-15
Dryocopus pileatus	Pileated Woodpecker	S5				√					1		
Tyrannidae	**Tyrant Flycatchers**												
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC			1		1		1		1
Empidonax alnorum	Alder Flycatcher	S5B				√	1						
Myiarchus crinitus	Great Crested Flycatcher	S4B					1			1	1	1	1
Tyrannus tyrannus	Eastern Kingbird	S4B					1					1	
Vireonidae	**Vireos**												
Vireo olivaceus	Red-eyed Vireo	S5B											1
Corvidae	**Crows & Jays**												
Cyanocitta cristata	Blue Jay	S5					2	1	1		1	1	1
Corvus brachyrhynchos	American Crow	S5B					1		1	1	1	1	1
Alaudidae	**Larks**												
Eremophila alpestris	Horned Lark	S5B						9			1		
Hirundinidae	**Swallows**												
Tachycineta bicolor	Tree Swallow	S4B									1		
Hirundo rustica	Barn Swallow	S4B	THR	T			2		2	2			
Paridae	**Chickadees & Titmice**												
Poecile atricapillus	Black-capped Chickadee	S5					2				1	1	1
Sittidae	**Nuthatches**												
Sitta carolinensis	White-breasted Nuthatch	S5					2				1		1
Certhiidae	**Creepers**												
Certhia americana	Brown Creeper	S5B				√					1		
Troglodytidae	**Wrens**												
Troglodytes aedon	House Wren	S5B					2		1		1		
Regulidae	**Kinglets**												
Regulus satrapa	Golden-crowned Kinglet	S5B				√					1		1
Regulus calendula	Ruby-crowned Kinglet	S4B				√	1						
Turdidae	**Thrushes**												
Sialia sialis	Eastern Bluebird	S5B	NAR	NAR		√	2						
Catharus ustulatus	Swainson's Thrush	S4B				√					1		
Hylocichla mustelina	Wood Thrush	S4B	SC	T							1		
Turdus migratorius	American Robin	S5B					1	1	1	1	1	1	1
Mimidae	**Mockingbirds, Thrashers & Allies**												
Dumetella carolinensis	Gray Catbird	S4B					1					1	
Toxostoma rufum	Brown Thrasher	S4B				√	1				1		
Sturnidae	**Starlings**												
Sturnus vulgaris	European Starling	SNA					1	5	1	1	1	8	1

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Abundance (#)						
							Kartway Property	Northgate Property					
							WSU-11	WSU-9	WSU-10	WSU-12	WSU-13	WSU-14	WSU-15
Bombycillidae	**Waxwings**												
Bombycilla cedrorum	Cedar Waxwing	S5B					1				1		1
Fringillidae	**Finches & Allies**												
Carpodacus mexicanus	House Finch	SNA									1		
Spinus pinus	Pine Siskin	S4B				√	1				1		1
Spinus tristis	American Goldfinch	S5B					1	1	1	1	1	1	1
Parulidae	**Wood Warblers**												
Geothylpis trichas	Common Yellowthroat	S5B					1				2	1	
Setophaga petechia	Yellow Warbler	S5B					1						
Setophaga striata	Blackpoll Warbler	S4B					1				1		
Setophaga pinus	Pine Warbler	S5B				√	1						1
Emberizidae	**New World Sparrows & Allies**												
Spizella arborea	American Tree Sparrow	S4B					2						
Spizella passerina	Chipping Sparrow	S5B					1	1			1	1	1
Pooecetes gramineus	Vesper Sparrow	S4B				√		1					
Melospiza melodia	Song Sparrow	S5B					1	1		1		1	
Junco hyemalis	Dark-eyed Junco	S5B					1						
Cardinalidae	**Cardinals, Grosbeaks & Allies**												
Cardinalis cardinalis	Northern Cardinal	S5					1		1	1	1	1	1
Pheucticus ludovicianus	Rose-breasted Grosbeak	S4B					1		1				
Passerina cyanea	Indigo Bunting	S4B					1	1	1	1	1	1	1
Icteridae	**Blackbirds**												
Agelaius phoeniceus	Red-winged Blackbird	S4					1			1	1	2	1
Quiscalus quiscula	Common Grackle	S5B					3	1	1	1		1	1
Molothrus ater	Brown-headed Cowbird	S4B					1	1		1	1	1	1
Icterus galbula	Baltimore Oriole	S4B										1	
						Total	**49**	**16**	**15**	**21**	**40**	**24**	**29**

[1]MNRF 2019, [2]MECP 2019, [3]Government of Canada 2018, [4]Martin 1996

LEGEND
SRANK
S4 Apparently Secure
S5 Secure
SNA Unranked
COSSARO/COSEWIC
NAR Not at Risk
SC Special Concern
THR/T Threatened
SARA Schedule
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Waterloo Region
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APPENDIX V

Anuran Monitoring Data from within the Subject Property (2014 – 2019)

Anuran Monitoring Data from within the Subject Property (2014-2019)

