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1.0 Introduction

The purpose of this report is to examine the viability of a subsurface disposal alternative solution for the Erin Urban Centre Wastewater Servicing Class EA (UCWS EA) either servicing the entire study area using a single treatment plant or as multiple systems servicing components of the study area. The intent of the report is to either confirm selection of the preferred alternative solution established through the Servicing and Settlement Master Plan (SSMP) or to recommend further study of the subsurface disposal alternative during Phase 3 of the UCWS EA. The request to consider this alternative was made by members of the Public Liaison Committee (PLC) and by members of the community group Transition Erin who were concerned that the viability of treating wastewater at multiple smaller facilities was being overlooked.

The SSMP provided a rationalisation for limiting surface water discharge to a location between 10th Line and Winston Churchill Boulevard in Erin Village. The surface water discharge limitation provided justification of the SSMP conclusions to establish a single wastewater treatment facility in Erin discharging to the West Credit River. The SSMP provides significant rationale for the single surface water discharge location and the decision was supported by the conclusions of the CVC "Environmental Component – Existing Conditions Report" which stated the following:

"The surface water quality in the upper portion of the study area [Hillsburgh] is fair in terms of impact to the health of aquatic biota. This lower ranking is the result of elevated levels of bacteria, total phosphorus, and nitrate-nitrogen. In addition, the West Credit River through Hillsburgh is a losing stream, thus reducing its assimilative capacity. In the mid-portions of the study area, the water quality ranking improves as downstream stations with significant groundwater discharge contribute to higher flows, which increase the streams ability to assimilate contaminant inputs. In the Villages of Hillsburgh and Erin, the influence of roads, septic systems and urban land use with higher population density is apparent because median concentration of total phosphorus, bacteria and nitrate are higher than in rural areas. Downstream of the Village of Erin, at 10th Line, the water quality improves once again as a result of significant groundwater discharge into the West Credit River. This indicates that throughout this sub-watershed the quantity of groundwater discharges contribute significantly to improving the surface water quality."

The conclusions of the SSMP, to establish a single plant with surface water discharge downstream of Erin, are supported by the findings of the CVC. In addition, work completed during this UCWS EA has established effluent limits for a surface water discharge between 10th Line and Winston Churchill, that can support a population up to 14,500 from a single tertiary wastewater treatment plant. This single surface water discharge is a valid solution for both urban areas and if confirmed as the preferred alternative solution will provide sufficient capacity to allow the full development of vacant residential, commercial and industrial lands in both Erin village and Hillsburgh. Treatment alternatives will be established and evaluated during Phase 3 of the UCWS EA.

The viability of establishing subsurface disposal systems for the management of effluent will be further investigated in this technical memorandum as a Phase 2 activity of the Class EA process.

1.1 Subsurface Disposal Alternative

The SSMP did not review the viability of subsurface disposal as an alternative solution. However, due to the growth restrictions (population of 6,000) that were identified in the SSMP, resulting from the original West Credit River assimilative capacity assessment; subsurface disposal was identified as a possible means to increase the amount of growth possible for the two urban areas. The SSMP review of subsurface disposal is provided below:

"In order to provide a comprehensive review of all wastewater servicing options for the Town to consider, preliminary consideration was given to the possibility of a system that would discharge to the subsurface. It is generally agreed, by the various approval agencies, that a review of the feasibility of a subsurface discharge is site specific and will require detailed assessments at specific locations and cannot be completed in the broad based technical review of the SSMP. As such, this SSMP provides a description of the studies that would need to be completed to sufficiently review the feasibility of a subsurface discharge

Just as you would complete a preliminary Assimilative Capacity Study of a surface water body in order to demonstrate the feasibility of discharge of treated effluent to a surface water, it is necessary to demonstrate, in at least a preliminary manner, that the site has the proper characteristics to support the hydraulic loading of effluent and to identify whether there are any constraints to the operation of a subsurface system such as restrictive soil horizons, groundwater sensitive habitat or existing groundwater users whose wells cannot be jeopardized. This would include, but not be limited to, a detailed hydrogeological investigation including:

- *Assessment of soil permeability and infiltration rates in the receiving geologic unit, including whether there are any potential impedances to infiltration (e.g. low permeability layers).*
- *Determination of depth to the water table to ensure there is sufficient unsaturated zone to allow for water table mounding and dissipation of the infiltrating effluent.*
- *Assessment of the ability of the soils to treat (i.e. attenuate) contaminants of concern such as nitrate, phosphorous and BOD.*
- *Determination of the probable migration path of the sewage impacted aquifer systems.*
- *Identification of potential environmental receptors such as wetlands or cold water fisheries.*

After having demonstrated the viability of a particular site(s) due to suitable soils and lack of other constraints, it would also be necessary to undertake an assessment of impact on the water resources (both ground and surface) prepared following the guidance in section 22.5 of the Design Guidelines for Sewage Works, 2008, MOE and following the guidance in ministry Guideline B-7 which is more commonly referred to as the Reasonable Use Guideline. This particular assessment would include, but not be limited to the following:

- *A water resources impact assessment of to all sensitive users including drinking water and environmental receptors (e.g. the West Credit River and its tributaries) using applicable water quality guidelines.*
- *Determination of critical contaminants such as nitrate in groundwater and phosphorous and ammonia potentially discharging to surface water.*
- *Setting water quality limits in accordance with the Reasonable Use Guideline, which*

would include assessing existing and background water quality, and prediction of contaminant attenuation and dilution at the property boundary.
- *Assessment of sewage effluent volumes.*
- *Assessment of effluent quality.*

The above assessment is better suited as part of a Schedule "C" Class EA in order to fully demonstrate feasibility and enable the subsequent consideration of different technologies. A long term environmental monitoring program might also be required to assess the effectiveness of the proposed groundwater aquifer contamination control measures."

Should subsurface disposal be established as a viable alternative solution, then the above-noted activities would need to be carried out during Phase 3 of the UCWS EA.

1.2 Objectives

The main objective of this technical memorandum is to review and establish the viability of treating wastewater and discharging treated effluent to subsurface disposal fields within the study area. The Ministry of Environment and Climate Change (MOECC) guidelines refer to these systems as "Large Subsurface Sewage Disposal Systems (LSSDS)". As such, this technical memorandum:

- Documents regulations and likely effluent standards for treatment and subsurface disposal
- Performs a hydrogeological/geotechnical overview of the study area based on existing knowledge, studies, etc. (no field work) to determine water table conditions, general flow direction, vulnerability of the underlying aquifers etc.
- Reviews available background water quality of local shallow groundwater to aid in determining potential treatment requirements
- Identifies opportunities for treatment and subsurface disposal for existing Erin and Hillsburgh communities and for growth areas
- Identifies potential service areas, treatment requirements and size of disposal fields for each decentralized system
- Identifies land requirements and environmental constraints (wetlands, surface waters, source water protection areas, areas of high aquifer vulnerability, etc.)
- Identifies conceptual level capital and operating costs for potentially viable subsurface disposal alternatives
- Determines whether any treatment/subsurface disposal opportunities represent viable and cost effective alternatives to surface water discharge
- Identifies scope, cost and time implications to include treatment/subsurface disposal alternatives in Phase 3 and 4 of the UCWS EA for any viable alternatives

2.0 Review of Legislation and Guidelines for Subsurface Disposal

An overview of practices for the design of Large Subsurface Sewage Disposal Systems (LSSDS) is presented in Chapter 22 of the Design Guidelines for Sewage Works published by the MOECC. The guidelines are applicable to systems exceeding 10 m^3/d. Systems with lower flow rates are under the jurisdiction of the *Building Code Act*. Most existing private sewage systems in the urban areas of Erin Village and Hillsburgh fall under the building code.

As outlined in the design guidelines, there is a significant amount of site investigation required for the establishment of a LSSDS. In order to obtain MOECC approval for a LSSDS the following investigations would be required to fully understand the site characteristics and ensure proper operation of the system:

1. Full hydrogeological, hydrological / surface water assessment
2. Reasonable Use Guideline assessment (MOECC Guideline B-7)
3. Groundwater / water well, surface water / aquatic life and microbiological risk assessments;
4. Water well survey within 2 to 5 km of site (radius may vary depending on specific geologic conditions etc.);
5. Integrated groundwater - surface water flow modelling;
6. Anticipated area of land required for beds (and therefore not available for other use);
7. Influent, effluent, groundwater and surface water monitoring plans, and performance criteria that would need to be met (MOECC Guideline B-7-1);
8. Contingency plans to address system failure;

It is anticipated that the treatment facility required prior to subsurface discharge would involve a plant similar to a traditional secondary sewage treatment plant discharging to surface water. The facility design would be required to demonstrate that the suite of contaminants in the raw sewage and contaminant loadings would be treated to meet MOECC requirements and to safely percolate the effluent into the disposal field. Engineering design would likely need to demonstrate effluent discharge requirements to the bed for nitrate, anticipated to be no greater than 2.5 mg/L to accommodate the size of the beds required, and meet reasonable use guidelines at the property boundary.

It should be noted that previous feedback from the MOECC and CVC has indicated that surface water discharge through Hillsburgh and Erin village was not a preferred option due to the high background phosphorus levels in the West Credit River in the area and the fact that, for this reach, the West Credit is a losing stream. Any subsurface disposal systems must therefore demonstrate that there will be no impact on the River or any surface waters through this area. The design guidelines state that, in most cases, a 300m separation is sufficient to ensure that there are no appreciable impacts on the surface water. However, due to the rolling topography of the study area, it is likely that the separation would need to be at least 300m. A key aspect of this technical memorandum will, therefore, be the establishment of available land for the LSSDS systems. Wastewater will need to be pumped from the collection systems to a suitable location for treatment and subsurface disposal.

Treated effluent requirements similar to those established for the surface water discharge proposed at 10th Line will be triggered unless it can be established that a proposed LSSDS does not influence surface water. CVC have also indicated that they would not support a discharge through Hillsburgh and Erin Village where there is influence on the West Credit River.

3.0 Review of Similar Systems in Ontario

Large subsurface disposal systems are a common effluent management practice throughout rural Ontario. Typically LSSDS are used for small single developments such as nursing homes, hotels, subdivisions, recreational parks and centres, industrial and commercial parks. Such applications are typically designed in concert with the individual development and the environmental reviews are completed by the developer/owner. Implementation of a proposed LSSDS system by the developer/owner typically means that the land required is already in the hands of the developer/owner. LSSDS are typically designed for an average day flow (ADF) of 10-80 m^3/d. Greater than 80 m^3/d would generally represent a large system for this approach to wastewater management.

Based on operational experience with LSSDS systems, one of the important design considerations is avoidance of “plugging” of the disposal beds wherein excessive solids build up in the bed eventually stops effective percolation resulting in effluent breakout at the surface. Subsurface disposal systems have been documented to plug even at average total suspended solids (TSS) values less than 10 mg/L. It is likely that plugging results from short term spikes in TSS values which deposit in the system over time and eventually cause failure. The design of an LSSDS therefore needs to account for plugging as an eventuality and provide a contingency measure for this type of failure. The simplest and most likely contingency measure would be the establishment of additional / reserve disposal beds. In addition, treatment systems must be robust and achieve effluent TSS levels less than 10 mg/L which is equivalent to a reasonably high level of secondary treatment.

As noted, within Ontario, an ADF of 80 m^3/d would represent a large system for a LSSDS. In comparing this scale to the UCWS EA study area, it is noted that the volume of effluent anticipated from just the existing Erin Village would need to accommodate an ADF of 2,244 m^3/d, while the existing community of Hillsburgh would need to accommodate an ADF of 599 m^3/d (assuming gravity sewers). At the typical size for a LSSDS, servicing the existing communities would likely require some 30 to 40 separate systems each with their own treatment systems and disposal fields and each requiring their own effluent limits and MOECC approval and ongoing operation, maintenance, monitoring and reporting.

3.1 Centre 2000 Review

In Erin Village, the Erin District High School and Erin Community Centre (Centre 2000) are currently serviced by a secondary sewage treatment system discharging to an LSSDS with a design ADF of 40 m^3/d. The system at Centre 2000 was upgraded in 2011 to a series of three Waterloo BioFilter units (trickling filter, denitrification trickling filter, polishing trickling filter). The effluent criteria for the system is outlined in the plant Environmental Compliance Approval (ECA # 5808-95HSF5) as described in Table 1. The effluent criteria must be met by the system prior to discharging to the tile beds.

Table 1 – Effluent Requirements for Centre 2000

Parameter	Concentration (mg/L)
$CBOD_5$	15
Suspended Solids	15
(Ammonia + Ammonium) Nitrogen	2 (summer), 3 (winter)
Nitrate Nitrogen	3.6
TKN	3 (summer), 4 (winter)

The effluent results from 2012-2015 at the Centre 2000 plant are provided in Table 2. As shown, the plant is able to maintain adequate effluent concentrations for most parameters, however, the average Nitrate concentration in the effluent is in exceedance of the ECA. The Nitrate levels in the effluent vary greatly with some samples measuring very high for Nitrate and other samples measured as low as 0.06 mg/L. Overall, over the 2012-2015 period, 49 of 104 samples measured in exceedance of the ECA for Nitrate. Based on the effluent data, the treatment efficacy for Nitrate with the existing system appears to correlate with sewage flow rates.

Table 2 – Effluent Characteristics 2012-2015

Year	ADF (m^3/d)	CBOD (mg/L)	TSS (mg/L)	TAN (mg/L)	NO3-N (mg/L)	TKN (mg/L)
2012	10.0	3	3	0.3	7.78	1.9
2013	8.9	10	4	0.4	6.08	1.6
2014	10.9	12	6	1.3	8.21	2.3
2015	9.9	10	4	0.5	3.75	1.1

The failure of the Centre 2000 to adequately treat Nitrate does not necessarily mean that all treatment processes will have difficulty meeting effluent requirements. However, for larger systems sized appropriately for multiple areas of the Erin-Hillsburgh service area, it would be imperative to ensure consistent compliance with effluent requirements and clearly a more robust and reliable treatment system would be required. Failure to meet effluent requirements would likely result in orders from the MOECC to enhance the treatment provided.

3.2 Island Lake Subdivision

The Island Lake subdivision is a 71 Hectare development in the Town of Mono, with 335 detached residential lots and may be considered a very large application for an LSSDS. To service the 335 lots, a treatment system discharging to an LSSDS was proposed. In 2014 an ECA was obtained for a 365 m^3/d system consisting of primary, secondary and, tertiary wastewater treatment. The system is also equipped with a 140 m^3 equalization tank to manage peak flows.

The treatment at the plant consists of a primary clarifier, a rotating biological contactor (RBC) for secondary treatment discharging to a final clarifier, and upflow continuous backwash sand filters for tertiary treatment. In order to meet the effluent limits, tertiary filters are used to reduce nitrate and phosphorus levels. Effluent limits for the system are described in Table 3.

Table 3 – Effluent Requirements for Island Lake Estates

Parameter	Concentration (mg/L)
$CBOD_5$	10
Suspended Solids	10
(Ammonia + Ammonium) Nitrogen	2.0
Nitrate Nitrogen	3.0
Total Phosphorus	0.25

The total length of distribution pipe required was calculated based using Equation 1 as provided in Section 8.7.3.1 of the Ontario Building Code (OBC):

Equation 1 – Length of Distribution Piping for LSSDS

$$L = \frac{Q * T}{300}$$

Where:
L = Total length of pipe required
Q = Design flow (L/d)
T = Percolation rate (min/cm)

Based on an extensive geotechnical investigation at the site which included a total of 51 test pits and 47 bore holes, it was concluded that the native soils at the site had percolation times (T-Times) which were too high for a functional tile bed. A series of boreholes within the tile bed area and down gradient from the tile bed were established as monitoring wells to allow for groundwater quality monitoring to ensure adequate attenuation is maintained. As a result of the percolation rates, a partially raised tile bed was selected and sand fill was specified for the site to achieve a percolation rate of 6min/cm. For a design flow rate of 335 m^3/d and a percolation rate of 6 min/cm, the total length of distribution pipe was calculated to be 6.7 km. To accommodate the proper spacing for the distribution chambers, spacing for piping to each leaching bed cell, a clay berm around the tile bed, and a mantle in the direction of shallow groundwater flow, the total area needed for the site was over 2.8 Ha.

It is believed that the all-in system cost, including investigations, engineering, treatment and the disposal bed, was $7 million to implement (excluding collection system sewers). This represents around $21,000 per lot for wastewater treatment and disposal alone. It should also be noted that this is a new development wherein the developer owned and controlled sufficient land area to complete the development and construct the disposal field.

4.0 Establishing Effluent Standards

The effluent requirements for LSSDSs' are determined through a review of the land where the system is proposed. The land is reviewed under the MOECC Guideline B-7 for Reasonable Use which provides a standard approach for the determination of "reasonable use" for the groundwater/soil in the vicinity of the site. The determination of reasonable use at a site is a Ministry decision and is based largely on three major considerations: the present use of groundwater in the vicinity, the potential use of groundwater in the vicinity, and the existing quality and quantity of the groundwater in the vicinity.

The reasonable use of the groundwater at a site is most often associated with the current use, however if no current use is established it is typically assumed that groundwater will be used for drinking water. The reasonable use determined for a site dictates the effluent requirements. In general, a LSSDS will be restricted to polluting the groundwater up to a limit of 25% of the health-related water quality objectives or up to 50% of non-health-related water quality objectives. Nitrates, for example, are a health-related water quality objective with a limit of 10 mg/L to ensure safe drinking water; in following the guidelines the maximum discharge concentration would be limited to 2.5 mg/L. Based on broad generalisation of groundwater quality within the Town, the key effluent quality requirements anticipated are listed in Table 4.

Table 4 – Potential Effluent Requirements Subsurface Disposal

Parameter	Concentration (mg/L)
BOD_5	10
TSS	10
NO_3-N	2.5

In contrast to the effluent requirements expected for the LSSDS, the effluent requirements for surface water disposal previously identified through the UCWS EA are listed in Table 5.

Table 5 – Potential Effluent Requirements Surface Disposal

Parameter	Concentration (mg/L)
BOD_5	7.5
TSS (mg/L)	10
Total Phosphorus (mg/L)	0.046
Total Ammonia (mg/L)	2.0
NO_3-N	6
TKN (mg/L)	3

Both discharge scenarios will require a form of tertiary treatment. The effluent requirements for surface water discharge are much more stringent for phosphorus concentration and somewhat less stringent for nitrate concentration. In effect, this will require a plant discharging to the surface water to have advanced tertiary treatment for the removal of both phosphorus and nitrate. A plant discharging to the subsurface will require tertiary treatment to achieve the lower nitrate requirement while phosphorus limits can likely be achieved using secondary treatment processes.

5.0 System Capacity Requirements

Should the Town proceed with an LSSDS for effluent management, the system capacity required for the existing communities of Erin and Hillsburgh are listed in Table 6. Also listed in the table are the projected flow rates for the growth areas in the Urban Areas which would also have to be managed.

Table 6 – Projected Sewage Flow Rates

	Erin	Hillsburgh	Total
Existing Community	2,244.1 m^3/d	599.4 m^3/d	2,843.5 m^3/d
Growth Areas	2,523.0 m^3/d	1,805.7 m^3/d	4,328.7 m^3/d
Total	4,767.1 m^3/d	2,405.1 m^3/d	7,172.2 m^3/d

The flow rates presented in Table 6 are the total projected average day flows for the study area as established in the recently completed system capacity assessment based on gravity collection systems.

Whereas the alternative solution for surface water discharge is based on a single treatment facility for the existing communities and all growth areas, the alternative for subsurface disposal can be based on a range of alternatives involving multiple treatment plants and disposal fields.

In order to confirm viability of subsurface disposal, the following alternatives are considered for each of Erin Village and Hillsburgh:

- Alternative 1: Discrete treatment systems servicing sewer decision areas established in the Septic System Survey technical memorandum.
- Alternative 2A: centralised treatment system with a series of disposal fields distributed to areas suitable for subsurface disposal based on the hydrogeological overview of the study area
- Alternative 3A: centralised system with a single disposal field suitable for subsurface disposal based on the hydrogeological overview of the study area

Consideration for each approach will be explored in detail in Section 8.

6.0 Study Area Suitability for Subsurface Disposal

6.1 Overview

The approach taken to determine areas potentially suitable for subsurface disposal was to identify constraint areas for LSSDS wastewater disposal and remove these areas from further assessment. This was preformed through a "desktop" assessment, using information from existing studies and reports. Additional considerations were then factored for any remaining areas to determine if any sites would be potentially suitable (i.e. not determined to be unsuitable), which would require further assessment through site specific investigations, in particular geotechnical investigations. It is recognized that any potential site would likely be comprised of a number of privately owned parcels of land and no contact or agreements have been made with any property owners. Whether potentially suitable lands would be available for use has not been determined.

The determination of the suitability of an area for subsurface wastewater disposal was divided into three components:

- existing and future urban areas as per the current Official Plan
- natural environment constraint areas including topography, and
- hydrogeological constraint areas.

Existing and future urban development areas within the Hillsburgh and Erin urban boundaries were not assessed but were included as a constraint, given that is where development and growth will occur. Growth areas are shown in the constraints figures for Erin Village and Hillsburgh.

6.2 Environmental Constraint Areas

Environmental constraints are primarily related to natural heritage features with the majority of the information obtained from the data base at Credit Valley Conservation (CVC) and mapping provided by CVC. Areas determined to be unsuitable for large-scale subsurface wastewater disposal due to environmental constraints included the following:

- any wetland areas and surface water features
- a 300 metre buffer from wetland and surface water features, as previously discussed in Section 2, and

- any forested areas

Figure 1, provided in foldout, shows the wetlands, rivers and streams in Erin and the surrounding area as provided by the CVC. Figure 2, also in foldout, shows the 300m buffer zone from wetlands and watercourses in Erin Village.

Figure 3, provided in foldout, shows the wetlands, rivers and streams in Hillsburgh and the surrounding area as provided by the CVC. Figure 4, also in foldout, shows the 300m buffer zone from wetlands and watercourses in Hillsburgh.

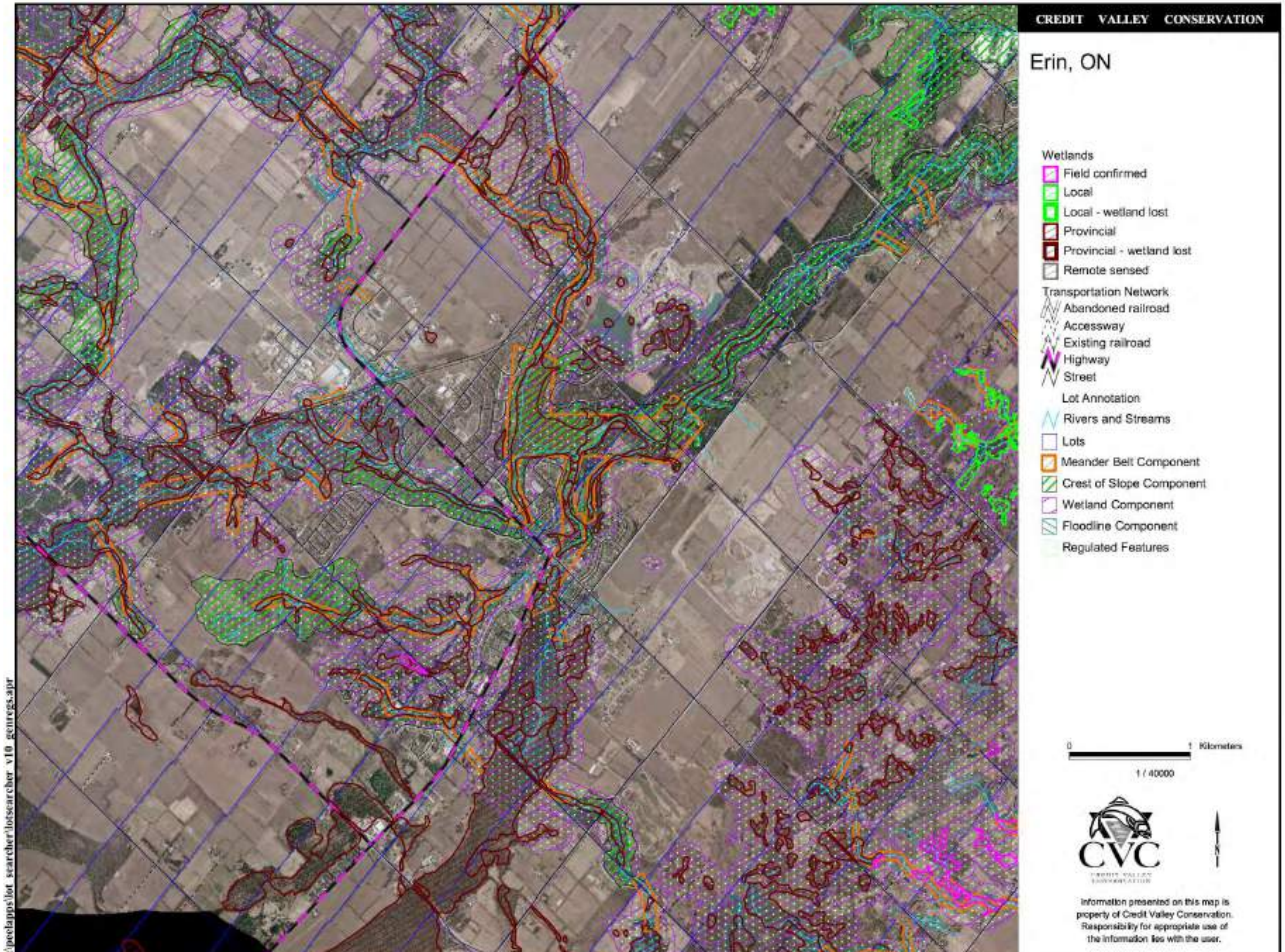
6.3 Hydrogeological Constraint Areas

Hydrogeological constraints are primarily related to protection of municipal water supplies, and to a lesser extent, private water wells, and include the following:

- Well Head Protection Areas (WHPAs) for the current municipal wells, and
- source water protection areas that have been designated as having Highly Vulnerable Aquifers (HVAs), which is typically a shallow aquifer with limited natural protection from surface source of contamination.

Well Head Protection Areas (WHPAs) were developed through the Clean Water Act (2006) and Source Protection studies and are documented in the Updated Approved Assessment Report – Credit Valley Source Protection Area, dated July 2015. WHPAs are created for several zones, primarily based on the time of travel from the surface to the well head. There are four main zones: WHPA – 100 m radius around a municipal well; WHPA-B – pathogen management zone (0-2 Year Time of Travel); WHPA-C – DNAPL contaminant protection zone (2-5 Year Time of Travel); and, WHPA-D – secondary protection zone (5-25 years). Within these zones, the vulnerability of the aquifer from surface sources of contamination was also assessed (low, medium, and high) to determine the risk to the water supply for various types of contaminant threats. As part of the assessment a groundwater vulnerability analysis was conducted to determine highly vulnerable aquifers (HVAs) and significant recharge areas (SRAs). HVAs were designated through the development and use of geological and numerical models to produce a vulnerability score based on level of protection and travel time of a potential surface contaminant to the underlying aquifer.

As well as vulnerability scores, various types of drinking water threats were determined and were prescribed a range of levels of threat. As outlined in the Approved Source Protection Plan for the CTC Source Protection Region (July 2015), sewage is a prescribed drinking water threat. Sewage is defined as "*The establishment, operation or maintenance of a system that collects stores transmits, treats or disposes of sewage*". There are numerous sub-categories ranging from septic systems to sanitary sewers to sewage treatment plant effluent discharges. Although, as previously discussed in Section 2, there are design guidelines for LSSDS's exceeding 10 m^3/day, the volume of discharge of septic effluent to the subsurface from the large subsurface wastewater disposal system proposed for Hillsburgh or Erin Village will be much greater than any sub-category addressed in the prescribed drinking water threats.   An understanding of the potential types and concentration of contaminants from any large-scale subsurface disposal system may be necessary, to assign the potential risk associated with the scale of subsurface wastewater discharge that would be required.



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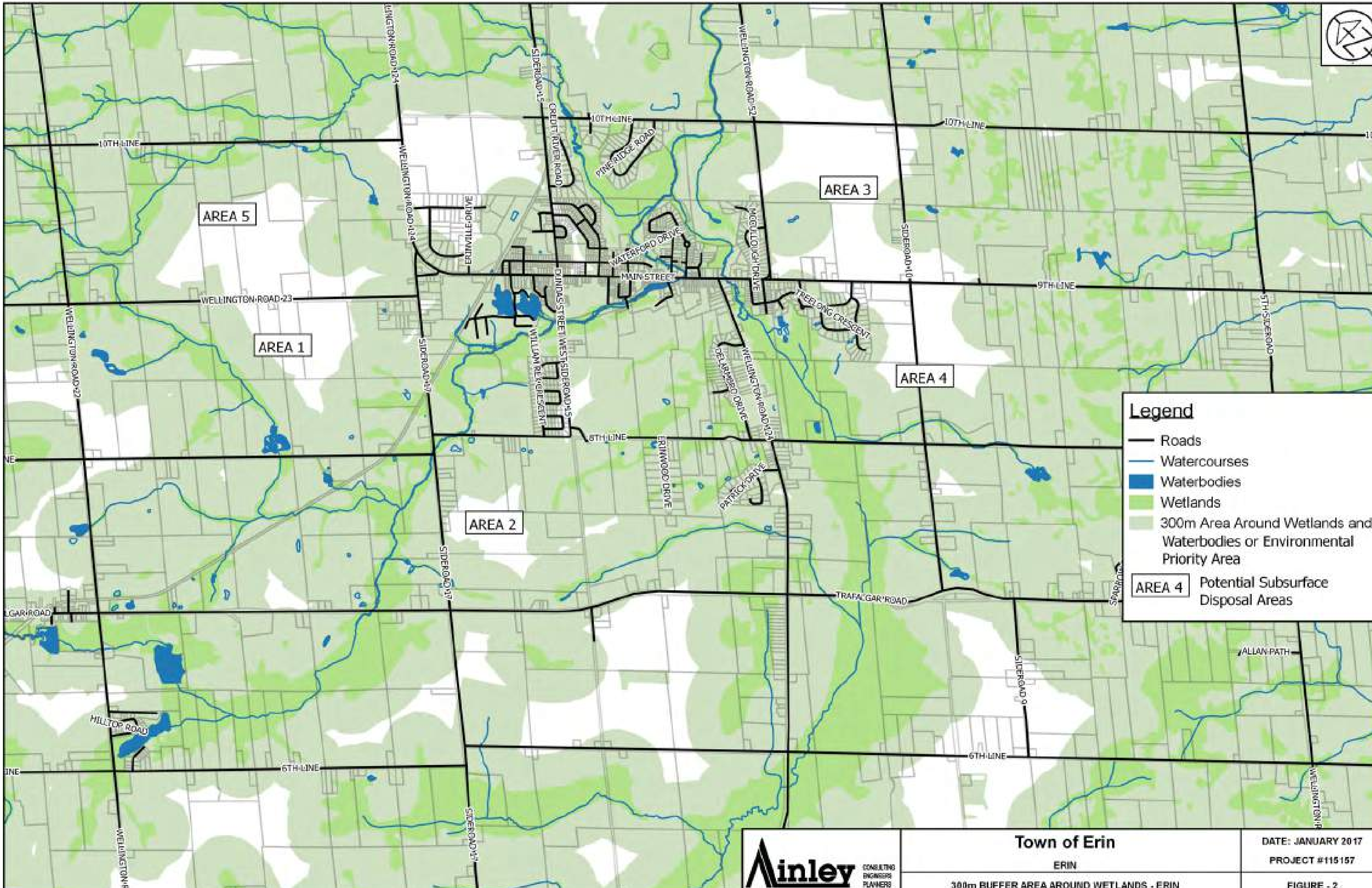
Printed on: 20 JAN 2017

Figure 1 – CVC Wetlands and Watercourses Erin


AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
10TH LINE
9TH LINE
8TH LINE
6TH LINE
TRAFALGAR ROAD
MAIN STREET
WELLINGTON ROAD 23
WELLINGTON ROAD 22
WELLINGTON ROAD 124
WELLINGTON ROAD 52
SIDEROAD 15
SIDEROAD 17
SIDEROAD 10
SIDEROAD 9
5TH SIDEROAD
CREDIT RIVER ROAD
PINE RIDGE ROAD
WATERFORD DRIVE
MCCULLOUGH DRIVE
TREELINE CRESCENT
ERINVILLE DRIVE
DUNDAS STREET WEST
WILLIAM REXE CRESCENT
DELARMBRO DRIVE
ERINWOOD DRIVE
PATRICK DRIVE
HILLTOP ROAD
ALLAN PATH
Legend
Roads
Watercourses
Waterbodies
Wetlands
300m Area Around Wetlands and Waterbodies or Environmental Priority Area
AREA 4 Potential Subsurface Disposal Areas
Ainley CONSULTING ENGINEERS PLANNERS
Town of Erin
ERIN
300m BUFFER AREA AROUND WETLANDS - ERIN
DATE: JANUARY 2017
PROJECT #115157
FIGURE - 2

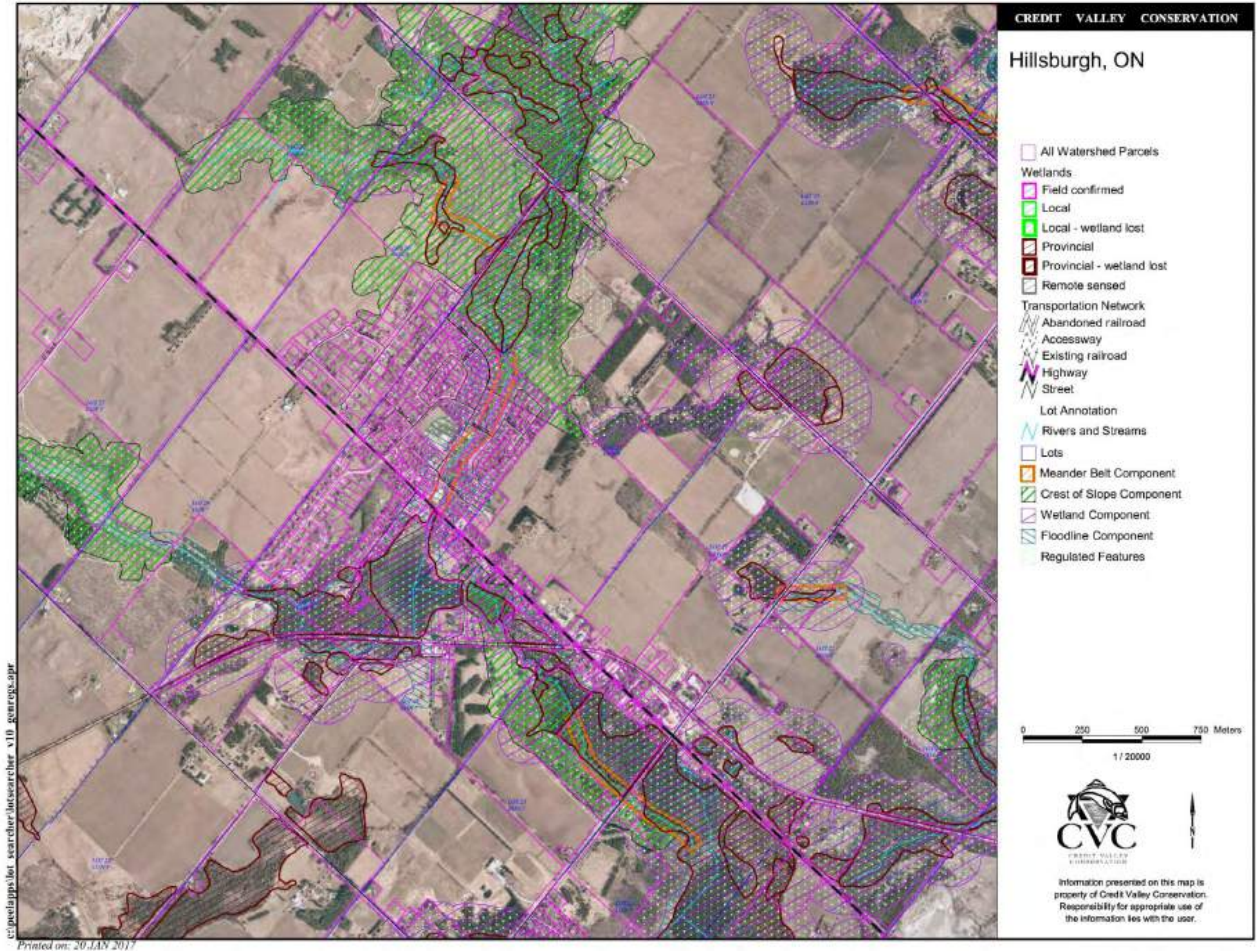
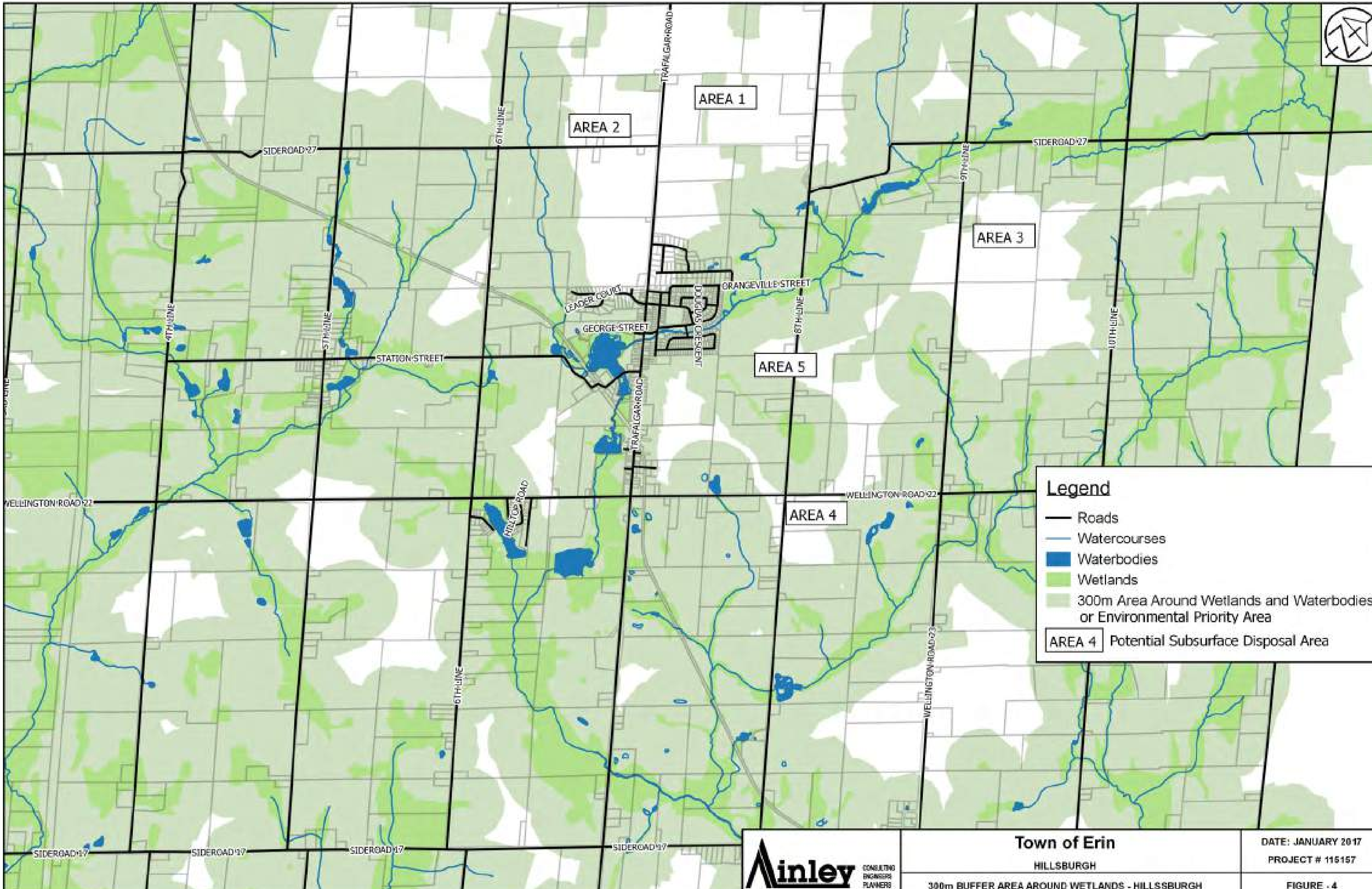


Figure 3 – CVC Wetlands and Watercourses Hillsburgh


AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
TRAFALGAR ROAD
SIDEROAD 27
6TH LINE
9TH LINE
ORANGEVILLE STREET
LEADER COURT
GEORGE STREET
DOUGLAS CRESCENT
STATION STREET
4TH LINE
5TH LINE
8TH LINE
10TH LINE
WELLINGTON ROAD 22
HILLTOP ROAD
WELLINGTON ROAD 23
SIDEROAD 17
Legend
Roads
Watercourses
Waterbodies
Wetlands
300m Area Around Wetlands and Waterbodies or Environmental Priority Area
AREA 4 Potential Subsurface Disposal Area
Ainley CONSULTING ENGINEERS PLANNERS
Town of Erin
HILLSBURGH
300m BUFFER AREA AROUND WETLANDS - HILLSSBURGH
DATE: JANUARY 2017
PROJECT # 115157
FIGURE - 4

6.4 Other Considerations

Other considerations need to be factored in to determine the potential suitability for large-scale subsurface wastewater disposal. These include, but are not limited to:

- the location of private water wells and the level of protection of these wells
- the ability of the surficial geologic material to accept large volumes of wastewater
- depth to the local water table and the ability of the site to accept the large volume of wastewater without mounding of the water table to ground surface, and
- the topographic slope of the site

These considerations require site-specific geotechnical investigations. As well, aggregate extraction areas and certain agricultural areas would be excluded from consideration. An additional factor to consider will be potential future municipal well sites and the associated Well Head Protection Areas. The potential future population growth will require a number of additional municipal water supply wells and any siting of a large subsurface disposal bed may exclude a considerable geographic area in the vicinity of Hillsburgh or Erin Village for consideration as a future well site. The following discussion is presented, summarizing the findings for the Hillsburgh and Erin Village areas.

6.5 Erin Village

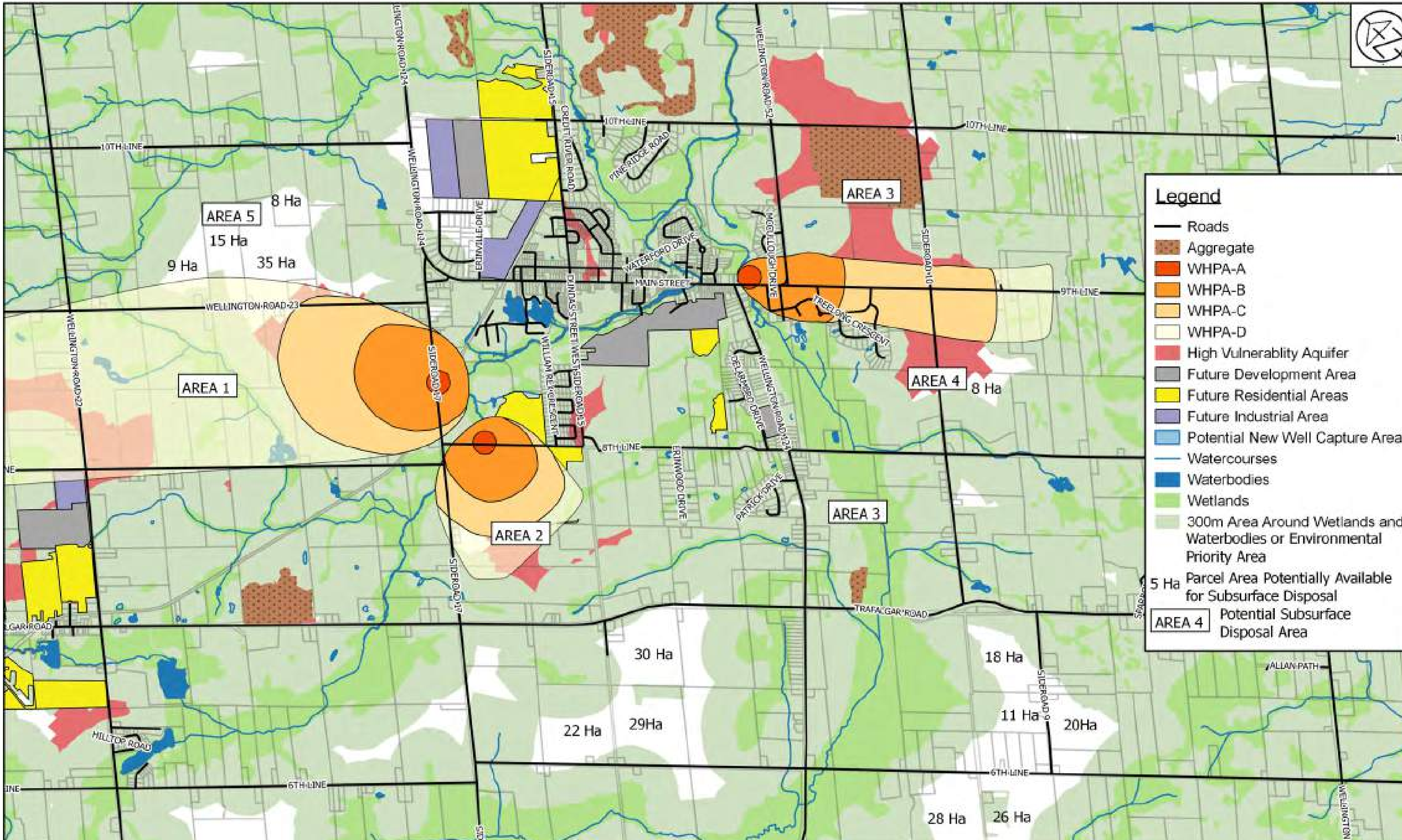
6.5.1 Environmental

The environmental constraints in the vicinity of the Erin Village Urban Area are shown in Figure 1. Many of the constraint areas are located, as expected, along the West Credit River, primarily west and east of Erin. There are numerous small tributaries and wetlands. When factoring in a 300 m setback from these features, a considerable portion of the area surrounding Erin is excluded from consideration, as shown in Figure 2. There are no areas within the existing developed area of Erin village that would be suitable for subsurface disposal and treated wastewater would likely need to be pumped some distance from the community for disposal. Areas outside the developed village area with potentially less environmental constraints were the focus of a more detailed assessment of hydrogeological constraints.

6.5.2 Hydrogeological

The assessment of hydrogeological constraints in the vicinity of Erin Village focussed on the designated source protection areas and the sensitivity of these areas to surface sources of contamination, in particular in the geographic areas where there were potentially no environmental or land use constraints. Figures 2 identifies five (5) areas in the vicinity of Erin with this potential. Figure 5 also shows the current WHPAs for the Erin municipal wells and the Bel-Erin municipal wells. Figure 5 also shows the areas designated as having a Highly Vulnerable Aquifer (HVA). As previously indicated, this aquifer may not be the municipal aquifer, and is typically the shallowest aquifer capable of producing sufficient water for domestic water wells. Much of the area within and surrounding Erin Village is highly vulnerable to surface contamination, with the exception of the area to the northwest of Erin.

Areas 1-5 labeled on Figures 2 and 5 represent five (5) areas near Erin Village where there are potentially less land use or environmental constraints. The following is noted for each area, with



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	ERIN	PROJECT # 115157
	ERIN AREA ADDITIONAL CONSTRAINTS	FIGURE - 5

respect to the hydrogeological conditions and the potential for subsurface wastewater disposal in these areas:

Area 1 – This area contains the WHPA for Erin Municipal well E7. Much of the WHPA area is designated as having a High Vulnerability Aquifer, although the vulnerable aquifer is not the municipal aquifer. Much of the area where there are no environmental constraints is within the WHPA-C protection zone. Given the potential volume of subsurface wastewater discharge, it is likely that the potential discharge would be considered a drinking water threat. Considerable site specific investigation would be required to assess Area 1 as a potential site. It is noted that this area was previously the subject of a private proposal for a subsurface waste disposal facility and substantial concerns were raised with respect to the potential long-term impact on recharge to the municipal aquifer system.

Area 2 – This area contains the WHPA for Erin Municipal well E8. All of the WHPA area is designated as having a High Vulnerability Aquifer, although the vulnerable aquifer is not the municipal aquifer. Much of the area where there are no environmental constraints, to the west of the well, is within the WHPA-C and WHPA-D protection zone. Given the potential volume of subsurface wastewater discharge, it is likely that the potential discharge would be considered a drinking water threat. Considerable site specific investigation would be required to assess Area 2 as a potential site.

Area 3 – This area is one of the largest areas where there are few environmental constraints. Most of the area is designated as aggregate extraction and much of the area is currently an active extraction area. The area is also designated as having a Highly Vulnerable Aquifer and is part of a major recharge area. Based on this information the area is not considered suitable for large volume subsurface wastewater disposal. This is the area proposed for a Wastewater Treatment Plant for the Surface Water Disposal Alternative.

Area 4 – This is one of the few areas near Erin Village which contains a reasonable size area of land with no environmental constraints; however, the area is also designated as having a Highly Vulnerable Aquifer and part of a major recharge area.

Area 5 – This area, north of Erin Village, contains a large zone with no environmental constraints and is within an area designated as having a low vulnerability to aquifer contamination. Based on the known environmental and hydrogeological constraints, the potential exists for subsurface disposal in this area; however, the area is mapped as having a lower permeability till unit at ground surface and would have to be further investigated to determine the capability of the surficial geologic material to infiltrate a large volume of subsurface discharge of wastewater.

6.6 Hillsburgh

6.6.1 Environmental Constraints

The environmental constraints in the vicinity of the Hillsburgh Urban Area are shown in Figure 3. Many of the constraint areas are located, as expected, along the West Credit River, primarily north and south of Hillsburgh. There are numerous small tributaries and wetlands. When factoring in a 300 m setback from these features, a considerable portion of the area surrounding Hillsburgh is excluded from consideration, as shown in Figure 4. Several larger areas, located to the northwest and east of Hillsburgh have potentially less environmental constraints and were the focus of a more detailed assessment of hydrogeological constraints. These are labelled as Areas 1 to 5 on Figure 6.

6.6.2 Hydrogeological Constraints

The assessment of hydrogeological constraints focussed on the designated source protection areas and the sensitivity of these areas to surface sources of contamination, in particular in the geographic areas where there were no environmental or land use constraints. Figure 6 shows the current WHPAs for Hillsburgh, from the Approved Source Protection Plan: CTC Source Protection Region, July, 2015. Figure 6 also shows the areas designated as having a Highly Vulnerable Aquifer (HVA), as indicated in the Approved Assessment Report: Credit Valley Source Protection Area, February 2015. As previously indicated, this aquifer may not be the municipal aquifer, and is typically the shallowest aquifer capable of producing sufficient water for domestic water wells. Much of the area within and surrounding Hillsburgh is highly vulnerable to surface contamination.

Areas 1-5 labeled on Figures 4 and 6 represent five (5) areas near Hillsburgh where there are potentially less land use or environmental constraints. The following is noted for each area, with respect to the hydrogeological conditions and the potential for subsurface wastewater disposal in these areas:

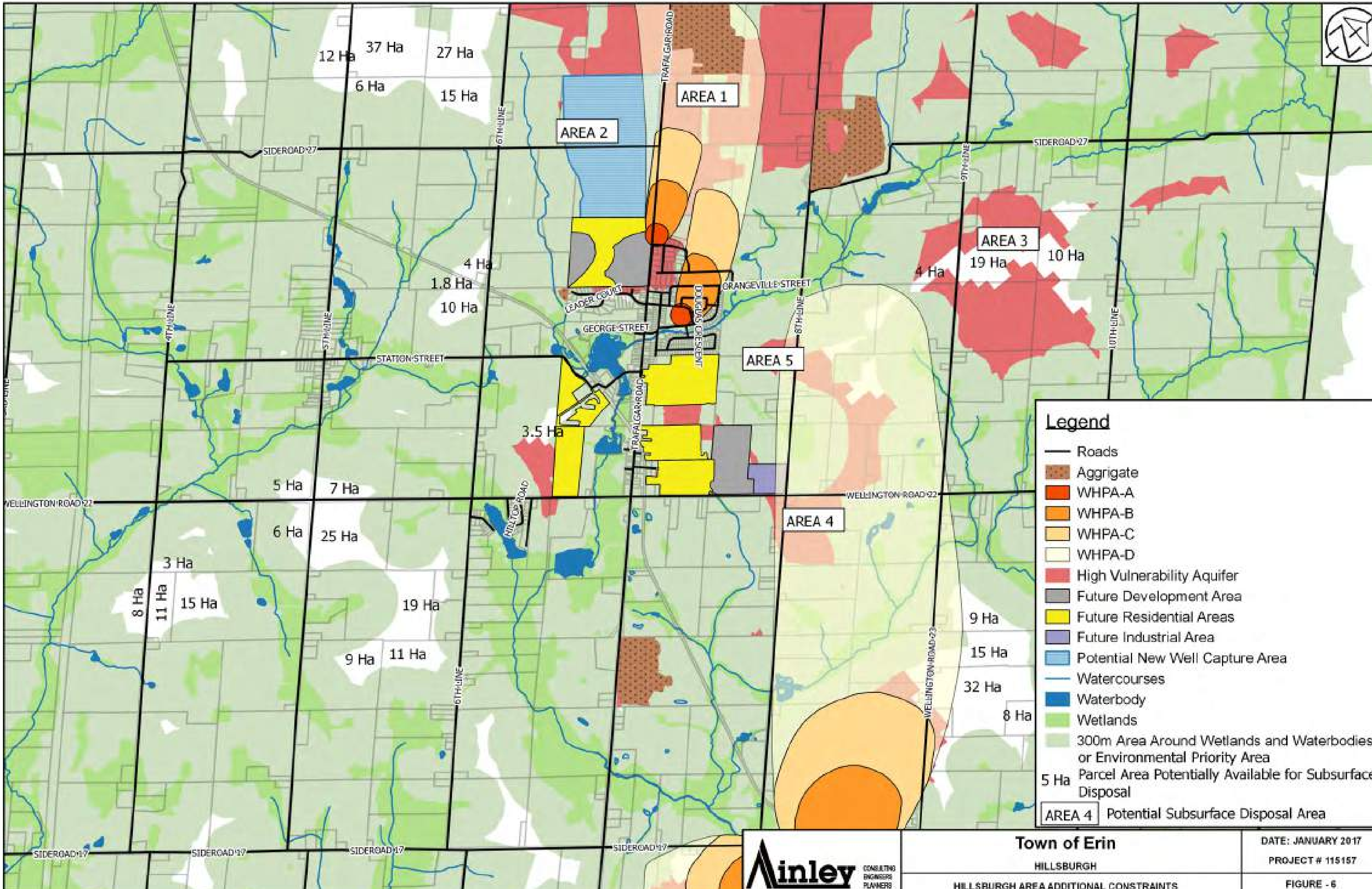
Area 1 – This area contains the WHPAs for both of the current Hillsburgh municipal wells. Although much of the WHPA does not have a high aquifer vulnerability, much of the WHPA is a secondary protection zone. Given the potential volume of subsurface wastewater discharge, it is likely that the potential discharge would be considered a drinking water threat. Considerable site specific investigation would be required to assess Area 1 as a potential site.

Area 2 – Although not a WHPA, the area is being assessed as a potential new source of municipal water under the Water Component of the Class Environmental Assessment and is interpreted as having the same hydrogeological constraints as Area 1.

Area 3 – This area is one of the largest areas where there are potentially few land use and/or environmental constraints. The area is designated as having a Highly Vulnerable Aquifer and is part of a major recharge area. Based on this information, the area is not considered suitable for large volume subsurface wastewater disposal.

Area 4 – This is one of the few areas near Hillsburgh which contains an area of land with potentially no environmental constraints; however the area is also designated as having a Highly Vulnerable Aquifer and part of a major recharge area. WHPA-D for Well E7.

Area 5 – This area contains a zone with potentially no environmental constraints and is within an area designated as having a Low Vulnerability Aquifer. Based on the known environmental and hydrogeological constraints, the potential exists for subsurface disposal in this area; however, the area is mapped as a having a lower permeability till unit at ground surface and would have to be further investigated.



AREA 1
AREA 2
AREA 3
AREA 4
AREA 5
12 Ha
37 Ha
27 Ha
6 Ha
15 Ha
4 Ha
1.8 Ha
10 Ha
3.5 Ha
5 Ha
7 Ha
6 Ha
25 Ha
3 Ha
8 Ha
11 Ha
15 Ha
19 Ha
9 Ha
11 Ha
4 Ha
19 Ha
10 Ha
9 Ha
15 Ha
32 Ha
8 Ha
TRAFALGAR ROAD
SIDEROAD 27
6TH LINE
4TH LINE
5TH LINE
8TH LINE
9TH LINE
10TH LINE
ORANGEVILLE STREET
LEADER COURT
GEORGE STREET
DOUGLAS CRESCENT
STATION STREET
WELLINGTON ROAD 22
WELLINGTON ROAD 23
HILLTOP ROAD
SIDEROAD 17
Legend
Roads
Aggrigate
WHPA-A
WHPA-B
WHPA-C
WHPA-D
High Vulnerability Aquifer
Future Development Area
Future Residential Areas
Future Industrial Area
Potential New Well Capture Area
Watercourses
Waterbody
Wetlands
300m Area Around Wetlands and Waterbodies or Environmental Priority Area
5 Ha Parcel Area Potentially Available for Subsurface Disposal
AREA 4 Potential Subsurface Disposal Area
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HILLSBURGH
HILLSBURGH AREA ADDITIONAL CONSTRAINTS
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FIGURE - 6

7.0 Subsurface Disposal Bed Requirements

7.1 Sizing and Cost

As discussed in Section 5, this technical memorandum will include consideration of a range of alternatives. To support development of these alternatives, the sizing and costs of a range of LSSDS systems have been examined as follows:

- A LSSDS servicing a single drainage area/subdivision.
- A LSSDS servicing the existing Hillsburgh community
- A LSSDS servicing full build out of Hillsburgh
- A LSSDS servicing full build out of Erin Village

Size requirements for LSSDSs' are determined on the basis of local geological/ hydrogeological conditions. Important factors in the design include the soil infiltration rates, soil attenuation capacity, and local groundwater levels. Generally, based on MOECC Sewage Works Guidelines, if the soils at any proposed LSSDS site are not well suited for the disposal bed application, soils would need to be brought to the site. When designing the disposal bed, a minimum of 900mm depth should be maintained from the bottom of the disposal bed trenches to the groundwater level/bedrock/ impervious soil layer. If this separation is not available naturally then additional soils must be imported to build up the disposal field.

Infiltration rates are typically measured as "T-Time"; For example, Hillsburgh, T -Times have been documented along with the septic bed records for a number of properties throughout the community. On average, the T-Time for the soils in Hillsburgh is 12. Soil conditions vary throughout the communities and include some areas with higher T-Times. The MOECC Guidelines provide information on system sizing based on general soil types. The guidelines provide areas which align closely with the standard method for calculating required disposal pipe lengths under the Building Code shown in Equation 1 in section 3 of this technical memorandum.

Assuming a LSSDS site in Hillsburgh would have average soil characteristics (T-Time = 12) for the area, the trench length needed for the existing population of Hillsburgh would be 24 km. For the ultimate buildout population of Hillsburgh, the total trench length would be 96 km. In order to approximate how much land area would be required for the leaching bed, the size of the Island Lake Subdivision LSSDS (illustrated above) is prorated based on the total length of trench required. A pro-rated cost of the disposal bed, based on bed area, is also provided for reference.

Table 7 illustrates the disposal system sizing and estimated cost for a range of systems. Native Soil (NS) notation in Table 6 denotes the construction of the subsurface disposal system in the native soils with an assumed T-Time of 12. Imported Fill (IF) notation denotes the construction of the subsurface disposal system using imported fill with an assumed T-Time of 6. Approximately 40% of the tile bed cost calculated for Island Lakes LSSDS was associated with the imported sand fill. Costing for the construction of the LSSDS in native soils has therefore been calculated pro rata with a 40% cost reduction; it should be noted however, that the cost of tile bed construction does not take into account the cost of purchasing the land so a land cost has been calculated assuming $25,000/Ha. The reference values are highlighted in orange.

Table 7 – Subsurface Disposal System Sizing and Cost

System Capacity (m^3/d)	100	365	600	2,400	4,750
	Subdivision	Island Lake	Existing Hillsburgh	Full Hillsburgh	Full Erin
Trench Length (m) – IF	2,000	6,700	12,000	48,000	95,000
Tile Bed Area (m^2) – IF	8,120	27,200	48,700	194,865	385,670
Tile Bed Cost (million $) – IF	0.7	2.33	4.2	16.7	33.0
Land Cost (million $) - IF	0.02	0.07	0.12	0.49	0.97
Total Disposal Field Cost (million $) – IF	**0.72**	**2.40**	**4.32**	**17.19**	**33.97**
Trench Length (m) – NS	4,000		23,975	96,200	190,000
Tile Bed Area (m^2) – NS	16,240		97,330	390,540	771,350
Tile Bed Cost (million $) – NS	1.4		8.3	33.5	66.1
Land Cost (million $) – NS	0.04		0.24	0.97	1.93
Total Disposal Field Cost (million $) – NS	**1.44**		**8.54**	**34.47**	**68.03**
Treatment Plant Cost (million $) (IF & NS)	**1.5**	**3.5**	**5.2**	**17.5**	**33.0**
Total System Cost (million $) (IF)	**2.22**	**5.9**	**9.52**	**34.69**	**66.97**
Total System Cost (million $) (NS)	**2.94**		**13.74**	**51.97**	**101.03**

It should be noted that the full build out costs reflect costs to the existing residents and for all growth. Since the soil properties of the potential sites are not known in detail the thickness of the imported fill required was assumed to be approximately 2.1m, the hydraulic properties of the native overburden were not taken into account in this assumption.

As shown in Table 7 the reduction in trench length and land area for establishing an LSSDS with imported fill reduces cost overall when compared to a system designed for the native soils with an assumed T-Time of 12.

It should be noted that the areas and capital costs prorated from the Island Lake example may not be directly applicable to the larger scale systems that are required to service Erin and Hillsburgh. The area provided for the Island Lake design was sufficient for the distribution piping and near-ideal layout which was possible for this particular disposal system. In effect, the tile bed area needed for larger Erin Village and Hillsburgh systems may need to be disproportionately larger to adequately disperse the higher flow. In addition, the Island Lake system did not include additional disposal beds to manage the risk of disposal bed failure. For Erin Village and Hillsburgh, extra disposal beds would likely be a mandatory contingency requirement and therefore the areas presented below would need to be increased substantially to accommodate this spare bed area.

7.2 LSSDS Design

Figure 7 provides an example layout for an LSSDS field. Individual distribution pipes are generally arranged into cells with a maximum length of 30 m and each pipe must be separated by 1.6m. In the Island Lake example, the field was surrounded with an impermeable clay berm to control the direction of shallow groundwater flow. Separation is provided between the cells to provide space for distribution piping and monitoring locations. Monitoring will generally be required throughout the tile field and at locations downgradient in the direction of shallow groundwater flow. A shallow grade should be maintained from the tile field towards the attenuation mantle to encourage the direction of the shallow groundwater flow.

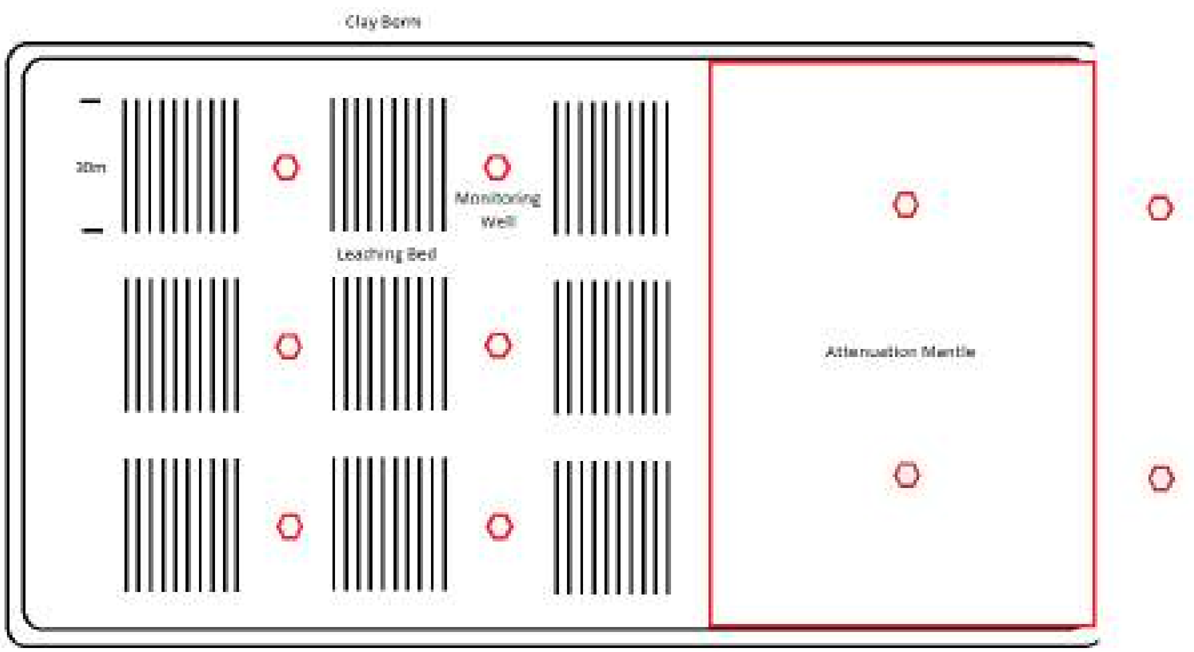


Figure 7- Example LSSDS Design

8.0 Subsurface Disposal Alternatives

In order to confirm the viability of subsurface disposal systems within the UCWS EA study area, there are a range of alternatives which may be considered as discussed in section 5 above. For each of Erin Village and Hillsburgh these include:

- Alternative 1 -- Discrete treatment systems servicing sewer decision areas established in the Septic System Survey technical memorandum.
- Alternative 2 -- A centralised treatment system with a series of disposal fields distributed to areas suitable for subsurface disposal based on the hydrogeological overview of the study area

- Alternative 3 -- A centralised system with a single disposal field suitable for subsurface disposal based on the hydrogeological overview of the study area

8.1 General Requirements for Alternatives

All of the alternatives defined above will be required to conform to the regulations and guidelines outlined in Section 3.0. The main factor which will determine the level of treatment required under any alternative will be the characteristics of the disposal sites. In general, it is expected that any alternative selected will require, at a minimum, primary and secondary wastewater treatment with tertiary treatment for nitrate reduction, before discharging effluent to the subsurface. Biosolids management will also be required. While it is anticipated that specific processes applicable to surface water discharge criteria may be eliminated, where strict nutrient levels do not have to be met, treatment plants for subsurface disposal sites will still have to meet MOECC strict requirements for design of wastewater facilities in Ontario including secure utilities with reliable control systems and standby power. All of the required treatment plant facilities will be defined in the plant ECA and plant operations would be monitored against that.

Each subsurface disposal field will also need to be designed in accordance with the MOECC guidelines to ensure adequate attenuation of contaminants downgradient of the discharge area. Regular monitoring of groundwater quality will be required to ensure that the system remains in compliance with the ECA. The regular monitoring will require the establishment of monitoring wells within the LSSDS and at multiple points downgradient, in the direction of shallow groundwater flow. The Town will need to either own the downgradient land or obtain an access agreement to the downgradient land to ensure that monitoring can be conducted.

8.2 Treatment Plant Requirements for Alternatives

While the exact requirements to obtain an ECA for a treatment system and LSSDS will depend on the local conditions of a site, there are a number of requirements which will be imposed regardless of the site selected. In order to meet the anticipated effluent requirements a treatment process with primary and secondary treatment will be needed as a minimum. To manage the expected nitrate limits, a denitrification system will likely be required. There are a range of approaches to provide denitrification, this process can be integrated into secondary treatment by establishing an anoxic zone for denitrifying bacteria or it can be integrated into a tertiary treatment process such as a deep bed upflow sand reactor. Regardless of the system selected, there is considerable management requirement for denitrification processes due to the sensitivity of denitrifying bacteria to environmental conditions.

Further investigation would be required to determine whether phosphorus removal would also be required for the system. Due to the low dilution volumes in comparison to the effluent discharge, it is likely that the overall dilution is insignificant. While the sorption capacity of the soil may provide sufficient attenuation of phosphorus in the near-term, the sorption capacity of the soils is finite, and phosphorus breakthrough would occur over time.

The management of biosolids will also need to be considered under each alternative. To meet the MOECC guidelines for biosolids storage, a minimum of 240 days of storage volume must be available. The total volume of storage does not necessarily need to be at the treatment plant site, however, for the sake of comparing alternatives it will be assumed that each treatment facility will have adequate storage for its own needs in order to minimise trucking of biosolids around the community to a central storage system.

As discussed above, a treatment facility discharging to an LSSDS will require the following components:

1. Preliminary Treatment (screening and grit removal)
2. Primary Treatment (sedimentation)
3. Secondary Treatment/Clarification
4. Denitrification
5. Biosolids Storage/ Management
6. Subsurface Disposal Field
7. Plant common facilities including standby power

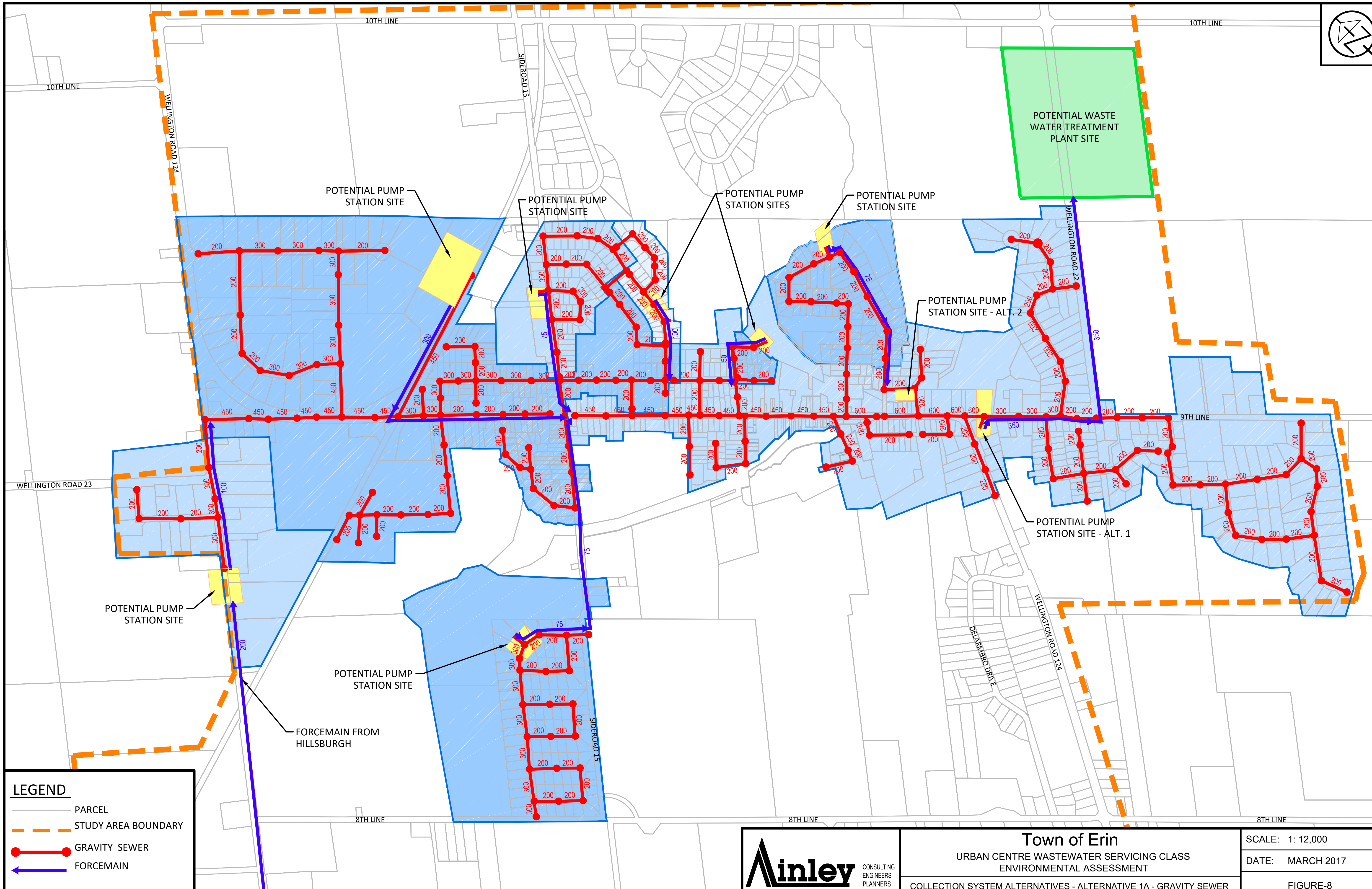
8.3 Erin Village Subsurface Disposal Alternatives

8.3.1 Erin Village Alternative 1 - Multiple Plants and Disposal Fields

As previously described, Alternative 1 is the option for the Town to establish multiple treatment plants throughout the communities each with an independent treatment plant and disposal field. In order to evaluate the viability of this alternative, it is assumed that the pumping station catchments for gravity sewers, described in the Collection System Alternatives Memorandum, will delineate the catchments for the separate treatment systems. The gravity sewer catchments are selected because they are based on the pre-existing topography of the Town and represent natural drainage areas, minimizing the need for pumping stations. Figure 5 shows the areas which are suitable for subsurface discharge in Erin Village. The pumping station catchments proposed for Erin Village are outlined on Figure 8 in foldout.

As noted in section 6 above, there is very little land available for subsurface disposal around Erin Village and there is no solution for Erin wherein multiple treatment plants and disposal fields can service each sewer catchment area. Erin Heights subdivision consists of 114 residential lots, which combine for a projected ADF of 112.6 m^3/d and would likely be a suitable size for a LSSDS. In addition, it is remote from Erin Village on the west side of the river making it more expensive to connect to a communal system. However there is no land around the subdivision suitable for a subsurface disposal system. The lands are either unsuitable due to proximity to surface water, within WHPA's or with highly vulnerable aquifers. In addition most of the adjacent lands have substantial slopes. The closest available lands are 3.8 km away which makes it more expensive to pump to a LSSDS than the proposed Erin Village collection system.

For all of the catchments in the village there are no suitable disposal locations within the immediate area or even within a 2 km radius. As such, Alternative 1 is not a viable solution for Erin Village. The slightly less costly treatment alternative in this case would be largely offset by the additional cost for land purchase and disposal bed construction leaving very little capital cost benefit over the surface water discharge alternative. Considering the added cost to operate and maintain multiple plants and the disposal fields, this alternative for Erin Village is considered non-competitive. This is further reinforced by the added risk of failure of the disposal field.


10TH LINE
10TH LINE
10TH LINE
SIDEROAD 15
WELLINGTON ROAD 124
WELLINGTON ROAD 22
WELLINGTON ROAD 23
9TH LINE
8TH LINE
8TH LINE
8TH LINE
SIDEROAD 15
DELARMBRO DRIVE
WELLINGTON ROAD 124
POTENTIAL WASTE WATER TREATMENT PLANT SITE
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITES
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITE - ALT. 2
POTENTIAL PUMP STATION SITE - ALT. 1
POTENTIAL PUMP STATION SITE
POTENTIAL PUMP STATION SITE
FOREMAIN FROM HILLSBURGH
LEGEND
PARCEL
STUDY AREA BOUNDARY
GRAVITY SEWER
FORCEMAIN
Ainley CONSULTING ENGINEERS PLANNERS
Town of Erin
URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT
COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 1A - GRAVITY SEWER
SCALE: 1: 12,000
DATE: MARCH 2017
FIGURE-8

8.3.2 Erin Village Alternative 2 - One Plant and Multiple Disposal Fields

As previously described, Alternative 2 is the option for the Town to establish a single treatment plant in Erin Village with a series of disposal fields throughout the village to manage the effluent. For Erin Village, the full build-out of the village is expected to generate an ADF of 4,770 m^3/d, which will require a total of 38.6 Ha of land for subsurface disposal.

Figure 5 shows the areas which are suitable for subsurface discharge in Erin and it can be seen from the figure that there are a limited number of locations which are suitable for discharge. Once the various restrictions on discharge are considered there is only “Area 5” on Figure 5 which provides a viable discharge location for a system of this size. “Area 5” is situated along 10 Sideroad between 8th Line and 9th Line and is also aligned along the zone of influence for one of the Town’s water supply wells. As there is only the single suitable location for the disposal field, Alternative 2 is non-viable.

8.3.3 Erin Village Alternative 3 - One Plant and One Disposal Field

As previously described, Alternative 3 is the option for the Town to establish a single treatment plant in Erin Village with a single disposal field to manage the effluent. For Erin Village, the full build-out of the village is expected to generate an ADF of 4,770 m^3/d, which will require a total of 38.6 Ha of land for subsurface disposal.

As discussed in Section 8.3.2 there is only a single viable treatment and discharge location, namely “Area 5” on Figure 5. “Area 5” is located to the north of Erin and is located approximately 4.2 km from the ideal primary pumping station location for the village which is twice as far as the proposed location of the treatment plant for the surface water discharge alternative. It is possible that Alternative 3 may provide a viable solution for Erin Village, however, as with Alternative 2, there is no cost saving in terms of collection and pumping and the added cost of land purchase and the disposal beds as well as the pumping costs to the disposal area likely do not offset the less costly treatment cost. There is little cost advantage over the surface water discharge alternative. Considering the added cost to operate and maintain the disposal fields, this alternative for Erin Village is considered non-competitive. This is further reinforced by the added risk of failure of the disposal bed.

8.4 Hillsburgh Subsurface Disposal Alternatives

8.4.1 Hillsburgh Alternative 1 - Multiple Plants and Disposal Fields

This analysis uses the full build out population and projected sewage flows established for the surface water discharge alternative. While an alternative exists to service the existing community only using a subsurface disposal alternative, there is over 100 Ha designated for development within the community and a solution for wastewater servicing is also required for these lands. Including full build out population also incorporates the advantage of not having to pump wastewater to Erin.

As previously described, Alternative 1 is the option for the Town to establish multiple treatment plants throughout Hillsburgh each with an independent disposal field. In order to evaluate the viability of this alternative, it is assumed that the pumping station catchments for gravity sewers, described in the Collection System Alternatives Memorandum, will delineate the catchments for the separate treatment systems. The gravity sewer catchments are selected because they are based on the pre-existing topography of the Town and represent natural drainage areas, minimizing the need for pumping stations. The pumping station catchments proposed for Hillsburgh are outlined on Figure 9. Figure 6 shows the areas which are suitable for subsurface discharge in Hillsburgh. In total, the full build-out of Hillsburgh, is expected to generate an ADF of 2,400 m^3/d, which will require a total of 19.5 Ha of land for subsurface disposal.

The disposal areas identified in Figure 4 are heavily dominated by various environmental constraints. "Area 3" is the only area which has land available which is unaffected by one or more constraint. Some additional pockets of land are available to the south/ west of the village but do not serve the spirit of Alternative 1 which seeks to treat and dispose of waste as close to the point of production as possible.

The closest location, west of the village between Sideroad 27 and Station Street, lies along three separate properties for a total area of 15.8 Ha. This location is approximately 2.5 km from the proposed pumping station site for the main residential area of Hillsburgh assuming that a forcemain could be constructed along Station Street.

Two additional locations which could be considered are "Area 3" as shown on Figure 6 and the pocket of viable land to the west of the village along Wellington Road 22. These locations are both at a similar distance from the village.

The locations described provide sufficient space for the construction of the necessary disposal beds and treatment. Based on potential availability of disposal lands, this alternative will be evaluated in more detail and compared to the surface water discharge alternative which involves pumping all of Hillsburgh's wastewater to Erin Village for treatment and surface water disposal.

8.4.2 Hillsburgh Alternative 2- One Plant and Multiple Disposal Fields

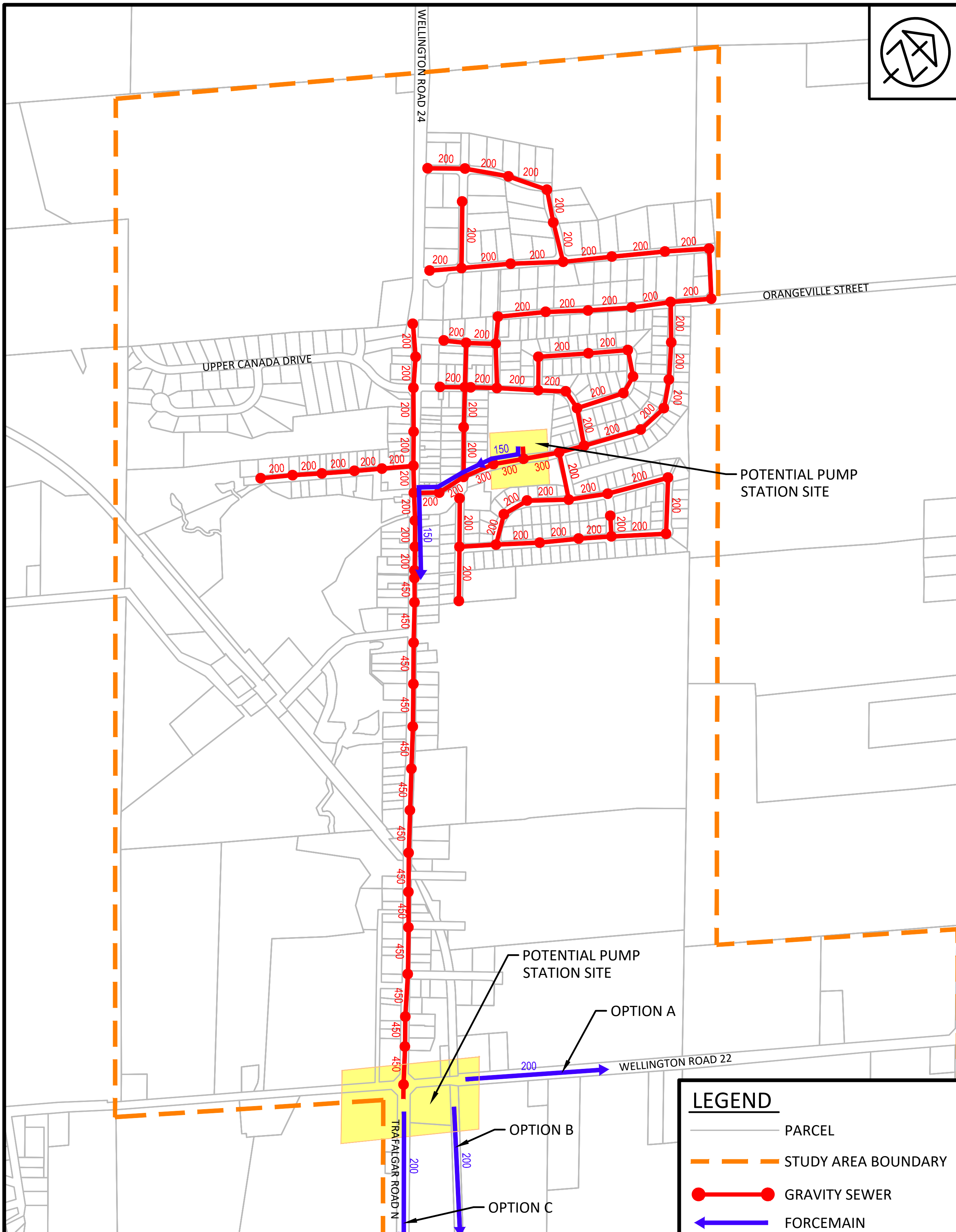
As previously described, Alternative 2 is the option for the Town to establish a single treatment plant in Hillsburgh with a series of disposal fields throughout the village to manage the effluent. For Hillsburgh, the full build-out of the community is expected to generate an ADF of 2,400 m^3/d, which will require a total of 19.5 Ha of land for subsurface disposal.