Station ANR-004		2014			2015			2016			2017			2018			2019		
Common Name	**Scientific Name**	April 21	May 12	June 10	April 16	May 25	June 16	April 18	May 17	June 21	April 11	May 18	June 22	April 26	May 16	June 18	April 28	May 22	June 18
American Toad	*Bufo americanus*	Nothing Heard	Nothing Heard	Nothing Heard			Nothing Heard		Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard
Northern Spring Peeper	*Pseudacris crucifer crucifer*				3			1(1)											
Tetraploid Gray Treefrog	*Hyla versicolor*					2 (3)													
Western Chorus Frog	*Pseudacris triseriata*																		
Northern Leopard Frog	*Rana pipiens*																		
Pickerel Frog	*Rana palustris*																		
Green Frog	*Rana clamitans melanota*																		
Mink Frog	*Rana septentrionalis*																		
Bullfrog	*Rana catesbeiana*																		
Wood Frog	*Rana sylvatica*																		
	Beaufort Wind Scale	1	2	2	3	3	1	1	1	0	3	1-2	3	0	1	2	0	0	0
	% Cloud Cover	100	100	50	100	30	0	0	10	40	100	0	85	5	20	95	0	5	60
	Air temp. (°C)	17	16.5-18	21.6-23	9	14	16	13	13	16	10	19	23	9	21	22	5	12	19
	Water temp. (°C)	N/A	N/A	N/A	N/A	17.4	16.6	N/A	11.3	N/A	N/A	N/A	17	N/A	N/A	N/A	N/A	N/A	N/A
	Water pH	N/A	N/A	N/A	N/A	8.8	7.8	N/A	6.8	N/A	N/A	N/A	8.5	N/A	N/A	N/A	N/A	N/A	N/A
	Precipitation	None	Drizzle	Drizzle	None	Light rain	None	None	None	None	None	None	None	None	None	None	None	None	None

Station ANR-005		2014			2015			2016			2017			2018			2019		
Common Name	**Scientific Name**	April 21	May 12	June 10	April 16	May 25	June 16	April 18	May 17	June 21	April 11	May 18	June 22	April 26	May 16	June 18	April 28	May 22	June 18
American Toad	*Bufo americanus*	Nothing Heard	Nothing Heard	Nothing Heard			Nothing Heard		Nothing Heard		Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard		Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard
Northern Spring Peeper	*Pseudacris crucifer crucifer*				3	3		1 (2)							3				
Tetraploid Gray Treefrog	*Hyla versicolor*					1 (1)									2 (3)				
Western Chorus Frog	*Pseudacris triseriata*																		
Northern Leopard Frog	*Rana pipiens*																		
Pickerel Frog	*Rana palustris*																		
Green Frog	*Rana clamitans melanota*									1 (1)									
Mink Frog	*Rana septentrionalis*																		
Bullfrog	*Rana catesbeiana*																		
Wood Frog	*Rana sylvatica*																		
	Beaufort Wind Scale	1	2	2	1	3	1	1	1	0	3	2	1	0	1	3	0	0	0
	% Cloud Cover	100	100	50	100	20	0	0	10	40	100	0	90	5	20	85	0	5	60
	Air temp. (°C)	17	16.5-18	21.6-23	9	14	16	13	12	16	9	19	23	7	20	21	5	11	19
	Water temp. (°C)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Water pH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Precipitation	None	Drizzle	Drizzle	Light rain	None	None	None	None	None	None	None	Light rain	None	None	None	None	None	None

Station ANR-006		2014			2015			2016			2017			2018			2019		
Common Name	**Scientific Name**	April 21	May 12	June 10	April 16	May 25	June 16	April 18	May 17	June 21	April 11	May 18	June 22	April 26	May 16	June 18	April 28	May 22	June 18
American Toad	*Bufo americanus*	Nothing Heard	Nothing Heard	Nothing Heard				1 (1)		Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard
Northern Spring Peeper	*Pseudacris crucifer crucifer*				3	1 (1)		2 (5)	1 (2)										
Tetraploid Gray Treefrog	*Hyla versicolor*						1 (2)												
Western Chorus Frog	*Pseudacris triseriata*																		
Northern Leopard Frog	*Rana pipiens*																		
Pickerel Frog	*Rana palustris*																		
Green Frog	*Rana clamitans melanota*																		
Mink Frog	*Rana septentrionalis*																		
Bullfrog	*Rana catesbeiana*																		
Wood Frog	*Rana sylvatica*				1 (1)			1 (2)											
	Beaufort Wind Scale	1	2	2	3	3	1	1	1	0	3	2	4	0	1	2	0	0	0
	% Cloud Cover	100	100	50	100	30	0	0	10	40	100	0	95	5	20	95	0	5	60
	Air temp. (°C)	17	16.5-18	21.6-23	8	14	16	13	12	18	10	19	24	9	20	22	5	12	19
	Water temp. (°C)	N/A	N/A	N/A	N/A	N/A	19.5	N/A	N/A	16.4	N/A	N/A	15.5	N/A	N/A	N/A	N/A	N/A	N/A
	Water pH	N/A	N/A	N/A	N/A	N/A	7.9	N/A	N/A	7.7	N/A	N/A	8.8	N/A	N/A	N/A	N/A	N/A	N/A
	Precipitation	None	Drizzle	Drizzle	Light rain	Light rain	None	None	None	None	None	None	None	None	None	None	None	None	None

Station ANR-007		2014			2015			2016			2017			2018			2019		
Common Name	**Scientific Name**	April 21	May 12	June 10	April 16	May 25	June 16	April 18	May 17	June 21	April 11	May 18	June 22	April 26	May 16	June 18	April 28	May 22	June 18
American Toad	*Bufo americanus*	Station Not Surveyed	Station Not Surveyed	Station Not Surveyed	Nothing Heard	Nothing Heard		1 (1)	Nothing Heard	Nothing Heard		Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard
Northern Spring Peeper	*Pseudarcris crucifer crucifer*							3			1 (1)								
Tetraploid Gray Treefrog	*Hyla versicolor*						1 (2)												
Western Chorus Frog	*Pseudacris triseriata*																		
Northern Leopard Frog	*Rana pipiens*																		
Pickerel Frog	*Rana palustris*																		
Green Frog	*Rana clamitans melanota*																		
Mink Frog	*Rana septentrionalis*																		
Bullfrog	*Rana catesbeiana*																		
Wood Frog	*Rana sylvatica*							1 (2)											
	Beaufort Wind Scale	1	2	2	3	3	1	1-2	1	0	3	2-3	4	0	1	3	0	0	0
	% Cloud Cover	100	100	50	100	30	0	0	10	40	100	0	85	5	20	90	0	5	60
	Air temp. (°C)	17	16.5-18	21.6-23	8	14	16	13	13	16	11	18	24	8	20	22	5	12	19
	Water temp. (°C)	N/A	N/A	N/A	N/A	N/A	14.7	13.3	11.4	N/A	12.7	N/A	19.5	N/A	N/A	N/A	N/A	N/A	N/A
	Water pH	N/A	N/A	N/A	N/A	N/A	7.8	8.2	6.9	N/A	7.8	N/A	8.4	N/A	N/A	N/A	N/A	N/A	N/A
	Precipitation	None	Drizzle	Drizzle	Light rain	Light rain	None	None	None	None	None	None	None	None	None	None	None	None	None

Station ANR-008		2014			2015			2016			2017			2018			2019		
Common Name	**Scientific Name**	April 21	May 12	June 10	April 16	May 25	June 16	April 18	May 17	June 21	April 11	May 18	June 22	April 26	May 16	June 18	April 28	May 22	June 18
American Toad	*Bufo americanus*	Station Not Surveyed	Station Not Surveyed	Station Not Surveyed		Nothing Heard				Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard		Nothing Heard		Nothing Heard	Nothing Heard
Northern Spring Peeper	*Pseudarcris crucifer crucifer*				3			3	1 (2)						3				
Tetraploid Gray Treefrog	*Hyla versicolor*						1 (2)								2 (3)				
Western Chorus Frog	*Pseudacris triseriata*																		
Northern Leopard Frog	*Rana pipiens*																		
Pickerel Frog	*Rana palustris*																		
Green Frog	*Rana clamitans melanota*																		
Mink Frog	*Rana septentrionalis*																		
Bullfrog	*Rana catesbeiana*																		
Wood Frog	*Rana sylvatica*																1 (1)		
	Beaufort Wind Scale	1	2	2	3	3	1	1	1	0	3	2	3	0	1	1	0	0	0
	% Cloud Cover	100	100	50	100	20	0	0	10	40	100	0	90	5	20	95	0	5	60
	Air temp. (°C)	17	16.5-18	21.6-23	8	14	18	13	12	18	10	18	23	8	20	22	5	12	19
	Water temp. (°C)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Water pH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Precipitation	None	Drizzle	Drizzle	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None

LEGEND		
X individual seen, but not calling		
# ( ) call intensity and estimated number of individuals		
Call Level Codes		
1 Calls can be counted; not simultaneous		
2 Some simultaneous calls; yet distinguishable		
3 Calls not distinguishable individually; overlapping		
NA (Not Applicable) denotes lack of water or not recorded		
Beaufort Wind Scale #	**KPH**	**Description**
0	0-2	Calm; smoke rises vertically
1	3 to 5	Light air movement; smoke drifts
2	6 to 11	Slight Breeze; felt on face, leaves rustle
3	12 to 19	Gentle breeze; leaves and small twigs in constant
4*	20-30	Moderate breeze; small branches are moving, raises
5*	31-39	Fresh breeze; small trees in leaf begin to sway,
6*	40-50	Strong breeze, large branches in motion
	*	Unacceptable wind strengths for amphibian surveys

APPENDIX VI

Mammal Species Observed within the Subject Property (2014 – 2019)

Mammal Species Observed within the Subject Property (2014-2019)

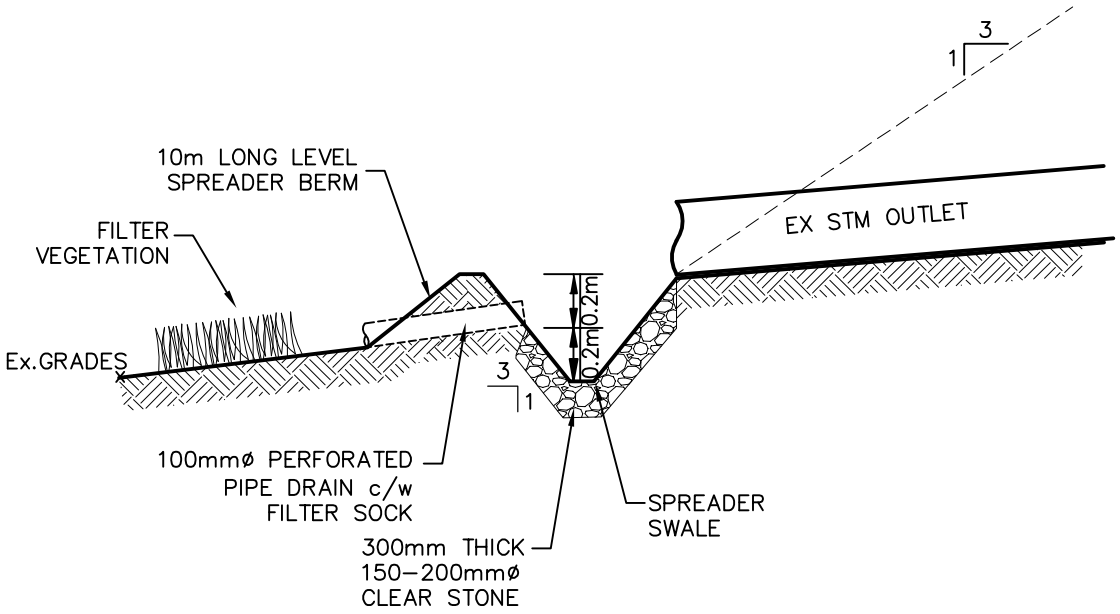
Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Ontario Mammal Atlas[5]	NRSI Observed
Didelphimorphia	**Opossums**							
Didelphis virginiana	Virginia Opossum	S4				R	X	X
Insectivora	**Shrews and Moles**							
Blarina brevicauda	Northern Short-tailed Shrew	S5					X	
Condylura cristata	Star-nosed Mole	S5					X	
Parascalops breweri	Hairy-tailed Mole	S4				R	X	
Sorex sp.	Shrew sp.							X
Sorex cinereus	Masked Shrew	S5				G	X	
Sorex fumeus	Smoky Shrew	S5				R	X	
Sorex palustris	Water Shrew	S5				R	X	
Chiroptera	**Bats**							
Eptesicus fuscus	Big Brown Bat	S5					X	
Lasionycteris noctivagans	Silver-haired Bat	S4					X	
Lasiurus borealis	Red Bat	S4					X	
Lasiurus cinereus	Hoary Bat	S4					X	
Myotis lucifugus	Little Brown Myotis	S4	END	E	Schedule 1		X	
Myotis septentrionalis	Northern Myotis	S3	END	E	Schedule 1		X	
Perimyotis subflavus	Tri-colored Bat	S3?		E	Schedule 1		X	
Lagomorpha	**Rabbits and Hares**							
Lepus americanus	Snowshoe Hare	S5				S	X	
Lepus europaeus	European Hare	SNA					X	
Sylvilagus floridanus	Eastern Cottontail	S5					X	X
Rodentia	**Rodents**							
Castor canadensis	Beaver	S5				S	X	
Erethizon dorsatum	Porcupine	S5				S	X	
Glaucomys sabrinus	Northern Flying Squirrel	S5				R	X	
Marmota monax	Woodchuck	S5					X	X
Microtus pennsylvanicus	Meadow Vole	S5					X	X
Mus musculus	House Mouse	SNA					X	
Napaeozapus insignis	Woodland Jumping Mouse	S5					X	
Ondatra zibethicus	Muskrat	S5					X	
Peromyscus sp.	Mouse sp.							X