Figure 6 shows the areas which are suitable for subsurface discharge, as described above the locations available for discharge are heavily limited by the existing environmental constraints. The areas identified in Section 8.4.1 would also be considered for Alternative 2. Ultimately, due to the limitations which exist, the only significant difference between Alternative 1 and Alternative 2 is the establishment of two treatment plants compared to the establishment of a single treatment plant.

Based on potential availability of disposal lands, this alternative will also be evaluated in more detail and compared to the surface water discharge alternative which involves pumping all of Hillsburgh's wastewater to Erin Village for treatment and surface water disposal.

8.4.3 Hillsburgh Alternative 3- One Plant and One Disposal Field

As previously described, Alternative 3 is the option for the Town to establish a single treatment plant in Hillsburgh with a single disposal field to manage the effluent. For Hillsburgh, the full build-out of the village is expected to generate an ADF of 2,400 m^3/d, which will require a total of 19.5 Ha of land for subsurface disposal.



Ainley CONSULTING ENGINEERS PLANNERS

Town of Erin

URBAN CENTRE WASTEWATER SERVICING CLASS ENVIRONMENTAL ASSESSMENT

COLLECTION SYSTEM ALTERNATIVES - ALTERNATIVE 1 - GRAVITY

SCALE:	1: 12,500
DATE:	MARCH 2017
FIGURE-9	

Figure 6 shows the areas which are suitable for subsurface discharge. As described above, the locations available for discharge are heavily limited by the existing environmental constraints. Two locations exist which provide land viable for discharge and sufficient space for the establishment of the necessary disposal field. The two locations are "Area 3" as indicated on Figure 6 and the land surrounding the intersection of 5th Line and Wellington Road 22. For the purpose of evaluating this option it will be assumed that the later area will be selected.

Based on potential availability of disposal lands, this alternative will also be evaluated in more detail and compared to the surface water discharge alternative which involves pumping all of Hillsburgh's wastewater to Erin Village for treatment and surface water disposal.

8.5 Conclusions

8.5.1 Alternatives for Erin Village

Based on the above, it is concluded that there is little opportunity around Erin Village to support a multiple plant/multiple disposal bed solution. While there is likely the required 38.6 Ha available to support the single treatment plant and either multiple disposal fields or a single disposal field from lands further outside Erin, there is also little cost advantage in either of these Alternatives and added risk associated with disposal bed failure. It is also considered that land purchase for the purpose of wastewater disposal could prove problematic. A commitment to meet compliance limits downstream of the disposal fields before the effluent reaches surface water, also represents a considerable risk for the Town. It is further noted that the vulnerability of the aquifers in the potential disposal areas represents further risk moving ahead with more detailed studies as potential disposal areas may ultimately prove to be non-viable. It is therefore concluded that subsurface disposal Alternatives do not provide a viable option to surface water discharge for Erin Village.

8.5.2 Alternatives for Hillsburgh

Based on the above, it is concluded that there is opportunity around Hillsburgh to support a multiple plant/multiple disposal bed solution. The required 19.5 Ha is also likely available to support the single treatment plant and either multiple disposal fields or a single disposal field from lands around Hillsburgh. For this reason these alternatives are considered in more detail in Section 9.0 to identify whether there is sufficient cost advantage to outweigh the added risk associated with subsurface disposal.

9.0 Conceptual Cost Estimate

Section 8 concludes that there is likely little cost advantage in the subsurface disposal alternatives for Erin village but that there may be a cost advantage for Hillsburgh. This section provides a more detailed cost assessment of subsurface alternatives for Hillsburgh. Cost estimates for each of the alternatives proposed in Section 8.4 are presented herein.

The cost estimate for Alternative 1, which assumes the establishment of two independent treatment systems in Hillsburgh each with an independent LSSDS, is provided in Table 8.

Table 8 - Hillsburgh Alternative 1 Cost Summary

System Component	Description	Estimated Capital Cost
Forcemain (1)	2,500m, 150 mm dia.	$ 1,000,000
Forcemain (2)	850m, 150 mm dia.	$ 340,000
Treatment Facilities	2 x 1,200 m^3/d ADF	$ 18,800,000
Land Cost	28 Ha	$ 700,000
Tile Beds	2 x 9.8 Ha beds	$ 18,000,000
Total		$ 38,840,000

The cost estimate for Alternative 2, which assumes the establishment of one treatment system in Hillsburgh discharging to two separate LSSDS, is provided in Table 9.

Table 9 - Hillsburgh Alternative 2 Cost Summary

System Component	Description	Estimated Capital Cost
Forcemain (1)	850m, 250 mm φ	$ 425,000
Forcemain (2)	1,900m, 150 mm φ	$ 760,000
Treatment Facility	2,400 m^3/d ADF	$ 17,500,000
Land Cost	28 Ha	$ 700,000
Tile Beds	2 x 9.8 Ha beds	$ 18,000,000
Total		$ 37,385,000

The cost estimate for Alternative 3, which assumes the establishment of one treatment system for Hillsburgh with a single LSSDS, is provided in Table 10.

Table 10 - Hillsburgh Alternative 3 Cost Summary

System Component	Description	Estimated Capital Cost
Forcemain	1,550m, 250 mm φ	$ 775,000
Treatment Facility	2,400 m^3/d ADF	$ 17,500,000
Land Cost	28 Ha	$ 700,000
Tile Beds	19.5 Ha bed	$ 18,000,000
Total		$ 36,975,000

From the above cost estimates, it is likely that the cost of a single plant and single disposal field is less than the cost of the alternatives involving multiple plants and/or multiple disposal fields. In addition, alternatives involving multiple facilities require a higher operating cost. It is therefore apparent that Alternative 3 with one plant and one disposal field represents the best alternative for a subsurface disposal alternative for Hillsburgh. The cost for full build out of Hillsburgh for Alternative 3 represents approximately $18,500 per lot as compared to the Island Lake example previously illustrated which cost approximately $21,000 per lot for a smaller system. The cost to service just the existing community would likely be closer to the Island Lake example.

For the purposes of estimating costs, the total land area assumed for each alternative is based on the required tile bed area with additional land assumed for the establishment of additional tile beds if necessary to manage failures and space for the treatment plant. It should be noted that it is unlikely that an exact area of land suitable for establishing these systems can be purchased. It is likely that larger areas of land would need to be purchased as it may be inconvenient for a land owner to sell only a portion of their property. Once all suitable lands are identified, it would be necessary to identify land owners willing to sell property and to conduct all of the necessary studies. The final disposal field solution may include multiple fields throughout the community with the costs being closer to those identified for Alternative 2.

Forcemain costs were estimated on the same basis as provided in the Collection System Alternatives memorandum. The cost tables are available in that report. Treatment plant costs were interpolated from the known construction costs of treatment plants within southern Ontario. The costs were interpolated on the basis of treatment capacity. The cost of the tile beds was calculated on a pro rata basis from the construction cost of the Island Lake system in Mono.

10.0 Comparison of Subsurface Disposal and Surface Water Discharge

Section 9 above identifies the potential cost for a subsurface solution for Hillsburgh. This cost has to be set against the total cost of a wastewater solution for both communities and compared to the surface water discharge solution which was identified as the preferred alternative in the SSMP.

Table 11 below provides a cost comparison of alternatives for treatment and disposal excluding the cost of collection. Costs are for full build out and not all of these costs are applicable to the existing community.

“Hillsburgh Alternative 3” assumes that there will be two separate systems for Erin Village and Hillsburgh with the Hillsburgh system discharging effluent to an LSSDS and the Erin Village system discharging to the West Credit River.

“Erin Surface Water Discharge” assumes all wastewater from both communities is pumped to Erin Village for treatment and surface water disposal as outlined in the SSMP. The preferred collection system is anticipated to be predominantly the same and is therefore not included in the cost summary.

Table 11 – Cost Comparison of Treatment and Disposal Alternatives

	Hillsburgh Alternative 3		**Erin Surface Water Discharge**
System Component	**Hillsburgh (2,400 m^3/d)**	**Erin (4,700 m^3/d)**	**(7,170 m^3/d)**
Hillsburgh to Erin Forcemain	N/A	N/A	$ 3,750,000
Hillsburgh Forcemain to Treatment Site	$ 775,000	N/A	N/A
Preliminary Treatment	$ 1,200,000	$ 2,200,000	$ 3,725,000
Primary Treatment	$ 1,750,000	$ 3,400,000	$ 5,730,000
Secondary Treatment	$ 3,500,000	$ 6,700,000	$ 11,460,00
Clarification	$ 2,100,000	$ 3,950,000	$ 6,700,000
Denitrification	$ 2,675,000	N/A	N/A
Tertiary Treatment	N/A	$ 4,800,000	$ 8,600,000
Disinfection	$ 465,000	$ 960,000	$ 1,400,000
Biosolids Storage/ Management	$ 4,100,000	$ 7,910,000	$ 14,300,000

System Component	Hillsburgh Alternative 3 Hillsburgh (2,400 m^3/d)	Erin (4,700 m^3/d)	Erin Surface Water Discharge (7,170 m^3/d)
Effluent Pumping	$ 230,000	$ 480,000	$ 720,000
Subsurface Disposal Field	$ 18,700,000	N/A	N/A
Outfall	N/A	$ 600,000	$ 800,000
Plant Common Facilities/ Site works	$ 1,480,000	$ 2,600,000	$ 4,500,000
Additional Site Investigation	$ 500,000	N/A	N/A
Subtotal	$ 37,475,000	$ 33,600,000	N/A
Total	**$ 71,075,000**		**$ 61,685,000**

It should be noted that the cost estimates provided in Table 11 are preliminary for the purpose of this comparative evaluation.

Based on the above analysis, in terms of capital cost, there is no advantage for the Hillsburgh subsurface alternative and it is likely to cost between 10 – 20% more to construct this alternative. In addition, the costs to operate two plants instead of one would likely be approximately 10% more in ongoing operation and maintenance cost. While the surface water alternative involves the cost of pumping wastewater from Hillsburgh to Erin, the subsurface alternative likely involves a similar cost in pumping to the disposal fields. Further, there are several additional costs for subsurface disposal that were not included in the overall costing; extensive long-term monitoring of ground water quality, additional disposal beds to manage potential failures and effluent holding tanks for high groundwater level conditions may also be required to have a successful groundwater disposal system.

The above cost analysis includes an additional cost of $500,000 for the technical studies required to establish whether lands are suitable for subsurface disposal. It is likely that this alternative would also incur considerable realty and legal costs in order to support the purchase of the disposal field lands.

As listed in Section 2.0 the following assessments would need to be conducted to obtain approval for the site(s) of a subsurface disposal field(s).

1. Full hydrogeological, hydrological / surface water and Reasonable Use Guideline assessment (exceeding that in Ch.22 of the Design Guideline for Sewage Works, 2008);
2. Groundwater / water well, surface water / aquatic life and microbiological risk assessments;
3. Water well survey within 2 to 5 km of site (radius may vary depending on specific geologic conditions etc.);
4. Integrated groundwater - surface water flow modelling;
5. Engineering design with comparable effluent treatment and disinfection, prior to discharge, to a traditional sewage treatment plant required to demonstrate that the suite of contaminants in sewage effluent and contaminant loadings would be addressed;
6. Engineering design would also need to demonstrate effluent discharge requirement to the bed for nitrate, anticipated to be no greater than 2.5 mg / L to accommodate the size of the beds required, and meet reasonable use at the property boundary;
7. Anticipated area of land required for beds (and therefore not available for other use);

8. Influent, effluent, groundwater and surface water monitoring plans, and performance criteria that would need to be met;
9. Contingency plans to address system failure;

In addition to the above subsurface disposal studies, it will be necessary to integrate this work with the Water Supply Class EA to ensure that future supply wells are not impacted.

It is likely that further investigation of the subsurface disposal alternative would delay the Class EA by up to one year.

11.0 Conclusions and Recommendations

The purpose of this report is to examine the viability of a subsurface disposal alternative solution for the Erin Urban Centre Wastewater Servicing Class EA (UCWS EA) either servicing the entire study area using a single treatment plant or as multiple systems servicing components of the study area. The intent of the report is to either confirm selection of the preferred alternative solution established through the Servicing and Settlement Master Plan (SSMP) or to recommend further study of the subsurface disposal alternative during Phase 3 of the UCWS EA. The request to consider this alternative was made by members of the Public Liaison Committee (PLC) and by members of the community group Transition Erin who were concerned that the viability of treating wastewater at multiple smaller facilities was being overlooked.

- The 2014 SSMP provided a brief review of subsurface disposal and a rationale for the disposal of waste effluent to the West Credit River below Erin Village, however, an in-depth review of subsurface disposal viability was not completed.
- The rationale for disposing of effluent in the West Credit River was originally based on the characteristics of the West Credit River through Hillsburgh in comparison to Erin Village.
- The decision to treat wastewater at a single treatment plant and discharge to the West Credit River below Erin Village was supported by feedback from the CVC.
- Design standards for large subsurface disposal systems (LSSDS) are outlined in the existing MOECC Design Guidelines for Sewage Works.
- An ECA application acceptance requires extensive site investigations to ensure the system is properly designed for the site and that the Reasonable Use Guidelines are met. These additional investigations are estimated to cost $500,000.
- LSSDSs are a common effluent management practice in Ontario, however, the scale of the system needed for managing waste from an entire village the size of Erin Village or Hillsburgh is well beyond any system currently operating in Ontario.
- At the typical size for an LSSDS, servicing the existing communities would likely require some 30 to 40 separate systems each with their own treatment systems and disposal fields and each requiring their own effluent limits and MOECC approval and ongoing operation, maintenance, monitoring and reporting.
- Based on broad generalisation of groundwater quality within the Town, the approved effluent standards of similar systems and an understanding of the Reasonable Use Guidelines, the key effluent quality requirements anticipated are listed in Table 12.

Table 12 – Potential Effluent Requirements Subsurface Disposal

Parameter	Concentration (mg/L)
BOD_5	10
TSS	10
NO_3-N	2.5

- Should the Town proceed with an LSSDS for effluent management, the system capacity required for the existing communities of Erin Village and Hillsburgh are listed in Table 13. The equivalent disposal bed area required is also provided for reference.

Table 13 – Projected Sewage Flow Rates and Disposal Area

	Erin		Hillsburgh		Total	
	Flow (m^3/d)	Disposal Area (Ha)	Flow (m^3/d)	Disposal Area (Ha)	Flow (m^3/d)	Disposal Area (Ha)
Existing Community	2,244.1	18.17	599.4	4.87	2,843.5	23.03
Growth Areas	2,523.0	20.44	1,805.7	14.62	4,328.7	35.07
Total	4,767.1	38.61	2,405.1	19.48	7,172.2	58.09

- The alternative for subsurface disposal can be based on a range of alternatives involving multiple treatment plants and disposal fields. In order to confirm viability of subsurface disposal, the following alternatives are considered for each of Erin and Hillsburgh:
  - Alternative 1: Decentralised treatment systems servicing sewer decision areas established in the Septic System Survey technical memorandum.
  - Alternative 2A: centralised treatment system with a series of disposal fields distributed to areas suitable for subsurface disposal based on the hydrogeological overview of the study area
  - Alternative 3A: centralised system with a single disposal field suitable for subsurface disposal based on the hydrogeological overview of the study area
- All of the alternatives defined above will be required to conform to the regulations and guidelines as described in the MOECC guidelines.
- The selection of any alternative presented is restricted heavily by existing environmental conditions in the area surrounding Erin Village and Hillsburgh.
- Prior to the selection of a location for a disposal bed, the existing environmental and hydrogeological constraints must be considered as well as the location of existing wells and the geology of the area.
- The known environmental constraints are shown graphically in Figure 5 and Figure 6 and include the existing Well Head Protection Areas (WHPAs), Highly Vulnerable Aquifers (HVAs), woodland areas, wetlands, watercourses, and a 300m buffer from surface water features.
- The level of treatment required at any LSSDS site can only be established when all the characteristics of the disposal site are known.
- It is anticipated that any subsurface alternative selected will require, at a minimum, the following treatment components:
  - Preliminary Treatment (screening and grit removal)
  - Primary Treatment (sedimentation)

- Secondary Treatment/Clarification
  - Denitrification
  - Biosolids Storage/ Management
  - Subsurface Disposal Field
  - Plant common facilities including standby power
- Alternative 1, Alternative 2 and Alternative 3 were all determined to be non-viable solutions for Erin Village.
  - There is likely not enough viable land within Erin Village to support Alternative 1.
  - There is little cost advantage in either Alternative 2 or Alternative 3 and added risk associated with disposal bed failure, the cost of land purchase, the commitment to meet compliance limits downstream of the disposal fields, and the added cost of further study make these alternatives non-competitive with the surface water disposal alternative.
- Alternative 1, Alternative 2 and Alternative 3 were all determined to be potentially viable solutions for the community of Hillsburgh.
- As these alternatives are considered potentially viable they were evaluated economically to identify whether there is sufficient cost advantage to outweigh the added risk associated with subsurface disposal.
- Including treatment cost, tile bed construction and land acquisition the estimated costs associated with each subsurface disposal alternative for full build out of Hillsburgh are summarised in Table 14. These costs include both the existing community costs and new growth costs.

Table 14 – Estimated Costs for Subsurface Alternatives in Hillsburgh

	Estimated Capital Cost
Alternative 1	$ 38,840,000
Alternative 2	$ 37,385,000
Alternative 3	$ 36,975,000

- Since Alternative 3 was the least costly alternative for subsurface disposal in Hillsburgh, a cost comparison with the single plant, surface water discharge solution for Erin Village and Hillsburgh was completed.
- The total full build out treatment and disposal cost, for Alternative 3, including the construction of an independent treatment and disposal system for the community of Hillsburgh and a separate treatment and disposal system for Erin is $71,075,000, exclusive of collection system costs.
- Comparatively, the full build out treatment and disposal costs for the single treatment plant located downstream of Erin Village (original SSMP solution) with surface water disposal, including the cost of a forcemain connection from Hillsburgh to Erin Village, is estimated to be $ 61,685,000.
- Based on the above, it is clear that the single plant with surface water discharge provides the most economical solution in terms of capital cost. In addition, the operation and maintenance costs associated with two plants would be greater than for the single plant.
- The risks associated with developing a subsurface disposal alternative, in purchasing the necessary lands and obtaining approvals for the system, combined with the added costs means that there is no advantage in further development of subsurface disposal alternatives for either community.

- Based on the findings herein, the recommendation of this report is that the Town of Erin proceed with the SSMP recommendation to establish a single treatment plant in Erin Village with surface water discharge to the West Credit River to provide wastewater servicing to both Hillsburgh and Erin Village.

Appendix - A

Review Agency Comments

CREDIT VALLEY CONSERVATION

May 2, 2017

Town of Erin
5684 Trafalgar Road
RR2 Hillsburgh, ON
N0B 1Z0

Attention: Dina Lundy, Clerk

Re: Town of Erin
Urban Centre Wastewater Servicing Class Environmental Assessment
Technical Memorandum Subsurface Disposal Alternative
Final for Agency Comment

Staff of Credit Valley Conservation (CVC) have reviewed Town of Erin Town of Erin Urban Centre Wastewater Servicing Class EA – Technical Memorandum – Subsurface Disposal Alternatives Final for Agency Review. March 2017 and provide the following comments for your consideration

It is our understanding that the goal of this study was to be a high level screening report to determine the feasibility of Subsurface Disposal in the Town of Erin (specifically in the Hillsburgh area). Recognizing the high level nature of the report, CVC is satisfied with the conclusion outlined in section 11of the report. There are significant risks and uncertainties in determining the long term effects of subsurface disposal in the Hillsburgh study area.

In addition, CVC is concerned with the ability of Subsurface Disposal systems to consistently meet the low nitrogen levels required (<2.5 mg/L) to ensure protection of aquatic resources. Effluent monitoring results from existing LSDDS systems at Centre 2000 and St. John Brebeuf elementary school have shown a high exceedance rates for nitrate. This is particularly concerning for surface water features downgradient of large tile beds which support habitats sensitive to nitrate in groundwater discharge.

If the Town is considering moving forward with subsurface disposal due to the highly vulnerable nature of the aquifer in the Hillsburgh region, more specific studies will be needed. These include the assessment of the hydraulic connection between the surficial sand and gravel aquifer and the wetlands and surface water receptors. The evaluation of the potential impacts to localized wetland water balance, from continuous hydrologic loading in areas downgradient of large tile fields will be needed. CVC is specifically concerned due to the specific vulnerability of the shallow subsurface environment, as there may be limited protection to surficial aquifer systems (ie. silts, clays, aquitards) and a relatively short travel time for contaminants to move vertically through the soils. Given this, there is a danger of potential impacts to both local private wells and significant natural heritage features.

In conclusion while a large subsurface system may be feasible, there is a significant risk to the Town that they will not be able to confirm the viability of this mode of servicing. In addition, there is also concern with respect to the long-term effects that could result to the natural environment. Therefore, CVC would recommend that the Town continue with determining the viability of the surface water discharge.

Please do not hesitate to contact me, if you have any additional questions.

Yours truly,

Liam Marray
Senior Manager Planning Ecology

Cc: Triton Engineering Services Limited
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cfurlong@tritoneng.on.ca

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Attention: Barb Slattery
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Barbara.slattery@ontario.ca

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Ministry of the Environment and Climate Change
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Ministère de l'Environnement et de l'Action en matière de changement climatique
Région du Centre-Ouest

119 rue King ouest
12e étage
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Tél.: 905 521-7640
Téléc.: 905 521-7820

Memorandum

Date: April 10, 2017

To: Barbara Slattery
EA/Planning Coordinator, Technical Support Section (TSS)

From: Salah Sharif
Hydrogeologist, Technical Support Section (TSS)

Re: Technical Review of the Subsurface Disposal Alternatives for the Communities of Erin Village and Hillsburgh, Town of Erin, Ontario (IDS Ref. No. 6881-AKVP6R)

As requested, I have reviewed the following report:

Town of Erin Urban Centre Wastewater Servicing - Class Environmental Assessment: Technical Memorandum - Subsurface Disposal Alternative - Final Draft, prepared by Ainley Group Consulting Engineers & Planners, and dated March 2017.

The above mentioned technical memorandum (hereafter referred to as memorandum) examines the option for subsurface disposal of treated effluent from the existing and full build-out communities of Erin Village and Hillsburgh in the Town of Erin as an alternative of the preferred option for surface water disposal to the West Credit River downstream of Erin Village.

This memorandum provides a screening level overview of the technical feasibility and applicability of the MOECC's design requirements for subsurface disposal for Large Subsurface Sewage Disposal Systems (LSSDS) with respect to the option for subsurface disposal of treated effluent from the existing and full build-out communities of Erin Village and Hillsburgh. No detailed hydrogeologic investigation was conducted to evaluate the feasibility of LSSDS and the assessment was based on desktop study using existing information gathered as part of the Servicing and Settlement Master Plan (SSMP), Erin Urban Centre Wastewater Servicing Class EA (UCWS EA) and associated Class EA studies.

The major objectives of the above mentioned memorandum are as follows:

- To determine whether subsurface disposal of treated effluent is a feasible option for the communities of Erin Village and Hillsburgh as an alternative of the preferred option established in the SSMP involving surface water discharge to the West Credit River downstream of Erin Village;

- The above assessment/feasibility was based on screening level desktop studies using available information and no site-specific detailed geotechnical and hydrogeological investigation and risk assessments were conducted;
    - To identify whether there is any merit in proceeding with detailed field investigations (i.e., hydrogeologic investigations, modeling, and risk assessments) to be required for detailed feasibility assessment for LSSDS.

<u>MOECC's Comments</u>

1. The "*Executive Summary*" of the memorandum reported that "*It is anticipated that the treatment facility required prior to subsurface discharge would involve a plant similar to a traditional secondary sewage treatment plant discharging to surface water. The facility design would be required to demonstrate that the suite of contaminants in the raw sewage and contaminant loadings would be treated to meet MOECC requirements. Effluent limit for nitrates would be anticipated to be no greater than 2.5 mg/L to accommodate the size of the beds required, and meet MOECC "Reasonable Use" policies at the property boundary. Required effluent limits would require the establishment of a denitrification system".*

   The above statement is highly confusing as the alternative under consideration is subsurface disposal of treated sewage effluent; therefore, the criteria of effluent quality are achieved before disposal to subsurface. There is no requirement to ensure MOECC's "Reasonable Use" criteria before subsurface disposal of treated effluent. The MOECC's "Reasonable Use" criteria are applicable at property boundary (i.e., down-gradient of the leaching bed and area of natural attenuation), which are expected to be much lower than pre-disposal treated effluent due to natural attenuation processes.

2. Based on MOECC's "Reasonable Use" criteria the key effluent quality requirements for subsurface disposal at property boundary (i.e., down-gradient of the leaching bed and area of natural attenuation) are anticipated as BOD, TSS, and NO_3-N with concentrations of 10 mg/L, 10 mg/L, and 2.5 mg/L, respectively. The effluent quality requirement for surface water disposal were identified through the UCWS EA (i.e., BOD; 7.5 mg/L; TSS: 10 mg/L; total phosphorus: 0.046 mg/L; total ammonia: 2 mg/L; NO_3-N: 6 mg/L, and TKN: 3 mg/L). The requirement for additional treatment of the treated sewage effluent for any of the above parameters should be based on predictive calculation provided in the Section 22.5.8 of the 2008 MOECC's Design Guideline for Sewage. The calculation provides contaminants concentration at down-gradient property boundary using annual dilution volume, dilution area, total volume of water, annual sewage volume, actual concentration in the sewage, and annual dilution precipitation rate.

Therefore, the requirement for additional treatment of the treated sewage effluent for the subsurface disposal should be evaluated based on Section 22.5.8 of the 2008 MOE Design Guideline for Sewage and system design parameters for site-specific LSSDS. Subsurface disposal effluent quality at discharge point can be assessed based on the effluent discharge quality after secondary treatment and effluent quality requirements for subsurface disposal at property boundary (i.e., down-gradient of the leaching bed). This assessment will evaluate the need for tertiary treatment, specifically for NO3-N and TSS.

3. Environmental and hydrogeological constraints due to large-scale subsurface disposal of sewage effluent for Both Erin Village and Hillsburgh were evaluated. The evaluation did not consider possible changes in the groundwater flow systems, hydraulic connection between shallow and deep aquifers (i.e., municipal aquifer), and surface water-groundwater interaction (i.e., losing-gaining relationship of the Credit River with respect to shallow aquifer due to large-scale subsurface infiltration of effluent into the shallow aquifer). Any mounding effect with locally high hydraulic gradient due to large-scale infiltration and low permeability in the soil below the infiltration bed may significantly increase the groundwater flow velocity, as well as decrease travel time, which may affect the designated WHPA-B, WHPA-C, and WHPA-D.

4. The capacity of the surficial geologic material to accept large volumes of wastewater was not evaluated. It is understood that extensive site-specific geotechnical, lithologic, and hydrogeologic investigation together with qualitative and quantitative risk assessment and groundwater modeling (i.e., integrated surface water – groundwater interaction and water budget) are required to understand the environmental and hydrogeological constraints due to large-scale subsurface disposal system in the area.

5. Section "*6.3 Hydrogeological Constraint Areas"* reported that "*An understanding of the potential types and concentration of contaminants from any large-scale sub-surface disposal system may be necessary, to assign the potential risk associated with the scale of subsurface wastewater discharge that would be required."*

   The estimated effluent volume for subsurface disposal from combined or either Erin Village or Hillsburgh is so high that there is no comparable existing or proposed subsurface disposal system is available. Therefore, even the screening level evaluation for the feasibility of the large-scale subsurface disposal from Erin Village and Hillsburgh is a unique case study and uncertainties exist at every level of prediction. A cumbersome and costly measure/investigation is required to reduce the inherent uncertainty in the prediction of technical feasibility and costing perspective. Therefore, it is critical to adequately evaluate for merit, if any, in proceeding with detailed and expensive field investigations to be required for LSSDS.

6. Subsurface disposal bed requirements and associated costings for Erin Village and Hillsburgh were estimated based on Island Lake Subdivision in the Town of Mono with an approved ECA for subsurface sewage volume of 365 m^3/day. It is considered reasonable to utilize Island Lake data to estimate disposal bed requirements and system costings for Erin Village and Hillsburgh; however, it is not clear whether the reasonable thickness of the disposal bed (i.e., imported fill) was considered based on hydraulic properties of native overburden for the calculation of the volume of imported fill.

7. Section *"8.2 Treatment Plant Requirements for Alternatives"* reported several components including denitrification for a treatment facility discharging to an LSSDS. It is not clear whether the leaching bed has capacity to attenuate total phosphorus below the MOECC's "Reasonable Use" criteria at property boundary (i.e., down-gradient of the leaching bed). Due to low dilution volume compared to total sewage discharge volume, it is likely that dilution is insignificant as a natural attenuation for phosphorus. The sorption capacity of soil may be sufficient to attenuate the phosphorus concentrations below the MOECC's "Reasonable Use" criteria at property boundary (i.e., down-gradient of the leaching bed); however, breakthrough of phosphorus due to exceedance of sorption capacity of soil with time cannot be ignored.

8. The conclusion that the subsurface disposal alternatives do not provide a viable alternative to surface water discharge for Erin Village is not based on detailed site-specific investigations, which is considered very extensive in nature, as well as expensive; however, the assumptions, design criteria, reference examples, environmental and hydrogeological constraints, associated risks, and level of uncertainties in the subsurface disposal option for Erin Village used to conclude to this conclusion are considered reasonable in terms of screening level evaluation.

9. Area 5 in the Hillsburgh (i.e., Figure 6) is considered to have potential for subsurface disposal based on the fact that there exists potentially no environmental constraints and the area is designated as having Low Vulnerability Aquifer as indicated in the Approved Assessment Report: Credit Valley Source Protection Area, February 2015. The shallow aquifer in Area 5 and other areas in Hillsburgh is not the municipal aquifer, and is typically the shallowest aquifer capable of producing sufficient water for domestic water wells and is highly vulnerable to surface contamination. No information is provided between the interaction (i.e., hydraulic connectivity) of this shallow aquifer and municipal aquifer. It is also reported that the Area 5 is mapped as having low permeability till at ground surface; therefore, Area 5 was not evaluated for suitability of leaching bed, possibility of mounding in case of raised bed consisting of imported fill, and changing hydrodynamic condition due to infiltration of large-scale sewage effluent, changing shallow groundwater and surface water interaction, and possible water quality impacts in municipal aquifer.

10. It is concluded that there may be opportunity around the Hillsburgh community to support a subsurface disposal option, specifically having potential areas for subsurface disposal consisting of either multiple disposal beds or a single disposal field. This conclusion was based on physical, environmental and hydrogeological constraints (i.e., distribution of surface drainage, topography, woodlands, wetlands, potential impact on drinking water supplies, wellhead protection areas, highly vulnerable aquifers, 300 m setback distance between leaching bed and surface water bodies, interference with existing and potential future municipal wells, and future development in the communities) in the Hillsburgh. Although the screening level evaluation presented in the memorandum supports a subsurface disposal option for Hillsburgh, the long-term cumulative effect of the subsurface disposal system on the surface water and groundwater system in the quality and quantity perspective was not evaluated, this is considered very extensive, as well as expensive and may bring more constraints to support the above conclusion.

11. It was concluded that in terms of capital cost, there is no advantage for the Hillsburgh subsurface alternative with Erin Village having surface water disposal option and it is likely to cost 10-20% more to construct this alternative compared to surface water discharge option at Erin Village with a single treatment system for pumped sewage disposal from both Erin Village and Hillsburgh. It is not clear whether the cost for extensive monitoring and contingency plans (i.e., replaceable disposal beds, reservoir/holding tanks to accommodate high groundwater level condition/floods) to address subsurface disposal system failure was included in cost summary for Hillsburgh, which will further increase the capital cost for subsurface disposal system at Hillsburgh.

<u>Conclusions and Recommendations:</u>

Based on the review and evaluation of the findings of the subject memorandum, it is my opinion that there is no significant benefits in terms of capital cost for the inclusion of a subsurface disposal option for Hillsburgh; however, a detailed feasibility investigation will involve significant time, cost and uncertainties, which may further negate the option of subsurface disposal for Hillsburgh.

Further investigation (i.e., geotechnical, hydrogeological, modeling, and risk assessments) to support a subsurface disposal option for Hillsburgh is not recommended while there is a feasible option for subsurface disposal with known constraints and risks exists.

Instead, the interactive surface water-groundwater modeling can be further developed to understand the long-term cumulative effect in terms of risks and quality and quantity of water resources (i.e., surface and groundwater) perspective for this preferred surface water disposal system for the Erin Village and Hillsburgh communities.

I trust that the above comments will be of benefit. If you have any questions, I can be reached at 905-521-7705 or salah.sharif@ontario.ca

Statement of Limitations:

The purpose of the preceding review is to provide advice to the Ministry of the Environment regarding subsurface conditions based on a review of the information provided in the above referenced document. The conclusions, opinions and recommendations of the reviewer are based on information provided by others. The Ministry cannot guarantee that the information that has been provided by others is accurate or complete. A lack of specific comment by the reviewer is not to be construed as endorsing the content or views expressed in the reviewed material.

Salah Sharif, Ph.D., P.Geo.
Hydrogeologist

Appendix - G

Fluvial Geomorphological Assessment

Fluvial Geomorphological Assessment of West Credit River to Support Siting of a Proposed WWTP Discharge Location

Prepared for

Hutchinson Environmental Sciences Ltd.

December 13, 2017

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

374 Wellington Street West, Suite 3, Toronto, ON M5V 1E3 ***t*** *647-795-8153*

December 13, 2017

Deborah Sinclair
Hutchinson Environmental Sciences Ltd.
1-5 Chancery Lane
Bracebridge, ON
P1L 2E3

Dear Ms. Sinclair,

Re: Fluvial Geomorphological Assessment of West Credit River to Support Siting of a Proposed WWTP Discharge Location

Palmer Environmental Consulting Group Inc. is pleased to provide the results of our fluvial geomorphological assessment of West Credit River between 10th Line and Winston Churchill Boulevard, in the Town of Erin, in support of the overall Class Environmental Assessment for urban centre wastewater servicing.

The subject reach of West Credit River is an irregular-meandering, partly confined channel that has adopted a stable cross-sectional form and pool-riffle bed morphology. The proposed effluent discharge (0.083 m^3/s) will have negligible impact on erosion processes along West Credit River, and the two proposed discharge locations (10th Line and Winston Churchill Boulevard) are both morphologically stable.

Should you have any questions, please do not hesitate to contact Robin McKillop at 647-795-8153 (ext. 106) or robin@pecg.ca.

Yours truly,
Palmer Environmental Consulting Group Inc.

Robin McKillop, M.Sc., P.Geo., CISEC
Principal, Senior Fluvial Geomorphologist

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1 Introduction

Palmer Environmental Consulting Group Inc. (PECG) is pleased to provide Hutchinson Environmental Sciences Ltd. (HESL) with the results of our fluvial geomorphological assessment of West Credit River, between 10th Line and Winston Churchill Boulevard, in the Town of Erin (**Figure 1**). The fluvial geomorphological assessment will support the overall Class Environmental Assessment for urban centre wastewater servicing in the Town of Erin, which includes a proposed wastewater treatment plant (WWTP) along County Road 52. Effluent from the WWTP will discharge into West Credit River. A fluvial geomorphological assessment is required as a basis for evaluating the morphological implications of increased flow in West Credit River. As well, the assessment encompassed candidate discharge locations, with an emphasis on documenting and analyzing conditions in the areas most sensitive to increases in flow.

2 Methods

The fluvial geomorphology of West Credit River was assessed through a combination of desktop and field investigations. We reviewed a number of important background information sources for the study area, including Credit Valley Conservation's (CVC) 2005 and 2013 Watershed Report Cards, Management Plan Credit River Fisheries (2002), and Rising to the Challenge: A Handbook for Understanding and Protecting the Credit River Watershed (2009); 50 cm topographic contour data provided by HESL; and Ontario Geological Survey bedrock and surficial geology mapping (Ontario Geological Survey, 2014a,b). Ortho-photography (2010) of the study area and Google Earth (2004, 2006, 2012, 2013, 2014, 2015, 2016) provided a basis for characterizing channel conditions in West Credit River.

Field reconnaissance and detailed data collection were completed on June 28, 2016 by PECG's Fluvial Geomorphologist during baseflow conditions without any significant antecedent precipitation. West Credit River was walked from ~400 m upstream of 10th Line to ~350 m downstream of Winston Churchill Boulevard to observe channel conditions, examine patterns and processes of local erosion, determine channel reach breaks, and ground truth aerial photograph-based interpretations. Furthermore, a Rapid Geomorphic Assessment (RGA; Ontario Ministry of the Environment, 2003) was completed along the study reach to document evidence of channel aggradation, degradation, widening and planimetric form adjustment. The RGA tool provides a useful checklist of evidence to consider, but its results are dependent on the presence or absence of a set number of specific features within a reach and thus must be interpreted carefully to ensure accuracy (McKillop, 2016).

Detailed data were collected at three sites in order to establish erosion thresholds: ~100 m downstream of 10th Line, ~100 m upstream of Winston Churchill Boulevard, and ~100 m downstream of Winston Churchill Boulevard (**Figure 1**). The three sites were deemed likely WWTP discharge locations through consultation with HESL (the proposed WWTP discharge locations were not determined at the time of the field work). Four to five cross-sections and a longitudinal profile were surveyed at each site according to CVC Fluvial

Geomorphic Guidelines (2015). The surveyed cross-sections were strategically positioned in representative morphological units (e.g. pools, riffles). Bankfull dimensions were based on field indicators defining the principal limit of scour, including abrupt changes in bank vegetation, material and steepness (Harrelson et al., 1994), which is assumed to represent the 'channel-forming discharge'. The grain size distribution of the alluvial material within each site was determined through modified Wolman (1954) pebbles counts.

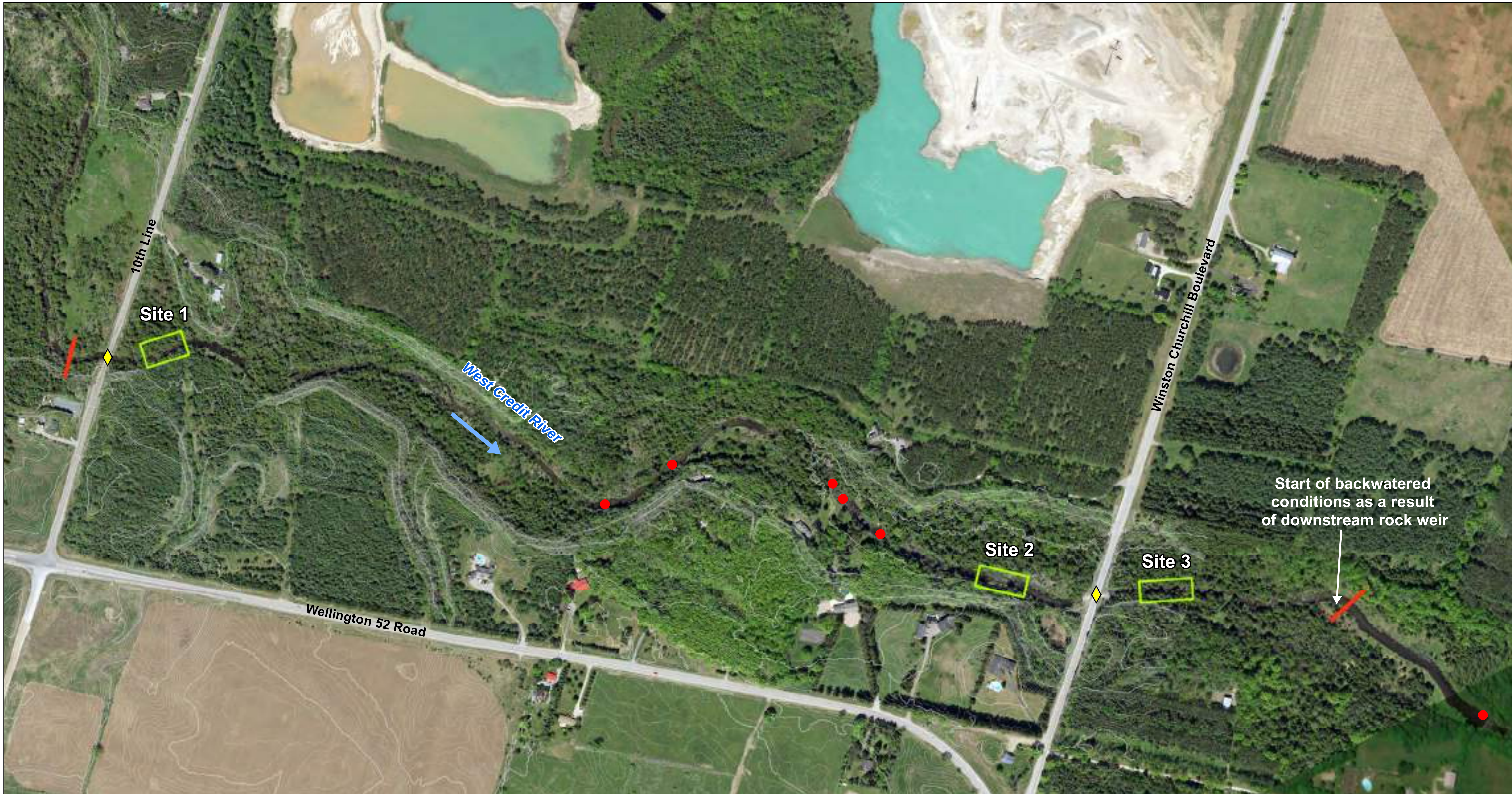
All bed erosion threshold and critical discharge analyses were completed based on a Shields (1936) approach as outlined by Church (2006), as it is a semi-empirical approach (as opposed to completely empirical) and is well-suited for gravel bed rivers. A bed erosion threshold is the hydraulic condition at which the channel bed is in a state of incipient motion, and the critical discharge is the flow that produces that threshold condition at a particular location along the channel. Iterative hydraulic simulations were completed to determine the flow at which the erosion threshold is exceeded (i.e. critical discharge).

3 Physical Setting and Historical Changes

The Credit River watershed is within the Regional Municipality of Peel, Regional Municipality of Halton, Wellington County, and Dufferin County. Major urban centers within the watershed include Caledon, Brampton and Mississauga. The entire watershed encompasses 871 km^2 and the main branch of Credit River is ~90 km long and contains over 1,500 km of tributaries (Credit Valley Conservation, 2002). The Niagara Escarpment, a major topographic feature, runs diagonally across the watershed. The headwaters of Credit River, including West Credit River, are located above the Niagara Escarpment. Streams above the Niagara Escarpment have remained in a relativity natural condition (Credit Valley Conservation, 2009).

The West Credit River subwatershed comprises hummocky moraines and drumlins (Guelph Drumlin Field) as well as glacial spillways, yielding undulating topography (Credit Valley Conservation, 2009). Within the study area, the West Credit River flows within a valley dominated by glaciofluvial deposits and the channel is underlain by modern alluvial deposits. Prominent fluvial terraces are present along the edges of the valleys (Ontario Geological Survey, 2014b). The coarse sands and gravels of the surficial material are highly permeable and support high infiltration rates. As such, baseflow in West Credit River is maintained from groundwater discharge. Maximum stream flow typically occurs in late winter or early spring as a result of snowmelt or rainfall on frozen ground, or a combination of both. High intensity summer storms also lead to high flow events. Stream monitoring conducted by CVC in 2003 suggests that watercourses within the West Credit River subwatershed are stable channels that are "In Regime" (Credit Valley Conservation, 2009).

Traditionally, agricultural (primarily beef cattle farming) has been a dominant land use in the upper Credit River watershed; however, there has been a significant decrease in the amount of land cultivated in recent decades. Deciduous forests and white cedar swamps are common atop the Niagara Escarpment and it is estimated that 60% of the upper watershed is forested (Credit Valley Conservation, 2009). Upstream of the study reach, land use is mostly natural areas and agricultural. Furthermore, the West Credit River catchment has many wetland complexes that moderate flood flows (Credit Valley Conservation, 2002).



Client: Hutchinson Environmental Services Limited
Project: Erin Waster Water Treatment Plant

PREPARED BY:
PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
DESIGNED: D. McParland
CHECKED: R. McKillop
PROJECT: 13183
DATE Jul 26, 2017

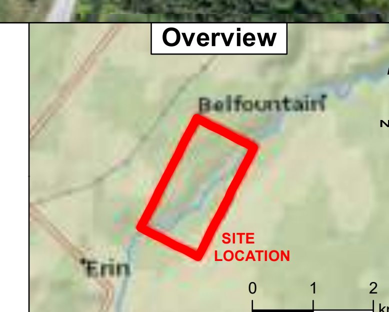
LEGEND
- Detailed Data Collection Site
- Anthropogenic Rock Weir
- Candidate Discharge Location
- Reach Break
- Flow Direction
- Contour (5 m Interval)
- Contour (1 m Interval)

DATA SOURCES: SWOOP Aerial imagery (2010) and topographic data provided by Hutchinson Environmental Services Limited. Roads, Additional basemap imagery ©ESRI, DigitalGlobe 2010. Inset backgorund - National Geographic, Esri, DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN (Content may not reflect National Geographic's current map policy).

COORDINATE SYSTEM:
NAD 1983 UTM ZONE 17N
SCALE: 1:5000

0 50 100 150 200 250
METRES

Overview



Study Area and Detailed Data Collection Sites

FIGURE 1

Document Path: C:\Egnyte\Shared\Projects\Active\1318 - HESL\13183 - Town of Erin Sewage Treatment\Mapping\Draft\mxd\13183_Figure1_Site_new.mxd

4 Description of Channel Morphology

A description of channel morphology at the reach scale is provided in Section 4.1. Results of the site-scale detailed data collection, including the erosion threshold analyses, is documented in Section 4.2.

4.1 Reach Scale

A partly confined reach extending from ~50 m upstream of 10th Line to ~350 m downstream of Winston Churchill Boulevard was identified (**Figure 1**). Upstream of the reach, West Credit River is unconfined and low gradient and contains many large woody debris (LWD) jams. Downstream of the reach, the channel is significantly backwatered upstream of an anthropogenic rock weir. The identified reach exhibits a low-sinuosity, irregular meander pattern and is partly confined by prominent fluvial terraces and valley walls. The channel has a moderate gradient and, generally, has a defined pool-riffle bed morphology with pools located near the apices of meanders. The pool cross-sections tended to be asymmetric with larger depths along the outer bank, whereas riffles are typically symmetrical.

Bed material in the riffles is mostly coarse gravel and cobble derived from erosion of the underlying glaciofluvial materials. The coarser cobble particles are commonly covered in aquatic lichens and mosses, indicating they are rarely entrained (**Photo 1**). The bed material in the pools is dominated by gravel covered with a thin veneer of silts and sands. Bank materials are dominated by alluvial sands and silts. The channel banks are well-vegetated and have gentle slopes. Minimal bank and bed erosion was observed within the reach. The riparian vegetation, which is a mixture of herbaceous and mature forest, has locally been cleared near residential properties. Throughout the reach, fallen/leaning trees line the channel banks and many LWD jams are present (**Photo 2**). The jams locally perturb the energy gradient, cause local channel braiding/cutoffs, and store significant volumes of gravel (**Photo 3**). Furthermore, five anthropogenic rock weirs were observed adjacent to the residential properties (**Photo 4**). The rock weirs cause local channel impoundment but have minimal impact on channel morphology at the reach scale.

Overall, the study reach of West Credit River exhibits only minor departures from a state of dynamic equilibrium with an RGA Stability Index of 0.29 (**Table 1**). According to the RGA, aggradation and widening were the dominant modes of adjustment based on the following observations: embedded coarse material in riffles, siltation in pools, deposition in overbank zone, fallen/leaning trees, occurrence of large organic debris, exposed tree roots. Based on professional interpretation of reach-scale geomorphological form and processes, the channel lacked strong evidence of a dominant mode of channel adjustment and was in a state of dynamic equilibrium. Localized channel instabilities were, for the most part, caused by LWD jams.

Photo 1. Algae covered cobble

Photo 2. Fallen trees within the bankfull channel

Photo 3. Local channel splitting due to downstream LWD jam

Photo 4. Looking upstream at an anthropogenic rock weir

Table 1. Summary Results of Rapid Geomorphic Assessment (RGA) along West Credit River

Form/Process	Index
Evidence of Aggradation	0.43
Evidence of Degradation	0.00
Evidence of Widening	0.43
Evidence of Planimetric Form Adjustment	0.29
Stability Index	**0.29**
Classification	**Transitional or Stressed**

4.2 Site Scale

All three detailed data collection sites had similar bankfull channel dimensions (**Table 2**) and bankfull channel hydraulics (**Table 3**). The width to depth ratios are greater than 20 at all three sites, indicating the channel has good access to its floodplain (i.e. is not entrenched). Due to increases in cross-sectional area, the bankfull discharge increased in the downstream direction. All three sites have sub-critical flows conditions (Froude Number < 1) at bankfull conditions.

Table 2. Averaged bankfull channel dimensions

Measure	Site 1	Site 2	Site 3
Width (m)	11.62	13.25	13.25
Average Depth (m)	0.52	0.52	0.66
Maximum Depth (m)	0.71	0.65	0.88
Width:Average Depth	22.56	26.43	20.06
Cross-sectional Area (m^2)	6.02	6.80	8.83

Table 3. Averaged bankfull channel hydraulics

Measure	Site 1	Site 2	Site 3
Energy Gradient (m/m)	0.0028	0.0036	0.0025
Discharge (m^3/s)	6.23	9.51	10.49
Average Velocity (m/s)	1.03	1.38	1.18
Froude Number	0.46	0.62	0.46
Average Shear Stress (N/m^2)	13.82	24.84	15.85

Notes: Manning's 'n' assumed to be 0.035 for all-cross-sections for the full range of flows because the beds are level with water levels much deeper than the grains are in diameter and the channel had moderate sinuosity (Hicks and Mason, 1998)

All three sites had similar grain size distributions dominated by gravels (**Table 4**). The critical discharge was lowest at Site 2, likely because it had the steepest energy gradient that induces entrainment of the gravel bed material more readily than the other two sites (**Table 5**). The critical discharges ranged from 52 to 84% of bankfull discharge, indicating there are few sediment transport inducing events in a given year. The stable pool-riffle morphology and moss-covered cobble corroborate these critical values.

Table 4. Grain size distribution summary statistics

Measure	Site 1	Site 2	Site 3
D_{16}	5	9	5
D_{35}	13	18	16
D_{50}	22	26	24
D_{65}	35	34	35
D_{84}	58	70	90

Notes: D_x is the grain size than which X% of the substrate is finer

Table 5. Critical hydraulic conditions

Measure	Site 1	Site 2	Site 3
Critical Shear Stress (N/m^2)	16.02	18.81	17.16
Critical Discharge (m^3/s)	5.21	4.91	7.84
% of Bankfull Flow	84	52	75

Notes: Critical Shields parameter used to calculate erosion thresholds was 0.045 because the channel had stable gravel-cobble bedforms (Church, 2006)

5 Effluent Discharge Rate and Location

The following information regarding the effluent discharge rates and location was provided to PECG by HESL in February 2017:

- The proposed effluent discharge will be a constant 0.083 m^3/s
- The 7Q20 flow for the subject reach of West Credit River is 0.225 m^3/s
- The two candidate discharge locations are the 10th Line road crossing and the Winston Churchill Boulevard road crossing

The proposed effluent discharge of 0.083 m^3/s is 0.8% to 1.3% of the bankfull discharge and 1.1% to 1.7% of the critical discharge, based on channel measurements and erosion threshold analyses at three sites (see **Section 4.2**). Given that sediment transport occurs almost exclusively during moderate to high flow events, once a local erosion threshold has been exceeded, it follows that channel morphology (and the aquatic habitat it supports) is largely determined by moderate to high flows (Knighton, 1998). A relatively small increase in discharge at critical and bankfull conditions will have an unmeasurable and negligible impact on natural erosional processes along West Credit River. Furthermore, due to minimal anthropogenic disturbance and upstream urbanization, West Credit River has adopted a stable geomorphological form. Thus, there is little concern the effluent discharge will disrupt the existing dynamic equilibrium of West Credit River or exacerbate existing instabilities.

Detailed morphological data were collected immediately downstream of both candidate effluent discharge locations. Both locations are morphologically stable with no specific erosion concerns. Discharging the effluent at either location is appropriate from a fluvial geomorphological perspective. The outlet should be oriented in the downstream direction require energy dissipation measures regardless of the flow conditions in the channel. The flow dissipation can be as simple as a rip-rap splash pad, baffle features, and/or a drop-structure. Discharging the effluent downstream of the road crossing is ideal from a fluvial geomorphology perspective because crossing inlets can be zones of complex hydraulics that lead to bank and bed scour. Additional flow from the proposed outlet could exacerbate the tractive forces and turbulent flow at the inlet. However, discharging the effluent upstream of the crossing is appropriate from a geomorphology perspective provided appropriate energy dissipation measures are installed and the hydraulic modelling confirms that the discharge will not exacerbate tractive forces or turbulent flow at the inlet and through the road crossing.

6 Summary and Conclusions

PECG completed a fluvial geomorphological assessment of West Credit River between 10th Line and Winston Churchill Boulevard, in the Town of Erin, as a basis for evaluating the morphological implications of increased flow in West Credit River from a proposed WWTP. The assessment included establishing erosion thresholds and documenting existing channel processes and areas of instability. The subject reach of West Credit River is an irregular-meandering, partly confined channel that has adopted a stable cross-sectional form and pool-riffle bed morphology. The proposed effluent discharge (0.083 m^3/s) will have negligible impact on erosion processes along West Credit River. The two proposed discharge locations (10th Line and Winston Churchill Boulevard) are morphologically stable with no existing erosion concerns. The outlet should be constructed in such a manner that flow is not directed towards the bed and/or bank, and some form of energy dissipation is utilized.

7 Certification

This report was prepared and reviewed by the undersigned:

Prepared by:

Dan McParland, M.Sc., P.Geo.
Fluvial Geomorphologist

Reviewed by:

Robin McKillop, M.Sc., P.Geo., CISEC
Principal, Senior Fluvial Geomorphologist

8 References

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Appendix - H

Natural Environment Report

Hutchinson
Environmental Sciences Ltd.

Town of Erin Class EA
Natural Environment Report

Prepared for: Ainley Group
Job #: J160005

April 23, 2018

1-5 Chancery Lane, Bracebridge ON P1L 2E3 | 705-645-0021
202-501 Krug Street, Kitchener ON N2B 1L3 | 519-576-1711

April 23, 2018 HESL Job #: J160005

Mr. Joe Mullan
550 Welham Road
Barrie, ON
L4N 8Z7

Dear Mr. Mullan:

Re: Town of Erin Class EA – Natural Environment Report

We are pleased to submit the Natural Environment Report in support of the Class Environmental Assessment (Class EA) for a communal wastewater and collection system for the Village of Erin and Hillsburgh. This version of the report incorporates feedback from reviewers (from the Credit Valley Conservation Authority, the Ontario Ministry of Natural Resources and Forestry, the Ontario Ministry of the Environment and Climate Change, and the Township of Wellington) and our responses to their comments are provided in Appendix E.

We have collected and summarized baseline data on aquatic characteristics (fisheries, benthic invertebrates, and aquatic habitat) and terrestrial communities (vegetation communities, vascular plants, amphibians, breeding birds) and species at risk. The report includes contributions from Palmer Environmental Consulting Group on terrestrial assessment components.

The effects of the alternative design concepts on the natural environment (fisheries and aquatic resources, amphibians, birds, and vegetation communities) have been assessed and recommendations for mitigation to minimize negative effects and maximize positive effects have been provided. We have incorporated

We thank you for the opportunity to work on this project. If you have any questions please do not hesitate to contact me.

Sincerely,
Per. Hutchinson Environmental Sciences Ltd.

Brent Parsons, M.Sc.
brent.parsons@environmentalsciences.ca

Signatures

Report Prepared by:

Brent Parsons, M.Sc.
Senior Aquatic Ecologist

Andrea Smith, Ph.D.
Senior Ecologist

Dirk Janas, B.Sc. (Palmer Environmental Consulting Group)
Senior Ecologist

Natalie Dunn, B.Sc. (Palmer Environmental Consulting Group)
Ecologist

Report Reviewed by:

Neil Hutchinson, Ph.D.
President, HESL

List of Abbreviations

Abbreviation	Meaning
ACS	Assimilative Capacity Study
BMP	Best Management Practice
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CVC	Credit Valley Conservation
EA	Environmental Assessment
ECA	Environmental Compliance Approval
ELC	Ecological Land Classification
EPT	Ephemeroptera, Plecoptera and Trichoptera
ESA	Environmentally Significant Area
HBI	Hilsenhoff Biotic Index
IBI	Index of Biological Integrity
MNR	Ministry of Natural Resources
MNRF	Ministry of Natural Resources and Forestry
NAI	Natural Areas Inventory
NHIC	Natural Heritage Information Centre
OBBN	Ontario Benthic Biomonitoring Network
PNA	Priority Natural Area
PSW	Provincially Significant Wetland
PWQO	Provincial Water Quality Objectives
SAR	Species at Risk
SPS	Sewage Pumping Station
SSMP	Servicing and Settlement Master Plan
SWH	Significant Wildlife Habitat
WWTP	Wastewater Treatment Plant

Executive Summary

The Town of Erin is currently completing a Class Environmental Assessment (Class EA) for a communal wastewater and collection system for the Villages of Erin and Hillsburgh. The infrastructure for the communal wastewater servicing will consist of a system of main sewers, sewage pumping stations (SPS), forcemains and gravity sewers conveying sewage to a wastewater treatment plant (WWTP), which will discharge treated effluent through an outfall to the West Credit River. The purpose of this natural environment report is to assess the effects of the alternative design concepts for the proposed wastewater collection system, WWTP location, and outfall location on the natural environment (fisheries and aquatic resources, amphibians, birds, and vegetation communities) within the study area and provide recommendations for mitigation to ensure that the project can be completed with no significant adverse effects to the natural environment.

We conducted a background review of information relating to the biological and physical setting of the study area, as well as field investigations to characterize the aquatic and terrestrial ecology.

The proposed wastewater servicing infrastructure is located entirely within the "Protected Countryside" designation of the provincial Greenbelt Plan. Parts of the infrastructure also transect or are adjacent to the County of Wellington's Greenlands System.

The study area contains a cold-water thermal regime, mixed rocky substrates, a diverse benthic invertebrate assemblage and ample cover habitat that in turn, support a robust population of sensitive coldwater fish species and critical Brook Trout spawning habitat. The most productive Brook Trout spawning reaches and the best Brook Trout populations in the West Credit River are located downstream of Erin Village and the longest contiguous Brook Trout habitat in the Credit River watershed is the West Credit River between Erin and Belfountain.

The study area encompasses a variety of vegetation communities representing both upland and wetland environments, including agricultural landscapes, deciduous, coniferous and mixed forests, and swamp and marsh. The West Credit Provincially Significant Wetland (PSW) Complex extends throughout much of the area and includes the West Credit River at Hillsburgh Environmentally Significant Area (ESA), which is characterized by coniferous swamps and an undisturbed forested valley that provide important habitat for rare species and important groundwater discharge for the West Credit River. Significant woodlands (as identified by the County's Greenlands System and the Greenbelt Plan) occur throughout the study area.

A total of 165 species of vascular plant species were recorded in the study area, comprised mainly of native species, ten of which are recognized as locally or regionally rare.

Six amphibian species were heard calling in the study area, including one threatened species, Western Chorus Frog, along Forcemain Options 1 and 3. Fifty-three bird species were documented in the area, including five species at risk (Eastern Wood-pewee, Barn Swallow, Golden-winged Warbler along Forcemain Option 1; Bobolink, and Eastern Meadowlark at proposed WWTP sites). Thirteen area sensitive bird species (which rely on large continuous areas of suitable habitat for breeding) were also recorded throughout the study area. Snapping Turtle, a special concern species, was observed along Forcemain Option 1.

The potential effluent outfall locations at 10th Line and Winston Churchill Blvd. were evaluated based on aquatic ecology criteria. The preferred outfall location is Winston Churchill Boulevard to avoid the more sensitive and rare aquatic features and functions at 10th Line.

The three WWTP site locations were evaluated based on presence of provincially and/or nationally designated SAR, sensitive bird species, and significant habitat. The screening criteria indicated that the west field (Site 1) is the preferred choice for the location of the WWTP site, based on the presence of two species at risk in suitable breeding habitat in Sites 2A and 2B. However, Site 1 does provide suitable breeding habitat for the area sensitive Savannah Sparrow, and thus qualifies as significant wildlife habitat under the PPS. As such, development and site alteration are only permitted if there will be no negative impacts on the natural features or their ecological functions. Furthermore, Site 1 contained a rare and uncommon plant species (Wild Geranium) and is located next to the West Credit PSW Complex. Appropriate mitigation measures were therefore recommended to ensure no negative effects on species of conservation concern and important natural heritage features in the vicinity.

Three forcemain route options were evaluated based on presence of provincially and/or nationally designated SAR, sensitive bird species, and significant habitat. Although Forcemain Option 2 avoids the most sensitive habitats, Option 1 is feasible with the implementation of the mitigation techniques identified in this report and a deviation from the proposed route. We recommend that, should this option be selected, the route go along Sideroad 17 to Main St. and bypass the portion of the trail between Sideroad 17 and Main St. so that the wetland adjacent to the trail is not disturbed.

Mitigation measures and BMPs should be defined for the specific features of the preferred alternatives when they are selected and during detailed design. These should be incorporated into the site preparation, construction and maintenance of all infrastructure to minimize and avoid negative impacts on natural features and their ecological functions.

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Appendices

1. Introduction

1.1 Background

The Town of Erin is currently completing a Class Environmental Assessment (Class EA) for a communal wastewater and collection system for the Villages of Erin and Hillsburgh (Figure 1). The Class EA is informed by the conclusions of the Servicing and Settlement Master Plan (SSMP; BM Ross 2014), which completed part of Phase 1 and part of Phase 2 of the Class EA process. The SSMP identified a general area (along Wellington County Road 52) for the location of a wastewater treatment plant (WWTP) with an outfall to the West Credit River in the vicinity of the 10^{th} Line. Credit Valley Conservation (CVC) completed an extensive Existing Conditions Report (CVC et al. 2011) as part of the SSMP, which summarized the existing hydrogeology, hydrology, geomorphology, aquatic ecology (fish and benthos), terrestrial ecology (vegetation), water quality and hydraulics in the SSMP study area (approximately 5^{th} Line to Winston Churchill Blvd, and 5^{th} Sideroad to Highpoint Sideroad). The preliminary Assimilative Capacity Study (ACS; BM Ross 2014) was based on water quality data contained within the CVC report, as it provided an excellent baseline of the natural environment in the study area. The 2014 BM Ross ACS was updated in March 2017 as part of Phase 1 and 2 of the current Class EA process (HESL 2017). It confirmed that the West Credit River downstream of 10th Line was a preferred discharge location and provided recommended effluent limits for discharge. The Town is now engaged in completing Phase 3 and Phase 4 of the EA, identifying and evaluating collection system alternatives, plant locations, and outfall locations.

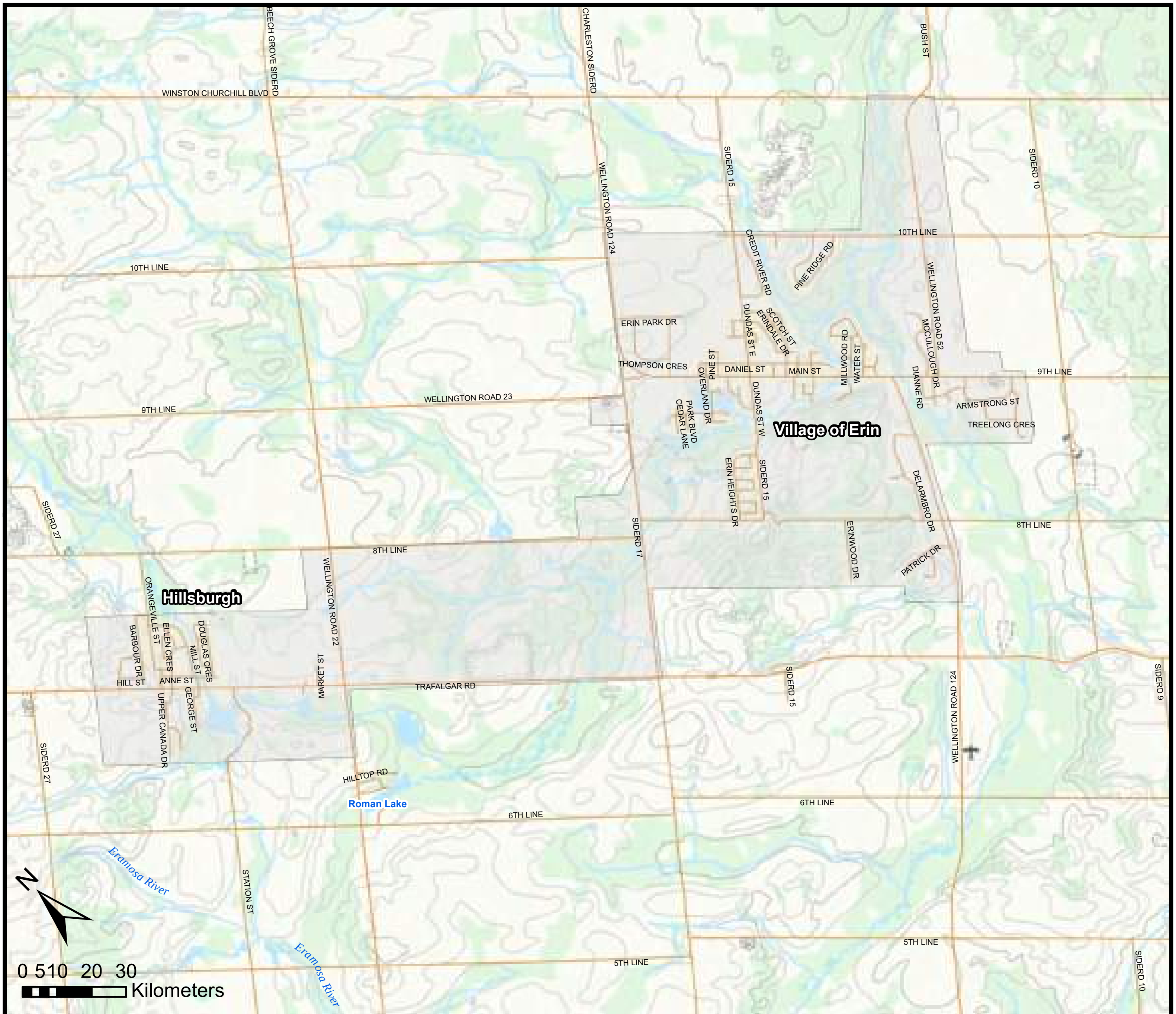
The purpose of this natural environment report is to assess the effects of the alternative design concepts for the proposed wastewater collection system, WWTP location, and outfall location on the natural environment (fisheries and aquatic resources, amphibians, birds, and vegetation communities) within the study area (Figure 1) and provide recommendations for mitigation to ensure that the project can be completed with no significant adverse effects to the natural environment. The locations of potential sewage pumping stations (SPS) were constrained by engineering considerations and were selected prior to this natural environment assessment. Thus, this report does not provide a comparison of alternative sites for SPS sites based on environmental considerations. However, the report does characterize the environmental features at SPS sites so that mitigation measures can be recommended that will minimize their environmental impact.

1.2 Description of Different Project Options

The infrastructure for the communal wastewater servicing will consist of a system of main sewers, SPS, forcemains and gravity sewers conveying sewage to a WWTP, which will discharge treated effluent through an outfall to the West Credit River (Figures 2-4). The preliminary ACS identified the West Credit River between 10^{th} Line and Winston Churchill Boulevard as the best location for the WWTP outfall (Ainley Group 2017). Three potential outfall sites have been proposed in this general area: two at 10^{th} Line and one at Winston Churchill Boulevard (Figure 2). Three potential WWTP locations were identified at Wellington Rd. 52 and 10^{th} Line:

- Site 1 on the west side of Wellington Rd. 52;
- Site 2A on the southeast side of Wellington Rd. 52; and
- Site 2B on the northeast side of Wellington Rd. 52 (Figure 2).

An additional potential WWTP location (Site 2C) was added for consideration after completion of this Natural Environment Report, and thus is not assessed herein. If Site 2C is ultimately selected as the preferred site, its natural heritage features should be characterized through background review and field surveys as part of detailed design.



Legend

- Roads
- Rivers
- Lakes
- Survey Area

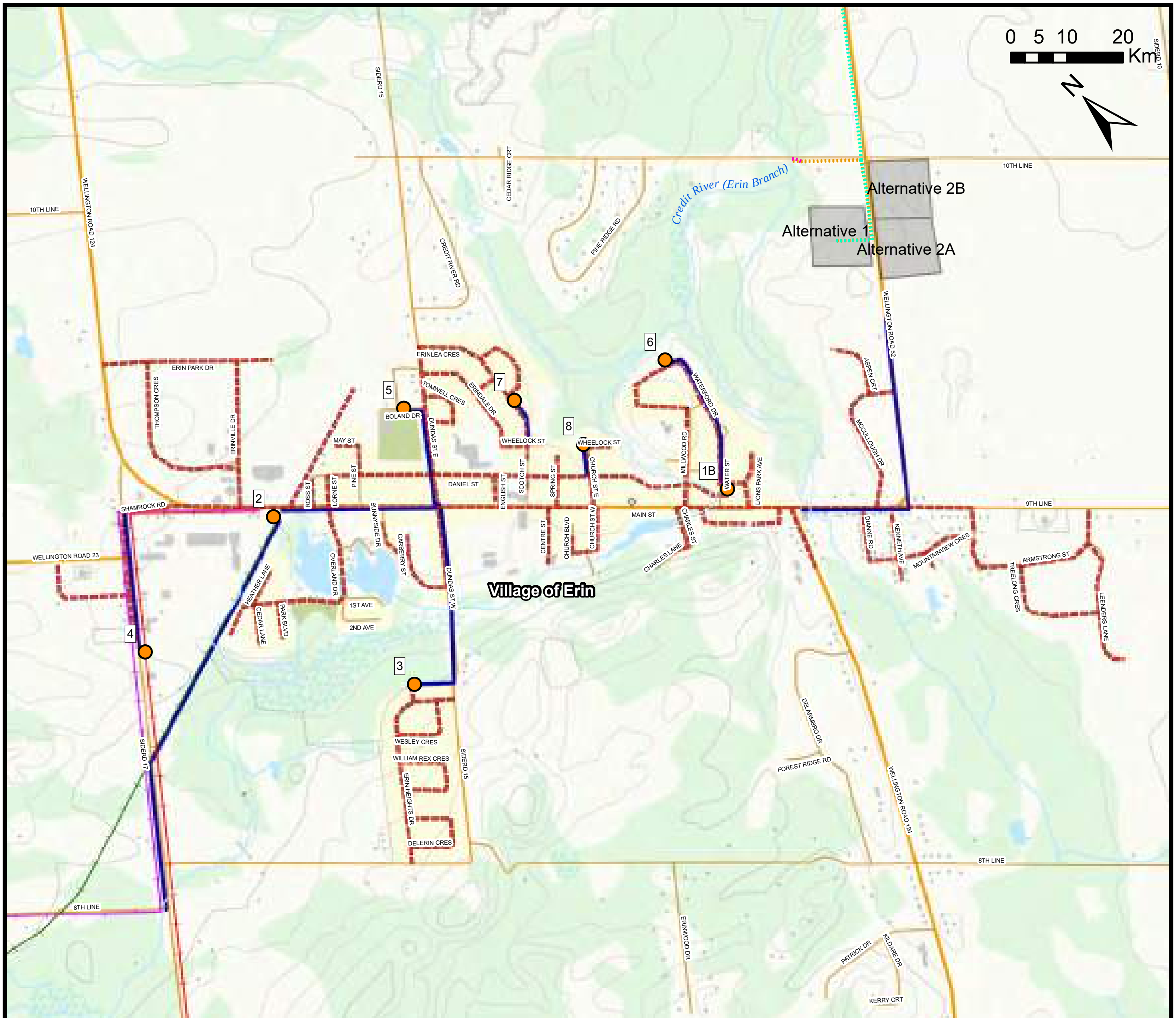
Project Lead: Brent Parsons
Prepared by: Kris Hadley
Data Source: HESL,Ontario Land, ESRI
Coordinate System: NAD 1983 UTM Zone 17N

Figure 1:
Study Area

Project: Town of Erin UCWS Class EA – Natural Environment

Project #: J160005

Hutchinson Environmental Sciences Ltd.



Legend

- Roads
- Rivers
- Lakes
- Forcemain
- Sewer
- Potential Pump Stations
- Potential WWTP Sites
- Forcemain Route Alternative 1
- Forcemain Route Alternative 2
- Forcemain Route Alternative 3
- Outfall Alternative1A
- Outfall Alternative 1B
- Outfall Alternative 2

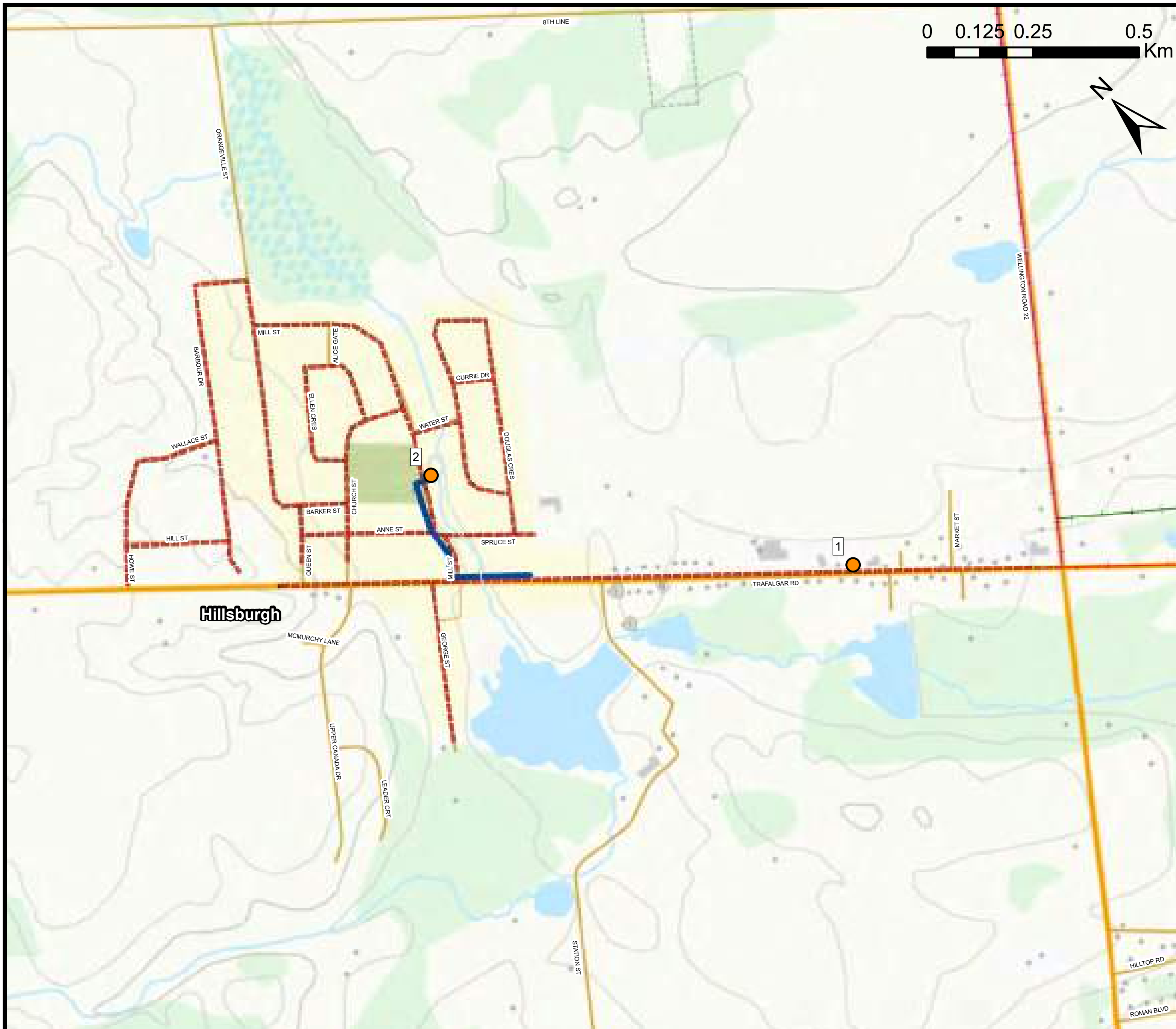
Figure 2:
Proposed Infrastructure for Erin Servicing – Erin Village

Project: Town of Erin UCWS Class EA – Natural Environment

Project #: J160005

Project Lead: Brent Parsons
Prepared by: Kris Hadley
Data Source: HESL,Ontario Land, ESRI
Coordinate System: NAD 1983 UTM Zone 17N

Hutchinson Environmental Sciences Ltd



Legend

- Roads
- Rivers
- Lakes
- Potential Pump Stations
- Forcemain Route Alternative 1
- Forcemain Route Alternative 2
- Forcemain Route Alternative 3
- Forcemain
- Sewer

Figure 3:
Proposed Infrastructure for Erin Servicing – Hillsburgh

Project: Town of Erin UCWS Class EA – Natural Environment

Project #: J160005

Project Lead: Brent Parsons
Prepared by: Kris Hadley
Data Source: HESL,Ontario Land, ESRI
Coordinate System: NAD 1983 UTM Zone 17N

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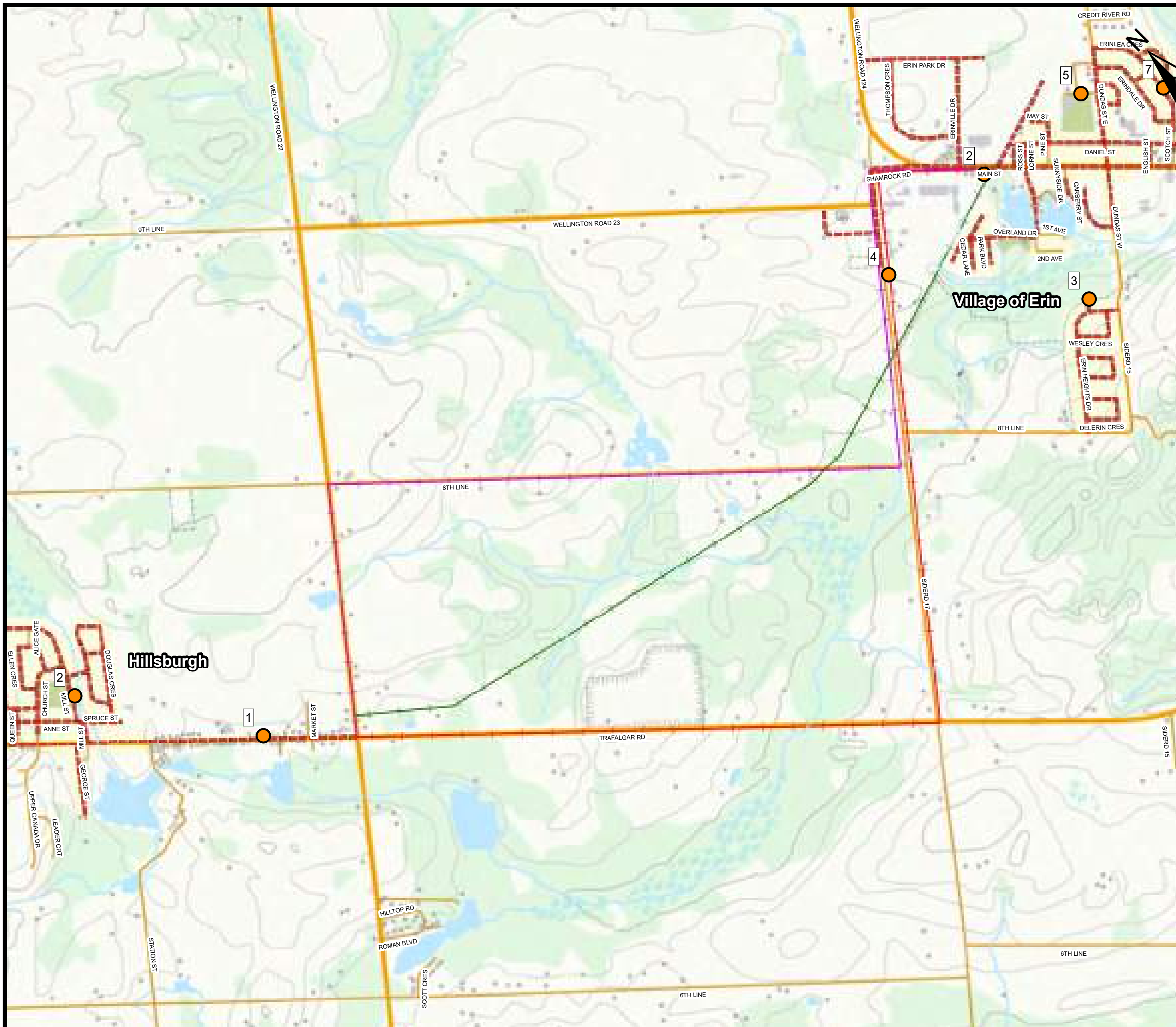

Legend

- Roads
- Sewer
- Rivers
- Lakes
- Potential Pump Stations
- Forcemain Route Alternative 1
- Forcemain Route Alternative 2
- Forcemain Route Alternative 3

Figure 4:
Proposed Infrastructure for Erin Servicing – Hillsburgh to Village of Erin Forcemain

Project: Town of Erin UCWS Class EA – Natural Environment

Project #: J160005

Project Lead: Brent Parsons
Prepared by: Kris Hadley
Data Source: HESL,Ontario Land, ESRI
Coordinate System: NAD 1983 UTM Zone 17N

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2. Methodology

2.1 Background Review

We conducted a background review of information relating to the biological and physical setting of the subject area. The following information sources were reviewed:

- Erin Servicing and Settlement Master Plan. Phase 1 – Environmental Component – Existing Conditions (CVC et al. 2011);
- A Cooperative Management Planning Initiative for the Credit River Fishery (Ontario Ministry of Natural Resources (MNR) and CVC 2002);
- Credit River Watershed and Region of Peel Natural Areas Inventory – Volume 1 and 2 (CVC 2011);
- Ontario Ministry of Natural Resources and Forestry (MNRF) Natural Heritage Information Centre (NHIC) records of species at risk and natural areas (MNRF 2014a, MNRF 2017a,b);
- MNR/MNRF Natural Heritage Reference Manual and Significant Wildlife Habitat resource material (e.g., MNR 2000; MNRF 2015)
- Ontario Breeding Bird Atlas records for the area (Bird Studies Canada et al. 2006).
- Monitoring results from CVC's Integrated Watershed Monitoring Program (IWMP),
- Other sources of information, such as aerial photography and topographic maps, were also consulted prior to commencing field investigations.