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Ontario Mammal Atlas[5]	NRSI Observed
Peromyscus leucopus	White-footed Mouse	S5					X	
Peromyscus maniculatus	Deer Mouse	S5					X	
Rattus norvegicus	Norway Rat	SNA					X	
Sciurus carolinensis	Eastern Gray Squirrel	S5					X	X
Tamiasciurus hudsonicus	Red Squirrel	S5					X	X
Tamias striatus	Eastern Chipmunk	S5					X	X
Zapus hudsonius	Meadow Jumping Mouse	S5					X	
Carnivora	**Carnivores**							
Canis latrans	Coyote	S5				S	X	X
Mephitis mephitis	Striped Skunk	S5					X	X
Mustela sp.	Weasel sp.							X
Mustela erminea	Ermine	S5					X	X
Mustela frenata	Long-tailed Weasel	S4				S	X	
Mustela vison	American Mink	S4				S	X	X
Procyon lotor	Northern Raccoon	S5					X	X
Vulpes vulpes	Red Fox	S5					X	X
Artiodactyla	**Deer and Bison**							
Odocoileus virginianus	White-tailed Deer	S5					X	X
[1]MNRF 2019, [2]MECP 2019, [3]Government of Canada 2018, [4]Regional Municipality of Waterloo 1985, [5]Dobbyn 1994						**Total**	**40**	**17**

LEGEND
SRANK
S3 Vulnerable
S4 Apparently Secure
S5 Secure
S#? Rank Uncertain
SNA Unranked
COSSARO/COSEWIC
END/E Endangered
SARA Schedule
Schedule 1 Officially protected under SARA
Region of Waterloo
G General
R Rare
S Scarce

APPENDIX VII

Spreader Berm and Spreader Swale Design Drawing (Kartway Property)



SPREADER BERM AND SPREADER SWALE

N.T.S.

APPENDIX VIII
Blanding's Turtle Mitigation Plan

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Memo

1531B

Date: **June 8, 2020**

Re: **Blanding's Turtle Habitat Mitigation North Waterloo**

Blanding's Turtle Mitigation Plan Technical Memo

A large portion of the Beaver Creek Meadows District Plan (BCMDP) community is within the regulated habitat of Blanding's Turtle (*Emydoidea blandingii*). Blanding's Turtle is a Threatened species in Ontario and the species receives both individual and general habitat protection under the Endangered Species Act (2007). This mitigation plan is based on the original technical submission that was approved by MECP in 2019 (M. Karam and T. Copeland) and provides further detail on how the mitigation strategy is to be implemented.

NRSI is working for a number of landowners in the BCMDP area who are proposing residential development of their properties. Information Gathering Forms (IGF) have been submitted previously for 2155881 Ontario Limited, Northgate Corporation and Erbsville Kartway. NRSI is also working on an environmental study for the proposed communal stormwater management pond in the study area and has been in contact with MNRF and MECP on the implications of development in this area on Blanding's Turtle. Stantec Consultants is working for the City of Waterloo and has submitted an IGF and is working on further information as part of a municipal Class Environmental Assessment for the improvements to Conservation Drive and Beaver Creek Road. All of these projects are within the mapped habitat of Blanding's turtle, and it was determined through advice from MNRF that a collaborative approach amongst the teams would be appropriate to ensure that mitigation measures to protect the turtle and its habitat are being considered and proposed at a landscape level.

Blanding's Turtle habitat has been categorized by the MNRF, as follows:

- Category 1: Nest and area within 30m or Overwintering sites and the area within 30m.
- Category 2: The wetland complex (i.e. all suitable wetlands or waterbodies within 500m of each other) that extends up to 2 km from an occurrence, and the area within 30m around those suitable wetlands or waterbodies.
- Category 3: Area between 30m and 250m around suitable wetlands/waterbodies identified in Category 2, within 2 km of an occurrence.