2.2 Field Investigations

2.2.1 Aquatic Ecology

Information was collected on fisheries, benthic invertebrates and aquatic habitat for the West Credit River between 10th Line and Winston Churchill Boulevard to:

a) Determine and document the quality of aquatic habitat at each site to inform preferred effluent outfall site selection.

b) Inform selection of mitigation measures based on site-specific sensitivities.

c) Establish a baseline data set with which to compare future conditions and assess the presence or absence of impacts associated with treated effluent.

Data on water quality and flow conditions in the West Credit River are provided in the ACS report (HESL 2017).

2.2.1.1 Fisheries

CVC provided information on the resident fish assemblages in the study reach from surveys that they had completed (CVC et al. 2011). The findings from the CVC study were combined with the aquatic habitat assessment and observations made during field surveys to characterize fish assemblages as part of the impact assessment. An assessment of spawning habitat and Brook Trout (*Salvelinus fontinalis*) spawning activity was made in November 2016 (Section 2.2.1.3).

The spawning assessment was completed with Jon Clayton, Aquatic Biologist, CVC on November 1, 2016 in accordance with CVC protocol (CVC 2015). Brook Trout are known to spawn in the Credit River between late-September and mid-December (MNR and CVC 2002) and active spawning was noted during the assessment. The spawning assessment was completed from approximately 500 m downstream of Winston Churchill Boulevard to 10th Line. Redds were marked via GPS, counted and categorized as Category 1 (definite redd, confirmed, fish may be seen on redd), Category 2 (probable but not 100% sure), or Category 3 (possible; Figure 5).

2.2.1.2 Benthic Invertebrates

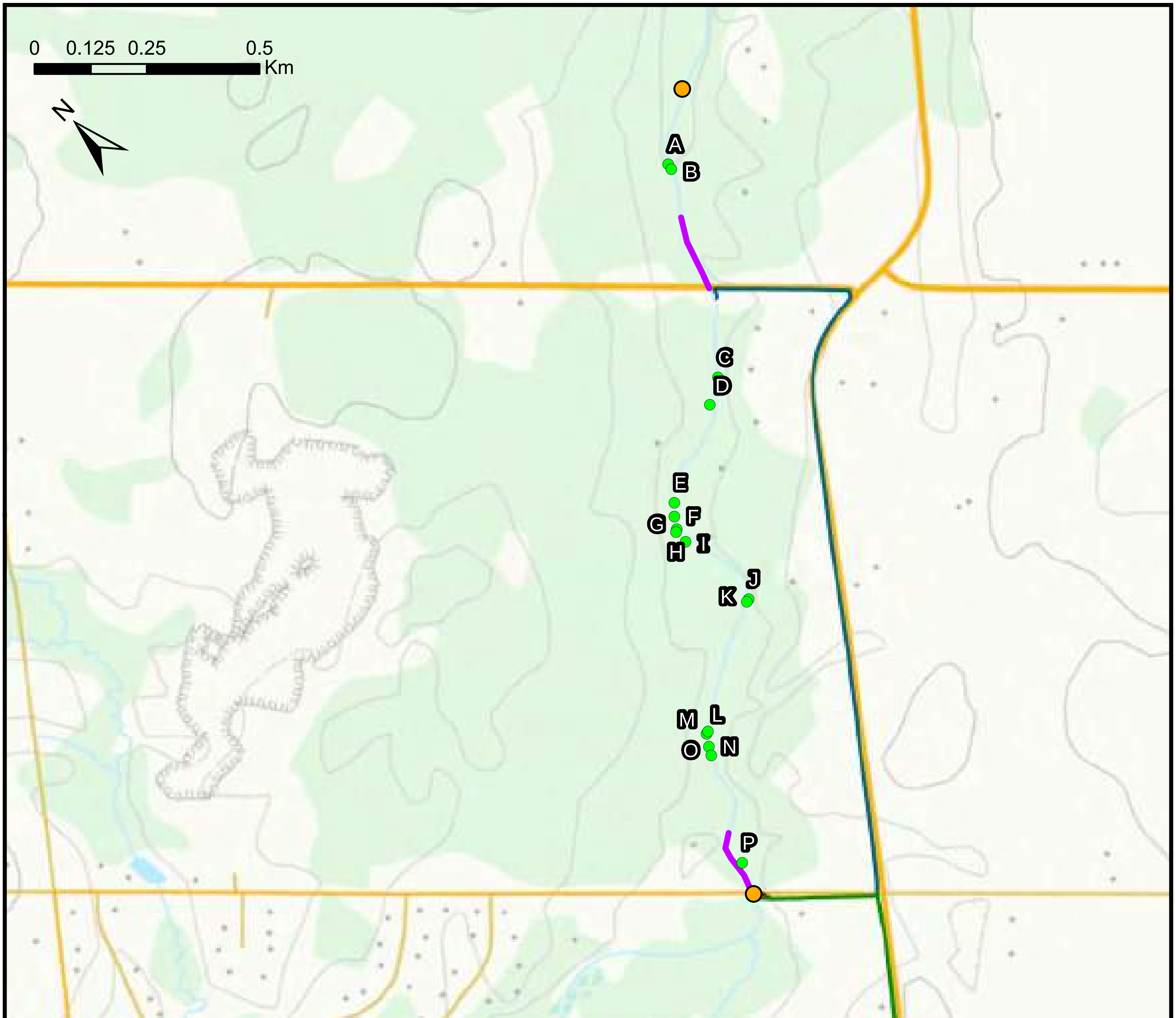
Benthic invertebrates were collected following the Ontario Benthic Biomonitoring Network (OBBN) protocol (Jones et al. 2007) and in the summer (August 15, 2017) to align with current CVC sampling methodology and to allow for future like-to-like comparison of data in accordance with requests by CVC staff. Triplicate samples were collected near the potential effluent outfall locations at 10th Line and Winston Churchill Boulevard through a 2-minute travelling kick-and-sweep sampling effort with a 500 µm D-net (Figure 6). Samples were preserved in the field with 99% isopropyl alcohol and sent to Richard Bland Associates, to identify the first 100 animals from the samples to the lowest practical taxonomic level.

A variety of biological metrics were calculated from the taxonomic data for each replicate, and from combined replicates in each study area. Metrics were selected to match those used in the background review (CVC et al. 2011) and included: taxa abundance, taxa richness, EPT (*Ephemeroptera, Plecoptera* and *Trichoptera*) taxa richness, % EPT, % *Chironomidae*, Shannon Diversity, and the Hilsenhoff Biotic Index (HBI). The biological metrics provide an indication of stream health and a robust description of the benthic community.

Habitat is a key driver of benthic assemblages and should be controlled during sampling and assessed during interpretation to separate natural variability due to habitat from changes related to identified stressors. All samples were therefore collected from the vicinity of proposed effluent outfall locations. These areas were comprised solely of riffle or shallow run habitat, which is ubiquitous in the study reach. Benthic habitat was described according to morphology, substrate and food sources (e.g., aquatic vegetation and woody debris).

2.2.1.3 Aquatic Habitat

Aquatic habitat was described at the benthic invertebrate sampling locations and characterized in the general vicinity of the potential effluent outfall locations on August 15, 2017. Habitat features such as substrates, morphological features, macrophytes, woody debris, riparian vegetation and water depth were described and photographed.



Legend

- Roads
- Rivers
- Lakes
- Outfall Alternative 1A
- Outfall Alternative 1B
- Outfall Alternative 2
- Brook Trout Spawning Redds
- Survey Extent
- Near-Field Mixing Zone

Figure 5:
Spawning Redds

Project: Town of Erin UCWS
Class EA – Natural Environment

Project #: J160005

Project Lead: Brent Parsons
Prepared by: Kris Hadley
Data Source: HESL,Ontario Land, ESRI
Coordinate System: NAD 1983 UTM Zone 17N

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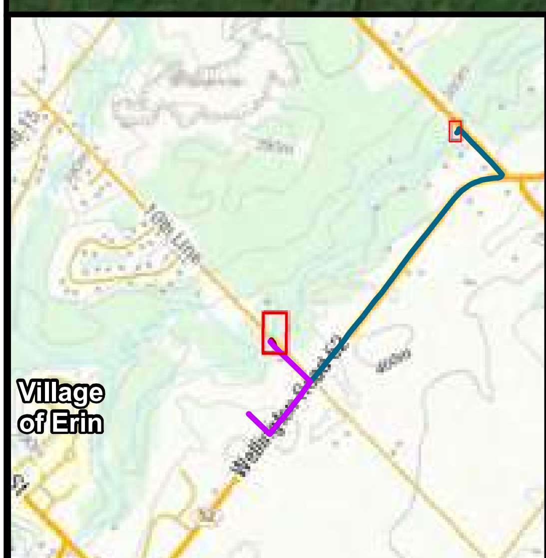

Legend

- Roads
- Rivers
- Lakes
- Outfall Alternative 1A
- Outfall Alternative 1B
- Outfall Alternative 2
- Benthic Sampling Sites

N

0 0.05 0.1 0.2 km

Figure 6:
Benthic Invertebrate Sampling Sites

Project: Town of Erin UCWS Class EA – Natural Environment

Project #: J160005

Project Lead: Brent Parsons
Prepared by: Kris Hadley
Data Source: HESL,Ontario Land, ESRI
Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere

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2.2.2 Terrestrial Ecology

2.2.2.1 Vegetation Communities

Vegetation communities were identified at the following study sites (Figure 7) and within the adjacent lands (120 m radius):

- Eight Sewage Pumping Stations (SPS) in Erin Village;
- Two locations proposed for SPS in Hillsburgh;
- Three potential locations for the WWTP (Sites 1, 2A and 2B); and
- Along Route Option 1 for the Hillsburgh to Erin Connection Forcemain.

One of the proposed SPS locations (Hillsburgh SPS #2) was not surveyed since the location was proposed after the field season.

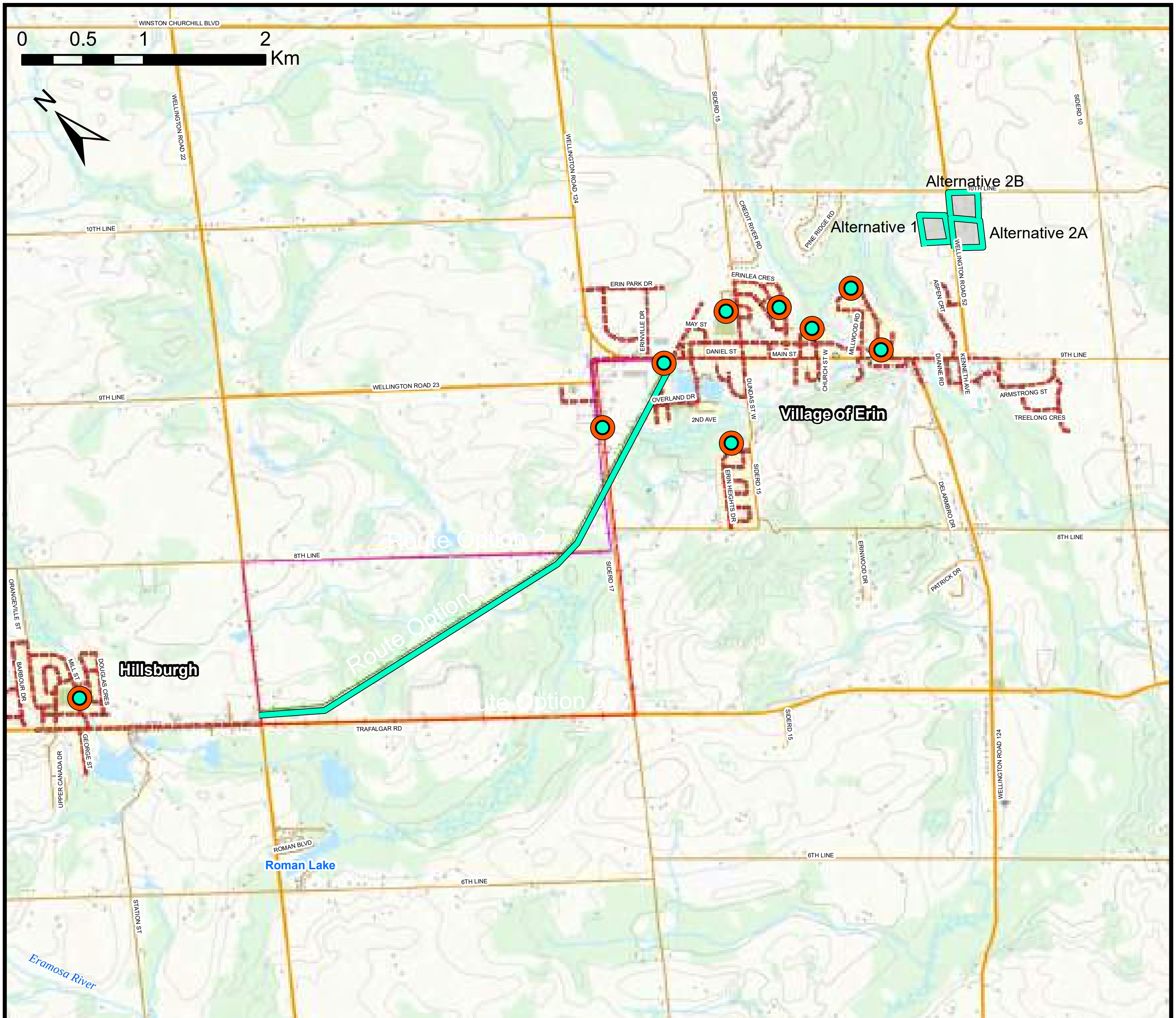
Vegetation communities were mapped and described following the Ecological Land Classification (ELC) System for Southern Ontario (Lee et al. 1998). Vegetation community boundaries were delineated on field maps through the interpretation of recent aerial photographs and refined in the field. Information collected during ELC surveys included dominant species cover, community structure, as well as level of disturbance, presence of indicator species, and other notable features.

Spring and early summer site visits were initially conducted on May 16 and June 29, 2017 with weather conditions ranging from no wind to light breeze, no precipitation, and temperatures around 12ºC and 19ºC, respectively. Late summer site visits were conducted on August 15 and September 6, 2017 with weather conditions ranging from no wind to light breeze, no precipitation, and temperatures were around 19ºC and 13 ºC, respectively.

2.2.2.2 Vascular Plants

A summer season botanical survey was completed by traversing the sites and recording species observed in each vegetation community. The botanical surveys were completed in conjunction with the ELC field investigations (Figure 7). Due to the limited site level access, most surveys were completed from the edge of vegetation communities. Many of the locations surveyed are within Natural Areas Inventory (NAI) sites and the core inventory data was used to provide supplemental vascular plant information.

Peel Region and CVC watershed rarity status was based on the *Plants of the Credit River Watershed* (CVC 2002). Regional and Ecodistrict 6E-7 plant status was based on *The Vascular Plant Flora of the Greater Toronto Area* (Varga et al. 2000). Provincial plant status was based on the *Provincially Rare Flora of Ontario* (Oldham and Brinker 2009) and NHIC information (MNRF 2017a).



Legend

- Roads
- Sewer
- Rivers
- Lakes
- Potential Pump Stations
- Potential WWTP Sites
- Forcemain Route Alternative 1
- Forcemain Route Alternative 2
- Forcemain Route Alternative 3
- Vegetation Survey Locations
- Vegetation Survey Transect

Figure 7:
Vegetation Community Survey

Project: Town of Erin UCWS
Class EA – Natural Environment

Project #: J160005

Project Lead: Brent Parsons
Prepared by: Kris Hadley
Data Source: HESL,Ontario Land, ESRI
Coordinate System: NAD 1983 UTM Zone 17N

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2.2.2.3 *Breeding Amphibians*

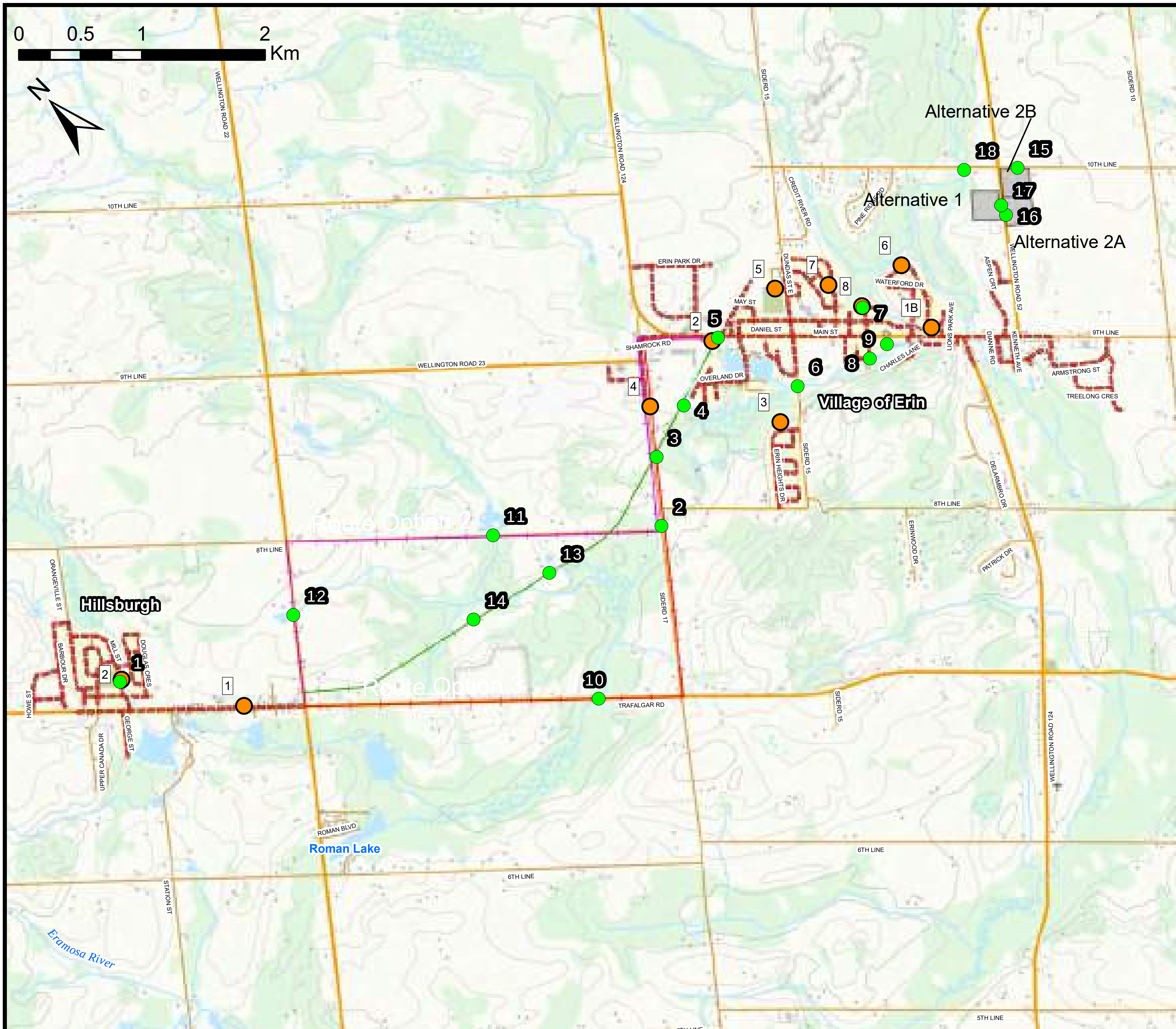
Amphibian surveys were completed following the Marsh Monitoring Program protocol (Bird Studies Canada et al. 2009). A background review of aerial imagery and a preliminary site investigation were completed to determine suitable sampling locations near appropriate breeding habitat (i.e., wetlands or vernal ponds) within the study area with particular focus on areas within or adjacent to the footprint of project infrastructure. Eighteen sampling locations were selected (Figure 8, Table 1). One of the proposed SPS locations (Hillsburgh SPS #2) was not surveyed since the location was proposed after the field season.

We conducted three-minute surveys at each location, recording the species and number of amphibians detected, as well as their approximate locations. Surveys were completed on April 26, May 30 and May 31, and June 27 (Table 1) between 21:30 and 24:00 h. Weather conditions during surveys ranged from a few clouds to partly cloudy, with no wind to light air, no precipitation to light drizzle, and temperatures from 9ºC to 17ºC.

Table 1. Location of Breeding Amphibian Survey Stations.

Station	Location	Survey Dates	Site Description
1	Hillsburgh SPS #1	April 26, May 30, and June 27, 2017	Urban Park beside Fresh-moist Lowland Deciduous Forest
2	8th Line and 17 Sideroad (Route Option 2)	April 26, May 30, and June 27, 2017	Dry-fresh Poplar Mixed Forest
3	Entrance to Cataract Trail off 17 Sideroad	April 26, May 30, and June 27, 2017	White Cedar-Conifer Organic Coniferous Swamp
4	Cataract Trail at wetland	April 26, May 30, and June 27, 2017	Cattail Mineral Shallow Marsh
5	Cataract Trail and Main St. (SPS #2)	April 26, May 30, and June 27, 2017	Dry-moist Old Field Meadow
6	Dundas St. W wetland	April 26, May 30, and June 27, 2017	West Credit River and Floodplain
7	East Church St. (SPS #8)	April 26, May 30, and June 27, 2017	Mineral Cultural Woodland
8	Church Boulevard (Riverside Park)	April 26, May 30, and June 27, 2017	West Credit River and Floodplain
9	Church Boulevard E	April 26, May 30, and June 27, 2017	West Credit River and Floodplain

Station	Location	Survey Dates	Site Description
10	Trafalgar Rd. N (along Forcemain Option 3)	April 26, May 30, and June 27, 2017	Watercourse, Manicured Edge of Road and Deciduous Forest
11	8th Line (along Forcemain Option 2)	April 26, May 30, and June 27, 2017	Watercourse and Adjacent Artificial Pond
12	22nd Sideroad	May 31, and June 27, 2017	Watercourse and Floodplain with Adjacent Pond
13	Hillsburgh Cataract Trail East (along Forcemain Option 1)	May 31, and June 27, 2017	Dry-fresh White Cedar Coniferous Forest
14	Hillsburgh Cataract Trail West (along Forcemain Option 1)	May 30, and June 27, 2017	White Cedar – Conifer Mineral Coniferous Swamp
15	WWTP Site 2B	April 26, May 30, and June 27, 2017	Dry-moist Old Field Meadow
16	WWTP Site 2A	April 26, May 30, and June 27, 2017	Dry-moist Old Field Meadow
17	WWTP Site 1	April 26, May 30, and June 27, 2017	Dry-moist Old Field Meadow, adjacent to White Cedar-Conifer Organic Coniferous Swamp
18	Credit River at 10th Line	April 26 andMay 30, 2017	White Cedar-Conifer Organic Coniferous Swamp



Legend

- Roads
- Sewer
- Rivers
- Lakes
- Potential Pump Stations
- Potential WWTP Sites
- Forcemain Route Alternative 1
- Forcemain Route Alternative 2
- Forcemain Route Alternative 3
- Amphibian Survey Site

Project Lead: Brent Parsons
Prepared by: Kris Hadley
Data Source: HESL,Ontario Land, ESRI
Coordinate System: NAD 1983 UTM Zone 17N

Figure 8:
Breeding Amphibian Surveys

Project: Town of Erin UCWS
Class EA – Natural Environment

Project #: J160005

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2.2.2.4 Breeding Birds

Breeding bird surveys were conducted to document bird communities throughout the Town of Erin, in areas that could be directly impacted by infrastructure for the urban centre wastewater servicing system (Figure 9; Gregory et al. 2004):

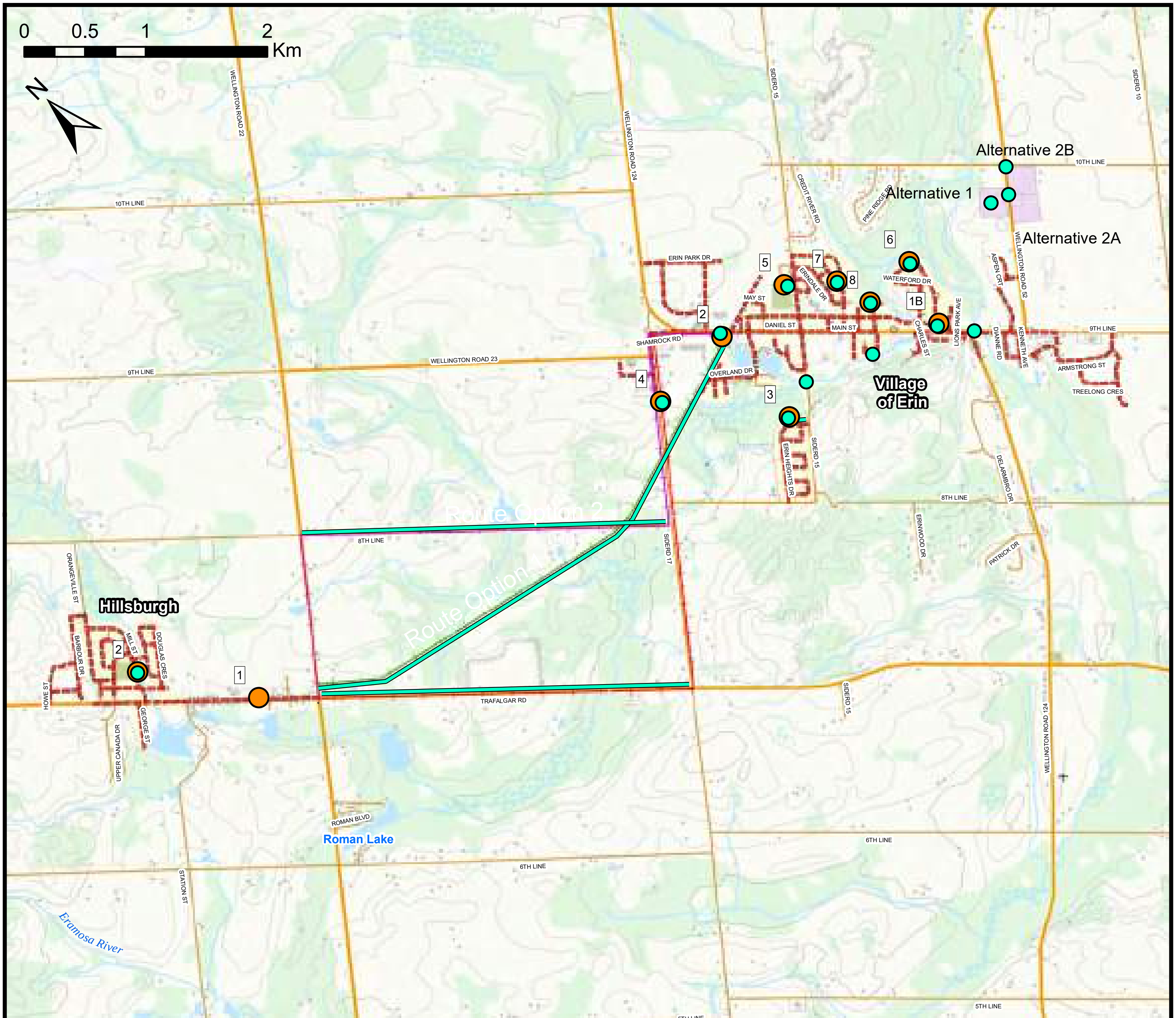
- At seven locations proposed for SPS in Erin Village;
- At SPS #1 in Hillsburgh;
- Along the proposed forcemain from SPS #3 to Dundas St. W. in Erin Village;
- At the Dundas St. W. marsh along the Credit River in Erin;
- At Riverside Park in Erin
- At three potential locations for the WWTP; and
- Along Route Option 1 for the Hillsburgh to Erin Connection Forcemain.

In addition, we drove along Route Options 2 and 3 for the Hillsburgh to Erin Connection Forcemain. One of the proposed SPS locations (Hillsburgh SPS #2) was not surveyed since the location was proposed after the field season. We recommend that a breeding bird survey be conducted at this site during the detailed design stage.

We conducted both point counts and line transect surveys to accommodate the variety of locations to be sampled (Gregory et al. 2004). Five-minute point counts were carried out at smaller survey locations (each of the SPS sites, the Credit River site) and where access to the site was limited or could disturb birds (the Credit River marsh, WWTP sites). All birds seen or heard within 25-50 m of the observer were recorded during point counts. We carried out walking line transects along two proposed forcemain routes (from SPS #3 and Route Option 1), in which we slowly walked along the trail recording all birds heard or seen within 50 m of the route. For the Route Options 2 and 3 we conducted line transects by car, slowly drove along the routes (at approximately 10-20 km/h) with the windows open, recording congregations of birds seen or heard within 100 m of the road. These proposed routes are located along existing roads. We have assumed that forcemain construction would occur solely within the existing footprint of these roads and their immediate right of way. Any birds occurring along these roads are already exposed to disturbance from road traffic and associated human activity, and any additional disturbance due to the forcemain would be limited to its construction phase.

The approximate location of all birds detected during surveys was marked on aerial photos of the study area. We noted any species designated as at risk federally and/or provincially, as well as species considered area sensitive (i.e., area sensitive species require large areas of continuous habitat for breeding and foraging; MNR 2000).

Surveys were conducted on June 1 and 21, 2017 between 05:45 and 11:45 h. Weather conditions during surveys ranged from clear to 50% overcast, with no wind to strong breezes, no precipitation, and temperatures between 6ºC and 19ºC.



Legend

- Roads
- Sewer
- Rivers
- Lakes
- Potential Pump Stations
- Potential WWTP Sites
- Forcemain Route Alternative 1
- Forcemain Route Alternative 2
- Forcemain Route Alternative 3
- Bird Survey Locations
- Bird Survey Transect

Figure 9:
Breeding Bird Surveys

Project: Town of Erin UCWS
Class EA – Natural Environment

Project #: J160005

Project Lead: Brent Parsons
Prepared by: Kris Hadley
Data Source: HESL,Ontario Land, ESRI
Coordinate System: NAD 1983 UTM Zone 17N

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2.2.2.5 Species at Risk

We recorded all species at risk detected during field work and conducted a background review (see Section 2.1) to determine potential species at risk that could occur in the study area. Species at risk are designated federally by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and under the federal *Species at Risk Act*, and provincially by the Committee on the Status of Species at Risk in Ontario (COSSARO; under Ontario's *Endangered Species Act*).

3. Results

3.1 Aquatic Ecology

3.1.1 Fisheries

3.1.1.1 Background Review

The watershed supports 60 fish species (MNR and CVC 2002), of which 15 have been collected in the study area (CVC et al. 2011; Table 2). The study reach supports cold, cool and warm water species that are sensitive, moderately tolerant and tolerant to stressors according to CVC classifications (CVC et al. 2011; Table 2). CVC also characterized fish communities in the West Credit River near the 10th Line between 1999 and 2009 and noted that there was "good" health after the first seven years of sampling based on Index of Biological Integrity (IBI) scores, likely because ubiquitous groundwater upwellings in the area are able to moderate any negative impacts of runoff from Erin Village and from its two online impoundments. In January 2009, CVC collected 15 Rainbow Trout (*Oncorhynchus mykiss*), one Brown Trout (*Salmo trutta)* and 209 Brook Trout from the area (Table 2). IBI scores calculated from sampling halfway between the 10th Line and Winston Churchill Boulevard in 2008 indicated fish health as "fair" with Brook Trout dominating the catch.

Brook Trout were stocked from the 1940s to 1981 and the study reach of the West Credit River currently supports a self-reproducing population. MNR and CVC (2002) identify the protection of Brook Trout as a fisheries objective in the Credit River and they are an indicator species of pristine, coldwater habitat.

Table 2. Fish Species List for the WCR at 10th Line and Winston Churchill (CVC 2011).

Fish Species	Preferred Thermal Regime	Sensitivity	1980-1999[a]		2009
			10th Line	Winston Churchill	10th Line
Brook Trout	Cold water	Sensitive	2	37	209
Pearl Dace	Cool water	Moderately tolerant		2	
Central Mudminnow	Cool water	Moderately tolerant		2	
Northern Redbelly Dace	Cool water	Moderately tolerant	4		
Rainbow Trout	Cold water/ Cool water	Sensitive			15
Brown Trout	Cold water/ Cool water	Sensitive			1
White Sucker	Warm water	Tolerant	7		
Bluntnose Minnow	Warm water	Tolerant	4		
Fathead Minnow	Warm water	Tolerant	1	20	
Blacknose Dace	Warm water	Tolerant	13	62	
Longnose Dace	Warm water	Sensitive	1		
Creek Chub	Warm water	Tolerant	9		
Brown Bullhead	Warm water	Tolerant		10	
Brook Stickleback	Warm water	Tolerant		1	
Pumpkinseed	Warm water	Tolerant	3	1	
Atlantic Salmon	Cold water	Sensitive	Stocked as fry at Winston Churchill Blvd.		

Notes: a – From CVC 2011 – sampling years not provided

3.1.2 Benthic Invertebrates

3.1.2.1 Background Review

Benthic invertebrates were sampled halfway between the 10th Line and Winston Churchill Boulevard in 2007 and 2008, and at the 10th Line from 1999-2006 through CVC's Integrated Watershed Monitoring Program (CVC et al. 2011). Samples were collected in July or August using a travelling kick-and-sweep collection technique in all microhabitats with a 500 µm D-net. Replicates were composited and the first 300 animals were picked from each sample and assessed through biological metrics (Table 3; Appendix A).

Table 3. CVC Benthic Invertebrate Sampling Results from Station 50115003 (10th Line) and 15-04-01 (between 10th Line and Winston Churchill Boulevard).

Station	Year	Taxa Richness	EPT Taxa Richness	% EPT	% Oligochaeta	% Chironomidae	Shannon Diversity	HBI
10th Line	1999	51	20	40	3	29	3.5	5.43
	2000	47	15	36	2	47	4.95	5.06
	2001	53	23	51	10	25	4.83	4.40
	2001	52	18	29	8	41	5.15	5.45
	2002	53	17	22	5	54	3.99	6.02
	2003	47	14	46	5	24	4.63	5.54
	2004	32	13	46	10	22	3.80	5.25
	2005	57	18	43	6	22	4.71	4.55
	2006	61	22	38	5	21	4.59	5.15
	Average (1999-2006)	50	18	39	6	32	4.46	5.20
Halfway between 10th Line and Winston Churchill Boulevard	2008	53	12	38	3	40	4.27	3.84

Taxa richness ranged from 32 to 61 at 10th Line with an average of 50 taxa, while 53 taxa were collected downstream in 2008. Average EPT taxa and % EPT at the 10th Line were 18 and 39 respectively, and 12 and 38 halfway between the 10th Line and Winston Churchill Boulevard in 2008. % *Oligochaeta* at the 10th Line ranged from 2 to 10% and averaged 6%, while % *Oligochaeta* further downstream in 2008 was 3%. % *Chironomidae* was much higher at the 10th Line (average = 32%) than the sample collected further downstream in 2008 (10%). Shannon Diversity was similar between the two sites: 4.46 on average at the 10th Line and 4.27 further downstream in 2008. The average HBI score of 5.2 indicates "fair" water quality with "fairly substantial pollution likely", which is in contrast to the cold water and high oxygen conditions in this reach (HESL 2017). The HBI was lower halfway between the 10th Line and Winston Churchill Boulevard (3.84) indicating that water quality was "very good', a likely response to the large groundwater inputs along this reach.

3.1.2.2 Field Investigations

Sampling locations are presented in Figure 6, habitat characteristics are described in Table 4 and biological metric results are provided in Table 5. The first 100 animals were to be picked from each replicate sample in accordance with OBBN protocol, but greater than 100 were picked and identified from every sample. Site comparison, therefore focused on the proportionate metrics: % EPT, % Chironomidae, Shannon Diversity and HBI.

All samples were extremely productive – the required sample size of at least 100 invertebrates was obtained from 1-9% of the volume of each sample. There was variance between the triplicate samples taken at each of the WCB and CR10 sites but, overall, when replicate data were combined, metric results were similar (Table 5). Richness, and EPT Taxa Richness were the same, while %EPT, %*Chironomidae*, diversity and the Hillsenhoff Biotic Index Scores were slightly higher at CR10. The relatively high changes in benthic assemblages within replicate sites was likely habitat related. For example, Site CR10-A was located in a riffle as opposed to a more depository run and riffles generally support a more diverse benthic assemblage because of higher dissolved oxygen concentrations and other important habitat variables.

Table 4. Habitat Characteristics at Sampling Locations.

Sample Site	Substrate	Morphology	Aquatic Vegetation	Woody Debris
CR10-A	Rocky with some sand	Riffle	None	Moderate
CR10-B	Rocky substrates moderately covered in periyphton	Sluggish run	None	Moderate
CR10-C	Rocky substrates moderately covered in periphyton and underlying sand	Run	Moderate (Water Celery (*Vallisneria Americana)*, Lake Watercress (*Nasturtium officinale*)	Abundant
WCB-A	Rocky substrates largely covered with periphyton and underlying sand	Riffle	None apart from periphyton	None
WCB-B	Rocky substrates largely covered in periphyton, sand and organics	Run	Sparse	Abundant
WCB-C	Mainly organics with sand deposits	Run	Very abundant (Sago Pondweed (*Stuckenia pectinate*), Lake Watercress, Curly Leaved Pondweed (*Potamogeton crispus*), Water Celery, Milfoil spp. (*Myriophyllum*)	Sparse

Table 5. Benthic Invertebrate Biological Metric Results.

Biological Metric	CR10-A	CR10-B	CR10-C	CR10	WCB-A	WCB-B	WCB-C	WCB
Abundance	115	112	103	330	141	119	120	380
Richness	27	24	27	96	22	23	15	96
EPT Taxa Richness	12	7	9	28	8	4	4	28
% EPT	40.87	23.21	49.51	37.58	34.75	13.45	49.17	32.63
% Chironomidae	38.26	69.64	38.83	49.09	48.23	50.42	40.00	46.32
Diversity	2.90	2.47	2.61	3.18	2.54	2.52	1.71	2.96
HBI - Family biotic index	2.77	4.53	5.80	4.84	3.50	4.56	5.01	4.51
HBI - Water quality	Excellent	Good	Fairly Poor	Good	Excellent	Good	Fair	Good
HBI - Degree of organic pollution	Organic pollution unlikely	Some organic pollution probable	Substantial pollution likely	Some organic pollution probable	Organic pollution unlikely	Some organic pollution likely	Fairly substantial pollution likely	Some organic pollution probable

The benthic communities differed slightly between the sampling locations as communities contained greater % EPT taxa and diversity on average at sites located adjacent to the 10th Line. Assemblages near the 10th Line are supported by more habitat features such as rocky riffles which support diverse assemblages.

3.1.3 Aquatic Habitat

3.1.3.1 Background Review

MNR and CVC (2002) note that the upper section of the Credit River watershed has baseflow which is maintained from springs and groundwater discharge, and generally good water quality. There is a quick recovery of temperatures and Brook Trout populations near 10th Line after impacts associated with impoundments in Erin as groundwater baseflows improve along with a confluence of other tributaries (CVC 2011). Fish can migrate into the study area from Belfountain, which is 6.5 km downstream and is all coldwater habitat (CVC et al. 2011). The best Brook Trout populations and spawning areas are in the subwatershed downstream of Erin Village. Between the 10th Line and 400 m downstream, >10 redds were surveyed by CVC while 5-10 redds were surveyed between 400 and 800 m downstream of the 10th Line.

Water temperatures were collected from the West Credit River downstream of 10th Line and Winston Churchill Boulevard in 2008 as part of the SSMP (CVC et al. 2011) and in 2016 as part of the ACS (HESL 2017; Table 6). In 2008, the average daily maximum temperature and seasonal maximum increased from upstream to downstream, but was below CVC's average daily target of 20ºC and seasonal maximum target of 26ºC for water temperatures in coldwater habitat. In 2016, the average daily maximum temperature decreased between 10th Line and Winston Churchill, but both sites exceeded the average daily maximum target of 20ºC. The seasonal maximum temperatures were both below the seasonal maximum target of 26ºC. The average daily maximum water temperature at 10th Line was approximately 3ºC higher at the two sites in 2016 than 2008, however groundwater discharge between 10th Line and Winston Churchill had a moderating effect on the water temperatures downstream in 2016.

Table 6. Water Temperatures Monitored in 2008 (CVC et al. 2011) and 2016 (HESL 2017) from within the Study Area.

	2008 (CVC 2011)[a]			**HESL (2016)[b]**		
Site	Average Daily Max (Target: 20ºC)	Seasonal Max (Target: 26ºC)	Percent Exceedance over 26°C	Average Daily Max (Target: 20ºC)	Seasonal Max (Target: 26ºC)	Percent Exceedance over 26°C
10th Line	16.7	20.4	0	22.0	24.3	0
Winston Churchill Blvd.	17.8	21.7	0	20.9	23.7	0

Notes: a – June to September 2008 (dates note provided), b - June 10 to August 25, 2016

3.1.3.2 Field Investigations

Winston Churchill Boulevard

The West Credit River transitioned from a shallow run approximately 50 m downstream of Winston Churchill Boulevard to a riffle within 10 m of the culvert. The shallow run contains wetted widths of approximately 10-12 m, water depths up to 0.5 m deep and rocky substrates such as small boulders, cobble and gravel partially covered in periphyton, with underlying sand and organic substrates found in the depository areas. Riparian vegetation was dominated by Eastern White Cedar (*Thuja occidentalis*) which provided up to 70% canopy coverage (Photograph 1). Instream cover consisted of abundant woody debris and sparse accumulations of Lake Watercress (*Nasturtium officinale*) and Pickerelweed (*Pontederia cordata*). The riffle located within 10 m on either side of the culvert was dominated by cobble with underlying sands and shallow water depths (<0.3 m). Cover habitat was limited to branches and limited overhanging vegetation.

The riffle transitioned into a deeper (up to 1 m), more depository run approximately 10 to 70 m upstream of Winston Churchill Boulevard (Photograph 2). Substrates were mixed and contained a greater proportion of sand and unconsolidated organic substrates than found in the downstream riffle. A thick mat of submerged macrophytes was observed running from 30 m to 80 m upstream of the culvert; species included Lake Watercress (*Nasturtium officinale*), Curly-Leaf Pondweed (Potamogeton crispus), Water Celery (Vallisneria sp.), Sago Pondweed (*Stuckenia pectinata)* and Milfoil (Myriophyllum spp; Photograph 3). The river transitioned back into riffle habitat like that observed downstream of Winston Churchill Boulevard 70+ m further upstream from Winston Churchill Boulevard.

10th Line

The West Credit River contained riffle run morphology from 100 m downstream of 10th Line to 10th Line. The channel was approximately 11-12 m wide with average depths of approximately 0.5 m. Substrates were predominantly coarse gravel and cobble, and sands with some organic material located in quiescent areas. Cover was provided by abundant woody debris along log deflectors and overhanging Eastern White Cedar. The rifle habitat transitioned through a partial beaver dam to a sluggish run 60 m downstream of 10th Line. Substrates were sandy with some cobble and gravel, and unconsolidated organics at the river edges. Patches of Canada Waterweed (*Elodea canadensis*), Lake Watercress (*Nasturtium officinale*), and Water Celery (*Vallisneria spp.)* were noted in this section. The channel transitioned back into riffle/shallow run habitat closer to the 10th Line with dominant rocky substrates and underlying sand, abundant woody debris and sporadic accumulations of macrophytes (Photographs 4 and 5).

Photograph 1. A view of the West Credit River facing downstream, approximately 30 m east of Winston Churchill Blvd. Note the mixed substrates, abundant woody debris and dense overhanging White Cedar.

Photograph 2. A view of the West Credit River facing upstream from the western end of the culvert beneath Winston Churchill Blvd. Periphyton covered rocky substrates were dominant in this riffle habitat with underlying sands.

Photograph 3. A view of the river facing upstream approximately 30 m west of Winston Churchill Blvd. highlighting more quiescent conditions and accumulations of submerged macrophytes along the river margins.

Photograph 4. Riffle habitat located approximately 30 m downstream of the 10th Line.

Photograph 5. A view of the West Credit River facing the 10th Line from approximately 20 m downstream.

3.1.4 Spawning Assessment

Brook Trout spawning redds are shown on Figure 5 and described in Table 7. Ninety-four redds were observed in 16 areas within the study reach. Of the 94 redds, 61 were classified as definite (Category 1), 15 as probable (Category 2), and 10 as possible (Category 3) based on redd formation and presence or absence of Brook Trout. Observed redds were located between 350 m downstream of Winston Churchill Boulevard and 75 m downstream of the 10th Line, with the majority of redds located greater than 300 m downstream of 10th Line and 200 m upstream of Winston Churchill Boulevard. Redds were generally located in cobble, gravel and sandy substrates.

Many spawning Brook Trout were observed on and adjacent to redds and migrating throughout the West Credit River (Photograph 6) during the November 2016 survey. Fish presence at individual redds is likely under-representative because of disturbance from the presence of the biologists (Table 7). Many redds were freshly cleaned off and spawning behaviour such as males nipping one another was evident in many locations (Photograph 7).

Table 7. Spawning Assessment Results.

Site ID	# Redds	Redd Category	Fish Presence
A	8	3	Many
B	7	1	Many
C	6	1	Yes
D	1	3	No
E	2	1	Juveniles
F	12	1	Yes
G	3	3	Yes
H	9	1	Yes
I	4	1	No
J	2	3	Yes
K	1	1	Yes
L	5	2	Juveniles
M	4	3	Juveniles
N	10	2	Yes
O	17	1	Many
P	3	1	No

Photograph 6. Spawning Brook Trout were abundant throughout much of the study reach.

Photograph 7. Many Brook Trout redds were freshly cleaned by spawning females.

3.2 Terrestrial Ecology

3.2.1 Natural Heritage Designations

Greenbelt Plan Area Designations

As depicted on *Detailed Mapping of the Greenbelt Plan Area – Map # 66* (Town of Erin and Town of Caledon), the proposed forcemain route and WWTP alternatives are entirely located within designated "Protected Countryside" lands of the Greenbelt Plan. In addition, the proposed sewage pumping stations (SPS, and effluent outfall) are specifically located within the boundaries of Hillsburgh and Erin, both identified as "Towns and Villages" of the Greenbelt's Protected Countryside as depicted on Map #66. Portions of the proposed route alternatives are also located within the Towns and Villages designations, providing connection to the additional proposed infrastructure features (SPS', WWTPs).

As per Greenbelt Plan Section 4.2: General Infrastructure Policies new infrastructure that has been approved under the *Environmental Assessment Act* may be allowed should it meet one of the following objectives:

a. "*It supports agriculture, recreation and tourism, rural settlement areas, resource use or the rural economic activity that exists and is permitted within the Greenbelt; or*
b. *It serves the significant growth and economic development expected in southern Ontario beyond the Greenbelt by providing for the appropriate infrastructure connections among urban growth centres and between these centres and Ontario's borders*."

The proposed works satisfy the above requirements, as they will provide appropriate wastewater servicing infrastructure connection between, and improved servicing within, the settlements of Hillsburgh and Erin. Such infrastructure will provide the necessary infrastructure to support the expansion/urban growth of these settlement areas.

In general, the policies provided throughout Section 4.2 of the Plan require that proposed infrastructure works minimize impacts to the landscape wherever possible (including Natural Heritage System lands), and the most reasonable alternatives should be chosen. The Natural Environment Report has provided a thorough assessment of route alternatives.

Additionally, portions of each alternative also transect lands further defined on Map #66 as "Natural Heritage System"; however, each route alternative is proposed along existing transportation infrastructure features (roadways, former rail line), thus allowing impacts to the natural landscape to be further minimized through design and mitigation measures.

County of Wellington Greenlands System Designations

As depicted on *Schedule A2: Erin* (updated May 26, 2016) of the County of Wellington's Official Plan, portions of all three of the proposed route alternatives, and one potential WWTP site (Site 1) transect or are adjacent to areas of the County's "Greenlands System" (includes both "Greenlands" and "Core Greenlands" designations). As per *Part 5.4* of the Official Plan, Core Greenlands may include such features as Provincially Significant Wetlands (PSWs). As illustrated in *Appendix 3* of the Official Plan (as well as Figure 10 of the Natural Environment Report), portions of the Credit River PSW exist throughout the general study area, comprising much of the identified "Core Greenlands" lands.

Further, "Greenlands" located beyond the Core Greenlands boundaries may include "*other significant natural heritage features including habitat, areas of natural and scientific interest, streams and valleylands, woodlands, environmentally sensitive areas, ponds, lakes and reservoirs and natural links*".

The project team reviewed *Part 5* of the *The County of Wellington Official Plan* (November 9, 2017 update) for policies regarding development adjacent to the Greenlands System. In accordance with *Section 5.4.1* of the Official Plan, development/site alteration is prohibited within PSWs. As discussed, each route and WWTP alternative is proposed along existing transportation infrastructure features (roadways, former rail line). As such, there will be no new encroachment into PSW features. Design and mitigation measures have been recommended within the Natural Environment Report to mitigate potential impacts to adjacent wetland features.

In general, Section 5.6.2 also indicates that development proposed within or adjacent to other components of the Greenlands system may be permitted, subject to the satisfaction of the County or local municipality, once it has been demonstrated that the features have been accurately identified and impacts have been assessed.

Significant Woodlands

The identification of significant woodlands for this study was based on the components of the County's Greenlands System (Schedule A2: Erin of the County of Wellington's Official Plan, updated May 26, 2016). The County of Wellington's significant wooded areas (https://sgis.wellington.ca) were therefore used as a reference for guidance on the identification of the significant woodlands. The criteria of the Greenbelt Plan 2005 Technical Guide for Significant Woodlands (whereby woodlands of 10 hectares [ha] or more qualify for designation) would apply because the project is within the North Area of the Greenbelt Plan (the Town of Erin and study area are located north of the Oak Ridges Moraine Conservation Plan Area and west of the Niagara Escarpment Plan Area). Other criteria include natural composition, age or tree size, proximity to other significant natural features (i.e., a significant wetland, significant habitat of an endangered or threatened species, or a significant woodland), for woodlands 4 ha or more in size, and rarity (for woodlands 0.5 ha or more). Where feasible based on desktop review, woodland areas that qualify as significant and were not captured in the County's mapping were added (Figure 10).

West Credit River Provincially Significant Wetland (PSW) Complex

The West Credit River Provincially Significant Wetland (PSW) Complex covers a relatively large area between the towns of Hillsburgh and Erin (Figure 10**)**. This wetland complex is largely comprised of coniferous and mixed swamps. The dominant coniferous species is Eastern White Cedar, while Balsam Fir (*Abies balsamea*) is commonly observed, and Black Spruce (*Picea mariana*) is occasionally present (CVC et al. 2011). Organic soils are commonly recorded within this wetland complex and large amounts of groundwater are known to discharge throughout the area (CVC et al., 2011).

West Credit River at Hillsburgh Environmentally Significant Area (ESA)

Environmentally Significant Areas (ESA) within CVC's watershed are specially protected areas which comprise ecosystem features or functions of ecological importance. The ESA meets one or several of the following criteria: part of a distinctive or unusual landform, significant hydrological function, critical wildlife habitat, contains provincially or regionally rare species or communities, high species diversity, and aesthetic value in the context of the surrounding landscape (CVC et al. 2011).

The West Credit River at Hillsburgh ESA is part of the West Credit River Wetland Complex. It is characterized as an undisturbed forested valley with the presence of coniferous swamps and provides important habitat for rare species and important groundwater discharge for the West Credit River (CVC et al. 2011). This ESA is found within the study area to the south of Hillsburgh on either side of Wellington Road 24. The northern section of the ESA parallels the Cataract-Elora Trail.

Credit River Watershed and Region of Peel Natural Areas Inventory (NAI)

The Natural Areas Inventory (NAI) is a comprehensive watershed and municipal wide biological resource inventory for key natural areas. Information available in the NAI is a compilation of ESA reports, wetland evaluations, Forest Resource Inventories, as well as recent and ongoing field investigations. The NAI provides detailed information on flora, fauna and vegetation communities. Much of this information is available for natural heritage features within the study area and was used as background information to supplement the current study. This information will also be of use as the EA advances to the detailed design stage. Information from site visits and existing data were gathered and used as primary information for current assessments and for the identification of potential sensitivities and mitigation measures at the site-specific level. There are several NAI in the study area which are illustrate in Appendix B. The following specific NAI Site Summaries were updated in October 2011 and have been referenced for this study:

- Eight Line – 17 Sideroad (NAI Area #6497)
- Eight Line – Dundas W (NAI Area #6273)
- Main – Dundas – Woolen Mills (NAI Area #6500, 6609)
- Sixth Line – 24 Sideroad (NAI Area #6336, 6523)
- Sixth Line – Wellington 22 (NAI Area #6293, 6294, 6499, 6517, 6519)
- Trafalgar – 22 Sideroad (NAI Area #6498)
- Tenth Line - Dundas South (NAI Area #6501)
- Eighth - Dundas North (NAI Area #7006288).

Eight Line – 17 Sideroad (NAI Area #6497) is part of PSW – West Credit River Wetland Complex. The area is privately owned, with greater than 4 ha of forest communities and over 0.5 ha of wetlands. The eastern half is largely natural, with a network of walking trails for recreation. Treed parts of this area are regenerating from previous land clearing from past logging or agriculture land use and are mostly young to mid-aged communities with the exception of a mature, possibly old-growth Sugar Maple deciduous forest. This natural area contains a high diversity of species and specialized wildlife habitats, which support several regionally rare communities and species. The western half of the area is highly fragmented by the development of golf course fairways that intrude into the natural forest and wetland communities.

Eight Line – Dundas West (NAI Area #6273) is part of the PSW - West Credit River Wetland and Greenbelt Plan located southwest of Erin Village. The area is linear in shape and is comprised of deciduous and mixed forest, swamp and a stream, over rolling terrain. Seeps and vernal pools are present, breeding bird biodiversity is high, old growth forest may be present and several species at risk and rare species are supported by this natural area. Fragmentation by agricultural land use occurs and wildlife road mortality is a concern in this area.

Main – Dundas – Woolen Mills (NAI Area #6500, 6609) is part of PSW – West Credit River Wetland Complex. The whole area is in the Greenbelt Plan and the central portion is part of the Greenbelt Plan Natural Heritage System. As such, this area contributes to connectivity between major provincial corridors and allows for migration of species across large areas of the province. The area has been highly fragmented by urban residential development but a large part of this natural area lies within the Woolen Mills Conservation Area (which has public walking trails). There is also a medium-sized patch of interior forest habitat present in the northwest part of this natural area known to support one species of area sensitive bird (Black-and-white Warble, *Mniotilta varia*). Extensive stream restoration guided by CVC has recently been conducted through community participation and stewardship projects.

Sixth Line – 24 Sideroad (NAI Area #6336, 6523) is part of the PSW - West Credit River Wetland Complex and is comprised predominantly of wetlands with some forest on drier valley slope. The West Credit River runs the length of the natural area, passing through two millponds. The swamps all have a coniferous component and support flora and fauna with northern affinities. Despite its relatively small size, this area supports four species at risk (Barn Swallow, *Hirundo rustica*; Bobolink, *Dolichonyx oryzivorus*; Monarch Butterfly, *Danaus plexippus*; and Eastern Snapping Turtle, *Chelydra serpentina*), 31 species of regionally rare plants[1] and four species of area sensitive forest interior birds (Hairy Woodpecker; *Picoides villosus*; Pileated Woodpecker, *Dryocopus pileatus;* Red-breasted Nuthatch, *Sitta canadensis*; and Black-throated Green Warbler, *Setophaga virens*). Therefore, this area should be evaluated to determine if significant wildlife habitat is present in accordance with the Provincial Policy Statement.

Sixth Line – Wellington 22 (NAI Area #6293, 6294, 6499, 6517, 6519) is mostly in the Credit River West-Hillsburgh ESA, PSW West Credit River and the Greenbelt Plan Natural Heritage System. It is comprised predominantly of lowland forest and treed wetlands. The high quality of this natural area is reflected in its PSWs and in its inclusion as part of an ESA. Due to its extensive wetlands, much of this natural area remains relatively undisturbed, however, several patches of plantation do exist. Most of the area is lowland forest or treed wetlands providing a large amount of interior forest habitat for a variety of area sensitive forest species and overall high bird species diversity. As a part of the provincial Greenbelt Plan Natural Heritage System, this area offers connectivity between major provincial corridors, and allows for migration of species across large areas of the province.

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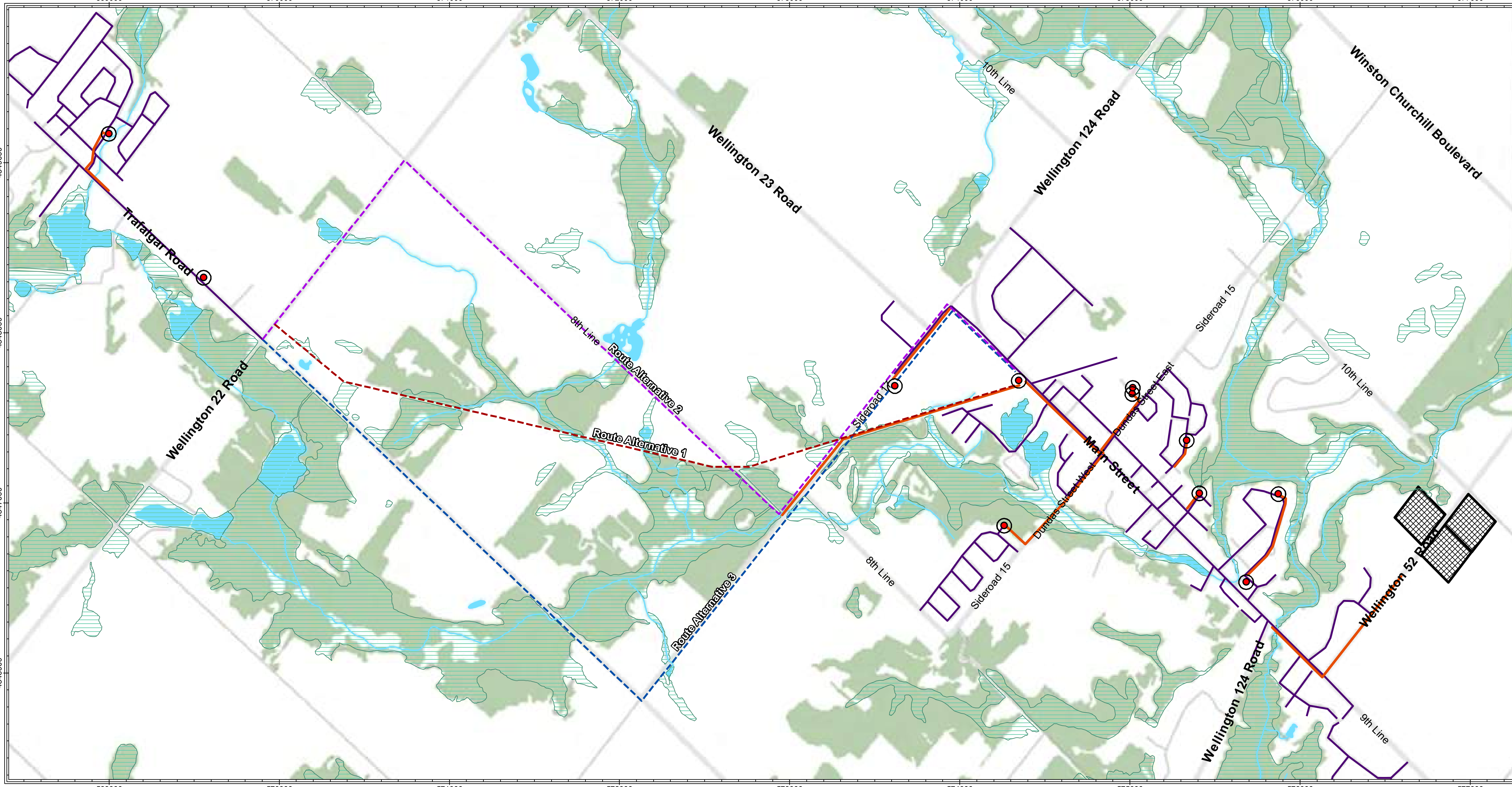
[1] *Ticklegrass (Agrostis scabra), Marsh Bellflower (Campanula aparinoides), Smooth-sheath Sedge (Carex laevivaginata), Smooth-sheath Sedge (Carex laevivaginata), Three-seed Sedge (Carex trisperma var. trisperma), American Golden-saxifrage (Chrysosplenium americanum), Showy Lady's-slipper (Cypripedium reginae), Roundleaf Sundew (Drosera rotundifolia), Purple-leaf Willow-herb (Epilobium coloratum), Marsh Horsetail (Equisetum palustre), Thinleaf Cottonsedge (Eriophorum viridi-carinatum), Stiff Marsh Bedstraw (Galium tinctorium), Creeping Snowberry (Gaultheria hispidula), Purple Avens (Geum rivale), Spotted St. John's-wort (Hypericum punctatum), Richardson Rush (Juncus alpinoarticulatus), Narrow-panicled Rush (Juncus brevicaudatus), Kalm's Lobelia (Lobelia kalmii), Swamp Fly-honeysuckle (Lonicera oblongifolia), One-side Wintergreen (Orthilia secunda), Mountain Woodsorrel (Oxalis acetosella ssp. montana), Golden Ragwort (Packera aurea), Northern Beech Fern (Phegopteris connectilis), Black Spruce (Picea mariana), Springs Clearweed (Pilea fontana), Leafy Pondweed (Potamogeton foliosus), Smooth Gooseberry (Ribes hirtellum), Hidden Spike-moss (Selaginella eclipes), Bog Goldenrod (Solidago uliginosa), Hooded Ladies Tresses (Spiranthes romanzoffiana), Lesser Bladderwort (Utricularia minor) and Smooth White Violet (Viola macloskeyi ssp. pallens).*

Trafalgar – 22 Sideroad (NAI Area #6498) is part of ESA - Credit River West-Hillsburgh and the Greenbelt Plan Natural Heritage System. This natural area is comprised of swamp, marsh, wet forest, fen and some drier forest and plantation on higher terrain. The West Credit River passes through the length of this natural area in a broad, shallow valley, with widespread areas of associated riparian communities and wetlands. Groundwater seepage occurs throughout the lowland parts of this natural area. The area is highly fragmented by surrounding land uses, due to agricultural and aggregate extraction but some old fields are now regenerating to natural communities restoring connectivity in previously fragmented habitat. Interior forest habitat is present supporting a high bird biodiversity and flora and fauna with northern affinities. Suitable breeding habitat for frogs exists along the river and in numerous vernal pools scattered through this natural area.

Tenth Line - Dundas South (NAI Area #6501) is part of PSW West Credit River PSW Greenbelt Plan Natural Heritage System. This area is limited by roads on three sides and a quarry to the northwest. A major proportion of the area is plantation that has restored tree cover from previously cleared agricultural lands. However, biodiversity is lower here than any other nearby natural area.

Eighth - Dundas North (NAI Area #7006288) is part of PSW West Credit River Wetland Complex Greenbelt Plan – Protected Countryside. The area is linear in shape, narrowly restricted on the east bank of the river by village commercial and residential development but is wider on the west bank and extends partially up a large hill that overlooks the village. The river and riparian habitat in this area has been extensively impacted historically by fluctuating ponding and flows associated with milling activity on this part of the West Credit River. Two dams and millponds still exist within this natural area. The area is predominantly wetland and despite its size and shape, this area still provides habitat that supports amphibian breeding and several species at risk and rare species.



Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Apr 20, 2018

Legend

- SPS location
- SPS locations buffer (120 m)
- Forcemain
- Gravity Sewer
- Potential WWTP site
- Route Alternative 1
- Route Alternative 2
- Route Alternative 3
- Provincially Significant Wetland
- Significant Woodland

NOTE:
Significant woodland features georeferenced from County of Wellington "Explore Wellington" web map.

N

COORDINATE SYSTEM:
NAD 1983 UTM ZONE 17N
SCALE: 1:22000

0 0.5 1
kilometres

Natural Heritage Features in Study Area

FIGURE 10

Base Map. Contains infromation licensed under the Open Government Licence - Canada.

Document Path: C:\Egnyte\Shared\Projects\Active\1318 - HESL\13183 - Town of Erin Sewage Treatment\Mapping\Draft\mxd\13183_ErinWWTP_Infra_Overview.mxd

3.2.2 Vegetation Communities

Field investigations identified 22 different vegetation communities in total. The following number of different vegetation communities were identified at each site:

- Eight at the proposed SPS in Erin Village;
- Two at the proposed SPS in Hillsburgh;
- Two at the potential locations for the WWTP; and
- 15 along Route Option 1 for the Hillsburgh to Erin Connection Forcemain.

These communities and their corresponding boundaries are illustrated on ELC Maps 1 to 12 (Appendix B) with vegetation community descriptions provided below in Table 8 and photographs in Appendix B.

Both upland and wetland vegetation communities have been recorded within the proposed sites. The limits of wetland communities were identified and mapped to the extent possible recognizing that site level access was limited in most areas. Aerial photo interpretation and background mapping, including the MNRF PSW mapping, was used in the assessment of wetland limits. All wetland communities identified in Table 8 are part of the West Credit River PSW Complex.

Table 8. Vegetation Community Descriptions.

ELC vegetation communities	Sites	Description
CUM1-1: Dry-moist Old Field Meadow	Erin SPS #2; Erin SPS #4; Erin SPS #5; Erin SPS #6; WWTP; Route Option 1	Canopy sparsely vegetated with various species of trees including Manitoba Maple (*Acer negundo*), Trembling Aspen (*Populus tremuloides*), and Eastern White Cedar (*Thuja occidentalis*), usually providing less than 10% cover at a height of 6 to 25 m. The subcanopy is occasionally vegetated with Choke Cherry (*Prunus virginiana*), Tartarian Honeysuckle (*Lonicera tatarica*), and European Buckthorn (*Rhamnus cathartica*), typically providing less than 10% cover at a height of 2 to 6 m. Understory is dominated by Canada Goldenrod (*Solidago canadensis*), Wild Carrot (*Daucus carota*), Smooth Brome (*Bromus inermis*), Redtop (*Agrostis gigantea*), New England Aster (*Symphyotrichum novae-angliae*), and Common Milkweed (*Asclepias syriaca*), providing greater than 60% cover at a height of 1 to 2 m. The ground layer is sparsely vegetated with Bird's-foot Trefoil (*Lotus corniculatus*), Tufted Vetch (*Vicia cracca*), and grasses, providing greater than 60% cover at a height of 0.2 to 0.5 m. All sites listed with this vegetation community differ slightly, however, no notable attributes were identified at any of these location with the exception of large sized communities such as the potential WWTP provide habitat for grassland birds discussion in Sections 3.2.4.
CUP3: Coniferous Plantation	Route Option 1	Canopy is predominantly composed of White Spruce (*Picea glauca*) with occurrences of White Pine (*Pinus stobus*) providing greater than 60% cover at a height of 6 to 25 m. The subcanopy, understory, and ground layer are essentially un-vegetation.
CUP3-2: White Pine Coniferous Plantation	Route Option 1	Canopy is composed of White Pine (*Pinus stobus*) with White Spruce (*Picea glauca*), providing greater than 60% cover at a height of 6 to 25 m. The subcanopy is composed of Eastern White Cedar and White Ash (*Fraxinus americana*) samplings, providing a less than 10% cover at a height of 2 to 6 m. The understory and ground layer are essentially un-vegetation.

ELC vegetation communities	Sites	Description
CUW1: Mineral Cultural Woodland	Erin SPS #1A; Erin SPS #1B; Erin SPS #8; Route Option 1	The canopy is composed of numerous species including Trembling Aspen, White Ash, Manitoba Maple, Sugar Maple (*Acer saccharum*), and Black Cherry (*Prunus serotina*), providing 35 to 60% cover at a height of 6 to 25 m. The subcanopy is composed of Manitoba Maple, Eastern White Cedar, Sugar Maple samplings and Trembling Aspen sampling, ranging from 10 to 60% cover at a height of 2 to 6 m. The understory is typically composed of Alternate-leaved Dogwood (*Cornus alternifolia*), Red-osier Dogwood (*Cornus sericea*), European Buckthorn, and Eastern White Cedar samplings, ranging from 10 to 60% cover at a height of 1 to 2 m. The ground layer is predominantly composed of Garlic Mustard (*Alliaria petiolata*), Field Horsetail (*Equisetum arvense*), Canada Goldenrod, and Riverbank Grape (*Vitis riparia*), providing greater than 60% cover at a height of 0.5 to 1 m. Although the Erin SPS-8 site is highly disturbed with frequent dumping of yard waste, Spotted Jewelweed (*Impatiens capensis)* was recorded in the understory layer beyond the proposed footprint for the SPS. This may be indicative of a seepage location which will be discussed in greater detail in the Impact Assessment section below.
FOC: Coniferous Forest	Erin SPS #7; Erin SPS #8	Vegetation community assessment was conducted based on desktop assessment due to limited access.
FOC2-2: Dry-fresh White Cedar Coniferous Forest	Route Option 1	The canopy is dominated with Eastern White Cedar with occurrences of Black Cherry and Trembling Aspen, providing greater than 60% at a height of 6 to 25 m. The subcanopy is composed on Eastern White Cedar samplings providing 10 to 25% cover at a height of 2 to 6 m. The understory is composed of White Ash providing less than 10% cover at a height of 1 to 2 m. The ground layer is comprised of Sedges (*Carex sp*.) and Spotted Geranium (*Geranium maculatum*), providing less than 10% cover at a height of less than 0.2 m.
FOC4-1: Fresh-moist Cedar Coniferous Forest	Route Option 1	The canopy is dominated by Eastern White Cedar providing greater than 60% cover at a height of 6 to 25 m. The understory is composed of Choke Cherry proving less than 10% cover at a height of 1 to 2 m. The ground layer is essentially un-vegetated.
FOD5-8: Dry-fresh Sugar Maple - White Ash Deciduous Forest	Erin SPS #3	The canopy is dominated by White Ash and Sugar Maple, providing greater than 60% cover at a height of 6 to 25 m. The subcanopy is composed of White Ash with European Buckthorn providing 25 to 60% cover at a height of 2 to 6 m. The understory is composed of Alternate-leaved Dogwood and Black Raspberry (*Rubus occidentalis*) providing 10 to 25% cover at a height of 1 to 2 m. The ground layer is vegetated by Garlic Mustard, Broad-leaved Enchanter's Nightshade (*Circaea canadensis*), and Sugar Maple seedlings, providing 10 to 25% cover at a height of 0.2 to 0.5 m.
FOD7: Fresh-moist Lowland Deciduous Forest	Hillsburgh SPS #2;	The canopy is predominantly composed of Balsam Poplar (*Populus balsamifera*) and Manitoba Maple with occurrences of Norway Maple (*Acer platanoides*) and Willows (*Salix sp*.), providing greater than 60% cover at a height of 6 to 25 m. The subcanopy is composed of Manitoba Maple, Norway Maple, and Willow trees, providing 25 to 60% cover at a height of 2 to 6 m. The understory is comprised on Purple Loosestrife (*Lythrum salicaria*), Reed Canary Grass (*Phalaris arundinacea*), and European Buckthorn, providing 25 to 60% cover at a height of 0.5 to 1 m. The ground layer is Spotted Jewelweed and grasses, providing greater than 60% cover at a height of 0.2 to 0.5 m.
FOM3-2: Dry-fresh Sugar Maple –	Route Option 1	The canopy is dominated by Sugar Maple with occurrence of Eastern Hemlock (*Tsuga canadensis*), providing greater than 60% cover at a height of 6 to 25 m. The subcanopy is solely composed of Sugar Maple saplings,

ELC vegetation communities	Sites	Description
Hemlock Mixed Forest		providing 10 to 25% cover at a height of 2 to 6 m. The understory layer is essentially unvegetated while the ground layer is comprised of grasses and Sedges, providing 10 to 25% cover at less than 0.2 m in height.
FOM4-2: Dry-fresh White Cedar – Poplar Mixed Forest	Erin SPS #2; Route Option 1	The canopy is composed of Eastern White Cedar, Elm (*Ulmus sp*.), Norway Maple, Balsam Poplar and White Pine, providing greater than 60% cover at a height of 6 to 25 m. The subcanope is composed of Eastern White Cedar, Manitoba Maple, European Buckthorn, and Norway Maple, providing 25 to 60% cover at a height of 2 to 6 m. The understory is predominantly comprised of Manitoba Maple samplings, providing 10 to 25% cover at a height of 1 to 2 m. The ground layer is dominated by Garlic Mustard with greater than 60% cover and a height of 0.5 to 1 m. This vegetation community is heavily disturbed.
FOM5-2: Dry-fresh Poplar Mixed Forest	Route Option 1	The canopy is composed of Trembling Aspen and Balsam Poplar with occurrences of White Spruce, providing greater than 60% cover at a height of 6 to 25 m. The subcanopy is comprised of White Ash and Eastern White Cedar, providing 25 to 60 % cover at a height of 2 to 6 m. The understory is comprised of Red-osier Dogwood and Willow shrubs, providing greater than 60% cover at a height of 1 to 2 m. The ground layer is predominantly composed of Field Horsetail and Woodland Strawberry (*Fragaria vesca*) with 10 to 25% cover at a height of 0.2 to 0.5 m.
MAS2-1: Cattail Mineral Shallow Marsh	Route Option 1	The canopy is typically comprised of Trembling Aspen of Willow, providing less than 10% cover at a height of 2 to 6 m. The understory is dominated by Narrow-leaved Cattail (*Typha angustifolia*) with occurrences of Red-osier Dogwood, Purple Loosestrife, as well as Common Reed (*Phragmites autralialis*) and Spotted Joe Pye Weed (*Eutrochium maculatum*) in some cases. This layer provides greater than 60% cover at a height of 1 to 2 m. The ground layer is sparse vegetation with Field Horsetail and Devil's Beggarticks, and Watershield (*Brasenia schreberi*), providing less than 10% cover at a height of 0.2 to 0.5 m.
SWC: Coniferous Swamp	Erin SPS #6	Vegetation community assessment was conducted based on desktop assessment due to limited access.
SWC1-2: White Cedar – Conifer Mineral Coniferous Swamp	Route Option 1	The canopy is dominated by White Spruce providing greater than 60% cover, greater than 25 m in height. The subcanopy is predominantly comprised of Eastern White Cedar and Tamarack, providing greater than 60 % cover at a height of 6 to 25 m. The understory is primarily composed of Eastern White Cedar, providing 10 to 25% cover at a height of 1 to 2 m. The ground layer is comprised of Sedges, grasses, Field Horsetail, and ferns, providing 10 to 25% cover at a height of 0.2 to 0.5 m.
SWC3-2: White Cedar – Conifer Organic Coniferous Swamp	Hillsburgh SPS #1; WWTP; Route Option 1	The canopy is composed of Tamarack, Trembling Aspen, Eastern White Cedar, and White Spruce, providing greater than 60% cover at a height of 6 to 25 m. The subcanopy is comprised of Eastern White Cedar and Tamarack as well as some pockets of Common Reed, providing 25 to 60% cover at a height of 2 to 6 m. The understory is primarily composed of Eastern White Cedar, Balsam Fir (*Abies balsamea*), Red-Osier Dogwood and Spotted Jewelweed, providing less than 10% cover ranging from 0.5 to 1 m in height. The ground layer is composed of moss, Field Horsetail, Bulblet Fern (*Cystopteris bulbifera*), Sensitive Fern (*Onoclea sensibilis*), Wild Calla (*Calla palustris*), and Rushes (*Juncus sp*.), providing less than 10% cover at a height of 0.2 to 0.5m.
SWD4-1: Willow Mineral Deciduous Swamp	Route Option 1	The canopy is composed of Balsam Poplar, Weeping Willow (Salix babylonica), and Trembling Aspen, providing 25 to 35% cover at a height of 6 to 25 m. The subcanopy is composed of Willow species and Trembling Aspen, with 25 to 60% cover and ranging from 2 to 6 m in height. The understory is composed of Red-Osier Dogwood, Spotted Jewelweed,

ELC vegetation communities	Sites	Description
		Spotted Joe Pye Weed, and Broad-leaved Cattail (*Typha latifolia*), providing greater than 60% cover at a height of 1 to 2 m. The ground layer less than 10% covered by Field Horsetail at a height of 0.2 to 0.5m.
SWM: Mixed Swamp	Erin SPS #1B; Erin SPS #6	Vegetation community assessment was conducted based on desktop assessment due to limited access.
SWM3-2: Poplar Conifer Mineral Mixed Swamp	Route Option 1	The canopy is dominated by Trembling Aspen, providing 25 to 60% cover at greater than 25 m in height. The subcanopy is composed of Green Ash, Eastern White Cedar, and Eastern Hemlock, providing greater than 60% cover at a height of 6 to 25m. The understory is composed on Alternate-leaved Dogwood and Choke Cherry, providing 10 to 25% cover at a height of 1 to 2 m. The ground layer is composed of Barren Strawberry (*Geum fragarioides*), and Sedges, providing 10 to 25% cover at a height of 0.2 to 0.5m.
SWT2-2: Willow Mineral Thicket Swamp	Route Option 1	The canopy is composed of Willow species and Easter White Cedar at a height of 2 to 6 m and providing greater than 60% cover. The subcanopy is primarily composed of Red-osier Dogwood and Narrow-leaved Cattail, providing 10 to 25% cover at a height of 1 to 2m. The understory is composed of Sedges and Marsh Fern (*Thelypteris palustris*), providing 10 to 25% cover at a height of 0.5 to 1m. The ground layer is primarily composed of Devil's Beggarticks, providing 10 to 25% cover at a height of 0.2 to 0.5 m.

3.2.3 Vascular Plants

The botanical inventory resulted in the identification of 165 species of vascular plants from the combined survey sites. Fifty-nine (36%) of the recorded species are non-native to Ontario. The majority of the non-native species were recorded from the perimeter of the survey sites where there is greater disturbance.

Eight plants recorded in the study area are listed as locally or regionally uncommon or rare in Peel Region, CVC watershed, and/or Ecodistrict 6E-7 (Table 9; Varga et al. 2000; CVC 2002). The specific locations of these species were not recorded. No other provincially or nationally rare species were recorded. A complete list of the flora identified from the study area is provided in Appendix B, which includes a summary of species locations by survey site.

Table 9. Rare/Uncommon Plants Recorded from the Study Area.

Scientific Name	Common Name
Brasenia schreberi	Watershield
Calla palustris	Wild Calla
Chelone glabra	Turtlehead
Cypripedium pubescens var. pubescens	Large Yellow Lady's-slipper
Galium asprellum	Rough Bedstraw
Galium tinctorium	Stiff Marsh Bedstraw
Geranium maculatum	Wild Geranium
Picea glauca	White Spruce

Additional occurrences of uncommon or rare species where observed northwest of the proposed WWTP site locations along the watercourse outside the study area. Reoccurrences of Turtlehead, Wild Geranium and White Spruce were found as well as Yellow Sedge (*Carex* flava) and Bristly Buttercup (*Ranunculus hispidus var. hispidus*).

3.2.4 Breeding Amphibians

Six amphibian species were heard calling in the study area during surveys: American Toad (*Anaxyrus americanus*), Gray Treefrog (*Hyla versicolor*), Spring Peeper (*Pseudacris crucifer*), Western Chorus Frog (*Pseudacris triseriata*), Northern Leopard Frog (*Lithobates pipiens*) and Green Frog (*Rana clamitans*; Table 10, Appendix C). Amphibians were detected at 15 out of the 18 survey stations. Five species were heard calling on April 26 (all except Gray Treefrog), all species were heard calling on May 30, four species were heard on May 31 (American Toad, Gray Treefrog, Spring Peeper and Green Frog) and only one species (Green Frog) was heard calling on June 27.

Table 10. Amphibian Species Recorded in the Amphibian Breeding Surveys.

Species	**Survey Stations**														
	2	3	4	5	6	7	8	9	10	12	13	14	15	16	17
American Toad	✓	✓	✓	✓						✓			✓	✓	
Gray Treefrog				✓		✓			✓	✓	✓	✓	✓	✓	
Spring Peeper		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Western Chorus Frog			✓						✓						
Northern Leopard Frog			✓		✓			✓						✓	
Green Frog			✓		✓				✓	✓		✓			

Notes: only stations where amphibians were heard calling are presented

Western Chorus Frogs were heard calling at station 4, which is a cattail mineral shallow marsh next to the Cataract-Elora Trail (Forcemain Option 1), and at station 10, a lowland creek along Trafalgar Rd. (Forcemain Option 3). They are listed as a threatened species nationally under the federal *Species at Risk Act* (COSEWIC 2008). The Great Lakes/St. Lawrence – Canadian Shield population (which occurs in the study area) has experienced a 43% population decline in Ontario over the past decade due to habitat loss and fragmentation (COSEWIC 2010). Compared with other frog species, Western Chorus Frog has relatively low mobility and high fidelity to natal ponds, making it particularly sensitive to degradation of habitat (COSEWIC 2008).

Western Chorus Frogs breed in temporary wetlands and shallow portions of permanent wetlands that dry up in the summer (COSEWIC 2008). Breeding wetlands are located in open habitat, such as forest clearings, wet meadows, fallow lands and shrubby areas (COSEWIC 2015). Chorus Frogs forage within 250-300 m of breeding wetlands and hibernate within 100-200 m of them, in soft soil, existing burrows, or under rocks, dead trees or decaying leaves (COSEWIC 2015). The species is threatened by activities likely to destroy or degrade its habitat, including construction and maintenance of linear infrastructure (e.g., roads, trails, utility and energy pipelines), urban development, agricultural intensification, and wetland alteration (e.g., levelling, drainage and channelization; Environment Canada 2015).

3.2.5 Breeding Birds

A total of 53 bird species were documented in the study area, including five species at risk and 13 area sensitive species (Table 11, Appendix D). Species at risk and area sensitive species were found primarily along the proposed Forcemain Route Option 1 (Cataract-Elora Trail), along the proposed forcemain from SPS #3 to Dundas St. W., and at the three proposed locations for the WWTPs.

Table 11. Bird Species of Conservation Concern Recorded in the Breeding Bird Surveys.