The first step in managing impacts to the turtle and its habitat is to map the current extent of habitat and its existing condition. The MNRF provided baseline mapping of Category 2 and 3 habitats and this was applied to the study area. The habitat categories were edited based on knowledge of the sites in terms of barriers to turtle movement (i.e. existing chain link fencing) and areas that are not suitable (i.e. existing road surfaces). Category 1 habitat is not shown for data sensitivity reasons.

The known proposed developments in the local area are overlaid onto the categories of habitat mapping and shown on Map 1. This includes the draft plan of subdivision for Northgate South, Erbsville Kartway, 2115881 Ontario Limited and Activa. The City planned projects including the road improvements to Conservation Drive and Beaver Creek Road are shown as well as the preferred option for the communal stormwater management pond. Preliminary concepts plans for Northgate North and its connection through the Creekside Community church property are shown for context. No concepts were available for Mar-View Farms or the north central land parcel or other properties. Lands to the south and east of the BCMDP are owned by the Grand River Conservation Authority (GRCA) and will not be developed, but are used for outdoor recreation and education. Lands to the north of the BCMDP are outside of the City of Waterloo boundary and will remain in a rural state. There is potential for additional development of lands to the west and southwest of the BCMDP but this is limited due to the City of Waterloo urban boundary and the presence of provincially significant wetlands, floodplain and the Laurel Creek Headwaters Environmentally Sensitive Landscape mapped in the Region of Waterloo Official Plan.

Efforts were made in designing the proposed developments to avoid Category 2 habitats. In some cases in the study area it is not possible to avoid activities in Category 2 habitat such as road improvements, stormwater management functions and grading. Blanding's Turtles depend on these areas as movement corridors between wetlands. Knowing that the proposed developments overlap with the Category 2 and 3 habitats for Blanding's turtle, a series of maps were prepared to show a collaborative approach to mitigate impacts. Overlaps by the proposed developments with Category 2 habitat are very limited and include small encroachments along Beaver Creek Road and Conservation Drive due to widening and location of a stormwater outlet along Beaver Creek Road due to the City of Waterloo projects. Minimal encroachment (<5m) for transitional grading and location of a community trail may be necessary on Northgate and other developer properties.

Avoiding impacts to Category 2 habitat includes delineation and protection of a 30m buffer around the wetlands. Improvements to roads that are adjacent to wetlands cannot avoid encroaching into Category 2 habitat. The potential impact of such encroachments is to be addressed through design and enhanced mitigation measures. Culverts for eco-passage, construction fencing to limit the extent of the work and permanent fencing to prevent turtles from accessing the road surface will mitigate the potential for road mortality of the species. These measures are proposed by Stantec for the Conservation Drive and Beaver Creek Road project to avoid damage or destruction of Category 2 habitats.

Stormwater management facilities are proposed by individual developers as part of their developments as well as the communal stormwater management pond. The ponds themselves are generally located in Category 3 habitat, adjacent to wetlands, but outside of the Category 2 habitat. Some grading for pond slopes may encroach into the outer 15m of the Category 2 habitat. The grading will be a temporary impact during construction, following which those areas will be seeded and restored to natural vegetation. Permanent turtle barrier fencing is proposed to prevent turtles from accessing the open water portion of the ponds based on guidance from the MNRF to avoid harm to the species.

Impacts to Category 3 habitat are associated with the residential developments proposed in the agricultural fields as well as road widenings, roundabout and the communal and other stormwater management facilities.

A plan to mitigate impacts to Category 3 habitats is the main focus of this memo. Maps 1-7 show the proposed mitigation measures to ensure that safe and suitable movement corridors continue to be provided through the development of the subject properties. The mitigation plan maps are organized by Phase based on anticipated timing. Mitigation measures are described in Table 1 and shown on the maps to indicate proponent responsibility.

Table 1. Mitigation Plan Organization (see Maps 1-7)

Phase	Undertaking	Responsiblily	Anticipated Date	Mitigation Details
1a	Beaver Creek Road	City of Waterloo	2020	• Turtle barrier fencing along length of wetlands • Laurel Creek culvert improvements for ecopassage with directional fencing • Retention of existing Laurel Creek culvert with directional fencing • Turtle nesting beds on east side of Beaver Creek Road
1b	Conservation Drive East	City of Waterloo	2020	• Turtle barrier fencing along length of wetlands • Beaver Creek culvert improvements for ecopassage with directional fencing
2	BCMDP Communal SWM Facility	City of Waterloo	2022	• Turtle barrier fencing along south side of property
3	Northgate South / Erbsville Kartway, Activa, 2115881 Ontario Ltd.	Developers	2023	**Northgate South / Erbsville Kartway** • Turtle barrier fencing along outer edge of NHS buffer • Ecopassage at access road with directional fencing **2115881 Ontario Ltd.** • Turtle barrier fencing along outer edge of NHS buffer **Activa** • None
4	Conservation Drive West to Erbsville Road	City of Waterloo	2025	• Turtle barrier fencing along north and south side of road • Ecopassage at Laurel Creek tributary with directional fencing
5	Northgate North and others	Developers	2030	• Turtle barrier fencing along outer edge of NHS buffer

Map 1 is a key map showing the study area and the context of the more detailed Maps 2-7 which show the mitigation measures phase by phase, as listed in Table 1. Phases 1a and 1b are the City-planned improvements to the main roads in the study area and are anticipated to be the first development activities to proceed. The mitigation strategy for Phases 1a and 1b is shown approximately on Maps 2 and 3 based on drawings provided by Stantec. Mitigation measures for these projects are designed by Stantec on behalf of the City, as part of the detailed design process and full details are provided in their reports. Potential impacts to Blanding's turtles related to these phases are primarily due to road mortality and therefore, mitigation focuses on preventing turtles from accessing the road surface, and providing passage under Beaver Creek Road and Conservation Drive. Road improvements include ecopassage measures by maintaining and upgrading culverts at key locations for turtles to be able to travel from wetland to wetland safely. New culverts at the Laurel Creek wetlands and at Beaver Creek are shown in red on Maps 2 and 3.. Culverts have been designed according to the recommendations of the MNRF document "*Best Management Practices for Mitigating the Effects of Roads on Amphibian and Reptile Species at Risk in Ontario (2016)".* In combination with the ecopassage culverts, permanent barrier fencing is proposed along the roads to direct turtles towards the safe passage and to prevent them from entering the travelled portion of the road. Barrier fencing associated with the road improvements and Category 2 habitat is a City of Waterloo responsibility and is shown in purple on Maps 2 and 3. Turtle nesting beds are proposed to be constructed by the City of Waterloo along the eastern side of Beaver Creek Road (shown in pink on Map 2), creating new potential Category 1 habitat.

Phase 2 of the development of this study area is expected to be the construction of the BCMD Communal SWM facility, as shown on Map 4. The SWM facility has been placed outside of Category 2 habitat but will require permanent fencing to prevent turtles from entering the pond. The City typically requires SWM facilities to be fenced for public safety, but a specific wildlife type of fence is required such that turtles, including very small juveniles, cannot move through the fence. We recommend ERTEC or Animex Free Standing Wildlife Fencing, or MTO Mesh/Wood design (or similar) at a height of 26". This fencing is a permanent solid product with an overhang that provides one-way access for wildlife, such that if trapped, turtles or other animals can exit the developed side of the fence, but cannot climb over from the natural heritage side of the fence. An example of the fencing is shown on Drawing 1, attached. This fencing can be combined with standard chain link if necessary. Fencing is recommended on the south side of the facility, at the property boundary.

Map 4 in the series shows the next anticipated step in the development process; the development of the residential subdivisions, listed as Phase 3 in Table 1. This includes the applications by Northgate South, Erbsville Kartway, Activa and 2115881 Ontario Ltd. It is expected that initial construction work on these subdivisions may begin during or overlap with the City-led works described in Phases 1 and 2. In order to provide uninterrupted protection for Blanding's turtle during the time when construction projects are beginning to move forward, Map 4 shows measures needed to be implemented by the active developers. Turtle barrier fencing on the developer's properties is to be installed as shown along the outer buffer limit of natural features, encompassing Category 2 habitat as well as some Category 3. Activa does not have any natural features or Blanding's turtle habitat on their property and therefore do not need to implement any fencing or other measures. On the other developer properties, the turtle barrier fencing will be continued in a seamless fashion from the road ecopassage crossings and along the outer Natural Heritage System limits. This approach maintains habitat connectivity such that turtles may travel freely along the Beaver Creek and Laurel Creek corridors but provides protection to the species as they will not be able to wander into residential development areas, storm ponds or access the road surfaces. Additional Category 2 habitat is created on the

Erbsville Kartway lands by the removal of the existing chain link fencing, go-kart track and buildings, and restoration of the 30m wetland buffer in that location. Northgate South will install culverts for ecopassage under the access road to the internal field, to provide connection between the wooded wetlands of the ESPA in that area. The ecopassage and barrier fencing will be installed in concert with the construction of that access road.

Phase 4 will be the continued improvements by the city of Waterloo to Conservation Drive westerly from the Beaver Creek crossing to the study limits. Mitigation for this phase is the same as the easterly portion of Conservation Drive; a continuation of turtle barrier fencing along the road right of way limits adjacent to Category 2 habitat. Turtle barrier fencing is shown in purple on Map 5 as well as an additional ecopassage culvert where wetland abut the road on either side. Details of the ecopassage are designed by Stantec. Barrier fencing will have to manage a number of driveway entrances onto Conservation Drive. This phase extends beyond the boundary of the BCMDP but shows conceptually the approach to be taken.

Map 6 shows the proposed mitigation strategy for future build out of additional lands beyond the BCMDP. These lands are included in this plan to provide a comprehensive approach to the whole of the regulated habitat for Blanding's turtle. Phase 5 shows a schematic representation of this future development which includes the Creekside Church and Northgate North as well as lands west of Erbsville Road. Developers would individually be responsible for implementing turtle barrier fencing on their own properties (shown in blue). Fencing would continue to encompass the watercourses, wetlands and woodland natural features plus their buffers equivalent to the extent of Category 2 habitat. Stormwater management ponds would continue to require placement outside of Category 2 habitat and exclusion fencing would be necessary as described above. This method retains all Category 2 habitat as well as some Category 3 habitat.