Bird Species	**Location**	**Species at Risk Status**	**Area Sensitive**
Eastern Wood-pewee (*Contopus virens)*	Along Forcemain Option 1	Special Concern (COSEWIC, COSSARO)	No
Barn Swallow (*Hirundo rustica*)	At SPS# 4, Along Forcemain Option 1	Threatened (COSEWIC, COSSARO)	No
Golden-winged Warbler (*Vermivora chrysoptera*)	Along Forcemain Option 1	Threatened (COSEWIC and SARA), Special Concern (COSSARO)	No
Bobolink (*Dolichonyx oryzivorus*)	At potential WWTP site on east side of Wellington Rd 52 (Site 2A)	Threatened (COSEWIC, COSSARO)	Yes
Eastern Meadowlark (*Sturnella magna*)	At potential WWTP sites on west and east side of Wellington Rd 52 (Sites 1, 2A and 2B)	Threatened (COSEWIC, COSSARO)	Yes
Yellow-bellied Sapsucker (*Sphyrapicus varius*)	Along Forcemain from SPS #3 to Dundas St W	N/A	Yes
Hairy Woodpecker (*Picoides villosus*)	At SPS #3, Along Forcemain Option 1	N/A	Yes

Bird Species	Location	Species at Risk Status	Area Sensitive
White-breasted Nuthatch (*Sitta carolinensis*)	Along Forcemain from SPS #3 to Dundas St W, Along Forcemain Option 1	N/A	Yes
Brown Creeper (*Certhia americana*)	Along Forcemain Option 1	N/A	Yes
Winter Wren (*Troglodytes hiemalis*)	Along Forcemain Option 1	N/A	Yes
Veery (*Catharus fuscescens*)	Along Forcemain Option 1	N/A	Yes
Black-throated Green Warbler (*Setophaga virens*)	Along Forcemain Option 1	N/A	Yes
Black-and-white Warber (*Mniotilta varia*)	Along Forcemain Option 1	N/A	Yes
American Redstart (*Setophaga ruticilla*)	At Hillsburgh SPS #1, Along Forcemain from SPS #3 to Dundas St W, Along Forcemain Option 1	N/A	Yes
Ovenbird (*Seiurus aurocapillus*)	At SPS #3, Along Forcemain from SPS #3 to Dundas St W	N/A	Yes
Savannah Sparrow (*Passerculus sandwichensis*)	At potential WWTP sites on west and east side of Wellington Rd 52 (Sites 1 and 2B), Along Forcemain Option 1	N/A	Yes

Most of the bird species recorded in the Town of Erin sites (i.e., at the proposed SPS sites in Erin and Hillsburgh, along the forcemain from SPS #3 to Dundas St. W., at the Credit River marsh, and at Riverside Park) were typical of forest edge, open field habitat, and urban areas (e.g., Mourning Dove, *Zenaida macroura*; Blue Jay, *Cyanocitta cristata*; American Robin, *Turdus migratorius*; European Starling, *Sturnus vulgaris*; American Goldfinch, *Spinus tristis*; Appendix D). Several species associated with aquatic habitats were documented in wetland or riverine habitats, such as Belted Kingfisher (*Ceryle alcyon*) Northern Waterthrush (*Parkesia noveboracensis*), Red-winged Blackbird (*Agelaius phoeniceus*), and Common Grackle (*Quiscalus quiscula*).

Many of the same species recorded in urban areas were also documented at the proposed WWTP sites (e.g., American Robin, European Starling, Red-winged Blackbird, American Goldfinch), as well as birds typical of agricultural fields and hedgerow habitats (e.g., Eastern Kingbird, *Tyrannus tyrannus*; Bobolink, Eastern Meadowlark, and Savannah Sparrow).

The greatest diversity of bird species was observed along Forcemain Option 1, reflecting the wide variety of habitats this route traverses (Photographs 8 and 9). These species included birds that are characteristic of parks, residential areas, edges and thickets (e.g., Black-capped Chickadee, *Poecile atricapillus*; Gray Catbird, *Dumetella carolinensis*; Indigo Bunting, *Passerina cyanea*), open woodlands, forest clearings and agricultural woodlots (e.g., Great-crested Flycatcher, *Myiarchus crinitus*; Red-eyed Vireo, *Vireo olivaceus*; Ovenbird), orchards, meadows and fields (e.g., Killdeer, *Charadrius vociferous*; Yellow Warbler, *Setophaga petechia*; Field Sparrow, *Spizella pusilla*), and wetlands and wooded swamps (e.g., Brown Creeper; House Wren, *Trolgodytes aedon*; Veery).

Eastern Wood-pewee, found in the forest along Forcemain Option 1, is designated as a special concern species both federally and in Ontario. It breeds in a wide variety of deciduous, coniferous and mixed forest habitats, including mature woodlands, urban shade trees, woodlots and orchards (McCarty 1996). Although it is considered one of the most common and widely distributed songbirds in eastern North America, it has experienced ongoing population declines in Canada and the United States over the past 40 years. Causes of the decline are not well understood, but may be linked to habitat loss and degradation, increased predation, and reduced availability of insect prey (Government of Ontario 2017a).

Barn Swallow is listed as a threatened species federally and in Ontario. Individuals were observed foraging at SPS #3 and in a marsh beside Forcemain Option 1. The species relies on human structures (e.g., barns, bridges, and eaves) for nesting habitat, and forages in open habitat near water (e.g., fields, parks, roadways; Brown and Brown 1999). Barn Swallow has experienced drastic population declines since the mid-1980s, which are believed to be caused by loss of nesting and foraging habitat (as farms modernize and farmland is converted to urban development) and reduction in the availability of insect prey (due to the application of agricultural pesticides; Government of Ontario 2017b).

Golden-winged Warbler was heard calling in the open field habitat along Forcemain Option 1. It is designated as a threatened species nationally and a special concern species in Ontario. The small songbird nests in shrubby habitat, in open areas often surrounded by mature forest, such as clearcuts, abandoned farmland and field edges (Confer et al. 2011; Government of Ontario 2017c). The species is declining in Canada and the United States because of loss of habitat, hybridization with Blue-winged Warbler (*Vermivora cyanoptera*), and nest parasitism by Brown-headed Cowbird (*Molothrus ater*; Government of Ontario 2017c).

Bobolink and Eastern Meadowlark are threatened species both nationally and provincially. These grassland birds were observed in the open fields proposed as potential sites for the WWTP (Bobolink at two proposed sites on the east side of the road and Eastern Meadowlark at all three proposed sites on both the east and west sides of the road). Both species breed in a wide range of open farmland, including pastures, meadows, hayfields and overgrown fields (Cornell University 2015; Government of Ontario 2017d,e). The two species are experiencing population declines in eastern North America primarily due to habitat loss and degradation (through mowing of hay during the breeding period, over-grazing by livestock, urban development, and reforestation; COSEWIC 2011; Ontario 2017d,e).

The habitat requirements of area sensitive birds vary by species. For example, Yellow-bellied Sapsucker generally has a territory of 2 to 5 ha and depends on dead trees greater than 25 cm diameter at breast height for breeding. Brown Creeper and Black-throated Green Warbler need at least 30 ha of continuous forest habitat, while Savannah Sparrow requires grassland areas of at least 50 ha. Winter Wren is an area sensitive species typically associated with interior forest, and thus depends on habitat at least 100 m from the forest edge (MNR 2000).

Photograph 8. Early successional scrub habitat along Cataract-Elora Trail (Forcemain Option 1).

Photograph 9. Coniferous forest habitat along Cataract-Elora Trail (Forcemain Option 1).

3.2.6 Species at Risk

The Ontario Ministry of Natural Resources and Forestry (MNRF) reports 27 species at risk in the Wellington Region (MNRF 2017b). Four of these species were documented in the study area (Snapping Turtle; Barn Swallow, Bobolink, and Eastern Meadowlark; Figure 11). Eight other species have potential habitat in the study area: Jefferson's Salamander (*Ambystoma jeffersonianum*), Eastern Ribbonsnake (*Thamnophis sauritus*), Blanding's Turtle (*Emydoidea blandingii*), Northern Map Turtle (*Graptemys geographica*), Short-eared Owl (*Asio flammeus*), Henslow's Sparrow (*Ammodramus henslowii*), Yellow-breasted Chat (*Icteria virens*), and Rusty-patched Bumblebee (*Bombus afinis*).

Seven species at risk were recorded within the Erin SSMP study area, which includes the study area of the present report (CVC et al. 2011). Two of these species (Snapping Turtle and Western Chorus Frog) was documented in our surveys (Figure 11). All the other species have potential habitat in the study area: Red-shouldered Hawk (*Buteo lineatus*), Chimney Swift (*Chaetura pelagica*), Canada Warbler (*Cardellina canadensis*), Hooded Warbler (*Setophaga citrina*), and Monarch Butterfly. A baby Snapping Turtle (designated as Special Concern provincially and nationally) was observed along the edge of the Cataract-Elora trail (Forcemain Option 1) during breeding bird surveys on June 1, 2017 (Photograph 10; Figure 11).

NHIC records three provincially tracked species at risk in the study area: Bobolink, Eastern Meadowlark, and Gypsy Cuckoo Bumblebee (*Bombus bohemicus*; although this record was from 1979; MNRF 2014a).

The Ontario Breeding Bird Atlas lists 124 bird species in the two 10 km^2 squares (17NJ64 and 17NJ74) that encompass the study area, including 10 species at risk (Bird Studies Canada et al. 2006). Four of these species were documented in the study area (Eastern Wood-pewee, Barn Swallow, Bobolink and Eastern Meadowlark; Figure 11). A further five of these species at risk have potential habitat in the study area: Short-eared Owl, Chimney Swift (*Chaetura pelagica*), Wood Thrush (*Hylocichla mustelina*), Canada Warbler, and Grasshopper Sparrow (*Ammodramus savannarum*).

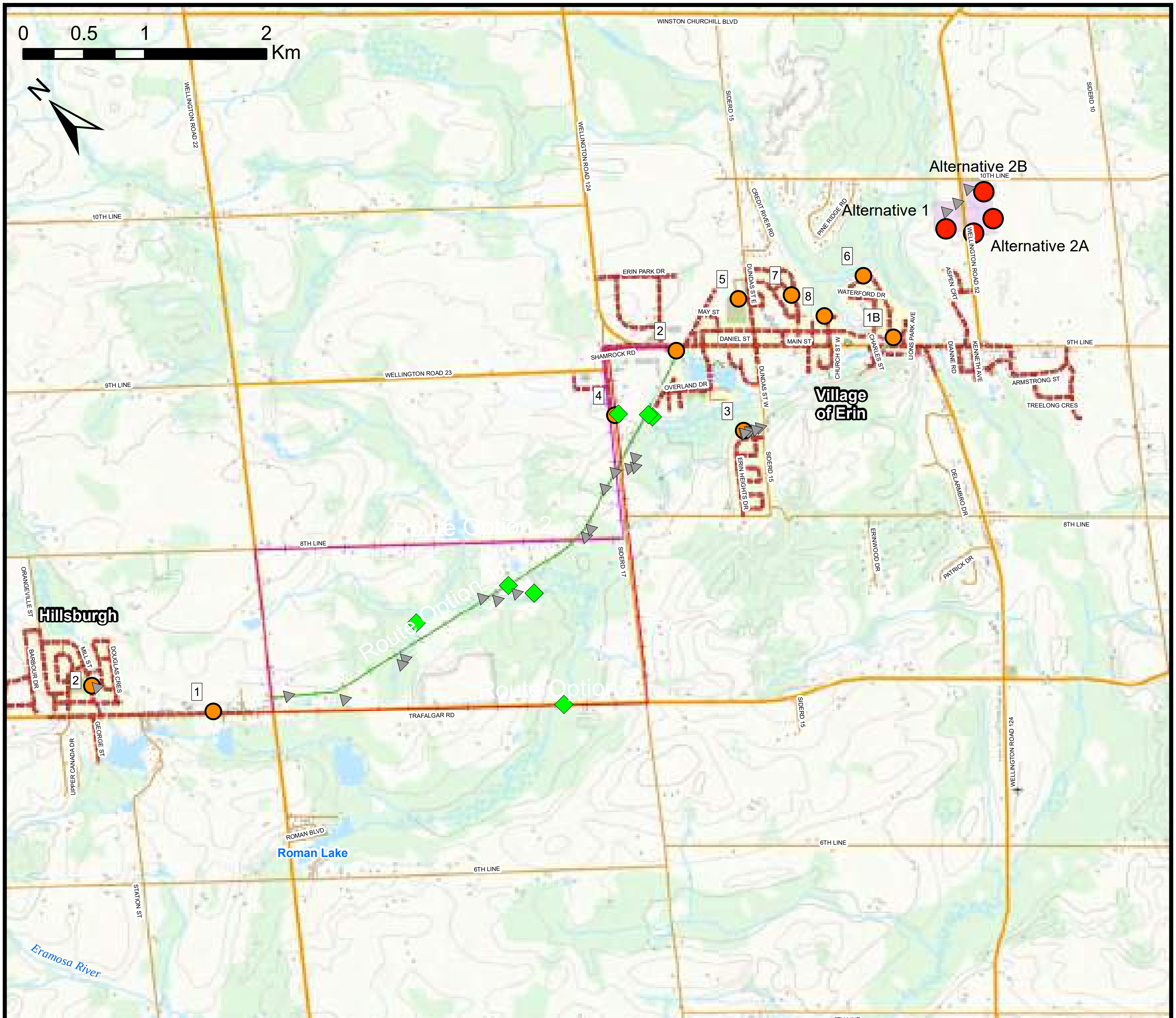
3.2.7 Significant Wildlife Habitat

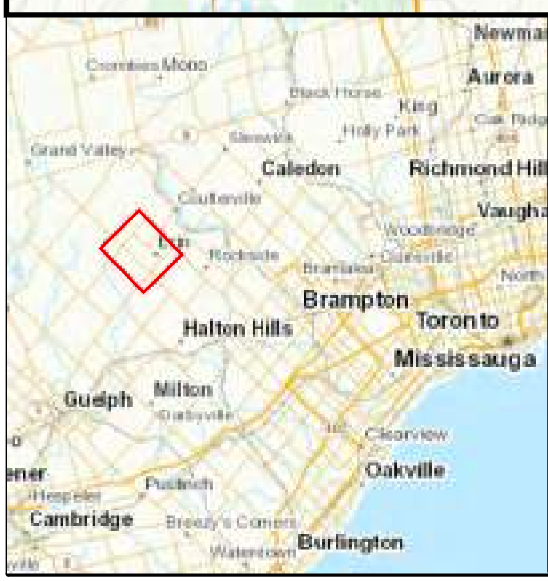
MNRF identifies different types of significant wildlife habitat that might occur in Ecoregion 6E, which encompasses the Erin SSMP study area (MNRF 2015). Significant wildlife habitat includes seasonal concentration areas, rare vegetation communities or specialized habitat for wildlife, habitat for species of conservation concern, and animal movement corridors. Based on a review of the ELC vegetation communities described for the study area (Table 8), several candidate significant wildlife habitat types may occur in the area:

- Raptor Wintering Area Habitat in the forest and fields adjacent to the Cataract-Elora Trail;
- Woodland Raptor Nesting Habitat in the forest adjacent to the trail;
- Bat Maternity Colonies Habitat in the forest adjacent to the trail;
- Amphibian Breeding Habitat (Wetlands and Woodlands) in the wetland and forest adjacent to the trail; and
- Deer Yarding Areas in the forest and fields along the trail and the fields at the potential WWTP sites.

Several confirmed significant wildlife habitats were identified through field surveys:

- Area Sensitive Bird Breeding Habitat in the forest adjacent to the trail;
- Open Country Bird Breeding Habitat in the fields adjacent to the trail and at the potential WWTP sites; and
- Shrub/Early Successional Bird Breeding Habitat in the fields adjacent to the trail.





Legend

- Roads
- Sewer
- Rivers
- Lakes
- Species at Risk + Area Sensitive Species
- Species at Risk
- Area Sensitive Species
- Potential Pump Stations
- Potential WWTP Sites
- Forcemain Route Alternative 1
- Forcemain Route Alternative 2
- Forcemain Route Alternative 3

Figure 11:
Species at Risk and Area Sensitive Bird Species Documented in the Study Area

Project: Town of Erin UCWS Class EA – Natural Environment

Project #: J160005

Project Lead: Brent Parsons
Prepared by: Kris Hadley
Data Source: HESL,Ontario Land, ESRI
Coordinate System: NAD 1983 UTM Zone 17N

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Table 12. Habitat Description and Availability for Species at Risk with Potential to Occur in the Study Area.

Species at Risk	Status	Habitat Description	Availability in Study Area
Jefferson's Salamander	Endangered (provincially and nationally)	Mature deciduous or mixed forests containing, or adjacent to, breeding ponds	Along Forcemain Option 1
Eastern Ribbonsnake	Special Concern (provincially and nationally)	Wetland edges and forest	Along Forcemain Option 1, along Forcemain from SPS #3 to Dundas St W
Blanding's Turtle	Threatened (provincially and nationally)	Wetlands and shallow ponds	Along Forcemain Option 1
Northern Map Turtle	Special Concern (provincially and nationally)	Large rivers and lakes	Credit River
Red-shouldered Hawk	Special Concern (nationally)	Mature deciduous or mixed forest, wooded swamps	Along Forcemain Option 1
Short-eared Owl	Special Concern (provincially and nationally)	Grasslands, old pastures, agricultural fields, marshes	Along Forcemain Option 1, at potential WWTP sites
Chimney Swift	Threatened (provincially and nationally)	Urban areas, often near water	Erin and Hillsburgh
Wood Thrush	Special Concern (provincially) and Threatened (nationally)	Mature deciduous and mixed forest	Along Forcemain Option 1
Canada Warbler	Special Concern (provincially) and Threatened (nationally)	Wet forest, forest wetlands and swamps, riparian thickets	Along Forcemain Option 1
Hooded Warbler	Threatened (nationally)	Mature deciduous or mixed forest, ravine edges	Along Forcemain Option 1

Species at Risk	Status	Habitat Description	Availability in Study Area
Yellow-breasted Chat	Endangered (provincially and nationally)	Thickets and shrubs in overgrown clearings	Along Forcemain Option 1, at potential WWTP Site 1
Henslow's Sparrow	Endangered (provincially and nationally)	Tall grasslands in abandoned farm fields, pastures, wet meadows	Along Forcemain Option 1, at potential WWTP Site 1
Grasshopper Sparrow	Special Concern (provincially and nationally)	Open grasslands, hayfields, pasture	Along Forcemain Option 1, at potential WWTP Site 1
Gypsy Cuckoo Bumblebee	Endangered (provincially and nationally)	Open meadows, agricultural and urban areas, woodlands	Along Forcemain Options 1-3, at 3 potential WWTP sites, at all SPS sites
Rusty-patched Bumblebee	Endangered (provincially and nationally)	Mixed farmland, urban areas, open woods, marshes	Along Forcemain Options 1-3, at 3 potential WWTP sites, at all SPS sites
Monarch Butterfly	Special Concern (provincially and nationally)	Abandoned farmland, meadows, roadsides	Along Forcemain Options 1-3, at 3 potential WWTP sites

Photograph 10. Baby Snapping Turtle found along Cataract-Elora Trail (Forcemain Option 1).

4. Impact Assessment

4.1 Sensitivity Assessment on Natural Environment

4.1.1 Aquatic Ecology

4.1.1.1 Potential Effluent Outfalls

Construction of the effluent outfall, discharge of effluent from the WWTP, and the potential for bypasses of partially treated effluent, have the potential to negatively impact aquatic ecology in the short-term through construction related impacts associated with earthworks and sedimentation, and in the long-term from effluent discharge. Receiving Water Assessments or Assimilative Capacity Studies typically describe effluent limits suffcient to ensure that effluent is not directly toxic, determine the characteristics of the mixing zone and calculate water quality at the point of complete mixing. Water quality modelling results are compared to Provincial Water Quality Objectives (PWQO) or Canadian Water Quality Guidelines to determine the potential for any impacts to aquatic biota. Water quality objectives and guidelines are protective of all forms of aquatic life and all aspects of the aquatic life cycles during indefinite exposure to water (MOE 1994). There is an additional requirement that the effluent stream, at the point of discharge, not be acutely lethal to aquatic life.

The size and shape of the effluent plume and water quality in the mixing zone was modelled using the CORMIX water quality model, and oxygen and temperature modelling of the discharge was modelled using the Qualk2K model (HESL 2017). The 10th Line was used as the modelled effluent outfall location, but the results can be conservatively applied at Winston Churchill Boulevard since there is approximately 15% more dilution potential at Winston Churchill Boulevard due to inputs of groundwater between the two locations.

HESL (2017) included the following conclusions which are most relevant to aquatic life, including fisheries and sensitive Brook Trout habitat in the study area:

- For the Full Build Out summer low flow scenario, dissolved oxygen concentrations were predicted to decrease by 1.33 mg/L to a minimum concentration of 6.39 mg/L at a distance approximately 700 m downstream of the WWTP discharge location and then begin recovering. As such, dissolved oxygen concentrations were predicted to remain well above the PWQO of 5 mg/L for cold water biota at river temperatures of 20°C and 25°C.
- Given that the maximum summer water temperature for the WWTP effluent of 19°C proposed by BM Ross (2014) is below the 75th percentile West Credit River water temperature of 21.18°C, the input from the WWTP effluent will slightly cool the river temperatures downstream of the outfall.
- A total ammonia effluent limit of 2.1 mg/L or less would meet the requirement for non-lethality during the summer discharge period. The distance to meet the PWQO for un-ionized ammonia at is 153 m from the outfall at full build out and through implementation of a multiport diffuser. The mixing zone does not occupy the complete width of the river and meets all MOECC requirements for mixing zones (MOE 1994).

The effluent limits proposed for the Erin WWTP are provided in Table 13.

Table 13. Proposed Erin WWTP Effluent Limits.

Parameter	Stage 1 (Effluent flow of 3,380 m^3/d)	Full Build Out (Effluent flow of 7,172 m^3/d)
pH	Within range of 7 – 8.6	
Total suspended solids	5 mg/L	
Total phosphorus	0.07 mg/L	0.045 mg/L
Total ammonia nitrogen	1.2 mg/L summer: 2 mg/L winter	0.6 mg/L summer: 2 mg/L winter
Nitrate nitrogen	5 mg/L	
E.coli	100 cfu/100 mL	
Dissolved oxygen	4 mg/L	
5-day carbonaceous biochemical oxygen demand (CBOD5)	5 mg/L	

The effluent limits recommended in HESL (2017) are protective of all fish at all critical life stages (MOE 1994) and so meets the requirements for protection of aquatic habitat. Mitigation to achieve an even higher level of protection, in consideration of the resident population of Brook Trout describe in Section 3.

Bypasses of untreated or partially treated WWTP effluent are minimized through the design and contingency features incorporated into WWTP design and are a rare event. Bypasses are short-term events and are most likely to occur when storm events, coupled with infiltration, overwhelm plant capacity. In these cases, assimilation volumes in the river will be high and will dilute effluent to non-lethal conditions. The degraded state will be temporary, such that no residual impacts are expected.

4.1.1.2 Gravity Sewers Near Open-Water Habitat

It is proposed that gravity sewers will be installed through the West Credit River at Dundas St. W, Charles St., Millwood Road and the Main Street within the Town of Erin. The West Credit River supports a sensitive coldwater fish population as noted previously and construction could result in sedimentation through earthworks and habitat disruption through temporary dewatering. Effective mitigation includes tunnelling beneath the river which requires no dewatering and no disruption of habitat and the use of sediment and erosion control measures installed on land to prevent sediments entering the river.

4.1.2 Terrestrial Ecology

The main anticipated impacts to the terrestrial environment and species would be associated with site preparation, and construction and would include temporary habitat disruption, but no long-term loss for infrastructure such as sewers and forcemains built below grade. Construction of pumping stations and the WWTP itself would involve temporary habitat disruption during construction and small permanent losses of habitat within the immediate infrastructure footprint.

Direct loss of habitat will therefore occur within the footprint of all development (e.g., WWTP sites, SPS sites, forcemain routes), while habitat degradation could occur in surrounding habitat, if its ecological function deteriorates as a result of the development.

The fields proposed for the WWTP sites, provide important breeding habitat for several grassland bird species of conservation concern (Bobolink, Eastern Meadowlark, Savannah Sparrow, House Wren). These and other bird species associated with open country have very specific habitat requirements that limit their distribution (MNRF 2014b). Loss of grassland and shrubland habitat results in loss of nesting territories, cover, and food available for these breeding birds, which ultimately leads to reduced reproductive success. Site alteration surrounding the development footprint can also change vegetation composition or structure of remaining habitat, which can have further negative impacts on these species (although natural succession of fields to forest over time would also have this effect). The fields adjacent to Forcemain Option #1 also provide important breeding habitat to grassland species of conservation concern (Savannah Sparrow, House Wren, and Golden-winged Warbler).

The fields adjacent to Forcemain Option #1 also provide candidate significant wildlife habitat for wintering raptor habitat. Disturbance to these grassland habitats can change vegetation structure and drainage patterns, reducing habitat suitability for raptor roosting and hunting during the winter (MNRF 2014b). These fields, as well as the ones at the proposed WWTP sites, also provide candidate significant wildlife habitat for deer yards. Development adjacent to these areas can also negatively affect deer movement in or out of their wintering habitat (MNRF 2014b).

The forests adjacent to Forcemain Option #1 provide important breeding habitat to area sensitive forest bird species (e.g., Veery, Winter Wren, Black-throated Green Warbler). These species require large mature woodlands with interior habitat to provide shelter, nesting habitat and food. Development that results in removal of forest cover or encroachment into the forest causes a disproportionately large loss of interior habitat on which these species depend. In addition to the direct effects of habitat loss, development adjacent to forest habitat can result in increased predation, competition, nest parasitism and disturbance for forest breeding birds (MNRF 2014b).

The forests adjacent to Forcemain Option #1 also provide candidate significant wildlife habitat for winter raptor habitat, raptor woodland breeding habitat, bat maternity colonies habitat, amphibian woodland breeding habitat, and deer yard habitat. Development along the trail could lead to wildlife disturbance, loss of habitat (e.g., tree clearing, draining or filling of vernal pools, forest wetlands, and seeps) and disruption of wildlife movement corridors.

All of the wetland communities identified from the various study sites are part of the West Credit River PSW Complex. The hydrological setting and function association with the wetland communities includes surface water and in some cases groundwater dependence. For example, the open water wetland community (OAO) to the south of SPS #2 is a surface water dependent feature. The coniferous swamp community (SWC3-2) located to the north of the proposed WWTP site supports deeper organic soils and likely has groundwater input supporting the feature. In order to maintain the wetlands and their ecological functions in the study area, the associated water levels and hydrological regime must be maintained.

Amphibians occurring in habitat adjacent to the proposed forcemain routes may also be affected by the proposed development. Amphibians rely on wetlands for breeding and foraging, and upland habitat (often forest) for foraging and over-wintering. They may therefore be subject to habitat loss and degradation throughout their life cycle. Amphibians will be influenced by changes to water quality and quantity in wetlands (e.g., excess nutrients or sedimentation, loss of groundwater flow or increased surface flow) as well as loss and alteration of forest habitat. In addition, amphibian movement corridors between lowland and upland habitat can be affected by development, which may act as a barrier to dispersal, and cause direct mortality. In the case of the forcemain, this would only be a concern during the construction phase of the development.

Vernal pools are generally small to medium sized areas of temporary standing water found in forest depressions or other upland areas on the natural landscape and provide breeding amphibian habitat opportunities. The sensitive period to for maintaining water quantity and quality is from April to into June (depending on the species and onset of spring conditions). The overland sheet flow from the lands adjacent to amphibian habitat contributes to the hydrological maintenance and is an important consideration in maintaining these features. Design and construction activities should ensure that the wetland hydrology is maintained during and post-construction. Pre- and post-construction monitoring of the wetland hydrology is recommended.

Disturbance due to increased human activity during development (especially during the site preparation and construction phases, but also due to ongoing maintenance once the infrastructure is in place) can also negatively impact terrestrial ecology. The increased presence of humans, as well as machine noise, dust and activity, may disturb amphibians and birds during the sensitive breeding period, potentially causing them to avoid or abandon breeding in a disturbed area.

4.2 Screening Criteria to Assess Different Options

4.2.1 Aquatic Ecology

A variety of criteria were used as indicators of rarity and sensitivity in the West Credit River. Water temperature and dissolved oxygen are important indicators of habitat for sensitive, coldwater fish species such as Brook Trout, and data were collected in 2016 to inform the ACS (HESL 2017) as both parameters were assessed.

Brook Trout redds were extremely abundant in the study reach and the study area provides productive habitat for this critical life stage. The number of redds within the mixing zone, and within the reach of dissolved oxygen sag were evaluated (HESL 2017).

Benthic invertebrates provide a bioassessment tool for benthic habitat and water quality and a food source for resident fish species. Two proportionate biological metrics were evaluated to characterize the community: % EPT and diversity as they represent differing measures of rarity and sensitivity.

4.2.2 Terrestrial Ecology

Several criteria were selected as indicators of sensitivity for the terrestrial ecology component, relating to species of conservation concern and important natural heritage features that support native biodiversity and ecological integrity:

- Species of Conservation Concern
  - Species at Risk;
  - Area Sensitive Breeding Bird Species;
  - Regional, Local and Watershed Level Rare and Uncommon Plant Species.
- Important Natural Heritage Features
  - Provincially Significant Wetlands;
  - Significant Wildlife Habitat;
  - Environmentally Significant Areas;
  - Interior Forest Core Habitat; and
  - Priority Natural Areas.

The proposed locations for the WWTPs and the forcemain route between Erin and Hillsburgh were screened for environmental sensitivity using these criteria. In each case, the option with the least number of sensitive features was highlighted as the preferred choice for infrastructure siting. We recognize, however, that appropriate and effective mitigation is available to manage construction-related impacts and so the screening is most important for those sites and project activities or infrastructure that represent permanent landscape alterations.

We have assumed that installation of a forcemain as part of Alternatives #2 or #3 would occur within the shoulder of the roads because of various engineering considerations. If Forcemain Alternatives #2 or #3 are ultimately selected and the forcemain is located outside of the shoulder of the roads, the impact assessment should be updated during detailed design to develop suitable mitigation measures.

4.2.2.1 Species of Conservation Concern

Species at risk are native species that have been listed as at risk of extinction (or extirpation) in Ontario and/or in Canada and fall under three risk status categories:

- Endangered (face imminent risk of extinction or extirpation);
- Threatened (likely to become endangered if steps are not taken to address threats);
- Special Concern (not currently threatened or endangered but may become so due to a combination of biological traits and threats).

Area sensitive wildlife require large continuous areas of suitable habitat to sustain their populations over the long-term. These species experience population declines when suitable habitat is fragmented and reduced in size, due to increased competition, predation and nest parasitism (MNR 2000). Area sensitive bird species rely on large continuous habitat areas for successful breeding. Area sensitive forest species typically need core areas of forest interior that are at least 100 m from the forest edge in addition to the overall size of habitat. Habitat closer to the forest edge tends to have higher rates of nest predation and nest parasitism, as well as altered microclimate (e.g., temperature, moisture, wind) that can negatively affect reproduction rates of these bird species. Similarly, in grassland area sensitive species, large areas provide greater protection from disturbance, more opportunities for nesting, and increased distance from the edge effects of forest boundaries (i.e., nest predation and nest parasitism; MNR 2000).

Regional, local and watershed level rare and uncommon plant species are indicators of potential sensitive habitat (e.g., organic wetlands) or vegetation communities that have limited disturbance and a higher floristic quality than surrounding areas.

4.2.2.2 Important Natural Heritage Features

Provincially significant wetlands (PSWs) are evaluated based on their significance in maintaining natural ecological processes, and in providing benefits to humans (MNRF 2014c). They are protected from development and site alteration under Ontario's Provincial Policy Statement (PPS; MMAH 2014).

Significant wildlife habitat is defined under the PPS as habitat that supports plants, animal and other organisms and that is ecologically important (e.g., seasonal concentration areas, rare vegetation communities, specialized habitat, animal movement corridors). MNRF has developed guidance on the identification and protection of different types of significant wildlife habitat (MNR 2000; MNRF 2015). Certain criteria must be met for wildlife habitat to qualify as significant (e.g., Area Sensitive Bird Breeding Habitat must have at least three of the listed bird species present; MNRF 2015). Significant wildlife habitat is protected from development and site alteration under the PPS.CVC has identified several additional significant habitat areas in the Town of Erin (CVC et al. 2011). Environmentally Significant Areas (ESAs) are defined as areas where ecosystem features or functions require special protection. To be designated, ESAs must meet one or more of the following ecologically important criteria:

- Part of a distinctive or unusual landform;
- Provide an important hydrological function;
- Represent critical wildlife habitat;
- Contain provincially or regionally rare species or ecological communities;
- Have high species diversity; and
- Be of high aesthetic value.

Interior Forest Core Habitat are forest patches that contain forest at least 100 m from the forest edge. Environment Canada (2004) recommends that at least 10% of forest cover within a watershed be over 100 m from the edge (core habitat), and that at least 5% of forest cover be over 200 m from the edge (deep core habitat) to protect against negative edge effects. Values in the Erin study area fall well below these targets (4.6% and <1% respectively; CVC et al. 2011).

CVC identifies Priority Natural Areas as significant natural areas because of their community diversity, core habitat, relative community size, and special features (CVC et al. 2011). High Priority Areas are essential for maintaining the ecological health of the subwatershed, such as:

- Natural communities or patches containing a special feature;
- Natural communities that are significant because of size;
- Natural communities that are core areas or contribute to the core (i.e., 100 m around core habitat, 200 m around deep core habitat);
- Forest and wetland communities that have high species diversity (CVC et al. 2011).

Medium Priority Areas are also significant, but require additional study to determine their overall role in the subwatershed (CVC et al. 2011).

4.3 Preferred Options

4.3.1 Potential Effluent Outfalls

The potential effluent outfall locations at 10th Line and Winston Churchill Boulevard were evaluated through the following criteria characterizing aquatic ecology conditions: water temperature, dissolved oxygen, Brook Trout redds and benthic invertebrate biological metric results (Table 14). Criteria were weighted based on an assessment of rarity and sensitivity of each criterion. Water temperature and dissolved oxygen data were gathered from HESL (2017) and compared at each site.

Water temperatures were cooler in the summer at Winston Churchill Boulevard, as measured as maximum water temperature and 75th percentiles, because groundwater upwellings are abundant in the study reach. Dissolved oxygen concentrations were slightly higher as well at Winston Churchill Boulevard because of upstream groundwater inputs (HESL 2017). These provide more resilience and potential for assimilation of effluent and any associated changes in temperature and oxygen demand.

Only three Brook Trout redds were observed in the potential mixing zone within 153 m of the 10th Line. The benthic invertebrate assemblage at the 10th Line contained a greater proportion of sensitive invertebrates as measured by %EPT and a more diverse assemblage as measured by the Shannon Index.

The preferred location based on our assessment of criteria in the West Credit River is Winston Churchill Boulevard because of the presence of more sensitive aquatic features and functions at the 10th Line and the density of Brook Trout redds downstream. Treated effluent discharged at the 10th Line would flow downstream through the sensitive study area to Winston Churchill Blvd. and beyond but an outfall location at Winston Churchill Blvd. would avoid the most sensitive area altogether, initial mixing would occur within the culvert where habitat has already been impacted and there is ~ 15% more assimilation flow (HESL 2017).

Table 14. Screening Criteria to Assess Effluent Outfall Locations.

Criteria	**Details**	**10th Line**	**Winston Churchill Boulevard**
Water Temperature	Maximum Water Temperature - June to August (°C)	24.3	23.7
	75% Water Temperature - June to August (°C)	20.7	19.6
Dissolved Oxygen	75% Dissolved Oxygen Concentration - June to August (mg/L)	7.93	8.5
Brook Trout Redds	# redds within mixing zone (153 m)	3	0
Benthic Invertebrate assemblage	% *Ephemeroptera*, *Plecoptera* and *Trichoptera*	37.6	32.6
	Shannon Index to measure community diversity	3.18	2.96
	Preferred Location		✓

4.3.2 Potential WWTP Sites

Two species at risk, Bobolink and Eastern Meadowlark, were detected during bird surveys of the three proposed WWTP sites (Table 11). On June 1, 2017 both species were heard in the fields on the east side of Wellington Road 52 where two proposed sites for the WWTP are located (Sites 2A and B), and Eastern Meadowlark was also heard on the west side of Wellington Road 52 within the third proposed WWTP site (Site 1). On June 21, 2017 Bobolink and Eastern Meadowlark were only heard in the east fields (Sites 2A and B).

The fields on the east side of Wellington Road 52 (Sites 2A and B) represent potential breeding habitat for both Bobolink and Eastern Meadowlark. These species breed in grassland habitat, such as farm fields, uncut pastures and meadows. The field on the west side of Wellington Road 52 (Site 1) appears less suitable as breeding habitat, since it is more overgrown, with scattered shrubs. The fact that an Eastern Meadowlark was heard in this field only on the first visit suggests that the species is likely not using this habitat for breeding.

Bobolink and Eastern Meadowlark are threatened species under Ontario's *Endangered Species Act*. As such, certain provisions apply to development that will damage or destroy the habitat of these birds. No permit is required if the area to be developed is equal to or less than 30 ha, but the following rules must be followed:

- The work and affected species must be registered with the MNRF before the work begins;
- A habitat management plan must be prepared and followed;
- Habitat for the affected species must be created or enhanced, and managed;
- A written undertaking must be submitted to MNRF indicating that any habitat created or enhanced will be managed over time;
- No activity likely to damage or destroy habitat, or kill, harm or harass individuals of the affected species will be carried out between May 1 and July 31;
- Reasonable steps will be taken to minimize adverse effects on the affected species (e.g., locating access routes outside of the birds' habitat);
- Records relating to the work and habitat must be prepared and maintained; and
- Sightings of rare species must be reported (and registration documents updated, as needed).

Additional details on these rules and related requirements are available at: https://www.ontario.ca/page/bobolink-and-eastern-meadowlark-habitats-and-land-development.

Savannah Sparrow, an area sensitive species, was also recorded in the fields of the three proposed WWTP sites (Sites 1 and 2B; Table 11). Its breeding habitat is considered Significant Wildlife Habitat (Open Country Bird Breeding Habitat) because this type of habitat is declining across Ontario and North America (MNRF 2015). As such, development and site alteration are only permitted if there will be no negative impacts on the natural features or their ecological functions (MMAH 2014).

One rare and uncommon plant species was observed within Site 1 (Wild Geranium, Appendix B), while four rare and uncommon plant species were associated with the adjacent West Credit PSW complex: Yellow Sedge, Turtlehead, White Spruce, and Bristly Buttercup (Appendix B).

Each of the three proposed WWTP site locations contained sensitive features. Site 1 provided significant wildlife habitat for an area sensitive grassland species (Savannah Sparrow), and had a rare and uncommon plant growing on site (Wild Geranium). Although Eastern Meadowlark was heard on site early in the breeding habitat, the vegetation characteristics of the site are not ideal habitat for the species, and it is unlikely to breed here. Sites 2A and 2B had two species at risk present (Bobolink and Eastern Meadowlark), and one area sensitive grassland bird species (Site 2B).

We recommend the west field (Site 1) as the preferred choice for the location of the WWTP site (Table 15). This site is the best choice to minimize negative effects on natural features and their ecological functions because it will avoid suitable breeding habitat for two species at risk. However, Site 1 does provide suitable breeding habitat for the area sensitive Savannah Sparrow, and thus qualifies as significant wildlife habitat under the PPS. It also contains a rare and uncommon plant species (Wild Geranium). If recommended mitigation measures are adopted (such as minimizing development footprint and locating it directly along road, avoiding construction during wildlife breeding periods, limiting clearing of successional vegetation, See Section 4.4.3) adverse impacts on the species of conservation concern located on site (as well as the adjacent West Credit PSW complex) can be avoided.

Table 15. Screening Criteria to Assess Alternative WWTP Site Locations.

Natural Heritage Feature	Criteria	Details	Site 1	Site 2A	Site 2B
Species of Conservation Concern	Species at Risk (SAR)	Presence of provincially and/or nationally designated SAR (i.e., Endangered, Threatened, Special Concern)	Yes	Yes	Yes
	Area Sensitive Breeding Bird Species	Presence of area sensitive bird species	Yes	No	Yes
	Rare and Uncommon Plant Species	Presence of rare and uncommon plant species	Yes	No	No
Important Natural Heritage Features	Provincially Significant Wetlands (PSWs)	Presence of PSWs	No	No	No
	Significant Wildlife Habitat (SWH)	Presence of SWH	Yes	No	Yes
	Environmentally Significant Areas (ESAs)	Presence of ESAs	No	No	No

Natural Heritage Feature	Criteria	Details	Site 1	Site 2A	Site 2B
	Interior Forest Core Habitat	Presence of interior forest	No	No	No
	Priority Natural Areas (PNAs)	Presence of PNAs	No	No	No
		Preferred Location	✓		

4.3.3 Potential Forcemain Routes

Table 16 summarizes the assessment of proposed SPS sites for potential impacts to Provincially Significant Wetlands (PSWs) and Environmentally Sensitive Areas (ESAs). Table 17 summarizes the assessment of alternative forcemain routes between Hillsburgh and Erin for potential impacts to Provincially Significant Wetlands (PSWs) and Environmentally Sensitive Areas (ESAs).

4.3.3.1 Forcemain Option 1

Five species at risk, Snapping Turtle, Western Chorus Frog, Eastern Wood-pewee, Barn Swallow, and Golden-winged Warbler, were found along the Cataract Elora Trail (Forcemain Option 1), as well as nine area sensitive bird species. A Snapping Turtle was found on the trail, and Western Chorus Frog were heard in an adjacent wetland. All of the bird species were using habitat adjacent to the trail (in some cases more than 100 m away), not the trail itself.

The forest habitat adjacent to the trail qualifies as significant wildlife habitat because of the presence of several area sensitive forest bird species (i.e., Veery, Black-throated Green Warbler and Winter Wren; MNRF 2015).

The grassland habitat adjacent to the trail qualifies as significant wildlife habitat because of the presence of area sensitive Savannah Sparrow (Open Country Bird Breeding Habitat) and the species at risk Golden-winged Warbler (Shrub/Early Successional Bird Breeding Habitat). These grassland habitats are disappearing across Ontario and North America.

Siting and construction of the forcemain along the trail would not cause significant disturbance to these bird species if the construction footprint is limited to the existing trail area itself, and timing of construction is restricted to of outside the breeding bird period. There would be no long-term effects on habitat after the construction period provided that measures for sediment and erosion management and control were followed.

The forcemain alignment along the Cataract-Elora Trail (Route Option 1) parallels several areas of the West Credit River PSW Complex and sensitive terrestrial and aquatic features. Construction dewatering and discharge may alter wetland characteristics but may be mitigated by the design and construction techniques, including:

- Ensuring any dewatering is regulated through a Permit to Take Water and that the discharge water quality meets applicable guidelines;
- Maintaining effective erosion and sediment controls within construction zones (shafts and open cuts) and staging and stockpiling areas;
- Topsoil management for effective restoration, particularly at open cut crossings.
- Tunneling routed to avoid intercepting any perched water table in adjacent wetlands.
- Direct dewatering discharge to affected wetlands following temperature and clarity controls.

Part of the proposed route (from 17th Sideroad to Wellington Rd. 22) coincides with the Credit River West-Hillsburgh ESA, which was designated by the CVC because it represents:

- Undisturbed forested valley with coniferous swamp;
- Part of the West Credit Wetland Complex;
- Important groundwater discharge areas for the West Credit River; and
- Important habitat for rare species (CVC et al. 2011).

Seven rare and uncommon plant species were documented along the proposed route: Watershield, Wild Calla, Turtlehead, Large Yellow Lady's-slipper, Stiff Marsh Bedstraw, Wild Geranium, and White Spruce (Appendix B).

Table 16. Screening to Assess Alternative SPS sites for Potential Impacts to PSW and ESA.

Sites		Potential Groundwater Functions	Wetland	Watercourse	ESA	Recommendation
Hillsburgh	**SPS #1**	High water table expected at this site due to the nature of the White Cedar - Conifer Organic Coniferous Swamp (SWC3-2) vegetation community	West Credit River Wetland Complex. Supports amphibians.	N/A	South side of Wellington 22 Rd is within West Credit River - Hillsburgh ESA	Not Recommended - Removed from Consideration
	SPS #2	N/A	No wetland present No amphibian habitat.	Proposed site is located in close proximity to watercourse	N/A	Near water works timing and Erosion and Sediment Controls

Sites		Potential Groundwater Functions	Wetland	Watercourse	ESA	Recommendation
				(approx. 5m).		
Erin	**SPS #1A**	N/A	West Credit River Wetland Complex. Riparian wetland vegetation within proposed site. Amphibian habitat not assessed at this location.	Existing watercourse present within proposed site.	Brisbane Swamp ESA located adjacent (south of Wellington 52 Rd and east of Wellington 124 Rd.)	Not Recommended - Removed from consideration
	SPS #1B	N/A	Portion of West Credit River Wetland Complex associated with the watercourse within 120 m. No amphibian habitat associated with watercourse.	Proposed site located in close proximity to watercourse (approx. 20m) but is bisected by existing road.	N/A	Design to maintain wetland hydrology. Tree removal to be completed outside of migratory bird timing window
	SPS #2	N/A	Open water vegetation community associated part of West Credit River Wetland Complex, amphibian habitat is located within 120 m of proposed site.	N/A	N/A	Design to maintain any surface water contribution to wetland and maintain water quality during discharge.
	SPS #3	N/A	N/A	N/A	N/A	Tree removal to be completed outside of migratory bird timing window

Sites		Potential Groundwater Functions	Wetland	Watercourse	ESA	Recommendation
	SPS #4	N/A	N/A	N/A	N/A	
	SPS #5	N/A	N/A	N/A	N/A	Tree removal to be completed outside of migratory bird timing window
	SPS #6	N/A	West Credit River Wetland Complex within 120 m. Amphibian habitat not assessed at this location.	N/A	N/A	Design to maintain wetland hydrology and water quality from discharge. Tree removal to be completed outside of migratory bird timing window
	SPS #7	N/A	West Credit River Wetland Complex within 120 m.	N/A	N/A	Design to maintain wetland hydrology and water quality from discharge.
	SPS #8	Presence of Spotted Jewelweed nearby indicates potential groundwater seepage	Proposed site adjacent to West Credit River Wetland Complex. Supports amphibian habitat.	N/A	N/A	Design to maintain wetland amphibian habitat hydrology and water quality from discharge. Tree removal to be completed outside of migratory bird timing window
WWTP	**1**	N/A	Proposed site is directly adjacent to Evaluated PSW which supports amphibian habitat.	N/A	N/A	Tree removal to be completed outside of migratory bird timing window
	2A	N/A	N/A	N/A	N/A	N/A
	2B	N/A	N/A	N/A	N/A	N/A
Route Option 1		High water table is expected in the White Cedar - Conifer Organic Coniferous	Directly adjacent to West Credit PSW Complex which supports amphibian habitat (unit	Proposed route will require several (4) watercourse crossings	Directly adjacent to West Credit River – Hillsburgh ESA.	Design to maintain wetland hydrology and water quality from discharge. Near water works timing and ESC. Tree removal to be completed outside

Sites	Potential Groundwater Functions	Wetland	Watercourse	ESA	Recommendation
	Swamp (located east and west of Sideroad 17) due to the nature of this vegetation community.	21 south of trail). River PSW Complex adjacent to trail.			of migratory bird timing window

Several forest patches along the proposed route provide Interior Forest Core Habitat (100 m from the edge; CVC et al. 2011).

Most of the proposed route is designated as either High Priority or Medium Priority Natural Areas (CVC et al. 2011).

4.3.3.2 Forcemain Option 2

All of the screening indicators were negative for the Forcemain Option 2, meaning that none of these sensitivity factors for terrestrial ecology were found along the proposed route.

4.3.3.3 Forcemain Option 3

The Western Chorus Frog, a species at risk, was heard calling in a wetland adjacent to Trafalgar Rd, the proposed location for Forcemain Option 3.

Table 17. Screening Criteria to Assess Forcemain Routes between Erin and Hillsburgh.

Natural Heritage Feature	**Criteria**	**Details**	**Route 1**	**Route 2**	**Route 3**
Species of Conservation Concern	Species at Risk (SAR)	Presence of provincially and/or nationally designated SAR (i.e., Endangered, Threatened, Special Concern)	Yes	No	Yes
	Area Sensitive Breeding Bird Species	Presence of area sensitive bird species	Yes	No	No

Natural Heritage Feature	Criteria	Details	Route 1	Route 2	Route 3
	Rare and Uncommon Plant Species	Presence of rare and uncommon plant species	Yes	Not Surveyed	Not Surveyed
Important Natural Heritage Features	Provincially Significant Wetlands (PSWs)	Presence of PSWs	Yes	No	No
	Significant Wildlife Habitat (SWH)	Presence of SWH	Yes	No	No
	Environmentally Significant Areas (ESAs)	Presence of ESAs	Yes	No	No
	Interior Forest Core Habitat	Presence of interior forest	Yes	No	No
	Priority Natural Areas (PNAs)	Presence of PNAs	Yes	No	No
		Preferred Location		✓	

Based on the absence of sensitive features found along Forcemain Option 2, this proposed route was selected as the preferred choice. This assessment does not, however, consider implementation of mitigation measures.

4.4 Recommended Mitigation Measures

4.4.1 Gravity Sewers

Where gravity sewers are installed at water crossings the following mitigation measures should be implemented to minimize impacts:

- Any in-stream work should adhere to Fisheries and Oceans Canada's in-stream construction timing windows for spring (March 15 to July 15) and/or fall spawners (October 1 to May 31) to protect the sensitive life stages of spawning and rearing for resident species.

- An Erosion and Sediment Control Plan should be developed to help mitigate the impacts of development by encouraging infiltration of stormwater to the subsurface per recommendations in 4.4.1.

- Gravity sewers should be installed via directional drilling where possible. If open trenching is utilized, a fish rescue should be completed from isolated waterbodies by a professional to avoid fish kills.

4.4.2 Potential Effluent Outfalls

The following mitigation measures should be considered during detailed site design at latter stages in the EA to minimize impacts associated with construction of effluent outfalls and effluent dispersal.

- Any in-stream work should adhere to Fisheries and Oceans Canada's in-stream construction timing windows for spring (March 15 to July 15) and fall spawners (October 1 to May 31) to protect the sensitive life stages of spawning and rearing for resident species such as Rainbow and Brook Trout.
- An Erosion and Sediment Control Plan should be developed to prevent runoff and solids from entering the river. A construction mitigation plan should be developed (CISEC Canada 2012) to:
    - Utilize a multi-barrier approach;
    - Retain existing vegetation;
    - Minimize land disturbance area;
    - Slow down and retain runoff to promote settling;
    - Divert runoff from problem areas;
    - Minimize slope length and gradient of disturbed areas;
    - Maintain overland sheet flows and avid concentrate flows; and
    - Store/stockpile soil away from watercourses, drainage features, and tops of steep slopes.

A variety of best management practices (BMPs) can be employed to accomplish these goals depending on the site conditions. The effectiveness of BMPs is contingent on proper installation and maintenance, including inspection, details of which should be monitored by a certified environmental professional.

- Effluent will be treated to the limits proposed in HESL (2017) following approval by MOECC and will be regulated through the Environmental Compliance Approval (ECA) for the Erin WWTP. This will assure that effluent is not acutely lethal at the point of discharge, that water quality in the West Credit River meets water quality objectives, will minimize the mixing zone and ultimately avoid impacts to aquatic life.
- A monitoring plan should be developed in combination with the regulatory WWTP effluent monitoring to assess the response of the river to the effluent discharge. The monitoring plan will ultimately be reviewed by CVC and regulated through the ECA and should include an assessment of fisheries, benthic invertebrates and aquatic habitat with sufficient effort to allow for natural variability to be controlled and allow for a sensitive determination of any impact.

4.4.3 Potential WWTP Sites and Forcemain Routes

Several BMPs should be incorporated into the site preparation, construction and maintenance of all infrastructure to minimize and avoid negative impacts on natural features and their ecological functions. Although we have focused on discussion of mitigation measures that address features and functions identified through field surveys, these measures will also benefit any other potential features and functions that may be present in the study area (e.g., candidate significant wildlife habitat).

4.4.3.1 Site Selection

The size and location of the development can influence its impact on the surrounding environment. At each site the development footprint should be kept as small as possible to minimize the amount of natural habitat affected. Locating the development along the edge of the habitat (e.g., close to the road for SPS and WWTP sites) is preferable to having it centrally located within a site, since this avoids habitat fragmentation. In the case of the forcemain route, development should occur within the footprint of the existing road or trail option, so that surrounding natural habitat is not disturbed by the addition of this infrastructure feature.

Development should not be located where it will disturb or destroy habitat of species at risk. Therefore, we recommend that the WWTP be located at Site 1 to avoid breeding habitat of Bobolink and Eastern Meadowlark. Although our assessment concludes that a forcemain located along Route 2 will avoid any interaction with breeding habitats of Western Chorus Frog, Snapping Turtle; Eastern Wood-pewee, and Golden-winged Warbler, we recognize that these habitats are not present within (but are adjacent to) the forcemain footprint along Route 1 and so that option can also be used with no direct disturbance of habitat, provided appropriate mitigation measures are implemented (e.g., limit disturbance to trail footprint, time construction to avoid breeding periods).

Additional mitigation will be required depending on the alternatives selected. For instance, in the case of Forcemain Route Option 1, development should be restricted to the existing trail area only so it does not encroach on species at risk habitat. Furthermore, we recommend that the Route Option 1 bypass the portion of the trail between Sideroad 17 and Main St. so that the wetland adjacent to the trail (where Western Chorus Frog was heard and Barn Swallow was observed) is not disturbed. Instead, the forcemain route could go along Sideroad 17 to Main St.

Where construction activities such as trenching or shaft locations are adjacent to, or within, natural vegetation areas, the limits of disturbance should be clearly flagged and identified in advance of any construction activity. Vegetation and tree protection barriers/exclusion fencing should be installed using methods suitable to the site conditions and as approved by the agencies.

While we have presented generic and effective mitigation measures, we recognize that mitigation measures specific to the natural heritage features and functions of the preferred alternatives will need to be confirmed at detailed design stage. This may include specialized protection measures for rare plants or sensitive habitat features such as breeding amphibian areas. The use of trenchless tunneling construction methodology could be considered in highly sensitive areas.

4.4.3.2 Timing

Construction and maintenance activities should be scheduled for times of the year that avoid or minimize wildlife disturbance (e.g., outside migration and breeding periods) and environmental damage (e.g., not during high runoff periods in spring and fall).

Amphibian and reptile populations are active from March to October in southern Ontario (MNRF 2016). It is recommended that construction activity be scheduled outside of these periods to avoid disturbance of these species and their habitats and movement corridors. The sensitive period for maintaining water quantity and quality breeding amphibian habitat is from April to into June (depending on the species and onset of spring conditions).

The federal *Migratory Birds Convention Act (1994)* protects the nests, eggs and young of most bird species from harm or destruction. The breeding bird season for the Erin study area extends from early April through late August for most species (ECCC 2017). As a result, clearing of vegetation should be scheduled outside of these periods. For any proposed clearing of vegetation within these dates, or where birds may be suspected of nesting outside these typical dates, an ecologist should undertake detailed nest searches immediately prior to any site alteration to ensure that no active nests are present.

To minimize potential impacts on bat populations, tree removal should be avoided from April 30th to September 30th, and any construction during this period should be limited to daylight hours (T. McKenna pers. comm.).

4.4.3.3 Landscaping and Restoration

The preferred location for the WWTP is Site 1, which is surrounded by shrubby field habitat that is not actively farmed. This early successional habitat is often viewed as marginal habitat when in fact it provides important breeding habitat for a variety of grassland bird species, many of which are experiencing declines across North America (including the area sensitive species Savannah Sparrow). When development occurs within such habitat, the tendency is to manage the surrounding landscape to rid it of its natural vegetation, and replace with manicured lawns or tree cover. We therefore recommend that grassland and shrubland habitat be maintained around the development footprint to preserve the critical ecological function of the early successional habitat present at Site 1. As time goes on, active management may be required to prevent the natural successional process from replacing grasses and shrubs with trees.

The areas of proposed disturbance have been minimized by selecting SPS and forcemains locations which are in previously disturbed areas or at the edge of features. Restoration plans should be developed according to CVC guidelines based on the nearby vegetation communities. Site-specific restoration and edge management plans should be developed specific to the vegetation community types (e.g., wetland or forest).

The project should include topsoil management in areas where construction will disturb a natural vegetation community. For example, the top 20 – 30 cm of any stripped topsoil should be retained, stored, and used in restoration works so that the native and local seedbank is retained.

4.4.3.4 Stormwater Management

Any development that occurs adjacent to wetlands should adopt appropriate stormwater management measures to ensure water quality and hydroperiod are not adversely affected. This would normally involve developing and following sediment and erosion control plans and obtaining and following the requirements of a Permit to Take Water from MOECC for any dewatering activities. A site-specific assessment of mitigation required to avoid adverse effects to wetland and terrestrial communities should be completed as part of the detailed design. Mitigation measures should incorporate an assessment of the hydrological and ecological conditions that are to be maintained.

4.4.4 Woodland Mitigation

A variety of BMPs can be incorporated to avoid or minimize negative impacts to the woodlands. The limit of disturbance can be delineated with the installation of tree protection fencing. The tree protection fencing should be 1.2 to 1.8 m tall, well anchored into the ground, highly visible, and maintained for the entire duration of the construction-related activities. The fencing should be spaced no closer to trees than the perimeter of their driplines to reduce impacts such as breaking tree limbs, wounding tree trunks and damaging tree roots by soil compaction during construction works. Where suitable, consideration can be given to develop a woodland edge management plan.

Mitigation measures should also be taken to reduce the impacts to uncommon and rare plants. The plants identified in Section 3.2.3 have a high conservation status and preservation methods are recommended, such as transplanting rare species where direct impacts are proposed (i.e., within the development footprint). The locations of rare plants should be identified and staked during the flowering season and transplanting should occur during the fall (i.e., after the flowering period but while the vegetative material is still visible) into suitable habitat that will not be impacted by the development.

5. Summary and Conclusions

An inventory and assessment of the natural environment was undertaken as part of Phase 4 of the Class EA for a communal wastewater collection, treatment and disposal system for the Villages of Erin and Hillsburgh. The effects of the alternative design concepts on the natural environment (fisheries and aquatic resources, amphibians, birds, and vegetation communities) were evaluated and recommendations for mitigation to minimize negative effects and maximize positive effects were provided.

5.1 Summary of Baseline Conditions

5.1.1 Aquatic Ecology

The study area contains a cold-water thermal regime, mixed rocky substrates, a diverse benthic invertebrate assemblage and ample cover habitat that in turn, support a robust population of sensitive coldwater fish species and critical Brook Trout spawning habitat as proven by the observation of 94 Brook Trout redds in 2016. The most productive Brook Trout spawning reaches and the best Brook Trout populations in the West Credit River are located downstream of Erin Village (CVC et al. 2011) and the longest contiguous Brook Trout habitat in the Credit River watershed is the West Credit River between Erin and Belfountain.

5.1.2 Terrestrial Ecology

The study area encompasses a variety of vegetation communities representing both upland and wetland environments, including agricultural landscapes, deciduous, coniferous and mixed forests, and swamp and marsh. The West Credit PSW Complex extends throughout much of the area, and includes the West Credit River at Hillsburgh ESA, which is characterized by coniferous swamps and an undisturbed forested valley that provide important habitat for rare species and important groundwater discharge for the West Credit River. A total of 165 species of vascular plant species were recorded in the study area, comprised mainly of native species, ten of which are recognized as locally or regionally rare.

Six amphibian species were heard calling in the study area, including one threatened species, Western Chorus Frog, along Forcemain Options 1 and 3. Fifty-three bird species were documented in the area, including five species at risk (Eastern Wood-pewee, Barn Swallow, Golden-winged Warbler along Forcemain Option 1; Bobolink, and Eastern Meadowlark at proposed WWTP sites). Thirteen area sensitive bird species (which rely on large continuous areas of suitable habitat for breeding) were also recorded throughout the study area. Snapping Turtle, a special concern species, was observed along Forcemain Option 1.

5.2 Impact Assessment and Preferred Options

The potential effluent outfall locations at 10th Line and Winston Churchill Blvd. were evaluated based on aquatic ecology criteria. The preferred outfall location is Winston Churchill Boulevard to avoid the more sensitive and rare aquatic features and functions at 10th Line.

The three WWTP site locations were evaluated based on presence of provincially and/or nationally designated SAR, sensitive bird species, and significant habitat. The screening criteria indicated that the west field (Site 1) is the preferred choice for the location of the WWTP site, based on the presence of two species at risk in suitable breeding habitat in Sites 2A and 2B. However, Site 1 does provide suitable breeding habitat for the area sensitive Savannah Sparrow, and thus qualifies as significant wildlife habitat under the PPS. As such, development and site alteration are only permitted if there will be no negative impacts on the natural features or their ecological functions. Furthermore, Site 1 contained a rare and uncommon plant species (Wild Geranium) and is located next to the West Credit PSW Complex. Appropriate mitigation measures were therefore recommended to ensure no negative effects on species of conservation concern and important natural heritage features in the vicinity.

Three forcemain route options were evaluated based on presence of provincially and/or nationally designated SAR, sensitive bird species, and significant habitat. Although Forcemain Option 2 avoids the most sensitive habitats, Option 1 is feasible with the implementation of the mitigation techniques identified in this report and a deviation from the proposed route. We recommend that, should this option be selected, the route go along Sideroad 17 to Main St. and bypass the portion of the trail between Sideroad 17 and Main St. so that the wetland adjacent to the trail is not disturbed.

Mitigation measures and BMPs should be defined for the specific features of the preferred alternatives when they are selected and during detailed design. These should be incorporated into the site preparation, construction and maintenance of all infrastructure to minimize and avoid negative impacts on natural features and their ecological functions.

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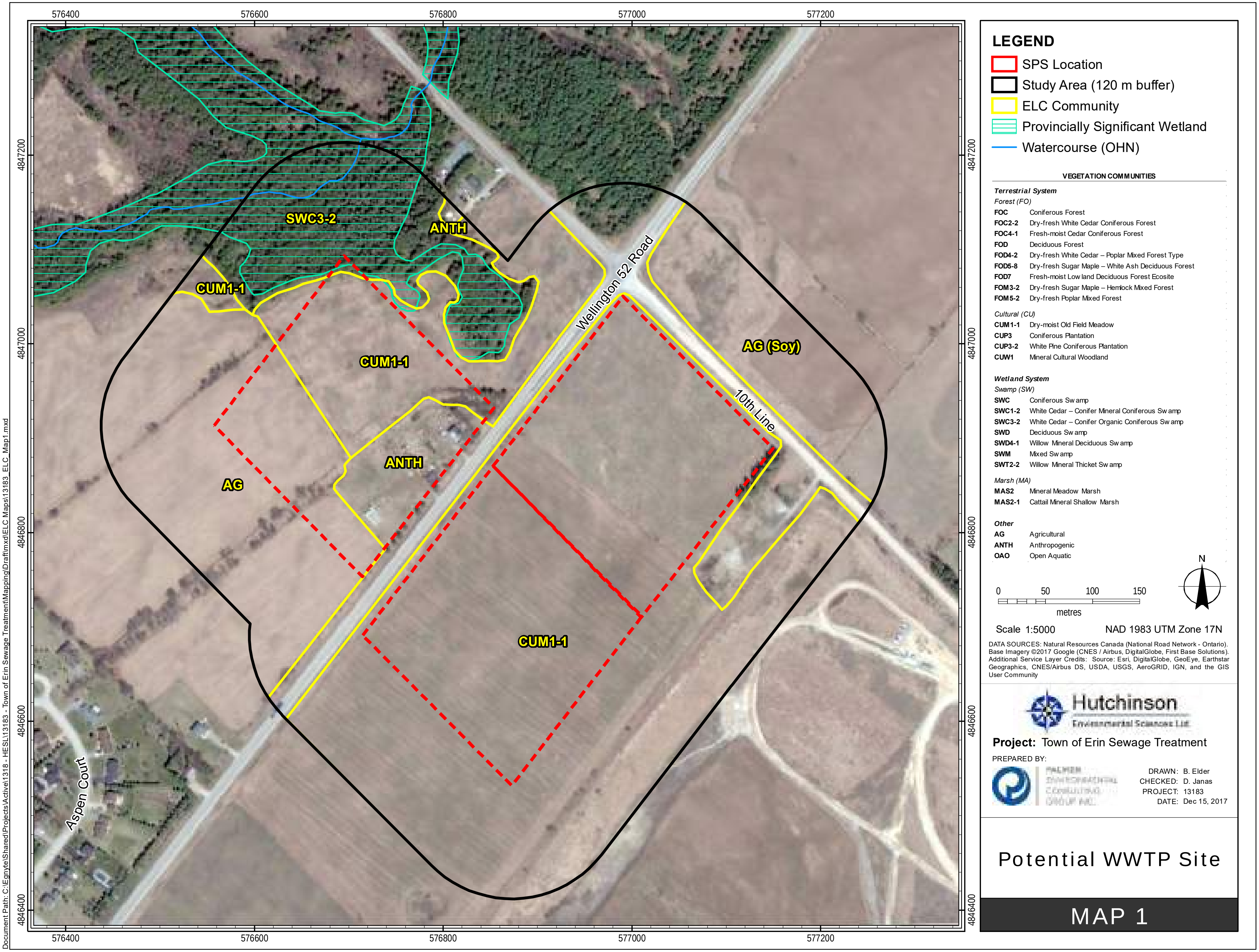
Appendix A. Benthic Invertebrate Results, August 2017

GROUP	FAMILY	TAXON	10A	10 B	10 C	WCB A	WCB B	WCB C
ACARI	Hygrobatidae	Hygrobates sp	1		1			
	Lebertiidae	Lebertia sp			1			
	Sperchontidae	Sperchon sp				1		
AMPHIPODA	Hyalellidae	Hyalella azteca					6	
DECAPODA	Cambaridae	Orconectes sp juv	1		1			
COLEOPTERA	Elmidae	Dubiraphia sp larvae		4	4		2	4
		Optioservus sp larvae	11		3	9	1	
		Optioservus fastiditus	5					
		Stenelmis sp larvae	2	4				
		Stenelmis crenata	2					
DIPTERA	Athericidae	Atherix sp larvae	1					
	Ceratopogonidae	Ceratopogonidae type IV					1	
	Chironomidae							
	Chironominae	Cladopelma sp		2	1	1	5	
		Cryptochironomus sp		4			5	1
		Dicrotendipes sp					1	
		Microtendipes sp			1			
		Paralauterborniella sp		4				
		Paratendipes sp					9	1
		Polypedilum aviceps gp	11	2	3	1		1
		Cladotanytarsus sp		40	17		26	37
		Paratanytarsus sp			1			
		Rheotanytarsus sp	3			11	2	
		Stempellinella sp					2	
		Tanytarsus sp	9	5				
	Diamesinae	Pagastia sp	10	1	1	32	2	
	Orthocladiinae	Brillia sp			1			
		Cricotopus trifascia gp				2		
		Orthocladius sp	5	3	8	4		
		Parametriocnemus sp		1				
		Psectrocladius sp				1		
		Thienemanniella sp						1
		Tvetenia sp	6	2		16	1	4
		Orthocladiinae early instars		6			1	2
	Tanypodinae	Ablasbesmyia mallochi		3	2		1	
		Procladius sp		1			5	
		Tanypodinae early instars		4	5			1
	Ephydridae	Ephydridae				1		
	Simulidae	Simulium decorum				10		2
		Simulium venustum cplx						7
	Tipulidae	Antocha sp	1			2		
EPHEMEROPTERA	Baetidae	Acentrella sp	1		2	15		50
		Acerpenna pygmaea			1			
		Baetis sp juv ?flavistriga	19	2	1	3	3	6
	Caenidae	Caenis sp	4					1
	Ephemerellidae	pb Ephemerella sp juvs	1					
	Heptageniidae	Maccaffertium vicarium	2		1			
	Isonychiidae	Isonychia sp	4			15		
	Leptohyphidae	Tricorythodes sp	4	15	22	5	9	
HEMIPTERA	Corixidae	Corixidae nymphs					28	
		Palmacorixa nana					3	
MEGALOPTERA	Corydalidae	Nigronia serricornis				1		
	Sialidae	Sialis sp			1		2	
ODONATA	Aeshnidae	?Boyeria sp juv incpte			1			
PLECOPTERA	Leuctridae	Leuctra sp		1	1			
	Pteronarcyidae	Pteronarcys sp	1					
TRICHOPTERA	Glossosomatidae	Glossosoma sp	1					
	Hydropsychidae	Cheumatopsyche sp	3	1	3	6		
		Hydropsyche sp juv	3	1		3		2
		Hydropsyche slossonae	1			1		
	Hydroptilidae	Hydroptila sp		1	1	1		
	Leptoceridae	Mystacides sp juv		4	17		3	
		Oecetis sp		1	2			
	Philopotamidae	Chimarra sp	3					
	Polycentropodidae	Polycentropodidae early instars					1	
		TOTALS	115	112	103	141	119	120
		Percentage picked	7	9	5	1	2	1

Appendix B. Vegetation Community Data


576400
576600
576800
577000
577200
4847200
4847000
4846800
4846600
4846400
SWC3-2
ANTH
CUM1-1
CUM1-1
AG
ANTH
AG (Soy)
CUM1-1
Wellington 52 Road
10th Line
Aspen Court
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LEGEND
SPS Location
Study Area (120 m buffer)
ELC Community
Provincially Significant Wetland
Watercourse (OHN)
VEGETATION COMMUNITIES
Terrestrial System
Forest (FO)
FOC Coniferous Forest
FOC2-2 Dry-fresh White Cedar Coniferous Forest
FOC4-1 Fresh-moist Cedar Coniferous Forest
FOD Deciduous Forest
FOD4-2 Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8 Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7 Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2 Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2 Dry-fresh Poplar Mixed Forest
Cultural (CU)
CUM1-1 Dry-moist Old Field Meadow
CUP3 Coniferous Plantation
CUP3-2 White Pine Coniferous Plantation
CUW1 Mineral Cultural Woodland
Wetland System
Swamp (SW)
SWC Coniferous Swamp
SWC1-2 White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2 White Cedar – Conifer Organic Coniferous Swamp
SWD Deciduous Swamp
SWD4-1 Willow Mineral Deciduous Swamp
SWM Mixed Swamp
SWT2-2 Willow Mineral Thicket Swamp
Marsh (MA)
MAS2 Mineral Meadow Marsh
MAS2-1 Cattail Mineral Shallow Marsh
Other
AG Agricultural
ANTH Anthropogenic
OAO Open Aquatic
N
0 50 100 150
metres
Scale 1:5000
NAD 1983 UTM Zone 17N
DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Hutchinson
Environmental Sciences Ltd.
Project: Town of Erin Sewage Treatment
PREPARED BY:
PALMER ENVIRONMENTAL CONSULTING GROUP INC.
DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Dec 15, 2017
Potential WWTP Site
MAP 1

LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

N

0 25 50
metres

Scale 1:2000 NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Dec 15, 2017

SPS-1

MAP 2

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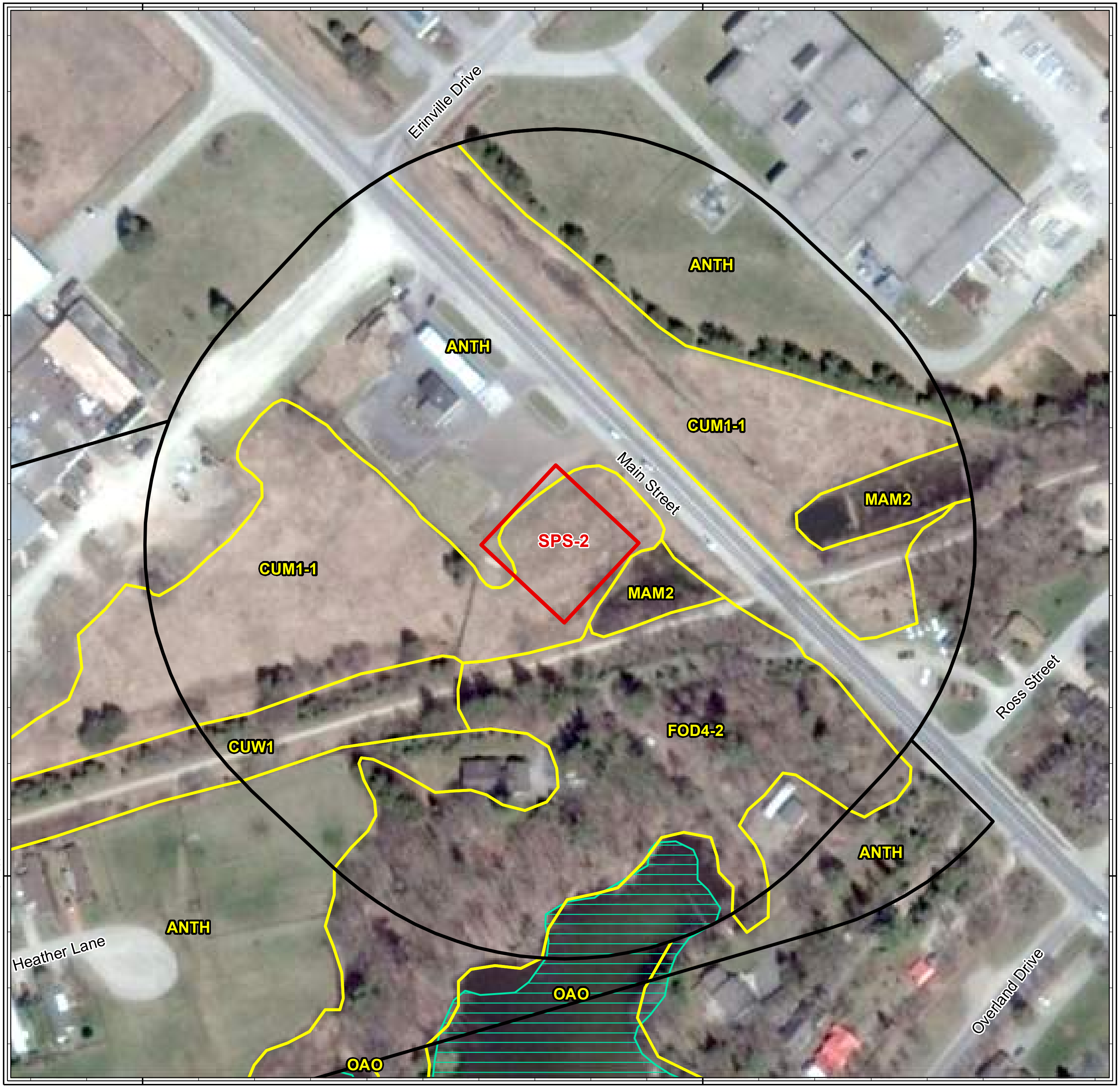

LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
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CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
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SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

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N

0 25 50
metres

Scale 1:2000 NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

Palmer Environmental Consulting Group Inc.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Dec 15, 2017

SPS-2

MAP 3

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LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Significant Woodland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
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FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

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CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Sw amp
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MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

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ANTH	Anthropogenic
OAO	Open Aquatic

N

0 25 50
metres

Scale 1:2000

NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Apr 20, 2018

SPS-3

MAP 4

LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Significant Woodland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

0 25 50
metres

N

Scale 1:2000 NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Apr 20, 2018

SPS-4

MAP 5

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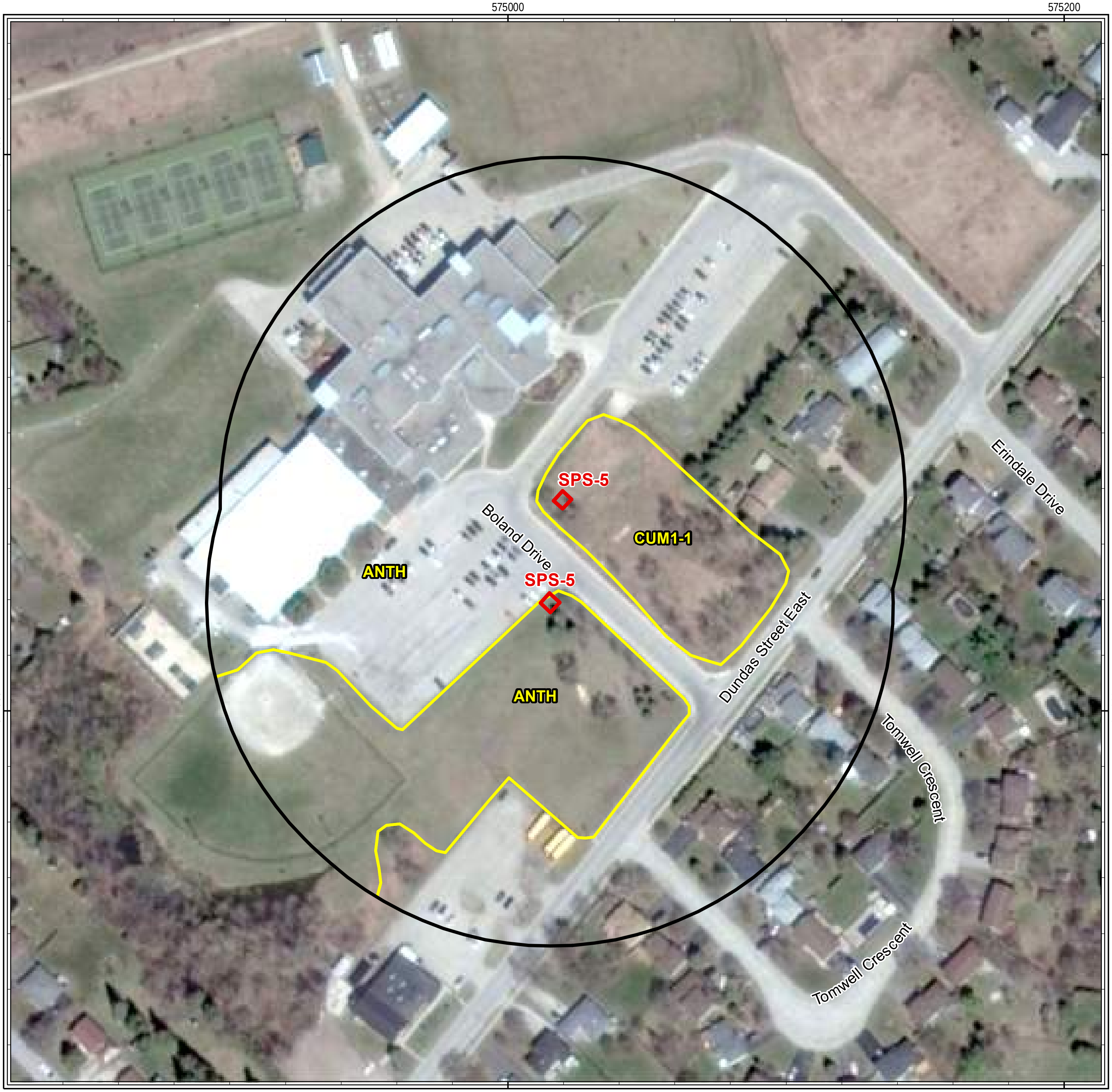

LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

N

0 25 50
metres

Scale 1:2000 NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Project: Town of Erin Sewage Treatment

PREPARED BY:

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CHECKED: D. Janas
PROJECT: 13183
DATE: Dec 15, 2017

SPS-5

MAP 6

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LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

N

0 25 50
metres

Scale 1:2000 NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Project: Town of Erin Sewage Treatment

PREPARED BY:

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Dec 15, 2017

SPS-6

MAP 7

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LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

N

0 25 50 metres

Scale 1:2000

NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Dec 15, 2017

SPS-7

MAP 8

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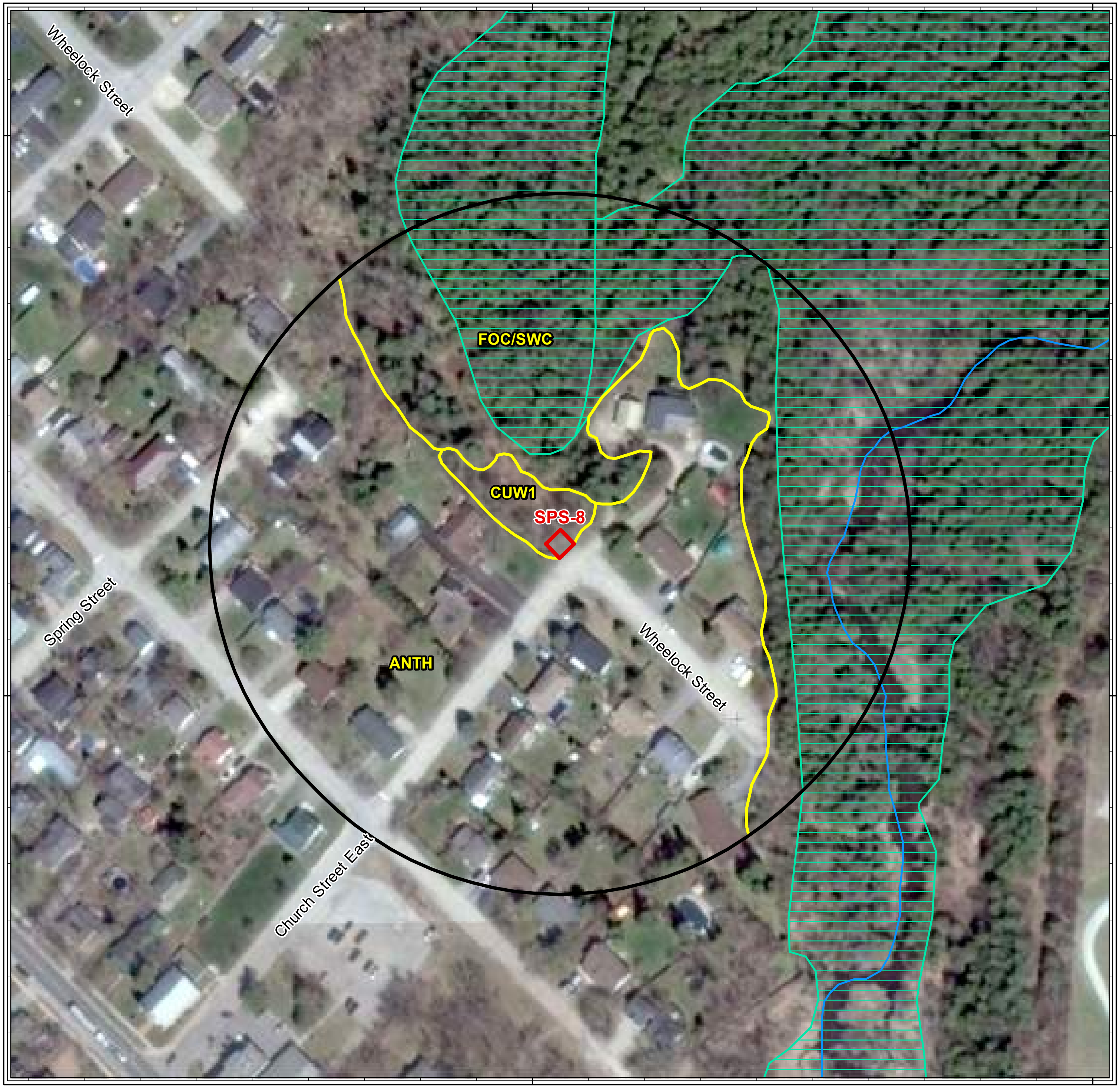

LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

N

0 25 50

metres

Scale 1:2000

NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits:

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Project: Town of Erin Sewage Treatment

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DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Dec 15, 2017

SPS-8

MAP 9

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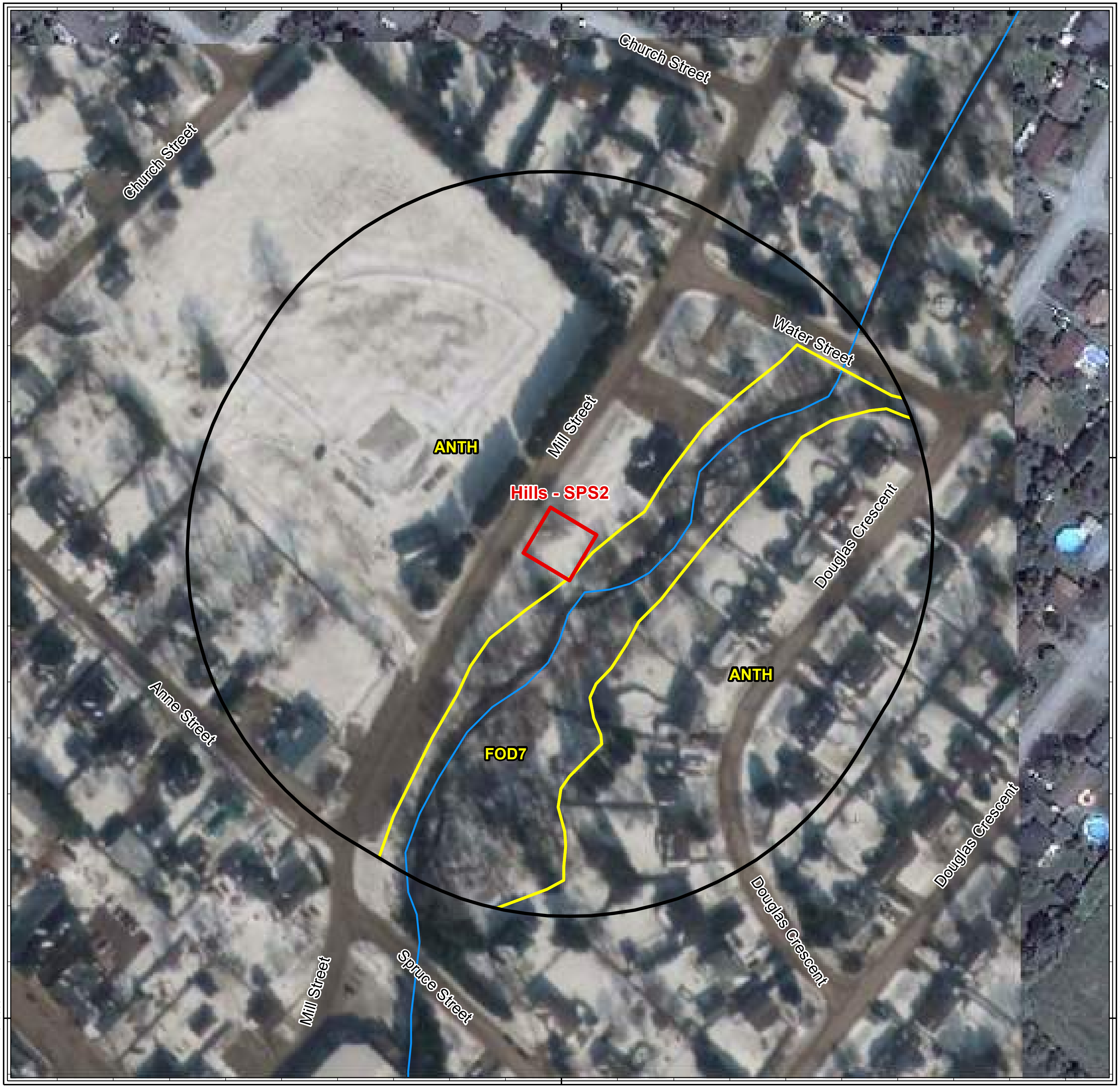

LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

N

0 25 50
metres

Scale 1:2000 NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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PROJECT: 13183
DATE: Dec 15, 2017

Hills - SPS2

MAP 10

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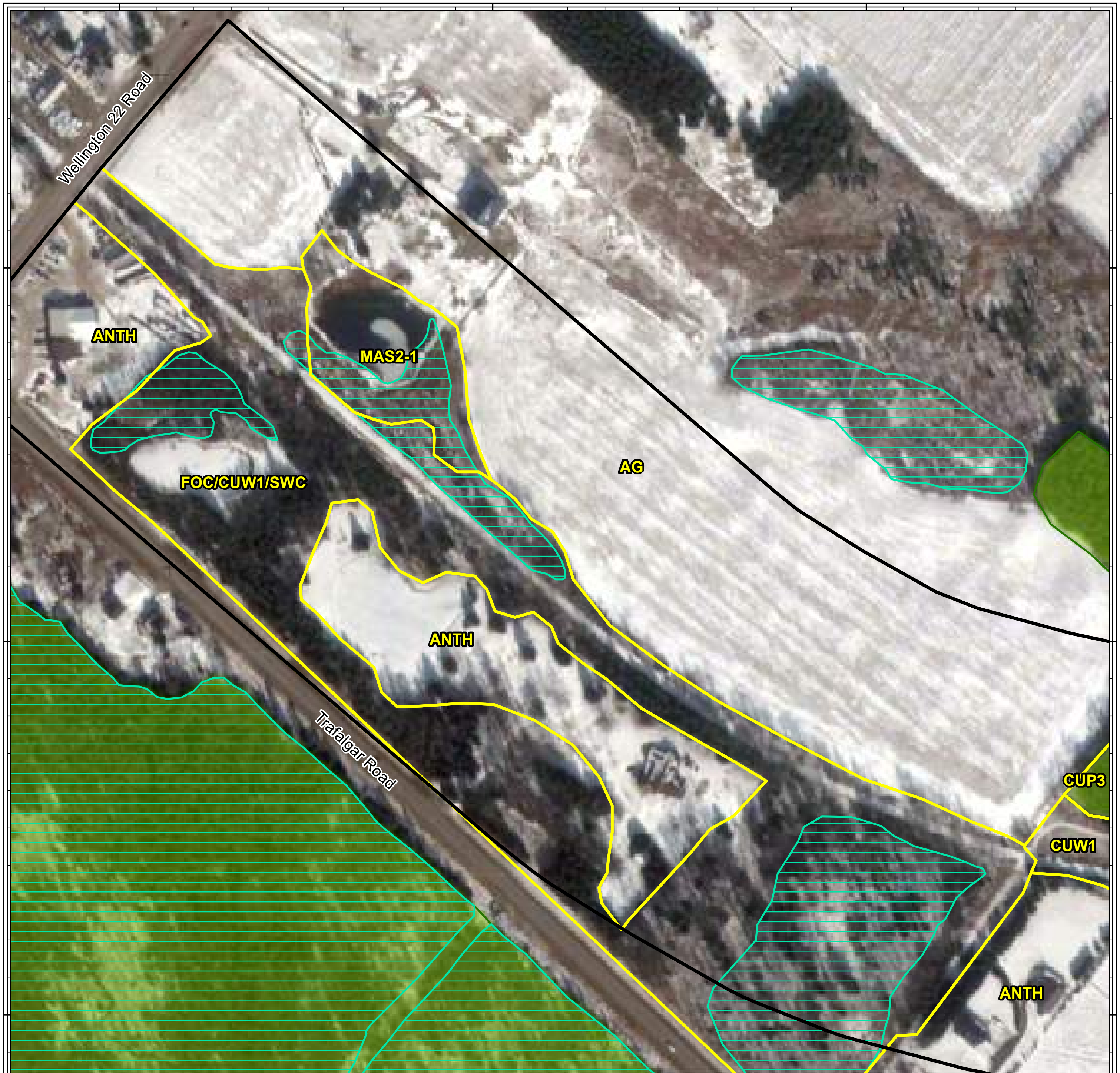

LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Significant Woodland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

0 50 100 metres

N

Scale 1:3000

NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Apr 20, 2018

Route Alternative 1

MAP 11A

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LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Significant Woodland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

0 50 100 metres

N

Scale 1:3000

NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

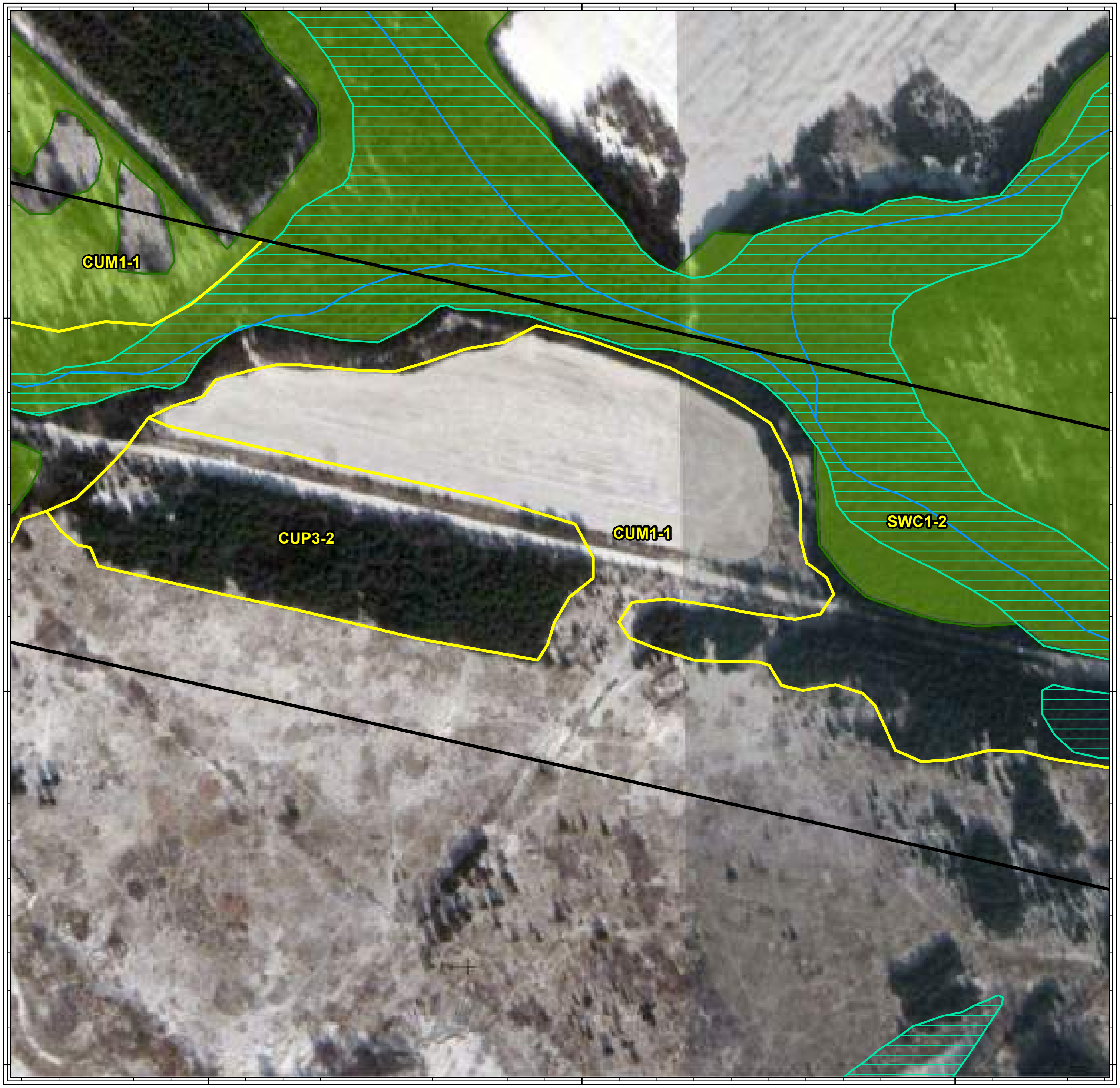
PREPARED BY:

Palmer Environmental Consulting Group Inc.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Apr 20, 2018

Route Alternative 1

MAP 11B



LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Significant Woodland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Low land Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Sw amp
SWC1-2	White Cedar – Conifer Mineral Coniferous Sw amp
SWC3-2	White Cedar – Conifer Organic Coniferous Sw amp
SWD	Deciduous Sw amp
SWD4-1	Willow Mineral Deciduous Sw amp
SWM	Mixed Sw amp
SWT2-2	Willow Mineral Thicket Sw amp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

0 50 100
metres

N

Scale 1:3000 NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Apr 20, 2018

Route Alternative 1

MAP 11C

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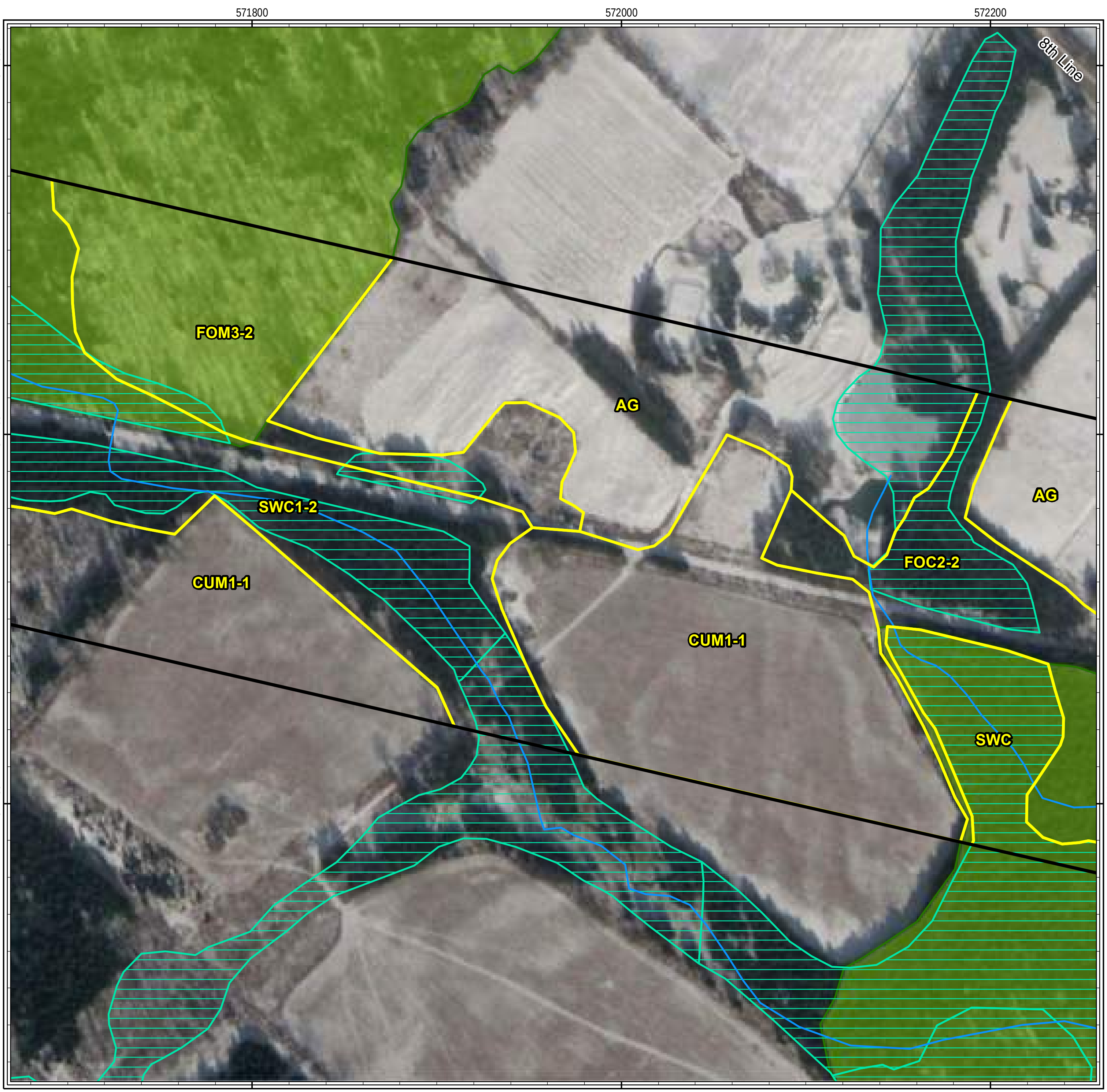

LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Significant Woodland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

N

0 50 100
metres

Scale 1:3000

NAD 1983 UTM Zone 17N

DATA SOURCES: Natural Resources Canada (National Road Network - Ontario). Base Imagery ©2017 Google (CNES / Airbus, DigitalGlobe, First Base Solutions). Additional Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Apr 20, 2018

Route Alternative 1

MAP 11D

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LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Significant Woodland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

N

0 50 100

metres

Scale 1:3000 NAD 1983 UTM Zone 17N

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Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Apr 20, 2018

Route Alternative 1

MAP 11E

LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Significant Woodland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

N

0 50 100
metres

Scale 1:3000 NAD 1983 UTM Zone 17N

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Project: Town of Erin Sewage Treatment

PREPARED BY:

PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Apr 20, 2018

Route Alternative 1

MAP 11F

Document Path: C:\Egnyte\Shared\Projects\Active\1318 - HESL\13183 - Town of Erin Sewage Treatment\Mapping\Draft\mxd\ELC Maps\13183_ELC_Map12F.mxd

Document Path: C:\Egnyte\Shared\Projects\Active\1318 - HESL\13183 - Town of Erin Sewage Treatment\Mapping\Draft\mxd\ELC Maps\13183_ELC_Map12G.mxd

LEGEND

- SPS Location
- Study Area (120 m buffer)
- ELC Community
- Provincially Significant Wetland
- Significant Woodland
- Watercourse (OHN)

VEGETATION COMMUNITIES

Terrestrial System

Forest (FO)

FOC	Coniferous Forest
FOC2-2	Dry-fresh White Cedar Coniferous Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD	Deciduous Forest
FOD4-2	Dry-fresh White Cedar – Poplar Mixed Forest Type
FOD5-8	Dry-fresh Sugar Maple – White Ash Deciduous Forest
FOD7	Fresh-moist Lowland Deciduous Forest Ecosite
FOM3-2	Dry-fresh Sugar Maple – Hemlock Mixed Forest
FOM5-2	Dry-fresh Poplar Mixed Forest

Cultural (CU)

CUM1-1	Dry-moist Old Field Meadow
CUP3	Coniferous Plantation
CUP3-2	White Pine Coniferous Plantation
CUW1	Mineral Cultural Woodland

Wetland System

Swamp (SW)

SWC	Coniferous Swamp
SWC1-2	White Cedar – Conifer Mineral Coniferous Swamp
SWC3-2	White Cedar – Conifer Organic Coniferous Swamp
SWD	Deciduous Swamp
SWD4-1	Willow Mineral Deciduous Swamp
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp

Marsh (MA)

MAS2	Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

Other

AG	Agricultural
ANTH	Anthropogenic
OAO	Open Aquatic

0 50 100
metres

N

Scale 1:3000

NAD 1983 UTM Zone 17N

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Hutchinson Environmental Sciences Ltd.

Project: Town of Erin Sewage Treatment

PREPARED BY:

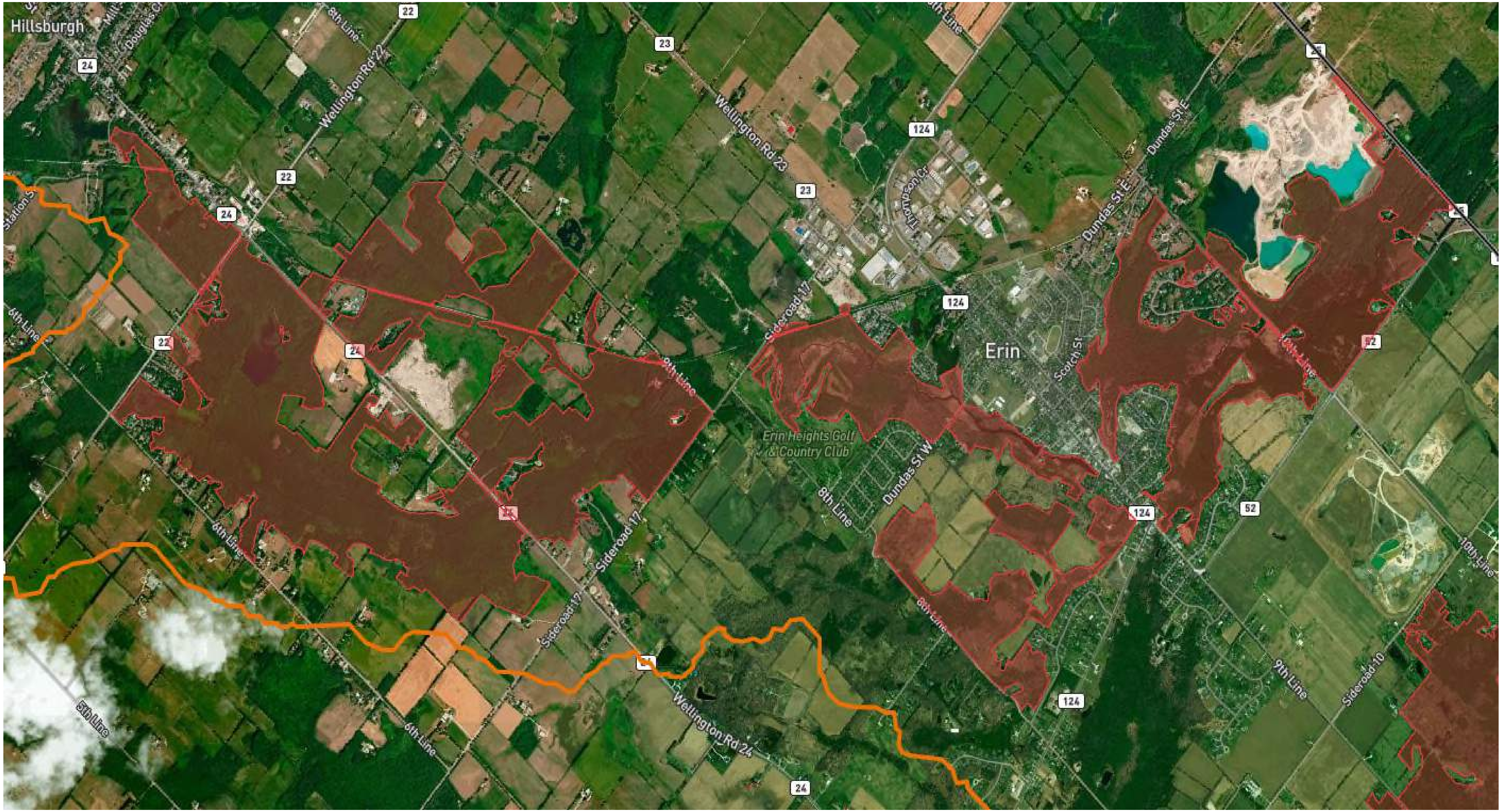
PALMER ENVIRONMENTAL CONSULTING GROUP INC.

DRAWN: B. Elder
CHECKED: D. Janas
PROJECT: 13183
DATE: Apr 20, 2018

Route Alternative 1

MAP 11G

Combined Nature Areas Inventory (NAI) Feature Limits within Study Area



Photograph 1. **CUM1-1: Dry-moist Old Field Meadow (Route Alternative 1).**

Photograph 2. **CUP3: Coniferous Plantation (Route Alternative 1).**

Photograph 3. **CUP3-2: White Pine Coniferous Plantation (Route Alternative 1).**

Photograph 4. **CUW1: Mineral Cultural Woodland (Route Alternative 1).**

Photograph 5. **FOC2-2: Dry-fresh White Cedar Coniferous Forest (Route Alternative 1).**

Photograph 6. **FOC4-1: Fresh-moist Cedar Coniferous Forest (Route Alternative 1).**

Photograph 7. **FOD5-8: Dry-fresh Sugar Maple – White Ash Deciduous Forest (Erin SPS-3).**

Photograph 8. **FOD7: Fresh-moist Lowland Forest (Hillsburgh SPS-2).**

Photograph 9. **FOM3-2: Dry-fresh Sugar Maple – Hemlock Mixed Forest (Route Alternative 1).**

Photograph 10. **FOM4-2: Dry-fresh White Cedar – Poplar Mixed Forest (Route Alternative 1).**

Photograph 11. **FOM5-2: Dry-fresh Poplar Mixed Forest (Route Alternative 1).**

Photograph 12. **MAS2-1: Cattail Mineral Shallow Marsh (Route Alternative 1).**

Photograph 13. **SWC1-2: White Cedar – Conifer Mineral Coniferous Swamp (Route Alternative 1).**

Photograph 14. **SWC3-2: White Cedar – Conifer Organic Coniferous Swamp (Route Alternative 1).**

Photograph 15. **SWD4-1: Willow Mineral Deciduous Swamp (Route Alternative 1).**

Photograph 16. **SWM3-2: Poplar Coniferous Mineral Mixed Swamp (Route Alternative 1).**

Photograph 17. **SWT2-2: Willow Mineral Thicket Swamp (Route Alternative 1).**

Hillsburgh	Erin	Erin	Erin	Erin	Erin	Erin	Erin	Erin		WWTP	WWTP	WWTP	WWTP						
SPS-2	**SPS-1**	**SPS-2**	**SPS-3**	**SPS-4**	**SPS-5**	**SPS-6**	**SPS-7**	**SPS-8**	**Route Alternative 1**	**Location 1**	**Location 1**	**Location 2B**	**Location 2A**	**ScientificName**	**CommonName**	**SRANK**	**Peel**	**CVC (Kaiser 2000)**	**CVC/PEEL STATUS (CVC 2002)**
Anth	**CUW1**	**CUM1-1**	**FOD5-8**	**CUM1-1**	**CUM1-1**	**CUM1-1**	**Anth**	**CUW1**	**All**	**CUM1-1**	**SWC3-2**	**CUM1-1**	**CUM1-1**						
									x					Abies balsamea	Balsam Fir	S5			
	x	x			x			x	x					Acer negundo	Manitoba Maple	S5			
	x	x	x						x					Acer platanoides	Norway Maple	SE5			
					x				x					Acer X freemanii	Freeman's Maple	S5			
		x												Achillea millefolium var. millefoliu	Common Yarrow	SE?			
								x						Aegopodium podagraria	Goutweed	SE5			
														Agrostis sp	Bentgrass Species				
				x		x			x					Agrostis gigantea	Redtop	SE5			
											x			Agrostis stolonifera	Spreading Bentgrass	S5			
	x		x		x			x	x					Alliaria petiolata	Garlic Mustard	SE5			
														Alnus glutinosa	European Black Alder	SE4			
											x			Alnus incana spp. rugosa	Speckled Alder	S5			
														Ambrosia artemisiifolia	Annual Ragweed	S5			
											x			Anemone virginiana var. virginiana	Virginia Anemone	S5			
					x									Arctium minus	Lesser Burdock	SE5			
											x			Asclepias incarnata ssp. incarnata	Swamp Milkweed	S5			
		x		x					x					Asclepias syriaca	Common Milkweed	S5			
											x			Aster ericoides var. ericoides	Heath Aster	S5			
									x					Aster lateriflorus var. lateriflorus	Calico Aster	S5			
											x			Symphyotrichum lanceolatum var. l	Panicled Aster	S5			
				x					x					Symphyotrichum novae-angliae	New England Aster	S5			
									x					Symphyotrichum puniceum var. pu	Swamp Aster	SU			
											x			Athyrium filix-femina var. angustur	Lady-fern	S5			
									x					Betula alleghaniensis	Yellow Birch	S5			
									x					Betula papyrifera	Paper Birch	S5			
											x			Bidens cernua	Nodding Beggar's Ticks	S5			
									x					Bidens frondosa	Devil's Beggar's Ticks	S5			
									x					Brasenia schreberi	Watershield	S5	R1	R/L	rare
		x	x		x				x	x		x	x	Bromus inermis ssp. inermis	Smooth Brome	SE5			
									x					Calla palustris	Wild Calla	S5	U		
									x					Carex sp	Sedge Species				
									x					Cardamine diphylla	Broad-leaved Toothwort	S5			
											x			Carex flava	Yellow Sedge	S5	R8	L	rare
											x			Carex gracillima	Graceful Sedge	S5			
									x					Carex stricta	Tussock Sedge	S5			
		x		x										Centaurea jacea	Brown Knapweed	SE5			
									x		x			Chelone glabra	Turtlehead	S5	U		
								x						Chelidonium majus	Greater Celadine	SE5			
		x			x				x					Cichorium intybus	Chicory	SE5			
		x			x									Cirsium arvense	Crepping Thistle	SE5			
			x						x					Circaea lutetiana ssp. canadensis	Enchanter's Nightshade	S5			
					x									Cirsium vulgare	Bull Thistle	SE5			
											x			Clematis virginiana	Virginia Virgin-bower	S5			
						x								Convolvulus arvensis	Field Bindweed	SE5			

			x						x					Cornus alternifolia	Alternate-leaf Dogwood	S5			
									x					Cornus sericea ssp. sericea	Red-osier Dogwood	S5			
											x			Cuscuta sp	Dodder Species				
									x					Cypripedium pubescens var. pubesc	Large Yellow Lady's-slipper	S5	R5	L	rare
											x			Cystopteris bulbifera	Bulblet Fern	S5			
				x		x								Dactylis glomerata	Orchard Grass	SE5			
	x	x		x	x	x			x	x		x		Daucus carota	Queen Anne's Lace	SE5			
		x	x					x						Echinocystis lobata	Wild Mock-cucumber	S5			
		x				x								Echium vulgare	Common Viper's-bugloss	SE5			
									x					Elaeagnus umbellata	Autum Olive	SE3			
											x			Eleocharis sp	Spikerush Species				
		x												Elymus repens	Quack Grass	SE5			
									x					Epipactis helleborine	Eastern Helleborine	SE5			
									x					Equisetum arvense	Field Horsetail	S5			
					x									Erigeron annuus	White-top Fleabane	S5			
									x					Erythronium americanum ssp. amer	Yellow Trout-lily	S5			
									x		x			Eupatorium maculatum var. macula	Spotted Joe-pye Weed	S5			
									x					Euthamia graminifolia	Grass-leaved Goldenrod	S5			
x	x	x	x						x					Fraxinus americana	White Ash	S5			
											x			Fraxinus nigra	Black Ash	S5			
									x					Fraxinus pennsylvanica	Green Ash	S5			
x									x					Fragaria vesca ssp. americana	Woodland Strawberry	S5			
											x			Fraxinus sp	Ash Species				
													x	Galium sp	Bedstraw Species				
														Galium asprellum	Rough Bedstraw	S5	U		
									x					Galium palustre	Marsh Bedstraw	S5			
														Galium triflorum	Sweet-scent Bedstraw	S5			
									x	x				Geranium maculatum	Wild Geranium	S5	U		
								x						Geranium robertianum	Herb-robert	SE5			
									x		x			Glyceria striata	Fowl Manna Grass	S5			
									x	x				Hieracium caespitosum	Field Hawkweed	SE5			
		x												Hieracium lachenalii	Common Hawkweed	SE2?			
									x					Hydrophyllum virginianum	Virginia Waterleaf	S5			
				x	x				x					Hypericum perforatum	St. John's-wort	SE5			
			x					x	x		x			Impatiens capensis	Spotted Jewel-weed	S5			
									x					Iris sp	Iris Species				
	x								x	x				Juglans nigra	Black Walnut	S4			
									x		x			Juncus sp	Rush Species				
									x					Larix laricina	American Larch	S5			
											x			Leersia oryzoides	Rice Cutgrass	S5			
					x			x						Leonurus cardiaca ssp. cardiaca	Common Motherwort	SE5			
														Linaria vulgaris	Butter-and-eggs	SE5			
					x						x			Lonicera tatarica	Tartarian Honeysuckle	SE5			
		x		x					x					Lotus corniculatus	Bird's-foot Trefoil	SE5			
									x					Lythrum salicaria	Slender-spike Loosestrife	SE5			
														Malva moschata	Musk Mallow	SE5			
									x					Malus pumila	Common Apple	SE5			
											x			Matteuccia struthiopteris var. pensy	Ostrich Fern	S5			
x	x				x									Medicago lupulina	Black Medic	SE5			

														Medicago polymorpha	Multi-formed Medick	SEH			
		x												Melilotus alba	White Sweet Clover	SE5			
									x					Mentha arvensis	Corn Mint	S5			
					x									Mentha X piperita	Peppermint	SE4			
									x					Mitella nuda	Naked Bishop's-cap	S5			
											x			Nasturtium sp	Watercress Species				
		x							x		s			Onoclea sensibilis	Sensitive Fern	S5			
		x								x				Parthenocissus vitacea	Thicket Creeper	S5			
									x					Pastinaca sativa	Wild Parsnip	SE5			
		x							x		x			Phalaris arundinacea	Reed Canary Grass	S5			
		x			x									Phlox paniculata	Fall Phlox	SE3			
		x							x					Phleum pratense	Timothy	SE5			
									x					Phragmites australis	Common Reed	S5			
												x		Picea abies	Norway Spruce	SE3			
									x		x			Picea glauca	White Spruce	S5	R3	L	
					x									Picea pungens	Colorado Spruce	SE1			
x						x			x					Pinus strobus	Eastern White Pine	S5			
		x		x	x	x								Plantago lanceolata	English Plantain	SE5			
											x			Poa sp	Bluegrass Species				
x	x				x	x	x							Poa pratensis ssp. pratensis	Kentucky Bluegrass	S5			
		x							x					Populus balsamifera ssp. balsamifer	Balsam Poplar	S5			
				x					x					Populus tremuloides	Quaking Aspen	S5			
		x							x					Prunus serotina	Wild Black Cherry	S5			
			x	x	x				x					Prunus virginiana var. virginiana	Choke Cherry	S5			
x	x								x					Prunella vulgaris ssp. vulgaris	Common Heal-all	SE3			
	x													Quercus rubra	Northern Red Oak	S5			
									x					Ranunculus acris	Tall Buttercup	SE5			
											x			Ranunculus hispidus var. hispidus	Bristly Buttercup	S3	R2	P/R/L	rare
								x						Ranunculus recurvatus var. recurvat	Hooked Crowfoot	S5			
	x	x	x	x	x			x	x					Rhamnus cathartica	Buckthorn	SE5			
			x											Ribes cynosbati	Prickly Gooseberry	S5			
										x				Robinia pseudo-acacia	Black Locust	SE5			
			x						x					Rubus occidentalis	Black Raspberry	S5			
									x					Rubus pubescens	Dwarf Raspberry	S5			
		x			x				x					Rumex crispus	Curly Dock	SE5			
									x		x			Salix sp	Willow Species				
									x					Salix eriocephala	Heart-leaved Willow	S5			
									x					Salix pedicellaris	Bog Willow	S5		R/L	rare
									x					Salix X sepulcralis	Weeping Willow	SE2			
											x			Sambucus sp	Elderberry Species				
									x					Schoenoplectus tabernaemontani	Soft-stemmed Bulrush	S5			
														Solidago sp	Goldenrod Species				
	x	x		x	x					x		x		Solidago canadensis	Canada Goldenrod	S5			
					x			x			x			Solanum dulcamara	Climbing Nightshade	SE5			
									x		x			Solidago rugosa ssp. rugosa	Rough Goldenrod	S5			
			x		x									Sonchus arvensis ssp. arvensis	Field Sowthistle	SE5			
	x													Sorbus sp	Mountain-ash Species				
											x			Sparganium sp	Bur-reed Species				
														Spiraea alba	Narrow-leaved Meadow-swee	S5			

	x									x		x		Syringa vulgaris	Common Lilac	SE5			
x	x		x		x	x		x	x					Taraxacum officinale	Common Dandelion	SE5			
											x			Thalictrum pubescens	Tall Meadowrue	S5			
									x					Thelypteris palustris var. pubescens	Marsh Fern	S5			
				x					x	x	x			Thuja occidentalis	Northern White Cedar	S5			
	x													Tilia cordata	Small leaf Linden	SE1			
						x								Trifolium pratense	Red Clover	SE5			
														Trifolium repens	White Clover	SE5			
									x					Tsuga canadensis	Eastern Hemlock	S5			
									x		x			Tussilago farfara	Colt's Foot	SE5			
									x					Typha angustifolia	Narrow-leaved Cattail	S5			
									x					Typha latifolia	Broad-leaf Cattail	S5			
									x					Ulmus sp	Elm Species				
											x			Ulmus americana	American Elm	S5			
											x			Urtica dioica ssp. gracilis	Slender Stinging Nettle	S5			
											x			Verbena sp	Vervain Species				
											x			Verbena hastata	Blue Vervain	S5			
		x			x				x					Verbascum thapsus	Common Mullein	SE5			
									x					Viburnum acerifolium	Maple-leaf Viburnum	S5			
		x		x	x				x					Vicia cracca	Tufted Vetch	SE5			
		x							x					Vitis riparia	Riverbank Grape	S5			
									x					Waldsteinia fragarioides	Barren Strawberry	S5			
										x				Zea mays	Indian Corn	SE2			

Hillsburgh	**Erin**	**Erin**	**Erin**	**Erin**	**Erin**	**Erin**	**Erin**	**Erin**		**WWTP**	**WWTP**	**WWTP**	**WWTP**						
SPS-2	**SPS-1**	**SPS-2**	**SPS-3**	**SPS-4**	**SPS-5**	**SPS-6**	**SPS-7**	**SPS-8**	**Route Alternative 1**	**Location 1**	**Location 1**	**Location 2B**	**Location 2A**	**ScientificName**	**CommonName**	**SRANK**	**Peel (Varga 2000)**	**CVC (Kaiser 2000)**	**CVC/PEEL STATUS (CVC 2002)**
Anth	**CUW1**	**CUM1-1**	**FOD5-8**	**CUM1-1**	**CUM1-1**	**CUM1-1**	**Anth**	**CUW1**	**All**	**CUM1-1**	**SWC3-2**	**CUM1-1**	**CUM1-1**						
									x					Brasenia schreberi	Watershield	S5	R1	R/L	rare
									x					Calla palustris	Wild Calla	S5	U		
											x			Carex flava	Yellow Sedge	S5	R8	L	rare
									x		x			Chelone glabra	Turtlehead	S5	U		
									x					Cypripedium pubescens var. pubescens	Large Yellow Lady's-slipper	S5	R5	L	rare
									x	x				Geranium maculatum	Wild Geranium	S5	U		
									x		x			Picea glauca	White Spruce	S5	R3	L	
											x			Ranunculus hispidus var. hispidus	Bristly Buttercup	S3	R2	P/R/L	rare

Appendix C. Summary of Erin Breeding Amphibian Surveys, April, May and June 2017

Summary of Breeding Amphibians Surveys, April, May, and June 2017

Date Surveyed
26-Apr-17

Station Surveyed	**1**			**2**			**3**			**4**			**5**			**6**		
Station Start Time (24 hr)	20:15			21:45			22:30			22:15			22:40			22:45		
Background Noise	1			1			2			1			2			2		
No Calls Heard	0			0														
Species Name	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In
American Toad							1	1	0	1	2	1	1	2	0			
Fowler's Toad																		
Gray (Tetraploid) Treefrog																		
Cope's (Diploid) Gray Treefrog																		
Spring Peeper							1	3	0	2	6	6	1	3	3	2	6	6
Chorus Frog																		
Blanchard's Cricket Frog																		
Wood Frog																		
Northern Leopard Frog										1	3	0				1	2	2
Pickeel Frog																		
Green Frog																1	1	1
Mink Frog																		
Bullfrog																		

Station Surveyed	**7**			**8**			**9**			**10**			**11**			**12**		
Station Start Time (24 hr)	22:59			23:05			23:10			9:30			N/A			N/A		
Background Noise	1			3			1			3								
No Calls Heard	0																	
Species Name	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In
American Toad																		
Fowler's Toad																		
Gray (Tetraploid) Treefrog																		
Cope's (Diploid) Gray Treefrog																		
Spring Peeper				1	3	0	1	3	0	1	2	0						
Chorus Frog										1	1	1						
Blanchard's Cricket Frog																		
Wood Frog																		
Northern Leopard Frog							1	1	0									
Pickeel Frog																		
Green Frog																		
Mink Frog																		
Bullfrog																		

Station Surveyed	**13**			**14**			**15**			**16**			**17**			**18**		
Station Start Time (24 hr)	N/A			N/A			22:03			23:47			23:58			23:54		
Background Noise							1			1			1			1		
No Calls Heard																0		
Species Name	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In
American Toad							1	4	4	1	2	2						
Fowler's Toad																		
Gray (Tetraploid) Treefrog																		
Cope's (Diploid) Gray Treefrog																		
Spring Peeper							2	7	7	1	4	4	2	4	4			
Chorus Frog																		
Blanchard's Cricket Frog																		
Wood Frog																		
Northern Leopard Frog										1	1	0						
Pickeel Frog																		
Green Frog																		
Mink Frog																		
Bullfrog																		

Weather Conditions: Cloud Cover 1, Beauford Wind Scale 0, Temperature 9ºC, Precipition none.

Date Surveyed
30-May-17

20 and 21 on May 31/2017

Station Surveyed	**1**			**2**			**3**			**4**			**5**			**6**		
Station Start Time (24 hr)	22:35			21:55			21:45			21:30			22:05			23:20		
Background Noise	1			3			0			2			2			1		
No Calls Heard	0																	
Species Name	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In
American Toad				1	2	2				1	3	0						
Fowler's Toad																		
Gray (Tetraploid) Treefrog													1	2	2			
Cope's (Diploid) Gray Treefrog																		
Spring Peeper																		
Chorus Frog										1	3	1						
Blanchard's Cricket Frog																		
Wood Frog																		
Northern Leopard Frog																		
Pickeel Frog																		
Green Frog										1	2	1				1	9	6
Mink Frog																		
Bullfrog																		

Station Surveyed	**7**			**8**			**9**			**10**			**11**			**12**		
Station Start Time (24 hr)	23:35			23:25			23:30			23:35			22:10			22:20		
Background Noise	1			1			1			1			2			2		
No Calls Heard				0									0					
Species Name	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In
American Toad																1	4	1
Fowler's Toad																		
Gray (Tetraploid) Treefrog	1	1	0													2	9	0
Cope's (Diploid) Gray Treefrog																		
Spring Peeper										1	2	0				1	2	2
Chorus Frog																		
Blanchard's Cricket Frog																		
Wood Frog																		
Northern Leopard Frog							1	1	1									
Pickeel Frog																		
Green Frog										1	2	2				1	1	1
Mink Frog																		
Bullfrog																		

Station Surveyed	**13**			**14**			**15**			**16**			**17**			**18**		
Station Start Time (24 hr)	21:35			22:00			23:05			23:10			23:15			0:00		
Background Noise	1			1			1			1			1			2		
No Calls Heard													0			0		
Species Name	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In
American Toad																		
Fowler's Toad																		
Gray (Tetraploid) Treefrog	1	6	0	1	5	0	1	6	0	1	1	0						
Cope's (Diploid) Gray Treefrog																		
Spring Peeper	1	2	0	1	4	0				1	4	0						
Chorus Frog																		
Blanchard's Cricket Frog																		
Wood Frog																		
Northern Leopard Frog																		
Pickeel Frog																		
Green Frog																		
Mink Frog																		
Bullfrog																		

Weather Conditions: Cloud Cover 6, Beauford Wind Scale 1, Temperature 17ºC, Precipition non/drizzle.

Date Surveyed
27-Jun-17

Station Surveyed	**1**			**2**			**3**			**4**			**5**			**6**		
Station Start Time (24 hr)	23:11			22:02			21:50			21:30			23:31			23:45		
Background Noise	1			1			1			1			1			1		
No Calls Heard	0			0			0			0			0					
Species Name	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In
American Toad																		
Fowler's Toad																		
Gray (Tetraploid) Treefrog																		
Cope's (Diploid) Gray Treefrog																		
Spring Peeper																		
Chorus Frog																		
Blanchard's Cricket Frog																		
Wood Frog																		
Northern Leopard Frog																		
Pickeel Frog																		
Green Frog																1	9	4
Mink Frog																		
Bullfrog																		

Station Surveyed	**7**			**8**			**9**			**10**			**11**			**12**		
Station Start Time (24 hr)	23:51			23:55			23:58			23:25			22:50			23:05		
Background Noise	1			1			1			1			0			0		
No Calls Heard	0			0			0						0					
Species Name	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In
American Toad																		
Fowler's Toad																		
Gray (Tetraploid) Treefrog																		
Cope's (Diploid) Gray Treefrog																		
Spring Peeper																		
Chorus Frog																		
Blanchard's Cricket Frog																		
Wood Frog																		
Northern Leopard Frog																		
Pickeel Frog																		
Green Frog										2	6	4						
Mink Frog																		
Bullfrog																		

Station Surveyed	**13**			**14**			**15**			**16**			**17**			**18**		
Station Start Time (24 hr)	22:17			22:28			0:08			0:02			0:02			N/A		
Background Noise	1			1			1			1			1					
No Calls Heard	0						0			0			0					
Species Name	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In	CC	Count	In
American Toad																		
Fowler's Toad																		
Gray (Tetraploid) Treefrog																		
Cope's (Diploid) Gray Treefrog																		
Spring Peeper																		
Chorus Frog																		
Blanchard's Cricket Frog																		
Wood Frog																		
Northern Leopard Frog																		
Pickeel Frog																		
Green Frog				1	3	1												
Mink Frog																		
Bullfrog																		

Weather Conditions: Cloud Cover 1, Beauford Wind Scale 1, Temperature 17ºC, Precipition: None.

Appendix D. Summary of Erin Breeding Bird Surveys, June 2017

Summary of Breeding Bird Surveys, June 2017

Common Name	Scientific Name	Status																			
		National Species at Risk COSEWIC designation[a]	National Species at Risk *Species at Risk Act* Designation[a]	Species at Risk in Ontario Listing[b]	Provincial breeding season SRANK[c]	Area-sensitive (OMNR)[d]	1B	2	3	4	5	6	8	9	A	B	C	D	E	F	G
Canada Goose	*Branta canadensis*				S5															1	
Killdeer	*Charadrius vociferus*				S5													1			
Mourning Dove	*Zenaida macroura*				S5					1				1				1			
Belted Kingfisher	*Ceryle alcyon*				S4														1	1	
Yellow-bellied Sapsucker	*Sphyrapicus varius*				S5	A															1
Hairy Woodpecker	*Picoides villosus*				S5	A			1									1			
Northern Flicker	*Colaptes auratus*				S4													2			
Eastern Wood-Pewee	*Contopus virens*	SC		SC	S4													1			
Willow Flycatcher	*Empidonax traillii*				S5														1		
Great Crested Flycatcher	*Myiarchus crinitus*				S4													2			
Eastern Kingbird	*Tyrannus tyrannus*				S4										1						
Tree Swallow	*Tachycineta bicolor*				S4					2							1				
Barn Swallow	*Hirundo rustica*	THR		THR	S4					3								1			
Blue Jay	*Cyanocitta cristata*				S5							1	1					2			1
American Crow	*Corvus brachyrhynchos*				S5			1					1					5			
Black-capped Chickadee	*Poecile atricapillus*				S5										1			7			1
White-breasted Nuthatch	*Sitta carolinensis*				S5	A												2			1
Brown Creeper	*Certhia americana*				S5	A												1			
House Wren	*Troglodytes aedon*				S5										1		1	3			
Winter Wren	*Troglodytes hiemalis*				S5	A												1			
Veery	*Catharus fuscescens*				S4	A												1			
American Robin	*Turdus migratorius*				S5		1			2	1	1	1	1	1		1	10		1	2
Gray Catbird	*Dumetella carolinensis*				S4													2			1
Cedar Waxwing	*Bombycilla cedrorum*				S5			1		1								3			2
European Starling	*Sturnus vulgaris*				SE					1				1	1		1	7		1	2
Warbling Vireo	*Vireo gilvus*				S5													1			
Red-eyed Vireo	*Vireo olivaceus*				S5		1											4	1		1
Golden-winged Warbler	*Vermivora chrysoptera*	THR	THR	SC	S4													1			
Nashville Warbler	*Oreothlypis ruficapilla*				S5													3			
Yellow Warbler	*Setophaga petechia*				S5					1								2			
Chestnut-sided Warbler	*Setophaga pensylvanica*				S5													1			
Yellow-rumped Warbler	*Setophaga coronata*				S5													2			
Black-throated Green Warbler	*Setophaga virens*				S5	A												1			
Black-and-white Warbler	*Mniotilta varia*				S5	A												4			
American Redstart	*Setophaga ruticilla*				S5	A								1				3			1
Ovenbird	*Seiurus aurocapillus*				S4	A			1												1
Northern Waterthrush	*Parkesia noveboracensis*				S5								1					7			
Mourning Warbler	*Geothlypis philadelphia*				S4													1			
Common Yellowthroat	*Geothlyphis trichas*				S5										1			5	1		1
Northern Cardinal	*Cardinalis cardinalis*				S5													3			1
Indigo Bunting	*Passerina cyanea*				S4													4			
Chipping Sparrow	*Spizella passerina*				S5		1				1	1			1		1	7			
Field Sparrow	*Spizella pusilla*				S4													1			
Savannah Sparrow	*Passerculus sandwichensis*				S4	A									2		1	1			
Song Sparrow	*Melospiza melodia*				S5			1		2	1		1		1			18	1	1	

Summary of Breeding Bird Surveys, June 2017

Common Name	Scientific Name	Status																				
		National Species at Risk COSEWIC designation[a]	National Species at Risk *Species at Risk Act* Designation[a]	Species at Risk in Ontario Listing[b]	Provincial breeding season SRANK[c]	Area-sensitive (OMNR)[d]	1B	2	3	4	5	6	8	9	A	B	C	D	E	F	G
Swamp Sparrow	*Melospiza georgiana*				S5														1		
Bobolink	*Dolichonyx oryzivorus*	THR		THR	S4	A										1					
Red-winged Blackbird	*Agelaius phoeniceus*				S4			1		1	1				1	2	2	5	6	1	2
Eastern Meadowlark	*Sturnella magna*	THR		THR	S4	A									1	1	1				
Common Grackle	*Quiscalus quiscula*				S5			1		1	1	2	1	1				4			1
Baltimore Oriole	*Icterus galbula*				S4									1				3			
House Finch	*Haemorhous mexicanus*				SNA													3			
American Goldfinch	*Spinus tristis*				S5			1				1	1	1	1			9	1	1	

Field Work Conducted On: June 1 and June 21 2017 between 5:45-11:45 h
Weather Conditions: 0-50% cloud, 0-6 Beaufort wind scale, 0% precipitation, 6-19º C

Location 1B - SPS #1B
Location 2 - SPS #2
Location 3 - SPS #3
Location 4 - SPS #4
Location 5 - SPS #5
Location 6 - SPS #6
Location 8 - SPS #8
Location 9 - Hillsburgh SPS #2
Location A - Potential WWTP on west side of Wellington Rd 52
Location B - Potential WWTP on southeast side of Wellington Rd 52
Location C - Potential WWTP on northeast side of Wellington Rd 52
Location D - Forcemain Option 1
Location E - Credit River marsh
Location F - Riverside Park
Location G - Forcemain from SPS #3 to Dundas St W

Number of Species: 53
Number of (provincial and national) Species at Risk: 5
Number of S1 to S3 Species: 0
Number of Area-sensitive Species: 13

Location D - Forcemain Option 1
Number of Species: 43
Number of (provincial and national) Species at Risk: 3
Number of Area-sensitive Species: 9

KEY
a COSEWIC = Committee on the Status of Endangered Wildlife in Canada
b Species at Risk in Ontario List (as applies to ESA) as designated by COSSARO (Committee on the Status of Species at Risk in Ontario)
END = Endangered, THR = Threatened, SC = Special Concern

[c] SRANK for breeding status if:
S1 (Critically Imperiled), S2 (Imperiled),S3 (Vulnerable), S4 (Apparently Secure), S5 (Secure)
SH (historical, possibly extirpated)

Summary of Breeding Bird Surveys, June 2017

		Status																			
Common Name	**Scientific Name**	**National Species at Risk COSEWIC designation[a]**	**National Species at Risk *Species at Risk Act* Designation[a]**	**Species at Risk in Ontario Listing[b]**	**Provincial breeding season SRANK[c]**	**Area-sensitive (OMNR)[d]**	**1B**	**2**	**3**	**4**	**5**	**6**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**	**G**

SNA (Not applicable…'because the species is not a suitable target for conservation activities'; includes non-native species),
NatureServe. 2015. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available at: http://explorer.natureserve.org

d Ontario Ministry of Natural Resources (OMNR). 2000. Significant Wildlife Habitat Technical Guide (Appendix G). 151 p plus appendices.

Appendix E. Response to Reviewers' Comments

Hutchinson
Environmental Sciences Ltd.

1-5 Chancery Lane, Bracebridge, ON P1L2E3 │ 705-645-0021

April 4, 2018 HESL Job #: J160005

Liam Marray
Credit Valley Conservation
1255 Old Derry Road
Mississauga, ON L5N 6R4

Dear Mr. Marray:

Re: Draft Town of Erin Urban Centre Waste Water Class EA and Draft supporting studies - Response to CVC Comments

Credit Valley Conservation provided a variety of comments on *Town of Erin EA Natural Environment Report* (Hutchinson Environmental Sciences Limited (HESL) 2017) and associated technical memorandums focused on site selection of different types of proposed infrastructure. Our responses focused on explaining rationale for the characterization of natural heritage features and functions, and the assessment developed to select preferred locations for various infrastructure, and acknowledging CVC comments that will improve the completeness of this portion of the EA and better align the work with relevant policies.

We will finalize the Natural Environment Report based on the responses and comments provided here-in but please contact Brent Parsons if you have any further questions or concerns.

Sincerely,
Hutchinson Environmental Sciences Ltd.

Brent Parsons, M.Sc.
brent.parsons@environmentalsciences.ca

The Credit Valley Conservation (CVC) provided a variety of comments on *Town of Erin EA Natural Environment Report* (Hutchinson Environmental Sciences Limited (HESL) 2017), *Wastewater Treatment Plant Site Selection Technical Memorandum* (Ainley Group 2017), *Effluent Outfall Site Selection Technical Memorandum* (Ainley Group 2017), and *Pumping Stations and Forcemains Technical Memorandum* (Ainley Group 2017). Our responses to the comments can be found on the following pages in *italics*. Some of the comments responses, as identified, are more appropriately addressed by the Ainley Group.

Natural Environment Report

<u>Benthic Invertebrates</u>

Comment #1:
Page 7 – Indicates OBB protocol followed, however goes on to indicate 'all samples were therefore collected from riffle or shallow run habitat'; OBBN protocol is to sample 2 riffles and one pool (and this is also consistent with CVC's approach). Please clarify.

The areas that could be most impacted by the installation of an effluent diffuser and conveyance of treated effluent were sampled for benthic invertebrates and compared to determine site sensitivity. There were no pools in those areas, so they weren't sampled. Sampling methodology will be clarified in the final Natural Environment Report to reflect this.

Comment #2:
Page 18 – (Chp 3.1.2.1): Sampling done through CVC's Integrated Watershed Monitoring Program (not Integrated Management Plan)

The change in terminology will be reflected in the final Natural Environment Report.

Comment #3:
Page 19 – (Table 3): % Chironomid at station halfway between 10th Line and Winston Churchill Blvd – in the Erin SSMP Phase 1 report, value reported at this station is 40% (not 10%)

% Chironomidae will be changed from 10% to 40% in the final Natural Environment Report.

Comment #4:
Page 21 – (Table 5 and associated text): Would be more appropriate to combine the three subsamples from each location for analysis purposes, i.e. in Table 5 rather than taking an average of each of the subsamples, metrics should be calculated from the summed taxa counts of the three subsamples. Discussion in text should focus on the overall site's results, not an average of the three subsamples.

The subsamples will be combined and analyzed in the final Natural Environment Report.

<u>Aquatic Ecology</u>

Comment #5:

Figure 5 – The start and finish of the spawning surveys should be shown. It would also be beneficial to show the mixing zones (e.g. nitrate, DO and temperature). The spawning surveys should extend beyond the mixing zones.

The mixing zone was predicted to be 152m long based on exceedance of the ammonia Provincial Water Quality Objective (PWQO) in West Credit River Assimilative Capacity Study (HESL 2017). No other water quality parameters were predicted to exceed the PWQO or Canadian Water Quality Guidelines and therefore 152m represents the end of the mixing zone as it is commonly defined. The spawning survey extended 500m downstream of Winston Churchill Blvd., or approximately 550m downstream of the proposed outfall, which is well beyond the mixing zone. The extent of the mixing zone for ammonia will be shown on a figure in the final Natural Environment Report.

The study should assess the impact of effluent on all life stages of brook trout (assumed most sensitive aquatic species and for all seasons). For example, water temperature should be assessed for all seasons.

The ACS compared water quality to the guidelines of CCME and MOECC, all of which are intended to protect the most sensitive life stage of the most sensitive species during indefinite exposure (i.e. all seasons). An evaluation of the impacts of effluent temperature on stream water temperature and brook trout in the West Credit River is provided in Appendix A.

Terrestrial Ecology

Comment #6:

Page 10 – it is recognized that Hillsburgh SPS #1 was not surveyed due to being identified after field season. This site should be surveyed as soon as possible.

Potential SPS were not compared and selected based on environmental sensitivities as were the other types of infrastructure because options were constrained due to various engineering considerations. Environmental features were still characterized at all SPS sites except #1 so that mitigation measures could be developed. Environmental features at SPS #1 should be characterized during detailed design so that mitigation measures can be developed.

The Hillsburgh SPS #1 site is located on an unopened road allowance in an urban area that is relatively disturbed, characterized by a few trees and shrubs. It is also in a proposed development area that will be subjected to further study before approvals. We recommend that a breeding bird survey be carried out at the site during detailed design. A characterization of its Ecological Land Classification community can likely be completed based on aerial photography. The site does not appear to provide suitable habitat for breeding amphibians.

Comment #7:

Page 29 – The NAI are based on current surveys (i.e. less than 20 years old). Although the surveys may identify ESA reports, wetland evaluations and Forest Resource Inventories (FRI) they were not the main source of information. The report should be revised accordingly. Location of the NAI survey should be shown on a Figure.

An identification of any Significant Wildlife Habitat (Candidate or Confirmed) within this study area based on Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E should be undertaken. As well as any significant woodlands should be identified.

Mapping reference to the location(s) of NAI areas will be added to the report. This information will be added to the ELC mapping if shapefiles are available through CVC. If not available, copies of the CVC mapping will be added to the report. The report will further discuss that the NAI mapping was reviewed as part of the background and then limits were refined were applicable at the site specific level (i.e., in areas adjacent to the survey sites).

We discussed several confirmed Significant Wildlife Habitats (based on our field surveys) in the report (i.e., Area-Sensitive Bird Breeding Habitat, Open Country Bird Breeding Habitat, Shrub/Early Successional Bird Breeding Habitat). We will add text to indicate that other candidate Significant Wildlife Habitat may also be present, as identified by the presence of specific ELC communities (e.g., Raptor Wintering Area, Woodland Raptor Nesting Habitat, Bat Maternity Colonies) and identify recommended mitigation measures to avoid negative impacts on these features.

Comment #8:
Page 34 – The location of the rare/uncommon plants should be shown on a Figure.

Rare/uncommon plants will be added to figures. Those species with accurate UTMs will be represented by point data, others will be referenced by ELC community.

Comment #9:
Page 51 – Further discussion is needed with respect to the location of WWTP with respect to SAR and the proposed pit for Site 2. The information from the proposed pit should be used to supplement the information already collected.

WWTP 1, 2A and 2B were assessed in the Natural Environment Report, while 1, 2A, 2B and 2C were considered in the WWTP Technical Memorandum. Site 2C was not assessed in the Natural Environment Report because it was added for consideration after completion of the report. Existing documentation exists that was used to characterize natural heritage features on the site but a comparison of historic conditions with conditions characterized during field surveys completed in 2017 does not represent a like-for-like comparison during site selection.

Site 2C appears to contain many of the same features as Sites 2A and 2B so similar mitigation measures will be required to minimize impacts. If Site 2C is ultimately selected as the preferred site, opportunity exists to characterize natural heritage features through background review and field surveys as part of the detailed design. The limitations associated with the assessment of 2C will be included in the final Natural Environment Report.

Comment #10:

Page 53 – Please confirm if the trailway is a break in woodland communities (i.e. greater than 20 metre) between tree branches. If not then the woodland should be map as one contiguous feature.

The report identifies mitigation measures for impacts to wetland characteristics but not for rare or uncommon species. The report should use a consistent approach.

Linear breaks in areas of woodlands (e.g., rail trail) will be reviewed to determine whether there is a recognized break based on a 20 m width. This will be reviewed in conjunction with the County of Wellington significant woodland mapping. The ELC mapping will be updated in areas where there are contiguous woodlands that are not divided or fragmented by a linear corridor and the mapping will reflect that these woodlands are connected (e.g., an arrow linking the adjacent ELC polygons)

Further mitigation recommendations will be provided, such as rare plant transplanting, for all significant natural heritage features (i.e., not only wetlands). For example, for significant woodlands this may include the need for edge management.

Comment #11:
Page 55 – For Forceman Alternative #2 and Forcemain #3 although they may be in the ROW this does not mean that there will not be impacts to wetlands, woodlands and associated functions (i.e. these features may be within the ROW). The report needs to be updated to address this issue.

Forcemain Alternative #1 was the preferred forcemain route selected in Pumping Stations and Forcemains Technical Memorandum (Ainley Group 2017) *so the impact assessment associated with Forcemain Alternatives #2 and #3 is not likely to be realized. Nonetheless, installation of the Forcemains would likely occur within the shoulder of the road because of various engineering considerations. If installation occurred outside of this area more impacts would be anticipated and would need to be addressed during detailed design. These qualifications will be included in the final Natural Environment Report.*

Comment #12:
Page 57 – As part of the mitigation options more discussion is needed with respect to location of the SPS and forcemains, restoration plans, construction techniques, etc.

Potential SPS were not compared and selected based on environmental sensitivities as were the other types of infrastructure but environmental features were still characterized so that mitigation measures could be developed. Additional mitigation options will be discussed in the final Natural Environment Report such as rare plant transplanting, for all significant natural heritage features (i.e., not only wetlands) but it should be noted that detailed mitigation requirements should be developed during detailed design and captured in an "Environmental Management Plan" for the project in order to obtain all required permits.

Comment #13:
Page 58 – The removal of the SPS should be through the EA process not just through Natural Environment Report.

The Owner of Site 1A did not grant access for the geotechnical work and so Site 1A was removed from consideration. Ainley will clarify this in the Sewage Pumping Station Technical Memorandum.

Comment #14:
Page 60 – Environmental Criteria should include Significant Woodlands. Impacts for the SPS should include construction access and area of impact, maintenance access. Did any other criteria be screened for the pumping stations for e.g. natural hazards.

Potential SPS were not compared and selected based on environmental sensitivities as were the other types of infrastructure but environmental features were still characterized so that mitigation measures could be developed.

Significant woodlands will be assessed per mapping and criteria listed in the County of Wellington Official Plan (County of Wellington 2017), and included as a criterion where applicable.

Impacts associated with maintenance access and other details is best determined during detailed design as those construction details have yet to be developed. Ainley has indicated that SPS sites were generally identified as suitable based on topographical (lowest elevation supporting gravity flow) and property considerations. Floodplain mapping was also considered. Property requirements were identified, however access and site development will all be based on a more detailed Environmental Management Plan prepared in support of approvals from MOECC and CVC.

<u>Monitoring</u>

Comment #15:
Section 4.4 states:

Effluent will be treated to the limits proposed in HESL (2017) following approval by MOECC and will be regulated through Environmental Compliance Approval (ECA) for the Erin WWTP. This will assure that effluent is not acutely lethal at the point of discharge, that water quality in the West Credit River meets water quality objectives, will minimize the mixing zone and ultimately avoid impacts to aquatic life.

A monitoring plan should be developed in combination with the regulatory WWTP effluent monitoring to assess the response of the river to the effluent discharge. The monitoring plan will ultimately be reviewed by CVC and regulated through the ECA and should include an assessment of fisheries, benthic invertebrates and aquatic habitat with sufficient effort to allow for natural variability to be controlled and allow for a sensitive determination of any impact.

Further discussion is recommended to determine the objectives, goals, and time lines for this instream monitoring program. It is recommended that impact levels for key monitoring parameters be determined during the monitoring design and mitigated actions be clearly understood.

Details associated with the monitoring program will be developed during the ECA process with MOECC and will include consultation with CVC.

West Credit Assimilative Capacity Study Final – December 2017

Comment #16:
Staff have worked with Hutchinson Environmental Sciences on previous drafts of the documents. We would just like to reiterate that the results show that under full build out effluent flows, instream chloride concentrations will exceed aquatic guidelines for chronic exposure. At the present time, it is not technically feasible to remove chloride in the treatment process; therefore the emphasis should be placed on controlling the input of chloride at the source. It is recognized that water softeners are a significant source of chloride/salts in the wastewater stream specifically in areas on groundwater drinking water supply.

It is recommended that the Erin Urban Centre Wastewater Servicing Class Environmental Assessment Environmental Study include conditions such as:

- New Developments: Subdivision agreements for new development areas to include conditions to require the installation of high efficiency water softeners.
- Existing Developments: There is a potential for funding to be available to private residents to upgrade plumbing infrastructure on private property to tie into the new sewer lines. It is recommended that the installation of high efficiency water softeners be part of the plumbing upgrades included in the funding model.
- Education Program: There will be the need for continuous education to Erin residents during the implementation of new wastewater servicing in the Town. CVC can provide information in different media formats on how residents can minimize their environmental impacts on their own property including the installation of high efficiency water softeners.

MOECC have commented on the chloride issue, most recently in Review of December 6, 2017 Assimilative Capacity Study Town of Erin Proposed Wastewater Treatment Plant (March 9, 2018) under Comment #2:

"An effluent criterion for chloride will not be required. However, we intend to advise our approvals staff to include a condition in any future approval under Section 53 of the Ontario Water Resources Act that chloride be monitored in the influent, effluent, and receiving water. The Ministry recommends that a contingency plan be developed for the management of chloride when it exceeds the long-term Canadian Water Quality Guideline of 120 mg/L in the receiving water. Costs associated with the implementation of the contingency plan should be estimated and included as part of the total project cost. The Ministry also supports the recommendations provided by Credit Valley Conservation in their May 10, 2017 memo suggesting the use of high efficiency water softeners at the household level as a means of reducing chloride loads at source."

Chloride concerns were previously addressed in West Credit River Assimilative Capacity Study (HESL 2017) on page 49-50:

"The predicted downstream fully mixed chloride concentrations in the West Credit River are 121 mg/L and 180 mg/L for Phase 1 and Full Build Out respectively using the maximum effluent chloride concentration of 534 mg/L and 7Q20 conditions. The Phase 1 concentration is just above the chronic (long-term) CWQG of 120 mg/L, and the Full Build Out concentration of 180 mg/L is 60 mg/L above the chronic CWQG. Using

average effluent chloride concentrations, the predicted chloride concentrations in the West Credit River are below the CWQG of 120 mg/L for Phase 1 (100 mg/L, Table 20), and 22 mg/L above the CWQG for Full Build Out (142 mg/L, Table 20). Under both conditions, the predicted receiver concentrations are well below the acute toxicity threshold of 640 mg/L.

These Cl concentrations were predicted using 7Q20 flows and so do not represent expected concentrations for the long-term indefinite exposures that are relevant to the CCME guideline of 120 mg/L. Exposure to the predicted concentrations (slightly above CCME) would be for brief periods (7 days every 20 years) and aquatic life would be exposed at concentrations well below the short-term exposure CCME guideline of 640 mg/L. We recommend that chloride concentrations in the WWTP influent and effluent be voluntarily monitored by the Town and, if these concentrations approach those used for the mass balance calculations, that the Town consider implementing a public education program focusing on the use of water softeners to mitigate chloride discharge to the sewage system as water softeners are the primary source of chloride levels in wastewater in these areas.

The Town may also consider a road salt and de-icing management and education program. While this would not address chloride source control, it may have a beneficial impact on background chloride concentrations in the West Credit River."

Relevant parties are well aware of the chloride issue and the opportunity exists to implement appropriate monitoring and mitigation measures during the ECA process.

Thermal Impact Assessment

Comment #17:
Page 45 – The original 2016 Assimilative Capacity Study (ACS) workplan refers to water temperature QUAL2K modelling that will be completed as part of the ACS final assessment. The Final Assimilative Capacity Study (December 2017) includes a brief assessment of summer conditions. It is recommended that year round thermal impact assessment be completed to determine the potential impacts during critical life stages in the winter/spring/fall periods in addition to summer conditions. This should also include the determination of the thermal mixing zone at both proposed outfall locations and an assessment of impacts.

An assessment of the thermal impacts of effluent on the West Credit River and Brook Trout is provided in Appendix A. It concludes that the temperature changes resulting from the WWTP discharge will not "significantly change the distribution and abundance of plant and animal life" per the Provincial Water Quality Objective.

Hutchinson
Environmental Sciences Ltd.

1-5 Chancery Lane, Bracebridge, ON P1L2E3 | 705-645-0021

April 11, 2018 HESL Job #: J160005

Tara McKenna
Ministry of Natural Resources and Forestry, Guelph District
1 Stone Road West
Guelph, ON N1G 4Y2

Dear Ms. McKenna:

Re: Town of Erin Urban Centre Wastewater Servicing Class Environmental Assessment – Draft Natural Environment Report – Town of Erin, County of Wellington – Response to MNRF Comments

The Ministry of Natural Resources and Forestry provided a variety of comments on *Town of Erin EA Natural Environment Report* (Hutchinson Environmental Sciences Limited (HESL) 2017) and associated technical memoranda focused on site selection of different types of proposed infrastructure. Our responses focused on:

1) Increasing MNRF's understanding of the objectives and scope of the EA through written responses and by providing *West Credit River Assimilative Capacity Study – Final Report – December 2017 Update* (HESL 2017).

2) Explaining rationale for the characterization of natural heritage features and functions, and the assessment developed to select preferred locations for various infrastructure.

3) Acknowledging MNRF comments that will improve the completeness of this portion of the EA and better align the work with relevant policies.

We will finalize the Natural Environment Report based on the comments and responses provided here-in but please contact Brent Parsons if you have any further questions or concerns.

Sincerely,
Hutchinson Environmental Sciences Ltd.

Brent Parsons, M.Sc.
brent.parsons@environmentalsciences.ca

The Ministry of Natural Resources and Forestry (MNRF) provided a variety of comments on *Town of Erin EA Natural Environment Report* (Hutchinson Environmental Sciences Limited (HESL) 2017[1]), *Technical Memorandum Wastewater Treatment Plant Site Selection* (Ainley Group 2017[2]), *Technical Memorandum Effluent Outfall Site Selection* (Ainley Group 2017[3]), *and Pumping Stations and Forcemains Technical Memorandum* (Ainley Group 2017[4]). Our responses to the comments can be found on the following pages in *italics*. Some of the MNRF comments, as identified, are more appropriately addressed by the Ainley Group.

<u>Location of WWTP Alternatives</u>

Comment #1:
The treatment plant alternatives are limited to three sites located at the same intersection – 10th Line and Regional Road 52. MNRF recommends that alternatives at different intersections across the subwatershed, with different aquatic sensitivities, be explored. MNRF staff would appreciate further clarification and discussion regarding the assessment undertaken for the location options.

Ainley Group has provided a response to this.

<u>Brook Trout Habitat Assessment</u>

Comment #2:
It is understood that the spawning assessment surveys completed for brook trout only went 500m downstream of Winston Churchill Boulevard. MNRF staff recommends that surveying 1.5 km would make for a better comparison.

The near-field mixing zone where water quality parameters have been modelled to exceed Provincial Water Quality Objectives (PWQO) was predicted to be 152 m long and occupy 40% of the channel width over this distance (HESL 2017[5]). PWQO are designed to be protective of all aquatic species at all life stages, including brook trout. The determination of the near-field mixing zone was also based on utilization of 7Q20 flows which are exceeded 99.5 – 99.9% of the time (Pyrce 2004[6]). The spawning assessment survey characterized the number of redds throughout the near-field mixing zone at all potential effluent outfall locations where PWQO could be exceeded during 7Q20 flows. This assessment is conservative and although a survey which includes assessment 1.5 km downstream of Winston Churchill Blvd. would be interesting from a research nature, it would not be overly informative for the selection of a preferred effluent outlet location as part of the Class EA because the 152m zone of water

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[1] Hutchinson Environmental Sciences Ltd. 2017. Town of Erin EA Natural Environment Report. Prepared for the Ainley Group.

[2] Ainley Group. 2017. Town of Erin Urban Centre Wastewater Servicing Class Environmental Assessment Technical Memorandum Wastewater Treatment Plant Site Selection Draft. Prepared for the Town of Erin.

[3] Ainley Group. 2017. Town of Erin Urban Centre Wastewater Servicing Class Environmental Assessment Technical Memorandum Treated Effluent Outfall Site Selection Draft. Prepared for the Town of Erin.

[4] Ainley Group. 2017. Town of Erin Urban Centre Wastewater Servicing Class Environmental Assessment Technical Memorandum Treated Effluent Outfall Site Selection Draft. Prepared for the Town of Erin.

[5] Hutchinson Environmental Sciences Ltd. 2017. West Credit River Assimilative Capacity Study Final Report – December 2017 Update. Prepared for the Ainley Group.

[6] Pyrce, R.S. 2004. Considering baseflow as a low flow or instream flow. WSC Report No.04-2004 Appendix, Watershed Science Centre, Peterborough Ontario, 17 p.

quality impact from the proposed outfall lies entirely within the 500m portion of the river surveyed at each location.

Comment #3:
Emphasis in the reporting is placed on the use of brook trout spawning assessments to assist in the location of an outfall. MNRF staff note that brook trout rely on groundwater upwelling during incubation, not surface water. However, brook trout fry, fingerlings and adults are very sensitive to ammonia and nitrates from an outfall. See the Canadian Council of Ministers of the Environment guides for ammonia and nitrate (attached in the email). Alternative locations of outfalls that avoid use of mixing zones in brook trout reaches should be considered.

PWQO are designed to be protective of all aquatic species at all life stages, including the impacts of ammonia and nitrate on brook trout fry, fingerlings and adults. Our ACS was completed with full consideration of the CCME guidelines and showed that guidelines would be met within 152m of the outfall.

The reach of the West Credit River between 10th Line and Winston Churchill was previously approved by MOECC and CVC as the preferred location of an effluent outfall because of water volumes and water quality in this area. Our field work showed brook trout spawning throughout the preferred reach of river, and our analysis was focused on selecting an outfall location between the 10th Line and Winston Churchill Blvd that was the least sensitive based on environmental features.

In addition, the MOECC approved effluent criteria for ammonia and nitrate were established through the Assimilative Capacity Study and the proposed treatment plant technology includes nitrification and denitrification to remove ammonia and nitrate from the effluent.

Also, see Ainley Response to #1.

Comment #4:
Table 2 lists the fish species of the West Credit. Atlantic salmon have not been included. MNRF staff note that this species is stocked annually as fry at Winston Churchill, and should be included. In addition, the table is limited to thermal sensitivity. MNRF staff recommends that Table 2 should be expanded to include chronic sensitivity to ammonia, nitrate and chloride.

Atlantic salmon will be added to Table 2.

All resident fish species will be protected through the effluent criteria recommended in the ACS. Effluent treatment criteria were determined through the ACS and comparison with PWQO and the Canadian Water Quality Guideline for chloride. These water quality guidelines are designed to be protective of all aquatic species at all life stages, and any impacts of ammonia, nitrate and chloride on Atlantic Salmon, as well as brook trout fry, fingerlings and adults were inherently considered in our analyses.

Comment #5:
The maximum summer water temperatures of effluent proposed is 19C, which is over the optimum for brook trout growth but within the maximum tolerance levels. Based on temperature data from Credit

Valley Conservation (CVC) dated February 5, 2018, this would increase the temperature slightly at Winston Churchill Boulevard throughout the summer months and increase the temperature at 10th Line in May and June but decrease it in July and August. Please clarify what the effluent temperature is proposed to be during the spawning season for brook trout (i.e. October to December).

An assessment of the thermal impacts of effluent on the West Credit River and Brook Trout is provided in Appendix A. It concludes that the temperature changes resulting from the WWTP discharge will not "significantly change the distribution and abundance of plant and animal life" per the Provincial Water Quality Objective.

Comment #6:
MNRF staff is of the opinion that more details are needed on by-pass events, and that potential impacts should be more thoroughly quantified.

Ainley has provided a response to this.

Comment #7:
The report notes a 0.045mg/L limit of phosphorus, however, it was noted in the West Credit River Subwatershed Study that the criteria should be no not net increase in total phosphorus to the Lower Great Lakes. MNRF recommends that the EA should address whether this limit meets this constraint.

The statement from the West Credit River Subwatershed Study should also be considered in light of the recent Environment and Climate Change Canada[7] finding that "Phosphorus levels are too low in the offshore waters of Lake Ontario, Lake Huron and Georgian Bay. Since 1972, levels have decreased to a point where preyfish populations are declining."

The ACS was completed to the requirements of MOECC Policy as outlined in MOE (1994a, 1994b). MOECC Policy 1 for surface water quality allows alteration of a river up to the PWQO of 0.03 mg/L for total phosphorus. The proposed effluent limit of 0.045 mg/L will only increase total phosphorus concentration in the river from the current value of 0.016 mg/L to 0.024 mg/L. The scope of the Assimilative Capacity Study/effluent requirements in relation to the Policy 1 status on the West Credit River was confirmed with MOECC at the Core Management Team Kick Off Meeting on March 8, 2016 (meeting minutes attached).

The recommendations from the ACS therefore represent a conservative and protective approach to water quality in the West Credit River and its receiver, Lake Ontario.

Comment #8:
The habitat in this area has also already been impacted by the culvert, and the initial mixing zone would be within the culvert. It would be beneficial to know how long the culvert is and the percentage of mixing zone that would be within the culvert.

[7] *Environment and Climate Change Canada (2017) Canadian Environmental Sustainability Indicators: Phosphorus levels in the offshore waters of the Great Lakes. Available at: www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=A5EDAE56-1.*

The culvert is approximately 45 m long and would occupy 30% of the 152 m near-field mixing zone at full build-out as defined by ammonia modeling in the Assimilative Capacity Study (HESL 2017[8]). We agree that the culvert does not represent ideal habitat and this supports our recommendation to locate the outfall at Winston Churchill Blvd.

<u>Significant Wildlife Habitat</u>

Comment #9:
The NER appears to be missing mapping of deer wintering areas in the study area, which would represent Significant Wildlife Habitat (SWH). The West Credit River between Erin and Belfountain is considered a deer wintering area. This should be included in the report, with consideration of any potential impacts.

We anticipate that little impact to deer wintering habitat will be projected since the sewage pumping stations and sewers are all located in urban environments and along roads. The forcemain is proposed to be located along the Cataract Trail, the WWTP within altered fields, and the outfall at Winston Churchill Boulevard. Deer wintering areas will however be assessed per requirements in Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E (MNRF 2015[9]) in the final Natural Environment Report.

Comment #10:
All three sites reviewed in the NER also provide Savannah Sparrow habitat (SWH Open Country Bird Breeding Habitat), and should be considered in the report.

Savannah Sparrow was recorded during breeding bird surveys in Sites 1 and 2B and in the fields adjacent to Forcemain Alternative 1. The species, its conservation status and habitat requirements, as well as proposed mitigation measures to avoid impacts on it, are discussed in the following sections of the NER: Section 3.2.5 Breeding Birds, Section 4.1.2 Terrestrial Ecology, Section 4.3.2 Potential WWTP, Section 4.3.3.1 Forcemain Alternative 1, Section 4.4.2.3 Landscaping and Restoration, and Section 5.2 Impact Assessment and Preferred Alternatives.

<u>Species at Risk</u>

Comment #11:
The SAR section of the NER does not appear to have considered SAR bats. A number of maps in Appendix B include candidate Ecological Land Classification communities that would support SAR bats. However, if the outfall site is constructed full within the right-of-way as proposed, MNRF does not anticipate impacts to the habitat. MNRF would appreciate clarification whether tree removal will be required, and if so, how much.

SAR bats were not reported by MNRF in the Wellington Region or during NHIC review, so habitat requirements of these species were not assessed. Potential habitat for SAR bats includes mixed wood or

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[8] Hutchinson Environmental Sciences Ltd. 2017. West Credit River Assimilative Capacity Study – Final Report – December 2017 Update

[9] Ministry of Natural Resources and Forestry. 2015. Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E.

deciduous trees and treed swamps that contain many large diameter cavity trees. The locations of the proposed infrastructure contains very little appropriate habitat, partly because infrastructure will be constructed within disturbed areas or meadows, and as a result, consideration of SAR bat habitat would not have swayed site selection. Nonetheless, SAR bat habitat will be assessed per requirements in Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E (MNRF 2015[10]) in the final Natural Environment Report.

An arborist report of all affected areas will be prepared as part of an overall Environmental Management Plan for the project during the design stage.

Comment #12:
MNRF note that the NER has included a mitigation measure of construction outside of the breeding period for birds. MNRF recommends that the timing window include the roost season for bats in this mitigation measure (i.e. no tree removal from April 30th to Sept. 30th) and to limit construction to daylight hours during the same period.

The construction timing windows will be expanded to include the roosting season for bats in the NER.

Comment #13:
MNRF staff agrees that where possible, all SPS should be located close to the road to limit habitat impacts.

Comment #14:
MNRF note that Site 1 may be considered Eastern Meadowlark habitat as the NER notes that this species was heard calling on the first site visit. It is recommended that either another Eastern Meadowlark survey should take place or registration under O. Reg. 424/08 s.23.6 should be considered.

Site 1 consists of a variety of open habitats, including fields with shrub vegetation close to the road and grassland further back from the road. At this point it is not clear where the proposed footprint for the WWTP would be located on Site 1 (if this site is selected). If the WWTP is located close to the road then the development footprint will likely not overlap with the grassland habitat that provides suitable habitat for Eastern Meadowlark. However, if it is sited further to the east, it will likely overlap with potential Eastern Meadowlark habitat. Once the exact location is known we propose conducting additional bird surveys in the affected habitat to document whether any species at risk and sensitive species are present (such as Eastern Meadowlark, Bobolink, Savannah Sparrow) and formulate potential mitigation plans should they be required.