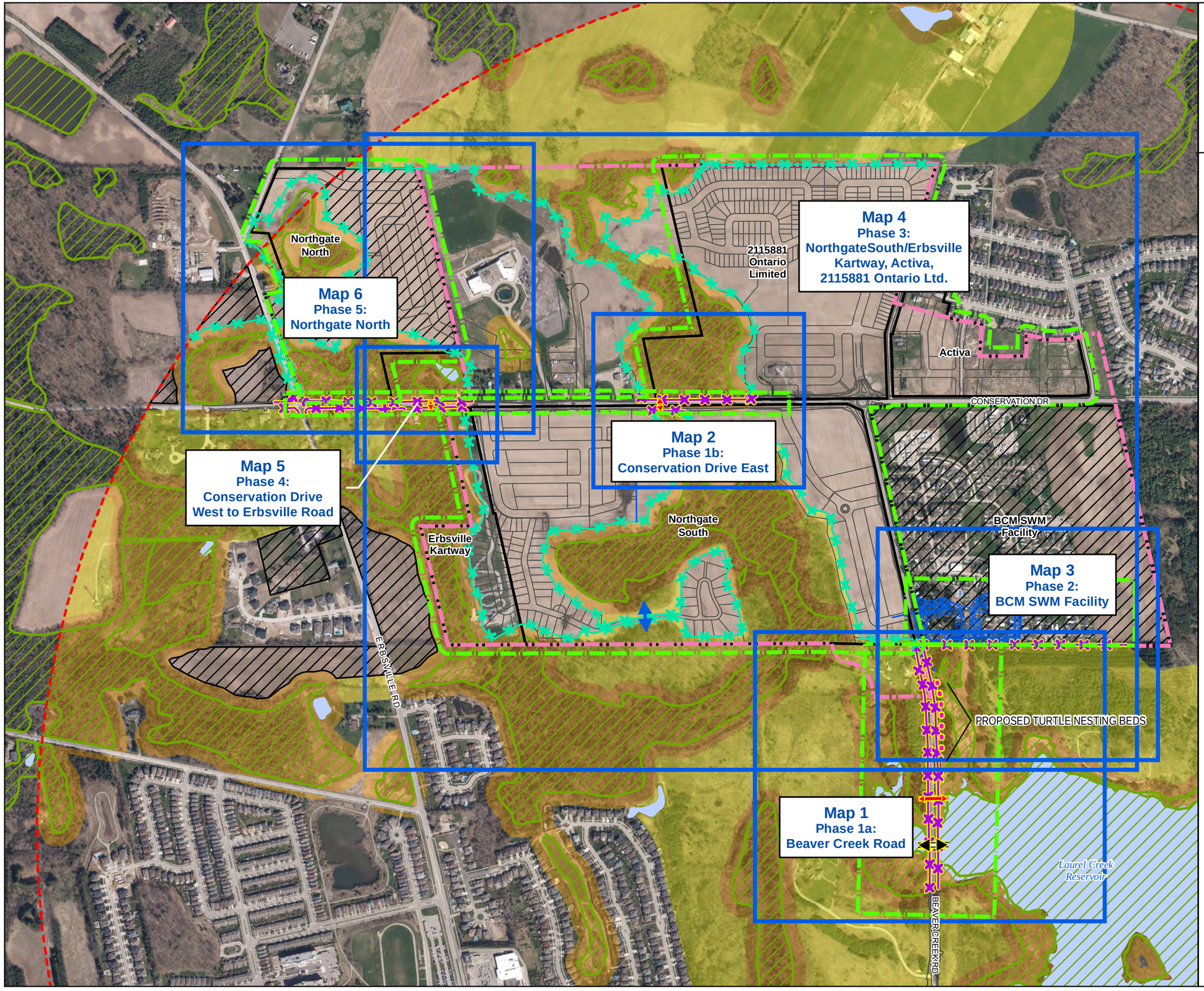
The timeframe for ultimate build-out is unknown, but this mitigation plan provides an approach for protection for turtles in the near future, while showing that the strategy can work throughout the extent of the regulated habitat in the long term. This plan allows flexibility if new information or techniques become available in the future. It is expected that this approach will create and maintain a continuous connected landscape for Blanding's Turtle and its movements through the development of the BCMDP area.

Elaine Gosnell, B.Sc., P. Biol.
Senior Terrestrial/Wetland Biologist

Map A

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan Key Map



Legend

- Subject Properties
- Map Extent
- Development Phase
- Beaver Creek Meadows District Plan Boundary
- Approximate Future Development
- 2km Buffer from Blanding's Turtle Site
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Proposed Turtle Nesting Beds (City of Waterloo)
- Culvert for Ecopassage (City of Waterloo)
- Culvert for Ecopassage (Developer)
- Existing Culvert to be Maintained (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development
- Proposed SWM Block

*Mitigation strategy shown is conceptual and is to be refined at development stage

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Aquatic, Terrestrial and Wetland Biologists

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Date: February 10, 2020

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Northgate South

BCM SWM Facility

PROPOSED TURTLE NESTING BEDS

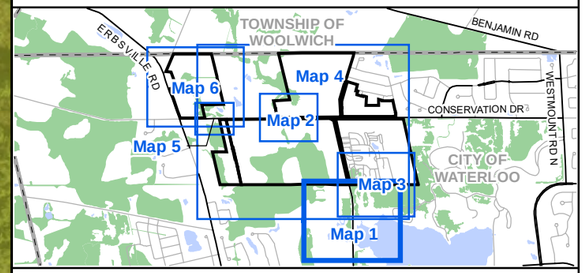
BEAVER CREEK RD

Laurel Creek Reservoir

Map 1

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan
Phase 1a: Beaver Creek Road



Legend

- Subject Properties
- Development Phase
- Beaver Creek Meadows District Plan Boundary
- Approximate Future Development
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Proposed Turtle Nesting Beds (City of Waterloo)
- Culvert for Ecopassage (City of Waterloo)
- Existing Culvert to be Maintained (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development
- Proposed SWM Block

*Mitigation strategy shown is conceptual and is to be refined at development stage

Phase 1a: Beaver Creek Road

Responsibility: City of Waterloo

Anticipated Date: 2020

Mitigation Details:

- Turtle barrier fencing along length of wetlands
- Laurel Creek culvert improvements for ecopassage with directional fencing
- Retention of existing Laurel Creek culvert with directional fencing
- Turtle nesting beds on east side of Beaver Creek Road

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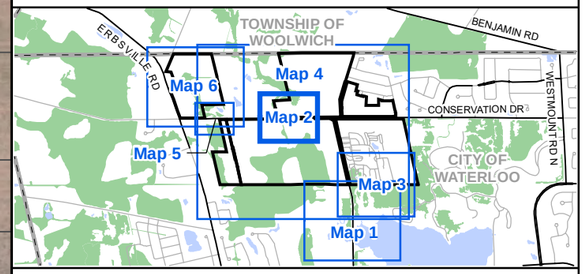
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Map 2