The NER was part of the Class EA process to compare alternative sites for the WWTP and the level of detail provided is considered sufficient to support the conclusions. A more detailed assessment of the selected site (including screening of sensitivities in relation to the actual footprint of the WWTP) will occur at the next stage.

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[10] *Ministry of Natural Resources and Forestry. 2015. Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E.*

Comment #15:
It is unclear from the NER whether surveys were completed for Gypsy Cuckoo Bumblebee or Rusty-patched Bumblebee, which were noted in the report as having potential to occur in the study area. MNRF would appreciate clarification.

Surveys were not completed for Gypsy Cuckoo Bumblebee or Rusty-patched Bumblebee. The Rusty-patched Bumblebee was reported in the Wellington Region but not in the study area while Gypsy Cuckoo Bumblebee was noted in the study area, but not since 1979. Both species have suffered rapid, severe population declines as only three "recent" Gypsy Cuckoo Bumble Bee sites are known to occur in Ontario (MNRF 2017[11]) and one sighting of Rusty-patched Bumblebee in Canada since 2002 at the Pinery Provincial Park on Lake Huron despite widespread surveys in Ontario (Colla and Taylor-Pinder 2011[12]).

Instead, we assessed the habitat requirements of each species and considered these habitat requirements during site selection but unfortunately both species are habitat generalists, so habitat preferences did not dictate site selection. Site-specific surveys could be completed in the future during detailed design if warranted.

<u>Other Comments</u>

Comment #16:
Multiple SPS are to be located within 120m of Provincially Significant Wetland or other wetlands; they should be constructed as per the recommendations to maintain wetland hydrology and water quality. Any SPS that are to be located near amphibian habitat should avoid construction from March to October.

Agreed and already included in the NER.

Comment #17:
MNRF staff would appreciate receiving a copy of the West Credit River Assimilative Capacity Study (HESL, 2017) and the Assimilative Capacity Study (B.M. Ross, 2014) which were referenced in the NER.

The ACS has been sent as requested.

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[11] *Ministry of Natural Resources and Forestry. 2017. Gypsy Cuckoo Bumble Bee in Ontario. Ontario Recovery Strategy Series.*

[12] *Colla, S.R. and Taylor-Pinder, A. 2011. Recovery Strategy for the Rusty-patched Bumble Bee (*Bombus affins*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. Vi + 21 pp.*

Hutchinson
Environmental Sciences Ltd.

1-5 Chancery Lane, Bracebridge, ON P1L 2E3 │ 705-645-0021

Meeting Minutes

Date: **May 30, 2016**

Location: **MOECC, 1 Stone Road, 3rd Floor, Room 305, Guelph**

Re: **J160005 – Erin Class EA – Assimilative Capacity Study Pre-Consultation Meeting**

Present:

Barbara Slattery (MOECC)
Craig Fowler (MOECC)
Manpreet Dhesi (MOECC)
Jennifer Dougherty (CVC)
Liam Murray (CVC)
John Sinnige (CVC)
Christine Furlong (Triton)
Ray Blackport (Blackport)
Gary Scott (Ainley)
Deborah Sinclair (HESL)
Neil Hutchinson (HESL)
Tara Roumeliotis (HESL)

Regrets: **Tim Mereu (CVC), Joe Mullan (Ainley)**

The purpose of the meeting was to review the ACS work plan with stakeholders and discuss any questions or concerns with the proposed approach (modelling, field investigations and analyses).

AGENDA

1. Introductions
2. Background
3. Review ACS work plan and tasks
4. Feedback and agreement on approach
5. Schedule and meetings
6. Additional items

ACTION ITEMS

Item	Description	Action
1	- Check the *Erin Servicing and Settlement Master Plan; Phase 1 – Environmental Component – Existing Conditions Report* ("Existing Conditions" report), May 2011, for raw data needed.	HESL
2	- Provide HESL with raw water quality data for 10th Line and Winston Churchill Blvd. that was used in the BM Ross preliminary ACS. Provide HESL with any additional water quality data acquired since that report (i.e., 2013 and onward)	CVC (Jennifer Dougherty)
3	- Provide group with updated 7Q20 memorandum within approximately 2 weeks.	CVC (John Sinnige)
4	- Confirm wastewater effluent flow for ACS - expected by end of summer	Ainley (Gary Scott)
5	- Measure flows at Winston Churchill and 10th Line during water quality sampling events for comparison - Evaluate need for to add chloride analyses to future water quality sampling events - Evaluate need to deploy pH logger in Credit River for diurnal pH cycle.	HESL

DISCUSSION NOTES

- Regarding additional data for the 10th Line (at West Credit River) station – CVC reported that there was no new water quality data for this station in 2013 through 2015. Only new water quality data is for the PQWMN station at Winston Churchill Blvd.
- CVC reported that they have a temperature gauge at 10th Line and at Winston Churchill Blvd.
- Septic Impact chapter in the *Erin Servicing and Settlement Master Plan; Phase 1 – Environmental Component – Existing Conditions Report* ("Existing Conditions" report), May 2011 provides flows measured by CVC at 10th Line and Winston Churchill Blvd. HESL to review report for raw flow data.
- Jennifer Dougherty (CVC) will provide HESL with any other raw data that BM Ross used in their preliminary ACS and that is not provided in the Existing Conditions report.
- John Sinnige provided an update on the 7Q20 calculation:
    - The rating curve for the 10th Line flow station is continually updated.

- CVC are using the 8th Line gauge as well as transposing the 10th Line data with the Belfountain WSC station, which has about 15 years' worth of data.
- The two gauges will give a lot more comfort in the 10th Line 7Q20.
- CVC are currently in the process of revising the extrapolation.
- Currently looking like the 7Q20 will remain the same or go up slightly.
- CVC hope to have the 7Q20 memorandum ready for peer review in two weeks and will email this out to the group. Ray Blackport to provide review. MOECC may potentially comment.

- HESL asked if anyone had completed water quantity measurements at 10th Line and Winston Churchill in order to better understand the rates of groundwater discharge to the West Credit River within this reach. Ray Blackport reported collecting some spot flow measurements at both 10th Line and Winston Churchill.
- HESL recommended that water quality be modelled at 10th Line, since this will be a more conservative location than Winston Churchill Blvd (which has higher flows due to groundwater inputs and has been shown to have better water quality).
- Craig Fowler asked if HESL intended to start the ACS process over. HESL responded that the intention was to build on the preliminary ACS work completed by BM Ross.
- Craig Fowler inquired about the wastewater flow predictions in the BM Ross preliminary ACS of 435 L/person/day, including I/I.
    - Christine Furlong explained that BM Ross looked at water taking records to estimate wastewater flows; that 435 L/person/day is a conservative estimate. Also noted that 450 L/person/day is the MOECC maximum recommended design wastewater flow.
    - HESL asked Gary Scott to confirm the wastewater effluent flow that should be used in the ACS.
    - Gary Scott noted that the starting point for deriving the effluent flow is 2,610 m^3/d for 6,000 people, and that it will be an iterative process.
    - MOECC requested that the ACS is not submitted for review until the final effluent flows are confirmed.
    - CVC requested to Ainley to be a part of the discussion on population serviced, who will remain on septic, etc.
    - Town of Erin would like some growth in Hillsburgh on partial services – on municipal water and private septic.
- HESL raised question as to whether modelling seasonal discharge at proposed WWTP was still desired. Christine Furlong clarified that seasonal discharge was recommended for consideration during the SSMP and therefore it needed to be included in the ACS.
- CVC suggested that HESL complete diurnal pH monitoring in West Credit River, in addition to the DO and temperature monitoring that is already planned.
    - CVC noted that they had completed continuous pH monitoring in West Credit River, which may be presented in the Existing Conditions report. If not, HESL will request this data from CVC, and assess need to deploy pH logger
- HESL noted that dye tracer study will be conducted at 10th Line. Group requested that HESL also conduct the dye tracer study at Winston Churchill station and HESL agreed.

- In preparation for the dye tracer study, agencies and media will be notified. HESL will prepare a media release, which will be provided to Ainley and Triton for distribution. HESL to let Craig Fowler know when dye tracer study will take place.

- CVC suggested that chloride be added as a parameter of interest to the ACS modelling exercises.
  - HESL to review need to analyse water samples collected at 10th Line for chloride analysis
- HESL noted that there is not much value in completing the ACS for three discharge locations since results will not vary significantly. CORMIX modelling will be completed for a 10th Line discharge, as the most conservative location. If future discharge location recommendations change, the CORMIX modelling can be re-run easily.
- HESL noted that the Orangeville WWTP (which discharges to the Credit River) includes denitrification of wastewater and has a TN limit of 15 mg/L.
- Group approved the ACS work plan put forward by HESL, with the following comments:
  - The MOECC recommended against any radical changes in the ACS from what BM Ross has completed. The MOECC had approved in principal what BM Ross had put forward in the preliminary ACS. West Credit River is a Policy 1 receiver.
  - CVC supports the proposed diurnal DO studies.
- Ainley noted that the first PIC meeting is scheduled for mid-November and will cover the following items:
  - Service area
  - Type of collection system
  - Population numbers
  - Discharge and plant location (3 options)
- MOECC noted that they would prefer to not be involved in the whole ACS process, but would rather just review the finalized ACS report.
- With respect to the draft effluent limits, to be recommended in the draft ACS, MOECC requested that they be sent a copy of these for possible comment, but do not necessarily need to come to a meeting on the limits.
  - MOECC noted that they do not need to peer review the 7Q20 if the number was calculated based on sound science and peer-reviewed by Ray Blackport.
- CVC raised a concern regarding the potential cumulative effects of septic system discharge to the watershed from the planned partial servicing at Hillsburgh. CVC noted that the Hillsburgh reach of the West Credit River is very small with elevated nitrate concentrations. Discussion included:
  - the observation that the net effect of the EA was to remove septic systems from the watershed by servicing the Town of Erin
  - the suggestion was that any septic servicing at Hillsburgh would require state of the art tertiary treatment and that developers would be informed of this.
- CVC requested a separate meeting to discuss/address cumulative impact of new septic systems within Erin and Hillsburgh since it was identified in the meeting that it was outside the scope of the current EA.
- Liam Murray asked the group if it would be an issue to the ACS predictions if the Erin and Hillsburgh ponds are taken offline. HESL responded that water quality would be expected to improve if the ponds were taken offline.

- Liam Murray noted that there is a new gravel pit in Peel, near Winston Churchill Blvd. To the group's knowledge, there are no water taking operations occurring at the new gravel pit.
- Christine Furlong noted that that next project meeting should include the CORE Management Team.
- The meeting was adjourned at 1215 PM.

April 11, 2018 HESL Job #: J160005

Barbara Slattery
Ministry of Environment and Climate Change, West Central Region
119 King Street West
12th Floor
Hamilton, Ontario L8P 4Y7

Dear Ms. Slattery:

Re: Review of Town of Erin Class EA Proposed Wastewater Treatment Plant Supporting Studies

The Ministry of Environment and Climate Change provided a variety of comments on *West Credit River Assimilative Capacity Study – Final Report – December 2017 Update* (HESL 2017), *Town of Erin EA Natural Environment Report* (Hutchinson Environmental Sciences Limited (HESL) 2017) and *Effluent Outfall Site Selection Technical Memorandum* (Ainley Group 2017).

Our responses focus on increasing MOECC's understanding of the objectives and scope of the Class EA and explaining the assessment developed to select preferred locations for various infrastructure.

We will finalize the Natural Environment Report based on the comments and responses provided here-in but please contact either of the undersigned if you have any further questions or concerns.

Sincerely,
Hutchinson Environmental Sciences Ltd.

Brent Parsons, M.Sc.
brent.parsons@environmentalsciences.ca

Deborah Sinclair, M.A.Sc.
Deborah.sinclair@environmentalsciences.ca

The Ministry of Environment and Climate Change provided a variety of comments on *West Credit River Assimilative Capacity Study – Final Report – December 2017 Update* (HESL 2017), *Town of Erin EA Natural Environment Report* (Hutchinson Environmental Sciences Limited (HESL) 2017) and *Effluent Outfall Site Selection Technical Memorandum* (Ainley Group 2017) on March 9, 2018. Our responses to the comments can be found on the following pages in *italics*. Some of the responses, as identified, are more appropriately addressed by the Ainley Group.

Comment #1: Our position is that the assessment of thermal effects resulting from the proposed effluent discharge on the receiving water is inadequate. To date, no detailed thermal effects were analyzed as to the potential impacts on growth, survival and reproduction of Brook Trout since each stage of the life cycle of Brook Trout requires a distinct thermal regime. As the thermal effects analysis was restricted to the month of August, it did not provide a complete understanding of the effects of the effluent discharge on the various life stages of Brook Trout populations throughout the years. Accordingly, the Ministry recommends that the current evaluation of thermal impacts be expanded to capture impacts at other crucial times of the year. The evaluation should also include the development of reasonable and effective mitigation measures that can be implemented if changes in ambient temperatures are determined to have the potential to impair established Brook Trout resources.

An assessment of the thermal impacts of effluent on the West Credit River and Brook Trout is provided in Appendix A. The following conclusions were made in the assessment.

The proposed effluent outfall diffuser will be placed approximately 2m upstream (i.e. south) of the large culvert that transmits flows beneath Winston Churchill Blvd. The culvert is approximately 45m long and represents degraded habitat because it is permanently shaded, doesn't permit macrophyte growth and limits the form of the stream bed and width of the channel.

The predicted increases in temperature in West Credit River downstream of the outfall as predicted through mass balance modeling are minimal. In the short-term (Phase 1), fully mixed water temperatures are predicted to stay the same (July) or increase up to 0.9ºC. Fully mixed water temperatures during Brook Trout spawning (October) and egg development (November to March) will remain well below their upper tolerance temperatures.

In the longer-term (Full Build out, > 20 years), fully mixed water temperatures are predicted to increase by a maximum of 1.7ºC. Except for July, water temperatures will remain below their upper tolerance thresholds for the various life stages. The nominal increase (0.2ºC) in July water temperature is not expected to affect the growth life stage of the local Brook Trout population for the following reasons:

1. *Brook Trout in this reach have acclimatized to water temperatures up to 24.3ºC (maximum water temperature of Winston Churchill),*
2. *Brook Trout routinely experience water temperatures of 19.3ºC in the study area,*
3. *Temperature predictions are conservative since they are focused on 7Q20 flows (which are exceeded 99.5 to 99.9% of the time; Pyrce 2004) and 75th percentile water temperatures,*
4. *Brook Trout commonly seek out thermal refugia (Ebersole et al. 2001),*

5. *Seasonal temperature cycles provide an acclimatization period for Brook Trout (Raleigh 1982), and*

6. *Fully mixed water temperatures during the sensitive spawning (October) and egg growth development (November to March) life stages will remain well below their upper tolerance temperatures.*

The maximum predicted distance to upper threshold temperatures in the West Credit River downstream of the outfall during Phase 1 as predicted through CORMIX modeling is 32m in August so increased temperatures will be constrained to degraded habitat located in the culvert. Predicted distances to upper threshold temperatures during Full Build Out are 84m in August and 715m in October but, the October distance of 715m is considered artificially high. By 35 m downstream of the diffuser (within the culvert) water temperatures are predicted to be 19.2ºC and 16.2ºC for August and October, respectively. This is only 0.2ºC greater than the upper tolerance thresholds for spawning and egg development. Any effects on Brook Trout populations will be partially mitigated in August by their ability to seek out thermal refugia, and from November - March egg and sac-fry development will not be impacted because Brook Trout commonly spawn overtop of rocky substrates and groundwater upwellings, and eggs develop within the interstitial spaces of the substrates. Groundwater inputs will not be impacted by the WWTP effluent and therefore water temperatures near these spawning and development areas and within the interstitial spaces between rocky substrates are not likely to change. Water temperature modelling is focused on the assimilation of effluent throughout the water column and not on water temperatures within or adjacent to sediments, so the prediction of impacts on spawning habitat represents a very conservative assessment of the change to water temperatures.

There are several qualifications mentioned throughout this assessment that made it conservative. Qualifications include:

1. *These predictions were made for 7Q20 low flow conditions as a conservative estimate of change - flows will be higher and temperature changes smaller 99.5% of the time.*
2. *Seasonal temperature cycles from summer highs to winter lows provide an acclimatization period to temperature extremes for Brook Trout (Raleigh 1982),*
3. *Brook Trout commonly seek out thermal refugia within streams (Ebersole et al. 2001),*
4. *Different Brook Trout strains have acclimatized to the water temperatures of their environment (Stitt et al. 2014), so it is challenging applying reported thermal tolerances of assemblages in the West Credit River when the studies were not completed on these populations,*
5. *Most importantly, Brook Trout commonly spawn overtop of rocky substrates and groundwater upwellings, and eggs develop within the interstitial spaces of the substrates. Groundwater inputs will not be impacted by the WWTP effluent and therefore water temperatures near these spawning areas and within the interstitial spaces between rocky substrates are not likely to change. Water temperature modelling is focused on the assimilation of effluent throughout the water column and not on water temperatures within or adjacent to sediments, so the prediction of impacts on spawning habitat represents a very conservative assessment of the effect of change to water temperatures.*

The Provincial Water Quality Objective for water temperature is, "The natural thermal regime of any body of water shall not be altered so as to impair the quality of the natural environment. In particular, *the diversity, distribution and abundance of plant and animal life shall not be significantly changed." (MOE 1994). Based on the results of the thermal assessment on Brook Trout, including the various conservative qualifications, we predict that these temperature changes resulting from the WWTP discharge will not "significantly change the distribution and abundance of plant and animal life" per the Provincial Water Quality Objective.*

Comment #2: An effluent criterion for chloride will not be required. However, we intend to advise our approvals staff to include a condition in any future approval under Section 53 of the Ontario Water Resources Act that chloride be monitored in the influent, effluent and receiving water. The Ministry recommends that a contingency plan be developed for the management of chloride when it exceeds the long-term Canadian Water Quality Guideline of 120 mg/L in the receiving water. Costs associated with the implementation of the contingency plan should be estimated and included as part of the total project cost. The Ministry also supports the recommendations provided by Credit Valley Conservation in their May 10, 2017 memo suggesting the use of high efficiency water softeners at the household level as a means of reducing chloride loads at source.

It is unlikely that chloride concentrations will exceed the Canadian Water Quality Guideline of 120 mg/L in the receiving water because predictions were calculated using 7Q20 flows and so do not represent expected concentrations for the long-term indefinite exposures that are relevant to the CCME guideline of 120 mg/L. Exposure to the predicted concentrations (slightly above CCME) would be for brief periods (7 days every 20 years) and aquatic life would be exposed at concentrations well below the short-term exposure CCME guideline of 640 mg/L.

We recommend that monitoring of chloride concentrations in the WWTP influent, effluent and receiver be included in the ECA and if these concentrations approach problematic levels in the West Credit River that the Town consider implementing a public education program focusing on the use of water softeners to mitigate chloride discharge to the sewage system as water softeners are the primary source of chloride levels in wastewater in these areas.

Comment #3: At this time MOECC is not able to concur with the preferred effluent outfall location being proposed for the west side of Winston Churchill Blvd for the following reasons:

i) Very limited data/information is available for the immediate downstream reach of the preferred discharge location (i.e. the approximately 1.5 km long reach from Winston Churchill Blvd. to Belfountain). All fisheries, benthic invertebrates, aquatic habitat, Brook Trout spawning survey and other river data are available from 10th Line to Winston Churchill Blvd (this reach is approximately 1.5 km long). The status of the fisheries, benthic invertebrates, aquatic habitat, Brook Trout spawning and other river data between Winston Churchill Blvd to Belfountain is not known to enable a like-for-like comparison with the upper reach.

The reach of the West Credit River between 10th Line and Winston Churchill Blvd. was previously selected as the location for a WWTP treated effluent outfall through the Town of Erin Servicing and Settlement Master Plan Final Report and in consultation with MOECC and CVC (BM Ross 2014). The purpose of the EA, as per the Request for Proposal, was to compare the environmental sensitivities between three candidate effluent outfall sites between 10th Line and Winston Churchill Blvd and to prepare an ACS to recommend effluent quality. HESL's Natural Environment Work plan[1] reviewed by Credit Valley

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[1] *Memorandum dated March 28, 2016 from Brent Parsons HESL to Shannon Dougherty, Credit Valley Conservation*

Conservation stated that "The assessment of aquatic ecology will be focused on the West Credit River between the 10th Line of Erin and Winston Churchill Boulevard with emphasis on the stretch between each of the three potential discharge locations and the end of the mixing zones as identified by CORMIX modelling."

The Brook Trout spawning survey was extended 500m downstream of Winston Churchill Blvd (outside of the study area) since preliminary Assimilative Capacity Study results indicated that the near-field mixing zone, as defined by ammonia, was <500m. Characterization of further downstream reaches was unnecessary because PWQOs would not be exceeded and therefore would not influence site selection. Aquatic habitat and benthic invertebrates were characterized near the proposed effluent outfalls to typify conditions that could be impacted through installation of a diffuser and near-field impacts associated with effluent, consistent with our work plan. Therefore, our conclusions were made on the basis of like-for-like comparisons of habitat and mixing zone characteristics.

ii) Brook Trout spawning survey and red counts were limited to the area 500 m downstream of Winston Churchill Blvd, and that data was compared with the redd counts surveyed for the 1.5 km long reach from 10th Line to Winston Churchill Blvd. That was not a like-for-like comparison.

See answer to i)

iii) The number of redds counted in an approximately 250 m long mixing zone downstream of 10th Line in November, 2016 (3 redds but no observance of spawning fish) was compared with the zero redds counted in the similar-sized mixing zone downstream of Winston Churchill Blvd. This information was considered as a strong argument to relocate the outfall to Winston Churchill Blvd. The MInistry does not see this as a strong argument as it was based on a single survey data point and no spawning fish presence was noted at the redds below 10th Line. Observing redds at a single point in time cannot prove/disprove that fish would congregate there for spawning. We suggest that data from a more robust spawning survey is needed to support the preferred location.

The assessment completed to determine the most appropriate outfall location was robust as the assessment included an evaluation of aquatic habitat, water quality, benthic invertebrates, fisheries and a spawning assessment. Brook Trout redds were weighted heavily in the assessment since MNR and CVC (2002[2]) identify the protection of Brook Trout as a fisheries objective in the Credit River and they are an indicator of high quality, coldwater habitat. The three redds under question were assigned category 1 status per CVC protocol (definite redd, confirmed, fish may be seen on redd) as opposed to category 2 (probable but not 100% sure) or 3 (possible), and although no fish were seen, as noted on page 26 of the Natural Environment Report, "Fish presence at individual redds is likely under-representative because of disturbance from the presence of the biologists". The reach was also noted as having >10 redds in CVC et al 2011[3], and habitat was ideal for Brook Trout spawning. Additional spawning surveys were discussed with CVC but it was agreed that the spawning survey completed on November 1, 2016 successfully characterized redd locations, and further stress on the Brook Trout assemblage was not warranted given

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[2] Ministry of Natural Resources and Credit Valley Conservation. 2002. A Cooperative Management Planning Initiative for the Credit River Fishery.

[3] Credit Valley Conservation, Aquafor Beech Inc. and Blackport Hydrogeology Inc. 2011. Erin Servicing and Settlement Master Plan – Phase 1 – Environmental Component, Existing Conditions Report.

the number of redds observed during the November 1, 2016 survey. We therefore conclude that our methods were robust and that an outfall location at Winston Churchill Blvd. will pose less of a potential threat to Brook Trout than 10th Line.

iv) According to the biologic metric results from Hutchinson's field sampling of benthic invertebrates in August, 2017, both sites appear to be very similar.

Our report states that %EPT (37.87%) and Diversity (2.66) were higher on average at the 10th Line sampling locations than at Winston Churchill Blvd (%EPT = 32.45%, Diversity = 2.26), indicating that the benthic environment at Winston Churchill Blvd supports a less sensitive invertebrate assemblage and, when considering benthic invertebrates as a bioassessment tool, poorer water quality conditions, and should therefore be the preferred location for an effluent outfall.

v) Habitat characteristics in the mixing zone (depth, width, substrates, canopy coverage etc.) are also very similar in both locations.

Habitat is similar and was not selected as a screening criterion to assess potential effluent outfall locations as a result. However, the 45m culvert located beneath Winston Churchill Blvd. limits the form of the stream bed and the width of the channel and as a result provides poorer habitat than the habitat located beneath the clear span bridge at the 10th Line, which is largely unaffected by the presence of the bridge.

vi) Effluent criteria agreed upon to date, would be protective of all forms of aquatic life and all aspects of aquatic life cycles during indefinite exposure irrespective of where it is discharged (temperature effects yet to be analyzed).

We agree that effluent criteria are designed to be protective of all life forms and all aspects of aquatic life cycles in the receiving environment, but the EA must also extend beyond effluent criteria to consider other aspects of the natural environment and, this case, considered an effluent outfall location that had fewer environmental sensitivities. Through the examination of a variety of different features, the least sensitive location in the study area was determined to be Winston Churchill Blvd.

vii) To discharge effluent at Winston Churchill Blvd, an additional 1.6 km long forcemain will be required to pump sewage against gravity. This would require considerable amounts of energy during the lifespan of the project. The associated carbon foot print of this energy expenditure would be significant and should be included as a cost associated with this discharge location.

Please refer to response by Ainley.

viii) Credit Valley Conservation had no objection to the 10th Line discharge in their January 31, 2017 letter.

The ACS was completed for a 10th Line discharge because this was the most conservative location from the perspective of flow and water quality, not aquatic habitat. Flows increased between 10th Line and Winston Churchill Blvd in 2016 by 9 - 32% due to groundwater discharge (HESL 2017). Water quality at Winston Churchill was also of higher quality (lower nutrients), also as result of groundwater discharge. It was decided at the Assimilative Capacity Pre-Consultation Meeting (meeting minutes appended) that the ACS would be completed for 10th Line, and results could be conservatively applied at Winston Churchill Blvd due to the higher flows and better water quality conditions. It is our understanding that CVC's January

31, 2017 letter is approval of the ACS from a water quality perspective, and not preference of the 10th Line over Winston Churchill Boulevard from an aquatic habitat perspective.

Summary

A proposed outfall at Winston Churchill Blvd is preferred over the 10th Line for a number of sound environmental reasons as discussed in the Natural Environment Report and ACS, including:

1. *It provides greater dilution (9-32% higher flows) than 10th Line;*
2. *Has greater ability to assimilate treated effluent and avoid thermal impacts to aquatic biota due to lower nutrient concentrations and cooler water temperatures;*
3. *Supports less Brook Trout spawning habitat and a lower quality benthic assemblage; and*
4. *The 45m long culvert directly downstream of the proposed outfall at Winston Churchill Blvd. represents degraded habitat compared to a location at the 10th Line. The culvert is permanently shaded and limits the form of the stream bed and width of the channel, and 30% of the near-field mixing zone will be contained within culvert.*

We completed a thorough assessment of thermal impacts and have reviewed comments from MOECC, CVC, MNRF and the County of Wellington on the Natural Environment Report, and continue to recommend that Winston Churchill Blvd is the more appropriate effluent outfall location.

Hutchinson
Environmental Sciences Ltd.

1-5 Chancery Lane, Bracebridge, ON P1L 2E3 │ 705-645-0021

Meeting Minutes

Date: May 30, 2016

Location: MOECC, 1 Stone Road, 3rd Floor, Room 305, Guelph

Re: J160005 – Erin Class EA – Assimilative Capacity Study Pre-Consultation Meeting

Present:

Barbara Slattery (MOECC)
Craig Fowler (MOECC)
Manpreet Dhesi (MOECC)
Jennifer Dougherty (CVC)
Liam Murray (CVC)
John Sinnige (CVC)
Christine Furlong (Triton)
Ray Blackport (Blackport)
Gary Scott (Ainley)
Deborah Sinclair (HESL)
Neil Hutchinson (HESL)
Tara Roumeliotis (HESL)

Regrets: Tim Mereu (CVC), Joe Mullan (Ainley)

The purpose of the meeting was to review the ACS work plan with stakeholders and discuss any questions or concerns with the proposed approach (modelling, field investigations and analyses).

AGENDA

1. Introductions
2. Background
3. Review ACS work plan and tasks
4. Feedback and agreement on approach
5. Schedule and meetings
6. Additional items

ACTION ITEMS

Item	Description	Action
1	- Check the *Erin Servicing and Settlement Master Plan; Phase 1 – Environmental Component – Existing Conditions Report* ("Existing Conditions" report), May 2011, for raw data needed.	HESL
2	- Provide HESL with raw water quality data for 10th Line and Winston Churchill Blvd. that was used in the BM Ross preliminary ACS. Provide HESL with any additional water quality data acquired since that report (i.e., 2013 and onward)	CVC (Jennifer Dougherty)
3	- Provide group with updated 7Q20 memorandum within approximately 2 weeks.	CVC (John Sinnige)
4	- Confirm wastewater effluent flow for ACS - expected by end of summer	Ainley (Gary Scott)
5	- Measure flows at Winston Churchill and 10th Line during water quality sampling events for comparison - Evaluate need for to add chloride analyses to future water quality sampling events - Evaluate need to deploy pH logger in Credit River for diurnal pH cycle.	HESL

DISCUSSION NOTES

- Regarding additional data for the 10th Line (at West Credit River) station – CVC reported that there was no new water quality data for this station in 2013 through 2015. Only new water quality data is for the PQWMN station at Winston Churchill Blvd.
- CVC reported that they have a temperature gauge at 10th Line and at Winston Churchill Blvd.
- Septic Impact chapter in the *Erin Servicing and Settlement Master Plan; Phase 1 – Environmental Component – Existing Conditions Report* ("Existing Conditions" report), May 2011 provides flows measured by CVC at 10th Line and Winston Churchill Blvd. HESL to review report for raw flow data.
- Jennifer Dougherty (CVC) will provide HESL with any other raw data that BM Ross used in their preliminary ACS and that is not provided in the Existing Conditions report.
- John Sinnige provided an update on the 7Q20 calculation:
    - The rating curve for the 10th Line flow station is continually updated.

- CVC are using the 8th Line gauge as well as transposing the 10th Line data with the Belfountain WSC station, which has about 15 years' worth of data.
- The two gauges will give a lot more comfort in the 10th Line 7Q20.
- CVC are currently in the process of revising the extrapolation.
- Currently looking like the 7Q20 will remain the same or go up slightly.
- CVC hope to have the 7Q20 memorandum ready for peer review in two weeks and will email this out to the group. Ray Blackport to provide review. MOECC may potentially comment.

- HESL asked if anyone had completed water quantity measurements at 10th Line and Winston Churchill in order to better understand the rates of groundwater discharge to the West Credit River within this reach. Ray Blackport reported collecting some spot flow measurements at both 10th Line and Winston Churchill.
- HESL recommended that water quality be modelled at 10th Line, since this will be a more conservative location than Winston Churchill Blvd (which has higher flows due to groundwater inputs and has been shown to have better water quality).
- Craig Fowler asked if HESL intended to start the ACS process over. HESL responded that the intention was to build on the preliminary ACS work completed by BM Ross.
- Craig Fowler inquired about the wastewater flow predictions in the BM Ross preliminary ACS of 435 L/person/day, including I/I.
    - Christine Furlong explained that BM Ross looked at water taking records to estimate wastewater flows; that 435 L/person/day is a conservative estimate. Also noted that 450 L/person/day is the MOECC maximum recommended design wastewater flow.
    - HESL asked Gary Scott to confirm the wastewater effluent flow that should be used in the ACS.
    - Gary Scott noted that the starting point for deriving the effluent flow is 2,610 m^3/d for 6,000 people, and that it will be an iterative process.
    - MOECC requested that the ACS is not submitted for review until the final effluent flows are confirmed.
    - CVC requested to Ainley to be a part of the discussion on population serviced, who will remain on septic, etc.
    - Town of Erin would like some growth in Hillsburgh on partial services – on municipal water and private septic.
- HESL raised question as to whether modelling seasonal discharge at proposed WWTP was still desired. Christine Furlong clarified that seasonal discharge was recommended for consideration during the SSMP and therefore it needed to be included in the ACS.
- CVC suggested that HESL complete diurnal pH monitoring in West Credit River, in addition to the DO and temperature monitoring that is already planned.
    - CVC noted that they had completed continuous pH monitoring in West Credit River, which may be presented in the Existing Conditions report. If not, HESL will request this data from CVC, and assess need to deploy pH logger
- HESL noted that dye tracer study will be conducted at 10th Line. Group requested that HESL also conduct the dye tracer study at Winston Churchill station and HESL agreed.

- In preparation for the dye tracer study, agencies and media will be notified. HESL will prepare a media release, which will be provided to Ainley and Triton for distribution. HESL to let Craig Fowler know when dye tracer study will take place.

- CVC suggested that chloride be added as a parameter of interest to the ACS modelling exercises.
  - HESL to review need to analyse water samples collected at 10th Line for chloride analysis
- HESL noted that there is not much value in completing the ACS for three discharge locations since results will not vary significantly. CORMIX modelling will be completed for a 10th Line discharge, as the most conservative location. If future discharge location recommendations change, the CORMIX modelling can be re-run easily.
- HESL noted that the Orangeville WWTP (which discharges to the Credit River) includes denitrification of wastewater and has a TN limit of 15 mg/L.
- Group approved the ACS work plan put forward by HESL, with the following comments:
  - The MOECC recommended against any radical changes in the ACS from what BM Ross has completed. The MOECC had approved in principal what BM Ross had put forward in the preliminary ACS. West Credit River is a Policy 1 receiver.
  - CVC supports the proposed diurnal DO studies.
- Ainley noted that the first PIC meeting is scheduled for mid-November and will cover the following items:
  - Service area
  - Type of collection system
  - Population numbers
  - Discharge and plant location (3 options)
- MOECC noted that they would prefer to not be involved in the whole ACS process, but would rather just review the finalized ACS report.
- With respect to the draft effluent limits, to be recommended in the draft ACS, MOECC requested that they be sent a copy of these for possible comment, but do not necessarily need to come to a meeting on the limits.
  - MOECC noted that they do not need to peer review the 7Q20 if the number was calculated based on sound science and peer-reviewed by Ray Blackport.
- CVC raised a concern regarding the potential cumulative effects of septic system discharge to the watershed from the planned partial servicing at Hillsburgh. CVC noted that the Hillsburgh reach of the West Credit River is very small with elevated nitrate concentrations. Discussion included:
  - the observation that the net effect of the EA was to remove septic systems from the watershed by servicing the Town of Erin
  - the suggestion was that any septic servicing at Hillsburgh would require state of the art tertiary treatment and that developers would be informed of this.
- CVC requested a separate meeting to discuss/address cumulative impact of new septic systems within Erin and Hillsburgh since it was identified in the meeting that it was outside the scope of the current EA.
- Liam Murray asked the group if it would be an issue to the ACS predictions if the Erin and Hillsburgh ponds are taken offline. HESL responded that water quality would be expected to improve if the ponds were taken offline.

- Liam Murray noted that there is a new gravel pit in Peel, near Winston Churchill Blvd. To the group's knowledge, there are no water taking operations occurring at the new gravel pit.
- Christine Furlong noted that that next project meeting should include the CORE Management Team.
- The meeting was adjourned at 1215 PM.

1-5 Chancery Lane, Bracebridge, ON P1L 2E3 │705-645-0021
www.environmentalsciences.ca

April 20, 2018

Ms. Sara Wilhelm
Manager of Development Planning
County of Wellington
74 Woolwich Street
Guelph, ON N1H 3T9

Dear Ms. Wilhelm:

Re: Response to Review of Phase 3 Documents – Town of Erin Urban Centre Wastewater Servicing Class EA

The County of Wellington provided a number of comments on a variety of documents related to the Erin Wastewater Servicing Class EA, including two comments on the Town of Erin EA Natural Environment Report (Hutchinson Environmental Sciences Ltd. 2017). Palmer Environmental Consulting Group have addressed the comments on the following pages.

We will finalize the Natural Environment Report based on the responses and comments provided here-in but please contact the undersigned if you have any further questions or comments.

Sincerely,
Per. Hutchinson Environmental Sciences Ltd.

Brent Parsons, M.Sc.
Senior Aquatic Scientist
brent.parsons@environmentalsciences.ca

Table 2: Natural Environment Report

2.1: General Comments

The report does not contain any mention of the Greenbelt Plan. As a result, it is unclear as to whether the study meets the requirements of the Greenbelt Plan in general, and Section 4.2 of the Plan in particular.

The requirements for infrastructure should be discussed and the report should include some indication as to whether these requirements are addressed in the consideration of alternatives, their impacts, and mitigation.

Response: As depicted on Detailed Mapping of the Greenbelt Plan Area – Map # 66 (Town of Erin and Town of Caledon), the proposed route and waste water treatment plant (WWTP) alternatives are entirely located within designated "Protected Countryside" lands of the Greenbelt Plan. In addition, the proposed sewage pumping stations (SPS, and effluent outfall) are specifically located within the boundaries of Hillsburgh and Erin, both identified as "Towns and Villages" of the Greenbelt's Protected Countryside as depicted on Map #66. Portions of the proposed route alternatives are also located within the Towns and Villages designations, providing connection to the additional proposed infrastructure features (SPS', WWTP's).

As per Greenbelt Plan Section 4.2: General Infrastructure Policies new infrastructure that has been approved under the Environmental Assessment Act may be allowed should it meet one of the following objectives:

a) *"It supports agriculture, recreation and tourism, rural settlement areas, resource use or the rural economic activity that exists and is permitted within the Greenbelt; or*

b) *It serves the significant growth and economic development expected in southern Ontario beyond the Greenbelt by providing for the appropriate infrastructure connections among urban growth centres and between these centres and Ontario's borders."*

The proposed works satisfy the above requirements, as they will provide appropriate wastewater servicing infrastructure connection between and improved servicing within the settlements of Hillsburgh and Erin. Such infrastructure will provide the necessary infrastructure to support the expansion/urban growth of these settlement areas.

In general, the policies provided throughout Section 4.2 of the Plan require that proposed infrastructure works minimize impacts to the landscape wherever possible (including Natural Heritage System lands), and the most reasonable alternatives should be chosen. The Natural Environment Report has provided a thorough assessment of route alternatives and recommended various mitigation measured designed to minimize impacts. Additionally, portions of each alternative also transect lands further defined on Map #66 as "Natural Heritage System"; however, each route alternative is proposed along existing transportation infrastructure features (roadways, former rail line), thus allowing impacts to the natural landscape to be further minimized through design and mitigation measures.

2.2: Section 3.2.1

The Natural Heritage Designations section does not reference the County or Town Official Plan Greenlands System designations. In particular, we note that the identification of Significant Woodlands is a municipal planning authority responsibility.

The extent of, and requirements for, development adjacent to the Greenlands System should be discussed and the report should include some indication as to whether these requirements are addressed in the consideration of alternatives, their impacts, and mitigation.

Response: As depicted on Schedule A2: Erin (updated May 26, 2016) of the County of Wellington's Official Plan, portions of all three of the proposed route alternatives, and one potential WWTP site (Option 1) transect/are adjacent to areas of the County's "Greenlands System" (includes both "Greenlands" and "Core Greenlands" designations). As per Part 5.4 of the Official Plan, Core Greenlands may include such features as Provincially Significant Wetlands (PSWs). As illustrated in Appendix 3 of the Official Plan as well as Figure 10 of the Natural Environment Report, portions of the Credit River PSW exist throughout the general study area, comprise much of the identified "Core Greenlands" lands.

Further, "Greenlands" located beyond the Core Greenlands boundaries may include "other significant natural heritage features including habitat, areas of natural and scientific interest, streams and valleylands, woodlands, environmentally sensitive areas, ponds, lakes and reservoirs and natural links".

The project team reviewed Part 5 of the The County of Wellington Official Plan (November 9, 2017 update) for policies regarding development adjacent to the Greenlands System. In accordance with Section 5.4.1 of the Official Plan, development/site alteration is prohibited within PSWs. As discussed, each route and WWTP alternative is proposed along existing transportation infrastructure features (roadways, former rail line). As such, there will be no new encroachment into PSW features. Design and mitigation measures have been recommended within the Natural Environment Report to mitigate potential impacts to adjacent wetland features.

In general, Section 5.6.2 also indicates that development proposed within/adjacent to other components of the Greenlands system may be permitted, subject to the satisfaction of the County or local municipality, once it has been demonstrated that the features have been accurately identified and impacts have been assessed.

Furthermore, it is acknowledged that the identification of "Significant Woodlands" is the responsibility of a municipal planning authority. The Ministry of Natural Resources and Forestry's Natural Heritage Reference Manual (2010) provides evaluation criteria for the identification and determination of significant woodlands. Under the Planning Act, the Province provides guidelines in identifying significant woodlands, but because such a designation is a relative exercise, it is the responsibility of the planning authority (i.e., the local or regional municipality) to complete the identification, evaluation, and designation of these features. As per Section 5.4.4, woodlands located within the County's rural lands may be considered "significant" if they are greater than 4 hectares in area (and plantations greater than 10 hectares). Significant woodlands are part of the County's Greenlands System as shown on Schedule A2: Erin (updated May 26, 2016) of the County of Wellington's Official Plan. Significant Woodlands will be mapped in the final Natural Environment Report and included in the impact assessment.

Appendix - I

Stage 1 Archaeological Assessment

Stage 1 Archaeological Assessment
Erin Wastewater Servicing
Part of Lots 22- 25, Concession 7,
Part of Lots 23-26, Concession 8,
Part of Lots 11-18, Concession 9,
and Part of Lots 12-17, Concession 10
(Former Township of Erin)
Town of Erin
County of Wellington, Ontario

ORIGINAL REPORT

Prepared for:

Ainley Group
2 County Court Blvd., 4th Floor
Brampton, ON L6W 3W8

Archaeological Licence #P094 (Merritt)
Ministry of Tourism, Culture and Sport PIF# P094-0233-2017
ASI File: 16EA-007

15 December 2017

ASI Archaeological & Cultural Heritage Services
528 Bathurst Street Toronto, ONTARIO M5S 2P9
416-966-1069 F 416-966-9723 asiheritage.ca

Stage 1 Archaeological Assessment
Erin Wastewater Servicing
Part of Lots 22, 23 and 25, Concession 7,
Part of Lots 23-26, Concession 8,
Part of Lots 11-18, Concession 9,
and Part Of Lots 12-17, Concession 10
(Former Township Of Erin)
Town Of Erin
County Of Wellington, Ontario

EXECUTIVE SUMMARY

Archaeological Services Inc. (ASI) was contracted by Ainley Group to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Erin Wastewater Servicing Municipal Class Environmental Assessment in the Town of Erin. This project involves the proposed construction of a wastewater collection system, forcemains, and sanitary pumping stations for the Villages of Erin and Hillsburgh and the establishment of a centralised wastewater treatment facility in Erin Village. The sewer network is not designed to depart the existing road right-of-ways.

The Stage 1 background study determined that two previously registered archaeological sites are located within one kilometre of the Study Area. The property inspection determined that parts of the Study Area exhibit archaeological potential and will require Stage 2 assessment, prior to development.

In light of these results, the following recommendations are made:

1. The Study Area exhibits archaeological potential. These lands require Stage 2 archaeological assessment by test pit and pedestrian survey at a five metre intervals, where appropriate, prior to any proposed impacts to the property;

2. The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance or low and wet conditions. These lands do not require further archaeological assessment; and,

3. Should the proposed work extend beyond the current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

PROJECT PERSONNEL

Senior Project Manager:	Lisa Merritt, MSc. (P094) *Partner / Director* *Environmental Assessment Division*
Project Coordinator:	Sarah Jagelewski, Hon. BA (R405) *Archaeologist / Assistant Manager* *Environmental Assessment Division*
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1.0 PROJECT CONTEXT

Archaeological Services Inc. (ASI) was contracted by Ainley Group to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Erin Wastewater Servicing Municipal Class Environmental Assessment in the Town of Erin (Figure 1). This project involves the proposed construction of a wastewater collection system, forcemains, and sanitary pumping stations for the Villages of Erin and Hillsburgh and the establishment of a centralised wastewater treatment facility in Erin Village. The sewer network is not designed to depart the existing road right-of-ways.

All activities carried out during this assessment were completed in accordance with the *Ontario Heritage Act* (1990, as amended in 2009) and the 2011 *Standards and Guidelines for Consultant Archaeologists* (S & G), administered by the Ministry of Tourism, Culture and Sport (MTCS).

In the S & G, Section 1, the objectives of a Stage 1 archaeological assessment are discussed as follows:

- To provide information about the history, current land conditions, geography, and previous archaeological fieldwork of the Study Area;
- To evaluate in detail the archaeological potential of the Study Area that can be used, if necessary, to support recommendations for Stage 2 archaeological assessment for all or parts of the Study Area; and,
- To recommend appropriate strategies for Stage 2 archaeological assessment, if necessary.

This report describes the Stage 1 archaeological assessment that was conducted for this project and is organized as follows: Section 1.0 summarizes the background study that was conducted to provide the historical and archaeological contexts for the project Study Area; Section 2.0 addresses the field methods used for the property inspection that was undertaken to document its general environment, current land use history and conditions of the Study Area; Section 3.0 analyses the characteristics of the project Study Area and evaluates its archaeological potential; Section 4.0 provides recommendations; and the remaining sections contain other report information that is required by the S & G, e.g., advice on compliance with legislation, works cited, mapping and photo-documentation.

1.1 Development Context

All work has been undertaken as required by the *Environmental Assessment Act,* RSO (1990) and regulations made under the Act, and are therefore subject to all associated legislation. This project is being conducted in accordance with the Municipal Engineers' Association document *Municipal Class Environmental Assessment* (2000 as amended in 2007, 2011 and 2015).

Authorization to carry out the activities necessary for the completion of the Stage 1 archaeological assessment was granted by Ainley Group on April 18, 2017.

1.2 Historical Context

The purpose of this section, according to the S & G, Section 7.5.7, Standard 1, is to describe the past and present land use and the settlement history and any other relevant historical information pertaining to the Study Area. A summary is first presented of the current understanding of the Indigenous land use of the Study Area. This is then followed by a review of the historical Euro-Canadian settlement history.

1.2.1 Indigenous Land Use and Settlement

Southern Ontario has been occupied by human populations since the retreat of the Laurentide glacier approximately 13,000 years before present (BP) (Ferris 2013). Populations at this time would have been highly mobile, inhabiting a boreal-parkland similar to the modern sub-arctic. By approximately 10,000 BP, the environment had progressively warmed (Edwards and Fritz 1988) and populations now occupied less extensive territories (Ellis and Deller 1990).

Between approximately 10,000-5,500 BP, the Great Lakes basins experienced low-water levels, and many sites which would have been located on those former shorelines are now submerged. This period produces the earliest evidence of heavy wood working tools, an indication of greater investment of labour in felling trees for fuel, to build shelter, and watercraft production. These activities suggest prolonged seasonal residency at occupation sites. Polished stone and native copper implements were being produced by approximately 8,000 BP; the latter was acquired from the north shore of Lake Superior, evidence of extensive exchange networks throughout the Great Lakes region. The earliest evidence for cemeteries dates to approximately 4,500-3,000 BP and is indicative of increased social organization, investment of labour into social infrastructure, and the establishment of socially prescribed territories (Ellis et al. 1990, 2009; Brown 1995:13).

Between 3,000-2,500 BP, populations continued to practice residential mobility and to harvest seasonally available resources, including spawning fish. Exchange and interaction networks broaden at this time (Spence et al. 1990:136, 138) and by approximately 2,000 BP, evidence exists for macro-band camps, focusing on the seasonal harvesting of resources (Spence et al. 1990:155, 164). It is also during this period that maize was first introduced into southern Ontario, though it would have only supplemented people's diet (Birch and Williamson 2013:13–15). Bands likely retreated to interior camps during the winter. It is generally understood that these populations were Algonquian-speakers during these millennia of settlement and land use.

From approximately 1,000 BP until approximately 300 BP, lifeways became more similar to that described in early historical documents. During the Early Iroquoian phase (AD 1000-1300), the communal site is replaced by the village focused on horticulture. Seasonal disintegration of the community for the exploitation of a wider territory and more varied resource base was still practised (Williamson 1990:317). By the second quarter of the first millennium BP, during the Middle Iroquoian phase (AD 1300-1450), this episodic community disintegration was no longer practised and populations now communally occupied sites throughout the year (Dodd et al. 1990:343). In the Late Iroquoian phase (AD 1450-1649) this process continued with the coalescence of these small villages into larger communities (Birch and Williamson 2013). Through this process, the socio-political organization of the First Nations, as described historically by the French and English explorers who first visited southern Ontario, was developed. By AD 1600, the communities within Simcoe County had formed the Confederation of Nations encountered by the first European explorers and missionaries. In the 1640s, the traditional enmity between the Haudenosaunee [1]and the Huron-Wendat (and their Algonkian allies such as the Nippissing and Odawa) led to the dispersal of the Huron-Wendat.

After the dispersal, the Haudenosaunee established a series of settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario, including Teiaiagon, near the mouth of the Humber River; and Ganestiquiagon, near the mouth of the Rouge River. Their locations near the mouths of the Humber and Rouge Rivers, two branches of the Toronto Carrying Place, strategically linked these settlements with the upper Great Lakes through Lake Simcoe. The west branch of the Carrying Place followed the Humber River valley northward over the drainage divide, skirting the west end of the Oak Ridges Moraine, to the East Branch of the Holland River. Another trail followed the Don River watershed.

When the Senecas established Teiaiagon at the mouth of the Humber, they were in command of the traffic across the peninsula to Lake Simcoe and the Georgian Bay. Later, Mississauga and earliest European presence along the north shore, was therefore also largely defined by the area’s strategic importance for accessing and controlling long established economic networks. Prior to the arrival of the Seneca, these economic networks would have been used by indigenous groups for thousands of years. While the trail played an important part during the fur trade, people would also travel the trail in order to exploit the resources available to them across south-central Ontario, including the various spawning runs, such as the salmon coming up from Lake Ontario or herring or lake trout in Lake Simcoe.

Due, in large part, to increased military pressure from the French upon their homelands south of Lake Ontario, the Haudenosaunee abandoned their north shore frontier settlements by the late 1680s, although they did not relinquish their interest in the resources of the area, as they continued to claim the north shore as part of their traditional hunting territory. The territory was immediately occupied or re-occupied by Anishinaabek groups, including the Mississauga, Ojibwa (or Chippewa) and Odawa, who, in the early seventeenth century, occupied the vast area extending from the east shore of Georgian Bay, and the north shore of Lake Huron, to the northeast shore of Lake Superior and into the upper peninsula of Michigan. Individual bands were politically autonomous and numbered several hundred people. Nevertheless, they shared common cultural traditions and relations with one another and the land. These groups were highly mobile, with a subsistence economy based on hunting, fishing, gathering of wild plants, and garden farming. Their movement southward also brought them into conflict with the Haudenosaunee.

Peace was achieved between the Haudenosaunee and the Anishinaabek Nations in August of 1701 when representatives of more than twenty Anishinaabek Nations assembled in Montreal to participate in peace negotiations (Johnston 2004:10). During these negotiations captives were exchanged and the Iroquois and Anishinaabek agreed to live together in peace. Peace between these nations was confirmed again at council held at Lake Superior when the Iroquois delivered a wampum belt to the Anishinaabek Nations.

In 1763, following the fall of Quebec, New France was transferred to British control at the Treaty of Paris. The British government began to pursue major land purchases to the north of Lake Ontario in the early nineteenth century, the Crown acknowledged the Mississaugas as the owners of the lands between Georgian Bay and Lake Simcoe and entered into negotiations for additional tracts of land as the need arose to facilitate European settlement.

[1] The Haudenosaunee are also known as the New York Iroquois or Five Nations Iroquois and after 1722 Six Nations Iroquois. They were a confederation of five distinct but related Iroquoian–speaking groups - the Seneca, Onondaga, Cayuga, Oneida, and Mohawk. Each lived in individual territories in what is now known as the Finger Lakes district of Upper New York. In 1722 the Tuscarora joined the confederacy.

In 1805, the Mississaugas were granted one mile (approximately 1.6 km) on either side of the Credit River, Twelve Mile Creek and Sixteen Mile Creek. In 1818, the majority of the Mississauga Tract was acquired by the Crown excluding the lands tracts flanking the Credit River, Twelve Mile Creek and Sixteen Mile Creek. In 1820, the remainder of Mississauga land was surrendered except approximately 81 hectares (ha) along the Credit River (Heritage Mississauga 2012:18). In 1825-26 the Credit Indian Village was established as an agricultural community and Methodist mission near present day Port Credit (Heritage Mississauga 2009a; Mississaugas of the New Credit First Nation 2014). By 1840 the village was under significant pressure from Euro-Canadian settlement that plans begun to relocate the settlement. In 1847 the Credit Mississaugas were made a land offer by the Six Nations Council to relocate at the Grand River. In 1847, 266 Mississaugas settled at New Credit, approximately 23 km southwest of Brantford. In 1848 a mission of the Methodist Church was established there by Rev. William Ryerson (Woodland Indian Cultural Education Centre 1985). Although the majority of the former Mississague Tract had been surrendered from the Mississauga by 1856 (Gould 1981), this does not exclude the likelihood that the Mississauga continued to utilise the landscape at large during travel (Ambrose 1982) and for resource extraction.

The eighteenth century saw the ethnogenesis in Ontario of the Métis, when Métis people began to identify as a separate group, rather than as extensions of their typically maternal First Nations and paternal European ancestry (Métis National Council n.d.). Living in both Euro-Canadian and Indigenous societies, the Métis acted as agents and subagents in the fur trade but also as surveyors and interpreters. Métis populations were predominantly located north and west of Lake Superior, however, communities were located throughout Ontario (MNC n.d.; Stone and Chaput 1978:607,608). During the early nineteenth century, many Métis families moved towards locales around southern Lake Huron and Georgian Bay, including Kincardine, Owen Sound, Penetanguishene, and Parry Sound (MNC n.d.). By the mid-twentieth century, Indigenous communities, including the Métis, began to advance their rights within Ontario and across Canada, and in 1982, the Métis were federally recognized as one of the distinct Indigenous peoples in Canada. Recent decisions by the Supreme Court of Canada (Supreme Court of Canada 2003, 2016) have reaffirmed that Métis people have full rights as one of the Indigenous people of Canada under subsection 91(24) of the Constitution Act, 1867.

1.2.2 Euro-Canadian Land Use: Township Survey and Settlement

Historically, the Study Area is located in the Former Erin Township, County of Wellington in part of Lots 22, 23 and 25, Concession 7, part of Lots 23-26, Concession 8, part of Lots 11-18, Concession 9, and part Of Lots 12-17, Concession 10.

The S & G stipulates that areas of early Euro-Canadian settlement (pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches, and early cemeteries are considered to have archaeological potential. Early historical transportation routes (trails, passes, roads, railways, portage routes), properties listed on a municipal register or designated under the *Ontario Heritage Act* or a federal, provincial, or municipal historic landmark or site are also considered to have archaeological potential.

For the Euro-Canadian period, the majority of early nineteenth century farmsteads (i.e., those that are arguably the most potentially significant resources and whose locations are rarely recorded on nineteenth century maps) are likely to be located in proximity to water. The development of the network of concession roads and railroads through the course of the nineteenth century frequently influenced the siting of farmsteads and businesses. Accordingly, undisturbed lands within 100 m of an early settlement road are also considered to have potential for the presence of Euro-Canadian archaeological sites.

The first Europeans to arrive in the area were transient merchants and traders from France and England, who followed Indigenous pathways and set up trading posts at strategic locations along the well-traveled river routes. All of these occupations occurred at sites that afforded both natural landfalls and convenient access, by means of the various waterways and overland trails, into the hinterlands. Early transportation routes followed existing Indigenous trails, both along the lakeshore and adjacent to various creeks and rivers (Archaeological Services Inc. 2006).

Erin Township

The land within Erin Township was acquired by the British from the Mississaugas in 1818. The first township survey was undertaken in 1819, and the first legal settlers occupied their land holdings in the following year. The township was first named after a poetic name for Ireland, *Ierne*, mentioned by the Greek geographer Strabo. Erin was initially settled by the children of Loyalists, soldiers who had served during the War of 1812, and by immigrants from England, Scotland and Ireland (Armstrong 1985:143; Erin Centennial Committee 1967; McMillan 1974; Rayburn 1997:113; Smith 1846:55–56). In 1842 a meeting was held in the home of Abraham Buck and the first officers were appointed to administer the affairs of the township. Henry Trout Sr. was appointed as the township clerk, Philander Hopkins was the collector of taxes, and Archibald Patterson and Robert Neily were made the township wardens (Mika and Mika 1977:680). The population of Erin had reached 981 by 1835 and by 1850 it had increased to 3035 (Mika and Mika 1977:680). Until this time Erin Township was part of the District of Wellington. During 1850 and 1851 it was under the jurisdiction of the Waterloo County Council. In 1852 Erin Township was run under the United Counties of Wellington, Waterloo, and Grey. It was made part of the County of Wellington when it was formed in 1854 (Mika and Mika 1977).

Village of Erin

A small community developed around 1828-29 with a series of mills on the Credit River, later rebuilt by Daniel McMillan (Brown 2017). In 1839 a post-office was established at "McMillan's Mills", and within a year village lots had been laid out. By 1851 the population was approximately 300 and had a distillery, a tannery, and carding, oatmeal and grist-mills. In 1879 the population had reached 750 and a branch of the Credit Valley Railway (CVR) was completed through Erin to Toronto. In the Village of Erin, as elsewhere, mills anchored growth and the settlement soon expanded to include more houses and two more mills that were built in 1838 and 1840. The first store was opened in 1836 by a Miss Caldwell, and William Cornock soon followed with the village's first dry goods store, a distillery and a post office. Churches, schools, inns, hardware stores and other amenities soon followed. Originally called McMillan's Mill after its founding family, in 1851 the village, population 300, was re-named Erin. The village was legally incorporated in 1879 and the first meeting of council took place in 1881 (County of Wellington 1998).

Village of Hillsburgh

The first settler in this region was Nathaniel Rozell, in 1820 who built a house on Lot 1, Concession 7. In 1821, William How and his family settled on Lots 22 and 23, Concession 7, and the settlement was named Howville (McMillan 1974:6–7; Erin Centennial Committee 1967). The village was not founded until the 1840s, when a tavern and sawmill were constructed by Hiram and Nazareth Hill (Town of Erin 2017a). It became a post office village in 1851, the same year Gooderham & Worts distillers bought land along the river to build a large grist mill, saw mill, and a cooperage for producing barrels for their business in Toronto, in what is now the iconic "Distillery District" (Town of Erin n.d.). Registered plans of subdivision for this village date from 1857-1862. It contained two grist mills, a woollen factory, a foundry and tannery. The village also contained four churches, four stores, three hotels, and a telegraph office. It was a station on the CVR, later the Canadian Pacific Railway (CPR), and the population was approximately 400 in 1873 (Crossby 1873:145; Rayburn 1997:158; Scott 1997:102; Winearls 1991:697). The "Station Road" over the Gooderham & Worts dam was built when the CVR arrived in 1879 to connect the village with the train on the west side of the mill pond (Town of Erin n.d.). The Hillsburgh Pioneer/God's Acre Cemetery was founded by the How family on Lot 24, Concession 7,and William How was buried there in 1854, among other early settlers (Town of Erin n.d.). The cemetery was not used after 1900 (Town of Erin 2017b).

Credit Valley Railway

The Credit Valley Railway was constructed between 1877 and 1879 to improve trade opportunities in southern Ontario (Town of Caledon 2009). The project was backed by George Laidlaw and was intended to connect Toronto with Orangeville via Streetsville. Construction began in 1874 and over several subsequent years several branches were added to the proposed line. The first section of track from Parkdale (Toronto) to Milton was opened in 1877. In 1873, survey work was completed and track was first laid in 1876. Construction on the railway reached the Forks of the Credit by 1879 with a station at the northern end of the longest curved timber trestle of the time, which spanned 1,146 feet through the river valley at a height of 85 feet (Town of Caledon 2009:7.30). The line was completed in 1881 but nearly bankrupted the company. It was established in direct competition with the Toronto, Grey and Bruce Railway in the hopes of stimulating trade and economic opportunities in the outlying areas. In 1883 the line was taken over by the Canadian Pacific Railway (Heritage Mississauga 2009b; Town of Caledon 2009). All trains were discontinued and the tracks were torn up in 1988, and the easement became the Elora-Cataract Trailway in 1993, a 47 kilometre long multi-use path, owned and managed by the Credit Valley and Grand River Conservation Authorities, which follows the former railroad easement, connecting Elora, Belwood, Orton, Hillsburgh, Erin, and Forks of the Credit Provincial Park (Town of Erin 2017c; Elora Cataract Trailway 2017).

1.2.3 Historical Map Review

The 1861 Map of the County of Wellington (Leslie and Wheelock 1861) and the 1881 Illustrated Historical Atlas of the Township of Erin (H. Parsell & Co. 1881) were examined to determine the presence of historic features within the Study Area during the nineteenth century (Figures 2 and 3).

It should be noted, however, that not all features of interest were mapped systematically in the Ontario series of historical atlases, given that they were financed by subscription, and subscribers were given preference with regard to the level of detail provided on the maps. Moreover, not every feature of interest would have been within the scope of the atlases.

In addition, the use of historical map sources to reconstruct/predict the location of former features within the modern landscape generally proceeds by using common reference points between the various sources. These sources are then geo-referenced in order to provide the most accurate determination of the location of any property on historic mapping sources. The results of such exercises are often imprecise or even contradictory, as there are numerous potential sources of error inherent in such a process, including the vagaries of map production (both past and present), the need to resolve differences of scale and resolution, and distortions introduced by reproduction of the sources. To a large degree, the significance of such margins of error is dependent on the size of the feature one is attempting to plot, the constancy of reference points, the distances between them, and the consistency with which both they and the target feature are depicted on the period mapping.

Table 1: Nineteenth-century property owner(s) and historical features(s) within or adjacent to the Study Area

		1861		*1877*	
Con #	**Lot #**	**Property Owner(s)**	**Historical Feature(s)**	**Property Owner(s)**	**Historical Feature(s)**
7	22	Howe & Brothers	None	Wm Howe	Saw mill
	23	Howe & Brothers	None	Wm Howe	House
	24	Gooderham & Worts	Saw mill Grist mill Store/Post Office Town lots	Gooderham & Worts	Town lots CVR
	25	Hiram Hill	Inn Town lots	Gooderham & Worts J. Collins	Town lots House
8	23	Geo. Henshaw	School house Town lots	M. Henshaw	Town lots, house, CVR
	24	Robert Nodwell	None	R. Nodwell	None
	25	Jno Green Jas. B. Boustead	Town lots Inn	J. Green J. Kirk	Town lots None
	26	Geo. Berry	None	A. Taylor	Town lots
9	11	Jno McLarin	None	J. McLaren	None
	12	Wm Clark	None	J. McLaren	House
	13	Crozier Chas McMillan	None Town lots	H. Crozier	House
	14	Chas McMillan	Town lots Mill pond Inn	A. Thompson	Town lots, mill pond
	15	Hugh McMillan Thos. Brown	None Town lots mill pond	D. Medley W. Hull	House Mill pond
	16	The Late Daniel McMillan	None	R. Johnston R. Medley D. McMillan J. McArthur S Irwine	None None None None House
	17	Edward White	None	E White	House, CVR
	18	Jno McMillan		J. McMillan	House
10	12	Mrs. Milloy Wm. Clark Wm Price	None None None	H. Malloy W. Hunter J.H. Mr. Gamble	None House None House
	13	John Shingler Hiram Shingler	Town lots None	J. Shingler W. Wilson	Town lots None
	14	None Wm Cornack S. L. Shotter	Inn (2), grist mill, town lots None None	W. Cornack	Town lots

		1861		*1877*	
Con #	**Lot #**	**Property Owner(s)**	**Historical Feature(s)**	**Property Owner(s)**	**Historical Feature(s)**
	15	None Late D. McMillan	Town lots None	A. McLellan	Town lots
	16	Dun McMillan	None	D. McMillan	House, CVR
	17	Jno. R. Thompson	None	J. R. Thompson A. Thompson	House House

According to the 1861 map, the villages of Hillsburgh and Erin were both established. Hillsburgh is depicted as having two inns, a store and post office, a saw and grist mill, and a school house, while Erin is shown to have three inns and a grist mill. The Study Area is illustrated within the historical centre the villages adjacent to the West Credit River, with historic transportation routes in Hillsburgh including what are now Main, Orangeville, Barker, Church, and Ann Streets; while in Erin these include what are now Main, Dundas, Daniel, English, William, Spring, Centre and Church Streets, Church Boulevard, and Country Road 124. The 1877, shows both town centres had grown, and the Credit Valley Railway ran through both Hillsburgh and Erin. Three mill ponds are illustrated in Erin.

1.2.4 Twentieth-Century Mapping Review

The 1906 Map of the County of Wellington, Villages of Hillsburg and Erin (Lloyd 1906), the 1937 National Topographic Series, Orangeville Sheet (Department of National Defence 1937), and the 1954 aerial photo of the Town of Erin (University of Toronto 1954) were examined to determine the extent and nature of development and land uses within the Study Area (Figures 4-7). The 1906 maps show that the Study Area is located within the historic centre of the villages of Erin and Hillsburgh. In Erin, historic transportation routes are shown, including the Canadian Pacific Railway and Main, Mill, Guelph, and Belfountain Streets, as well as the Credit River, mills ponds, parks, and numerous town lots. In Hillsburgh, the CPR, mills ponds, a church, and numerous town lots are also shown, as well as historic transportation routes such as Gravel Road (now Trafalgar Road North), Orangeville Street, and what is now Highway 22.

By 1937, numerous structures are shown within the Study Area along the main streets, as well as a few residential neighbourhoods on both sides of the road. Two farmsteads are shown in the area of the proposed WWTP sites. Both Erin and Hillsburgh have a grist mill, a school, a post office, and a church. Erin also has a race track, while there is a cemetery shown in Hillsburgh.

The 1954 aerial photo of the Town of Erin shows little development of the Study Area into the mid-twentieth century within the villages of Erin and Hillsburgh, surrounded by a rural agricultural landscape along the CPR and West Credit River.

A review of available Google satellite imagery in the village of Erin shows that the residential subdivision on Armstrong Street, Treelong Crescent and Leenders Lane was constructed in 2004, and commercial/industrial development intensified on Erin Park Drive, Erinville Drive, and Thompson Crescent since 2004. Imagery of the village of Hillsburgh shows that the Study Area has remained relatively unchanged since 2004.

1.3 Archaeological Context

This section provides background research pertaining to previous archaeological fieldwork conducted within and in the vicinity of the Study Area, its environmental characteristics (including drainage, soils or surficial geology and topography, etc.), and current land use and field conditions. Three sources of information were consulted to provide information about previous archaeological research: the site record forms for registered sites available online from the MTCS through “Ontario’s Past Portal”; published and unpublished documentary sources; and the files of ASI.

1.3.1 Current Land Use and Field Conditions

A Stage 1 property inspection was conducted on June 22, 2017 that noted the Study Area is located within the Villages of Erin and Hillsburgh. The Study Area in Hillsburgh follows Trafalgar Road North through the historic village centre, roughly between Wellington Road 22 and Howe Street. The Study Area in Erin follows Main Street/Ninth Line, roughly between Wellington Road 52 and Sideroad 17. Both villages have nineteenth- and twentieth-century residential developments to the east and west of the main streets, small public parks, commercial developments, schools and churches. The WWTP sites are within active agricultural fields southwest of Tenth Line on either side of Wellington Road 52. Development along Sideroad 17, Erin Park Drive, Thompson Crescent, and Erinvile Drive is predominantly commercial. Small creeks and ponds are dotted along both sides of Trafalgar Road North in the village of Hillsburgh, and drain into the village of Erin along the west side of Main Street. The former CPR alignment is now the Elora-Cataract Trailway, connecting both villages.

1.3.2 Geography

In addition to the known archaeological sites, the state of the natural environment is a helpful indicator of archaeological potential. Accordingly, a description of the physiography and soils are briefly discussed for the Study Area.

The S & G stipulates that primary water sources (lakes, rivers, streams, creeks, etc.), secondary water sources (intermittent streams and creeks, springs, marshes, swamps, etc.), ancient water sources (glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches, etc.), as well as accessible or inaccessible shorelines (high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh, etc.) are characteristics that indicate archaeological potential.

Water has been identified as the major determinant of site selection and the presence of potable water is the single most important resource necessary for any extended human occupation or settlement. Since water sources have remained relatively stable in Ontario since 5,000 BP (Karrow and Warner 1990:Figure 2.16), proximity to water can be regarded as a useful index for the evaluation of archaeological site potential. Indeed, distance from water has been one of the most commonly used variables for predictive modeling of site location.

Other geographic characteristics that can indicate archaeological potential include: elevated topography (eskers, drumlins, large knolls, and plateaux), pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground, distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings. Resource areas, including; food or medicinal plants (migratory routes, spawning areas) are also considered characteristics that indicate archaeological potential (S & G, Section 1.3.1).

The Study Area is situated within spillways and kame moraines of the Hillsburgh Sandhills and Guelph Drumlin Field physiographic regions. Spillways are typically broad troughs floored wholly or in part by gravel beds and are typically vegetated by cedar swamps in the lowest beds (Chapman and Putnam 1984:15). The Hillsburgh sandhills are a natural boundary on the southeastern flank of the Dundalk till plain and covers an area of approximately 16,576 hectares. This region was the first land exposed by the recession of the Laurentide glacier. The region has an elevation of between 427-488 metres above sea level and is characterised by rough topography, sandy materials and a flat-bottomed swampy valley intersection the moraine. Fine sand is the prevalent soil type (Chapman and Putnam 1984: 135-136).

The Guelph Drumlin Field physiographic region (Chapman and Putnam 1984: 137-139) centres upon the City of Guelph and Guelph Township and occupies roughly 830 square kilometres. Within the Guelph Drumlin Field, there are approximately 300 drumlins of varying sizes. For the most part these hills are of the broad oval type with slopes less steep than those of the Peterborough drumlins and are not as closely grouped as those in some other areas. The till in these drumlins is loamy and calcareous, and was derived mostly from dolostone of the Amabel Formation that can be found exposed below the Niagara Escarpment. Spillways are the former glacial meltwater channels. They are often found in association with moraines but in opposition are entrenched rather than elevated landforms. They are often, though not always, occupied by stream courses, the fact of which raises the debate of their glacial origin.

Figure 8 depicts surficial geology for the Study Area. The surficial geology mapping demonstrates that the Study Area is underlain by glaciofluvial deposits, diamicton or till, and ice-contact stratified deposits of sand and gravel (Ontario Geological Survey 2010). There are numerous former sand and gravel pits in the Village of Erin, and the Study Area is adjacent to drumlins. Figure 9 depicts the soil darinage in the Study Area. Soil types consist of Brisbane loam, Caledon fine sandy loam, Donnybrook sandy loam, and Hillsburgh fine sandy loam, all grey-brown podzols with good drainage; as well as Gilford loam, a grey-brown podzols wih poor drainage; and muck, an organic matter soil with very poor drainage (Hoffman et al. 1963).

The Study Area contains the West Credit River subwatershed, forming part of the headwaters of the Credit River. It covers approximately 105 square kilometres in the Towns of Erin of Caledon, draining from north-west of Hillsburgh to the Forks of the Credit, 68% of which is agricultural land, 15% is woodlands, 14% is wetland, and 3% is urban within Hillsburgh, the Village of Erin, and Belfountain (County of Wellington 1998).

1.3.3 Previous Archaeological Research

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database (OASD) maintained by the MTCS. This database contains archaeological sites registered within the Borden system. Under the Borden system, Canada has been divided into grid blocks based on latitude and longitude. A Borden block is approximately 13 km east to west, and approximately 18.5 km north to south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The Study Area under review is located in Borden block *AkHa.*

According to the OASD, two previously registered archaeological sites are located within one kilometre of the Study Area, neither of which is within 50 metres (Ministry of Tourism, Culture and Sport 2016). A summary of the sites is provided below.

Table 2: List of previously registered sites within one kilometre of the Study Area

Borden #	Site Name	Cultural Affiliation	Site Type	Researcher
AkHa-9	N/A	EuroCanadian	Homestead; scatter	Stantec 2002
AkHa-19	N/A	EuroCanadian	Homestead	AAL 2013

AAL – Archaeological Assessments Ltd.

According to the background research, one previous report details fieldwork within 50 m of the Study Area.

ASI (2014) conducted a Stage 1 Archaeological Assessment (Background Study and Property Inspection) as part of the Hillsburgh Dam Bridge Municipal Class Environmental Assessment, located on Station Street and was constructed in 1917. No previously registered archaeological sites were located within one kilometre of the study area, and the property inspection determined that the majority of the study area has been disturbed by previous dam construction and grading within the right-of-way (ROW). Small parts of the study area to the north and south of the dam were documented to possess archaeological potential and were recommended for Stage 2 test pit survey, prior to and proposed work.

2.0 FIELD METHODS: PROPERTY INSPECTION

A Stage 1 property inspection must adhere to the S & G, Section 1.2, Standards 1-6, which are discussed below. The entire property and its periphery must be inspected. The inspection may be either systematic or random. Coverage must be sufficient to identify the presence or absence of any features of archaeological potential. The inspection must be conducted when weather conditions permit good visibility of land features. Natural landforms and watercourses are to be confirmed if previously identified. Additional features such as elevated topography, relic water channels, glacial shorelines, well-drained soils within heavy soils and slightly elevated areas within low and wet areas should be identified and documented, if present. Features affecting assessment strategies should be identified and documented such as woodlots, bogs or other permanently wet areas, areas of steeper grade than indicated on topographic mapping, areas of overgrown vegetation, areas of heavy soil, and recent land disturbance such as grading, fill deposits and vegetation clearing. The inspection should also identify and document structures and built features that will affect assessment strategies, such as heritage structures or landscapes, cairns, monuments or plaques, and cemeteries.

The Stage 1 archaeological assessment property inspection was conducted under the field direction of John Sleath (P382) of ASI, on June 22, 2017, in order to gain first-hand knowledge of the geography, topography, and current conditions and to evaluate and map archaeological potential of the Study Area. It was a visual inspection only and did not include excavation or collection of archaeological resources. Fieldwork was only conducted when weather conditions were deemed suitable, per S&G Section 2. Previously identified features of archaeological potential were examined; additional features of archaeological potential not visible on mapping were identified and documented as well as any features that will affect assessment strategies. Field observations are compiled onto the existing conditions of the

Study Area in Section 7.0 (Figures 10-13) and associated photographic plates are presented in Section 8.0 (Plates 1-44).

3.0 ANALYSIS AND CONCLUSIONS

The historical and archaeological contexts have been analyzed to help determine the archaeological potential of the Study Area. These data are presented below in Section 3.1. Results of the analysis of the Study Area property inspection are presented in Section 3.2.

3.1 Analysis of Archaeological Potential

The S & G, Section 1.3.1, lists criteria that are indicative of archaeological potential. The Study Area meets the following criteria indicative of archaeological potential:

- Previously identified archaeological sites (AkHa-9, AkHa-19)
- Water sources: primary, secondary, or past water source (West Credit River);
- Early historic transportation routes (CVR; Main, Church, Orangeville, Barker, Ann, Dundas, Daniel, English, William, Spring, and Centre Streets, Church Boulevard, and Country Road 124);
- Proximity to early settlements (villages of Erin and Hillsburgh; mills, farmsteads); and
- Well-drained soils (Brisbane loam, Caledon fine sandy loam, Donnybrook sandy loam, and Hillsburgh fine sandy loam)

According to the S & G, Section 1.4 Standard 1e, no areas within a property containing locations listed or designated by a municipality can be recommended for exemption from further assessment unless the area can be documented as disturbed. The Town of Erin Heritage Register was not accessible at this time, however ASI is aware that there are many nineteenth-century properties still standing within the historic village centres of Erin and Hillsburgh (Town of Erin n.d., n.d.b). ASI will also be producing a Cultural Heritage Resource Assessment of the Study Area as part of this EA.

These criteria are indicative of potential for the identification of Indigenous and Euro-Canadian archaeological resources, depending on soil conditions and the degree to which soils have been subject to deep disturbance.

3.2 Analysis of Property Inspection Results

The property inspection determined that the proposed wastewater treatment plant sites are located within active agricultural fields and exhibit archaeological potential. The three sanitary pumping stations sites in Hillsburgh and sites #1A, 1B, 2, 3, 4, both site 5's, 7, and 8 in Erin all exhibit archaeological potential. Some sections of the proposed sewer and forcemain routes depart from the road and exhibit archaeological potential. These areas will require Stage 2 archaeological assessment prior to any development (Figures 10-13: areas highlighted in green and orange). According to the S & G Section 2.1.1, pedestrian survey is required in actively or recently cultivated fields (eg. Plates 41-44; Figure 13: areas highlighted in orange). According to the S & G Section 2.1.2, test pit survey is required on terrain where ploughing is not viable, such as wooded areas, properties where existing landscaping or infrastructure would be damaged, overgrown farmland with heavy brush or rocky pasture, and narrow linear corridors up to 10 metres wide (eg. Plates 1-2, 7, 16, 17, 21, 22, 24, 29-31, 33-35, 37, 39; Figures 10-13: areas highlighted in green).

The remainder of the gravity sewer and forcemain networks as well as SPS Site #6 and part of SPS site 1A have been subjected to deep soil disturbance events associated with the construction of the paved and graded-gravel road networks in Hillsburgh and Erin, a storm sewer system, and parking lots. According to the S & G Section 1.3.2 these areas do not require Stage 2 test pit survey (Plates 1-20, 22-29, 32, 33, 35-39, 41, 43; Figures 9-13: areas highlighted in yellow). Parts of the study area are located in low and wet conditions adjacent or crossing under the West Credit River, and according to the S& G Section 2.1 do not retain potential and do not require further survey (Plate 28, 34, ; Figure 7: areas highlighted in blue).

3.3 Conclusions

The Stage 1 background study determined that two previously registered archaeological sites are located within one kilometre of the Study Area. The property inspection determined that the proposed gravity sewer is within the existing disturbed roadways. Parts of the Study Area within the SPS and WWTP sites, and parts where the forcemains and sewers depart the road, exhibit archaeological potential and will require Stage 2 assessment, prior to development.

4.0 RECOMMENDATIONS

In light of these results, the following recommendations are made:

1. The Study Area exhibits archaeological potential. These lands require Stage 2 archaeological assessment by test pit and pedestrian survey at a five metre intervals, where appropriate, prior to any proposed impacts to the property;

2. The remainder of the Study Area does not retain archaeological potential on account of deep and extensive land disturbance or low and wet conditions. These lands do not require further archaeological assessment; and,

3. Should the proposed work extend beyond the current Study Area, further Stage 1 archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

NOTWITHSTANDING the results and recommendations presented in this study, ASI notes that no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. In the event that archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Cultural Programs Unit of the MTCS should be immediately notified.

5.0 ADVICE ON COMPLIANCE WITH LEGISLATION

ASI also advises compliance with the following legislation:

- This report is submitted to the Minister of Tourism, Culture and Sport as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, RSO 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological field work and report recommendations ensure the conservation, preservation and protection of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Tourism, Culture and Sport, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

- It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological field work on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act.*

- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with sec. 48 (1) of the *Ontario Heritage Act*.

- The *Cemeteries Act*, R.S.O. 1990 c. C.4 and the *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.

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7.0 MAPS

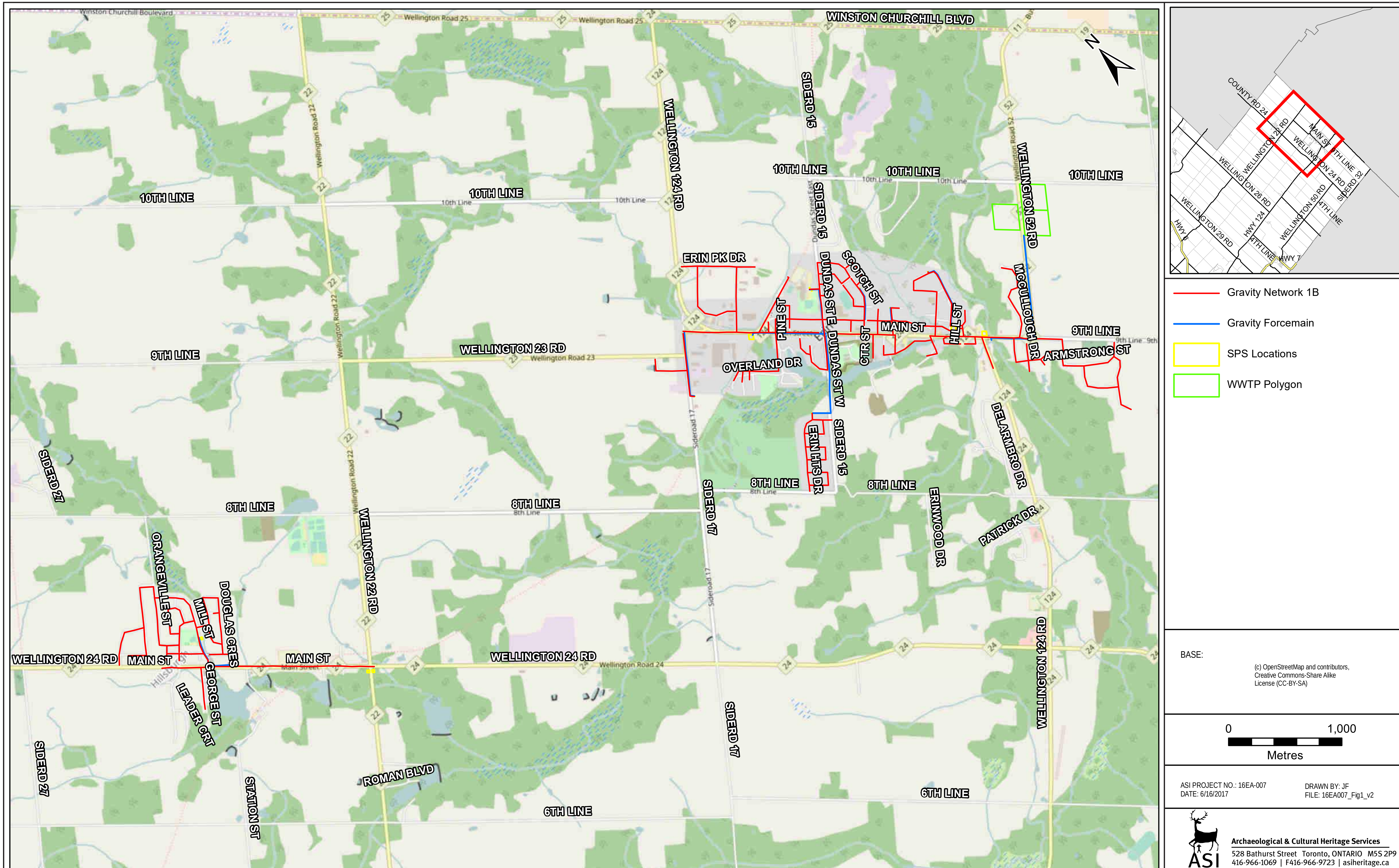
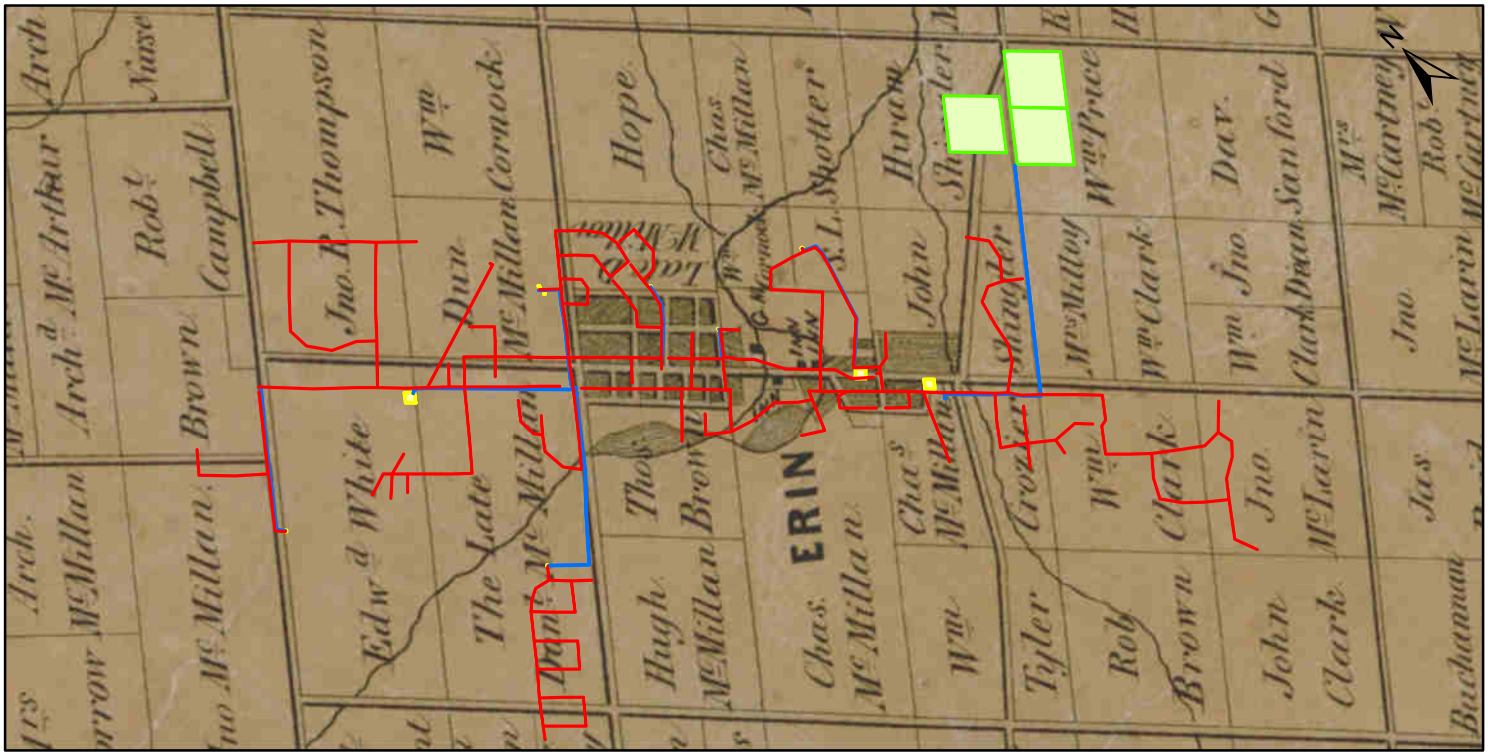
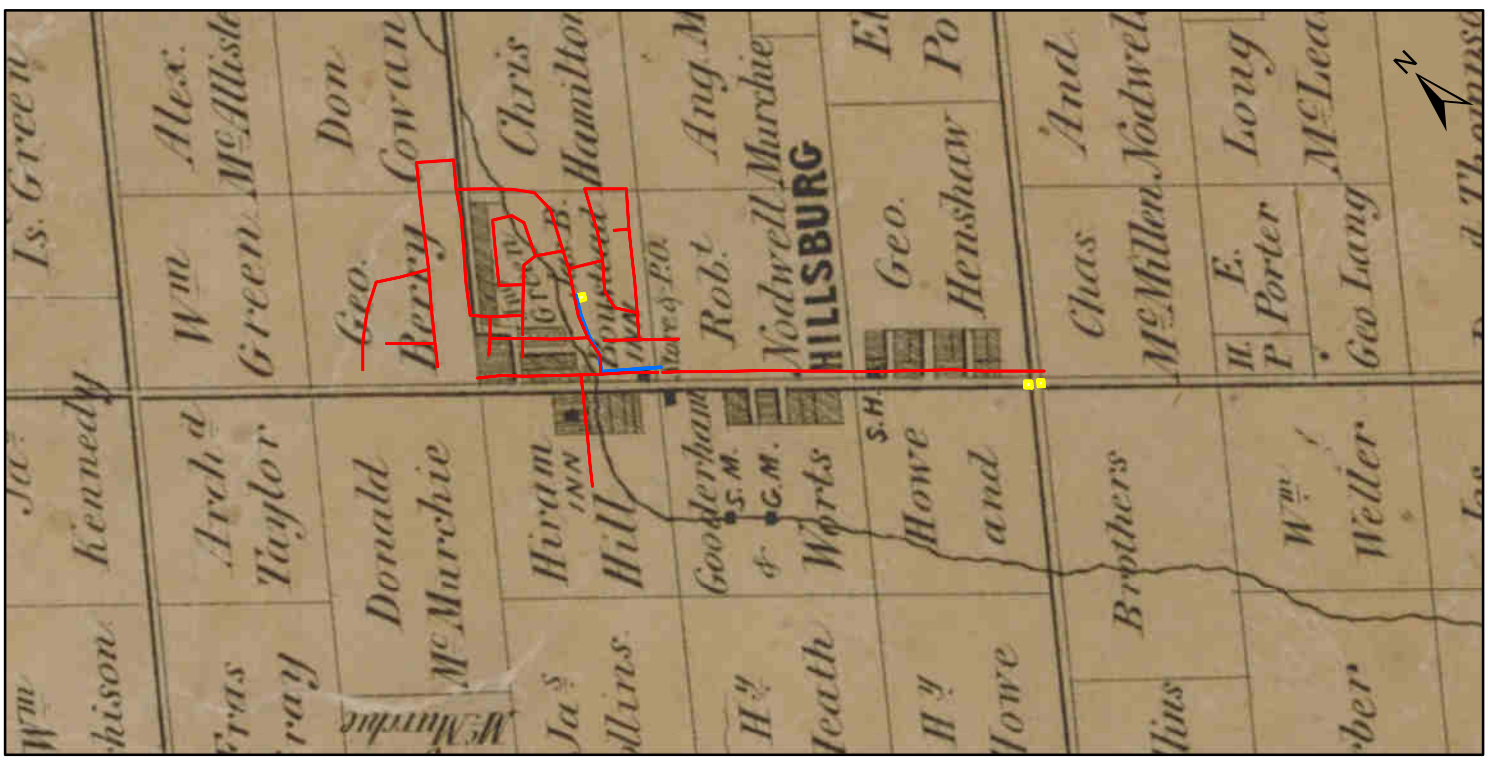


Figure 1: Erin Wastewater Servicing - Location of the Study Area



Erin



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Gravity Network 1B
Gravity Forcemain
SPS Locations
WWTP Polygon

Base:
1906 Map of the Village of Hillsburg
1906 Map of the Village of Erin

0 500
Metres

ASI PROJECT NO.: 16EA-007
DATE: 6/16/2017
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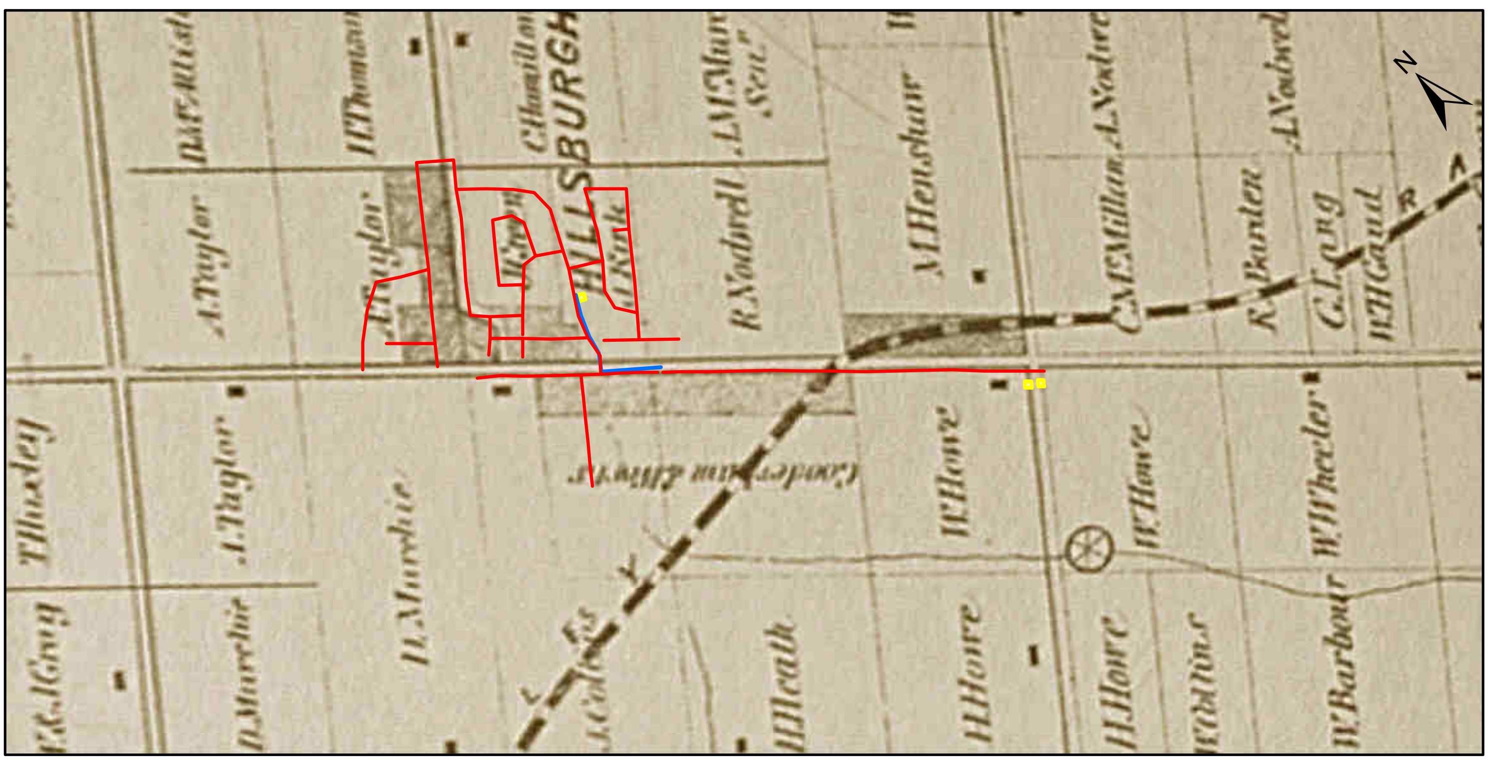
Figure 2: Erin Wastewater Servicing Study Area (Approximate Location) Overlaid on the 1862 Map of the County of Wellington

Erin



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Gravity Network 1B
Gravity Forcemain
SPS Locations
WWTP Polygon

Base:
1906 Map of the Village of Hillsburg
1906 Map of the Village of Erin

0 500
Metres

ASI PROJECT NO.: 16EA-007
DATE: 6/16/2017
DRAWN BY: JF
FILE: 16EA007_fig3_hist

Figure 3: Erin Wastewater Servicing Study Area (Approximate Location) Overlaid on the 1877 Illustrated Historical Atlas of the Township of Erin

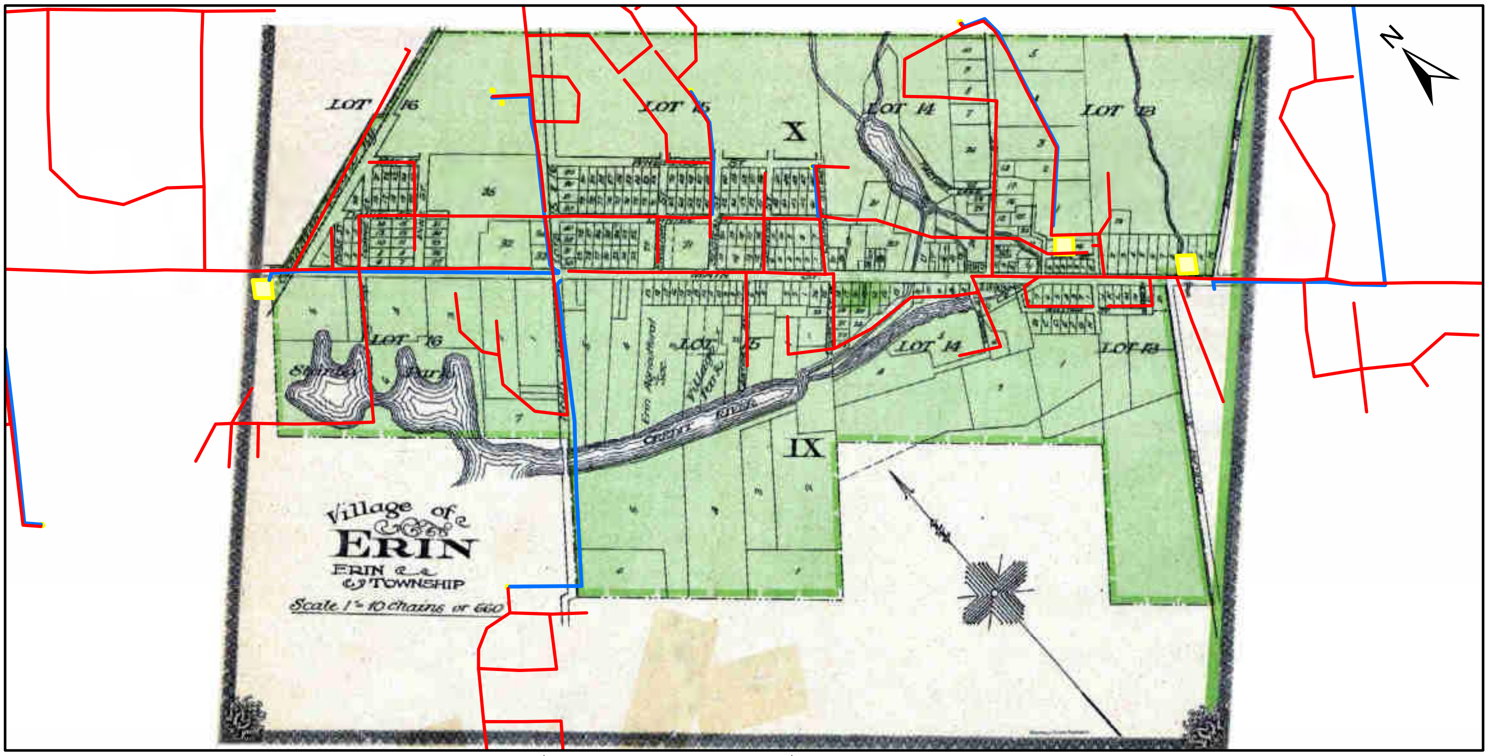


Figure 4: Erin Wastewater Servicing Study Area (Approximate Location) Overlaid on the 1906 Map of the Village of Erin

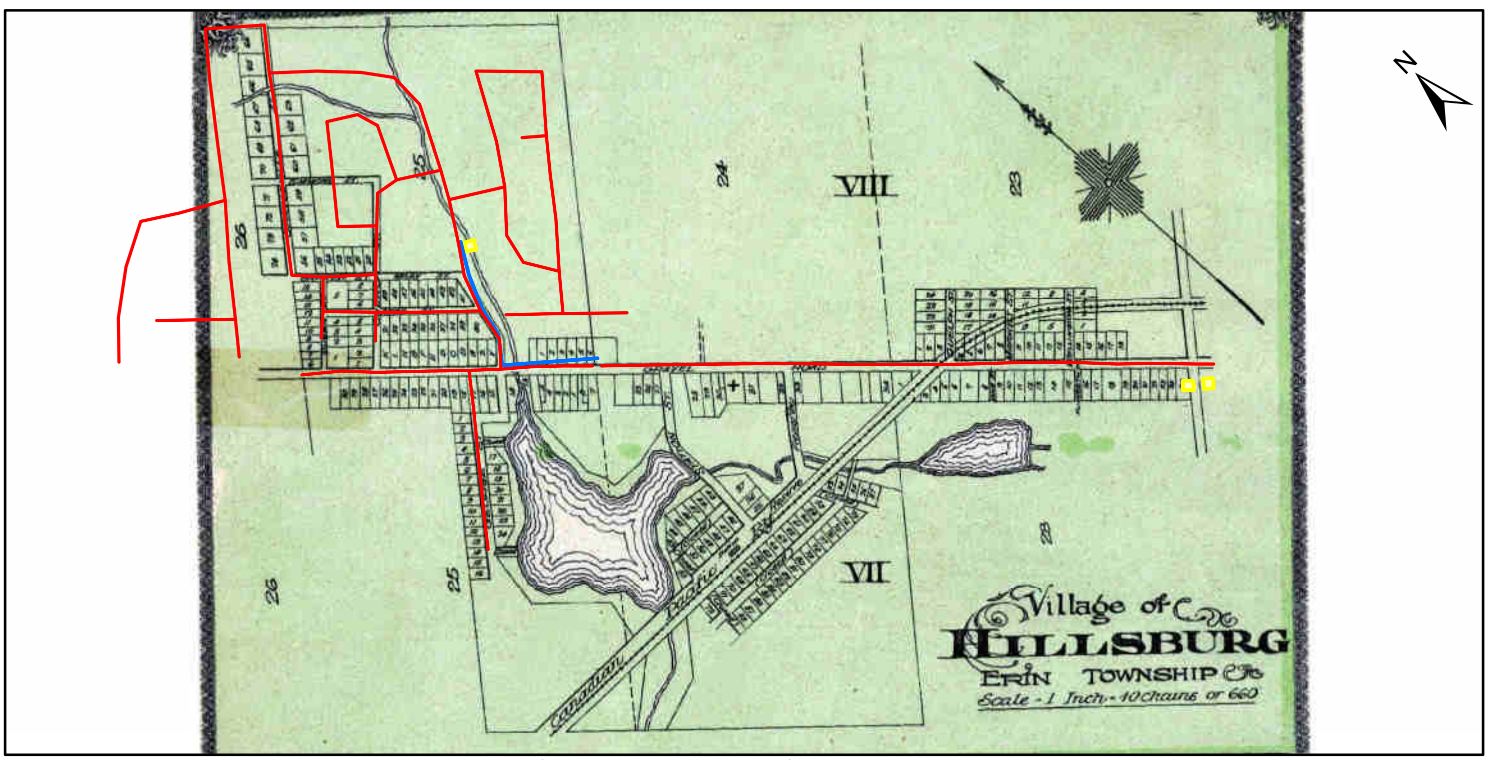
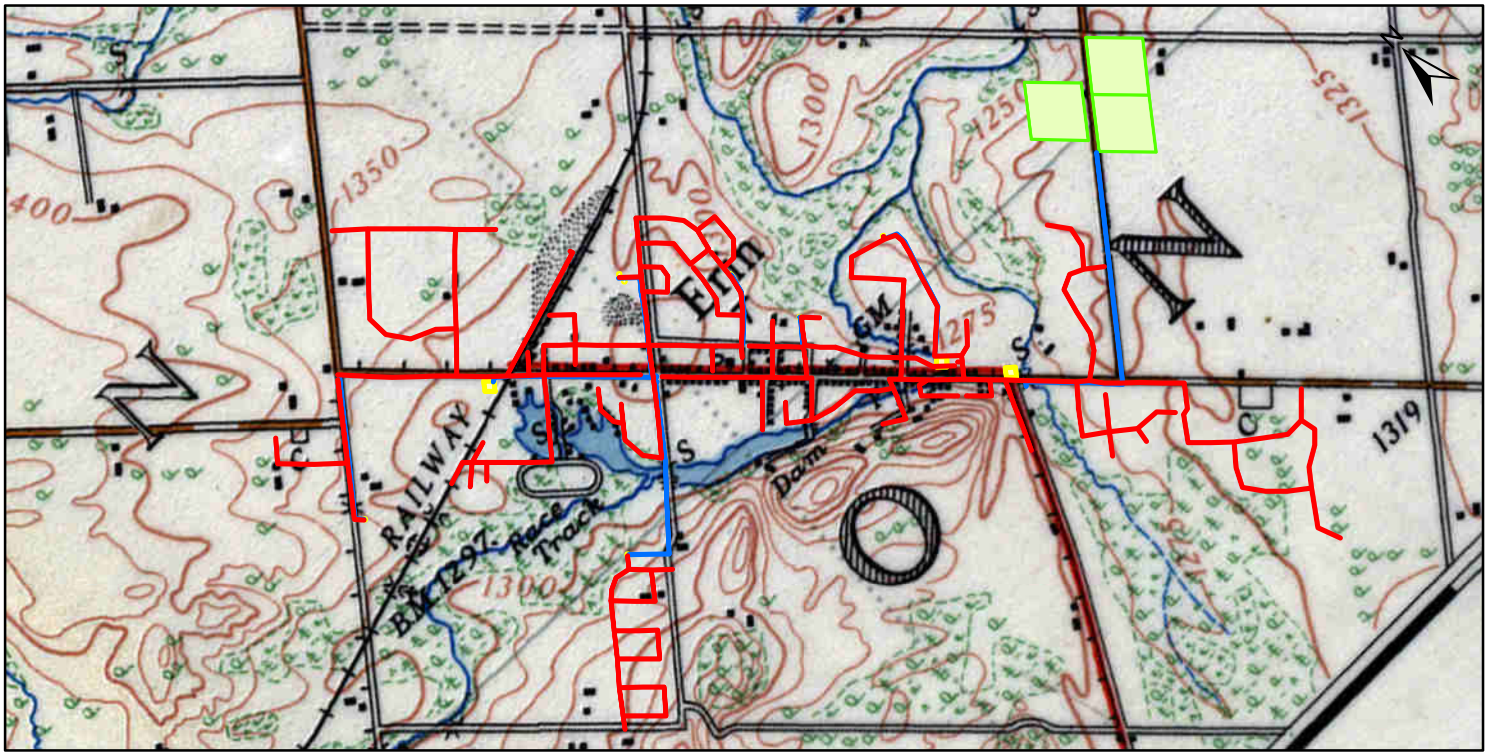


Figure 5: Erin Wastewater Servicing Study Area (Approximate Location) Overlaid on the 1906 Map of the Village of Hillsburg

ASI Archaeological & Cultural Heritage Services 528 Bathurst Street Toronto, ONTARIO M5S 2P9 416-966-1069 | F416-966-9723 | asiheritage.ca	Gravity Network 1B Gravity Forcemain SPS Locations WWTP Polygon	Base: 1906 Map of the Village of Hillsburg 1906 Map of the Village of Erin	0 500 Metres ASI PROJECT NO.: 16EA-007 DRAWN BY: JF DATE: 6/16/2017 FILE: 16EA007_fig4_5_hist



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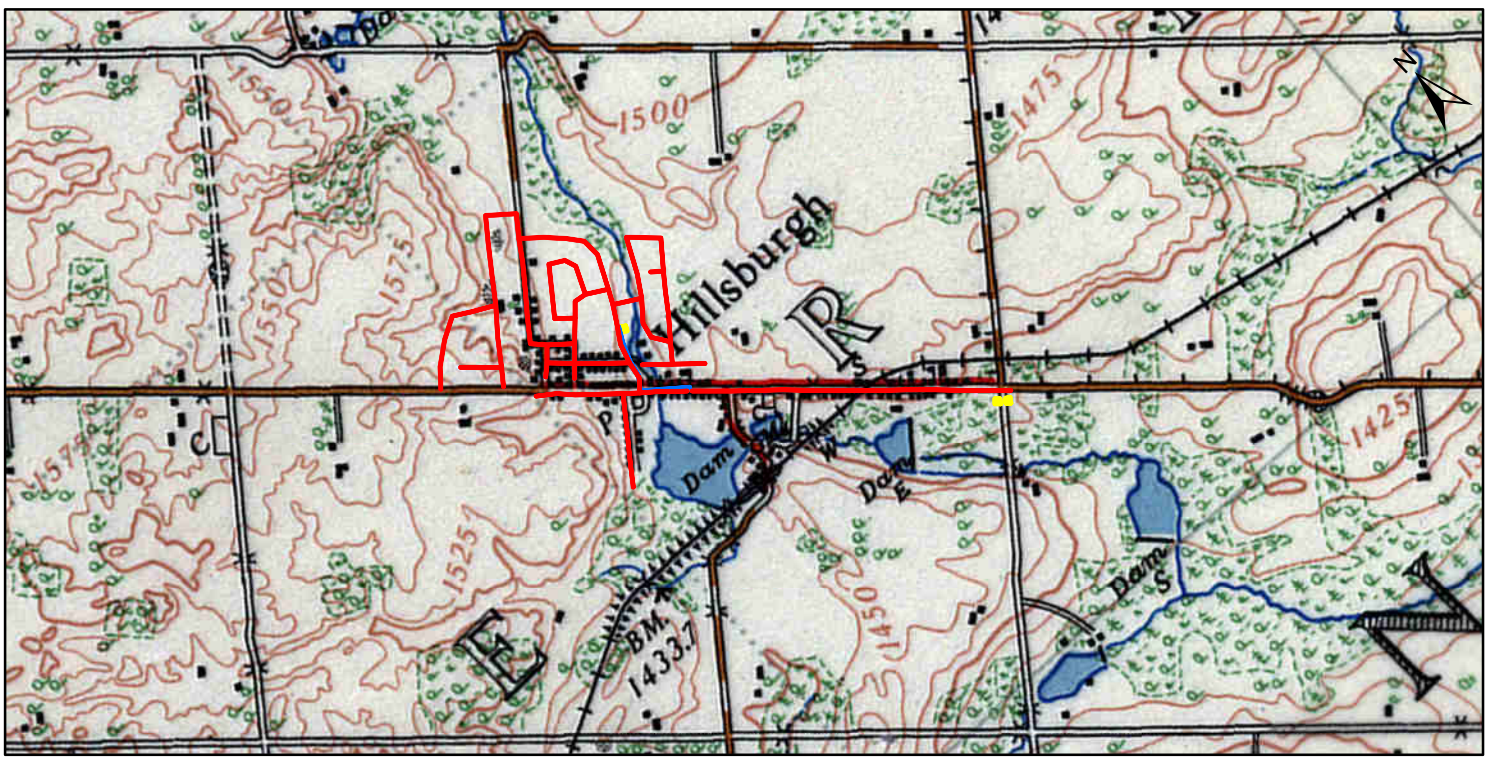

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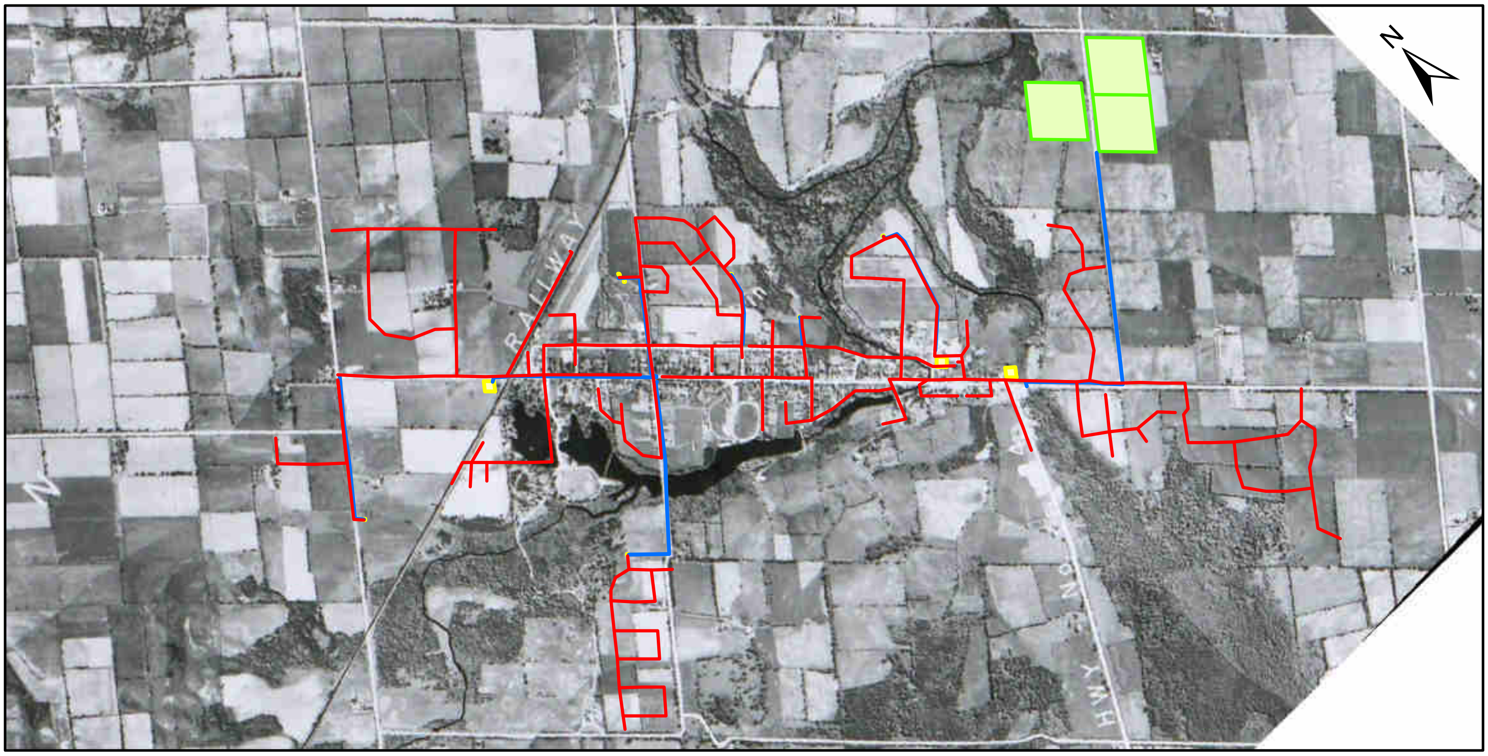
ASI Archaeological & Cultural Heritage Services 528 Bathurst Street Toronto, ONTARIO M5S 2P9 416-966-1069 | F416-966-9723 | asiheritage.ca	Gravity Network 1B Gravity Forcemain SPS Locations WWTP Polygon	Base: 1937 NTS of the Village of Hillsburg 1937 NTS of the Village of Erin	0 1 Kilometers ASI PROJECT NO.: 16EA-007 DATE: 2017-06-20 DRAWN BY: AB FILE: 16EA007_fig6_hist

Figure 6: Erin Wastewater Servicing Study Area (Approximate Location) Overlaid on the 1937 National Topographic System Orangeville Sheet



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Gravity Network 1B
Gravity Forcemain
SPS Locations
WWTP Polygon

Base:
1906 Map of the Village of Hillsburg
1906 Map of the Village of Erin

0 1
Kilometers

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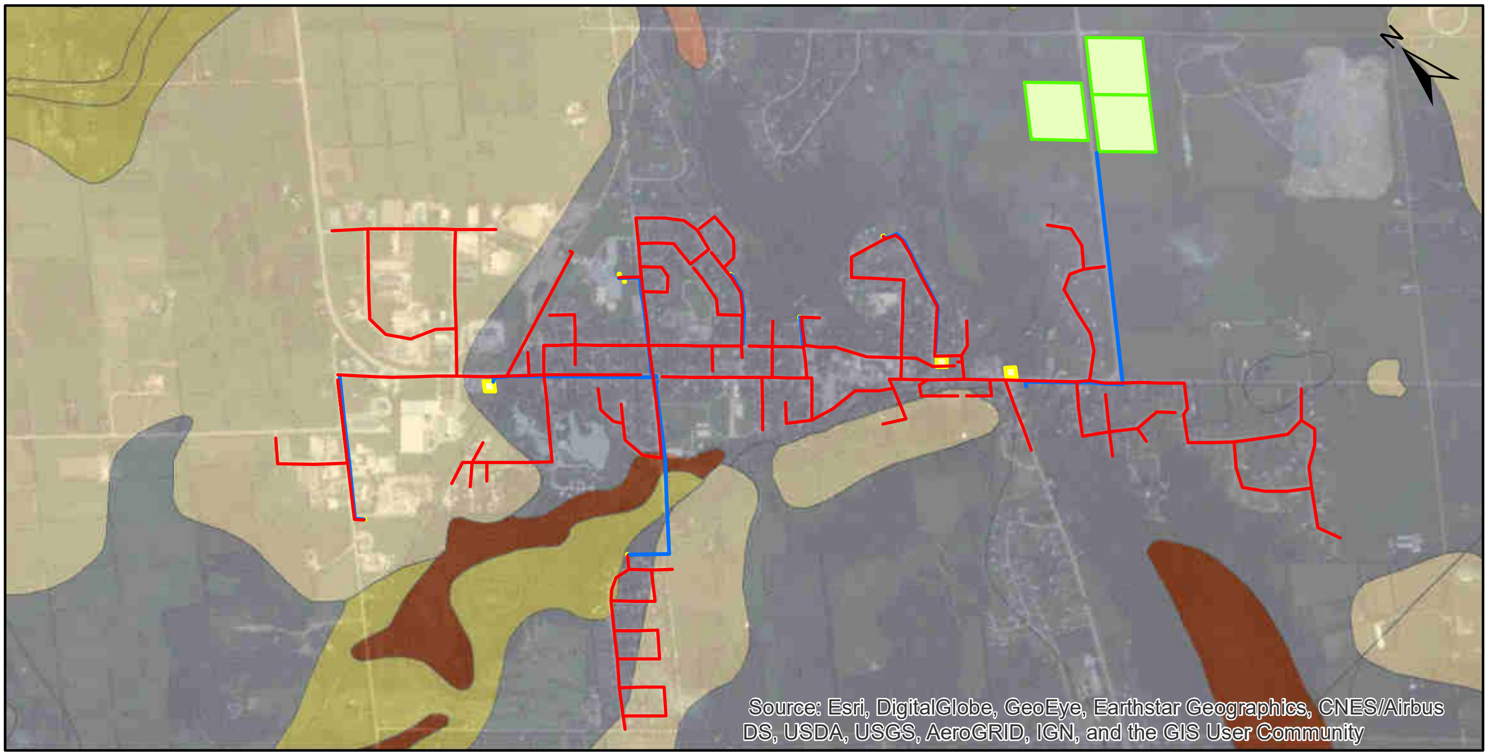
DATE: 2017-06-20
DRAWN BY: AB
FILE: 16EA007_fig7_hist

Figure 7: Erin Wastewater Servicing Study Area (Approximate Location) Overlaid on the 1954 Aerial Photo of the County of Wellington



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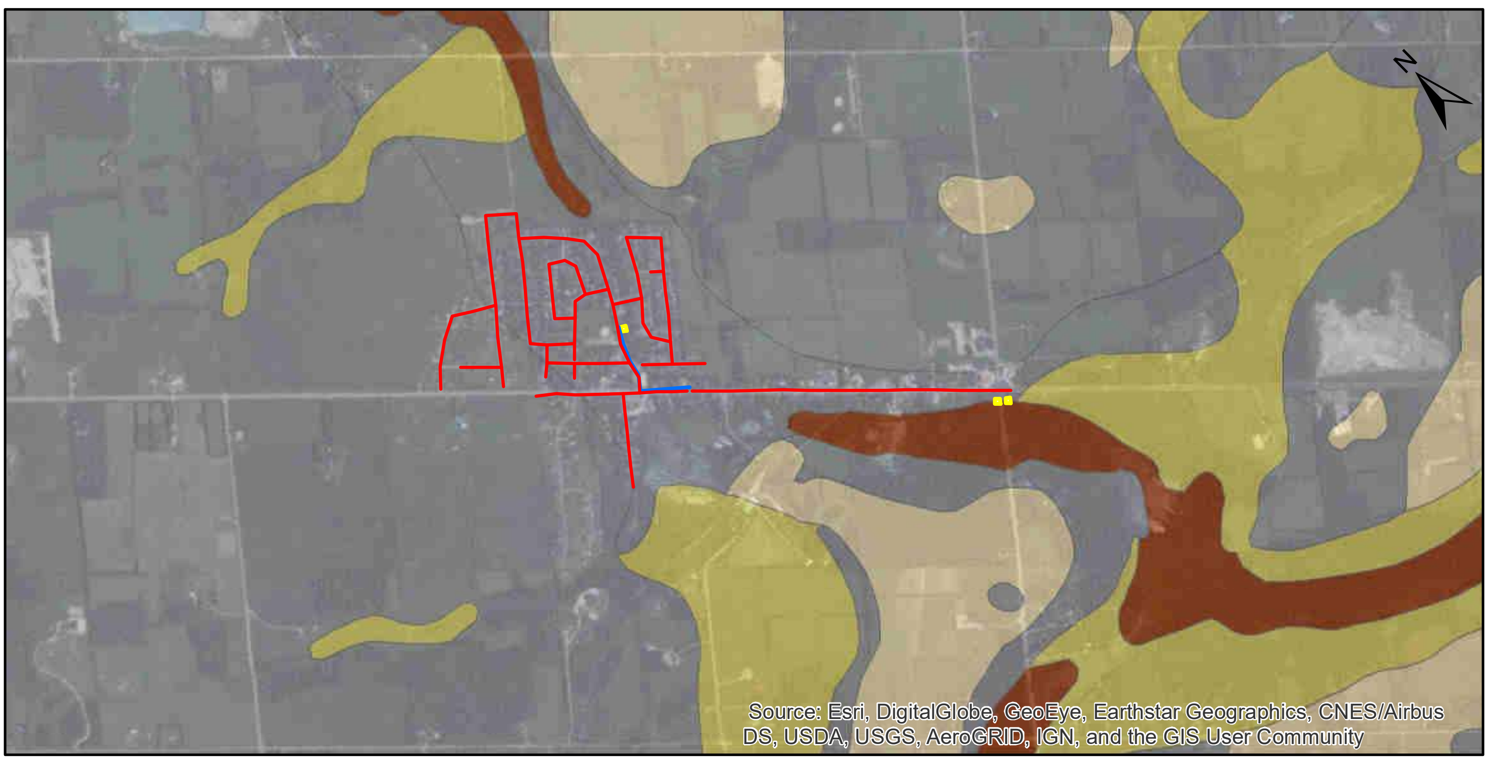

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Gravity Network 1B
Gravity Forcemain
SPS Locations
WWTP Polygon

Surfacial Geology
Paleozoic Bedrock
Diamicton
gravel
organic deposits
sand

Base:
Surficial Geology of Southern Ontario

Ontario Ministry of Northern Development and Mines

0 1
Kilometers

ASI PROJECT NO.: 16EA-007
DATE: 2017-06-20
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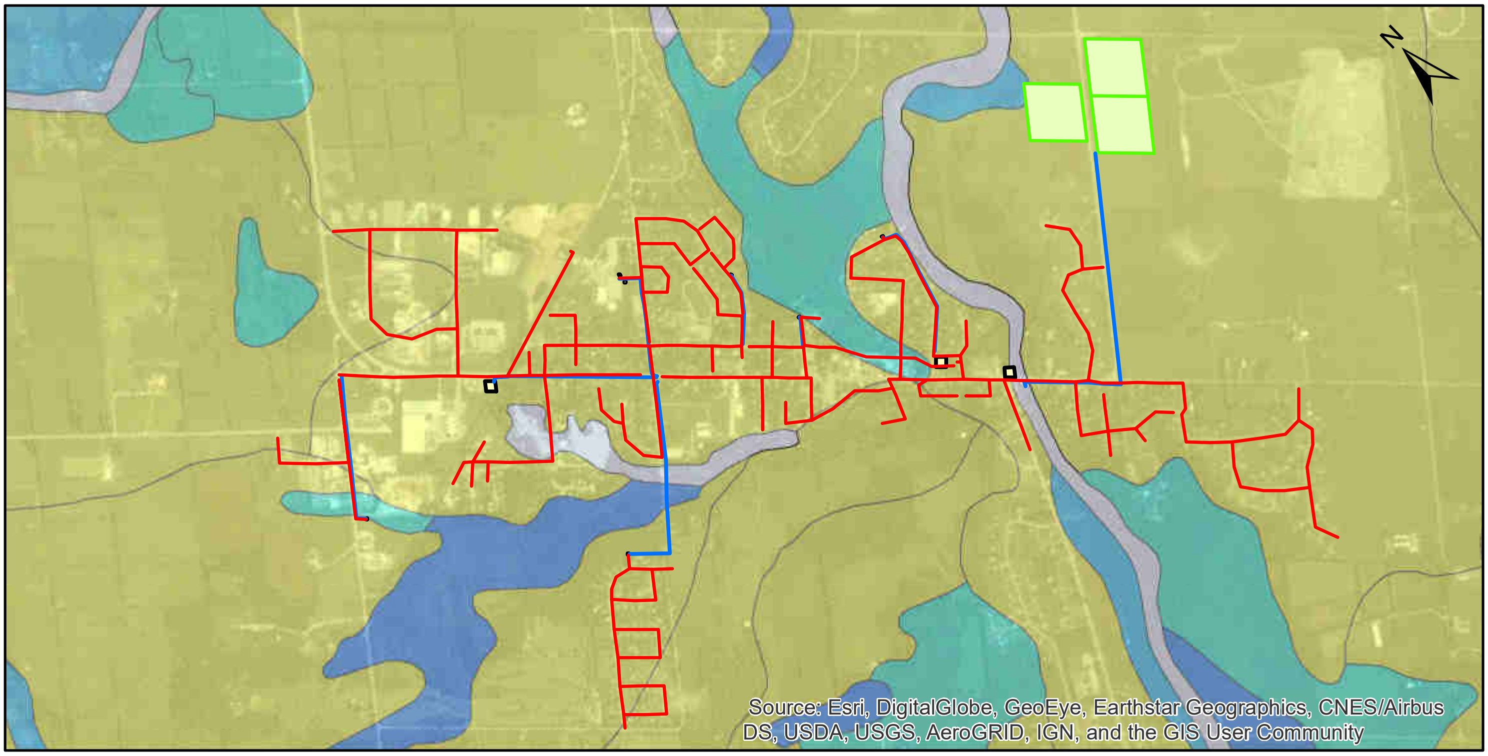
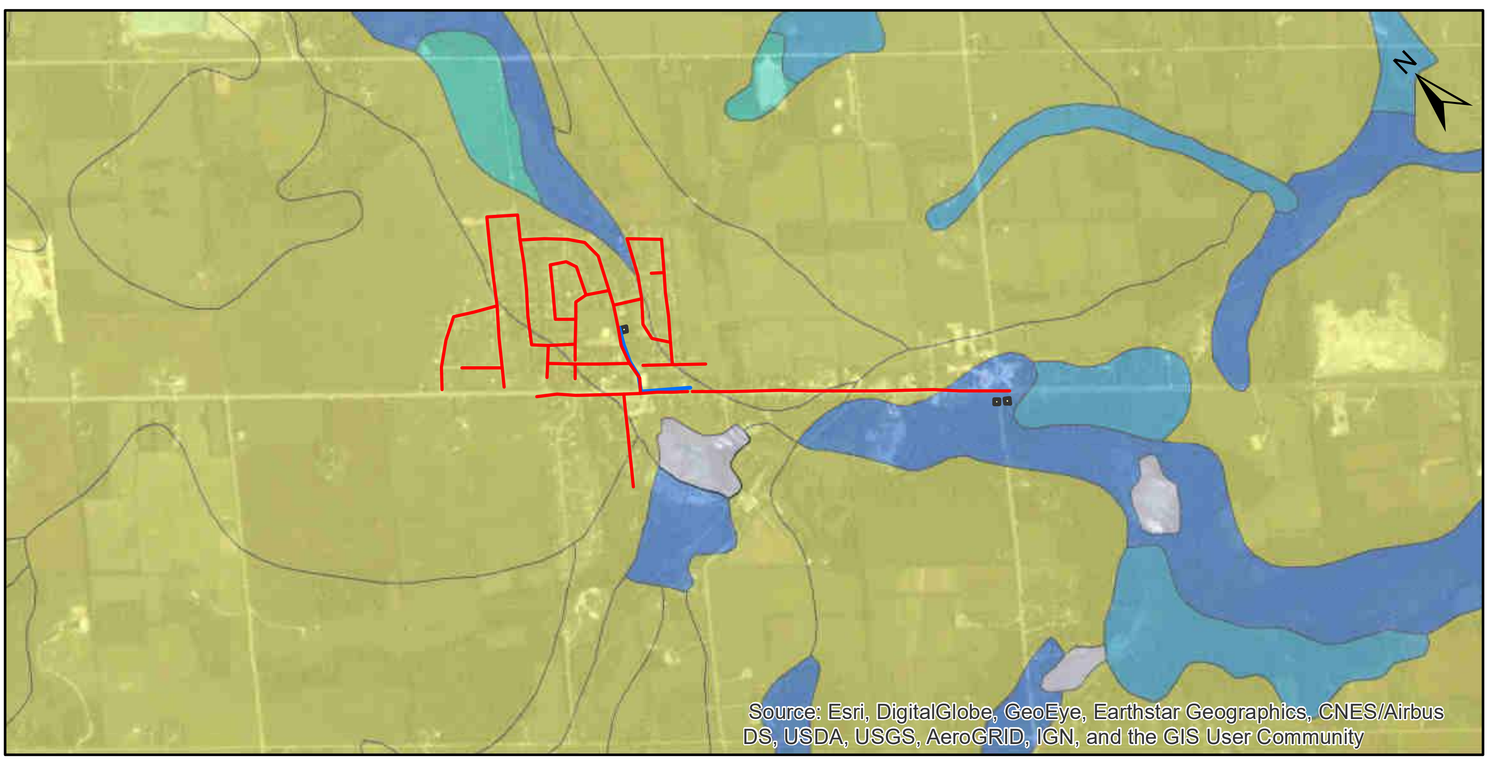
Figure 8: Erin Wastewater Servicing Study Area - Surficial Geology



Erin



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Gravity Network 1B
Gravity Forcemain
SPS Locations
WWTP Polygon

Wellington_Soils
No Data
Well
Imperfectly
Poorly
Very Poorly

Base:
Ontario Regional Soil Map for the Village of Hillsburg
Ontario Regional Soil Map for the Village of Erin

0 1
Kilometers

ASI PROJECT NO.: 16EA-007
DATE: 2017-06-20
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FILE: 16EA007_fig9

Figure 9: Erin Wastewater Servicing Study Area - Soil Drainage

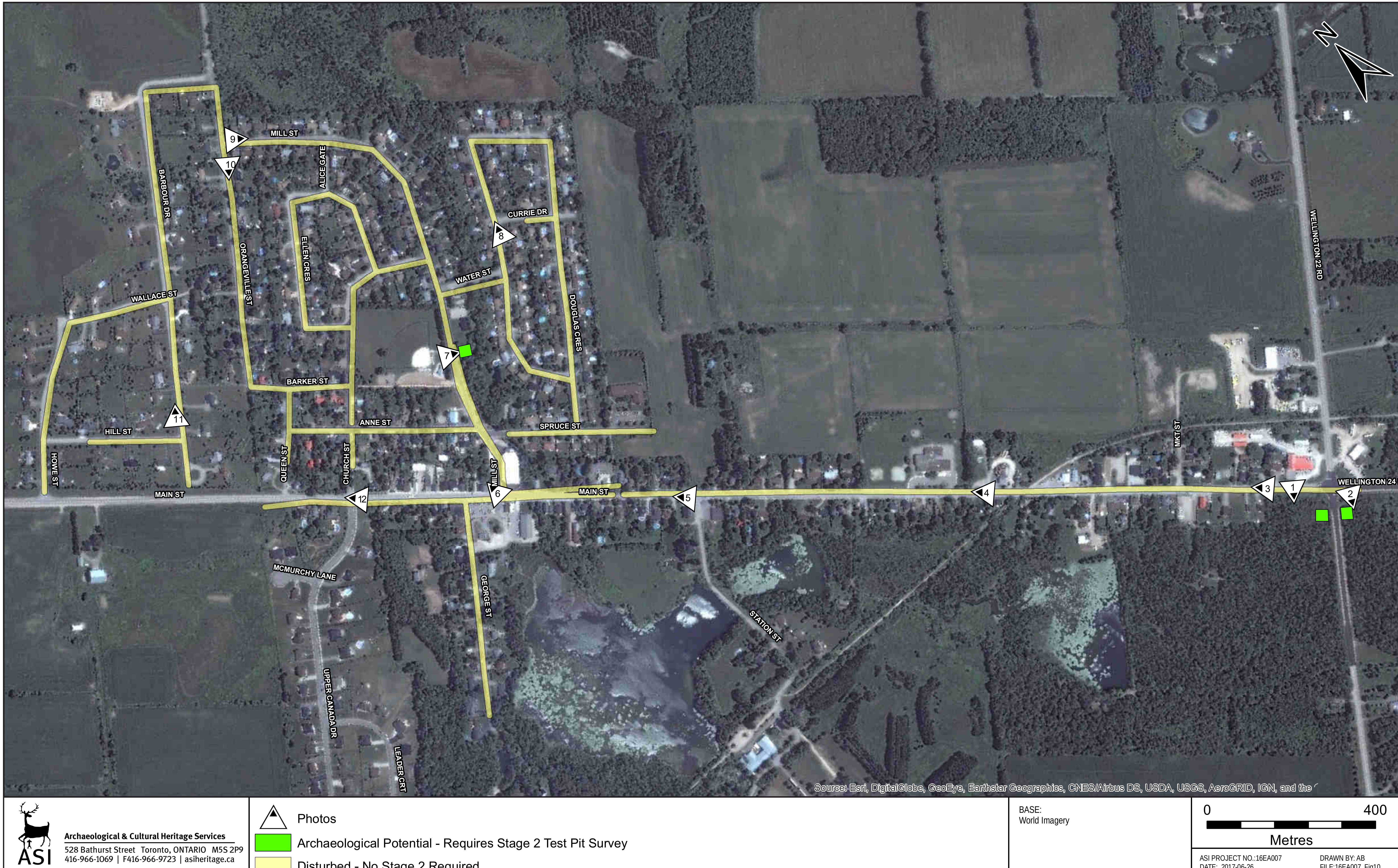
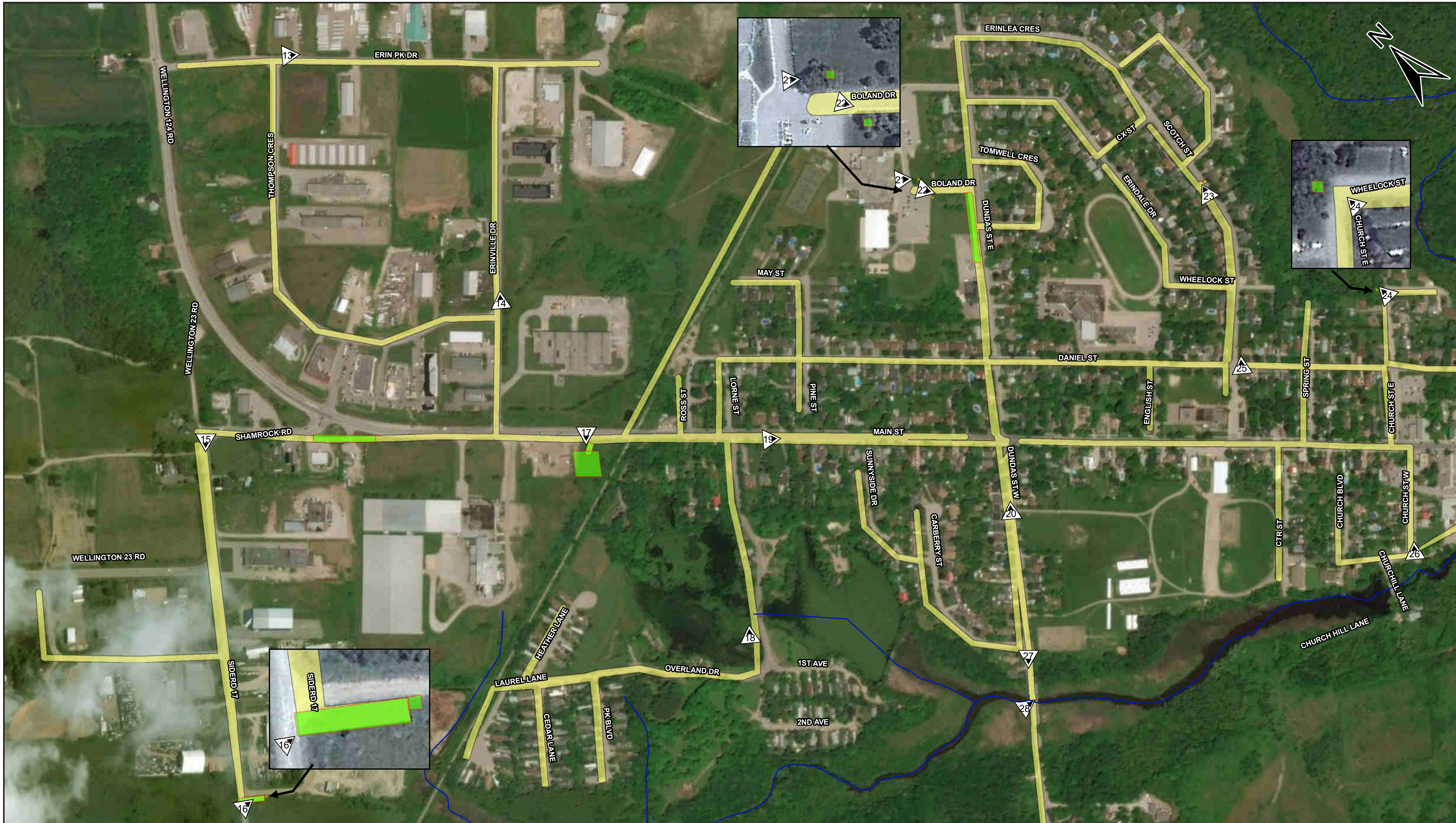


Figure 10: Erin Wastewater Servicing Study Area – Results of the Property Inspection in the Village of Hillsburgh (Sheet 1)



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Watercourses

Photos

Archaeological Potential - Requires Stage 2 Test Pit Survey

Archaeological Potential - Requires Stage 2 Pedestrian Survey

Disturbed - No Stage 2 Required

BASE:
World Imagery

0 400
Metres

ASI PROJECT NO.:16EA007
DATE: 2017-06-29
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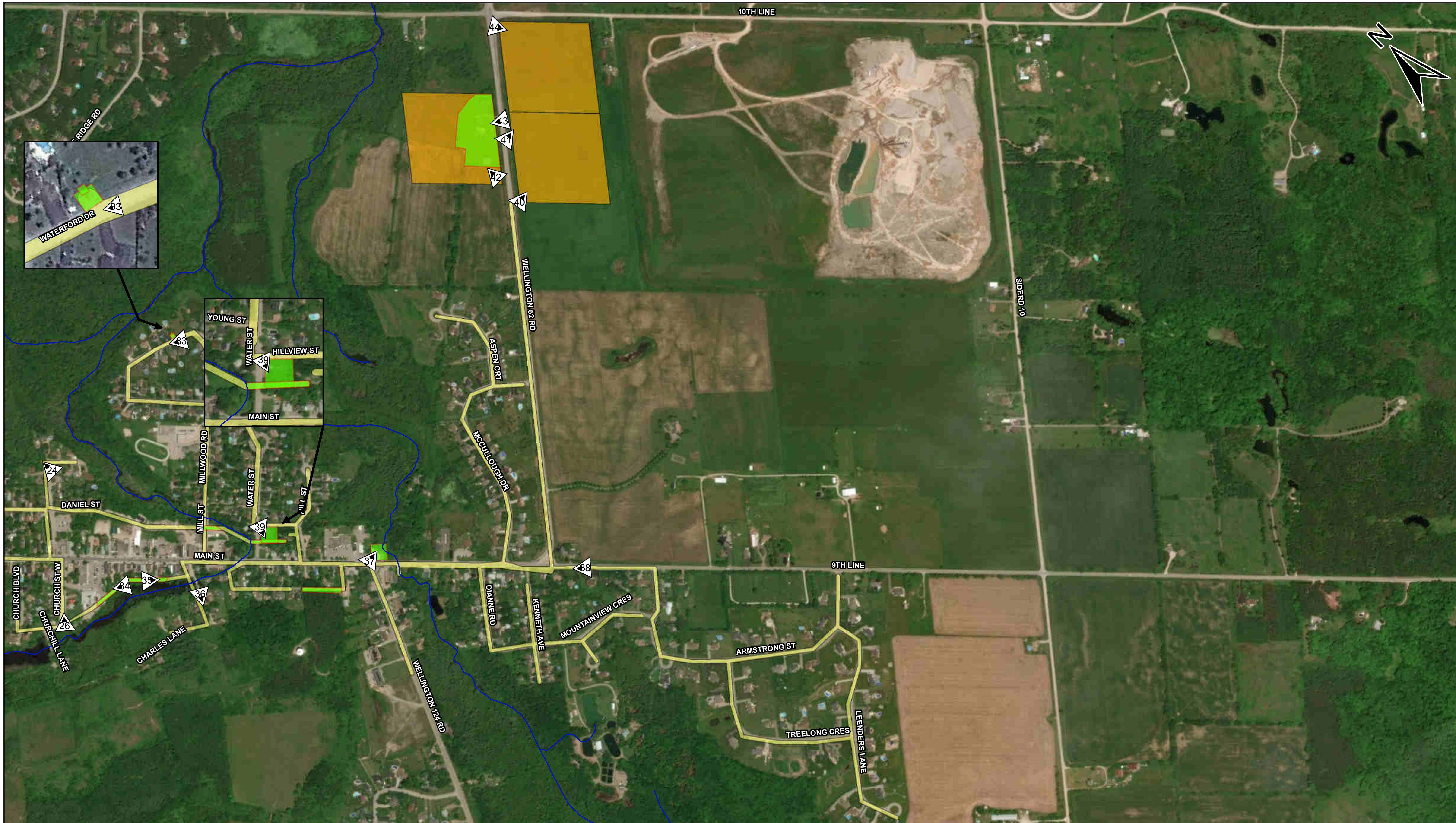
Figure 11: Erin Wastewater Servicing Study Area – Results of the Property Inspection in the Village of Erin (Sheet 2)



Watercourses

Photos

Archaeological Potential - Requires Stage 2 Test Pit Survey

Archaeological Potential - Requires Stage 2 Pedestrian Survey

Disturbed - No Stage 2 Required

BASE:
World Imagery

0 500
Metres

ASI PROJECT NO.:16EA007
DATE: 2017-06-29
DRAWN BY: AB
FILE:16EA007_Fig13

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Figure 12: Erin Wastewater Servicing Study Area – Results of the Property Inspection in the Village of Erin (Sheet 3)

Figure 13: Erin Wastewater Servicing Study Area – Results of the Property Inspection in the Village of Erin (Sheet 4)

8.0 IMAGES

Plate 1: Southwest view of Hillsburgh SPS site; Area beyond disturbed road exhibits potential, requires Stage 2 test pit survey

Plate 2: South view of Hillsburgh SPS site; Area beyond disturbed road exhibits potential, requires Stage 2 test pit survey

Plate 3: Northwest view of Main St, Hillsburgh; Proposed sewer route is within the disturbed ROW, no Stage 2 required

Plate 4: Northwest view of Main St, Hillsburgh; Proposed sewer route is within the disturbed ROW, no Stage 2 required


Plate 5: Northwest view of Main St, Hillsburgh; Proposed sewer route is within the disturbed ROW, no Stage 2 required


Plate 6: North view of Main St and Mill St, Hillsburgh; Proposed sewer route and forcemain are within the disturbed ROW, no Stage 2 required


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ASI

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Stage 2 required

footings are sloped, low and wet, no Stage 2 required

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Plate 44: South view of proposed WWTP site; Area southwest of the disturbed road retains potential, requires Stage 2 pedestrian survey

Appendix - J

Cultural Heritage Resource Assessment

CULTURAL HERITAGE RESOURCE ASSESSMENT:
BUILT HERITAGE RESOURCES AND CULTURAL HERITAGE LANDSCAPES

EXISTING CONDITIONS REPORT

ERIN WASTEWATER SERVICING
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT STUDY

PART OF LOTS 22- 25, CONCESSION 7,
PART OF LOTS 23-26, CONCESSION 8,
PART OF LOTS 11-18, CONCESSION 9,
AND PART OF LOTS 12-17, CONCESSION 10
(FORMER TOWNSHIP OF ERIN)
TOWN OF ERIN
COUNTY OF WELLINGTON, ONTARIO

Prepared for:

Ainley Group
2 County Court Blvd., 4th Floor
Brampton, ON L6W 3W8

ASI File: 16EA-008

August 2017 (Revised December 2017and April 2018)

ASI Providing Archaeological & Cultural Heritage Services
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CULTURAL HERITAGE RESOURCE ASSESSMENT:
BUILT HERITAGE RESOURCES AND CULTURAL HERITAGE LANDSCAPES

EXISTING CONDITIONS REPORT

ERIN WASTEWATER SERVICING
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT STUDY

Part of Lots 22, 23 and 25, Concession 7, Part of Lots 23-26, Concession 8, Part of Lots 11-18, Concession 9, and Part Of Lots 12-17, Concession 10
(Former Township of Erin), Town of Erin
County Of Wellington, Ontario

EXECUTIVE SUMMARY

ASI was contracted by Ainley Group to conduct a Cultural Heritage Resource Assessment as part of the Wastewater Servicing Municipal Class Environmental Assessment in the Town of Erin. This project involves the proposed installation of a sewage collection system, forcemains, sanitary pumping stations, and a wastewater treatment plant south of Erin Village. The sewer network is not designed to depart the existing road right-of-ways.

The purpose of this report is to present an inventory of cultural heritage resources, identify existing conditions of the Erin and Hillsburgh study area, identify impacts to cultural heritage resources, and propose appropriate mitigation measures. This research was conducted by Lauren Archer, Cultural Heritage Assistant, under the senior project management of Annie Veilleux, Manager of the Cultural Heritage Division, both of ASI. The following report has been prepared following a desktop review of archival resources, historical mapping, and fieldwork investigations, and provides an overview of the existing conditions within the study area.

Water and wastewater improvements may have a variety of impacts upon cultural heritage resources. The results of background historical research and a review of secondary source material, including historical mapping, revealed that the study area has a rural land use history dating back to the early nineteenth century. The background research, data collection, and field review conducted for the study area determined that 13 cultural heritage resources are located within the Erin WW study area. No significant impacts to the cultural heritage resources are anticipated to result from the proposed undertaking. Based on the results of the assessment, the following recommendations have been developed:

1. Staging and construction activities should be suitably planned and undertaken to avoid impacts to identified cultural heritage resources;

2. Once a preferred alternative or detail designs of the proposed work are available, a confirmation of impacts of the undertaking on cultural heritage resources identified within and/or adjacent to the study area should be undertaken; and,

3. Should future work require an expansion of the study area then a qualified heritage consultant should be contacted in order to confirm the impacts of the proposed work on potential heritage resources.

PROJECT PERSONNEL

Senior Project Manager: Annie Veilleux, MA
Cultural Heritage Specialist | Manager - Cultural Heritage Division

Project Manager: Lauren Archer, B.A. Hons.,
Cultural Heritage Specialist |Project Manager- Cultural Heritage Division

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Project Coordinator: Sarah Jagelewski, Hon. BA
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Archaeologist | Geomatics Specialist

Report Reviewer: Annie Veilleux

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1.0 INTRODUCTION

ASI was contracted by Ainley Group to conduct a Cultural Heritage Resource Assessment as part of the Wastewater Servicing Municipal Class Environmental Assessment in the Town of Erin. This project involves the proposed installation of a sewage collection system, forcemains, sanitary pumping stations, and a wastewater treatment plant south of Erin Village. The sewer network is not designed to depart the existing road right-of-ways (Figure 1-3).

The purpose of this report is to present an inventory of cultural heritage resources, identify existing conditions of the Town of Erin and Hillsburgh study area, identify impacts to cultural heritage resources, and propose appropriate mitigation measures. This research was conducted by Lauren Archer, Cultural Heritage Assistant, under the senior project management of Annie Veilleux, Manager of the Cultural Heritage Division, both of ASI.

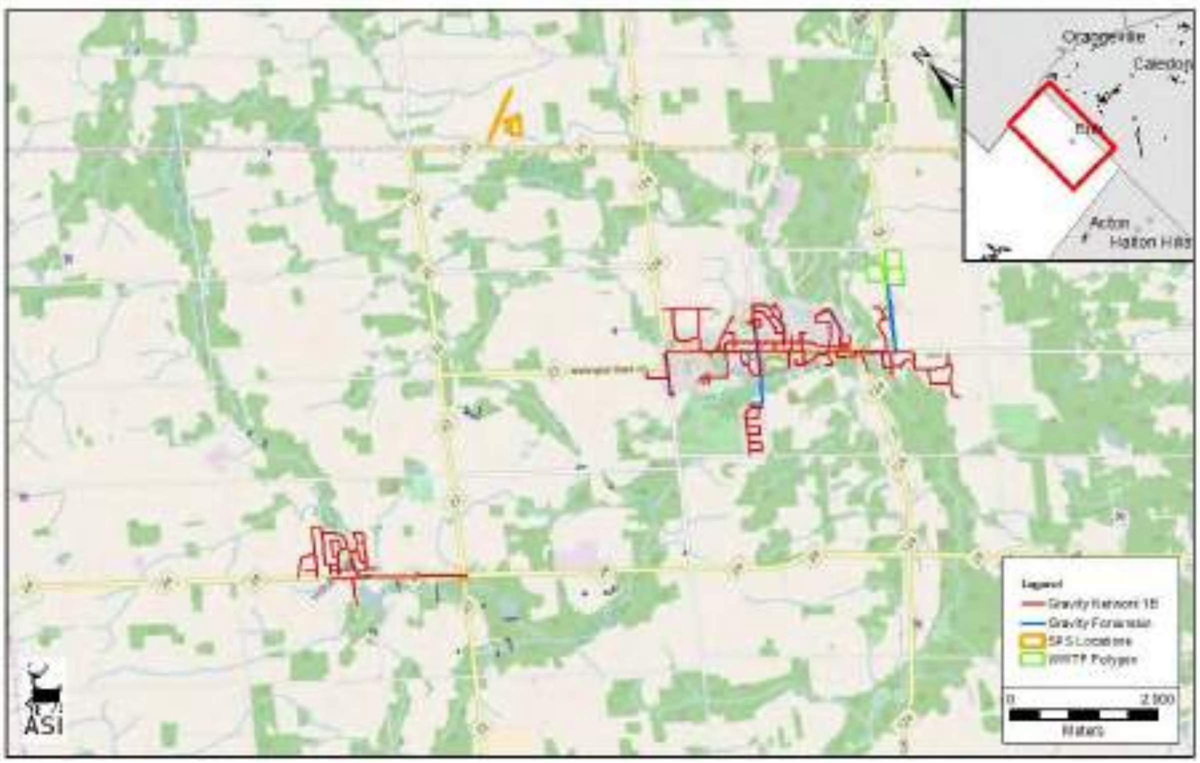

Figure 1: Location of the study area

Base Map:©OpenStreetMap and contributors, Creative Commons-Share Alike License (CC-BY-SA)

Figure 2: Location of the study area, Village of Erin
Base Map:©OpenStreetMap and contributors, Creative Commons-Share Alike License (CC-BY-SA)

Figure 3: Location of the study area, Village of Hillsburgh
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2.0 BUILT HERITAGE RESOURCE AND CULTURAL HERITAGE LANDSCAPE ASSESSMENT CONTEXT

2.1 Legislation and Policy Context

This cultural heritage assessment considers cultural heritage resources in the context of improvements to specified areas, pursuant to the *Environmental Assessment Act*. This assessment addresses above ground cultural heritage resources over 40 years old. Use of a 40 year old threshold is a guiding principle when conducting a preliminary identification of cultural heritage resources (Ministry of Transportation 2006; Ministry of Transportation 2007; Ontario Realty Corporation 2007). While identification of a resource that is 40 years old or older does not confer outright heritage significance, this threshold provides a means to collect information about resources that may retain heritage value. Similarly, if a resource is slightly younger than 40 years old, this does not preclude the resource from retaining heritage value.

For the purposes of this assessment, the term cultural heritage resources was used to describe both cultural heritage landscapes and built heritage resources. A cultural landscape is perceived as a collection of individual built heritage resources and other related features that together form farm complexes, roadscapes and nucleated settlements. Built heritage resources are typically individual buildings or structures that may be associated with a variety of human activities, such as historical settlement and patterns of architectural development.

The analysis throughout the study process addresses cultural heritage resources under various pieces of legislation and their supporting guidelines. Under the *Environmental Assessment Act* (1990) environment is defined in Subsection 1(c) to include:

- cultural conditions that influence the life of man or a community, and;
- any building, structure, machine, or other device or thing made by man.

The Ministry of Tourism, Culture and Sport is charged under Section 2 of the *Ontario Heritage Act* with the responsibility to determine policies, priorities and programs for the conservation, protection and preservation of the heritage of Ontario and has published two guidelines to assist in assessing cultural heritage resources as part of an environmental assessment: *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* (1992), and *Guidelines on the Man-Made Heritage Component of Environmental Assessments* (1981). Accordingly, both guidelines have been utilized in this assessment process.

The *Guidelines on the Man-Made Heritage Component of Environmental Assessments* (Section 1.0) states the following:

> When speaking of man-made heritage we are concerned with the works of man and the effects of his activities in the environment rather than with movable human artifacts or those environments that are natural and completely undisturbed by man.

In addition, environment may be interpreted to include the combination and interrelationships of human artifacts with all other aspects of the physical environment, as well as with the social, economic and cultural conditions that influence the life of the people and communities in Ontario. The *Guidelines on the Man-Made Heritage Component of Environmental Assessments* distinguish between two basic ways of visually experiencing this heritage in the environment, namely as cultural heritage landscapes and as cultural features.

Within this document, cultural heritage landscapes are defined as the following (Section 1.0):

> The use and physical appearance of the land as we see it now is a result of man's activities over time in modifying pristine landscapes for his own purposes. A cultural landscape is perceived as a collection of individual man-made features into a whole. Urban cultural landscapes are sometimes given special names such as townscapes or streetscapes that describe various scales of perception from the general scene to the particular view. Cultural landscapes in the countryside are viewed in or adjacent to natural undisturbed landscapes, or waterscapes, and include such land uses as agriculture, mining, forestry, recreation, and transportation. Like urban cultural landscapes, they too may be perceived at various scales: as a large area of homogeneous character; or as an intermediate sized area of homogeneous character or a collection of settings such as a group of farms; or as a discrete example of specific landscape character such as a single farm, or an individual village or hamlet.

A cultural feature is defined as the following (Section 1.0):

> …an individual part of a cultural landscape that may be focused upon as part of a broader scene, or viewed independently. The term refers to any man-made or modified object in or on the land or underwater, such as buildings of various types, street furniture, engineering works, plantings and landscaping, archaeological sites, or a collection of such objects seen as a group because of close physical or social relationships.

The Ministry of Tourism, Culture, and Sport has also published *Standards and Guidelines for Conservation of Provincial Heritage Properties* (MTC April 2010a; Standards and Guidelines hereafter). These Standards and Guidelines apply to properties the Government of Ontario owns or controls that have cultural heritage value or interest. They are mandatory for ministries and prescribed public bodies and have the authority of a Management Board or Cabinet directive. Prescribed public bodies include:

- Agricultural Research Institute of Ontario
- Hydro One Inc.
- Liquor Control Board of Ontario
- McMichael Canadian Art Collection
- Metrolinx
- The Niagara Parks Commission.
- Ontario Heritage Trust
- Ontario Infrastructure Projects Corporation
- Ontario Lottery and Gaming Corporation
- Ontario Power Generation Inc.
- Ontario Realty Corporation
- Royal Botanical Gardens
- Toronto Area Transit Operating Authority
- St. Lawrence Parks Commission

The Standards and Guidelines provide a series of definitions considered during the course of the assessment:

A provincial heritage property is defined as the following (14):

> Provincial heritage property means real property, including buildings and structures on the property, that has cultural heritage value or interest and that is owned by the Crown in right of Ontario or by a prescribed public body; or that is occupied by a ministry or a prescribed public body if the terms of the occupancy agreement are such that the ministry or public body is entitled to make the alterations to the property that may be required under these heritage standards and guidelines.

A provincial heritage property of provincial significance is defined as the following (14):

> Provincial heritage property that has been evaluated using the criteria found in *Ontario Heritage Act* O.Reg. 10/06 and has been found to have cultural heritage value or interest of provincial significance.

A built heritage resource is defined as the following (13):

> …one or more significant buildings (including fixtures or equipment located in or forming part of a building), structures, earthworks, monuments, installations, or remains associated with architectural, cultural, social, political, economic, or military history and identified as being important to a community. For the purposes of these Standards and Guidelines, "structures" does not include roadways in the provincial highway network and in-use electrical or telecommunications transmission towers.

A cultural heritage landscape is defined as the following (13):

> …a defined geographical area that human activity has modified and that has cultural heritage value. Such an area involves one or more groupings of individual heritage features, such as structures, spaces, archaeological sites, and natural elements, which together form a significant type of heritage form distinct from that of its constituent elements or parts. Heritage conservation districts designated under the *Ontario Heritage Act*, villages, parks, gardens, battlefields, mainstreets, and neighbourhoods, cemeteries, trails, and industrial complexes of cultural heritage value are some examples.

Additionally, the *Planning Act* (1990) and related *Provincial Policy Statement* (*PPS*), which was updated in 2014, make a number of provisions relating to heritage conservation. One of the general purposes of the *Planning Act* is to integrate matters of provincial interest in provincial and municipal planning decisions. In order to inform all those involved in planning activities of the scope of these matters of provincial interest, Section 2 of the *Planning Act* provides an extensive listing. These matters of provincial interest shall be regarded when certain authorities, including the council of a municipality, carry out their responsibilities under the *Act*. One of these provincial interests is directly concerned with:

> 2.(d) the conservation of features of significant architectural, cultural, historical, archaeological or scientific interest

Part 4.7 of the *PPS* states that:

> The official plan is the most important vehicle for implementation of this Provincial Policy Statement. Comprehensive, integrated and long-term planning is best achieved through official plans.

> Official plans shall identify provincial interests and set out appropriate land use designations and policies. To determine the significance of some natural heritage features and other resources, evaluation may be required.
>
> Official plans should also coordinate cross-boundary matters to complement the actions of other planning authorities and promote mutually beneficial solutions. Official plans shall provide clear, reasonable and attainable policies to protect provincial interests and direct development to suitable areas.
>
> In order to protect provincial interests, planning authorities shall keep their official plans up-to-date with this Provincial Policy Statement. The policies of this Provincial Policy Statement continue to apply after adoption and approval of an official plan.

Those policies of particular relevance for the conservation of heritage features are contained in Section 2-Wise Use and Management of Resources, wherein Subsection 2.6 - Cultural Heritage and Archaeological Resources, makes the following provisions:

> 2.6.1 Significant built heritage resources and significant cultural heritage landscapes shall be conserved.

A number of definitions that have specific meanings for use in a policy context accompany the policy statement. These definitions include built heritage resources and cultural heritage landscapes.

A *built heritage resource* is defined as: "a building, structure, monument, installation or any manufactured remnant that contributes to a property's cultural heritage value or interest as identified by a community, including an Aboriginal community" (PPS 2014).

A *cultural heritage landscape* is defined as "a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Aboriginal community. The area may involve features such as structures, spaces, archaeological sites or natural elements that are valued together for their interrelationship, meaning or association" (PPS 2014). Examples may include, but are not limited to farmscapes, historic settlements, parks, gardens, battlefields, mainstreets and neighbourhoods, cemeteries, trailways, and industrial complexes of cultural heritage value.

In addition, significance is also more generally defined. It is assigned a specific meaning according to the subject matter or policy context, such as wetlands or ecologically important areas. With regard to cultural heritage and archaeology resources, resources of significance are those that are valued for the important contribution they make to our understanding of the history of a place, an event, or a people (*PPS* 2014).

Criteria for determining significance for the resources are recommended by the Province, but municipal approaches that achieve or exceed the same objective may also be used. While some significant resources may already be identified and inventoried by official sources, the significance of others can only be determined after evaluation (*PPS* 2014).

Accordingly, the foregoing guidelines and relevant policy statement were used to guide the scope and methodology of the cultural heritage assessment.

2.2 Regional and/or Municipal Policies

Section 3.3 Cultural Heritage Resources of the Town of Erin Official Plan (2015) identified policies for the identification and management of cultural heritage resources.

3.3.2 Objectives Town of Erin Official Plan identifies key objectives, including:

The Town of Erin has the following objectives related to heritage resources:

a) *To encourage the protection of those heritage resources which contribute in a significant way, to the identity and character of the Town;*
b) *To encourage the maintenance, restoration and enhancement of buildings, structures, areas or sites in Erin which are considered to be of significant architectural, historical or archaeological value; and*
c) *To encourage new development, redevelopment and public works to be sensitive to, and in harmony with, Erin's heritage resources.*

3.3.3 Identifying Heritage Resources guides the identification of cultural heritage resources, including:

Heritage resources in the Town of Erin include, but are not necessarily restricted to:

a) A property or area of historic value or interest, possessing one of the following attributes:

- i) *an example of the Town's past social, cultural, political, technological or physical development;*
- ii) *a representative example of the work of an outstanding local, national or international personality;*
- iii) *a property associated with a person who has made a significant contribution to the social, cultural, political, economic, technological or physical development of the Town, County, Province or Country;*
- iv) *a property which dates from an early period in the Town's development.*

b) A property or area of architectural value or interest, possessing one of the following attributes:

- i) *a representative example of a method of construction which was used during a certain time period or is rarely used today;*
- ii) *a representative example of an architectural style, design or period of building;*
- iii) *an important Town landmark;*
- iv) *a work of substantial engineering merit;*
- v) *a property which makes an important contribution to the urban composition or streetscape of which it forms a part. Page 16 – Town of Erin Official Plan*

c) A property or area recognized by the Province as being archaeologically significant.

d) An area in which the presence of properties collectively represent a certain aspect of the development or cultural landscape of the Town, or which collectively are considered significant to the community as a result of their location or setting.

These policies will be considered when identifying Cultural Heritage Resources (CHRs) in the Town of Erin.

2.3 Data Collection

In the course of the cultural heritage assessment, all potentially affected cultural heritage resources are subject to inventory. Short form names are usually applied to each resource type, (e.g. barn, residence). Generally, when conducting a preliminary identification of cultural heritage resources, three stages of research and data collection are undertaken to appropriately establish the potential for and existence of cultural heritage resources in a particular geographic area.

Background historical research, which includes consultation of primary and secondary source research and historical mapping, is undertaken to identify early settlement patterns and broad agents or themes of change in a study area. This stage in the data collection process enables the researcher to determine the presence of sensitive heritage areas that correspond to nineteenth and twentieth-century settlement and development patterns. To augment data collected during this stage of the research process, federal, provincial, and municipal databases and/or agencies are consulted to obtain information about specific properties that have been previously identified and/or designated as retaining cultural heritage value. Typically, resources identified during these stages of the research process are reflective of particular architectural styles, associated with an important person, place, or event, and contribute to the contextual facets of a particular place, neighbourhood, or intersection.

A field review is then undertaken to confirm the location and condition of previously identified cultural heritage resources. The field review is also used to identify cultural heritage resources that have not been previously identified on federal, provincial, or municipal databases.

Several investigative criteria are utilised during the field review to appropriately identify new cultural heritage resources. These investigative criteria are derived from provincial guidelines, definitions, and past experience. During the course of the environmental assessment, a built structure or landscape is identified as a cultural heritage resource if it is considered to be 40 years or older, and if the resource satisfies at least one of the following criteria:

Design/Physical Value:

- It is a rare, unique, representative or early example of a style, type, expression, material or construction method.
- It displays a high degree of craftsmanship or artistic merit.
- It demonstrates a high degree of technical or scientific achievement.
- The site and/or structure retains original stylistic features and has not been irreversibly altered so as to destroy its integrity.
- It demonstrates a high degree of excellence or creative, technical or scientific achievement at a provincial level in a given period.

Historical/Associative Value:

- It has a direct association with a theme, event, belief, person, activity, organization, or institution that is significant to: the Town of Erin; the Province of Ontario; or Canada.
- It yields, or has the potential to yield, information that contributes to an understanding of the history of the: the Town of Erin; the Province of Ontario; or Canada.
- It demonstrates or reflects the work or ideas of an architect, artist builder, designer, or theorist who is significant to: the Town of Erin; the Province of Ontario; or Canada.
- It represents or demonstrates a theme or pattern in Ontario’s history.

- It demonstrates an uncommon, rare or unique aspect of Ontario's cultural heritage.
- It has a strong or special association with the entire province or with a community that is found in more than one part of the province. The association exists for historic, social, or cultural reasons or because of traditional use.
- It has a strong or special association with the life or work of a person, group or organization of importance to the province or with an event of importance to the province.

Contextual Value:

- It is important in defining, maintaining, or supporting the character of an area.
- It is physically, functionally, visually, or historically linked to its surroundings.
- It is a landmark.
- It illustrates a significant phase in the development of the community or a major change or turning point in the community's history.
- The landscape contains a structure other than a building (fencing, culvert, public art, statue, etc.) that is associated with the history or daily life of that area or region.
- There is evidence of previous historic and/or existing agricultural practices (e.g. terracing, deforestation, complex water canalization, apple orchards, vineyards, etc.).
- It is of aesthetic, visual or contextual important to the province.

If a resource meets one of these criteria it will be identified as a cultural heritage resource and is subject to further research where appropriate and when feasible. Typically, detailed archival research, permission to enter lands containing heritage resources, and consultation is required to determine the specific heritage significance of the identified cultural heritage resource.

When identifying cultural heritage landscapes, the following categories are typically utilized for the purposes of the classification during the field review:

Farm complexes:	comprise two or more buildings, one of which must be a farmhouse or barn, and may include a tree-lined drive, tree windbreaks, fences, domestic gardens and small orchards.
Roadscapes:	generally two-lanes in width with absence of shoulders or narrow shoulders only, ditches, tree lines, bridges, culverts and other associated features.
Waterscapes:	waterway features that contribute to the overall character of the cultural heritage landscape, usually in relation to their influence on historic development and settlement patterns.
Railscapes:	active or inactive railway lines or railway rights of way and associated features.
Historical settlements:	groupings of two or more structures with a commonly applied name.
Streetscapes:	generally consists of a paved road found in a more urban setting, and may include a series of houses that would have been built in the same time period.
Historical agricultural	

landscapes: generally comprises a historically rooted settlement and farming pattern that reflects a recognizable arrangement of fields within a lot and may have associated agricultural outbuildings, structures, and vegetative elements such as tree rows.