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan
Phase 1b: Conservation Drive East



2115881 Ontario Limited

CONSERVATION DR

Northgate South

Legend

- Subject Properties
- Development Phase
- Beaver Creek Meadows District Plan Boundary
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Proposed Development
- Proposed SWM Block
- Culvert for Ecopassage (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)

Phase 1b: Conservation Drive East

Responsibility: City of Waterloo

Anticipated Date: 2020

Mitigation Details:

- Turtle barrier fencing along length of wetlands
- Beaver Creek culvert improvements for ecopassage with directional fencing

*Mitigation strategy shown is conceptual and is to be refined at development stage

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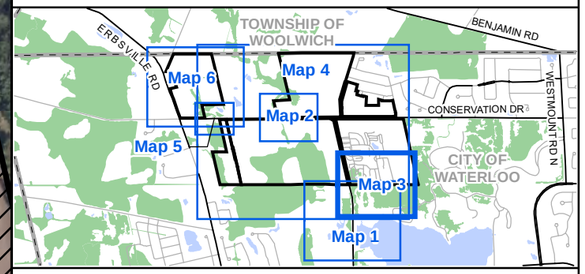
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Map 3

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan
Phase 2: BCM SWM Facility



Legend

- Subject Properties
- Development Phase
- Approximate Future Development
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Proposed Turtle Nesting Beds (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development
- Proposed SWM Block

*Mitigation strategy shown is conceptual and is to be refined at development stage

Phase 2: BCM SWM Facility

Responsibility: City of Waterloo

Anticipated Date: 2022

Mitigation Details:

- Turtle barrier fencing along south side of property

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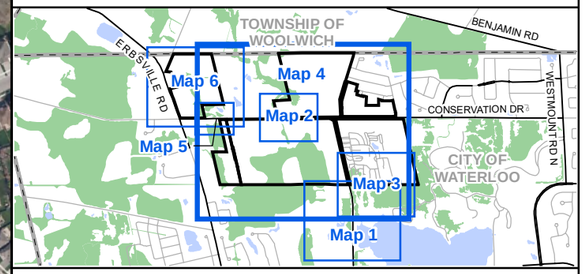
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Map 4

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan Phase 3: Northgate South/Erbsville Kartway, Activa, 2115881 Ontario Ltd.



Legend

- Subject Properties
- Development Phase
- Beaver Creek Meadows District Plan Boundary
- Approximate Future Development
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Proposed Turtle Nesting Beds (City of Waterloo)
- Culvert for Ecopassage (City of Waterloo)
- Culvert for Ecopassage (Developer)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development
- Proposed SWM Block

*Mitigation strategy shown is conceptual and is to be refined at development stage

Phase 3: Northgate South/Erbsville Kartway, Activa, 2115881 Ontario Ltd.

Responsibility: Developers (excluding work by City along Conservation Drive)

Anticipated Date: 2023

Northgate South/Erbsville Kartway Mitigation Details:

- Turtle barrier fencing along outer edge of NHS buffer
- Ecopassage at access road with directional fencing

Activa/2115881 Ontario Ltd. Mitigation Details:

- Turtle barrier fencing along outer edge of NHS buffer

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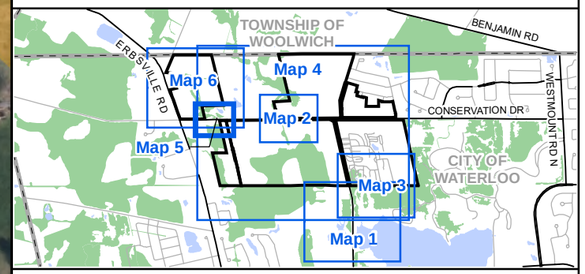
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Map 5

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan
Phase 4: Conservation Drive West to Erbsville Road



Northgate North

CONSERVATION DR

Northgate South

Erbsville Kartway

Legend

- Subject Properties
- Development Phase
- Beaver Creek Meadows District Plan Boundary
- Approximate Future Development
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Culvert for Ecopassage (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development

Phase 4: Conservation Drive West to Erbsville Road

Responsibility: City of Waterloo

Anticipated Date: 2025

Mitigation Details:

- Turtle barrier fencing along north and south side of road
- Ecopassage at Laurel Creek tributary with directional fencing

*Mitigation strategy shown is conceptual and is to be refined at development stage

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Project: 1531
Date: February 10, 2020

NAD83 - UTM Zone 17
Size: 11x17"
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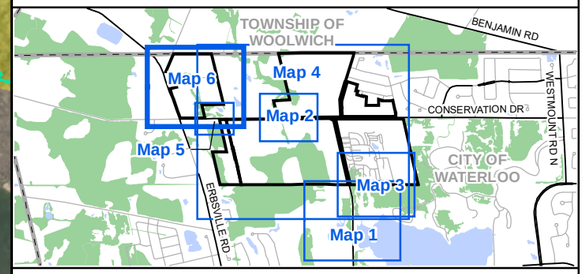
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Map 6

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan
Phase 5: Northgate North



Legend

- Subject Properties
- Beaver Creek Meadows District Plan Boundary
- Approximate Future Development
- 2km Buffer from Blanding's Turtle Site
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Culvert for Ecopassage (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development

*Mitigation strategy shown is conceptual and is to be refined at development stage

Phase 5: Northgate North

Responsibility: Developers

Anticipated Date: 2030

Mitigation Details:

- Turtle barrier fencing along outer edge of NHS buffer

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Project: 1531
Date: February 10, 2020

NAD83 - UTM Zone 17
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