Cemeteries: land used for the burial of human remains.

Results of the desktop data collection and field review are contained in Sections 4.0, while Sections 5.0 and 6.0 contain conclusions and recommendations with respect to potential impacts of the undertaking on identified cultural heritage resources. Cultural heritage resource location mapping is provided in Section 7.0.

3.0 BUILT HERITAGE RESOURCE AND CULTURAL HERITAGE LANDSCAPE ASSESSMENT

This section provides a brief summary of historical research and a description of identified above ground cultural heritage resources that may be affected by the proposed undertaking.

3.1 Background Historical Summary

A review of available primary and secondary source material was undertaken to produce a contextual overview of the study area, including a general description of physiography, Indigenous land use, and Euro-Canadian settlement

3.1.1 Physiography and Natural Heritage

The Study Area is situated within spillways and kame moraines of the Hillsburgh Sandhills and Guelph Drumlin Field physiographic regions. Spillways are typically broad troughs floored wholly or in part by gravel beds and are typically vegetated by cedar swamps in the lowest beds (Chapman and Putnam 1984:15). The Hillsburgh sandhills are a natural boundary on the southeastern flank of the Dundalk till plain and covers an area of approximately 16,576 hectares. This region was the first land exposed by the recession of the Laurentide glacier. The region has an elevation of between 427-488 metres above sea level and is characterised by rough topography, sandy materials and a flat-bottomed swampy valley intersection the moraine. Fine sand is the prevalent soil type (Chapman and Putnam 1984:135-136).

The Guelph Drumlin Field physiographic region (Chapman and Putnam 1984:137-139) centres upon the City of Guelph and Guelph Township and occupies roughly 830 square kilometres. Within the Guelph Drumlin Field, there are approximately 300 drumlins of varying sizes. For the most part these hills are of the broad oval type with slopes less steep than those of the Peterborough drumlins and are not as closely grouped as those in some other areas. The till in these drumlins is loamy and calcareous, and was derived mostly from dolostone of the Amabel Formation that can be found exposed below the Niagara Escarpment. Spillways are the former glacial meltwater channels. They are often found in association with moraines but in opposition are entrenched rather than elevated landforms. They are often, though not always, occupied by stream courses, the fact of which raises the debate of their glacial origin.

The Study Area contains the West Credit River subwatershed, forming part of the headwaters of the Credit River. It covers approximately 105 square kilometres in the Towns of Erin of Caledon, draining from north-west of Hillsburgh to the Forks of the Credit, 68% of which is agricultural land, 15% is woodlands, 14% is wetland, and 3% is urban within Hillsburgh, the Village of Erin, and Belfountain (County of Wellington 1998).

3.1.2 Indigenous Land Use and Settlement

Southern Ontario has been occupied by human populations since the retreat of the Laurentide glacier approximately 13,000 years before present (BP) (Ferris 2013). Populations at this time would have been highly mobile, inhabiting a boreal-parkland similar to the modern sub-arctic. By approximately 10,000 BP, the environment had progressively warmed (Edwards and Fritz 1988) and populations now occupied less extensive territories (Ellis and Deller 1990).

Between approximately 10,000-5,500 BP, the Great Lakes basins experienced low-water levels, and many sites which would have been located on those former shorelines are now submerged. This period produces the earliest evidence of heavy wood working tools, an indication of greater investment of labour in felling trees for fuel, to build shelter, and watercraft production. These activities suggest prolonged seasonal residency at occupation sites. Polished stone and native copper implements were being produced by approximately 8,000 BP; the latter was acquired from the north shore of Lake Superior, evidence of extensive exchange networks throughout the Great Lakes region. The earliest evidence for cemeteries dates to approximately 4,500-3,000 BP and is indicative of increased social organization, investment of labour into social infrastructure, and the establishment of socially prescribed territories (Ellis et al. 1990, 2009; Brown 1995:13).

Between 3,000-2,500 BP, populations continued to practice residential mobility and to harvest seasonally available resources, including spawning fish. Exchange and interaction networks broaden at this time (Spence et al. 1990:136, 138) and by approximately 2,000 BP, evidence exists for macro-band camps, focusing on the seasonal harvesting of resources (Spence et al. 1990:155, 164). It is also during this period that maize was first introduced into southern Ontario, though it would have only supplemented people’s diet (Birch and Williamson 2013:13–15). Bands likely retreated to interior camps during the winter. It is generally understood that these populations were Algonquian-speakers during these millennia of settlement and land use.

From approximately 1,000 BP until approximately 300 BP, lifeways became more similar to that described in early historical documents. During the Early Iroquoian phase (AD 1000-1300), the communal site is replaced by the village focused on horticulture. Seasonal disintegration of the community for the exploitation of a wider territory and more varied resource base was still practised (Williamson 1990:317). By the second quarter of the first millennium BP, during the Middle Iroquoian phase (AD 1300-1450), this episodic community disintegration was no longer practised and populations now communally occupied sites throughout the year (Dodd et al. 1990:343). In the Late Iroquoian phase (AD 1450-1649) this process continued with the coalescence of these small villages into larger communities (Birch and Williamson 2013). Through this process, the socio-political organization of the First Nations, as described historically by the French and English explorers who first visited southern Ontario, was developed. By AD 1600, the communities within Simcoe County had formed the Confederation of Nations encountered by the first European explorers and missionaries. In the 1640s, the traditional enmity between the Haudenosaunee [1]and the Huron-Wendat (and their Algonkian allies such as the Nippissing and Odawa) led to the dispersal of the Huron-Wendat.

[1] The Haudenosaunee are also known as the New York Iroquois or Five Nations Iroquois and after 1722 Six Nations Iroquois. They were a confederation of five distinct but related Iroquoian–speaking groups - the Seneca, Onondaga, Cayuga, Oneida, and

After the dispersal, the Haudenosaunee established a series of settlements at strategic locations along the trade routes inland from the north shore of Lake Ontario, including Teiaiagon, near the mouth of the Humber River; and Ganestiquiagon, near the mouth of the Rouge River. Their locations near the mouths of the Humber and Rouge Rivers, two branches of the Toronto Carrying Place, strategically linked these settlements with the upper Great Lakes through Lake Simcoe. The west branch of the Carrying Place followed the Humber River valley northward over the drainage divide, skirting the west end of the Oak Ridges Moraine, to the East Branch of the Holland River. Another trail followed the Don River watershed.

When the Senecas established Teiaiagon at the mouth of the Humber, they were in command of the traffic across the peninsula to Lake Simcoe and the Georgian Bay. Later, Mississauga and earliest European presence along the north shore, was therefore also largely defined by the area's strategic importance for accessing and controlling long established economic networks. Prior to the arrival of the Seneca, these economic networks would have been used by indigenous groups for thousands of years. While the trail played an important part during the fur trade, people would also travel the trail in order to exploit the resources available to them across south-central Ontario, including the various spawning runs, such as the salmon coming up from Lake Ontario or herring or lake trout in Lake Simcoe.

Due, in large part, to increased military pressure from the French upon their homelands south of Lake Ontario, the Haudenosaunee abandoned their north shore frontier settlements by the late 1680s, although they did not relinquish their interest in the resources of the area, as they continued to claim the north shore as part of their traditional hunting territory. The territory was immediately occupied or re-occupied by Anishinaabek groups, including the Mississauga, Ojibwa (or Chippewa) and Odawa, who, in the early seventeenth century, occupied the vast area extending from the east shore of Georgian Bay, and the north shore of Lake Huron, to the northeast shore of Lake Superior and into the upper peninsula of Michigan. Individual bands were politically autonomous and numbered several hundred people. Nevertheless, they shared common cultural traditions and relations with one another and the land. These groups were highly mobile, with a subsistence economy based on hunting, fishing, gathering of wild plants, and garden farming. Their movement southward also brought them into conflict with the Haudenosaunee.

Peace was achieved between the Haudenosaunee and the Anishinaabek Nations in August of 1701 when representatives of more than twenty Anishinaabek Nations assembled in Montreal to participate in peace negotiations (Johnston 2004:10). During these negotiations captives were exchanged and the Iroquois and Anishinaabek agreed to live together in peace. Peace between these nations was confirmed again at council held at Lake Superior when the Iroquois delivered a wampum belt to the Anishinaabek Nations.

In 1763, following the fall of Quebec, New France was transferred to British control at the Treaty of Paris. The British government began to pursue major land purchases to the north of Lake Ontario in the early nineteenth century, the Crown acknowledged the Mississaugas as the owners of the lands between Georgian Bay and Lake Simcoe and entered into negotiations for additional tracts of land as the need arose to facilitate European settlement.

In 1805, the Mississaugas were granted one mile (approximately 1.6 km) on either side of the Credit River, Twelve Mile Creek and Sixteen Mile Creek. In 1818, the majority of the Mississauga Tract was acquired by the Crown excluding the lands tracts flanking the Credit River, Twelve Mile Creek and Sixteen Mile Creek. In 1820, the remainder of Mississauga land was surrendered except approximately 81

Mohawk. Each lived in individual territories in what is now known as the Finger Lakes district of Upper New York. In 1722 the Tuscarora joined the confederacy.

hectares (ha) along the Credit River (Heritage Mississauga 2012:18). In 1825-26 the Credit Indian Village was established as an agricultural community and Methodist mission near present day Port Credit (Heritage Mississauga 2009a; Mississaugas of the New Credit First Nation 2014). By 1840 the village was under significant pressure from Euro-Canadian settlement that plans begun to relocate the settlement. In 1847 the Credit Mississaugas were made a land offer by the Six Nations Council to relocate at the Grand River. In 1847, 266 Mississaugas settled at New Credit, approximately 23 km southwest of Brantford. In 1848 a mission of the Methodist Church was established there by Rev. William Ryerson (Woodland Indian Cultural Education Centre 1985). Although the majority of the former Mississague Tract had been surrendered from the Mississauga by 1856 (Gould 1981), this does not exclude the likelihood that the Mississauga continued to utilise the landscape at large during travel (Ambrose 1982) and for resource extraction.

The eighteenth century saw the ethnogenesis in Ontario of the Métis, when Métis people began to identify as a separate group, rather than as extensions of their typically maternal First Nations and paternal European ancestry (Métis National Council n.d.). Living in both Euro-Canadian and Indigenous societies, the Métis acted as agents and subagents in the fur trade but also as surveyors and interpreters. Métis populations were predominantly located north and west of Lake Superior, however, communities were located throughout Ontario (MNC n.d.; Stone and Chaput 1978:607,608). During the early nineteenth century, many Métis families moved towards locales around southern Lake Huron and Georgian Bay, including Kincardine, Owen Sound, Penetanguishene, and Parry Sound (MNC n.d.). By the mid-twentieth century, Indigenous communities, including the Métis, began to advance their rights within Ontario and across Canada, and in 1982, the Métis were federally recognized as one of the distinct Indigenous peoples in Canada. Recent decisions by the Supreme Court of Canada (Supreme Court of Canada 2003, 2016) have reaffirmed that Métis people have full rights as one of the Indigenous people of Canada under subsection 91(24) of the Constitution Act, 1867.

3.1.3 Historical Euro-Canadian Township Survey and Settlement

Historically, the Study Area is located in the Former Erin Township, County of Wellington in part of Lots 22, 23 and 25, Concession 7, part of Lots 23-26, Concession 8, part of Lots 11-18, Concession 9, and part Of Lots 12-17, Concession 10.

The first Europeans to arrive in the area were transient merchants and traders from France and England, who followed Indigenous pathways and set up trading posts at strategic locations along the well-traveled river routes. All of these occupations occurred at sites that afforded both natural landfalls and convenient access, by means of the various waterways and overland trails, into the hinterlands. Early transportation routes followed existing Indigenous trails, both along the lakeshore and adjacent to various creeks and rivers (Archaeological Services Inc. 2006).

Erin Township

The land within Erin Township was acquired by the British from the Mississaugas in 1818. The first township survey was undertaken in 1819, and the first legal settlers occupied their land holdings in the following year. The township was first named after a poetic name for Ireland, *Ierne*, mentioned by the Greek geographer Strabo. Erin was initially settled by the children of Loyalists, soldiers who had served during the War of 1812, and by immigrants from England, Scotland and Ireland (Armstrong 1985:143; Erin Centennial Committee 1967; McMillan 1974; Rayburn 1997:113; Smith 1846:55–56). In 1842 a meeting was held in the home of Abraham Buck and the first officers were appointed to administer the affairs of the township. Henry Trout Sr. was appointed as the township clerk, Philander Hopkins was the collector of taxes, and Archibald Patterson and Robert Neily were made the township wardens (Mika and Mika 1977:680). The population of Erin had reached 981 by 1835 and by 1850 it had increased to 3035 (Mika and Mika 1977:680). Until this time Erin Township was part of the District of Wellington. During 1850 and 1851 it was under the jurisdiction of the Waterloo County Council. In 1852 Erin Township was run under the United Counties of Wellington, Waterloo, and Grey. It was made part of the County of Wellington when it was formed in 1854 (Mika and Mika 1977).

Village of Erin

A small community developed around 1828-29 with a series of mills on the Credit River, later rebuilt by Daniel McMillan (Brown 2017). In 1839 a post-office was established at "McMillan's Mills"", and within a year village lots had been laid out. By 1851 the population was approximately 300 and had a distillery, a tannery, and carding, oatmeal and grist-mills. In 1879 the population had reached 750 and a branch of the Credit Valley Railway (CVR) was completed through Erin to Toronto. In the Village of Erin, as elsewhere, mills anchored growth and the settlement soon expanded to include more houses and two more mills that were built in 1838 and 1840. The first store was opened in 1836 by a Miss Caldwell, and William Cornock soon followed with the village's first dry goods store, a distillery and a post office. Churches, schools, inns, hardware stores and other amenities soon followed. Originally called McMillan's Mill after its founding family, in 1851 the village, population 300, was re-named Erin. The village was legally incorporated in 1879 and the first meeting of council took place in 1881 (County of Wellington 1998).

Village of Hillsburgh

The first settler in this region was Nathaniel Rozell, in 1820 who built a house on Lot 1, Concession 7. In 1821, William How and his family settled on Lots 22 and 23, Concession 7, and the settlement was named Howville (McMillan 1974:6–7; Erin Centennial Committee 1967). The village was not founded until the 1840s, when a tavern and sawmill were constructed by Hiram and Nazareth Hill (Town of Erin 2017a). It became a post office village in 1851, the same year Gooderham & Worts distillers bought land along the river to build a large grist mill, saw mill, and a cooperage for producing barrels for their business in Toronto, in what is now the iconic "Distillery District" (Town of Erin n.d.). Registered plans of subdivision for this village date from 1857-1862. It contained two grist mills, a woollen factory, a foundry and tannery. The village also contained four churches, four stores, three hotels, and a telegraph office. It was a station on the CVR, later the Canadian Pacific Railway (CPR), and the population was approximately 400 in 1873 (Crossby 1873:145; Rayburn 1997:158; Scott 1997:102; Winearls 1991:697). The "Station Road" over the Gooderham & Worts dam was built when the CVR arrived in 1879 to connect the village with the train on the west side of the mill pond (Town of Erin n.d.). The Hillsburgh Pioneer/God's Acre Cemetery was founded by the How family on Lot 24, Concession 7,and William How was buried there in 1854, among other early settlers (Town of Erin n.d.). The cemetery was not used after 1900 (Town of Erin 2017b).

Credit Valley Railway

The Credit Valley Railway was constructed between 1877 and 1879 to improve trade opportunities in southern Ontario (Town of Caledon 2009). The project was backed by George Laidlaw and was intended to connect Toronto with Orangeville via Streetsville. Construction began in 1874 and over several subsequent years several branches were added to the proposed line. The first section of track from Parkdale (Toronto) to Milton was opened in 1877. In 1873, survey work was completed and track was first laid in 1876. Construction on the railway reached the Forks of the Credit by 1879 with a station at the northern end of the longest curved timber trestle of the time, which spanned 1,146 feet through the river valley at a height of 85 feet (Town of Caledon 2009:7.30). The line was completed in 1881 but nearly bankrupted the company. It was established in direct competition with the Toronto, Grey and Bruce Railway in the hopes of stimulating trade and economic opportunities in the outlying areas. In 1883 the line was taken over by the Canadian Pacific Railway (Heritage Mississauga 2009b; Town of Caledon 2009). All trains were discontinued and the tracks were torn up in 1988, and the easement became the Elora-Cataract Trailway in 1993, a 47 kilometre long multi-use path, owned and managed by the Credit Valley and Grand River Conservation Authorities, which follows the former railroad easement, connecting Elora, Belwood, Orton, Hillsburgh, Erin, and Forks of the Credit Provincial Park (Town of Erin 2017c; Elora Cataract Trailway 2017).

3.1.4 Review of Historical Mapping

The 1861 *Map of the County of Wellington* (Leslie and Wheelock 1861) and the 1881 *Illustrated Historical Atlas of the Township of Erin* were examined to determine the presence of historical features within the study area during the nineteenth century (Figures 4-7).

It should be noted, however, that not all features of interest were mapped systematically in the Ontario series of historical atlases, given that they were financed by subscription, and subscribers were given preference with regard to the level of detail provided on the maps. Moreover, not every feature of interest would have been within the scope of the atlases. In addition, the use of historical map sources to reconstruct/predict the location of former features within the modern landscape generally proceeds by using common reference points between the various sources. These sources are then geo-referenced in order to provide the most accurate determination of the location of any property on historic mapping sources. The results of such exercises are often imprecise or even contradictory, as there are numerous potential sources of error inherent in such a process, including the vagaries of map production (both past and present), the need to resolve differences of scale and resolution, and distortions introduced by reproduction of the sources. To a large degree, the significance of such margins of error is dependent on the size of the feature one is attempting to plot, the constancy of reference points, the distances between them, and the consistency with which both they and the target feature are depicted on the period mapping.

Historically, the study area is located in the former Township of Erin, Wellington County. Details of historical property owners and features in the study area in the mid and late-nineteenth-century are listed in **Error! Reference source not found.**.

Table 1: Nineteenth-century property owner(s) and historical features(s) within or adjacent to the Study Area

		1861		*1877*	
Con #	**Lot #**	**Property Owner(s)**	**Historical Feature(s)**	**Property Owner(s)**	**Historical Feature(s)**
7	22	Howe & Brothers	None	Wm Howe	Saw mill
	23	Howe & Brothers	None	Wm Howe	House
	24	Gooderham & Worts	Saw mill Grist mill Store/Post Office Town lots	Gooderham & Worts	Town lots CVR
	25	Hiram Hill	Inn Town lots	Gooderham & Worts J. Collins	Town lots House
8	23	Geo. Henshaw	School house Town lots	M. Henshaw	Town lots, house, CVR

		1861		*1877*	
Con #	**Lot #**	**Property Owner(s)**	**Historical Feature(s)**	**Property Owner(s)**	**Historical Feature(s)**
	24	Robert Nodwell	None	R. Nodwell	None
	25	Jno Green	Town lots	J. Green	Town lots
		Jas. B. Boustead	Inn	J. Kirk	None
	26	Geo. Berry	None	A. Taylor	Town lots
9	11	Jno McLarin	None	J. McLaren	None
	12	Wm Clark	None	J. McLaren	House
	13	Crozier	None	H. Crozier	House
		Chas McMillan	Town lots		
	14	Chas McMillan	Town lots Mill pond Inn	A. Thompson	Town lots, mill pond
	15	Hugh McMillan	None	D. Medley	House
		Thos. Brown	Town lots mill pond	W. Hull	Mill pond
	16	The Late Daniel McMillan	None	R. Johnston	None
				R. Medley	None
				D. McMillan	None
				J. McArthur	None
				S Irwine	House
	17	Edward White	None	E White	House, CVR
	18	Jno McMillan		J. McMillan	House
10	12	Mrs. Milloy	None	H. Malloy	None
		Wm. Clark	None	W. Hunter	House
		Wm Price	None	J.H.	None
				Mr. Gamble	House
	13	John Shingler	Town lots	J. Shingler	Town lots
		Hiram Shingler	None	W. Wilson	None
	14	None	Inn (2), grist mill, town lots	W. Cornack	Town lots
		Wm Cornack	None		
		S. L. Shotter	None		
	15	None	Town lots	A. McLellan	Town lots
		Late D. McMillan	None		
	16	Dun McMillan	None	D. McMillan	House, CVR
	17	Jno. R. Thompson	None	J. R. Thompson	House
				A. Thompson	House

According to the 1861 map, the villages of Hillsburgh and Erin were both established. Hillsburgh is depicted as having two inns, a store and post office, a saw and grist mill, and a school house, while Erin is shown to have three inns and a grist mill. The Study Area is illustrated within the historical centre of the villages adjacent to the West Credit River, with historical transportation routes in Hillsburgh including what are now Main, Orangeville, Barker, Church, and Ann Streets; while in Erin these include what are now Main, Dundas, Daniel, English, William, Spring, Centre and Church Streets, Church Boulevard, and Country Road 124. The 1877, shows both town centres had grown, and the Credit Valley Railway ran through both Hillsburgh and Erin. Three mill ponds are illustrated in Erin.

In addition to nineteenth-century mapping, historical topographic mapping and aerial photographs from the twentieth century were examined (Figures 8-15). This report presents maps and aerial photographs from 1906, 1937, 1954, and 2004. These do not represent the full range of maps consulted for the purpose of this study but were judged to cover the full range of land uses that occurred in the area during this period.

The 1906 Map of the County of Wellington, Villages of Hillsburg and Erin (Lloyd 1906) (Figures 8-9), the 1937 National Topographic Series, Orangeville Sheet (Department of National Defence 1937) (Figures 10-11), and the 1954 aerial photo of the Town of Erin (University of Toronto 1954) (Figures 12-13) were examined to determine the extent and nature of development and land uses within the Study Area.The 1906 maps show that the Study Area is located within the historic centre of the villages of Erin and Hillsburgh. In Erin, historical transportation routes are shown, including the Canadian Pacific Railway and Main, Mill, Guelph, and Belfountain Streets, as well as the Credit River, mills ponds, parks, and numerous town lots. In Hillsburgh, the CPR, mills ponds, a church, and numerous town lots are also shown, as well as historical transportation routes such as Gravel Road (now Trafalgar Road North), Orangeville Street, and what is now Highway 22.

By 1937, numerous structures are shown within the Study Area along the main streets, as well as a few residential neighbourhoods on both sides of the road. Two farmsteads are shown in the area of the proposed WWTP sites. Both Erin and Hillsburgh have a grist mill, a school, a post office, and a church. Erin also has a race track, while there is a cemetery shown in Hillsburgh.

The 1954 aerial photo of the Town of Erin shows little development of the Study Area into the mid-twentieth century within the villages of Erin and Hillsburgh, surrounded by a rural agricultural landscape along the CPR and West Credit River.

A review of available Google satellite imagery in the village of Erin shows that the residential subdivision on Armstrong Street, Treelong Crescent and Leenders Lane was constructed in 2004, and commercial/industrial development intensified on Erin Park Drive, Erinville Drive, and Thompson Crescent since 2004. Imagery of the village of Hillsburgh shows that the Study Area has remained relatively unchanged since 2004. (Figures 14-15)

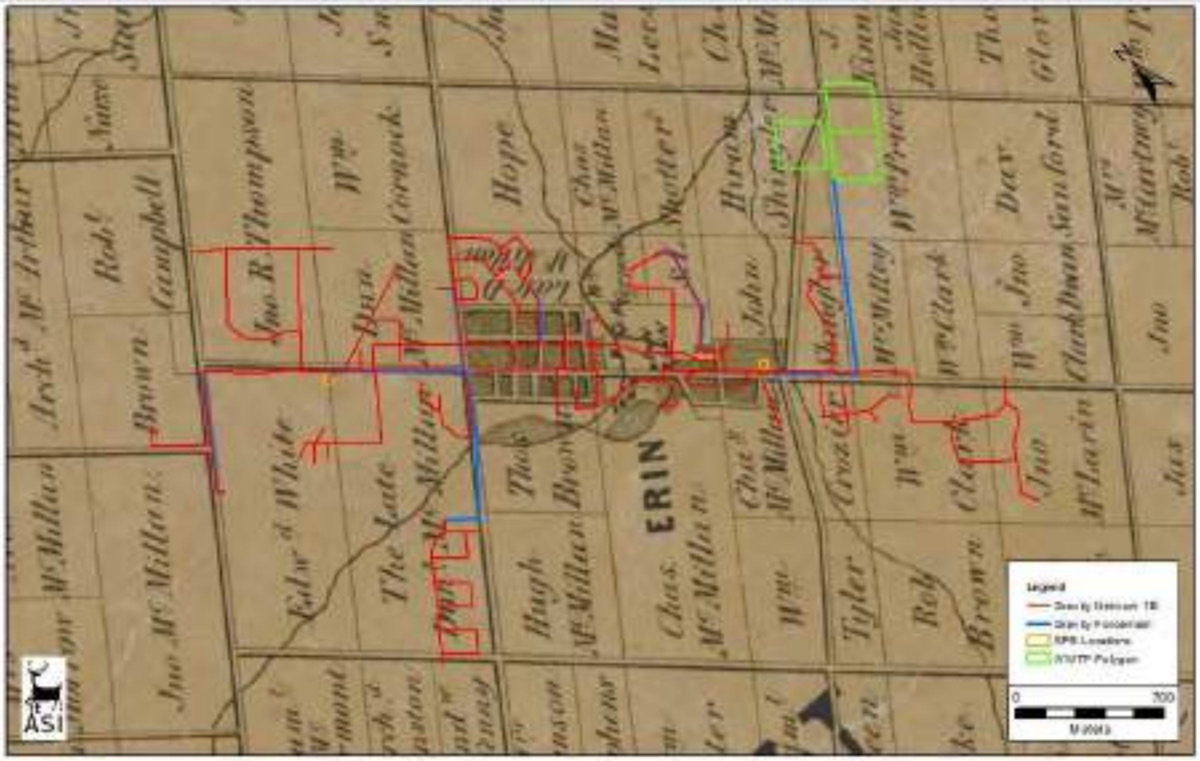

Figure 4: The Erin study area overlaid on the 1861 Tremaine's Map of the County of Wellington
Base Map: Tremaine 1861

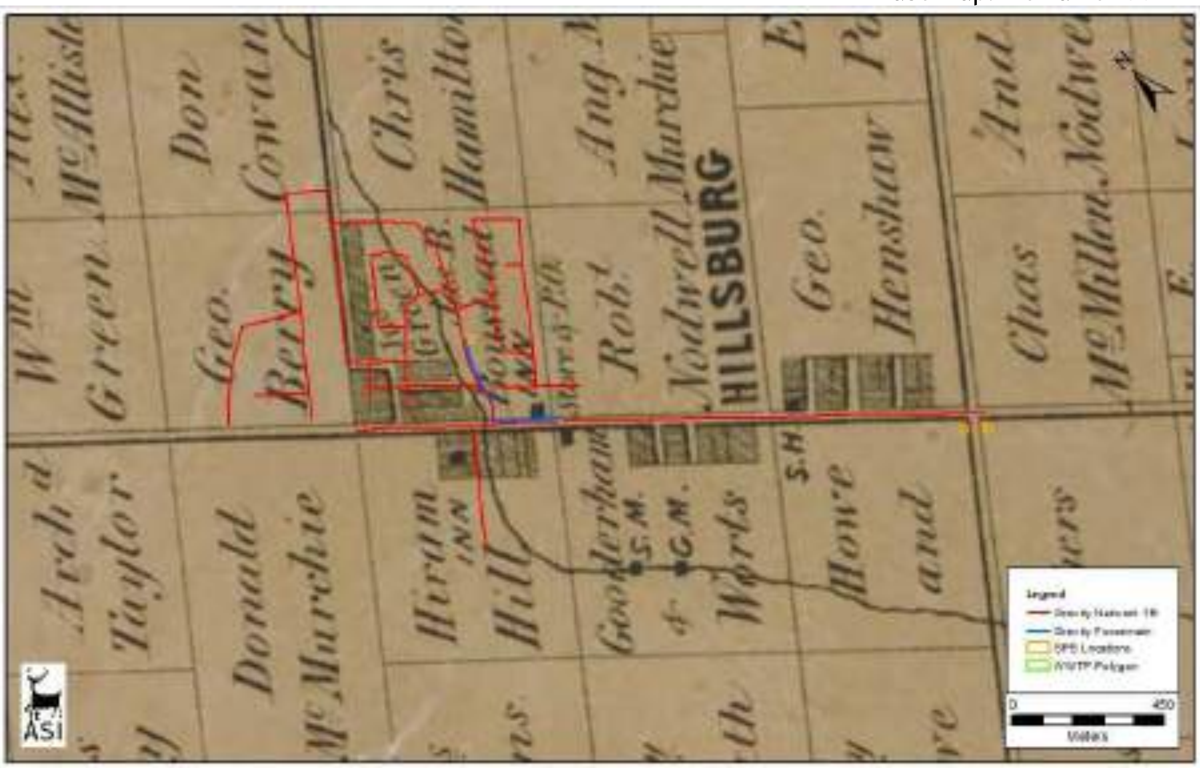

Figure 5: The Hillsburgh study area overlaid on the 1861 Tremaine's Map of the County of Wellington
Base Map: Tremaine 1861

Figure 6: The Erin study area overlaid on the 1881 Historical Atlas of the County of Wellington
Base Map: Miles and Co. 1881

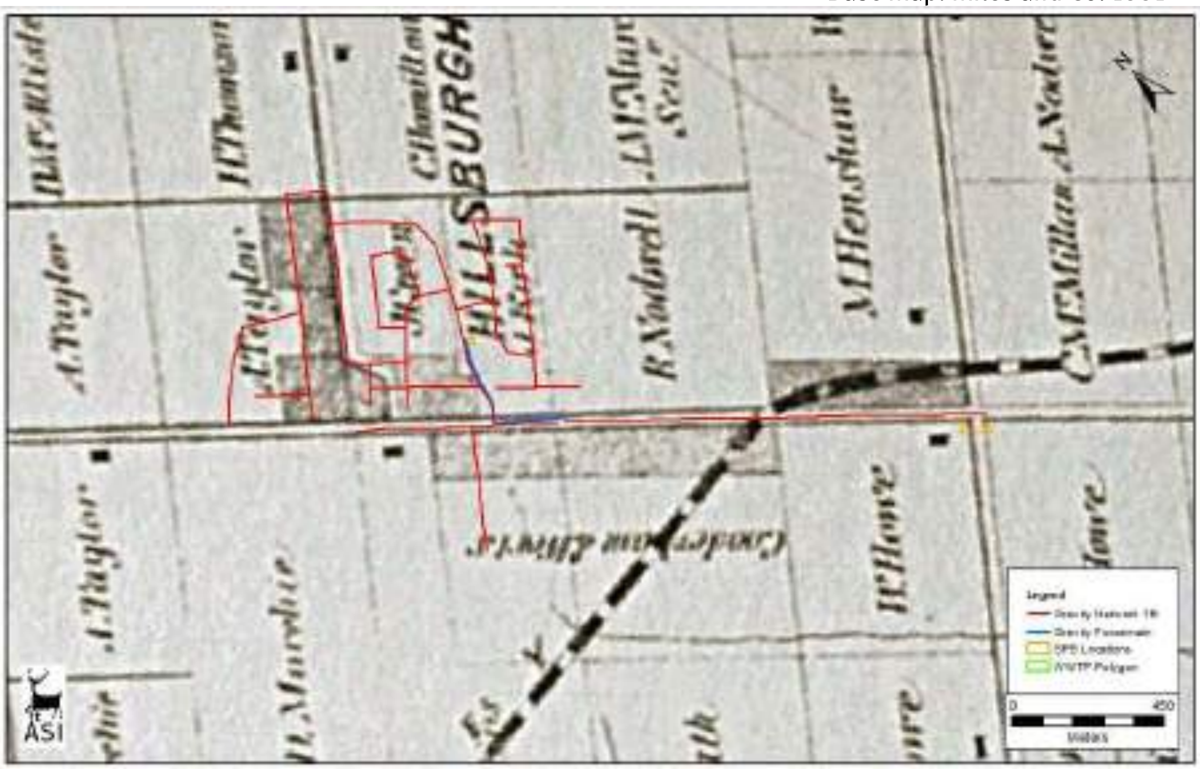

Figure 7: The Hillsburgh study area overlaid on the 1881 Historical Atlas of the County of Wellington
Base Map: Miles and Co. 1881

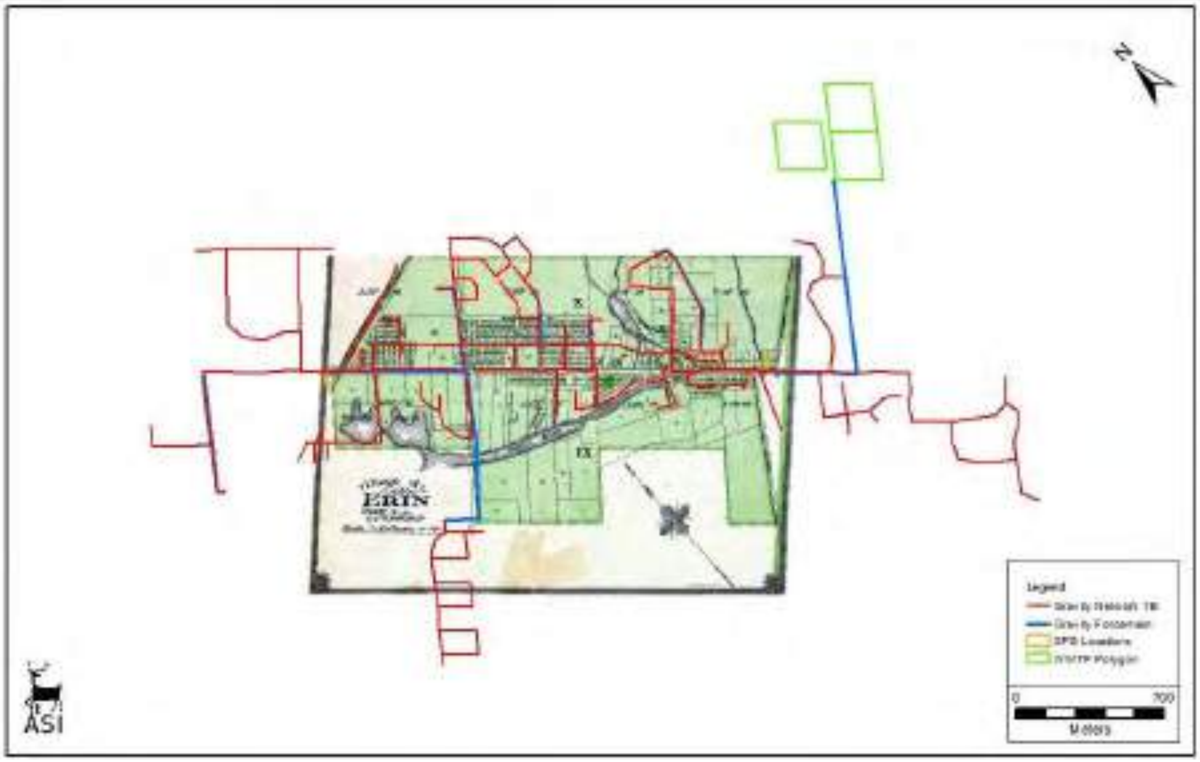

Figure 8: The study area overlaid on the 1906 Map of the Village of Erin.

Base Map: Lloyd 1906

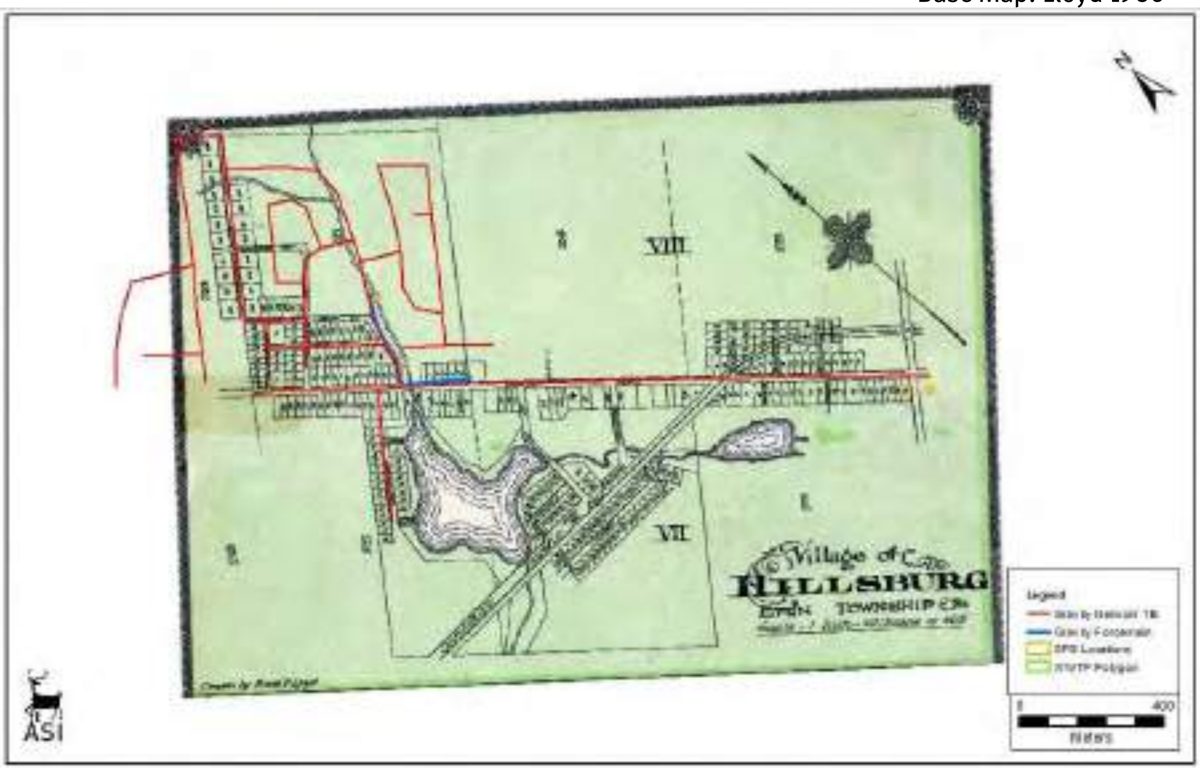

Figure 9: The study area overlaid on the 1906 Map of the Village of Hillsburgh.

Base Map: Lloyd 1906

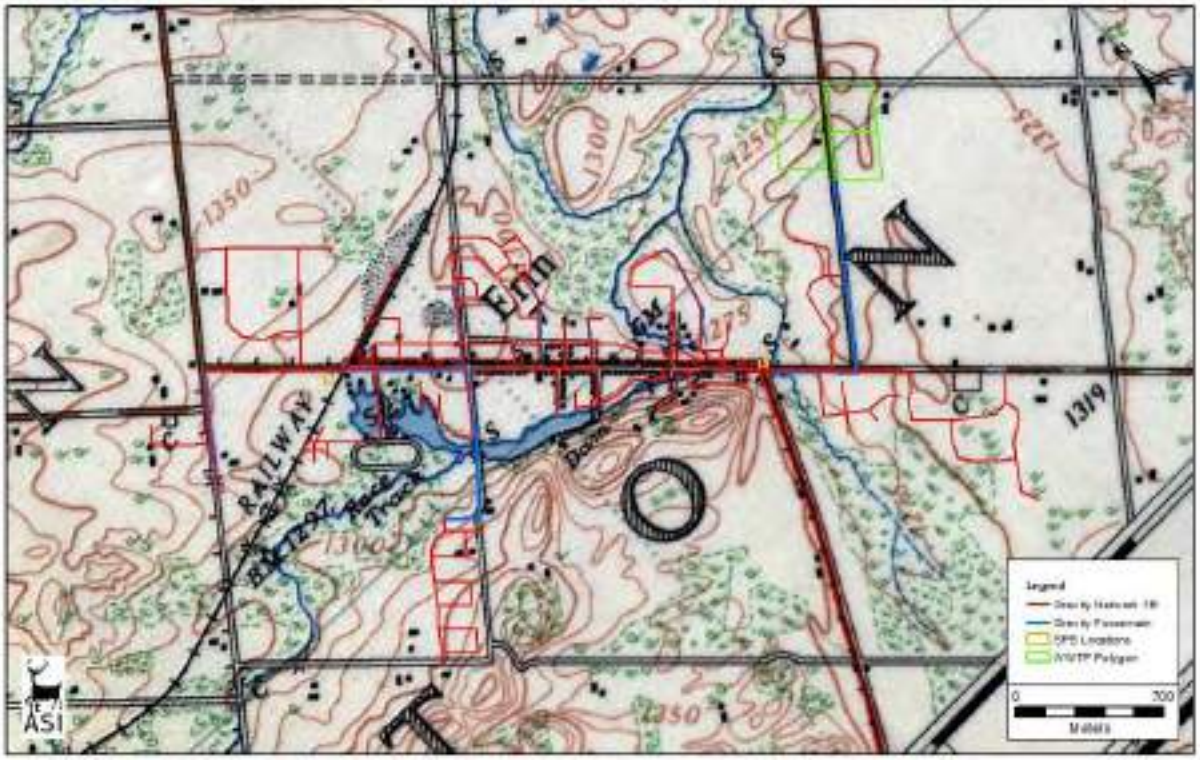

Figure 10: The Erin study area overlaid on the 1937 topographic map of Orangeville
Base Map: Department of National Defence 1937

Figure 11: The Hillsburgh study area overlaid on the 1937 topographic map of Orangeville
Base Map: Department of National Defence 1937

Figure 12: The study area overlaid on the 1954 aerial photograph of Erin
Base Map: Hunting Survey Corporation Ltd. 1954

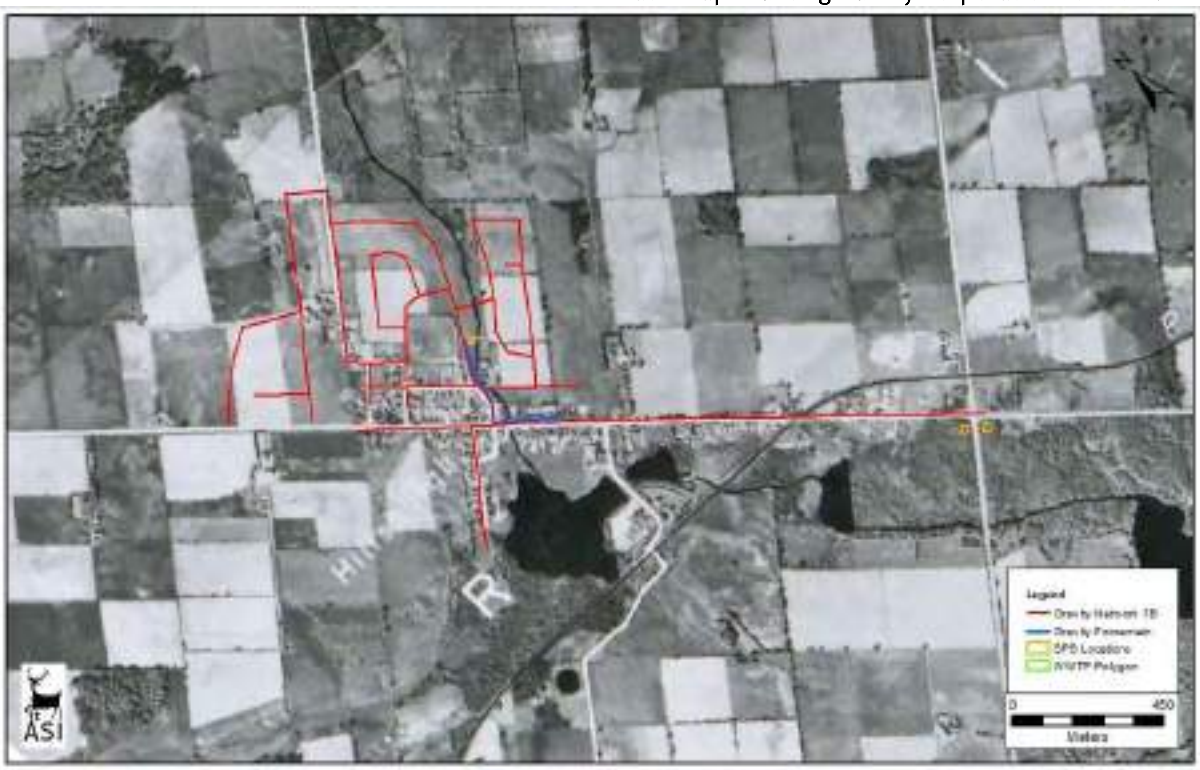

Figure 13: The study area overlaid on the 1954 aerial photograph of Hillsburgh
Base Map: Hunting Survey Corporation Ltd. 1954

Figure 14: The Erin study area overlaid on a 2004 aerial photo.

Base Map: Google Earth, 2004

Figure 15: The Hillsburgh study area overlaid on a 2004 aerial photo.

Base Map: Google Earth, 2004

3.2 Existing Conditions

3.2.1 Review of Existing Heritage Inventories

In order to make an identification of existing cultural heritage resources within the study area, a number of resources were consulted (MTCS 2016). Table 2 lists the resources consulted.

Table 2: Existing heritage inventories consulted

Inventory Reviewed	Description	URL	Date Reviewed
Town of Erin's Heritage Register	Includes an inventory of cultural heritage resources that are designated under Part IV of the *Ontario Heritage Act* and an inventory of listed properties that are of cultural heritage value or interest to the city	n/a	June 2017
Inventory of Ontario Heritage Trust easements	An online inventory of easement agreements curated by the Ontario Heritage Trust	http://www.heritagetrust.on.ca/en/index.php/property-types/easement-properties	June 2017
Ontario Heritage Trust's *Ontario Heritage Plaque Guide* and *Ontario's Historical Plaques* website	Two online, searchable databases of Ontario Heritage Plaques	http://www.heritagetrust.on.ca/en/index.php/online-plaque-guide and www.ontarioplaques.com	June 2017
Ontario Ministry of Government and Consumer Services *Inventory of known cemeteries/burial sites*	An online, searchable database of cemeteries and crematoriums	https://www.consumerbeware.mgs.gov.on.ca/esearch/cemeterySearch.do?eformsId=0	June 2017
Canadian Heritage River System	A national river conservation program that promotes, protects and enhances the best examples of Canada's river heritage	http://chrs.ca/the-rivers/	June 2017
Parks Canada's *Canada's Historic Places* website	This searchable register provides information on historic places recognized for their heritage value at the local, provincial, territorial, and national levels	http://www.historicplaces.ca/en/pages/about-apropos.aspx	June 2017
Parks Canada's *Directory of Federal Heritage Designations*	A searchable on-line database that identifies National Historic Sites, National Historic Events, National Historic People, Heritage Railway Stations, Federal Heritage Buildings, and Heritage Lighthouses	http://www.pc.gc.ca/apps/dfhd/search-recherche_eng.aspx	June 2017

Table 2: Existing heritage inventories consulted

Inventory Reviewed	Description	URL	Date Reviewed
United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Sites	An online interactive map that identifies UNESCO world heritage sites	http://whc.unesco.org/en/list/	June 2017

Based on the review of available municipal, provincial, and federal data, there are 250 previously identified listed built heritage resources within and/or adjacent to the study area. These resources together form cultural heritage landscapes resources, which will be identified and defined as a part of field review and analysis.

3.2.2 Field Review

A field review of the study area was undertaken by John Sleath of ASI, on 19 July 2017 to document the existing conditions of the study area. The field review was preceded by a review of available, current and historical, aerial photographs and maps (including online sources such as Bing and Google maps). These large-scale maps were reviewed for any potential cultural heritage resources which may be extant in the study area. The existing conditions of the study area are described below, and in Plates 1-16. Identified cultural heritage resources are discussed in Section 3.2.3 and are mapped in Section 8.0 of this report.

The Study Area in Hillsburgh follows Trafalgar Road North through the historic village centre, roughly between Wellington Road 22 and Howe Street. The Study Area in Erin follows Main Street/Ninth Line, roughly between Wellington Road 52 and Sideroad 17. Both villages have nineteenth- and twentieth-century residential developments to the east and west of the main streets, small public parks, commercial developments, schools and churches. The WWTP sites are within active agricultural fields southwest of Tenth Line on either side of Wellington Road 52. Development along Sideroad 17, Erin Park Drive, Thompson Crescent, and Erinvile Drive is predominantly commercial. Small creeks and ponds are dotted along both sides of Trafalgar Road North in the village of Hillsburgh, and drain into the village of Erin along the west side of Main Street. The former CPR alignment is now the Elora-Cataract Trailway, connecting both villages.

The Main Street Commercial Core of the Village of Erin consists of a traditional rural Ontario nineteenth century commercial streetscape, including construction at the lot lines, wide sidewalks, streetlamps, and 1-3 storey commercial buildings, including boomtown front, Italianate, Victorian commercial, Edwardian, and Romanesque-influenced architectural styles, as well as a mixture of contemporary, but compatible, buildings. (Plates 6 and 8)

The Historic Residential areas of the Town of Erin consists of traditional rural Ontario nineteenth century residential homes, and streetscape, including buildings set back from the lot lines, with large front and side yards, and 1-3 storey residential buildings, including Victorian, Ontario Gothic, Edwardian, Dutch Revival, and Italianate -influenced architectural styles, as well as a mixture of contemporary, but compatible, residential buildings. (Plates 1-4)

The Historic Residential areas ofHillsburgh consist of traditional rural Ontario nineteenth century residential homes, and streetscape, including buildings set back from the lot lines, with large front and side yards, and 1-3 storey residential buildings, including Victorian, Ontario Gothic, Edwardian, Dutch

Revival, and Italianate -influenced architectural styles, as well as a mixture of contemporary, but compatible, residential buildings. (Plate 15)

Main Street Hillsburgh consists of a mix of commercial and residential structures, consistent with small rural settlements. Hillsburgh consists of a traditional rural Ontario nineteenth century commercial and residential streetscape, including mixed uses, construction at the lot lines, wide sidewalks, streetlamps, and 1-3 storey commercial and residential buildings, including Second Empire, boomtown front, Dutch Revival, Victorian, Ontario Gothic, and Edwardian architectural styles, as well as a mixture of contemporary, but compatible, buildings.(Plates 11-13)

Plate 1: Residential Main Street, Village of Erin.

Plate 2: Residential Main Street, Village of Erin.

Plate 3: Residential side street, Village of Erin.

Plate 4: Residential side street, Village of Erin.


Plate 5: Erin Agricultural Society, Village of Erin


Plate 6: Commercial Main Street, Village of Erin

Plate 7: The Founding of Erin Plaque


Plate 8: Commercial Main Street, Village of Erin


Plate 9: Credit River, Village of Erin


Plate 10: Hillsburgh Dam and Pond, Village of Hillsburgh

Plate 11: Commercial Main Street, Village of Hillsburgh

Plate 12: Main Street, Village of Hillsburgh

Plate 13: Main Street, Village of Hillsburgh

Plate 14: God's Acre Pioneer Cemetery, Village of Hillsburgh

Plate 15: Residential Hillsburgh, Village of Hillsburgh

Plate 16: Erin Trails Network, including former Credit Valley Rail Trail

3.2.3 Identified Cultural Heritage Resources

Based on the results of the background research and field review, thirteen cultural heritage resources (CHR) were identified within and/or adjacent to the Erin WW study area. The cultural heritage resources are both cultural heritage landscapes (CHLs) and built heritage resources (BHRs) (Table 3). A detailed inventory of these cultural heritage resources within the study area and contributing listed properties is presented in Section 7.0 and mapping of these features are provided in Section 8.0 of this report. (Figures 17-18)

Table 3: Summary of built heritage resources (BHR) and cultural heritage landscapes (CHL) within and/or adjacent to the study area

	Location/Name	Recognition	Description/Comments
CHL 1	Erin Main Street Historic Commercial Core	Identified during field review.	The Main Street Commercial Core of the Town of Erin consists of a traditional rural Ontario nineteenth century commercial streetscape, including construction at the lot lines, wide sidewalks, streetlamps, and 1-3 storey commercial buildings, including boomtown front, Italianate, Victorian commercial, Edwardian, and Romanesque-influenced architectural styles, as well as a mixture of contemporary, but compatible, buildings.
CHL 2	Hillsburgh Historic Main Street	Identified during field review.	Main Street Hillsburgh consists of a mix of commercial and residential structures, consistent with small rural settlements. Hillsburgh consists of a traditional rural Ontario nineteenth century commercial and residential streetscape, including mixed uses, construction at the lot lines, wide sidewalks, streetlamps, and 1-3 storey commercial and residential buildings, including Second Empire, boomtown front, Dutch Revival, Victorian, Ontario Gothic, and Edwardian architectural styles, as well as a mixture of contemporary, but compatible, buildings.
CHL 3	Historic Residential Erin	Identified during field review.	The Historic Residential areas of the Town of Erin consists of traditional rural Ontario nineteenth century residential homes, and streetscape, including buildings set back from the lot lines, with large front and side yards, and 1-3 storey residential buildings, including Victorian, Ontario Gothic, Edwardian, Dutch Revival, and Italianate - influenced architectural styles, as well as a mixture of contemporary, but compatible, residential buildings.

Table 3: Summary of built heritage resources (BHR) and cultural heritage landscapes (CHL) within and/or adjacent to the study area

	Location/Name	Recognition	Description/Comments
CHL 4	Historic Residential Hillsburgh	Identified during field review.	The Historic Residential areas Hillsburgh consist of traditional rural Ontario nineteenth century residential homes, and streetscape, including buildings set back from the lot lines, with large front and side yards, and 1-3 storey residential buildings, including Victorian, Ontario Gothic, Edwardian, Dutch Revival, and Italianate - influenced architectural styles, as well as a mixture of contemporary, but compatible, residential buildings.
CHL 5	190 Main St - Erin Agricultural Society	Identified during field review.	The Erin Agricultural Society lands consist of a collection of agricultural buildings, including a fair building, and several barns, and an open field used for the annual fall fair. A metal fence and gate provides access to the fairgrounds. Outbuildings are clad in green metal siding with silver metal roofs. The original fair building burned to the ground in 1994. Erin Agricultural Society has been active at this site since 1850, originally funded by a government initiative to spread agricultural knowledge and technologies. The property is now used to promote and teach about the agricultural lifestyle.
BHR 1	12 Erinville Drive	Listed	The subject residence is a 1915-1920s Edwardian style two storey red brick farmhouse with a side addition and second storey balcony. A stone farm outbuilding is also present on the property. Formerly found within a nineteenth century agricultural context, these buildings are now located within an industrial area, to the north of the historic settlement area of Erin.
BHR 2	15 Wesley Street	Listed	Built circa 1900, this two storey, hipped roof, red brick Edwardian farmhouse includes a second storey porch and a dormer in the roof. A side verandah and a porch is also visible. Formerly found within a nineteenth century agricultural context, this building is now located within a twentieth century subdivision, to the south of the historic settlement area of Erin.
CHL 6	Stanley Park Gates	Designated Part IV	The Stanley Park Gates and Arch include fieldstones used were carefully fitted together and the integrity of the structure was ensured by an application of tooled, V-joint mortar between the fieldstone. The fieldstones are arranged so that the different colours of the stones are evenly distributed across the gate structure while incorporating different sizes of stones.

Table 3: Summary of built heritage resources (BHR) and cultural heritage landscapes (CHL) within and/or adjacent to the study area

	Location/Name	Recognition	Description/Comments
CHL 7	Former Railway	Identified during field review.	The Elora Cataract Trailway, formerly a part of the Credit Valley Railway, is part of the Trans-Canada trail. It runs through Hillsburgh and Erin and connects to the old Canadian Pacific rail line. Originally the route of the Credit Valley Railway, with its mainline between Toronto and Orangeville constructed in 1879, with a branchline from Cataract Junction to Fergus built in the same year.
CHL 8	64 Trafalgar Rd., Hillsburgh	Listed	An early nineteenth century pioneer cemetery, which has been converted into a single concrete monument, with headstones displayed in the centre of the cemetery. God's Acre Cemetery, now known as Hillsburgh Cemetery contains burials dating back to 1831. This cemetery has not been used since 1900. The cemetery was neglected until 1954, then 'restored' with all of the original headstones uncovered from the grass and embedded together at the front of the cemetery in a single, solid block of concrete.
CHL 9	Hillsburgh Pond and Dam – South of Hillsburgh	Identified during field review.	This property features an irregular parcel shape that encompasses the Hillsburgh Pond, the Hillsburgh Dam.The property is located within Lots 24 and 25, Concession VII. The property was once part of a larger parcel of land associated with Gooderham and Worts and the Awrey brothers, and was linked to milling from the mid-nineteenth to the early twentieth centuries.
CHL 10	Credit River	Identified during field review.	The Credit River is a river in southern Ontario which flows from headwaters above the Niagara Escarpment near Orangeville and Caledon East to empty into Lake Ontario at Port Credit, Mississauga. It drains an area of 1,000 square kilometers. The Credit River connects the Historic Settlement Areas of Hillsburgh and Erin.
BHR 3	Station Road Bridge - Station Road over the Hillsburgh Pond	Listed	The Station Road Bridge is located at the eastern terminus of the dam and consists of a single span, rigid frame structure with concrete railings. The bridge was built in 1917, in part by local stonemasons, Charles and William Smith.

Four of the identified cultural heritage landscapes (CHLs 1-4) include a collection of listed individual buildings, that together with other cultural landscape features, form distinct areas of cultural heritage value. The identified listed buildings within these CHLs have been provided for reference (Table 4), however, these do not represent every significant or contributing property within the CHL, only those that have been previously identified by the Town of Erin.

Table 4: Summary of listed property addresses with CHL boundaries.

Name	Listed Addresses with Boundary

Table 4: Summary of listed property addresses with CHL boundaries.

	Name	Listed Addresses with Boundary
CHL 1	Erin Main Street Historic Commercial Core	102 Main St, 103 Main St ,104 Main St, 105 Main St, 110 Main St, 115 Main St, 116 Main St, 120 Main St, 122 Main St, 128 Main St, 132 Main St, 155 Main St, 156 Main St, 157 Main St, 158 Main St, 159 Main St 160 Main St, 161 Main St, 162 Main St, 164 Main St, 166 Main St, 168 Main St 169 Main St, 170 Main St, 171 Main St, 172 Main St, 173 Main St, 174 Main St, 175 Main St, 176 Main St, 177 Main St, 178 Main St, 180 Main St, 182 Main St, 57 Main St, 58 Main St, 60 Main St, 61 Main St, 64 Main St, 67 Main St, 68 Main St, 72 Main St, 74 Main St, 76 Main St, 81 Main St, 86 Main St, 87 Main St, 88 Main St, 92 Main St, 98 Main St, 105 Main St, 109 Main St, 110 Main St, 111 Main St, 113 Main St, 114 Main St, 116 Main St, 117 Main St, 120 Main St, 121 Main St, 123 Main St, 125 Main St, 130 Main St, 132 Main St, 52 Main St, 56 Main St, 58 Main St, 60 Main St, 63 Main St, 63A Main St, 64 Main St, 68 Main St, 70 Main St, 72 Main St, 74 Main St, 76 Main St, 77 Main St, 78 Main St, 79 Main St, 80 Main St, 81 Main St, 82 Main St, 83 Main St, 86 Main St, 87 Main St, 88 Main St, 89 Main St, 92 Main St, 93 Main St, 98 Main St
CHL 2	Hillsburgh Historic Main Street	1 George St, 1 Wellington St, 100 Main St, 107 Main St, 112 Main St, 118 Main St, 119 Main St, 119 Main St, 133 Main St, 14 Wellington St, 15 Wellington St, 2 Church St, 3 Church St, 3 Market St, 3 Station St, 3 Wellington St, 4 Church St, 4 Mill St, 42 Main St, 44 Main St, 50 Main St, 75 Main St, 85 Main St, 90 Main St, 94 Main St, 95 Main St, 96 Main St, 97-100 Main St
CHL 3	Historic Residential Erin	1 Pine St, 1 Scotch St, 1 Spring St, 2 Spring St, 1 Union St, 1 Wellington County Road 124, 102 Main St, 103 Main St, 104 Main St, 105 Main St, 105 Main St, 109 Main St, 11 Church Blvd, 11 Spring St, 110 Main St, 110 Main St, 111 Main St, 113 Main St, 114 Main St, 115 Main St, 116 Main St, 116 Main St, 117 Main St, 12 Charles Lane, 12 Spring St, 120 Main St, 120 Main St, 121 Main St, 122 Main St, 123 Main St, 125 Main St, 128 Main St, 130 Main St, 132 Main St, 132 Main St, 155 Main St, 156 Main St, 157 Main St, 158 Main St, 159 Main St, 160 Main St, 161 Main St, 162 Main St, 163 Daniel St, 164 Daniel St, 164 Main St, 166 Main St, 168 Daniel St, 168 Main St, 169 Main St, 17 Main St, 170 Daniel St, 170 Main St, 171 Main St, 172 Main St, 173 Main St, 174 Main St, 175 Main St, 176 Main St, 177 Main St, 178 Main St, 180 Main St, 182 Main St, 192 Main St, 194 Main St, 196 Main St, 198 Main St, 199 Main St, 2 Centre St, 2 Ross St, 2 Spring St, 2 Union St, 202 Main St, 204 Main St, 205 Main St, 206 Main St, 207 Main St, 208 Main St, 21 Main St, 210 Main St, 211 Main St, 212 Main St, 213 Main St, 214 Main St, 215 Main St, 216 Main St, 217 Main St, 218 Main St, 219 Main St, 221 Daniel St, 225 Main St, 226 Main St, 23 Main St, 231 Daniel St, 237 Main St, 241 Main St, 243 Main St, 245 Main St, 246 Main St, 25 Dundas St W, 251 Main St, 253 Main St, 27 Main St, 29 Main St, 3 Centre St, 3 Church Blvd, 3 Dundas St E, 3 Spring St, 3 Union St, 30 Main St, 30 Main St, 32 Main St, 34 Main St, 34 Main St, 35 Main St, 36 Main St, 4 Centre St, 4 Dundas St E, 4 Lorne St, 4 Spring St, 40 Main St, 46 Main St, 48 Main St, 5 Charles St, 5 Church Blvd, 5 Spring St, 51 Main St, 52 Main St, 55 Main St, 56 Main St, 57 Main St, 58 Main St, 58 Main St, 58.5 Main St, 6 Centre St, 6 Charles St, 6 Spring St, 60 Main St, 60 Main St, 61 Main St, 63 Main St, 63A Main St, 64 Main St, 64 Main St, 67 Main St, 68 Main St, 68 Main St, 7 Church Blvd, 7 Spring St, 70 Main St, 72 Main St, 72 Main St, 74 Main St, 74 Main St, 76 Main St, 76 Main St, 77 Main St, 78 Main St, 79 Main St, 8 Centre St, 80 Main St, 81 Main St, 81 Main St, 82 Main St, 83 Main St, 86 Main St, 86 Main St, 87 Main St, 87 Main St, 88 Main St, 88 Main St, 89 Main St, 9 Church Blvd, 92 Main St, 92 Main St, 95.5 Main St, 98 Main St, 98 Main St
CHL 4	Historic Residential Hillsburgh	1 Ann St, 1 George St, 1 Spruce St, 10 Ann St, 10 Church St, 10 George St, 10 Orangeville St, 100 Main St, 107 Main St, 112 Main St, 118 Main St, 119 Main St, 119 Main St, 12 Ann St, 12 Church St, 13 Ann St, 13 George St, 133 Main St, 14 Ann St, 14 Church St, 15 Ann St, 16 Mill St, 17 George St, 17 Mill St, 18 Ann St, 18 Mill St, 19 George St, 2 Church St, 20 Ann St, 20 Mill St, 21 George St, 3 Ann St, 3 Church St, 3 George St, 4 Ann St, 4 Church St, 4 George St, 4 Mill St, 4 Queen St, 42989 George St, 5 Barker St, 5 Church St, 5 George St, 5 Orangeville St, 6 Ann St, 6 Church St, 6 George St, 6 Orangeville St, 7 Ann St, 7 Church St, 7 George St, 75 Main St, 8 Ann St, 8 Church St, 8 Orangeville St, 8 Queen St, 85 Main St, 9 Ann St, 9 Barker St, 90 Main, St, 94 Main St, 95 Main St, 97-100 Main St

3.3 Screening for Potential Impacts

To assess the potential impacts of the undertaking, identified cultural heritage resources are considered against a range of possible impacts as outlined in the document entitled *Check Sheet for Environmental Assessments: Screening for Impacts to Built Heritage and Cultural Heritage Landscapes* (MTC 2010b) which include:

- Destruction, removal or relocation of any, or part of any, significant heritage attribute or feature (III.1).
- Alteration which means a change in any manner and includes restoration, renovation, repair or disturbance (III.2).
- Shadows created that alter the appearance of a heritage attribute or change the exposure or visibility of a natural feature or plantings, such as a garden (III.3).
- Isolation of a heritage attribute from its surrounding environment, context, or a significant relationship (III.4).
- Direct or indirect obstruction of significant views or vistas from, within, or to a built or natural heritage feature (III.5).
- A change in land use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces (III.6).
- Soil disturbance such as a change in grade, or an alteration of the drainage pattern, or excavation, etc (III.7)

A number of additional factors are also considered when evaluating potential impacts on identified cultural heritage resources. These are outlined in a document set out by the Ministry of Culture and Communications (now Ministry of Tourism, Culture and Sport) and the Ministry of the Environment entitled *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* (October 1992) and include:

- Magnitude: the amount of physical alteration or destruction which can be expected;
- Severity: the irreversibility or reversibility of an impact;
- Duration: the length of time an adverse impact persists;
- Frequency: the number of times an impact can be expected;
- Range: the spatial distribution, widespread or site specific, of an adverse impact; and
- Diversity: the number of different kinds of activities to affect a heritage resource.

For the purposes of evaluating potential impacts of development and site alteration, MTC (2010b) defines "adjacent" as: "contiguous properties as well as properties that are separated from a heritage property by narrow strip of land used as a public or private road, highway, street, lane, trail, right-of-way, walkway, green space, park, and/or easement or as otherwise defined in the municipal official plan."

Where any above-ground cultural heritage resources are identified, which may be affected by direct or indirect impacts, appropriate mitigation measures should be developed. This may include completing a heritage impact assessment or documentation report, or employing suitable measures such as landscaping, buffering or other forms of mitigation, where appropriate. In this regard, provincial guidelines should be consulted for advice and further heritage assessment work should be undertaken as necessary.

3.3.1 Potential Impacts of the Preferred Design Concept on Cultural Heritage Resources

The proposed undertaking for the Erin WW study area consists of proposed installation of a gravity sewer system, gravity forcemains, sanitary pumping stations, and a wastewater treatment plant in the Villages of Erin and Hillsburgh. The sewer network is not designed to depart the existing road right-of-ways.

Mapping in Section 8.0 shows the study area in relation to identified cultural heritage resources. Table 5 lists potential impacts to identified cultural heritage resources.

Table 5: Potential Impacts of the Proposed Undertaking

Resource	Potential Impact(s)
CHL 1	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
CHL 2	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
CHL 3	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
CHL 4	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
CHL 5	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
BHR 1	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
BHR 2	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
CHL 6	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
CHL 7	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
CHL 8	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
CHL 9	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil

Resource	Potential Impact(s)
	disturbance of significant magnitude or severity.
CHL 10	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.
BHR 3	The proposed alterations will not result in the destruction, removal, relocation or alteration of the subject resource. The proposed work will not result in shadows, isolation of a heritage attribute, direct or indirect obstruction of significant views, change in land use or soil disturbance of significant magnitude or severity.

4.0 CONCLUSIONS

The results of background historical research and a review of secondary source material, including historical mapping, revealed a study area with a rural historical settlement area land use history dating back to the early nineteenth century. A review of federal registers and municipal and provincial inventories revealed that there are 250 previously identified listed built heritage resources of cultural heritage value within or adjacent to the Erin WW study area, which have been organized into 10 cultural heritage landscapes and three built heritage resources

Key Findings

- A field review of the study area confirmed that there are 13 cultural heritage resources consisting 10 cultural heritage landscapes (CHLs) and three built heritage resources within and immediately adjacent to the study area.

- The identified cultural heritage resources are historically, architecturally, and contextually associated with the nineteenth and twentieth century land use and settlement patterns of the Township of Erin.

- No significant impacts to the one identified cultural heritage resource are anticipated as a result of the proposed undertaking.

5.0 RECOMMENDATIONS

The background research, data collection, and field review conducted for the study area determined that 13 cultural heritage resources are located within the Erin WW study area. No significant impacts to the cultural heritage resources are anticipated to result from the proposed undertaking. Based on the results of the assessment, the following recommendations have been developed:

1. Staging and construction activities should be suitably planned and undertaken to avoid impacts to identified cultural heritage resources;

2. Once a preferred alternative or detail designs of the proposed work are available, a confirmation of impacts of the undertaking on cultural heritage resources identified within and/or adjacent to the study area should be undertaken; and,

3. Should future work require an expansion of the study area then a qualified heritage consultant should be contacted in order to confirm the impacts of the proposed work on potential heritage resources.

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7.0 CULTURAL HERITAGE RESOURCE INVENTORY

Resource	Type	Address or Location	Recognition	Description	Photos
CHL 1	Historic Settlement Centre	Erin Main Street Historic Commercial Core	Identified during field review.	Design: The Main Street Commercial Core of the Town of Erin consists of a traditional rural Ontario nineteenth century commercial streetscape, including construction at the lot lines, wide sidewalks, streetlamps, and 1-3 storey commercial buildings, including boomtown front, Italianate, Victorian commercial, Edwardian, and Romanesque-influenced architectural styles, as well as a mixture of contemporary, but compatible, buildings. History: A small community developed around 1828-29 with a series of mills on the Credit River, later rebuilt by Daniel McMillan. In 1839 a post-office was established at "McMillan's Mills", and within a year village lots had been laid out. By 1851 the population was approximately 300 and had a distillery, a tannery, and carding, oatmeal and grist-mills. Context: The area consists of Main Street from East Church Street to Union Street	 

CHL 2	Historic Settlement Centre	Hillsburgh Historic Main Street	Identified during field review.	Design: Main Street Hillsburgh consists of a mix of commercial and residential structures, consistent with small rural settlements. Hillsburgh consists of a traditional rural Ontario nineteenth century commercial and residential streetscape, including mixed uses, construction at the lot lines, wide sidewalks, streetlamps, and 1-3 storey commercial and residential buildings, including Second Empire, boomtown front, Dutch Revival, Victorian, Ontario Gothic, and Edwardian architectural styles, as well as a mixture of contemporary, but compatible, buildings. History: The first settler in this region was Nathaniel Rozell, in 1820 who built a house on Lot 1, Concession 7. In 1821, William How and his family settled on Lots 22 and 23, Concession 7, and the settlement was named Howville. The village was not founded until the 1840s, when a tavern and sawmill were constructed by Hiram and Nazareth Hill. It became a post office village in 1851, the same year Gooderham & Worts distillers bought land along the river to build a large grist mill,	 

				saw mill, and a cooperage. Context: The area consists of the entirety of Main Street, including a mix of residential and commercial uses, from Wellington 22 to Howe Street.	
CHL 3	Historic Settlement Centre	Historic Residential Erin	Identified during field review.	Design: The Historic Residential areas of the Town of Erin consists of traditional rural Ontario nineteenth century residential homes, and streetscape, including buildings set back from the lot lines, with large front and side yards, and 1-3 storey residential buildings, including Victorian, Ontario Gothic, Edwardian, Dutch Revival, and Italianate-influenced architectural styles, as well as a mixture of contemporary, but compatible, residential buildings. History: A small community developed around 1828-29 with a series of mills on the Credit River, later rebuilt by Daniel McMillan. In 1839 a post-office was established at "McMillan's Mills", and within a year village lots had been laid out. By 1851 the population was approximately 300 and had a distillery, a tannery, and carding, oatmeal and grist-mills. Context: The area consists of	 

				areas on Main Street outside of the Main Street Commercial Core, and off of Main Street within the Historically settled streets of May, Ross, Lorne, Pine, Daniel, Dundas, English, Scotch, Spring, East Church/Church, Centre, Charles, Water, William and March.	
CHL 4	Historic Settlement Centre	Historic Residential Hillsburgh	Identified during field review.	Design: The Historic Residential areas Hillsburgh consist of traditional rural Ontario 19^{th} century residential homes, and streetscape, including buildings set back from the lot lines, with large front and side yards, and 1-3 storey residential buildings, including Victorian, Ontario Gothic, Edwardian, Dutch Revival, and Italianate -influenced architectural styles, as well as a mixture of contemporary, but compatible, residential buildings. History: The first settler in this region was Nathaniel Rozell, in 1820 who built a house on Lot 1, Concession 7. In 1821, William How and his family settled on Lots 22 and 23, Concession 7, and the settlement was named Howville. The village was not founded until the 1840s, when a tavern and sawmill were constructed by Hiram and	

				Nazareth Hill. It became a post office village in 1851, the same year Gooderham & Worts distillers bought land along the river to build a large grist mill, saw mill, and a cooperage. Context: The area consists of the historically settled side roads off of Main Street including George Street to the South and Barker, Queen, Church, Ann, Barker, Mill, and Spruce Streets to the north.	
CHL 5	Recreational	190 Main St - Erin Agricultural Society	Identified during field review.	Design: The Erin Agricultural Society lands consist of a collection of agricultural buildings, including a fair building, and several barns, and an open field used for the annual fall fair. A metal fence and gate provides access to the fairgrounds. Outbuildings are clad in green metal siding with silver metal roofs. The original fair building burned to the ground in 1994. History: Erin Agricultural Society has been active at this site since 1850, originally funded by a government initiative to spread agricultural knowledge and technologies. The property is now used to promote and teach about the agricultural lifestyle. Context: The Erin Agricultural	

				Society is found at the centre of the historic settlement area of Erin, and maintains a strong relationship with the local community.	
BHR 1	Residential	12 Erinville Drive	Listed	Design: The subject residence is a 1915-1920s Edwardian style two storey red brick farmhouse with a side addition and second storey balcony. A stone farm outbuilding is also present on the property. History: In the 1861 mapping, the subject property is owned by Jno. R. Thompson. In the 1881 mapping, the property is owned by A. Thompson. No structure is located at the subject location in either map. A structure appears on the 1937 NTS map. Context: Formerly found within a nineteenth century agricultural context, these buildings are now located within an industrial area, to the north of the historic settlement area of Erin.	 

BHR 2	Residential	15 Wesley Street	Listed	Design: Built circa 1900, this two storey, hipped roof, red brick Edwardian farmhouse includes a second storey porch and a dormer in the roof. A side verandah and a porch is also visible. History: The property is identified as being owned by the late Daniel McMillan in the 1861 mapping, and by R. Medley in the 1881 mapping. No residence appears on the site at this time. The subject structure appears in the 1937 NTS mapping. Context: Formerly found within a nineteenth century agricultural context, this building is now located within a twentieth century subdivision, to the south of the historic settlement area of Erin.	
CHL 6	Recreational	Stanley Park Gates	Designated Part IV	Design: The Stanley Park Gates and Arch are representative of early twentieth century design and construction methods. The fieldstones used were carefully fitted together and the integrity of the structure was ensured by an application of tooled, V-joint mortar between the fieldstone. The fieldstones are arranged so that the different colours of the stones are evenly distributed across the gate structure while incorporating different sizes of stones.	

				History: The Stanley Park Gates and Arch were first constructed as the entrance to Stanley Park. As a result of the opening of the Credit Valley Railway in the 1880's, Stanley Park was established in anticipation of a flood of tourists from Toronto arriving by train. In the early twentieth century, the park served as a popular destination for picnics and sporting events. After the First World War, the gates and arch were commissioned to greet visitors arriving by car, and were made wide enough for a car to fit through the entrance. The gates reflect the work of local stone and concrete masons, Harry Sanders and Charles Smith. The two were hired by the owner of the park to build the gates Context: The Stanley Park Gates and Arch serve as a landmark and are linked to the character and history of the community. They are located within the Historic Settlement Area of Erin.	

CHL 7	Recreational – Former Railway	Former Railway	Identified during field review.	Design: The Elora Cataract Trailway, formerly a part of the Credit Valley Railway, is part of the Trans-Canada trail. It runs through Hillsburgh and Erin and connects to the old Canadian Pacific rail line. History: Originally the route of the Credit Valley Railway, with its mainline between Toronto and Orangeville constructed in 1879, with a branchline from Cataract Junction to Fergus built in the same year. It was incorporated into the Ontario & Quebec railway in 1883, and leased for 999 years to the Canadian Pacific Railway in 1884. The line was abandoned in 1984 and purchased by the Grand River and Credit Valley Conservation Authorities in 1993. Context: This rail train is a part of a broader Erin Trails network, and connects to the Trans-Canada trail.	 

CHL 8	Cemetery	64 Trafalgar Rd., Hillsburgh	Listed	Design: An early nineteenth century pioneer cemetery, which has been converted into a single concrete monument, with headstones displayed in the centre of the cemetery. History: God's Acre Cemetery, now known as Hillsburgh Cemetery contains burials dating back to 1831. This cemetery has not been used since 1900. The cemetery was neglected until 1954, then 'restored' with all of the original headstones uncovered from the grass and embedded together at the front of the cemetery in a single, solid block of concrete. Context: Located within the Historic Settlement Area of Hillsburgh, along Main Street.	 
CHL 9	Watercourse	Hillsburgh Pond and Dam – South of Hillsburgh	Identified during field review.	Design: This property features an irregular parcel shape that encompasses the Hillsburgh Pond, the Hillsburgh Dam. History: The property is located within Lots 24 and 25, Concession VII. The property was once part of a larger parcel of land associated with Gooderham and Worts and the Awrey brothers, and was linked to milling from the mid-nineteenth	

				to the early twentieth centuries. The Hillsburgh Pond and Dam were created by Gooderham and Worts sometime between 1846 and 1851. The property was severed by the Awrey Brothers in 1902 upon sale to the Caledon Mountain Trout Club. Context: The dam located south of the Historic Settlement Area of Hillsburgh, and is oriented generally north-south and features the paved, Station Street right-of-way along its crest, scrub vegetation along the slopes leading to Hillsburgh and Ainsworth Ponds, and guiderails constructed of steel and wood.	
CHL 10	Watercourse	Credit River	Identified during field review.	Design: The Credit River is a river in southern Ontario which flows from headwaters above the Niagara Escarpment near Orangeville and Caledon East to empty into Lake Ontario at Port Credit, Mississauga. It drains an area of 1,000 square kilometers. History: The river became known as Missinnihe, or "trusting creek" to the Mississaugas First Nation who met annually with white traders there. French fur traders supplied goods to the native people in advance against furs which would be delivered the following spring. It was known as the Rivière au Crédit.	

				Context: The Credit River connects the Historic Settlement Areas of Hillsburgh and Erin.	
BHR 3	Bridge	Station Road Bridge - Station Road over the Hillsburgh Pond	Listed	Design: The Station Road Bridge is located at the eastern terminus of the dam and consists of a single span, rigid frame structure with concrete railings. History: The bridge was built in 1917, in part by local stonemasons, Charles and William Smith. Context: Located along Station Road, to the south of the Historic Settlement Area of Hillsburgh, along the Hillsburgh Dam and Pond.	

8.0 CULTURAL HERITAGE RESOURCE LOCATION MAPPING

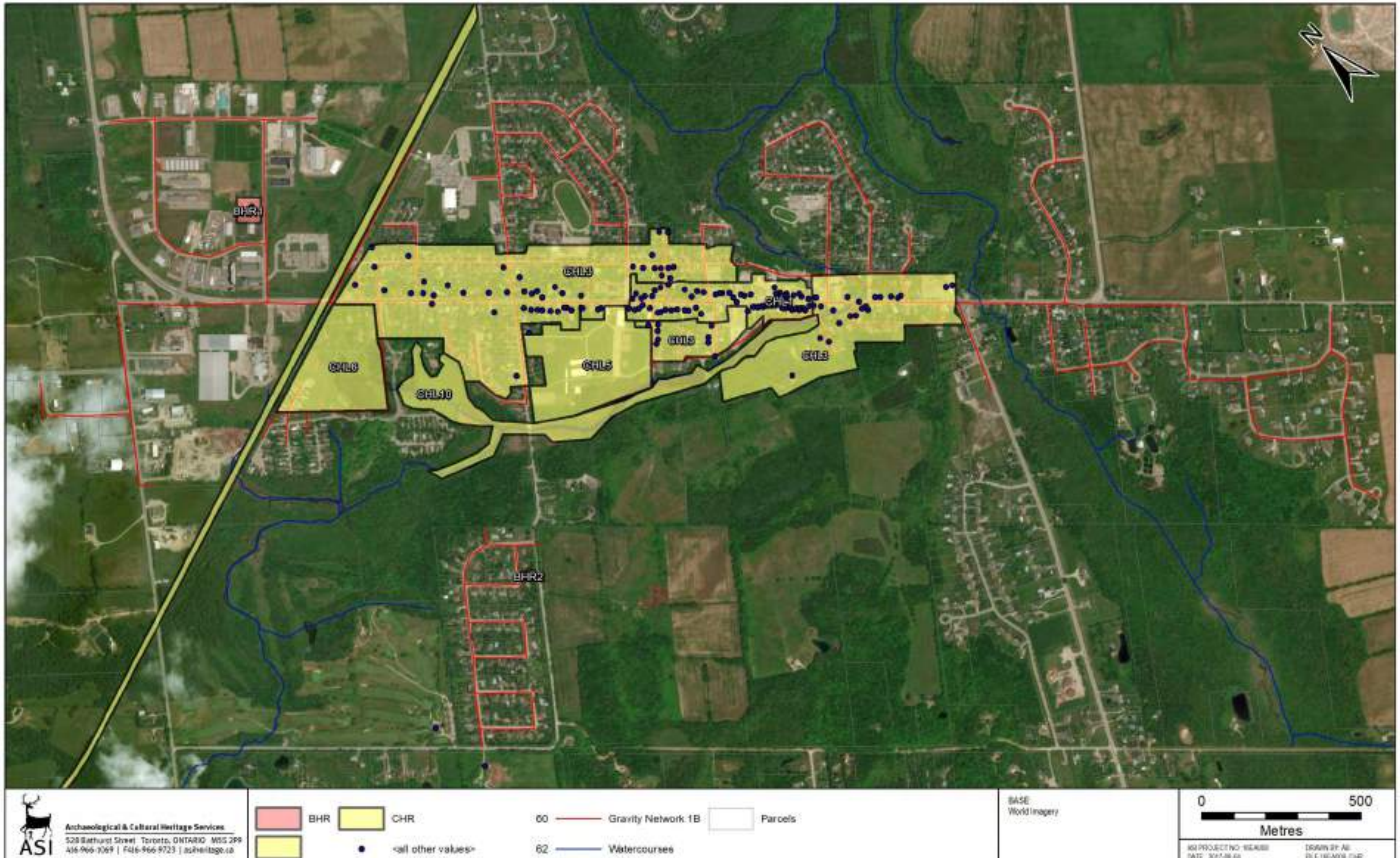

Figure 16: Location of Cultural Heritage Resources in the Erin WW study area, Village of Erin

Figure 17: Location of Cultural Heritage Resources in the Erin WW study area, Village of Hillsburgh